Grafton Gate Developments

Ewenny Road Industrial Estate

Environmental Desktop Study

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Date: November 2016
Reference: V-C8526.00
Status: Issue 1

Contents

EXECUTIVE SUMMARY

This executive summary outlines the key findings and conclusions of the Opus Desk Study Report. The reader should be familiar with the whole report and no reliance should be placed on any part of the executive summary.

This report describes the findings of a Desk Study carried out by Opus International Consultants (UK) Ltd, on the instruction of Grafton Gate Developments, to determine historical activities at the site and the potential for contamination within the shallow soils and local controlled waters.

Desk Study Findings

The historical map review has revealed that the site was initially occupied by a colliery that eventually encompassed the western, southern and central portions of the site before it closed around 1940. Four factory buildings occupied the western half of the site by 1949; two of the factories of which were used for manufacturing textiles and perfume. By the late 1960's Revlon occupied two of the factories, including the former perfume factory, which had been linked to the neighbouring factory unit to its south. A car components factory was shown to occupy the factory in the far south of the site.

Quarrying and mining activities were noted within the surrounding land particularly between the 1870's and towards the end of the 19th Century. However, no recorded historic or current landfill site has been reported within 2km of the site.

A review by Opus of the Johnson Poole & Bloomer Land Consultants (JPB) ground investigation reports has revealed that the entire site is underlain by a mantle of Made Ground, the depth of which ranges between 1.0m and 13.0m across the site. However, contaminants of concern appear to be present within relatively localised areas on site.

A gas monitoring exercise undertaken by JPB for the former PCMC section of the site identified moderately elevated levels of carbon dioxide (up to 7.8% v/v).

Risk Assessment

Based on the history of the site and the ground investigation data presented by JPB, it is considered that the site could pose a high potential risk to humans and a medium risk to controlled waters post site development. The contaminants of concern and historic features identified on site to date are considered to include the following:

- The known presence of a significant layer of Made Ground beneath the study site;
- The known storage of hydrocarbons across the site;
- Visual/olfactory evidence of hydrocarbons within subsurface soils observed during the ground investigations by JPB;
- Laboratory data confirmation of Total Petroleum Hydrocarbons including benzene detected within soil samples;
- Laboratory data confirmation of Volatile Organic Compounds including Vinyl chloride, 1,1 Dichloroethene, 1,2 Dichloroethene, Tetrachloroethene detected within soil samples;
- Inorganic and organic contaminants detected above the laboratory's method detection limit within water samples;
- Maximum carbon dioxide level of 7.8% v/v detected during ground gas monitoring exercise.

Due to the industrial/commercial nature of the previous land uses and potential associated contaminants, it is recommended that further ground investigation is undertaken to assess the site's pollution risk to local controlled waters and future site users.

1 Introduction

Opus International Consultants (UK) Limited (here referred to as Opus) has been requested by Grafton Gate Developments to undertake a Phase I Desk Study Report in relation to a proposed multi use development including residential, retail, leisure and commercial units for a site known as Ewenny Road Industrial Estate, Maesteg, CF34 9TU.

The Client's attention is drawn to Appendix C of this report for the Conditions and Limitations.

The procedure adopted for this study is in line with that given in BS 10175:2011 the British Standards Code of Practice for the investigation of Potentially Contaminated sites.

This report covers a Phase 1 Desk Study assessment only. No contamination based investigations have been undertaken at this stage.

1.1 Location and Access

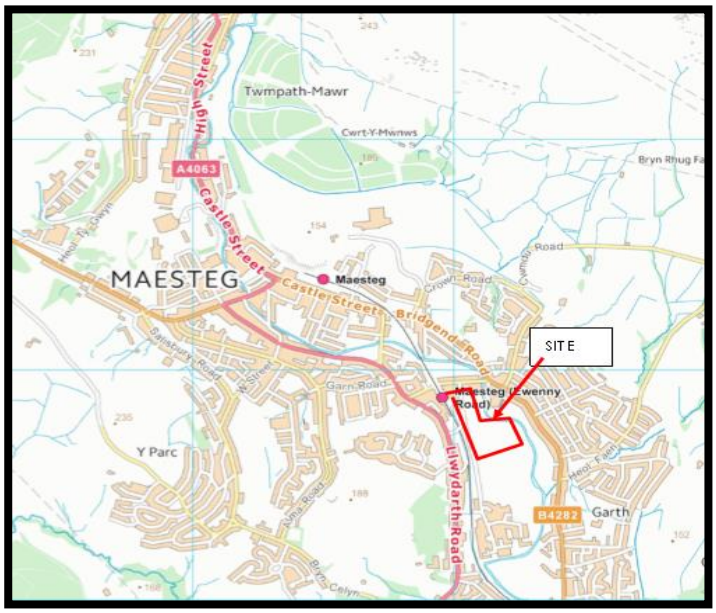
The site is located to the east of Oakwood Drive and the south of Ewenny Road approximately 900m to the south east of the centre of Maesteg (refer Figure 2.1). The site is centred at approximate National Grid Reference 286139, 190664.

Access to the site is via a number of gated entrances off Oakwood Drive. The first and second entrances are approx. 10m and 80m south, along Oakwood Drive, from the north west corner of the site. The third gated entrance is approx. 50m north, along Oakwood Drive, of the south west corner of the site.

In addition to these 'official' entrances there are a number of locations where the fence surrounding the site has been prised apart or removed entirely.

Figure 1.1 below indicates the location of the site.

Figure 1.1 Site Location Plan



1.2 Site Description

The site, as outlined by the red line on Drawing V-C8526.00/G01/R0/Ground Investigation Locations, is comprises two roughly rectangular sections forming an L-shape and is approximately 7.0 ha in plan.

A site reconnaissance was carried out by a Senior Geotechnical Engineer and Graduate Geotechnical Engineer from Opus on 13th October 2016. A series of site walkover photographs showing various views of the site and the immediate environs are presented in Appendix B.

At the time of the walkover survey, the site had been cleared of all buildings, but there were still floor slabs and other structural footings associated with its former uses remaining. The site was scattered with fly tipped household rubbish (eg. chairs and mattresses), industrial rubbish comprising canisters, drums and stripped cable (plate 1). Numerous piles of demolition rubble, which visually appeared to comprise mainly concrete and brick, with some minor wood, plastic, glass, foam, fibreglass and some suspected Asbestos Containing Material (ACM) (plate 2) were located across the site. Burnt rubbish was observed at numerous locations and the site was being used by some locals to walk their dogs. Only a portion of the borehole positions from the previous site investigation could be located, mainly where the concrete slabs had been cored.

Most recently the site was occupied by two large factory buildings. The northern part of the site (Area 1) was occupied by Pontardawe Coal and Metal Company Limited, while the southern part (Area 2) was occupied by the former Cooper Standard Factory. The boundary between these two areas is outlined on Drawing V-C8526.00/G01/R0/Ground Investigation Locations.

The western boundary of the site, along Oakwood Drive, comprised a steel fence with a number of gated entrances (plate 3). The fence along this boundary has been pulled apart and had sections removed along its length (plate 4). Inside the fence were a number of young and established trees and shrubs. The trees included beech, apple, birch and sycamore. To the west of Oakwood Drive, for the majority of the length of the site, was a concrete retaining wall.

The northern boundary of the site comprised a boundary wall with a builder's merchant.

The eastern boundary comprised a steel mesh fence, with barbed wire on-top, separating the site from a steep (>50°), heavily vegetated bank down to the Llynfi River (plate 5). The fence along this boundary has also been pulled open at various positions along its length. The vegetation along the bank comprised young and established trees, such as birch, ash and sycamore, shrubs, such as gorse and brambles, as well as the invasive species Japanese Knotweed (plate 6). The river was located approximately 3m below site level.

The southern boundary consisted of the same steel fencing as that on the western boundary and had similarly been pulled apart and had sections removed along its length. Beyond the fence was a steep vegetated bank down to a grass field in the south east and a housing estate in the south west (plate 7). The eastern side of the bank was located approximately 20° and had a track leading down to the field. The western side of the bank was observed to be far steeper (approx. 50°) with brambles and gorse located down its slope and a marshy area with reeds at its toe.

The northern portion of Area 1 comprised a narrow rectangular tarmacked area that was formerly a car park. The tarmac was noted to be cracked in numerous places and ha grass and shrubs growing through it (plate 8). To the south was a cast concrete road that entered the site through the second

entrance along Oakwood Drive. The road travelled east to the opposite boundary then ran south east and south along the eastern boundary fence. Along the section running south east was a large (approx. 200mm) curb on both sides of the road and an open manhole covered by a boulder. Similarly, the western boundary had a concrete road running along its perimeter.

The central portion of Area 1 consisted of a number of concrete slabs of varying dimensions and thicknesses (200-400mm higher than the road) (plate 9). Grass, shrubs and trees were observed to be growing through cracks and joins. This area contained numerous piles of demolition rubble that had become vegetated (plate 10). In the north east corner of the main section of Area 1 there were two raised (approx. 350mm) square concrete pads considered likely to have housed above ground tanks (plate 11). An electrical sub-station is noted to have been present in the centre of this Area, but could not be located during the walkover survey due to the presence of mounds of rubble.

In the south west corner of this area was a single room flat roofed hut, with what appeared to be a green pumping station on its north wall (plate 12). The hut was of red brick construction and had had its doors and windows removed. Inside, the walls are covered with graffiti, the ground littered with rubbish and a mattress showed evidence of fire damage. The green pumping station contained numerous pipes and valves (plate 13). A fire hydrant and water main manhole were observed in the south west corner of this area (plate 14).

A number of circular imprints on the concrete slab were observed located to the east of the hut. These imprints are considered to demark the locations of former circular above ground tanks. The imprints had diameters of approximately 1.5m and 2m (plate 15). An open manhole filled with rubble was observed within 5m to the east of this location. An additional circular slab (approx. 500mm thicker than the road) was observed within 20m south of this location (plate 16).

Close to the north-south fence between Area 1 and Area 2 was what appeared to be a raised loading bay with white lines (plate 17) and 'Non-Flammable' painted on the ground. A slot drain ran the length of this area along the road to the east (plate 18). A similar bay was observed to the south with 'Flammable', 'Non-Flammable' and 'Oxidants' painted on the ground. Further to the south were additional slabs with concrete plinths, potentially used to historically accommodate above ground storage tanks (plate 19). A red pipe with a green sealing cap was observed protruding from the ground adjacent to these (plate 20). To the east of this was what appeared to be a former delivery area on brick cobblestone (plate 21) with a slot drain running its length east to west. In the south east corner of this area were two rectangular concrete slabs, with what appeared to be a drainage channel between them. The northernmost slab had a bund located around the perimeter with a plastic membrane protruding (plate 22). The southern slab had a drain with water pooled around it (plate 23).

The boundary between Area 1 and Area 2 consisted of heras fencing with the feet of the fencing planted in concrete. The heras fencing had been pulled apart in numerous locations (plate 24) and had a block wall collapsed on it in the centre of the site.

A tarmac road ran parallel to the western boundary of Area 2, except where there was a gate in the boundary fence. At these locations a concrete road cut east through the tarmac to the central concrete slabs. The two northern gates were inaccessible and had mounds of rubble located behind them (plate 25). The third most southerly gate appeared to still be useable (plate 26). The tarmac road continued along the western and southern boundaries of the site and expanded into a parking area in the south and south eastern portions of the site (plate 27). An island was located in the central southern area of the tarmac that had become heavily overgrown with grass and shrubs. The western

part of this island consisted of a concrete slab with a bund around its perimeter (plate 28). No staining was observed on the slab. Another island was located approximately 80m to the east and comprised a concrete slab that may have potentially housed an above ground storage tank. The tank had a plastic membrane located beneath (plate 29). Approximately 50m to the east, towards the south east corner of the site is another island that was heavily vegetated with brambles (plate 30).

A small red pipe (plate 31) and monitoring well (plate 32) was observed protruding from the ground approximately 20m east of the northern most gate in Area 2. Along the north eastern boundary, between Area 1 and Area 2, where there has previously been extensive investigation for an adit, the land was strewn with rubble and was heavily overgrown (plate 33). No evidence of disturbed ground associated with the previous ground investigation was observed on this occasion.

Towards the south west of the site, to the south east of the usable gate, was a slab with multiple drainage runs (plate 34). No staining was observed in the vicinity. To the south of this was a slab covered in what appeared to be broken and peeling concrete tiles that may potentially be ACM (plate 35).

1.3 Description and Layout of Proposed Development

It is proposed to develop the site with a number of residential, commercial and retail buildings and associated car parking and community facilities as per the Masterplan Drawing provided in Appendix A.

1.4 Geology

The 1:50,000 scale Bedrock and Superficial Geological Map of the area, Sheet No. 248 indicates that the site is directly underlain by superficial (drift) material comprising Alluvium over Glacial Till (Boulder Clay). The underlying solid geology comprises the Middle Coal Measures Formation which is part of the South Wales Coal Measures Group. The Six inch Map of the area, Glamorgan Sheet 26 SW indicates the superficial soils comprise alluvial fan deposits along the western edge of the site underlain by Glacial Till.

Alluvium and alluvial fan deposits typically comprise clays, silts, sands and gravels.

Glacial Till comprises predominantly clay with some gravel, sand or boulder beds (moraines).

The Middle Coal Measures Formation is predominantly siltstone and mudstones which were deposited in lakes and delta plains. Marine bands and fluvial sandstones mark times of marine transgression or flood events (NERC, 2007). A number of coal seams are also present within this part of the bedrock sequence.

The 1:50,000 scale and Six inch geological maps indicate that the Cae David Coal seam outcrops across the centre of the site from east to west. The Two-and-a-Half seam is shown midway through the southern half of the site and the Upper Yard Seam is shown underlying the southern site boundary. The Eighteen Inch seam is not labelled but is intermediate between the Cae David and Two-and-a-Half seams.

The site is located towards the eastern end of an east to west trending anticline on the southern limb. The strata are indicated to dip to the south by approximately 8 degrees in the vicinity of the site.

1.5 Hydrogeology

Reference to available environmental data sheets for the site indicates that both the superficial and solid geology underlying the site have been designated with Secondary A aquifer status. Secondary A aquifers consist of permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases form an important source of base flow to rivers.

The overlying soils have been classified as being of High Leaching Potential (U). This description is given for soils located in urban areas where there are fewer observations than elsewhere. A worst case vulnerability classification is assumed until proven otherwise.

The site is not located within an Environment Agency designated groundwater Source Protection Zone.

A review of the environmental data sheets provided in the JPB information made available to Opus, indicates that the closest licensed discharge consent is operated by Dwr Cymru Cyfyngedig Water Company for the discharge of storm sewage overflow into the Nant Y Twlc. The discharge point is located approximately 90m south east of the site. A further two licensed discharge consents, both of which are also operated by Dwr Cymru Cyfyngedig for the discharge of storm sewage overflow, are located approximately 150m south east and north west of the site. One consent discharges into the River Llynfi and the other discharges into the Nant Y Twlc.

No licensed groundwater or surface water abstraction has been reported within 2km of the site.

1.6 Hydrology

The nearest surface water feature is the River Llynfi, which flows parallel to the site's eastern boundary. An arrow on the site sensitivity map indicates that the river flows in a roughly north to south direction.

1.7 Radon

Reference has been made to Annex A of the BR211 Radon: Guidance on protective measures for new dwellings (2015 edition). The BR211 guidance indicates that the property is in a lower probability radon area, as less than 1% of homes are above the action level and therefore no radon protective measures are required for the new residential buildings.

Although this guidance was not prepared for non-domestic buildings, the protection from radon at work is specified in the Ionising Radiations Regulations 1999 legislation made under the Health and Safety at Work Act administered by the Health and Safety Executive (HSE) and it is therefore considered prudent to consult this guidance for the proposed commercial units. The BR211 indicates that no radon protective measures are required for the new buildings.

1.8 Environmental Considerations

The salient issues that relate to the site are summarised as follows.

The closest recorded Local Authority Pollution Prevention and Controls (LAPPC) license historically pertained to Cooper Standard Automotive (UK) Sealings Ltd, located approximately 120m north

west of the site. The LAPPC pertained to the use of adhesive coatings. The second closest reported LAPPC pertained to a petrol filling station located approximately 230m north of the site.

The nearest reported pollution incident to controlled waters is noted to have occurred towards the centre of the site. The incident involved the spillage of detergents, surfactants and diesel oil however the receiving water is not provided. The Environment Agency recorded the severity of the incident as a Category 1 major incident for the released chemicals and Category 2 significant incident for the spillage of diesel. These incidents are both recorded as occurring on the 3rd September 1994.

Another pollution incident was recorded that occurred towards the site's eastern boundary. This incident involved the direct discharge of treated effluent. The incident was recorded as a Category 2 significant incident that occurred on the 10th January 1992.

Two Substantiated Pollution Incident Register entries have been recorded that both relate to the site. One incident is recorded as occurring on the 26th March 2010 and is noted to have been a Category 2 'significant impact' to land and a minor incident with regards to impact to water. The pollutant involved was registered as 'other organic chemical or product'. The second incident is recorded as occurring on the 30th June 2010 and is noted to have had a significant incident in terms of impact to land. The pollutant involved was registered as 'inert: construction / demolition material'.

No waste facility such as a BGS or Local Authority recorded landfill site, historic landfill site or licensed waste management facility has been reported within 2km of the site.

No designated sensitive land use type has been reported within 2km of the site.

The contemporary trades reported with 150m of the site are listed as follows in Table 1.1.

Table 1.1 Contemporary Trade Entries

Trade	Active/Inactive	Approximate distance from Study Areas
Builders' Merchants	Active	3m north west
Precision Engineers	Active	94m north
Garage Services	Active	100m north
Metal Products - Fabricated	Active	145m north west

1.9 Present and Former Site Uses

The site has been cleared of all buildings, but there are still floor slabs and other structural footings associated with its former uses remaining. Fly tipped material, piles of demolition rubble and burnt material from site fires are located across the site.

1.9.1 Historical Search

Opus has undertaken a study of historical OS map extracts for the site and surrounding area, which are contained in the JPB ground investigation reports. A review of the maps is provided in Table 1.2.

Table 1.2: Review of Historical Map Extracts

Date	Comments
1876 - 1877 source map scale 1:2,500	Oakwood Colliery is located on site. A railway terminus and sidings are located on the western site boundary and access tracks are shown to extend across the site from west to north east and south. The extent of opencast mining at the site is depicted on the map, which encompasses the central western section of the site. A number of buildings and cuttings are shown within this part of the site. No development appears to have occurred on the north and southern sections of the site. A tributary of the River Llynfi is shown to pass through the south eastern section of the site, entering the site from the central eastern boundary and exiting at the southern boundary. Two quarries are located in the surrounding land, one located approximately 250m south east of the site and one located approximately 250m west of the site. An area of excavated ground is also shown located beyond the railway line to the west of the site. Coke ovens have been identified on the land that appear to be located just beyond the site's south western site boundary.
1899 source map scale 1:2,500	The Colliery is now identified as being under the ownership of Maesteg Merthyr and the area of opencast mining appears to have extended towards the centre and south on site. An engine house is located on site and to the west of the western site boundary.
1918 - 1919 source map scale 1:2,500	The area of opencast mining has expanded further on site. A mining adit is noted on the western site boundary, which extends off site to the west and appears to terminate beyond the railway line.
1939 - 1940 source map scale 1:2,500	The colliery is no longer identified, however disturbed ground from historic mining is still illustrated on-site. A few of the buildings associated with the colliery are shown to have remained on site including a chimney. The quarries and coke ovens previously noted in the surrounding land are no longer shown,

Date	Comments
	although some cuttings remain in the surrounding land as evidence of previous earth works. The railway line sidings and station are no longer shown within the west of the site.
1949 source map scale 1:10,560 (aerial photograph)	The site is shown to be occupied by four buildings, three of which look identical in plan view.
1951 - 1971 source map scale 1:1,250	Three factories and a works are shown to occupy the western half of the site. Athenia Works (textiles) occupies the far north of the site. A perfume factory is identified to the south of the textile works. An electricity substation is located off the south west corner of the perfume factory. The other two factory's uses are not identified. The eastern half of the site is shown to be predominantly occupied by excavated ground. The tributary is no longer shown to cross the south eastern section of the site. A corporation yard is located immediately north of the site. A slaughter house is identified to the north east of the site, located immediately beyond the River Llynfi. A pond is located to the south west of the site with allotment gardens shown beyond.
1969 - 1976 source map scale 1:1,250	Athenia works remains in the north of the site, but the perfume factory and neighbouring factory have been linked and is identified as Revlon Works. Hoppers and tanks are shown located adjacent to the east and south of the works. A car components factory occupies the southernmost factory, which has been extended in size. Three tanks are shown located towards the southern site boundary. The eastern half of the site appears to have been levelled out.

Date	Comments
1993 source map scale 1:1,250	With exception to an electricity substation located in the southern half of the site, the site appears relatively unchanged compared to the previous edition.
1995 - 1996 source map scale 1:1,250	Athenia Works, which was previously located in the north of the site, appears to have been removed. The remainder of the site and surrounding land appears relatively unchanged compared to the previous edition.
1999 – 2011 source map scale 1:10,000	The site and surrounding land appears relatively unchanged compared to the previous edition.

2 PREVIOUS INVESTIGATIONS

It is understood that two separate ground condition assessments have been undertaken by Johnson Poole & Bloomer Land Consultants (JPB) for the study site, one for the Bridgend County Borough Council (BCBC) owned land and one for the Pontardawe Coal and Metal Company Ltd (PCMC) owned land. Opus has reviewed the following reports undertaken by JPB relating to both parts of the site.

2.1 Bridgend County Borough Council Owned Land

Johnson Poole & Bloomer Land Consultants *Former Cooper Standard Site Ewenny Road, Maesteg, Phase 2 Site Investigation and Grouting – Progress Report No.1* dated 10 March 2011 Reference Number LC304-96/NJW with supplementary information from JPB *Report on Site Investigations at Ewenny Road Industrial Estate Maesteg* dated October 2010 Reference Number KC709-65/NJW.

The progress report provided a summary of ground investigation works that had been completed at the Former Cooper Standard Site by JPB together with a summary of their findings with regards to ground contamination, mining stability and an old adit. The salient information in terms of ground contamination are summarised in Table 2.1.

Table 2.1: Summary of JPB comments and findings for Former Cooper Standard Site

Phase I Desk Study	
The report included a desk study with preliminary conceptual site model. The desk study report identified the following potentially contaminative land uses: • Likely presence of significant thicknesses of Made Ground on site, much of it comprising Colliery Spoil. • Due to the previous industrial use of the site, the potential for ground contamination exists, particularly in the area of previous "storage tanks" and historic "sub-stations". • Made Ground on site could be considered a potential source of "ground gas".	
Phase II Geo-Environmental Investigation	**Summary of JPB comments and findings**
Windowless Sample Holes	• 58 No. windowless sample holes total to max. depth 4.0m begl. (Feb 2010 - Feb 2011)
WS1 –	• Understood to have targeted an oil tank • 4 No. additional windowless sample holes sunk around WS1 in February 2011 as part of a delineation exercise • No specific mitigation was considered necessary based on no significantly elevated TPH being identified

WS9	• 12 No. additional windowless sample holes sunk around WS9 in February 2011 as part of a delineation exercise • Elevated levels of arsenic, lead and occasional cadmium identified within soil samples taken from between 0.45m and 0.70m depth.
Sub Station	• Five No. additional windowless sample holes sunk beneath and around location of an electricity substation as part of a delineation exercise to determine depth of contamination • No PCBs encountered • "Oils" noted at 1.20m depth at two locations with oil identification being undertaken to confirm type at the time of issuing the progress report. • Consideration of additional sampling • Consideration of remediation of soils due to landfill disposal route being considered unlikely
WS12 – local hydrocarbons	• 8 No. additional windowless sample holes sunk around WS12 in February 2011 as part of a delineation exercise. • Visual and olfactory evidence of hydrocarbons had been identified at shallow depth "east of original elevated levels" • Local risk to human health to be considered • The report recommended that if further ground investigation was to be undertaken, further laboratory analysis of soil samples to be considered.
"Pickling Shop" WS25	• 14 No. additional windowless sample holes sunk around WS25 in February 2011 as part of a delineation exercise. • Volatile Organic Compounds (VOCs) including Vinyl chloride and 1,2-Dichloroethene had been detected at concentrations within the soil that were considered by JPB to pose a significant risk to human health and possibly groundwater; • It was noted that additional VOC analysis was being undertaken at the time of issuing the progress report; • Consideration of further sampling in the area of WS25 "Pickling Shop" and installation of local groundwater monitoring facilities was noted;
Chemical Testing	**Highest values reported for soils:** • Arsenic WS909/0.75m **1358mg/kg** • Cadmium WS909/0.75m **31.28mg/kg** • Lead WS909/0.75m **12,280mg/kg** • Vinyl Chloride WS262/0.6m **1.38mg/kg** • 1,1 Dichloroethene WS262/0.6m **0.46mg/kg** • 1,2 Dichloroethene WS262/0.6m **146m/kg** • Tetrachloroethene WS262/0.6m **4.72mg/kg** • Benzene WS262/0.6m **0.026mg/kg**

	• Aliphatic C10-C12 WS124/0.4m **250mg/kg** • Aliphatic C12-C16 WS124/0.4m **311mg/kg**

2.2 Pontardawe Coal and Metal Company Ltd Owned Land

Johnson Poole & Bloomer Land Consultants (JPB) Summary Statement on Ground Conditions PCMC Project Ewenny Road, Maesteg dated 28 October 2013 Reference Number NC8383-80/NJW including factual information from this investigation.

This report provided a summary of ground conditions including the findings of recent investigation works, groundwater/ground gas monitoring and a historical land use review for the former Pontardawe Coal and Metals Company Limited (PCMC).

The site history review identified the following potential sources of contamination:

- Historic coal mining activities at the site and within the surrounding land
- Historic placement of spoil mounds located on site from the on-site Colliery
- A textiles factory occupied the north western corner of the site (Athenia Works)
- Factories and a works were located within the western half of the site, the 'central factory' identified as a perfume factory and later occupied by Revlon Cosmetics. Numerous tanks and hoppers were recorded on site associated with Revlon.

Johnson Poole & Bloomer Land Consultants Site Investigations for Portardawe Coal and Metals Company Ltd's Project Ewenny Road Maesteg dated November 2013 Reference Number NC838-83/NJW

Following on from the above summary statement, Opus has reviewed the full site investigation report undertaken at PCMC. The above report covers the intrusive site investigation that encompassed approximately 5.6 hectares of land that at the time of the report's issue was understood to be under the ownership of Pontardawe Coal & Metals Company Limited.

It is understood that the risk from Asbestos Containing Material (ACM) on site has been previously dealt with via the remediation of ACM impacted demolition material**.**

The study area included an irregularly shaped parcel of land located between Oakwood Drive, Maesteg and the Afon Llynfi (river). The report was required to facilitate the preparation of a technical report to accompany a Planning Application for mixed land uses including residential.

The outlines of historic buildings, which had been demolished by the time of the ground investigation, are understood to have been evident on-site. Mounds of screened demolition waste were scattered around the site at the time of carrying out the investigation works.

JPB was commissioned to provide an interpretative report that presented the fieldwork and laboratory testing undertaken together with information on the ground and groundwater conditions

underlying the site. A summary of the ground investigation methods and findings is presented as follows.

Phase I Desk Study	
The report included a desk study with preliminary conceptual site model. The desk study report identified the following potentially contaminative land uses: • Likely presence of significant thicknesses of Made Ground on site, much of it comprising Colliery Spoil. • Due to the previous industrial use of the site, the potential for ground contamination exists, particularly in the area of previous "storage tanks" and historic "sub-stations". • Made Ground on site could be considered a potential source of "ground gas".	
Phase II Geo-Environmental Investigation	**Summary of JPB comments and findings**
Trial Pits	11 No. trial pits 0.15 – 3.0m begl Assess the load bearing characteristics and ground chemistry of the near surface soil succession
Boreholes	8 No. boreholes 3.3m – 23.45m begl. Assess load bearing characteristics and ground chemistry of the near surface soil succession 5 No. completed as combined gas/groundwater monitoring and sampling wells.
Rotary Drilling	5 No. rotary open hole drillholes 28.0m – 35.0m Assess the solid geological/mining structure and investigate for the presence of old mine workings
Windowless Sample Holes	45 No. window sample holes 0.3m – 4.0m begl. Load bearing characteristics and ground chemistry of the near surface soil succession
Chemical Testing	**Soils Analysis:** • 50 No. total sulphate, water soluble sulphate, pH, sulphide, total sulphur, monohydric phenols, total cyanide, speciated Poly Aromatic Hydrocarbons (PAH USEPA 16), Arsenic, Mercury, Selenium, Lead, (Total and Hexavalent) Chromium, Cadmium, Copper, Nickel, Zinc and Soil Organic Matter • 19 No. Extractable Petroleum Hydrocarbons (EPH) Screen C10 to C40 (with clean-up). • 11 No. Speciated Total Petroleum Hydrocarbons (TPH) (CWG/UK) including BTEX Compounds and MTBE.

	• 12 No. Asbestos Screen. • 20 No. Volatile Organic Compounds (VOC's). • 5 No. Alcohols Suite with Acetone (4 No.). • 1 No. Polychlorinated Biphenyls (PCB's) (combined Dutch 7 and WHO 12 Congeners Suite). **Aggressive Ground Conditions – Buried Concrete** • 24 No. soil samples analysed for pH, water soluble and total sulphate and total sulphur • 7 No. soil samples analysed for pH and water soluble sulphate **Water Analysis:** • 4 No. water samples Arsenic, Mercury, Selenium, Copper, Nickel, Zinc, Lead, Chromium, Cadmium, Boron, pH, Sulphate, Sulphide, Sulphur, (total and free) Cyanide, Thiocyanate, Phenols and Poly Aromatic Hydrocarbons (PAH USEPA 16), Speciated Total Petroleum Hydrocarbons (TPH) (CWG/UK), BTEX Compounds and MTBE and Volatile Organic Compounds (VOC's). **Leachability Analysis:** • 4 No. displaying the highest total metals (Arsenic, Lead and Zinc) and 2No. speciated PAH (USEPA 16) **Potential Combustibility** • 14 No. Loss on Ignition (LOI) • 3 No. Calorific Value (CV)
Made Ground	Concrete typically 0.15m – 0.30m in thickness, commonly reinforced with mesh and often underlain by a thin layer of 'granular engineering fill'. Made Ground is located across the site that thickens in a southerly and easterly direction. The thickness of the Made Ground layer varied between 1.0 to 13m and consisted of a mixed material in the northern site reaches, burnt shale towards the centre of the site, slag fill beneath the central western reaches and colliery spoil within the southern reaches. An area of shallow obstructions (apparently slag fill) was encountered upon the central western reaches of the site, which limited the depth of investigation.
Superficial Deposits	Medium dense and dense, variably graded sands and gravels with cobbles encountered between 16.0m and 23.2m begl within the southern reaches of the site; 13.70 metres bgl just beyond the south-western corner of the site, adjacent to Ewenny Road; depth not generally proved on the central and northern reaches of the site.

Solid Deposits	The drilling works identified either intact coal or broken ground, interpreted to represent old workings in the Cae David seam, at depths of 22.30 to 30.80 metres below ground level. Four coal seams are anticipated to be located beneath and beyond the site to the south.
Groundwater	Groundwater was recorded generally between 1.0 and 2.7m bgl within the trial pits, which were excavated in the northern reaches of the site, where water was mainly encountered within the natural soils. No groundwater was encountered within the windowless sample holes, which targeted the Made Ground. Standing groundwater levels were recorded in 5 No. monitoring wells. The groundwater level ranged between 1.77 – 1.85m recorded in Borehole 1 located upon the northern reaches of the site and 5.38 – 7.21m recorded in Borehole 7 located upon the southern reaches of the site. Groundwater samples were retrieved from the site and sent for laboratory analysis. A groundwater risk assessment is beyond the scope of this report.
Exploratory Holes	Olfactory/visual evidence of contamination noted in the following: • WS6 0.8m and 1.0m hydrocarbon odour • WS24 0.12-2.0m strong hydrocarbon odour • WS28 0.8-2.0m hydrocarbon odour • WS42 0.1-4.0m hydrocarbon odour
Chemical Testing	Highest values reported for soils: • Benzene WS28/0.8-2.0m **0.66mg/kg** • Aliphatic C12-C16 WS24/0.12 – 0.50m **290mg/kg** • Aromatic C12-C16 WS24/0.12 – 0.50m **400mg/kg** • Aromatic C16-C21 WS24/0.12 – 0.50m **770mg/kg** • Aromatic C21-C35 WS24/0.12 – 0.50m **1900mg/kg** • VOCs – notes by testing laboratory 'deviating samples due to no sampled date supplied'.
Gas and Groundwater Monitoring	8 No. gas monitoring visits undertaken between 10.09.13 and 26.11.13. Summary of gas results as follows: • Range of methane levels 0.0% - 1.8% v/v, • Range of oxygen levels 0.3% - 21.6% v/v, • Range of carbon dioxide levels 0.0% - 7.8% v/v, • Range of carbon monoxide levels 0.0 – 7.0ppm, • Range of hydrogen sulphide levels 0.0% - 1.0ppm, • Range of flow rates 0.1 – 3.6l/hr The report's ground gas risk assessment determined the ground gas regime to fall within 'Amber 1' based on the gas data collected above.

The summary report's remarks regarding land contamination notes that 'mitigation measures' will not generally be required in the context of risk to human health. Proposed gardens and areas of soft landscaping will require a suitable growing medium. However, supplementary sampling was being undertaken for areas where locally elevated PAHs had been detected.

Additional groundwater sampling was considered necessary beneath/adjacent to tank locations.

Ground gas monitoring data indicated that some ground gas protection measures would be required based on the presence of elevated levels of carbon dioxide.

3 ENVIRONMENTAL ASSESSMENT

3.1 General

In order for land affected by contamination to cause harm or pollution, there must be a source of the contamination (such as toxic or harmful substances in the ground), a receptor that can be harmed (such as a person whose health could be affected by the contamination or a controlled water that could be polluted by it) and a pathway by which the receptor can be exposed to the contamination (such as through direct skin exposure to contaminated soil or ingestion of contaminated water or contaminated vegetables grown in the soil).

In addition to the risk to health and plant life, contaminants may also attack materials in building components. This includes the effect of sulphates on concrete structures and also contaminants passing through walls of water service pipes or causing degradation of pipework and affecting the taste or potability of water supplies and the accumulation of gases creating potentially explosive or asphyxiant conditions.

3.2 Potential Sources of Contamination

The study site currently comprises a vacant area of industrial land that has historically accommodated several industrial and commercial trades associated with coal mining, railway land, textile, cosmetics and automobile manufacturing.

The historical map review has revealed that the site was initially occupied by a colliery that eventually encompassed the western, southern and central portions of the site. The colliery is indicated to have become inactive by 1940. Much of the former colliery land appeared to have been levelled out with four factory buildings shown occupying the western half of the site by 1949; two of the factories of which were used for manufacturing textiles and perfume. An electricity substation was located within the grounds of the perfume factory.

A tributary of the River Llynfi was noted to have historically flowed through the south eastern portion of the site during the time of the colliery being operational.

By the late 1960's Revlon occupied two of the factories, including the former perfume factory, which had been linked to the neighbouring factory unit to its south. A car components factory was shown to occupy the factory in the far south of the site. Various hoppers and tanks were located within the grounds of the factories. No information has been found regarding the contents of the tanks on site, however the laboratory analysis reports provided in the JPB ground investigation reports indicate that diesel and heating oil were stored on site. Ground contamination associated with an electricity substation was also indicated on site.

A source of VOCs exists within the soils on site and appears to be associated with a 'pickling shop' historically located within the former Cooper Standard Factory area of the site. It is considered that the 'pickling shop' refers to activities that would have involved the finishing process in the production of metal automobile parts in which oxide and scale are removed from the surface of the metal by dissolution in acid. A solution of either hydrogen chloride (HCl) or sulfuric acid is generally used to treat carbon steel products, while a combination of hydrofluoric and nitric acids is often used for stainless steel.

If hydrogen chloride was used on site then potentially residues were left in the ground from leaks or spillages. Over time these residues may have reacted with a combination of naturally occurring elements such as oxygen and/or other residue contaminants to form chlorinated hydrocarbons resulting in the creation of compounds such as vinyl chloride.

The site remained relatively unchanged until the mid-1990's when the former textile factory was no longer mapped as occupying the far north of the site.

The surrounding land use appeared to change in accordance with the activities occurring at the colliery. The railway line currently located to the west of the site appears to have historically had infrastructure that was located at the western site boundary where the railway line was likely to have been used to transport coal from the site. This infrastructure (station and sidings) disappeared once the colliery was shown to no longer occupy the site by the 1940's.

Quarrying and mining activities were noted within the surrounding land particularly between the 1870's and towards the end of the 19th Century. However, no recorded historic or current landfill site has been reported within 2km of the site.

By the 1950's a corporation yard had appeared on the land located adjacent to the site's northern boundary and an abattoir occupied an area of land located to the north of the site, on the opposite side of the River Llynfi. A pond and allotment gardens were located to the south west of the site. A builder's merchants remains to the north of the site today.

Significant site investigation has been undertaken at the site in the last five years by JPB. A review of the reported information by Opus has revealed the following contaminants of concern within the soils at the site:

- Arsenic;
- Cadmium;
- Lead
- VOCs including Vinyl chloride, 1,1 Dichloroethene, 1,2 Dichloroethene, Tetrachloroethene
- Benzene
- TPH: predominantly diesel range organics

The contaminants detected above appear to be present within relatively localised areas on site.

JPB's ground investigations have revealed that the entire site is underlain by a mantle of Made Ground, the depth of which ranges between 1.0m and 13.0m across the site. Depths of Made Ground

are considered to vary based on activities associated with the closure of the colliery i.e. infilling of excavated land and redevelopment of the site for occupancy by the factory buildings such as general earthworks to bench and level the site. Infill material was found to consist of colliery spoil, burnt shale, slag or mixed material and its composition tends to vary by its location on site. In addition, historic coal shafts remain beneath the site and unspecified spoil heaps including demolition waste are located across the site's surface.

A gas monitoring exercise undertaken by JPB for the former PCMC section of the site identified moderately elevated levels of carbon dioxide (up to 7.8% v/v).

3.3 Receptors of Contamination and Migration Pathways

Receptors are defined as human beings, ecological systems, property or controlled waters that have the potential to experience adverse effects from direct or indirect exposure to contaminated material.

Migration pathways are defined as the courses chemicals take from a source to an exposed organism or receptor. The exposure pathway can be direct (i.e. stays within the same exposure media) or indirect where transport from one medium to another takes place.

Given the Secondary A aquifer status of the underlying geology and the close proximity to the River Llynfi, the environmental sensitivity of the site is considered to be high.

The following potential human health, property and environmental receptors have been identified assuming the proposed future redevelopment including residential and commercial uses:

» Humans	Site Residents – adults and children (proposed housing)
	Site Workers – adults (proposed commercial properties)
	Construction Workers - adults
	Service Maintenance Workers - adults
» Water	Local groundwater contained in the underlying Secondary A aquifer (superficial geology)
	River water (River Llynfi) from vertical and/or lateral migration
» Construction Materials	For new buildings

Based on the above the following plausible migration pathways and receptors have been identified assuming the proposed future residential and commercial land uses:

Inhalation

Human health can potentially be at risk from breathing dust and vapours from contaminated soil in the outdoor air and also the inhalation of fugitive dust inside buildings. Vapours from contaminated soil and groundwater can also migrate into buildings and be inhaled by the occupants.

Ingestion

Human health can potentially be at risk from eating and swallowing of contaminated soil. Ingestion can also occur by accidently or deliberately eating contaminated soil, particularly children e.g. when playing out in the garden, or indirectly by eating or smoking with dirty hands etc., or by ingestion of fugitive dust;

Dermal Contact

Human health can be potentially at risk from direct skin contact with contaminated soil and groundwater causing skin conditions such as dermatitis etc. and also dermal contact with fugitive dust inside buildings. Certain contaminants can be absorbed into the body through the skin or enter directly through open cuts and abrasions;

Uptake by Plants

Some contaminants may be toxic to plants (phytotoxic) but not necessarily to human health at the same concentrations. In addition, plants may uptake contaminants through their roots. Plant growth can also be adversely affected by ground gases;

Leaching

Infiltration of water through soil can leach out soluble contaminants resulting in groundwater pollution;

Migration of Contaminated Water

Depending on the permeability of ground conditions and any other man-made voids or preferential pathways, contaminated groundwater can potentially migrate laterally or vertically impacting adjacent surface and groundwater;

Migration of Ground Gas

Ground gases and/or volatile hydrocarbon vapours/VOC's may migrate laterally or vertically through permeable or voided ground and accumulate within unprotected buildings.

Aggressive Attack

Some buildings and materials can be damaged by direct contact with aggressive ground conditions, for example sulphate attack on concrete and hydrocarbon attack on plastics.

4 Conceptual Model and Hazard Assessment

4.1 Introduction

The legislative framework for the regulation of contaminated land is contained in Part 2A of the Environmental Protection Act 1990, which was implemented in the Contaminated Land (Wales) Regulations 2001 (and subsequent amendments). This legislation allows for the identification and remediation of land where contamination is causing unacceptable risks to human health or the wider environment. The basis of the UK contaminated land policy is the 'Suitable for Use' approach, which states that land should be suitable for its current use and made suitable for any new use as official permission (through the planning process) is given for that use.

Under Planning Policy Wales, dated January 2016 (Edition 8), the Welsh Government's objectives are to:

- maximise environmental protection for people, natural and cultural resources, property and infrastructure; and
- prevent or manage pollution and promote good environmental practice.

Land contamination must be considered in the preparation of development plans to ensure that:

- new development is not undertaken without an understanding of the risks, including those associated with the previous land use, mine and landfill gas emissions, and rising groundwater from abandoned mines;
- development does not take place without appropriate remediation;
- consideration is given to the potential impacts which remediation of land contamination might have upon the natural and historic environments.

Based upon the data collected to date the primary potential for contamination at this site arises from the following:

- historic industrial use of the site as a colliery with associated coal mining activities and railway land;
- historic commercial/industrial use of the site for the manufacturing of textiles, perfume, cosmetics and automobile parts;
- The known storage of hydrocarbons (laboratory analysis results indicate diesel and heating oil) across the site;
- Volatile Organic Compounds including Vinyl Chloride known to be present within the soils in the far south of the site;
- Visual observation of oils at approximate depth of 1.2m bgl. associated with an electricity substation
- Significant depth of Made Ground associated with on-site infilling activities located across the site known to comprise mixed materials, colliery spoil, burnt shale and slag.

Primary receptors are considered to be future site residents, construction workers, site employees, maintenance workers and local controlled waters including surface (River Llynfi) and groundwater (Secondary A aquifer).

4.2 Revised Conceptual Site Model

JPB has provided a preliminary conceptual site model within their Phase I assessment of the site, which was used to target their subsequent ground investigations. Therefore, Opus has produced a revised conceptual site model based on our review of JPB's ground investigation results and findings. The revised conceptual site model shows the likelihood of a relevant pollutant linkage being realised on site based on the site investigation data obtained to date by JPB and assuming the proposed future mixed residential and commercial end use. Also included in the revised CSM are potential pollutant linkages that are considered to require further consideration including ground investigation to determine their risk to the proposed development.

Source	Pathway	Receptor	Potential Risk[1¹] (R*/P**)	Exposure Pathway(s) considered relevant	Further Ground Investigation Required? Y/N
Elevated metals (Lead, Arsenic, Cadmium) impacted Made Ground local to WS9 Former Cooper Standard Site	Ingestion of contaminated soils P1	Construction workers	High (R)	P1, P2, P3 (short term)	N
		Maintenance workers	High (R)	P1, P2, P3 (short term)	N
	Dermal contact with contaminated soils P2	Future employees	Negligible	None	N
	Inhalation of contaminated dust P3 (indoor/outdoor air)	Future Residents	Medium (R)	P1, P2, P3 (long term)	N
Localised oil impacted Made Ground local to electricity substation Former Cooper Standard Site	Ingestion of contaminated soils P1	Construction workers	Medium to high (R)	P1, P2, P3 (short term)	Y
		Maintenance workers	Medium to high (R)	P1, P2, P3 (short term)	Y
	Dermal contact with contaminated soils P2	Future employees	Low (R)	P3 (potentially long term)	Y
	Inhalation of contaminated air P3 (indoor/outdoor air)	Future Residents	Low to Medium (R)	P1, P2, P3 (long term)	Y
Hydrocarbon contamination (diesel range organics) impacted Made Ground local to WS12 Former Cooper Standard Site	Ingestion of contaminated soils P1	Construction workers	Medium to high (R)	P1, P2, P3 (short term)	N
		Maintenance workers	Medium to high (R)	P1, P2, P3 (short term)	N
	Dermal contact with contaminated soils P2	Future employees	Low	P3 (potentially long term)	N
	Inhalation of contaminated air P3 (indoor/outdoor air)	Future Residents	Low	P3 (long term)	N

[1] * A Relevant Pollutant Linkage identified at a site describes the pollutant linkage that has been identified through the process of risk assessment to be casing or having the potential to cause harm.
** A Potential Pollutant Linkage requires further site investigation to be undertaken to determine if it is a relevant pollutant linkage.

Source	Pathway	Receptor	Potential Risk[1] (R*/P**)	Exposure Pathway(s) considered relevant	Further Ground Investigation Required? Y/N
VOC and benzene contamination impacted Made Ground local to WS25 (pickling shop) Former Cooper Standard Site	Ingestion of contaminated soils P1	Construction workers	High (R)	P1, P2, P3 (short term)	Y
		Maintenance workers		P1, P2, P3 (short term)	
	Dermal contact with contaminated soils P2				
		Future employees	High (R)	P3 (potentially long term)	Y
	Inhalation of contaminated air P3				
	(indoor/outdoor air)	Future Residents	Medium to High (R)	P1, P2, P3 (long term)	Y
TPH inc. benzene contamination (diesel and heating oil range organics) impacted Made Ground local to above ground fuel storage tanks within PCPW area	Ingestion of contaminated soils P1	Construction workers	High (R)	P1, P2, P3 (short term)	Y
		Maintenance workers	High (R)	P1, P2, P3 (short term)	Y
	Dermal contact with contaminated soils P2				
		Future employees	Low (R)	P3 (potentially long term)	Y
	Inhalation of contaminated air P3				
	(indoor/outdoor air)	Future Residents	Medium to High (R)	P1, P2, P3 (long term)	Y
Made Ground located across proposed development area	Ingestion of contaminated soils P1	Construction workers	Medium (R)	P1, P2, P3 (short term)	N
		Maintenance workers	Medium (R)	P1, P2, P3 (short term)	N
	Dermal contact with contaminated soils P2				
		Future employees	Low to negligible (R)	P3 (potentially long term)	N
	Inhalation of contaminated air P3				
	(indoor/outdoor air)	Future Residents	Medium (R)	P1, P2, P3 (long term)	N

Source	Pathway	Receptor	Potential Risk[1] (R*/P**)	Exposure Pathway(s) considered relevant	Further Ground Investigation Required? Y/N
TPH inc. benzene, PAH and VOCs detected within water samples retrieved from monitoring wells on-site	Ingestion of contaminated water P4	Construction workers	Low to medium (R/P)	P4, P5, P6 (short term)	Y
		Maintenance workers	Low to medium (R/P)	P4, P5, P6 (short term)	Y
	Dermal contact with contaminated water P5	Future employees	Low (R/P)	P6 (Potentially long term)	Y
	Inhalation of contaminated air P6 (indoor/outdoor air)	Future Residents	Low to medium (R/P)	P4, P5, P6 (long term)	Y
Contaminants detected within water samples	Lateral and vertical migration P7	Groundwater – Secondary A Aquifer	Medium (R/P)	P7 (long term)	Y
Contaminants detected within water samples	Lateral and vertical migration P7	River Llynfi	Medium (R/P)	P7 (long term)	Y
Ground gases from subsurface	Generation, migration and accumulation inside proposed buildings P8	Construction workers	Medium (R/P)	P9 (short term)	Y
		Maintenance workers	Medium (R/P)	P8/P9 (short term)	Y
	Exposure during ground works P9	Future employees	Low to medium (R/P)	P8/P9 (potentially long term)	Y
		Future Residents	Low to medium (R/P)	P8 (long term)	Y

5 Conclusions and Recommendations

Based on the history of the site and the JPB site investigation reports made available to Opus, it is considered that the site could pose a high potential risk to humans and a medium risk to controlled waters. The contaminants of concern and historic features identified on site to date are considered to include the following:

- The known presence of a significant layer of Made Ground beneath the study site;
- The known storage of hydrocarbons across the site;
- Visual/olfactory evidence of hydrocarbons within subsurface soils observed during the ground investigations by JPB;
- Laboratory data confirmation of Total Petroleum Hydrocarbons including benzene detected within soil samples;
- Laboratory data confirmation of Volatile Organic Compounds including Vinyl chloride, 1,1 Dichloroethene, 1,2 Dichloroethene, Tetrachloroethene detected within soil samples;
- Inorganic and organic contaminants detected above the laboratory's method detection limit within water samples;
- Maximum carbon dioxide level of 7.8% v/v detected during ground gas monitoring exercise.

Based on the findings of the JPB ground investigation, particularly the known presence of volatile organic compounds within the soil and proximity of the River Llynfi to the site, the site's water pollution risk needs to be assessed.

The majority of the site has been built up in level with Made Ground generally comprising colliery spoil. Ground gas and localised volatiles could potentially accumulate within the proposed buildings, which could pose a risk of asphyxiation and/or inhalation of contaminated air to future site users and/or a risk of explosion to the buildings. Further gas risk assessment should be undertaken to enable the ground gas regime beneath the site to be fully characterised with regard to the sensitivity of each proposed land use in accordance with BS 8485:2015 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.

Laboratory analysis for total petroleum hydrocarbons undertaken by JPB, indicates that the hydrocarbons detected within soil samples predominantly comprise diesel and heating oil range organics and therefore theoretically are not likely to readily volatilise. However a source of volatile organic compounds has been discovered in the southern section of the site, which could pose an inhalation risk to future site users.

It is recommended that gas level data is collected with regards to VOC levels in accordance with BS 8576:2013 Guidance on investigations for ground gas - Permanent gases and volatile organic compounds (VOCs). This would require further intrusive site investigation to provide appropriate monitoring well installation apparatus.

It is considered that the above proposed works be approved by Bridgend County Borough Council's Contaminated Land Team and the Environment Agency prior to any irrevocable work being carried out on site.

Waste Analysis Criteria (WAC) analysis is recommended to assist with the disposal of spoil on site to a suitably licensed landfill.

DRAWINGS

V-C8526.00/G01/R0/Ground Investigation Locations

APPENDIX A

Proposed Construction Masterplan

APPENDIX B

Site Walkover Survey Photographs

APPENDIX C

Conditions and Limitations

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