



Neath Port Talbot County Borough Council

Preliminary Contamination Assessment

Regent Street Gas Works, Briton Ferry

FINAL

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Ref: 08818/R3054

November 2005

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08818/MDW/R3054

**Regent Street Gas Works, Briton Ferry
Preliminary Contamination Assessment**

This report is approved for issue outwith the Company

..... **Project Director**
Paul Tucker

Issue History

Issue No	Issue Date	Purpose
01	November 2005	Draft
01	11th November 2005	Final Draft
01	16th November 2005	Final

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CONTENTS

EXECUTIVE SUMMARY	1
1.0 INTRODUCTION	2
2.0 DESK STUDY (B.20A)	4
3.0 SITE VISIT PRELIMINARY	18
4.0 PRELIMINARY CONCEPTUAL MODEL AND ASSESSMENT OF POTENTIAL POLLUTANT LINKAGES	19
5.0 CONCLUSIONS AND RECCOMENDATIONS	27
6.0 LIMITATIONS AND EXCEPTIONS	28
7.0 REFERENCES	29

TABLES

TABLE 1 SUMMARY OF SITE GEOLOGY

TABLE 2 SUMMARY OF SITE HYDROGEOLOGY

TABLE 3 SUMMARY OF SITE HYDROLOGY

TABLE 4 SUMMARY OF SITE HISTORY

TABLE 5 SUMMARY OF HISTORICAL CONTAMINATIVE SITE USES

TABLE 6 OTHER SITE SPECIFIC INFORMATION

TABLE 7 SOURCE PATHWAY RECPTOR RISK ASSESSMENT

DRAWINGS

08818/R3054/01	Site Plan
08818/R3054/02	Site Boundaries
08818/R3054/03	Site layout
08818/R3054/04	Conceptual Site Model

APPENDICES

Appendix A – Service Drawings

Appendix B – Envirocheck Report

Appendix C – Celtic Technologies Limited, Victoria Street, Briton Ferry, Factual Environmental
Assessment Site Investigation Report, No.R428B/02/1744. (Final)

Appendix D – Coal Authority Coal Mining Report Reference 10312904-04

Executive Summary

Introduction	Jacobs Babbie has been commissioned by Neath Port Talbot County Borough Council (NPTCBC) to undertake a preliminary contamination assessment at Regent Street Gas Works Briton Ferry.
Current Site Use	The site can be split into three areas as follows: • A fenced parcel of derelict land owned by Wales and West Utilities Limited (0.35 ha) • An operational Wales and West Utilities Limited compound (0.02 ha), and • 0.59 ha of land occupied by residential properties on Victoria Street and Regent Street West.
Site History	The site has an approximately 100 year history associated with gas manufacturing. The majority of the production / processing occurred in the south of the site. The site was however in decline from the late 1930's with production ceasing in approximately the mid 1940's. Whilst in decline the areas to the south and east of the site have been redeveloped with residential housing along Regent Street West and Victoria Road.
Geology, Hydrogeology and Hydrology	The ground conditions at the site are expected to comprise of made ground over estuarine alluvium underlain by glacial drift. The solid geology is expected to be of a sequence of Carboniferous upper Coal Measures consisting of Lower Pennant and Rhondda beds. The superficial deposits and Coal Measures are classified by the Environment Agency as minor aquifers. Shallow groundwater is anticipated to flow to the east.
Conceptual Model and Pollutant Linkage Assessment	Based on the information available a preliminary conceptual site model has been developed for the site. On the basis of this model three potential pollutant linkages have been identified these are • Human health of occupants of properties built on the former gas works along Regent Street West and Victoria Street, • Third party properties including building affects and the health of domestic pets, and • Groundwater in the Glacial Deposits.
Recommendations	Based on the above its recommended that an intrusive investigation in accordance with Para B.20c is undertaken to assess the significance of the identified Potential Pollutant Linkages

1.0 INTRODUCTION

Jacobs Babbie has been commissioned by Neath Port Talbot County Borough Council (NPTCBC) to undertake a preliminary contamination assessment at the Regent Street Gas Works, Briton Ferry.

1.1 Objectives

The overall objectives of the assessment are to assist NPTCBC with the inspection and determination of the site as defined in Part IIA of the Environmental Protection Act 1990, by undertaking those works detailed within paragraph B.20a of the statutory guidance.

1.2 Background and Requirements of Part IIA EPA (1990)

The Part IIA EPA (1990) came into force in Wales in July 2001 via the Contaminated Land (Wales) Regulations 2000, introducing a new regulatory regime for the identification and remediation of contaminated land.

Part IIA requires a strategic approach to the inspection and determination of contaminated land that, in accordance with paragraph B.20, may include one or all of the following stages:

- a) *Desk Study* – Collation and assessment of documentary information, or information from other bodies.
- b) *Site Visit* – For the purposes of visual inspection (and in some cases limited sampling).
- c) *Intrusive Investigation*.

This approach ensures that the local authority is satisfied that there is a reasonable possibility that a pollutant linkage exists at the site, before moving onto the next stage. For example, by way of an initial desk study to collate and assess documentary information, the local authority is satisfied that there is a reasonable possibility that a pollutant linkage exists before;

- A site visit / inspection is undertaken.
- And then, that the local authority is satisfied that the contamination is actually present and that the receptor is actually present or likely to be present, before;
- An invasive investigation is carried out using statutory powers.

The strategic approach prevents further unnecessary investigation of a pollutant linkage if at any stage there is no longer a reasonable possibility that the particular pollutant linkage exists.

1.3 Making the Determination of Contaminated Land

In accordance with the Part IIA guidance on the definition of contaminated land set out in Chapter A, there are four possible grounds for determination, namely that:

- Significant harm is being caused, in line with paragraph B.44.
- There is significant possibility that significant harm is being caused, in line with paragraph B.45 to B.49.
- Pollution of controlled waters is being caused, in line with paragraph B.50.

- Pollution of controlled waters is likely to be caused, in line with paragraph B.51.

Pollutant linkage or linkages should be identified as the basis for the determination and all three elements (i.e. source-pathway-receptor) should be identified. A linkage that forms the basis for determination that land is contaminated is then a 'significant pollutant linkage'.

1.4 Scope of Works

To achieve the above a desk study was undertaken in accordance with paragraph B.20a and the collation and assessment of available documentary information from various sources. This was to collate and review the following:

- Historical maps of the site and surrounding area.
- Information from statutory bodies, particularly the Environment Agency Wales.
- Information and plans on below-ground services information from relevant utility companies.
- Previous Investigation Report produced by Celtic Technologies:
Victoria Street, Briton Ferry, Neath Port Talbot County Borough Council. Factual Environmental Assessment Site Investigation Report. R428B/02/1744. 2002 (Final).
- Earlswood Materials Laboratory (1997), 12 Regent Street West, Briton Ferry,
Investigation of Ground Contamination, 01711/R957/RLS.

Determination of the site is outside the scope of this commission.

1.5 Information Sources

Information forming the basis of the desk study report has been obtained from the following sources:

- Landmark Group – Envirocheck report, commissioned by Babbie group.
- Western Power Distribution – Services
- NTL – Services
- Transco – Services
- National Grid - Services
- Dwr Cymru Welsh Water – Services
- NPTCBC – Services
- Environment Agency Wales
- Celtic Technologies Limited, Victoria Street, Briton Ferry, Factual Environmental Assessment Site Investigation Report, No.R428B/02/1744. (Final)
- Earlswood Materials Laboratory (1997), 12 Regent Street West, Briton Ferry,
Investigation of Ground Contamination, 01711/R957/RLS.
- British Geological Society Geology Maps
- Environment Agency Wales Groundwater Vulnerability Maps
- NPTCBC

Service plans were provided to Jacobs Babbie Limited by the above service companies.

2.0 DESK STUDY (B.20a)

2.1 Site Location

The former Regent Street Gas Works site is located at national grid reference (NGR) SS 738 943 within Briton Ferry, South Wales. The site is bounded by Regent Street to the south. Victoria Street to the East, Shelone Road to the west and garages/rough ground to the north. The site Plan is given in Drawing No. 08818/R3054/01.

The site is approximately rectangular in shape and occupies a total area of approximately 0.95 hectares. The site consists of occupied residential properties with gardens along Regent Street West and Victoria Street (0.58 ha), a palisade fenced Wales and West Utilities Limited compound (0.35 ha) and a fenced operational Wales and West Utilities Limited governor station (0.02 ha). The boundaries of the three areas detailed above are shown in Drawing No. 08818/R3054/02.

Ground cover across each of the areas of the site varies. The Wales and West Utilities Limited compound has approximately 5% hardstanding and 95% soft cover (either a burnt shale or exposed ground). The ground cover in the operational compound is not known. Ground cover across the residential properties is typical of a residential estate, some houses have paved gardens, some flower beds and some grassed.

Gas, Water, Electricity, Telecommunications, Sewers are present at the site. Service Plans showing the location of these services (provided by the service providers to Jacobs Babbie Limited) are presented in Appendix A.

2.2 Surrounding Land Use

The site is located in mixed residential / commercial area. Land use immediately surrounding the site is detailed below.

North	Privately owned garages and open space
South	Regent Street West beyond which is Llansawel Primary School
East	Victoria Street beyond which are residential properties
West	A small lane beyond which are further residential properties

2.3 Geology, Hydrogeology and Hydrology

2.3.1 Geology

The site geology is based on information obtained from the published 1:10,660 and 1:50,000 British Geological Survey (BGS) geological mapping sheets (Swansea) Solid and on information from previous investigations.

Ground conditions at the site are anticipated estuarine alluvium underlain by glacial drift. The solid geology is expected to be of a sequence of Carboniferous Upper Coal Measures consisting of Lower Pennant and Rhondda beds. The map indicates two unnamed coal seams one on the northern site boundary and one 100m to the south of the site. Both conjecturally outcrop beneath the superficial

deposits and based on the dip direction of the Rhondda beds to the north it is likely that the southern most coal seam will underlay the site. The site is located approximately 100m to the east of the Giants Grave Fault which runs in a north south orientation down throwing strata to the east, and has a large effect on the stratigraphy of the region.

Previous investigations at the site published mapped geology and BGS borehole data have indicated the Geological units and lithology thickness likely to be present at the site, details of this are summarised in Table 1.

Table 1: Summary of Site Geology:

Geological Unit or Lithology	Thickness (available Information)
Made Ground: Recent deposits expected to comprise of waste products from gas manufacture, clinker, coal rich materials, coke and reworked drift deposits.	Variable thickness up to 2.0 to 3.0m bgl expected possibly up to 4.50m within former gas holders.
Recent Deposits: Marine or Estuarine Alluvium consisting of clay and peat, then sand with gravel and sandstone fragments in a stiff brown silty sandy clay matrix.	Thickness varies from 1.0-10m.
Solid Geology: Carboniferous, Upper Coal Measures (Pennant), overlying Cefn Bryn Shales. Comprise of sandstone horizons separated by shale, siltstone, seat earth and coal.	Thickness not known. The site is located on a north-south trending fault. The downthrown side of the fault is to the east. The regional dip (30 to 40°) on both sides of the fault is northwards.

2.3.2 Hydrogeology

The Hydrogeology of the site is presented below in Table 2, and is based on the EAW Groundwater Vulnerability Map sheet 35, West Glamorgan together with an assessment of available geological information.

Table 2: Summary of Site Hydrogeology

Geological Unit	Aquifer Classification	Aquifer Characteristics	Source Protection Zone	Groundwater Abstractions
Made Ground	Not classified	Highly variable permeability and porosity. Perched water may be present with variable flow directions	No	None recorded within 1km of site
Glacial Drift and Estuarine Alluvium	Minor Aquifer	Variable permeability and porosity. Perched water may be present with variable flow directions	No	None Recorded within 1km of site
Carboniferous, Lower Pennant	Minor Aquifer	Variable permeability. Fractured or potentially	No	None Recorded within 1km of

Beds	Cont	fractured rock with low primary permeability. May contain a multi-layered aquifer system with separate water bodies in each sandstone horizon.	Cont	site
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Shallow groundwater is likely to be present in the made ground (1.5 to 2.0 m bgl). The shallow groundwater appears to flow west. Groundwater is also anticipated to be present in the Glacial Deposits. Waters with this unit also appear to flow west. There is however uncertainty with respect to the continuity between the two water bodies. The shallow groundwater appearing to be perched above the waters in the superficial deposits.

Groundwater flow direction in the Coal Measures is uncertain; there is likely to be a generally south westerly hydraulic gradient towards the sea, however fractures will have an impact on flow direction and rates.

Based on the EAW Groundwater Vulnerability map sheet 35 and the Envirocheck report, soils are described as being of a high leaching potential (U) over the site.

2.3.3 Hydrology

The hydrology of the study area and surrounding environs is presented in Table 3 and is based primarily on Ordnance Survey Maps, visual observations on information held by the EAW.

Table 3: Summary of Site Hydrology

Feature	Distance From Site	Flow	Classification	Abstractions	Discharge
Surface Runoff	N/A	Likely to infiltrate directly to ground.	N/A	N/A	N/A
Jersey Canal	250m west from the site.	Not Known	GQA Grade D (Fair) *	No Licensed abstractions within 1km of the site.	N/A
Neath River	400m m west from the site.	North east to south west to Baglan / Swansea bay.	Not Known	No Licensed abstractions within 1km of the site.	N/A

Notes: Based on information obtained from the Environment Agency Wales *GQA – General Quality Assessment scheme based on EA biological and chemical grading scheme. Watercourses are graded from A to F (A bring very good and F being bad).

The Jersey canal is located approximately 250m west of the site, it is uncertain whether the canals are tidally influenced; or in hydraulic continuity with the River Neath. The River Neath at its nearest point is approximately 400m west of the site, at this point the river remains tidally influenced.

2.4 Site History

The history of the site on which the Gas Works was constructed and the surrounding area has been based on historic Ordnance Survey Plans, information contained in the Envirocheck report, Celtic 2002 Report and EML 1997 Report. Copies of the historic maps and plans are included in Appendix B of this report. The historic land use of the site and adjacent area is summarised in Table 4.

Table 4: Summary of Site History

Date	Information Source	Site Land Use of Significance	Adjacent Land Use of Significance
1875	EML Report 1997.	Small gas works. Structure details are not given.	Farmland and residential properties.
1882	OS 1:2500	Gas works. Two unidentified tank structures (later identified as gas holders) present to south of the site. Small buildings in south east corner.	Residential dwellings to the southeast and southwest from Regent street. Site intersected by track orientated north east to south west Open fields to the north and west of site. Established railway track is located in the east. Iron Foundry located to the south east.
1884	OS 1:0560	As previous	As previous
1899	OS 1:2500	Gas works facility extends north with additional buildings shown on site. Two gas holders are no longer shown. Large Gas Holder tank situated in centre of site. Possible retort house developed in the southeast corner of the site.	Residential houses developed southeast on regent street west. School built to the south west. Undeveloped open space to the north and west of site. Railway infrastructure developed to the east of the site, know as the Rhondda & Swansea Bay Railway.
1900	OS 1:2500	The gas works site is extended to the east and north with utility building consisting of stables, cart shed, foreman's house and depot.	Briton ferry dock to the south. Jersey canal and River Neath to the west.
1910	OS 6" Sheet 24NE from Celtic 2002, Report	A larger Gas holder with a small building to the southeast has been constructed in the northeast of the	An iron foundry is indicated to the south of the gasworks.

Cont	Cont	site. Buildings have been removed from the south west corner. Land in the northeast corner of the site is part of the gas works. Buildings forming gasworks continue all along Victoria Street and Regent Street.	Cont
1918	OS 1:2500	Tank structure removed. Gas works buildings have been developed along the southern and eastern boundary of the site. A square structure is shown in the west of the site, near to the area occupied by No's 14 and 16 Regent Street West. We believe this to be the purifiers.	Residential housing developed to the north of the site along east side of Victoria Street. To the north west residential housing along Shalone Road developed. Sunday school located north east.
1921	OS 1:0560	Gas works. Two circular tank structures present. Small buildings developed in south and east of the site.	As previous.
1936	Borough of Neath Briton Ferry Gasworks Undertaking Scale 41.66 feet to an inch.	Indicates the Briton Ferry Gas Works layout consisting of two gas holders tanks, purifiers, retort house, depot and coal shed present on site. The purifiers are located on land occupied by Nos 14, 16 and 18 Regent Street West. Land to the west of the purifiers now occupied by No 12 is shown as an open yard.	Not shown.
1938	OS 1:0560	Purifiers and stores	No visible change.

Cont	Cont	have been removed from south west corner of the site which is now undeveloped. Concrete cul-de-sac entrance developed from Regent Street West into the site	Cont
1941	OS 1:2500	Gas work structures remains are confined to the northern part of north and east of the site, consisting of two gas holder tanks, meter house and some unidentified structures. Residential housing with gardens now occupies the south west portion of the site around the cul-de-sac of Regent Street West.	Small structures present to the north. Housing developed to north along Victoria Street. Foundry to the south east is now engineering workshops. Residential properties develop north and south along Shelone Road. Allotment gardens are shown approximately 130m to the east of the site
1951	OS 1:1250	Gas works. Gasholders referred to on site.	Industrial estate has been developed to the south east of site. Park Street to north east re-named as Jersey Terrace. Small structures increase to the north of the site.
1964	OS 1:1250	No visible change	Shelone Road residential housing extended north. No's 30-40 no longer shown on Regent Street West.
1970	OS 1:1250	Residential housing with gardens built on west boundary extending Victoria Street to south. Unidentified structure located northwest of large Gasholder.	North of the site numerous small structures developed. South boundary two blocks of flats replace terrace houses No 30-40. Houses developed along eastern boundary, now No's 14-28a Victoria Street. Play ground built south of Jersey Terrace.
1971	OS 1:2500	Gasholder station noted on map.	No significant change
1980	OS 1:10000	No change	No significant change
1999	OS 1:10000	All gas works structure have been removed and small structures	No significant change

Cont	Cont	replaced by open space. Residential housing still remains along Regent Street and Victoria Street.	Cont
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Notes: * Dates relate to Ordnance Survey mapping and document publishing dates. OS – Ordnance Survey.

It should be noted that site boundaries for the area in question are not clearly marked, and buildings on site have not always been labelled on OS plans. As such it has not been possible to accurately identify all former site uses.

Gas Journal, September 25, 1917: Gives a brief account of a Briton Ferry gas works site in 1897. It details production rates, supply costs, prepayment plans and that by 1917 practically every house had a supply of gas. The gas works site was scheduled to have a railway siding constructed into the site to transport coal in on, however at the time of writing it was still economical to bring coal into the retort by horse and cart. The passage describes the site as having four beds of six retort, with shallow generators, it also mentioned that the exhausters though not coupled are driven by a gas engine of shafting, which is also used to drive the rotary scrubber and all the pumps.

2.4.1 Summary of Site History

Based on the information available it appears that operations at the gas works site commenced pre 1875. Operations appeared to be in decline from the 1930's. By 1941 the southern portion of the site had been sold and had been developed for residential housing. Decline of operations appears to have continued, and in 1976 the eastern portion of the site was also sold on for residential development. The site layout is shown in Drawing No. 08818/R3054/03.

2.5 Potential Contaminative Land Use

2.5.1 Historic Potential Contaminative Site Use

The site has been connected to gas work manufacturing process for over 100 years with prolonged industry on site between 1920's to the late 1970's. In the most part the production (retort/purifiers) appears to have been concentrated to the more southern region of the site now occupied by Regent Street West. This area ceased being used for gas manufacture in the 1930's following sale of part of the area. The more northern proportion appears to have subsequently been utilised for gas storage and distribution.

Coal Gas manufacturing sites like Briton Ferry produced gas through a process of coal carbonisation which involving heating coal within retorts under oxygen deficient atmosphere; yielding a mixture of solid, liquid and gaseous products and leaving coke as the principal residue. On completion of the heating process the subsequent material were separated which in turn produced gas, liquor, tar and various other by products. Table 5 summarises the historical structures, uses and processes which have been identified as being present on, or near to the site, and details the associated potential contaminants.

Table 5: Summary of Historical Contaminative Site Uses

Process/ Structure	Location	Process Description	Potential Contaminants of Concern
Gas Holders	No longer present on site. Historical maps indicate the presence of two holders located within the Wales and West Utilities Limited site boundary. Another two Gas holder are shown on southern boundary of the site (1882 map).	Storage of gas. Water was to form a gas tight seal. Prolonged contact with the gas may have resulted in contamination with various compounds. Gasholders were often demolished and backfill with waste product from the operation.	Coal tar, sulphide compounds, cyanides and BTEX compounds. Backfill waste could have contained numerous contaminants. Typically waste consists of demolition material generated during decommissioning of site structures. If structures were in filled during operation of the site, the waste generated by coal gas production (spent lime and oxides, tars and liquors, ash and clinker) may have been used as fill materials.
Above Ground Tank	Located on the eastern boundary of the site	Often used for storage of oils, tars and liquors.	Unknown
Governor / Meter/ Pump House	Centre of the site	Used for metering and control of gas pressures. Contained valve and control for gasholders.	Lubricants and asbestos lagging of pipes.
Purifiers	Was situated in the west of the site but is no longer present on site. Plans indicate that it is replaced by residential housing.	To remove impurities like hydrogen sulphide, carbon dioxide and hydrogen cyanide from the gas, it was passed through slaked lime or ferric oxide. Waste bi-products were produced in the form of foul lime or spent oxide. The material was often reused on site to fill voids around the gas holder or simply discarded to the edges of the site boundary.	The primary contaminants may include up to 60% free sulphur, sulphate, sulphide and up to 5% cyanides and thiocyanate. Complex cyanides can be created under strong alkaline conditions or during combustion of complex cyanides. Hydrogen cyanide can also be produced from free cyanide.
Retort	Has been replaced by residential	Coal was heated to high temperatures in coal ovens with reduced	Compounds like clinker, coal, tar, phenols, ammonia, sulphate, sulphide, hydrogen

Cont	housing	oxygen. The gas stream exiting contained impure coal gas, ammonical liquor and tar. The fusion of ash created clinker by products.	sulphide, hydrogen cyanide and acids could be associated by products.
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2.5.2 Historic Potential Contaminative off site Uses

The only other potential contaminative site use to have occurred in the area is the operation of a former iron foundry. This is however located over 100m from the site.

2.5.3 Recent Contaminative Site Uses

The central portion of the site is currently occupied by a decommissioned Wales and West Utilities Limited site; this area is bound by locked palisade fencing. An operational Wales and West Utilities Limited governor compound is situated on the northern boundary of the site, routine maintenance of the governor may result in small releases of oils, greases and antifreezes. Additionally asbestos materials may have been released to environment from pipe laggings. The final area of the site comprises of residential housing Regent Street West and Victoria Street, this area of the site is not thought to have had any recent contaminative site usage.

2.5.3 Statutory Authorities and Information Sources

Information from the Coal Authority shows that the site is unlikely to be affected by past or present underground workings. At present no feasibility, licences and planning consents have been passed for future works, though workable coal exists in the locality of the site. The Coal Authority Report is shown in Appendix D.

Table 6: Other Site-Specific Information

Information Source	Information Summary
Envirocheck Report	Discharge consents There are no discharge consents within 250m of the site. There are a total of 29 discharge consents within 1km of the site discharging to the River Neath, estuarial waters of the River Neath and to land.
	Waste Management Giants Grave landfill is located approximately 850m north west of the site, when operational accepted household and industrial wastes equal or greater than 75,000 tonnes per year. There are five Licensed Waste Management Facilities within 1km of the site. Five waste transfer/treatment site's are within 1km of the site.
	Substantiated Pollution Incidents There are 8 substantiated incidents on the pollution register, 2 are within 500m of the site these involve lubricating oils and waste metals.

Cont	Pollution Incidents to controlled water There are 13 recorded pollution incidents to controlled waters within 1km of the site. None are related to the site. Four were recorded within 500m of the site. These are: • Unknown pollutant via leakage from Villiers Street Briton Ferry, category 3 Minor Incident. • Foam/Soap suds from Briton ferry category 2 - Significant Incident • Crude sewerage entered the canal by direct discharge, category 2 – Significant Incident. • Neath Cargo Terminal, adjacent to Giant Grave pollutant unknown, Category 3 – Minor Incident.
	Flooding A Tidal Indicative Floodplain is 199m south west of the site.
	Air Pollution There are three Air Pollution Controls within 1km of the site.
	Sensitive Land Uses Five within 1km of the site have been designated Sites of Special Scientific Interest (SSSI) on a geological merit.
	Compressible Ground Subsidence Hazards Risk rating high. Source British Geological Survey
Coal Authority Report	The report states that the site is not within a zone of likely physical influence on the surface from past underground coal workings. The site is not within a zone of likely physical influence on the surface from any present underground coal workings. There are no mine entries within, or within 20m of the site. The records do not disclose any damage or claim having been given, made or pursued in respect of the property since January 1984.
Glamorgan Gwent Archaeological Trust (GGAT). Celtic, 2002.	GGAT confirm there are no known archaeological sites or finds in the area of the site.
NPTCBC Planning Department	Hold no records for the site before the local Government re-organisation in 1974.
Countryside Council for Wales. Celtic, 2002.	Sites of Special Scientific Interest (SSSI). The nearest site is 2km west at Crumlin Burrows.

2.6 Results of Previous Investigations

A number of previous investigations and assessments have been produced within or in close proximity to the study area:

In 1997 Neath Port Talbot County Borough Council (NPTCBC) were contacted by a resident who expressed concern over a 'Blue' material associated with soil in the garden of the property and the lack of plant growth in that area. Following initial contact and the action was taken by NPTCBC and works completed as summarised overleaf.

Following the complaint the Environmental Health Section of NPTCBC recovered an initial soil sample from the garden of 12 Regent Street West, Briton Ferry on 16.06.97. The sample revealed excessively high concentration of Total cyanide (CN) 62,000mg/kg and Free CN 2,000 mg/kg.

On discovery of the elevated cyanide concentrations NPTCBC issued a door step questionnaire to 24 properties in the locality requesting information on visual evidence of contamination.

Following completion of the door step survey six of the properties had soils samples removed from the gardens and analysed for total and free cyanide. Two samples were recovered from each property. The exact locations from where the samples were retrieved and the reasons why the properties were chosen is not known. The properties sampled included the following:

- 28 Shelone Road
- 10 Regents Street
- 14 Regents Street
- 24 Regents Street
- 20 Victoria Street

The identity of the sixth property identified as G.S is unknown.

The 12 No. soil samples revealed levels of detection for total and free Cyanide (CN) below the guidance concentrations being used at the time (ICRCL trigger levels, for gardens and allotments).

Although none of the samples recorded concentration exceeding the guidance values used, it should be noted that the samples were in the majority retrieved from flower beds. The results are therefore unlikely to be representative of site wide conditions.

NPTCBC were in consultation with British Gas PLC Property Division regarding ownership of part of the land associated with the former Briton Ferry Gasworks site. Subsequent representation by British Gas stated housing land (Regent Street and Victoria Street) was appropriated to Council Borough of Neath via the Minister of Health on the 24.04.36, following an application by Neath Council under S.65 of the Housing Act 1925. The council then re-developed the site for housing (including Regent Street and Victoria Street). The lease of the site was assigned by The Wales Gas Board to the Council in 1967, although the Council had full control and management of the site since 1936.

Earlswood Material Laboratory, 1997 (12 Regent Street West, Briton Ferry. Investigation of Ground Contamination):

In 1997 following the initial sample from No 12 Regent Street EML (now Jacobs Babbie) were commissioned by NPTCBC to undertake an investigation of the ground beneath No 12 Regent Street West. The purpose of the investigation was to assess the nature and extent of ground contamination.

The fieldwork took place on the 11-12th August 1997, nine boreholes were completed at No. 12 Regent Street to depths between 0.5m-3.0m bgl. Groundwater was encountered at depths between 1.1m and 1.30m below ground level (bgl). During the investigation olfactory evidence of contamination was noted frequently in the made ground. Additionally at one location oily odours were noted in the Peat stratum identified below the Made Ground.

Chemical analysis revealed the Topsoil and Made Ground across the site to be heavily contaminated with cyanides, arsenic, PAH's, phenols and sulphates. Lower levels of other heavy metals, sulphur and mineral oils were also recorded.

The report recommended that additional investigations should be undertaken on the adjoining properties (Nos. 10 and 14 Regent Street West) to determine whether contamination extends beyond No 12. The report details removal of all 2.5m of Made Ground from the site would be ideal though in reality impractical. The suggested remedial works involve the use of a barrier layer between the ground surface and the contaminated soil. The report suggests that a 750mm thick barrier would be sufficient, comprising:

- 150mm topsoil
- 300mm clean subsoil.
- Geotextile filter membrane
- 300mm clean single size gravel, and
- geotextile filter membrane

The report provides an alternative method to reduce the size of excavation by using a 150mm reinforced slab over 150mm thick hardcore bed, which would provide suitable cover; this was subsequently employed at No. 12 Regent Street following the investigation.

Celtic Technologies Limited, (Victoria Street, Briton Ferry, Neath Port Talbot County Borough Council). Factual Environmental Assessment Site Investigation Report. R428B/02/1744. 2002 (Final).

Celtic Technologies Limited was commissioned by Lattice Property Holdings LTD (LPH) on behalf of Transco to produce an Environmental Assessment Site Investigation Report on land at Victoria Street, Briton Ferry. This report is presented in Appendix C.

The objective was to quantify the nature and extent of solid, liquid or gaseous phase contamination at the Victoria Street site in Briton Ferry. The investigation did not investigate the land outside the current Wales and West Utilities Limited boundary. The report detailed that the primary site use between the 1890's to the 1970's was for gas storage. The report states that land to the south of the site (within the NPTCBC site boundary) was involved in gas manufacture from approximately 1870 to the 1940's. Areas to the south and east were formerly part of the earlier gas works but their use is stated as unknown in the Celtic 2002, report. .

Site works were carried out on site between 26th June and 6th July 2002. The investigation comprised nine cable percussive boreholes to depths between 3.10m and 10.70m bgl. Nineteen trial pits and two hand dug pits were excavated to depths between 1.00m and 3.00m bgl. The trial pits and hand dug pits were excavated to provide representative solid and liquid samples, locate below ground structures, locate waste material and assess the made ground and site geology. All of the boreholes were installed with groundwater monitoring wells.

Three of the boreholes were installed in the two former Gas Holders on site. Two of the boreholes were installed with twin monitoring wells to discreetly monitor water in the made ground and the superficial deposits.

The results of the investigation indicated the site was underlain by made ground which extended to a maximum depth of 4.3m bgl. This was encountered inside a gas holder. Outside of the holders made ground extended to a maximum depth of 2.75m bgl. Beneath the made ground alluvial deposits were proved. These extended to a maximum of 4.7m bgl. Beneath these deposits Glacial Deposits were encountered. These were proven to depth of 10.7m bgl.

Groundwater was encountered within the Made Ground at its interface with the Alluvial deposits. Groundwater was also encountered within the Glacial Deposits. The CELTIC report states that the waters in the Glacial Deposits are confined by the overlying Alluvial clays. Review of the results of the monitoring indicates that there is however uncertainty with respect to this statement and the partial continuity between the two water bodies may occur at the site.

Forty-five representative soil samples were retrieved during the investigation. The samples were analysed for a range of toxic and phototoxic metals, inorganics, aromatics, PAH and TPH. Elevated Levels of the following determinants were encountered as shown below. Details of the exploratory excavation locations are given in the Celtic Report in Appendix C.

Maximum Concentrations Reported In CELTIC Technologies Ltd Report

Determinant	Maximum Concentration
arsenic	920mg/kg (BH1)
Lead	10,700mg/kg (BH1)
Mercury	4.3mg/kg (TP7)
Selenium	17mg/kg (BH1)
Copper	5,240mg/kg (BH1)
Zinc	46,000 (HP1)
TPH	8,400mg/kg (TP2/3)
Total PAH	1,189mg/kg (BH1)
Free cyanide	38mg/kg (TP16)
Complex cyanide	287mg/kg (HP1)
Elemental sulphur	6,300mg/kg (BH9)
Water soluble sulphate	6,955mg/kg (BH9)

The spatial distribution of these maximum concentrations is varied across the site. However there does seem to be a connection between the former gasworks structures and elevated levels of analysed determinants, though the relationship and distribution is not clear.

BH1 which is located on the southern boundary of the Wales and West Utilities Limited land recorded the maximum concentrations of determinants. These included PAH's, benzene, arsenic, lead, selenium, copper.

TPH was recorded at its maximum concentration in TP2 and TP3 which were excavated adjacent to BH1. This area of the site is situated north of the former retort houses (1877-1938) associated with the former Briton Ferry gas works.

Four of the soil samples tested for leachability (using NRA method) for a range of determinants. The following determinants were above levels of detection pH 7.9mg/l (TP14), total organic carbon 4.1mg/l (TP9), conductivity uS/cm (BH1), total sulphate 155mg/l (TP2/3), ammonium 3mg/l (BH1) and iron 1.1mg/l (BH3). There seems to be a relatively low leaching potential for most contaminants across the site.

Two rounds of water monitoring were completed at the site. Maximum concentrations are as follows:- total organic carbon 1,301mg/l (BH5 shallow), conductivity uS/cm 14,950mg/kg (BH3), TPH 0.13mg/l (BH5 shallow), thiocyanate 2.3mg/l, total sulphate as SO₄ 670mg/l (BH9), total ammonium 37.9mg/l (BH9), Arsenic 0.17mg/l (BH8), cadmium 0.05mg/l (BH8), lead 4.9mg/l (BH8) selenium 0.02mg/l (BH8), copper 5.6mg/l (BH8), nickel 0.66mg/l (BH8), zinc 11.7mg/l (BH8). Apart from BH9 and BH3 the elevated concentrations indicated above were recorded in samples taken from the perched water.

The report provides factual information on the ground investigation undertaken at the site in Briton Ferry. It states the primary site use was gas storage and later gas distribution. The investigation describes areas to the south and east of the Celtic site boundary which is now replaced with residential housing with gardens which were once part of the former Gas Works, but the extent and nature of contamination were outside the scope of investigation. The CELTIC report also indicated that potential contaminated soil and ground water could affect the properties of Regent Street West and Victoria Road, which had been developed onto the footprint of the former gas work site.

3.0 Site Visit

In order for the author to be familiar with the site, a site visit was completed on 11th October 2004.

The walk over confirmed that the site comprises of the following: - a decommissioned Wales and West Utilities Limited site an operational Wales and West Utilities Limited governor compound and residential housing with gardens.

The main access (double palisade gates) into the Wales and West Utilities Limited site is situated in the southeast corner via a track running from Victoria Street. Another double palisade (locked) gate is located on the northern boundary of the Wales and West Utilities Limited site, access to this is via a small track oriented east – west off Victoria street; pedestrian access to the Wales and West Utilities Limited governor can also be achieved from this point. The governor is contained within a palisade surround and seated on a gravel surround.

The topography across the site is generally flat with a slight slope to the south east of the site. An unidentified mound of materials was noted in the south east corner.

The Wales and West Utilities Limited site is primarily inhabited with short scrub and bramble species. Dense, well-established Japanese knotweed, gorse and bramble vegetation line the north and west perimeter fencing, preventing any visibility into the centre of the site.

The gardens of the properties are typical of the gardens of residential properties having areas of soft cover (grass & flower beds) and hardstand (paths, patios and car parking).

There is a derelict garage structure located adjacent to the main site access point. Hand tools and pipework were visible within.

Foundations of an above ground tank are situated in the eastern boundary of the site. The remains of a double chamber interceptor are located adjacent to the disused garage structure in the southeast corner of the site.

4.0 PRELIMINARY CONCEPTUAL MODEL AND ASSESSMENT OF POTENTIAL POLLUTANT LINKAGES

Based on the information collated Jacobs Babbie has developed the following site conceptual understanding of the study area. This is represented in Drawing 08818/R3054/04.

The site is approximately rectangular in shape and occupies approximately, 0.95 hectares. The site can be divided in three areas as follows:

- Residential properties with gardens along Regent Street West and Victoria Street,
- A palisade fenced Wales and West Utilities compound and
- An operational Wales and West Utilities Limited governor compound.

Source Characterisation

Based on the historical review of the land use the site, the former Briton Ferry Gas works was identified as the most significant potential source of contamination. The Gas Works site evolved over a period of time changing in area, shape and usage.

The Celtic 2002 site investigation identified Made Ground to comprise of mainly reworked natural material, building rubble, clinker and waste product associated with gas manufacture in varying quantities. Evidence of tar staining, oils and odours was noted during some excavations.

The results of chemical analysis of soils from the Wales and West Utilities Limited site have identified elevated concentrations of compounds of concern in the Made Ground (metals, inorganic's and organics). Elevated concentrations were also found in natural stratum underlying the Made Ground in BH9 and BH1. In the absence of site specific information it is anticipated that the conditions encountered beneath the Wales and West Utilities Limited site will be typical of the conditions of the soils outside the site boundary (but within the former gas works site boundary). This assumption appears supported by the results of testing of soils from No 12 Regent Street West.

Groundwater analysis revealed elevated concentration of contaminants predominantly in the perched water body on site. VOC's, production of CO₂ and reduced concentrations of O₂ were noted in soil atmospheres within some of the boreholes (BH8, 6 and 5) on site. Given the site investigations it is apparent that shallow soils and groundwater now present the main source of contamination on site.

Previous investigation by NPTCBC and Celtic Technologies has highlighted contamination of the near surface soils and the groundwater. However the extent and distribution of contaminants across the total area of the gas works site is still not fully understood.

A key set of unknowns highlighted by these investigations is the extent, concentrations and distribution of contamination below the properties of Victoria Street to the east and Regent Street West to the south, which we know to have been developed within the boundary of the former gas works.

Pathway Characterisation

Pathways refer to the means by which a contaminant may be exposed to susceptible receptors. This can include direct contact (such as ingestion or inhalation) or pathways where the contaminant has to physically move from its point of origin (groundwater migration, gas portioning).

Direct contact with the exception of site workers / trespassers will be minimal within the two fenced areas of the site. It is envisaged that site workers would be aware of the risks associated with such sites. Within the residential area access is not restricted; users of the properties have the potential therefore to come into direct contact with potentially contaminated soil, and atmospheres through direct contact (ingestion/inhalation).

The groundwater was encountered between 1.10m - 1.50m bgl. The monitoring results indicate that two water bodies are present beneath the site, one in the made ground and one in the underlying glacial deposits. Both water bodies appear to flow west towards the River Neath 400 m west.

There is variation in the rest water levels between groundwater in the made ground and the water in superficial deposits. This may indicate partial hydraulic continuity between the two water bodies. The shallow groundwater appears to be perched above the waters of the superficial deposits, with the Alluvial Deposits between the two bodies acting as an aquitard to the downwards migration of contamination. As outlined above the aquitard is however only partial. Absent waters from the made ground have the potential to migrate downwards into the waters in the Glacial Deposits. The chemistry of the waters appears to confirm this partial continuity, with impact to water in Glacial Deposits being recorded in BH1 and BH9.

Groundwater is also anticipated in the Lower Pennant Measures, these waters are anticipated to flow south to the sea. The sands and gravels are a highly permeable unit. With the unit horizontal rather than vertical groundwater movement is likely to occur. This is likely to restrict movement of contaminants from the Glacial Deposits into the Pennant Measures

Based on our present understanding of the site and information collated in the desk study,- it is plausible that the following pathways could be present on site:

- Direct Contact (including inhalation)
- Surface water movement
- Chemical attack
- Groundwater movement, and
- Vapour migration within unsaturated zone

Receptors Characterisation

'Receptor' is the term used in risk assessments for people or environment which may be exposed to impacted media or at or near an evaluated site.

As mentioned previously the two areas of the site that are fenced and secured from the public significantly reduce the contact with human receptors. Additionally it is anticipated that workers

employed to undertake works at these site's would be made aware of the risk by the site owners. Workers within this area are unlikely to represent a sensitive receptor.

Previous investigations have highlighted elevated levels of contamination in the gardens of No. 12 Regent Street West. The assessment of the site has indicated users of the residential properties developed on areas of the former gas works as potential receptors. Additional to the human receptors, domestic pets owned by residents (a third party property) also represents a potential receptor.

Groundwater has been identified beneath the Wales and West Utilities Limited site within the made ground and the glacial deposits. Within the waters encountered typical gas works compounds of concern have been identified. These waters appear to flow west towards the River Neath 400m away.

Based on the information collated the likely receptors associated with the site are:

- Human Receptors – Occupants of Regent Street West and Victoria Street.
- Third party property (including domestic pets)
- Surface waters in the River Neath, and
- Groundwater in Glacial Deposits

Based on this conceptual understanding a preliminary assessment of the pollutant linkages has been made. This is presented in Table 7 overleaf.

Table 7 Source Pathway Receptor Risk Assessment

Potential Receptor	Potential Source	Potential Pathway	Comments	Impact Event	Risk Ranking
Human Health	Contaminants associated with Former Gas Works	Direct contact Ingestion (including via ingestion of site grown vegetables) & Inhalation of dust	The preliminary Conceptual Site Model (CSM) has identified three areas of the site two of which are fenced and secured from public access and one which is occupied by residential houses along Regent Street West and Victoria Street. The risk of contact with contaminants in the two secured area remains low. It is assumed that visitors entering the secured areas of the site will be aware of the previous Gas Works land use and associated contaminants and have the appropriate training and PPE to work on the site. Therefore the risk to site workers in these areas is low. A trespasser scenario could present a risk element by direct contact, ingestion and inhalation. However given the well maintained fencing around the two areas of the site, the risk will remain low, but must be considered. Given our understanding of the site and the CSM we know contamination associated with the former gas works was found in the garden of No.12 Regent Street West. We also know from the Celtic 2002 investigation undertaken adjacent to Regent Street West and Victoria Street, that contamination was found site wide in the made ground and perched waters at the site. Given that residential properties were developed on to the footprint of the former gasworks site, it is plausible that similar levels of contamination encountered during the Celtic and EML investigation could be impacting on these properties. The risk of	Moderate-severe	Medium-High

Potential Receptor	Potential Source	Potential Pathway	Comments	Impact Event	Risk Ranking
			direct contact via the gardens is moderate to severe, based on site wide levels of contaminants.		
			Assessment has indicated that historical use of the site has contaminated the soils and groundwater beneath the site. These contaminants include a range of organic and inorganic contaminants.		
Human Health	Contaminants associated with Former Gas Works	Ingestion of drinking water pipes	Hydrocarbons can chemically attack certain plastics and taint the water carried. Plastic water mains do cross the site to serve the properties along Regent Street West and Victoria Street. The Celtic investigation found a maximum concentration of hydrocarbon of 8,400ppm. Risk of attack is likely to be greater if below groundwater. Groundwater is present beneath the site at approximately 1.5m to 2.0m bgl. It is anticipated that the services connecting the residential properties will be present at shallow depth (<1.5mbgl). Risk of attack is therefore considered medium, should mains water pipes be below groundwater risk would be increased.	Moderate	Medium
Human Health	Contaminants associated with Former Gas Works	Vapour migration and inhalation	VOC's have been detected in the soils atmosphere beneath the site. Additional hydrocarbons including volatile and semi volatile fractions have been identified in the soil and groundwater beneath the Wales and West Utilities Limited site. There is a potential for vapours to partition on site and affect the residents of Regent Street West and Victoria Street.	Serious	Medium - high

Potential Receptor	Potential Source	Potential Pathway	Comments	Impact Event	Risk Ranking
Future Site Users (including construction workers and maintenance staff)	Contaminants associated with the former Gas Works	Direct Contact	In the absence of mitigation / management development of the site has the potential to release a range of potential pollutant linkages. It is anticipated however that the planning process would result in appropriate measures being completed at the site as part of the development and that such measures would reduce the risk associated with developments on the site to an acceptable level. Risk's associated with development are therefore considered low. Should however such measure's not be implemented during development then risk to future site users could be high	Severe	Low to High
Groundwater In Glacial Deposits	Contaminants associated with former Gas Works	Shallow groundwater migration	Groundwater in which a range of compounds of concern have been detected within the Made ground beneath the Wales and West Utilities Limited site. This groundwater appears to be in a degree of continuity with the waters in the Glacial Deposits. The results indicate that although an aquitard is present beneath the two units. There is partial continuity between the two waters (as evidence by chemistry of BH9 and BH1) and that vertical gradient for migration of compounds from the Made ground to Glacial Deposits is present.	Moderate	Medium

Potential Receptor	Potential Source	Potential Pathway	Comments	Impact Event	Risk Ranking
Surface Waters	Groundwater in marine and estuarine deposits	Horizontal migration of groundwater	Shallow ground water within the made ground and glacial deposits could be in continuity with the surface waters of River Neath. The river is however located 400 m from the site. Given the distance between the site and the River Neath the influence on surface waters is anticipated to be negligible.	Moderate	Low
Ground Waters	Groundwater in the Coal Measures	Horizontal migration of groundwater	Considering the anticipated depth to the coal measures. It is considered that groundwater in the Coal Measures is unlikely to be in continuity with waters within the River Neath.	Moderate	Low
Third Party Properties (Building Affects)	Contaminants associated with former Gas Works.	Chemical Attack	Certain chemicals (pH and sulphate) can attack concretes. The site has been developed with residential properties constructed from concrete and brick masonry which may be at risk if aggressive ground conditions are present.	Moderate	Medium
Third Party Properties (Domestic Pets)	Contaminants associated with former Gas Works.	As Humans	As Humans	Moderate	As Humans

Notes: Definitions of terminology used for Qualitative Risk Assessment can be found in Appendix C.

4.1 Summary of Potential Pollutant Linkages

The assessment of the site has indicated that a range of potential pollutant linkages are associated with the soil and groundwater contamination potentially present beneath the site. The linkages present indicate that the following receptors may be at risk.

- Residents of properties on Regent Street West and Victoria Street which are located on the former gas works.
- Third party properties (i.e. the structure of buildings on the site)
- The domestic pets of owners of properties of Regent Street West and Victoria Street located on the former gas works.
- Controlled water within the superficial deposits.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The conclusion and recommendations of this report have been compiled based on our general understanding of the site, previous reports, information available at the time of writing and the written conceptual model presented in section 4.0.

The desk study information has detailed that the dominant land use at the site in Briton Ferry has been as a gas works. Gas work related industry has spanned approximately 100years. The site layout has changed some-what over this period, with areas to the south and east of the site being replaced by residential housing. However it remains clear that the primary source of contamination at this site is likely to be due to the Gas Work industry.

Previous investigation by NPTCBC and Celtic Technologies limited of behalf of Lattice Property Holdings Limited has highlighted ground surface water contamination at the site, although the extent and distribution of contaminants across the whole site is still not fully understood. A set of key unknowns highlighted by these investigations is the extent, concentrations and distribution of contamination below the properties of Victoria Street to the east and Regent Street West to the south, which we know to have been developed within the boundary of the former gas works.

The assessment of the site has indicated that direct contact, ingestion and inhalation of contamination by the occupants of houses located on former gas works land on Regent Street West and Victoria Street is a potential pollutant linkage. Furthermore the assessment indicated that domestic pets (a third party property) owned by occupants of the properties are also at risk.

Additional to risk to human health and third party property the soil and groundwater conditions present beneath the residential properties may also pose a risk to groundwater in the Glacial Deposits.

Based on the above further phased site works is recommended to assess the significance of the identified pollutant linkages. These works are likely to include soil sampling, groundwater monitoring and sampling, soil atmosphere monitoring and ambient air monitoring within the potentially affected properties.

6.0 LIMITATIONS AND EXCEPTIONS

In preparing this report it should be noted that:

- The findings and opinions contained within this report are based on information obtained from a variety of sources, as detailed in the report, which are believed to be reliable. Nevertheless the authenticity and reliability of this information cannot be guaranteed. Further it is possible that the preliminary investigation, while appropriate to comply with the agreed brief, failed to indicate fully the presence of contaminants in the study area. Assuming such additional contaminants actually exist, their presence could not have been considered in the formulation of the findings and opinions within this report.
- Jacobs Babbie believes that providing information about the exact scope of the work undertaken is essential to allow NPTCBC to identify and therefore manage their risks. These risks could be further defined, but not eliminated, by additional investigation works.
- The advice given in this report with respect to contamination is based on guidance and good practice established at the time of writing.
- This investigation was conducted and this report prepared for use solely by NPTCBC. This report shall not be relied upon or transferred to any other party without the prior written consent of Jacobs Babbie.

7.0 REFERENCES

1. Celtic Technologies Limited, Victoria Street, Briton Ferry, Factual Environmental Assessment Site Investigation Report, 2002. No.R428B/02/1744. (Final)
2. Environmental Protection Act 1990 Part IIA: Contaminated Land Consultation on Draft Statutory Guidance on Contaminated Land (2 Volumes), September 1996.
3. British Geological Survey 1:50,000 Solid and Drift Edition Mapping Sheet 247, Swansea.
4. Landmark Envirocheck Report, Reference 6131181-1-1.
5. Coal Authority Coal Mining Report Reference 10312904-04.
6. Environment Agency. Policy and Practice for the Protection of Groundwater, Vulnerability 1:100,000 Map Series, Sheet 35, West Glamorgan.
7. Earlswood Materials Laboratory (1997), 12 Regent Street West, Briton Ferry, Investigation of Ground Contamination, 01711/R957/RLS.

Drawings

08818/R3054/01	Site Plan
08818/R3054/02	Site Boundaries
08818/R3054/03	Site layout
08818/R3054/04	Preliminary Conceptual Site Model

Appendix A

Service Drawings

Appendix B
Envirocheck Report

Appendix C
Celtic Technologies Limited, Victoria Street, Briton Ferry, Factual Environmental
Assessment Site Investigation Report, No.R428B/02/1744. (Final)

Appendix D
Coal Authority Coal Mining Report Reference 10312904-04