

South Wales Metro

Hoover Geotechnical Desk Study

July 2018

Transport for Wales

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Executive Summary

Aspect	Details
Introduction	Transport for Wales (TfW) has commissioned MottMacDonald Ltd to undertake a geotechnical and geo-environmental desk study for the Hoover Strategic Regeneration Scheme (the 'site') as part of the proposed South Wales Metro.
Proposed Development	At the time of writing the proposed development for the Hoover Strategic Regeneration Scheme comprises a mixed end use. This includes a new park and ride station, a new metro
	station on the rail vale Railway Line, and aleas of residential, open space and employment.
Site Location and Description	The site covers a total area of approximately 47.6 hectares on the valley floor of the Taff Valley, approximately 1.9km (1.2 miles) south of Merthyr Tydfil. It is centred at approximate National Grid Reference 305486, 204655.
	The River Taff flows along the valley floor, and the Taff Valley is bound to the east by the Mynydd Cilfach-yr-encil and Merthyr Common and to the west by Mynydd Gethin of the Mynydd Merthyr.
	The northern area of the site lies to the west of the River Taff only, and the southern area of the site lies to the east and west of the River Taff. The Taff Vale Railway runs through the southern area of the site, immediately to the east of the River Taff.
	To the east of the River Taff the site comprises the former Hoover Factory, with a Sports
	Ground and Pavilion. To the east of the former Hoover Factory the site comprises 1.5 hectares of a car park for the Triangle Business Park, separated from the former Hoover Factory by the A4054.
	The western area of the site comprises the Abercanaid Industrial Estate, with approximately 3.3 hectares of rough grassland in the south. A Dismantled Railway crosses the western area of the site in the north.
Geology and Ground	The ground conditions beneath the site are likely to comprise:
Conditions	Made ground deposits across the site:
	 Superficial Deposits comprising Alluvium underlie the majority of the site, and Glacial Till underlies the southwest of the site;
	 Bedrock of the South Wales Lower Coal Measures underlies the north of the site, and South Wales Middle Lower Coal Measures underlie the south of the site; and
	 A northwest to southeast trending fault crosses through the South Wales Coal Measures in the north of the site.
	Groundwater was encountered at 4.57m bgl and 9.14m bgl in two historic boreholes on the former Hoover Factory.
Mining	The site lies in the South Wales Coalfield. The Coal Authority Report indicates there are twenty-two known worked shallow coal seams underlying the site, mined at depths between 10m and 156m between 1862 and 1950. It further identifies eleven worked coal seams and one worked ironstone seam in the surrounding area, mined at shallow depths between 36m and 174m between 1852 and 1949.
	Sixteen coal outcrops are indicated to cross the site, and where these coal outcrops are located Coal Authority Development High Risk areas are designated.
	Two areas of probable shallow coal mine workings are identified on and within 100m of the site, and fourteen areas of known shallow coal mine workings are noted by the Coal Authority on the site and in the surrounding area.
	Three shallow spine roadways are indicated in the southwest of the site, that extend beyond the western site boundary, where a further two shallow spine roadways are identified. Another three shallow spine roadways are located to the east of the site.
	Eight mine entries are indicated to be present on the site, and twenty-one mine entries are shown in the surrounding area by the Coal Authority.
Site History	The site lies within the South Wales Coalfield and therefore has a history of coal and mineral extraction. Other historical land uses on the site and within the surrounding area include; industrial and manufacturing factories, a dairy, depots, a wire works, a gas works, allotment gardens, tips, a dock, and a burial ground.
	The current land use on the site comprises a mix of commercial, industrial and agricultural.
Geo-environmental Constraints	Several geo-environmental constraints have been identified for the site based on the desk based review of available information relating to land use and ground conditions. The key potential constraints at the site associated with potentially contaminated soil and groundwater are:

Aspect	Details
	• Historical/current factories and depots associated with the Abercanaid Industrial Estate;
	 Historical tips from industrial activities in the area;
	 Historic railway lines and sidings, and the current Taff Vale Railway;
	Historical Gas Works;
	 Agricultural and allotment gardens; and
	 Fill materials from historical and current mining, quarries and pits.
Geotechnical Constraints	The desk based review of available information relating to land use and ground conditions has identified several geotechnical constraints. The key geotechnical constraints at the site are:
	 Unknown thickness and composition of Made Ground underlying the site;
	 Poor ground conditions associated with Made Ground and Alluvial Deposits;
	 Localised flooding and/or washout;
	 Potential shallow groundwater levels;
	Weathered bedrockat fault;
	 Unknown rockhead profile/ unknown thickness of superficial deposits; and
	 Coal Authority Designated High Risk Development Area, shallow mine workings and
	mine entrieson the site.
Recommendations	The desk study assessment has indicated known shallow coal and iron mining, under the site and in the surrounding area and the majority of the site is located within a Coal Authority Development High Risk Area. It is therefore recommended that a full mining risk assessment is undertaken to understand the associated risks. The full mining risk assessment will comprise, where available, the purchase and detailed review of mining abandonment plans, in conjunction with a detailed review of large scale geological maps (1:10,000), geological memoirs and available historic boreholes, as well as the location of mine entries in relation to future development works. This review will pay particular attention to the dip and dip direction of coal seams. This review may include ground investigation recommendations.
	The GI may include, but is not limited to, the following:
	 Trial pits to investigate the nature of the Made Ground and superficial deposits;
	 Dynamic sample boreholes, using a tracked dynamic sample rig, to investigate the nature of the superficial deposits, depth to bedrock and depth to groundwater;
	 Rotary boreholes to investigate the nature of the superficial deposits, the rockprofile and properties to determine the presence or otherwise of potential shallow mine workings;
	 Standard penetration tests (SPTs);
	 Soil, rock and groundwater sampling for geotechnical and geo-environmental laboratory testing; and
	 Standpipe installations for groundwater monitoring. The period of monitoring should be assessed on an individual basis and be reflective of seasonal changes. Monitoring periods may also be subject to access agreements.
	The proposed ground investigation should be reviewed and updated as the scheme develops.

1 Introduction

1.1 Background

Transport for Wales (TfW) has commissioned Mott MacDonald Ltd to undertake a geotechnical and geo-environmental desk study for the Hoover Strategic Regeneration Scheme (the 'site') as part of the proposed South Wales Metro.

1.2 Proposed Development

At the time of writing the proposed development for the Hoover Strategic Regeneration Scheme comprises a mixed end use. This includes a new park and ride station, a new metro station on the Taff Vale Railway Line, and areas of residential, open space and employment.

1.3 Objectives of the Report

The objectives of this report are to:

- Determine the likely ground conditions beneath the site;
- Establish the principal geotechnical risks for the site relating to mining, mass movement, historical land use and UXO;
- Establish areas with additional risks due to historical contamination;
- Develop a preliminary conceptual site model (CSM) and identify potential pollutant linkages for the site;
- Define geotechnical constraints that could be used for feasibility and outline design of foundations; and
- Develop guidance on the ground investigation (GI) requirements, including an outline GI plan.

1.4 Methodology

This report has been completed in cognisance of best practice methodology detailed in the following documents:

- BS EN 1997 1:2007, 'Eurocode 7 Geotechnical Design Part 1: General Rules' (Ref. 1)
- BS EN 1997 2:2007, 'Eurocode 7 Geotechnical Design Part 2: Ground Investigation and Testing'. (Ref. 2)
- BS10175:2011(+A1:2013), 'Investigation of Potentially Contaminated Sites', (Ref. 3)
- CLR 11, 'Model Procedures for the Management of Land Contamination' (2004) (Ref. 4)
- Construction and Industry Research and Information Associated (2001) Contaminated Land Risk Assessment – A Guide to Good Practice CIRIA Report C552 (Ref. 5)

1.5 Sources of Information

The following sources of information have been consulted to compile this report:

- Groundsure Geo-Insights and Enviro-Insights Report (Ref. 6);
- British Geological Survey Online Viewer (Ref. 7 & Ref. 8);
- Coal Authority Online Viewer (Ref. 9);

- Coal Authority, Coal Mining Report (Ref. 10);
- Environment Agency, What's in Your Backyard (Ref. 11);
- UXO Pre-Desk Study Assessment, Zetica (Ref. 12);

1.6 Limitations

A 100m reporting buffer has been applied to the site.

A detailed flood risk assessment was not undertaken for the site.

This report has been prepared for the titled project or named part thereof, and should not be relied upon or used for any other project without an independent check being carried out as to its suitability and prior written authority by Mott MacDonald obtained.

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This review considers the risks associated with the proposed use of the site only. This report should not be relied upon by any other third party.

Mott MacDonald is not insured for, and therefore will not undertake, surveys to identify asbestos or provide guidance on the treatment of asbestos. Should the presence of asbestos be suspected during development, Mott MacDonald would recommend the appointment of a specialist contractor to address the issue and would not provide advice on any risk or remedial measures required.

2 Site Location and Description

2.1 Site Location

The site is located in the Taff Valley of the South Wales Valleys, 1.9km (1.2 miles) south of Merthyr Tydfil, approximately 35km (22 miles) north of Cardiff. It is centred at approximate National Grid Reference (NGR) 305486, 204655.

The site location is shown in 367590-MMD-44-DR-GIS-C-0001, Location Plan in Appendix A.

2.2 Site Description

A summary of the site is presented in Table 1.

Table 1: Site Description Summary

Aspect	Detail
Site Description	The site lies on the valley floor of the Taff Valley, a feature that trends north-west to south-east between Merthyr Tydfil and Abercynon. The Taff Valley is bound to the east by Mynydd Cilfach-yr-encil and Merthyr Common, and to the west by Mynydd Gethin of the Mynydd Merthyr. The River Taff flows along the valley floor.
	The site covers a total area of approximately 47.6 hectares. The northern area of the site lies to the west of the River Taff only, and the southern area of the site lies to the east and west of the River Taff. In the southern area of the site the Taff Vale Railway runs through the site immediately to the east and orientated parallel to the River Taff. To the east of the River Taff the site comprises the former Hoover Factory, with a Sports Ground and Pavilion in the south. On the former Hoover Factory site there are two large factory buildings, and several smaller outbuildings. To the east of the former Hoover Factory the site comprises approximately 1.5 hectares of car park for the Triangle Business Park. The former Hoover Factory and car parkare separated by the A4054, which runs north to south.
	The western area of the site comprises the Abercanaid Industrial Estate, with a small area, approximately 3.3 hectares, of rough grassland in the south. The Abercanaid Industrial Estate consists of three large factory buildings, a depot, and multiple smaller buildings, with a Dismantled Railway crossing southwest to northeast in the north.
Topography	The valley floor of the Taff Valley at site lies at approximately 150m AOD, and rises to a maximum height of 445m AOD to the east at Mynydd Cilfach-yr-encil and to a maximum height of 491m AOD to the west at Mynydd Gethin.
Surrounding Area	The Taff Trail is a public footpath and cycleway that follows the northern boundary of the site, approximately 150m beyond which is the A4102. The A4102 connects the A470 and the A4054, and is orientated southwest to northeast. Merthyr Tydfil Leisure Village is located between the northern boundary of the site and the A4102, and beyond the A4102 there are residential and office buildings. In the northern area of the site the eastern boundary is bordered by the River Taff. Immediately to the east of the River Taff Vale Railway, and approximately 70m further east is the A4054. The A4054 is orientated north to south. Beyond the A4054 are residential buildings. The southern area of the site is bordered by a Business Park to the east, and the A4060 is approximately 70m further to the east orientated north to south. Beyond the A4060 is grassland with areas of non-coniferous woodland.
	Residential buildings and areas of grassland are located to the south of the site, with a school approximately 200m to the south-east.
	The Taff Trail also follows the western boundary of the site. The A470 runs northwest to southeast, approximately 90m to the west of the site, and between the western boundary of the site and the A470 are a few residential properties, areas of grassland and non-coniferous woodland. Further to the west, beyond the A470, is coniferous woodland to the south and non-coniferous woodland to the north. A Dismantled Railway runs through the woodland, orientated south west to northeast before entering the site.

Aspect	Detail
Designated Areas	Two areas of ancient woodland are designated within 100m of the western boundary of the site; one area is approximately 15m to the west and one area is approximately 50m to the west of the site.
	A Site of Special Scientific Interest (SSSI) called Cwm Glo A Glyndyryslies approximately 125m to the west of the site, and has been designated for biological reasons.
Watercourses	The River Taff flows in a southerly direction immediately adjacent to the eastern boundary of the site in the north, and through the centre of the site in the south.
	Nant Graig forms a confluence with the River T aff in the southeast of the site, and flows in the north-easterly direction.
	Three culverts join the River Taffin the southern area of the site, and extend beyond the site boundary. One of the culverts flows across the former Hoover Factory site and joins the River Taff from the east. The two remaining culverts join the River Taff at the same location from the east and west, flowing across the former Hoover Factory site and Abercanaid Industrial Estate.
	In the centre of the Abercanaid Industrial Estate in the western area of the site, a drain is present, forming the border to an area of mixed woodland and a road.
Utilities	Overhead power lines cross the former Hoover Factory and the Abercanaid Industrial Estate in the centre of the site, and are orientated east to west.
	In the north-east of the Abercanaid Industrial Estate is a gas station and several above ground pipes. Information regarding the gas station and above ground pipes is limited, and has only been obtained from the site reconnaissance and historical review.
	No utility surveys have been obtained for the site.

2.3 Site Reconnaissance

A site walkover was undertaken on 4th July 2018 by an Associate and Assistant Geotechnical Engineer from MML. Due to access constraints the walkover was undertaken using public access routes only. The walkover route is shown on the Site Walkover Route Map in Appendix C, which also shows the photograph locations. The weather was noted to be cloudy with some showers, and very warm.

It should be noted that Pentrebach Station was not included within the site walkover. However, a pedestrian underbridge is located just to the south of Pentrebach Station with large culverts orientated east to west. A walkover of Pentrebach Station was undertaken on 25th July 2017 and is detailed in Mott MacDonald report '*South Wales Metro Geotechnical and Geo-Environmental Desk study CAM-22-0 to CAM-24-2'*, dated January 2017.

The River Taff and Taff Vale Railway travel through the centre of the site, splitting the site into eastern and western sections.

The walkover started at the entrance of the Abercanaid Industrial Estate, where Amnitec, a hose and flexible pipe manufacturer, is located in the northeast of the site (Figure 4). Amnitec comprises a larger warehouse building surrounded by hardstanding and tarmacked areas. To the south of Amnitec is a large area of hardstanding with scattered stockpiles demolition waste potentially from the demolition of building within the site area. The stockpiles were noted to comprise a mixture of building materials including brick, roofing felt, masonry and possible asbestos. It is likely the foundations and buried services are still present from the previous buildings in this area.

To the east of Amnitec on the opposite side of the access road is a storage area for vehicles, holding approximately 70 new cars. A retaining wall is located along the embankment on which the access road is located.

Merthyr Self Storage is located to the south of Amnitec, to the west of the demolished area, and also appears to store vehicles. A warehouse building is located to the south of the Merthyr Self

Storage, and houses LoadLok; a manufacturer of cargo fastenings. The building to the south of LoadLok indicated on the Site Walkover Route Map has now been partly demolished, with some walls and foundations still present. Stockpiles of rubble from other demolition activities are also further southeast of this area, with hardstanding and tarmacked areas also present.

To the north of the roundabout into the Abercanaid Industrial Estate is an area called the Willows, which leads to the northern section of the site. The first building on the eastern side of the road is occupied by the RSPCA, and has several associated car parking spaces. To the north of the RSPCA building the road begins to decline towards the northern extent.

The northern section of the site has a number of industrial units. Triumph; a furniture manufacturer is located within the northwest of the site and includes a large warehouse building with surrounding hardstanding. At the entrance of the Triumph site is a small café/ takeaway food building, which lies adjacent to a car garage. The garage has many cars stored within its grounds, and further cars are located to the rear of the connecting house. The house appears to have formerly been a public House.

Opposite the house is an area of rough land with several parked ambulances. North of this area on the eastern side of the road is a large gas station with several large above ground pipes. A strong smell of gas was noted within this area. To the north and west of the gas station are newly constructed industrial units. Those to the west of the Willows road house a company called Screen Genie, and the units to the north of the gas station are storage facilities. Dragon Haulage and Powells scaffolding are in the western end of the Willows road. At the end of the Willows road is AMCO, and engineering firm. Behind this is a further storage area, which extends to the northern extent of the site.

The eastern section of the site is predominantly occupied by the Hoover Candy Group, which appears to be in operation, however some areas of the site appear to be disused. The area has several large articulated lorries stored and other heavy machinery. The eastern side of the north factory building appears to be constructed on a retaining wall, due to the difference in the external levels from the north to the south of the building. The ground level around the north building declines towards the southern end of the site. Further retaining walls were also noted around the northeast of the access road and parking, along the boundary between the railway line and the Hoover building.

A large derelict building is located within the southern section of the site, on the western side of the River Taff, and has a connecting covered walkway or conveyor belt system to the Hoover building on the eastern side of the river. Underneath this bridge there is also appears to be a pipeline bridge crossing the River Taff.

The small eastern section located on the opposite side of the A4054 appears to be employed as a temporary site compound for works being undertaken on the telegraph/electricity masts which cross the site. There is also a telegraph pole located within the centre of this area.

Japanese Knotweed was identified in many areas on the site boundary and banks of the River Taff (Figures 10, 11 and 16).

3 Published Geology

3.1 Made Ground

The BGS mapping indicates that Made Ground underlies the site at four locations (Ref. 7). In the eastern area of the site Made Ground is present in the north, underlying the former Hoover Factory and car park. It then extends beyond the northern and eastern site boundaries of the eastern area of the site. To the west of the River Taff Made Ground underlies the site to the north of the Dismantled Railway, around the depot and to the west of the River Taff in the centre of the site.

The distribution of mapped Made Ground is shown on Drawing 367590-MMD-44--DR-GIS-C-0002, Artificial Ground, included in Appendix A.

It is anticipated Made Ground will underlie the majority of the site, due to the historical development of the site.

3.2 Superficial Geology

The BGS mapping indicates the majority of the site is underlain by Alluvium, which follows the course of the River Taff on the valley floor of the Taff Valley. Glacial Till is present in the western extent of the southern area of the site, and its shown in the surrounding area on the slopes of the Taff Valley. It is anticipated the Alluvium may be underlain by the older Glacial Till (Ref. 7).

The Alluvium is described as a normally soft to firm consolidated compressible silty clay that can contain layers of silt, sand, peat and basal gravel, and may have a stronger desiccated surface zone. The Glacial Till is Diamicton, described as unsorted sediment with gravel in a fine mud matrix (Ref. 8).

The superficial geology is shown on Drawing 367590-MMD-DR-GIS-C-0003, Superficial Geology presented in Appendix A.

3.3 Bedrock Geology

The BGS mapping indicates the northern area of the site is underlain by the South Wales Lower Coal Measures Formation siltstone, mudstone and sandstone, with the South Wales Lower Coal Measures Formation sandstone in the north of the site. The southern area of the site is underlain by the South Wales Middle Coal Measures Formation. The older South Wales Lower Coal Measures and the younger South Wales Middle Coal Measures Formations are separated by the Amman Marine Band (Ref. 7).

The South Wales Lower Coal Measures and the South Wales Middle Coal Measures Formations are described as grey (productive) coal-bearing mudstones and siltstones with seatearths and minor sandstones (Ref. 8).

The bedrock geology is shown on Drawing 367590-MMD-44-DR-GIS-C-0004, Bedrock Geology included in Appendix A.

3.4 Structural Geology

The BGS mapping indicates a northwest to southeast trending fault crosses through the northern section of the site. It then follows the eastern boundary of the site, passing through

both the South Wales Lower Coal Measures and the South Wales Middle Coal Measures Formations (Ref. 7).

The fault is shown on Drawing 367590-MMD-44-DR-GIS-C-0004, Bedrock Geology, in Appendix A.

4 Mining and Quarrying

The site and surrounding area lie within the South Wales Coalfield, and are underlain by the South Wales Coal Measures. The Coal Authority therefore identifies it as being in a Coalfield Consultation Area.

A total of twenty-two coal outcrops are present within the site and surrounding area, with sixteen indicated to cross the site by the Coal Authority. The coal outcrops generally trend east to west, and where the coal outcrops are located Coal Authority Development High Risk Areas have been designated (Ref 9).

The Coal Authority Report indicates there are twenty-two known worked shallow coal seams underlying the site, mined at depths between 10m and 156m below ground level between 1862 and 1950. It further identifies eleven worked coal seams and one worked ironstone seam in the surrounding area, mined at shallow depths between 36m and 174m below ground level between 1852 and 1949 (Ref. 10).

Two areas of probable shallow coal mine workings are identified on and within 100m of the site. One area of probable shallow coal mine workings is identified extending across the southern area of the site, and into the surrounding area. The other area of probable shallow coal mine workings is located approximately 80m to the east of the northern area of the site, beyond the River Taff and the A4054. It then extends southwards, and is located approximately 100m east of the car park in the southern area of the site.

Seven areas of known shallow coal workings are noted by the Coal Authority in the southern area of the site, beneath the Sports Ground and Pavilion and Abercanaid Industrial Estate, and one area is identified in the car park in the east. A further seven areas of known shallow coal workings are identified in the surrounding area to the east and west of the site.

A total of three shallow spine roadways are indicated to underlie the Abercanaid Industrial Estate in the west of the southern area of the site. These spine roadways extend beyond the western site boundary into the surrounding area, where a further two shallow spine roadways are identified approximately 65m to the west of the site. Three shallow spine roadways are also shown approximately 25m to the east of the southern area of the site (Ref. 9).

Eight mine entries are indicated to be present on the site, and twenty-one mine entries are indicated within the surrounding area. Further information on the mine entries is presented in Table 2 and Table 3 (Ref. 10), and on Drawing 367590-MMD-44-DR-GIS-C-0010 in Appendix A.

Location	Mine Entry Type		
	Adit	Shaft	
On-Site	2	6	
Surrounding Area (<100m)	7	14	

Table 2: Mine Entries within 100m of the Site

Source: Coal Authority (Ref. 9)

Reference	Grid Reference	Entry Type	Treatment Details	Mineral
305203-005	305394, 203716	Shaft	This shaft has been filled to an unknown specification.	Coal
305203-004	305530, 203931	Shaft	Thisshaft is filled with hardcore. The shaft was topped up with hardcore and mounted on October 2009 by contractors acting on behalf of the Authority.	Coal
305204-060	305393, 204114	Adit	Uncovered during road improvements. The Coal Authority understand this adit was treated by K Wardell and Partners Consultant Mining Engineers.	Coal
305204-036	305409, 204083	Shaft	Thisshaft was filled, grouted and capped in 1975.	Coal
305204-037	305398, 204093	Shaft	This shaft was filled, grouted and capped in 1975.	Coal
305204-038	305409, 204091	Shaft	This <i>s</i> haft was filled, grouted and capped in 1975.	Coal
305204-069	305409, 204237	Adit	No detailsprovided.	Coal
305204-031	305409, 204288	Shaft	The shaft was grouted and capped in 1977.	Coal

Table 3: Mine Entries Located on the Site

Source: Coal Authority (Ref. 10)

4.1 Quarrying

The BGS GeoIndex indicates that there are no historic or active quarries on the site or within the surrounding 100m of the site (Ref. 7).

5 Land Mass Movements

No areas of mass movement are identified on the site or within 100m of the site boundaries (Ref. 6).

6 Hydrology and Hydrogeology

6.1 Hydrology

The River Taff is a primary watercourse that flows in a southerly direction immediately adjacent to the eastern boundary of the site in the north, and through the centre of the site in the south.

Nant Graig forms a confluence with the River Taff in the southeast of the site. It is a secondary watercourse that flows north-easterly, and extends outside the site boundary, where a tertiary watercourse joins it from the north.

Three culverts join the River Taff in the southern area of the site, and extend beyond the site boundary. One of the culverts flows across the former Hoover Factory site and joins the River Taff from the east, and two of the culverts join the River Taff at the same location from the east and west, flowing across the former Hoover Factory site and the Abercanaid Industrial Estate.

The Glamorganshire Canal flows in a southerly direction, approximately 20m from the western site boundary. It joins the culvert which flows across the Abercanaid Industrial Estate in the southern area of the site. Another watercourse also flows into the culvert in a northerly direction.

In the centre of the Abercanaid Industrial Estate in the western area of the site, a drain is present, forming the border to an area of mixed woodland and a road.

Nant Cwm-blacs and a culvert have a confluence with the River Taff immediately to the east of the northern area of the site, and flow in an easterly direction. Nant Cwm-blacs is a secondary watercourse (Ref. 6).

6.2 Flooding

The River Taff is at high risk of flooding from rivers, and the area immediately surrounding the River Taff is at low to medium risk of flooding from rivers. Two areas are also at low to medium risk of flooding from rivers are identified extending from the River Taff across the northern and southern areas of the Abercanaid Industrial Estate. These areas are designated as Flood Zone 2 and Flood Zone 3.

The superficial deposits underlying the site and surrounding area are susceptible to groundwater flooding, and site and surrounding area lie within a moderate groundwater flooding confidence area, with exception to the north of the site. The north of the site is susceptible to flooding from clearwater and in a low groundwater flooding confidence area, and the area of the Dismantled Railway lies in a high groundwater flooding confidence area.

No flood defences or flood storage areas are identified on the site or in the surrounding area (Ref. 6).

6.3 Hydrogeology

The Alluvium, the South Wales Lower Coal Measures Formation and South Wales Middle Coal Measures Formation are classed as a Secondary A Aquifers, and the Glacial Till is classed as a Secondary Undifferentiated Aquifer (Ref. 6).

Natural Resources Wales database (administered by the Environment Agency) defines a Secondary A Aquifer as permeable layers capable of supporting water supplies at local rather than strategic scale, and in some cases forming an important source of base flow to rivers. They

assign Secondary Undifferentiated Aquifers in cases where it has not been possible to attribute either category A or B to a rock type, and the layer may be unproductive in different locations due to the variable characteristics of the rock type (Ref. 11).

The site and surrounding areas are not located within a Source Protection Zone (SPZ).

The groundwater vulnerability of the site and surrounding area is defined as soils of high leaching potential, with soils of low leaching potential in the southwest of the site and surrounding area. Soils of high leaching potential are soils within urban areas and restored mineral workings that are assumed to be highly permeable in the absence of site specific data. Soils of low leaching potential are those in which pollutants are unlikely to penetrate the soil layer, as either water movement is largely horizontal or they have the ability to attenuate diffuse pollutants (Ref. 6).

At present no data is available on the groundwater levels throughout the site area.

7 Historical Development and Current Land Use

A review of the historical development of the site and surrounding area has been undertaken with reference to historic and current Ordnance Survey (OS) mapping (Ref. 6).

The site lies within the South Wales Coalfield and therefore has a history of coal and mineral extraction. Other historical land uses on the site and within the surrounding area include; industrial and manufacturing factories, a dairy, depots, a wire works, a gas works, allotment gardens, tips, a dock, and a burial ground.

The current land use on the site comprises a mix of commercial, industrial and agricultural.

For the ease of reporting the site has been split into the eastern area, lying to the east of the River Taff, and the western area, lying to the west of the River Taff. The eastern area comprises the former Hoover Factory, the Sports Ground and Pavilion, and the car park. The western area of the site encompasses the Abercanaid Industrial Estate and an area of rough grassland.

The pertinent historical and current land use of the east and west of the site and surrounding area, along with their distance and direction from the site are summarised in Table 4 and Table 5, and in Drawing 367590-MMD-44-DR-GIS-C-0007 to 367590-MMD-44-DR-GIS-C-0009, Geo-Environmental Constraints Plan, in Appendix A.

Ordnance Survey Mapping Dates	On-Site (Relevant Years)	Surrounding Area (Relevant Years)
East	 The Taff Vale Railway is dual-track orientated north to south (1875 to Present); Pentrebach Station located adjacent and to the east of the Taff Vale Railway in the south of the site (1900 to Present); A tramway is orientated north to south then to the east in the south of the site to join to the Pentrebach Iron Works. It is joined by multiple tramways in the south of the site (1875 to 1962); The tramway is not be south lead to heaps in the centre of the site, and to a building in the south (1875). The number of tramways in the south lead to heaps in the centre of the site, and to a building in the south (1875). The number of the heaps has expanded north and south (1919). A factory has been constructed (1948). The factory has been constructed on the slag heaps (1971). The two large factories have merged (1979 to Present); The A4054 runs north to south in the east of the site (1875 to Present) Pentrebach Feeder Canal enters the site in the north and flows east then south out of the site in the south and south south in the south in the site (1875 to Present) 	 The Plymouth Iron Works is located approximately 200m to the northeast. Associated with it are two air shafts approximately 10m and 80m north, an Engine House and old level (ironstone) approximately 5m east, a Limekiln and Mortar Mill approximately 80m east, an old level (coal) approximately 80m east, an old level (coal) approximately 80m east, and multiple tramways orientated northwest to southeast (1875 to 1900). A Pump House hasbeen built on part of the former Engine House approximately 15m east (1971 to 1979). A Tip is located on former tramways approximately 45m east (1979 to 1992). Car Park constructed on the tip (1992 to Present); The southeast of the site isbordered by the A4054 (1875 to Present); The Pentrebach Feeder Canal is approximately 20m east of the site beyond the A4054 orientated north to south (1875 to 1971); Pentrebach School and residential properties are approximately 25m east of the Pentrebach Feeder Canal is automately 25m east of the Pentrebach Feeder Canal is automately 25m east of the Pentrebach Feeder Canal is automately 25m east of the Pentrebach Feeder Canal is automately 25m east of the Pentrebach Feeder Canal is automately 25m east of the Pentrebach Feeder Canal is automately 25m east of the Pentrebach Feeder Canal (1875 to 1971). Factory constructed on the school (1971 to 1992). Buildings constructed on factory as part of Triangle Business Estate, and another building

Table 4: Summary of Historical Land Use On-Site and in the Surrounding Area

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Ordnance Survey Mapping Dates	On-Site (Relevant Years)	Surrounding Area (Relevant Years)
	 a south-westerly then south-easterly direction (1875 to 1962); An old shaft is located in the north of the site on the eastern boundary (1875 to 1962). An old shaft is located in the north of the site on the eastern boundary (1875 to 1962); An electrical substation is located on the western boundary (1962 to Present); and Woodland is present in the south (1875 to 1919) A Sports Ground, Bowling Green, Putting Green, Playground and Pavilion have been constructed on the woodland (1962). A small factory has been constructed on the playground (1971 to present). 	 has been constructed to the north (1992 to Present); Pentrebach Iron Works are approximately 125m east. Multiple tramways are present to the southeast of the site associated with the works (1875 to 1900). Factory constructed approximately 40m southeast (1948 to 1992). Buildings constructed on former factory as part of Triangle Business Park (1992 to Present). Rises approximately 70m south of the site (1922 to 1964); Roundabout constructed immediately to the south joining the A470, A4054 and A4060 (1964 to present); and Roundaboutbuilt immediately north of the site connecting the A5054 and the entry to the Abercanaid Industrial Estate (1971 to Present); Drain flows southwest into the River Taff approximately 30m south (1980 to 1983). A4054 been constructed off the roundabout and continues southwest (1983 to Present).
West	 The Vale of Neath Section of Great Western Railway is orientated southwest to northeast parallel to northern boundary of site (1875 to 1977); A watercourse enters the northern boundary of the site and flows southeast into the River Taff (1875 to 1948) Drain present (1948 to 1989); A tramway extends across the River Taff into the northeast of the site and travels south from the Plymouth lron works (1875 to 1919); Heaps are shown in the north and have tramways associated with them orientated north to south (1875 to 1977) Dairy has been constructed (1977 to 1989) Deport has been constructed (1977 to 1989) Deport has been constructed (1977 to 1989) Deport has been constructed (1977); Wire Works (disused) adjacent to the Willows. A tramway extends across the River Taff to the Wire Works (disused) orientated southeast to northwest (1900 to 1919). Gas Works (Merthyr Tydfil GasCompany) with two tanks and multiple buildings constructed on Wire Works (disused) (1919). Further buildings and a pipeline extending from the Gas Works across the River Taff built (1977). Two electrical substations constructed (1979) Gas Works no longer present (2018); Factory built adjacent to Gas Works (1962) Factory has been extended (1971) and extended further (1984 & 1988 to Present); Brandy Bridge Junction extends across the River Taff and enters the centre of the site from the eastern boundary (1900 to Present); A road has been constructed across Brandy Bridge Junction and is orientated north to south through the site (1962 to Present); A factory has been constructed in the centre of the site (1971 to Present). Another factory has 	 Multiple railway lines, including Taff Vale Railway, are approximately 20m east of the site in the north orientated north to south (1875 to 1979) Only Taff Vale Railway remains (1979 to Present); Saw Pit is present approximately 70m northeast (1875 to 1900); A railway line borders the northern site boundary, orientated southwest to northeast then north (1875 to 1965). Joins Vale of Neath Section of Great Western Railway to south (1965 to 1976). A Tip (disused) is present approximately 25m northwest of the site (1976 to 2018); The Glamorganshire Canal flows to the south, approximately 20m from the western site boundary in the north, and immediately adjacent to the eastern site boundary in the south, crossing through the site in the south (1875 to 1922); A spring is located on the western site boundary in the north (1900 to 1964); Glyn-dyrys Locks approximately 15m west of the north of the site on the Glamorganshire Canal (1875 to 1948); Well approximately 35m west of the Glyn- dyrys Locks (1919 to 1922); Upper Abercanaid Pit continues to the west of the site, associated with it are residential buildings approximately 35m west, and Engine House approximately 35m west, and Engine House approximately 50m west, two shafts approximately 80m west and a level (ironstone) approximately 70m west (1875 to 1919) Engine house present (1875 to 1948). Residential buildings constructed on pit (1988 to Present); Old shaft approximately 65m west of the centre of the site (1919 to 1922);

Ordnance Survey Mapping Dates	On-Site (Relevant Years)	Surrounding Area (Relevant Years)
Dates	 been constructed adjacent to it (1979 to Present). An Old Shaft (coal) is located in the centre of the site (1875 to 1964); A Dock is located on the western boundary of the centre of the site (1875 to 1919); The Upper Abercanaid Pit (coal) is in the south, and has a tramway, residential buildings, out buildings, Engine Houses and two shafts associated with it. The tramways extend to the east and to the Dock (1875 to 1919); A watercourse flows from the western boundary of the site near the Dock through the Upper Abercanaid Pit (coal) and into the River T aff (1875 to 1900); Heaps are to the east of the Upper Abercanaid Pit (coal) (1875 to 1971), then Disused Tips (1971). Large factory and smaller buildings constructed (1984 to 2018); Airshaft located on the southwest site boundary (1875 to 1900); Airshaft located in the southwest of the site (1875 to 1919) Allotment gardens around old airshaft (1962 to 2018); and 	 An Old Quarry is shown approximately 45m west of the centre of the site (1919 to 1922); A burial ground is present approximately 45m west of the south of the site (1875 to Present); A Saw Pit is approximately 25m west of the south of the site (1875 to 1900); A Smithy is approximately 60m west of the south of the site (1875 to 1900); An electrical substation is approximately 35m to the west of the south of the site (1875 to 1900); An electrical substation is approximately 35m to the west of the south of the site (1982 to present); Graig Pit (coal) is approximately 90m west of the ste in the south, and hasa shaft associated with it 70m west and heaps approximately 50m west (1875 to 1900). Residential buildings constructed on pit (1982 to Present); A spring is approximately 40m north of the south of the site (1900 to 1919); A railway follows the westem site border in the south (1875 to 1948). The G.W.R and Rhymney Joint Line join the railway (1900 to 1964); Residential buildings 70m west of the south of
	 Allotment Gardenson the western boundary of the site (1962 to 1979). 	 the site (1988 to Present); Gravel pit and heaps approximately 15m south (1919 to 1948) Expanded north (1948 to 1964); and

• Residential buildings border the eastern site boundary in the south beyond the Glamorganshire Canal (1875 to Present).

Table 5: Current Industrial Land Use

Area	On-Site	Surrounding Area (<100m)
East	 Two manufacturing and production factories; A distribution and storage depot; Taff Vale Railway Line; Distribution and storage on Hoover Factory site Three electricity substations; An electricity pylon; Two Gas Governor Stations; and Two tanks. 	 Triangle Business Estate including: Vehicle components suppliers, approximately 20m east; Vehicle parts and accessories, approximately 35m east; and Beds manufacturing and production, approximately 30m east. New vehicles retailor, approximately 90m north; Electricity substation, approximately 30m east; Tank, approximately 60m east; and Electricity substation, approximately 30m east.
West	 Abercanaid Industrial Estate including: Two distribution and haulage depots; A container and storage depot; A vehicle parts and accessories retailors; Office and shop equipment manufacturers; General construction supplies manufacturers; Vehicle hire and rental; and Three unspecified works or factories. 	 Electricity substation, approximately 40m north; Gas Governor station, approximately 10m north; Electricity station, 45m north; Electricity station, 95m north; Pipeline, 5m east; Vehicle cleaning services, 85m east; Construction and tool hire, 65m east; New vehicles retailers, 70m east; Refuse Tip, 20m west; Electricity substation, 40m west; and

Area	On-Site	Surrounding Area (<100m)		
	 Fourtanks; 	 Electricity substation, 35m south. 		
	 RSPCA centre; and 			
	 An electricity pylon. 			

8 Historical Ground Information

The BGS database of historic exploratory holes has been reviewed for the site and surrounding area. The relevant historic exploratory hole data is summarised below, and their locations are presented in Drawing 367590-MMD-44-DR-GIS-C-0005, Relevant Historic Borehole Plan, in Appendix A (Ref. 7).

Thirty-nine historic exploratory holes are located on the site, however only fourteen historic exploratory holes have been considered to assess the geology of the site. Twenty-five of the exploratory holes had restricted access or were confidential and therefore could not be used. It should be noted that the fourteen accessible exploratory holes are located on the former Hoover Factory in the east of the site only. The historical exploratory holes are summarised in Table 6 and Table 7.

Borehole	Borehole ID	Location		Total Depth	Elevation (m
Ref.		Easting	Northing	(m bgl)	bgl)
BH01	SO00SE536	305620	204140	3.20	-
BH02	SO00SE537	305640	204160	8.22	-
BH03	SO00SE538	305680	204200	6.24	-
BH04	SO00SE539	305710	204220	6.09	-
BH05	SO00SE540	305730	204240	19.20	-
BH06	SO00SE541	305690	204240	6.24	-
BH07	SO00SE542	305600	204180	5.71	-
BH08	SO00SE543	305660	204240	5.10	-
BH09	SO00SE544	305700	204280	5.79	-
BH10	SO00SE545	305570	204220	4.80	-
BH11	SO00SE546	305600	204250	8.07	-
BH12	SO00SE547	305620	204270	8.83	-
BH13	SO00SE548	305650	204280	4.11	-
BH14	SO00SE550	305670	204310	5.79	-

Table 6: Historic Exploratory Hole Information

Table 7: Geology Summary

	Depth and Th	nickness		Exploratory		
Geology	Depth to Top (m bgl)	Depth to Base (m bgl)	Thickness (m)	Holes Encountered Stratum	Stratum Description	
Made Ground	0.0	2.10-7.60	2.10-7.60	BH01-BH14	Black silt. Fused slag. Shale fill and clinker with occasional bricks. Brick and clinker. Fine red ash and small black clinker.	
Glacial Till	2.10-7.60	3.20-19.20*	0.20-12.20*	BH01-BH08 and BH10- BH14	Clay with cobbles and boulders. Silty sand and stones. Boulders, sand and gravel. Boulders and gravel in a clayey/ silty matrix.	

*Depth to base of stratum unproven. Thickness unproven.

Bedrock was not encountered in any of the historical exploratory holes.

Groundwater was encountered was encountered in exploratory holes BH02 and BH05, at 4.57m bgl and 9.14m bgl respectively in the Glacial Till.

9 Preliminary Contaminated Land Risk Assessment

9.1 Introduction

The framework for the assessment of potential land contamination adopted in this report is based on current guidance documents regarding the implementation of Part 2A of the Environmental Protection Act, 1990 (Ref. 13), and the assessment of potentially contaminated land, with reference to: Contaminated Land Research Report (CLR) 11 (Ref. 4), CIRIA Report C552 (Ref. 5) and British Standard BS10175:2011 + A2:2017 (Ref. 15).

This section provides a qualitative contaminated land risk assessment in relation to the proposed Hoover Strategic Regeneration Area. The risk assessment includes the development of a conceptual site model, which is achieved by undertaking a Source-Pathway-Receptor analysis of the site and proposed scheme:

- Sources are potential or known contaminant sources e.g. a former land use;
- Pathways are environmental systems through which a contaminant could migrate e.g. air, groundwater; and
- Receptors are sensitive environmental receptors that could be adversely affected by contaminants e.g. site occupiers, groundwater resources.

Where a source, relevant pathway and receptor are present, a pollutant linkage is considered to exist, meaning there is a circumstance through which environmental harm could occur and a potential environmental liability is considered to exist.

The works proposed for the Hoover Strategic Regeneration Area include, at the time of writing, a new park and ride facility, a new metro station along the Taff Vale Railway Line, and areas for residential, open space, retail, and employment. The development will be mixture of residential, and commercial/industrial land use, which will include areas of hard and soft standing, and the construction of infrastructures and foundations. End users are anticipated to range from residents of the area, commuters to the park and ride and potentially the new metro station, and workers in the retail/employment areas.

9.2 Anticipated Contaminant Sources

Based on the reviewed information, the anticipated contaminant sources which may affect the site are summarised in Table 8. Potential sources are considered based on what the source is, its distance from the site, and the locality of the source. Where possible reference has been made to the Department of Environment Industry Profiles (Ref. 16) published in 1995, which provided information on the processes, materials and waste associated with individual industries regarding land contamination.

Potential contaminants presented are not exhaustive, but present the likeliest based on reviewed historical land use. The area has been subjected to various phases of redevelopment and it is likely that contamination associated with the earlier iron and steel industry has been remediation to some extent to facilitate the later development.

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Table 8: Potential Sources of Contamination

Feature	Approximate Location	Potential Contaminants
Current industrial/commercial land use, such as LoadlokManufacturing, Amnitec.	Western central and northem areas of the site.	Metal contaminants. Organic compounds such as fuel oils or solvent which may be used. Asbestos in buildings.
Historical and current railway main lines, and sidings. Historical railway would have been associated with the collieries, iron works, and steelworks in the area. Transporting raw and waste materials from these industrial processes.	Current Taff Vale Railway line. Historically within site area to the south-east, crossing over the River Taff to the Upper Abercanaid Pit which was located approximately within the central western area.	 Metal contaminants. Organic compounds, such as: Fuel oils and lubricating oils; Polycyclic aromatic hydrocarbons; Solvents; and Herbicides. Asbestos, ash and fill, and sulphates. Materials associated with industrial land use in the area, such as slag, cinder, and coal.
Gas Works (Merthyr Tydfil GasCo.)	In the northern site area, west of the River Taff.	 Organic compounds, such as: Coal tar constituents; and Fuel oils, e.g. petroleum, naphtha. Inorganic compounds, such as: Acids, e.g. sulphuric, hydrochloric; Alkalis, e.g. sodium hydroxide, sodium carbonate; and Cyanide. Metal contaminants. Asbestos.
Historical mining quarries and pits.	Mainly located at and around the historical Upper Abercanaid Pit, which was located within the central western area.	Fill material would have likely come from a variety of sources including colliery spoil. Potentially with additional material from the industrial activities in the area. It can result in metals, organic, and inorganic contaminants being present.
Historical Hoover factory, unidentified factories, depots, and dairy factory.	Across most of site area along the River Taff.	Contaminants can include metals, organics, inorganics, and asbestos.
Historical and current allotment gardens	Generally, within the southern area of the site.	Heavy metalse.g. copper and zinc accumulation Fertiliærs and agrochemicals - Historical application of æwage sludge and other wastes.
Historical tips associated with the industrial activities in the area, which included iron works, and collieries. Identified historical tips included slag heaps, and cinder tips.	Across the site on land either side of the River Taff.	Metals. Acidification.
Historical and current vehicular traffic.	Across the site along roads and tracks.	Fuel oils. Polycyclic aromatic hydrocarbons.
Historical agricultural land use.	Within the sites southern area.	Heavy metalse.g. copper and zinc accumulation Fertiliærs and agrochemicals - Historical application of æwage sludge and other wastes.

Feature	Approximate Location	Potential Contaminants
Made Ground, infilled ground, Alluvium and the South Wales coal measure formations are potential sources of	Across the site.	Potential to be a source of hazardousground gasgeneration such as:
hazardousground gases.		Methane;Carbon dioxide;
		 Carbon monoxide; and Hydrogen sulphide. Made Ground and infilled ground can also be a source of volatile vapours.

Based on the available information reviewed, there has been significant development on-site or adjacent to the site that can potentially affect the site. The potential sources of contamination are presented below:

S1: Residual contamination from historical/current factories, and depots associated with the industrial estate.

S2: Residual contamination from the historical tips from industrial activities in the area, such as materials from the iron works, and collieries.

S3: Residual contamination from the historical railway lines and sidings, and current Taff vale Railway.

S4: Residual contamination from the historical gas works on-site.

S5: Residual contamination from agricultural and allotment gardens land use.

S6: Residual contamination from historical and current vehicular traffic on-site.

S7: Residual contamination from fill materials within the historical mining quarries, and pits.

S8: Aggressive ground conditions to buried structures, arising from Made Ground and underlying natural ground.

S9: Ground gas risk arising from infilled ground, Made Ground, Alluvium, and South Wales coal measure formations.

9.3 Potential Pathways

P1: Human uptake pathways:

- Dermal contact;
- Inhalation; and
- Ingestion.

P2: Surface water runoff.

P3: Leaching and vertical migration in the unsaturated zone.

- **P4:** Vertical and horizontal migration in the saturated zone.
- P5: Man-made pathways e.g. excavations, foundations etc.
- **P6:** Direct contact with construction material.
- P7: Vegetation root uptake.

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P8: Gas migration pathways.

9.4 Potential Receptors

R1: Resident end users.

- R2: Commuter end users.
- R3: Employment area worker end users.
- R4: Construction and maintenance workers.

R5: Surface water – River Taff, and the culverts and drains flowing to the river.

R6: Groundwater – Secondary A Aquifers of the Alluvium, South Wales Lower Coal Measures Formation, and South Wales Middle Coal Measures Formation.

R7: Site vegetation.

R8: Buried concrete structures and foundations.

R9: Potable water supply pipes.

9.5 Contaminated Land Risk Assessment

An evaluation of the risks associated with land quality at the site has been undertaken by considering the above source-pathway-receptor relationships in terms of both the probability (likelihood) that a contaminant linkage will be present and the potential consequences of the occurrence. The assessment is undertaken based on the information currently available.

This Preliminary Risk Assessment is presented in Table 9 in relation to the works proposed and the proposed development. The qualitative risk descriptors used are derived from the methodology described in EA, NHBC, CIEH (2008) (see Appendix B for more information).

Table 9: Qualitative Contaminated Land Risk Assessment

Potential Sources	Potential Pathways	Potential Receptors	Consequence	Probability	Risk Classification
 S1: Residual contamination from historical/current factories and depots associated with the industrial estate. S2: Residual contamination from the historical tips from industrial activities in the area, such as materials from the iron works, and collieries. 	 P1: Human uptake pathways: Dermal contact; Inhalation; and Ingestion. 	R1: Resident end users.	Medium: historical land use on-site can result in contaminants which can lead to adverse human health effects,	Low likelihood: residents will generally be limited to their homes, roads, and local retail/employments areas. These areas are likely to be covered in hardstanding, which acts as a physical barrier to underlying ground material. Any exposure will likely occur in their gardens, parks, or landscaped areas. If imported material will be used for these areas, a pathway is unlikely to form.	Moderate/low
S3: Residual contamination from the historical railway lines and sidings, and current Taff vale Railway.		R2: Commuter end users.		Unlikely: any commuters will not spend a lot of time on-site, as they will either be on- site to use the potential new Metro station, or to use the park and ride.	Low
 S4: Residual contamination from the historical gas works on-site. S5: Residual contamination from agricultural and allotment gardensland use. S6: Residual contamination from historical and current vehicular traffic on-site. S7: Residual contamination 	on rks on iment on it on ne , and	R3: Employment area worker end users.		Low likelihood: workers in the employment areas will generally spend their time in their place of work, which will likely be covered in hardstanding; providing a physical barrier to underlying ground material. Any exposure will be limited to their breaks or out of work hours where they may spend their time in outdoor landscape, or park areas. If imported material will be used for these areas, a pathway is unlikely to form.	Moderate/low
from fill materials within the historical mining quarries, and pits.		R4: Construction and maintenance workers.		Likely: due to the nature of construction works, workers will be exposed to potentially contaminated material, from working and handling material on-site.	Moderate
	P2: Surface water runoff. P4: Vertical and horizontal migration in the saturated zone.	R5: Surface water – River Taff, and the culverts and drains flowing to the river.	Medium: historical land use on-site can result in contaminants which can result in adverse effect to surface and groundwater quality at the site.	Likely: the River T aff flows through the middle of the site, and it is likely that during heavy rainfall, surface run-off will make their way to the river, or surface water courses which discharges to the river. Groundwater flow on-site will likely flow down towards the river, as it is at the base of the valley	Moderate
	P3: Leaching and vertical	R6: Groundwater – Secondary A		Likely: Alluvium and the South Wales coal measures underlie the site. As the River	Moderate

Potential Sources	Potential Pathways	Potential Receptors	Consequence	Probability	Risk Classification
	migration in the unsaturated zone. P4: Vertical and horizontal migration in the saturated zone. P5: Man-made pathways e.g. excavations, foundations etc.	Aquifers of the Alluvium, South Wales Lower Coal Measures Formation, and South Wales Middle Coal Measures Formation.		Taff flowsthrough the site, groundwater is likely to be in hydraulic connectivity to the river. Residual contaminant would have been leached or migrated over time to groundwater.	
	P7: Vegetation root uptake.	R7: Site vegetation.	Mild: historical land use on- site can result in contaminants which can result in vegetation damage to landscaped, park, or residential garden areas.	Likely: if no imported material will be used for the proposed vegetated areas, vegetation will be rooted in and grow from current on-site ground material which may potentially be contaminated.	Moderate/low
S8: Aggressive/unfavourable ground conditions to buried structures, arising from Made Ground and underlying natural ground.	P5: Man-made pathways e.g. excavations, foundations etc. P6: Direct contact with	R8: Buried concrete structures and foundations.	Medium: Made Ground or the underlying natural ground may pose aggressive ground conditions to concrete structures, or pose a risk of degradation to potable water supply pipes.	Likely: buried concrete structures will be built and/or founded in ground material on- site, which will be direct contact with potentially aggressive ground. The risk can be mitigated through the selection of the appropriate concrete design classification in accordance with BRE Special Digest 1.	Moderate
	construction material.	R9: Potable water supply pipes.		Likely: potable water supply pipes that are buried will likely be built in ground material on-site, which can pose unfavourable conditions to piping. The risk can be mitigated through the selection of the appropriate pipe material as stated within the UK Water Industry Research publication 10/WM/03/21 "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites".	Moderate
S9: Ground gas risk arising from infilled ground, Made Ground, Alluvium, and South	P1: Human uptake pathways:	R1: Resident end users.	Medium: historical industrial land use has the potential to result in Made Ground to contain decayable	Likely: residents will spend a lot of their time on-site, generally within their houses which have small internal volumes. Ground gas migration can occur through	Moderate

Potential Sources	Potential Pathways	Potential Receptors	Consequence	Probability	Risk Classification
Wales coal measure formations.	 Inhalation. P8: Gas migration pathways. 		components which can be a source of hazardous ground gas. The natural Alluvium and coal measure formations are natural sources of ground gas.	the foundations of the buildings, and through open areas such as their gardens A build-up of hazardous ground gas can occur in the houses. The risk can be mitigated through the assessment of the ground gas regime on-site in accordance with the National Building Council's "Guidance on Evaluation of Development Proposals on sites where Methane and Carbon Dioxide are present, Report Edition No.04".	
		R2: Commuter end users.		Unlikely: commuters will have limited time spent on-site, which will limit potential exposure. The areas of the potential new Metro station, and the park and ride are outdoor areas, where a build-up of ground gas is unlikely to occur; as these areas are well ventilated.	Low
		R3: Employment area worker end users.	-	Low likelihood: workers in the employment areas will spend their time at their places of work. Places of work are likely to have active ventilation, and be located in an area with substantial hardstanding. The can limit and mitigate the effects of a build-up of hazardous ground gases. The risk can be mitigated through the assessment of the ground gas regime on-site in accordance with BS8485:2015 "Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings".	Moderate/low
		R4: Construction and maintenance workers.	-	Likely: due to the nature of construction works, workers will potentially work in enclosed spaces such as excavation below ground surface, where a build-up of hazardous ground gases can occur. They may encounter localised sources of contaminated material, which can potentially generate hazardous volatile	Moderate

Potential Sources	Potential Pathways	Potential Receptors	Consequence	Probability	Risk Classification
				vapours. The risk will be mitigated by the contractor adopting and implementing a safe system of work.	

10 Unexploded Ordnance Risk

A Pre-Desk Study Assessment has been obtained for the site from Zetica Limited (Ref. 12), which indicates the site is in a low risk bomb area. Low bomb risk areas are those indicated as having less than 15 bombs per 1000 acres or less. A detailed desk study, whilst always considered prudent, is therefore not considered essential for the site.
11 Geotechnical Risk Register

11.1 Geotechnical Risk Assessment

Potential geotechnical hazards identified in association with Hoover Strategic Regeneration Scheme are summarised in the Geotechnical Risk Register presented in Table 14. The risks are assessed by the interaction of an Impact Index and a Likelihood Index, shown in Table 10 and Table 11 respectively. Table 12 is the Risk Matrix, which shows the actual risk level, rated from severe (maximum risk level) to negligible (minimum risk level). Table 13 details the designers' actions based on the risk level.

The geotechnical engineering constraints are outlined in Table 14 and in Drawing 367590-MMD-44-DR-GIS-C-0006, Geotechnical Engineering Constraints, in Appendix A. The Geotechnical Risk Register is considered a live document, and should be reviewed and updated as the scheme develops or more ground data becomes available.

Impact			Cost (C)	Time (T)	Health and Safety (H&S)	Environment (E)
1	Verylow	Negligible	Negligible	Negligible effect on programme	Negligible	Negligible
2	Low	Significant	> 1% budget	> 5% effect on programme	Minorinjury	Minor environmental incident
3	Medium	Serious	> 10% budget	> 12% effect on programme	Majorinjury	Environmental incident requiring management input
4	High	Threat to future work and client relations	> 20% budget	> 25% effect on programme	Fatality	Environmental incident leading to prosecution or protestor action
5	Very high	Threat to business survival and credibility	> 50% budget	> 50% effect on programme	Multiple fatalities	Major environmental incident with irreversible effects and threat to public health or protected natural resource

Table 10: Impact Index

Table 11: Likelihood Index

Likelihoo	d	Probability
1	Negligible/ improbable	<1%
2	Unlikely/remote	>1%
3	Likely/possible	>10%
4	Probable	>50%
5	Very likely/ almost certain	>90%

Table 12: Risk Matrix

Impact						
		1	2	3	4	5
	1	N	Ν	Ν	Α	Α
	2	N	Α	Α	Η	Н
_	3	Α	Η	н	S	S
hood	4	н	Η	S	S	S
Likeli	5	н	Η	S	S	S

Table 13: Designers' Action

Risk Level	Description	Action by Designer
N	Negligible	None
Α	Acceptable	Check that risks cannot be further reduced by simple design changes
Н	High	Amend design to reduce risk, or seek alternative option. Only accept option if justifiable on other grounds.
S	Severe	Amend design to reduce risk or seek alternative Option. Only accept option if justifiable on other grounds.

Table 14: Preliminary Assessment of Geotechnical Hazards for the scheme

	Hazard	Consequence	Impact	Likelihood	Current Risk	Potential Control Measures	Impact	Likelihood	Residual Risk
1	Highly variable thicknesses and constituents of Made Ground.	Excessive settlements/ differential settlements of foundations. Excavation and replacement of unsuitable material. Surplus unusable material generated.	3	3	High	Undertake GI to determine thickness of Made Ground across the site. Ground model produced from the results of the GI and used to inform the construction plan. Made Ground is normally an unsuitable bearing stratum for foundations.	3	2	Acceptable
2	Infilled Glamorganshire Canal/ watercourses.	Excessive settlements/ differential settlements of foundations. Excavation and replacement of unsuitable material. Surplus unusable material generated.	3	3	High	Undertake a GI to target areas of former Glamorganshire Canal/ watercourses. Ground model produced from the results of the GI and used to inform the construction plan.	3	2	Acceptable
3	Compressible soils associated with Alluvial Deposits	Excessive settlements/ differential settlements of foundations. Instability of structures.	3	3	High	Undertake an adequate GI and geotechnical testing to produce a ground model and design parameters to inform detailed design. Alluvium may be an unsuitable bearing stratum for foundations. May require piled foundations.	3	2	Acceptable
4	Running sands associated with Alluvial Deposits.	Difficulties in excavation for GI/ foundations due to collapse. Programme delay. Increased costs.	2	3	Acceptable	Ground model and design parameters to be produced from the results of the GI and used to inform construction plan. Excavation sides to be banked.	2	2	Acceptable
		Excessive settlements/ differential settlements of foundations. Instability of structures.	3	3	High	Undertake an adequate GI and geotechnical testing to produce a ground model and design parameters to inform detailed design. Alluvium is unsuitable bearing stratum for foundations. May require piled foundations.	3	2	Acceptable
5	Difficulty in excavating/ progressing though Glacial Till.	Programme delay. Increased costs.	2	3	Acceptable	Design an adequate GI for anticipated ground conditions. Ground model and design parameters to be produced from the results of the GI and used to inform construction plan.	2	2	Acceptable
		Precast piles and CFA piles may not be able to penetrate the Glacial Till. Programme delay. Increased costs.	3	3	High	Rotary piles may be required. Design engineer to take into account ground model and design parameters produced from the GI.	3	2	Acceptable
6	Unforeseen ground conditions.	Ground unsuitable for foundation design. Excessive settlements/ differential settlements of foundations. Programme delay. Increased costs.	3	3	High	Undertake an adequate GI and geotechnical testing to produce a suitable ground model for the site. Ground model to inform detailed foundation design.	3	2	Acceptable
7	Coal Authority Designated High- Risk Development Area and nine known mine entrieson the site. Refer to Drawing 367590-MMD- 44-DR-GIS-C-0010, in Appendix A.	Potential collapse of mine entries and shallow coal mines leading to the development of crown holes at ground surface. Damage to foundations and infrastructure. Safety of site workers and/ or users.	4	3	Severe	Full miningrisk assessment to be obtained from the Coal Authority. Coal Authority license to be obtained prior to GI. Areas affected by mining to be targeted by the GI.	4	2	High
8	Highly weathered bedrock where known fault crosses through the north of the site and adjacent to eastern boundary.	Differential settlement of foundations located across the fault.	3	2	Acceptable	Area of fault to be targeted by the GI. Ground model and design parameters to be produced from the results of the GI and used to inform construction plan.	3	1	Negligible

	Hazard	Consequence	Impact	Likelihood	Current Risk	Potential Control Measures	Impact	Likelihood	Residual Risk
9	Shallow groundwater conditions.	Foundation design unsuitable for ground conditions. Programme delay. Increased costs. Difficulties in excavation for GI/ foundations due to collapse. Safety of site workers.	3	3	High	Undertake a GI and groundwater monitoring to determine the groundwater levels at the site. Groundwater levels should be considered in detailed design. If groundwater is encountered in excavations groundwater control measures should be implemented.	3	2	Acceptable
10	Localised flooding/washout.	Scour and erosion leading to foundation failure from watercourses. Safety of site users.	3	3	High	Ensure culverts and secondary watercourses have well maintained channels. Undertake inspection programme of culverts and watercourses.	3	1	Negligible
11	Historical underground obstructions.	Programme delay. Increased costs. Difficulty in undertaking GI/ forming foundation level. Safety of site workers.	2	3	High	The desk study has indicated there are likely to be underground services/ obstructions due to the historical development of the site. All exploratory holes to be scanned prior to drilling/ excavation works commencing. Undertake a GPR survey. Obstructions encountered in the GI should be recorded. Works to cease immediately if services encountered and reported to site engineer. Programme and cost contingency in construction budget.	2	2	Acceptable
12	Live current and historical underground services.	Damage to existing services. Increased costs. Delaysto programme. Safety of site workers.	3	3	High	Obtain detailed service plansfrom utility providers prior to GI. Undertake a GPR survey. All exploratory holesto be scanned prior to drilling/ excavation works commencing. Works to cease immediately if services encountered and reported to site engineer. Programme and cost contingency in construction budget.	3	2	Acceptable
13	Overhead Lines	Damage to existing services. Ease of access of plant around powerline. Restriction of plant around powerline. Development may not be able to take place around powerline route. Increased costs. Delaysto programme. Safety of site workers.	2	2	Acceptable	Site inspection prior to GI to ensure safe access and working areas. Minimum safety zone to be maintained around overhead lines during GI.	2	1	Negligible
14	Site and surrounding area considered to be in a low risk UXO area.	Disturbance and potential detonation of UXO during GI or excavation of foundations. Safety of site workers.	5	1	Acceptable	All exploratory holes to be scanned prior to drilling/ excavations works commencing. Should anything be encountered in exploratory holes or excavations should be reported to the site engineer and a UXO specialist should be consulted.	5	1	Acceptable
15	Aggressive ground conditions.	Sulphate attack on concrete and grout causing corrosion and degradation of infrastructure and materials shortening their design life.	3	2	Acceptable	Undertake BRE chemical testing on samples obtained during the GI at a range of depths and in all strata.	3	1	Negligible

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	Hazard	Consequence	Impact	Likelihood	Current Risk	Potential Control Measures	Impact	Likelihood	Residual Risk
						Implement all recommendations of BRE Special Digest 1 during detailed design of buried structures.			
16	Contamination risk to sensitive receptors including human health, groundwater and surface water (preliminary assessment indicates moderate to low risk).	Unidentified sources of significant contamination can lead to delays and additional costs for mitigation/ remediation.	3	3	High	GI to include collection of soil and groundwater sampled for chemical analysis. Undertake a Quantitative Risk Assessment.	3	2	Acceptable

12 Recommendations for Further Works

12.1 Mining Risk Assessment

The desk study assessment has indicated known and probable shallow coal and iron mining, under the site and in the surrounding area and the majority of the site is located within a Coal Authority Development High Risk Area (Ref. 6 and 9). It is recommended that a full mining risk assessment is undertaken to understand the associated risks. The full mining risk assessment will comprise, where available, the purchase and detailed review of mining abandonment plans, in conjunction with a detailed review of large scale geological maps (1:10,000), geological memoirs and available historic boreholes. This review will pay particular attention to the dip and dip direction of coal seams.

There are eight mine entries and three shallow spine roadways identified on the site (Ref. 9 and 10), as summarised in Section 0. The full mining risk assessment should therefore also review any available historic records, and the location of mine entries and spine roadways in relation to the Hoover Strategic Regeneration Scheme.

It is recommended that given the potential risk of mine entries and shallow mine workings, this work is undertaken at the earliest opportunity. The full mining risk assessment may include additional GI recommendations.

12.2 Ground Investigation (GI) Works

It is recommended that a detailed GI is undertaken at the site to better understand the geotechnical risks posed to the Hoover Strategic Regeneration Scheme. The objectives of this ground investigation will be to target residual geotechnical risks to the scheme highlighted by the study and to:

- Confirm the ground conditions underlying the site;
- Confirm the groundwater levels beneath the site;
- Undertake geotechnical and geo-environmental testing on the soil and groundwater samples obtained during the GI works to inform foundation design; and
- Assess the thickness of the hardstanding underlying the site;
- Determine the risks posed by shallow mine workings, spine roadways and mine entries, if identified in the full mining risk assessment.

The GI scope may include, but is not limited to, the following:

- Trial pits to investigate the nature of the Made Ground and superficial deposits;
- Dynamic sample boreholes, using a tracked dynamic sample rig, to investigate the nature of the superficial deposits, depth to bedrock and depth to groundwater;
- Rotary boreholes to investigate the nature of the superficial deposits, rock profile and properties and determine the presence or otherwise of potential shallow mine workings;
- Standard penetration tests (SPTs);
- Soil, rock and groundwater sampling for geotechnical and geo-environmental laboratory testing; and

• Standpipe installations for groundwater monitoring. The period of monitoring should be assessed on an individual basis and be reflective of seasonal changes. Monitoring periods may also be subject to access agreements.

The proposed ground investigation should be reviewed and updated as the scheme develops.

A full services search will need to be undertaken, and liaison with landowners will be required prior to any GI works being completed. The liaison with landowners may limit the scope and location of the GI.

Provisions will be required in the GI scope for the coring of concrete as a result of historical hardstanding and foundations.

It should be noted that should the development proposals be taken further another targeted GI would be required to enable design.

13 References

- 1. BS EN 1997 1:2007, 'Eurocode 7 Geotechnical Design Part 1: General Rules';
- BS EN 1998 2:2007, 'Eurocode 7 Geotechnical Design Part 2: Ground Investigation and Testing';
- BS 10175:2011(+A1:2013), 'Investigation of Potentially Contaminated Sites Code of Practice';
- 4. Environment Agency, 'Model Procedures for the Management of Land Contamination', Contaminated Land Report (CLR) 11;
- 5. Construction and Industry Research and Information Association (CIRIA) C552, 'Contaminated Land Risk Assessment – A Guide to Good Practice';
- 6. Groundsure Geo Insights and Enviro Insights Report;
- British Geological Survey (BGS) on-line 'Geolndex' viewer (<u>http://mapapps2.bgs.ac.uk/geoindex/home.html</u>), (accessed June 2018);
- 8. BGS on-line 'Lexicon' (http://www.bgs.ac.uk/lexicon/) (assessed June 2018);
- Coal Authority on-line map viewer (<u>http://mapapps2.bgs.ac.uk/coalauthority/home.html</u>) (accessed June 2018);
- 10. Coal Authority, Coal Mining Report (Ref. 51001882897001), dated 4th July 2018;
- 11. Environment Agency What's in Your Backyard aquifers (<u>http://apps.environment-agency.gov.uk/wiyby/117020.aspx</u>) (accessed June 2018);
- 12. Zetica Limited, Pre-Desk Study Assessment Report, received July 2018;
- 13. Environmental Protection Act 1990. (www.legislation.gov.uk) (accessed June 2018);
- 14. Town and Country Planning Act 1990, England and Wales. (<u>www.legislation.gov.uk</u>), (accessed June 2018);
- 15. British Standards Institution. 2013. BS 10175:2011+A2:2017 Investigation of potentially contaminated sites Code of practice. BSI: London; and
- 16. Department of Environment. 1995. DoE Industry Profiles [Online]. Available at: <u>https://www.claire.co.uk/useful-government-legislation-and-guidance-by-country/76-key-documents/198-doe-industry-profiles</u> [Accessed June 2018].

Appendices

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A. Drawings

A.1 Drawing 367590-MMD-44-DR-GIS-C-0001 - Location Plan



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A.2 Drawing 367590-MMD-44--DR-GIS-C-0002 – Artificial Ground





A.3 Drawing 367590-MMD-DR-GIS-C-0003 – Superficial Geology



A.4 Drawing 367590-MMD-44-DR-GIS-C-0004 – Bedrock Geology



A.5 Drawing 367590-MMD-44-DR-GIS-C-0005 – Relevant Historic Borehole Plan



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A.6 Drawing 367590-MMD-44-DR-GIS-C-0006 – Geotechnical Engineering Constraints



A.7 Drawing 367590-MMD-44-DR-GIS-C-0007 – Geo-Environmental Constraints Plan



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A.8 Drawing 367590-MMD-44-DR-GIS-C-0008 – Geo-Environmental Constraints Plan





A.9 Drawing 367590-MMD-44-DR-GIS-C-009 - Geo-Environmental Constraints Plan



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A.10 Drawing 367590-MMD-44-DR-GIS-C-0010 – Associated Mining Risk Plan



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B. Contaminated Land Risk Assessment Context and Methodology

B.1 Preliminary Qualitative Risk Assessment Methodology

A qualitative risk assessment in accordance with NHBC, EA, CIEH (2008) guidance has been undertaken. This is described below:

B.1.1 Conceptual Model

A key element of an environmental risk assessment is the development of a conceptual model, which is done undertaking a Source – Pathway – Receptor analysis of the site:

- Sources (S) are potential or know contaminant sources e.g. a former land use;
- Pathways (P) are environmental systems through which a contaminant could migrate e.g. air, groundwater; and
- Receptors (R) are sensitive environmental receptors that could be adversely affected by contaminants e.g. site occupiers, groundwater resources.

When a source, relevant pathway and receptor are present, a contaminant linkage is considered to exist whereby there is a circumstance through which environmental harm could occur and a potential environmental liability is considered to exist.

B.1.2 Preliminary Qualitative Risk Assessment

For each potential pollutant linkage identified within the conceptual model presented in this report, the potential risk has been evaluated for ecological receptors, buildings, and construction/ maintenance workers and the final end users using a Preliminary Qualitative Risk Assessment based on the probability of the pollution event, and the severity it may have on site users and the environment.

R&D Publication 66 (NHBC, ES, CIEH, 2008) sets out the classification used in the Preliminary Qualitative Risk Assessment. The classification has been developed from DOE Guide to Risk Assessment and Risk Management for Environmental Protection and Statutory Guidance on Contaminated Land (Defra September 2006). The key to the classification is that the designation of risk is based on the consideration of both:

- The magnitude of the potential consequence (i.e. severity); and
 - [Takes into account both the potential severity of the hazard and the sensitivity of the receptor]
- The magnitude of the probability (i.e. likelihood).
 - [Takes into account both the presence of the hazard and receptor and the integrity of the pathway]

The methodology differs from that presented in CIRIA C552 (CIRIA, 2001), particularly in terms of the definitions of classification of consequence, which include a consideration of immediacy of hazards. The potential consequences of contamination risks occurring at this site are classified in accordance with Table 15.

Table 15: Classification of Consequence

Classification	Definition of Consequence
Severe	Highly elevated concentrations likely to result in 'significant harm' to human health as defined by the EPA 1990, Part 2A, if exposure occurs.
	Equivalent to a Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point; major impact on amenity value or major damage to agriculture or commerce.
	Major damage to aquatic or other ecosystems, which is likely to result in a substantial
	adverse change in its functionary or harm to a species of special scientific interest that endangers the long-term maintenance of the population.
	Catastrophic damage to crops, buildings or property.
Medium	Elevated concentrations which could result in 'significant harm' to human health as defined by the EPA 1990, Part 2A if exposure occurs.
	Equivalent to a Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to
	agriculture or commerce. Significant damage to aquatic or other ecosystems, which is unlikely to result in a
	substantial adverse change in its functioning or harm to a species of special interest that
	would endanger the long-term maintenance of the population.
	Significant damage to crops, buildings or property.
Mild	Exposure to human health unlikely to lead to 'significant harm'.
	Equivalent to EA Category 3 pollution incident including minimal or short-lived effect on water quality; marginal effect on amenity value, agriculture or commerce.
	Minor or short-lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that
	would endanger the long-term maintenance of the population.
	Minor damage to crops, buildings or property.
Minor	No measurable effect on humans.
	Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems.
	Repairable effects of damage to buildings, structures and services.

The probability of contamination risks occurring at this site is classified in accordance with Table 16. Note – a pollution linkage must first be established before probability is classified. If there is no pollution linkage then there is no potential risk. If there is no pollution linkage then there is no need to apply tests for probability and consequence.

Table 16: Classification of Probability

Classification	Definition of Probability
High Likelihood	There is a contaminant linkage and an event would appear very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution.
Likely	There is a contaminant linkage and all elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.
Low Likelihood	There is a contaminant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a long period such an event would take place, and is less likely in the shorter term.
Unlikely	There is a contaminant linkage but circumstances are such that it is improbable that an event would occur even in the very long-term.

For each possible contaminant linkage identified, the potential risk can be evaluated based upon the following probability x consequence matrix shown in Table 17.

Table 17: Overall Contamination Risk Matrix

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very high risk	Highrisk	Moderate risk	Moderate/Iow risk
	Likely	High risk	Moderate risk	Moderate/low risk	Lowrisk
	Low Likelihood	Moderate risk	Moderate/Iow risk	Lowrisk	Verylowrisk
	Unlikely	Moderate/ Iow risk	Lowrisk	Very low risk	Very low risk

R&D 66:2008 presents definitions of the risk categories, together with the investigatory and remedial actions that are likely to be necessary in each case. These definitions are reproduced in Table 18. These risk categories apply to each pollutant linkage, not simply to each hazard or receptor.

Table 18: Definition of Risk Categories and Likely Actions Required

Risk Category	Definition and Likely Actions Required
Very high	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without remediation action OR there is evidence that severe harm to a designated receptor is already occurring.
	Realisation of that risk is likely to present a substantial liability to be site owner/or occupier. Investigation is required as a matter of urgency and remediation works likely to follow in the short - term.
High	Harm is likely to arise to a designated receptor from an identified hazard at the site without remediation action.
	Realisation of the risk is likely to present a substantial liability to the site owner/or occupier.
	Investigation is required as a matter of urgency to clarify the risk. Remediation works may be necessary in the short - term and are likely over the longer term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely, that the harm would be relatively mild.
	Further investigative work is normally required to clarify the risk and to determine the potential liability to site owner/occupier. Some remediation works may be required in the longer term.
Low	It is possible that harm could arise to a designated receptor from identified hazard, but it is likely at worst, that this harm if realised would normally be mild.
	It is unlikely that the site owner/or occupier would face substantial liabilities from such a risk. Further investigative work (which is likely to be limited) to clarify the risk may be required. Any subsequent remediation works are likely to be relatively limited.
Very low	It is a low possibility that harm could arise to a design ated receptor, but it is likely at worst, that this harm if realised would normally be mild or minor.

C. Site Walkover Route and Photographs

The Site Walkover Route Map is shown in Figure 1 and Figure 2, and the site photographs are shown in Table 19.

Figure 1: Site Walkover Route Map



Figure 2: Site Walkover Route Map



Table 19: Site Walkover Photographs






5

looking north from entrance looking at upslope of entrence to Amnitec







7



8

Methyr Self Storage south west of Amnitec looking east



Photograph

Figure

9 LoadLokfacility 10 Japenese Knotweed located on western boundary of site near LoadLok









18 Looking west at gradient of field







Sign warning that the road will be closed for a half marathon 25th March 2018 21

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- Teras Milbourne à Chlôs Milbourne.
- Y briffordd sy'n dechrau wrth gefn ac i'r dwyrain â ffiniau cyffredin Rhifau 34, Stryd 3.
- Capel, Troedyrhiw ac sy'n ymestyn i'r de i Mount Pleasant Isaf ac sy'n parhau ar hyd ce Stryd Henry Richard at ei chyffordd â'r ffordd ddienw sy'n arwain at yr A4054, He 4
- Yr A4054, Heol Caerdydd o ochr de-ddwyreiniol Rhif 1, Teras Edward Stepher Troedyrhiw ac sy'n ymestyn i'r de at ochr ogleddol Rhif 9, Teras Danyderi , Ynys Owen.
- Y briffordd sy'n dechrau wrth gefn Rhif 9, Teras Danyderi, Ynys Owen ac sy'n ymestyn de trwy Deras Maes Hyfryd i Faes Grays. 6.
- Maes Grays, Ynys Owen o'i chyffordd â'r A4054, Heol Caerdydd i ac yn cynnwys Ma 7.
- Wester Sgwår yr Orsaf, Ynys Owen o'i gyffordd â Maes Wesle i'r gyffordd â Chlôs Tudur, y briffordd sy'n dechrau ar Sgwâr Wesle, Ynys Owen, yn gyfochrog â llinell y rheilffon 8 y prints ymestyn i'r de tuag at Rif 30, Darren Las.

ac sy in y Y briffordd drwy Bont-y-gwaith o'i chyffordd â'r A4054, Heol Caerdydd ac sy'n ymestyn 10. yfredinol i'r de, heibio i Eferm Pont y findinol i'r de, heibio i Fferm Pont-y-gwaith ac sy'n parhau o dan yr A470 at Lwybr Ta gyffreding Advis a cholo i Fferm Pont-y-gwaith ac sy'n parhau o dan yr Advio at Lwybr Ta Cilgant Canobie, Aber-fan rhwng ei chyffyrdd â Threm Hyfryd a'r ffordd gau sy'n arwain

- Rifau 17 i 24 Cilgant Canobie.
- Rifau II Aber-fan gan gynnwys y ffordd ddi-enw rhwng Cilgant Aberfan a rha 12. Rhiw'r Orsaf, Aber-fan
- ogledoù ur generañ. 13. Heol Cwmdu, Troedyrhiw rhwng ei chyffyrdd â Stryd Diana a'r ffordd sy'n arg 13. Janffordd yr A470.
- danffordd sy'n dechrau â'r gyffordd ar Heol yr Onnen, Troedyrhiw ac sy'n yme y brind at bwynt 85 metr i'r gogledd o Rif 13, Rhes y Ffwrnais.
- gogleda a trong metri'r gogledd o Rif 13, Rhes y Ffwrnais. Heol yr Onnen, Troedyrhiw am bellter o 15 metri'r dwyrain a'r gorllewin o'r fan lle y n 15. Heol yr Llwybr Taf.
- croeși Llwybr Taf, v briffordd yn Abercannaid o'i chyffordd a'r brif ffordd sy'n arwain i Abercannaid y brillolo Res y Pwll ac sy'n ymestyn i'r de, helbio i Res y Pwll at ochr ddeheuol Rhif 16.
 - es y Gamlas, v Cei o'i chyffordd â Chlôs Gh









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Looking south at roundabout from The Willows road









30	Looking north across River Taff



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36

Power cable mast within eastern section of site on eastern side of Merthyr Road













45 Signs of retaining wall within Hoover facility



46

Volkswagen new car storage area west of River Taff



D. Coal Authority Report



Consultants Coal Mining Report

Hoover Strategic Regneration Scheme Cardiff

Date of enquiry: Date enquiry received: Issue date: 4 July 2018 4 July 2018 4 July 2018

Our reference: Your reference: 51001882897001



Consultants Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

Sarah Onions

Enquiry address

Hoover Strategic Regneration Scheme Cardiff



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Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	FOUR FOOT	Coal	49AG	10	Beneath Property	7.2	South	168	1950
unnamed	FOUR FOOT	Coal	4WIG	16	Beneath Property	5.5	South	210	1866
unnamed	UPPER 6FT RIDER	Coal	4WJU	17	Beneath Property	6.2	South	170	1875
unnamed	UPPER 6FT RIDER	Coal	4WJT	19	Beneath Property	6.5	South	170	1875
unnamed	UPPER 6FT RIDER	Coal	4WJS	26	Beneath Property	4.5	South	170	1875
unnamed	UPPER 6FT (T.L.)	Coal	4WIK	27	Beneath Property	5.5	South	120	1862
unnamed	UPPER 6FT RIDER	Coal	4WJQ	29	Beneath Property	5.6	South-East	170	1900
unnamed	TWO FOOT NINE	Coal	4WLA	36	Beneath Property	6.6	South-East	66	1940
unnamed	LOWER 7FT BOTTOM LEAF	Coal	4E29	36	North-East	7.7	South-East	114	1907
unnamed	UPPER 6FT (T.L.)	Coal	49AU	36	West	0.0	East	120	1877
unnamed	UPPER 6FT RIDER	Coal	499R	37	West	0.0	East	100	1852
unnamed	TWO FOOT NINE	Coal	4WJ0	44	Beneath Property	5.2	South	130	1901
unnamed	UPPER 6FT (T.L.)	Coal	4WIJ	44	Beneath Property	7.0	South	120	1892
unnamed	TWO FOOT NINE	Coal	4WJ3	46	West	6.3	South	130	1949
unnamed	LOWER NINE FOOT	Coal	49AZ	48	Beneath Property	8.9	South	259	1885
unnamed	FOUR FOOT	Coal	4WL6	53	Beneath Property	6.6	South	210	1891
unnamed	UPPER 6FT (T.L.)	Coal	4WIL	53	Beneath Property	3.9	South-East	120	1891
unnamed	UPPER 6FT RIDER	Coal	4WMI	56	North-East	6.9	South-East	170	1900
unnamed	FOUR FOOT	Coal	4WL5	59	South-East	8.4	South-East	210	1891
unnamed	LOWER 7FT BOTTOM LEAF	Coal	4BDV	64	North-East	6.5	South-East	117	1902
unnamed	LOWER NINE FOOT	Coal	4WJD	69	Beneath Property	6.6	South-East	145	1868

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	LOWER 7FT BOTTOM LEAF	Coal	4E2A	77	Beneath Property	8.6	South-East	117	1889
unnamed	LOWER NINE FOOT	Coal	4WJK	81	Beneath Property	3.3	South-East	145	1932
unnamed	LOWER NINE FOOT	Coal	4BDK	88	North-East	0.0	East	183	1909
unnamed	LOWER NINE FOOT	Coal	4WJN	89	Beneath Property	7.1	South-East	145	1932
unnamed	LOWER NINE FOOT	Coal	4WLG	101	North-East	6.9	South	183	1935
unnamed	LOWER 7FT BOTTOM LEAF	Coal	4WK0	114	Beneath Property	4.3	South-East	117	1899
unnamed	LOWER 7FT BOTTOM LEAF	Coal	4WK1	118	Beneath Property	7.5	South-East	117	1899
unnamed	LOWER 7FT BOTTOM LEAF	Coal	4WK2	123	Beneath Property	5.9	South	117	1899
unnamed	BOTTOM VEIN IRONSTONE	Ironstone	499Y	137	East	16.4	South	100	1855
unnamed	LOWER 7FT BOTTOM LEAF	Coal	4WLQ	146	North-East	6.1	South-East	117	1902
unnamed	LOWER 7FT BOTTOM LEAF	Coal	4WJX	159	Beneath Property	6.0	South-East	117	1924
unnamed	LOWER 7FT BOTTOM LEAF	Coal	4WJZ	174	North-West	5.5	South-East	117	1899

Probable unrecorded shallow workings

Yes.

Spine roadways at shallow depth

Distance to spine roadway (m)	Direction to spine roadway
Within	N/A
Within	N/A
Within	N/A

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	305203-002	305441 203896	This shaft was filled at some time in the past to an unknown specificati on. It was further topped up and capped in 1978.	Coal	
Shaft	305203-003	305447 203889	This shaft was filled at some time in the past to an unknown specificati on. It was further topped up and capped in 1978.	Coal	
Shaft	305203-004	305530 203931	This shaft is filled with hardcore. The shaft was topped up with hardcore and mounded in October 2009 by contactors acting on behalf of the Authority.	Coal	
Shaft	305203-005	305394 203716	This shaft has been filled to an unknown specification	Coal	
Shaft	305204-002	305575 204759		Coal	
Shaft	305204-008	305592 204697		Coal	
Shaft	305204-009	305602 204677		Coal	
Adit	305204-011	305690 204719		Coal	
Shaft	305204-012	305713 204558		Coal	
Shaft	305204-013	305722 204552		Coal	
Adit	305204-014	305785 204576		Coal	
Adit	305204-028	305210 204204		Coal	
Shaft	305204-029	305298 204089		Coal	
Shaft	305204-030	305420 204053	Information providied to the Coal Authority by British Coal indicates th is shaft is filled	Coal	
Shaft	305204-031	305409 204288	This shaft was grouted and capped in 1977.	Coal	
Adit	305204-034	305163 204349		Ironstone	
Shaft	305204-035	305141 204364		Coal	
Shaft	305204-036	305409 204083	This shaft was filled grouted and capped in 1975.	Coal	
Shaft	305204-037	305398 204093	This shaft was filled grouted and capped in 1975.	Coal	
Shaft	305204-038	305409 204091	This shaft was filled grouted and capped in 1975.	Coal	
Shaft	305204-039	305754 204591		Coal	
Shaft	305204-045	305187 204318		Coal	Mid Glamorgan County Council 01/09/1991

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Adit	305204-060	305393 204114	Uncovered during road improvements we understand this adit was treated by K Wardell and Partners Consultant Mining Engineers.	Coal	
Adit	305204-069	305409 204237		Coal	
Shaft	305204-071	305244 204268		Coal	
Adit	305204-072	305719 204561		Coal	
Adit	305204-073	305226 204214		Coal	
Adit	305204-074	305196 204200		Coal	
Shaft	305204-107	305382 204074		Coal	

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

SWR1978	SWR3141	SW478
SWR1880	SWR3146	SW3612
SWR3622	SWR3601	SW479

Our records show we have more plans than those shown above which could affect the enquiry boundary.

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
2FT NINE MID LEAF	Coal	Yes	Within	N/A	96
6FT BOTTOM LEAF	Coal	Yes	Within	N/A	266
BUTE	Coal	Yes	Within	N/A	17
FIVE FOOT GELLIDEG	Coal	Yes	Within	N/A	80
LOWER 7FT BOTTOM LEAF	Coal	Yes	Within	N/A	76
LOWER 7FT BOTTOM LEAF	Coal	Yes	Within	N/A	127
LOWER 9FT AND BUTE	Coal	Yes	Within	N/A	198
LOWER NINE FOOT TOP LEAF	Coal	Yes	Within	N/A	206
RED VEIN	Coal	Yes	Within	N/A	255
TWO FOOT NINE	Coal	Yes	Within	N/A	99
UNNAMED	Coal	Yes	Within	N/A	96
UNNAMED	Coal	Yes	Within	N/A	101
UPPER 6FT RIDER	Coal	Yes	Within	N/A	100
UPPER 6FT RIDER	Coal	Yes	Within	N/A	225
UPPER FOUR FOOT	Coal	Yes	Within	N/A	104
YARD	Coal	Yes	Within	N/A	84

Geological faults, fissures and breaklines

Please refer to the 'Summary of findings' map (on separate sheet) for details of any geological faults, fissures or breaklines either within or intersecting the enquiry boundary.

Faults under or close to the property recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

Distance to site investigation (m)	Direction
Within	N/A

See Section 4 for further information.

Remediated sites

Distance to site remediation (m)	Direction
Within	N/A

See Section 4 for further information.

Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31st October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

Withdrawal of support notices

The property is not in an area where a notice to withdraw support has been given.

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

Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.
Section 4 – Further information

The following potential risks have been identified and as part of your risk assessment should be investigated further.

Development advice

The site is within an area of historical coal mining activity. Should you require advice and/or support on understanding the mining legacy, its risks to your development or what next steps you need to take, please contact us.

Site investigations

The site is within an area of previous interest. It is close to where the Coal Authority has received information relating to past site investigations.

The site requires further investigation and may influence how you approach your risk assessment.

Remediated sites

The site is within an area of previous interest. It is close to where the Coal Authority has investigated and where necessary remediated mine entries and/or shallow coal mine workings following specific reported hazards.

The site requires further investigation and may influence your risk assessment. We recommend that you order the Coal Authority **Surface Hazards Incident Report**, which will include more information about the hazard.

For further information on specific site or ground investigations in relation to any issues raised in Section 4, please call us on 0345 762 6848 or email us at groundstability@coal.gov.uk.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk.**

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

Mine water treatment schemes

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices

Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices

Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

Payment to owners of former copyhold land

Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

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Summary of findings

The map highlights any specific surface or subsurface features within or near to the boundary of the site.







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