
BakerHicks.

One Warwick Technology Park
Gallows Hill
Warwick, CV34 6YL

T. (0)1926 567800

bakerhicks.com

GEOTECHNICAL DESK STUDY: MARGAM FEED

Margam FEED

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			Prepared by	Checked by	Approved by
		Name	J. Taylor	V. Barnett T. Mitchell	P. Hooton
		Signature	JT	VB TM	PH
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			Prepared by	Checked by	Approved by
		Name	JT	V. Barnett T. Mitchell	P. Hooton
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1. Introduction

1.1. Scope and Objectives of the Scheme

The objective of the scheme is to provide power to the Port Talbot Steel works as TATA Steel undergo a transformation to secure Britain's steel manufacturing whilst reducing carbon output by replacing the existing blast furnaces with an electric powered arc furnace. The aim of the scheme is to provide the required infrastructure to power the new method of steel production.

1.2. Scope and Objectives of the Report

National Grid (NG) has appointed BakerHicks to complete a Front-End Engineering and Design (FEED) study for the development of 2no. new substations and associated HVDC cable routing.

This desk study report has been prepared in general accordance with the requirements of BS5930: Code of practice for Ground Investigations.

Initial optioneering has been undertaken for the 2no. proposed substations and associated HVDC cable routing. A summary of optioneering is presented below.

For the proposed Margam Substation 3no. options were initially considered within the Margam Connection Optioneering Report (Ref. [1]): Option 1, 2 & 3. An additional option was also mentioned but was not fully considered. The Optioneering report discounted Option 1 & 3 and determined that Option 2 was the most suitable option. However, following further discussion with National Grid it was determined to take Option 2 and the additional Option, now Option 4, forward to the next stage of the FEED design. Therefore, Option 2 and Option 4 are discussed in this report. It should be noted that the first revision of this desk study report (P01) did not include Option 4, as it was determined to take this option forwards later in the initial FEED stage.

For the proposed TATA Substation 3no. options were initially considered: Option 1, 2 & 3. During the initial optioneering Option 1 & 2 were discounted. Option 3 is now the only option being considered further within the next FEED stage.

Optioneering was undertaken for the cable route with initially 3no. Options (A-C) under consideration, however following the initial optioneering phase, which considered geographical, environmental and land access constraints Option A was dismissed. Options B & C are now being considered further within the next FEED stage. For details on the cable optioneering reference should be made to the cable route optioneering report (Ref [2]).

The total maximum length of the cable route options is as follows: Option B – 2884m & Option C – 2743m. The proposed cable route will connect the new proposed Margam GIS substation with the new proposed TATA Steel GIS substation. For the purpose of this report a chainage has been applied to the cable routes initiating at Margam Substation Option 2 and increasing in chainage to the east towards the TATA GIS substation. It should be noted that Margam substation Option 4 involves constructing the new substation immediately adjacent to the existing Margam substation which would require shortening the proposed cable route. For the purposes of this report the cable route chainage has been developed from Margam Substation Option 2 as this would require the longest route of cable. The chainages applied to the cable route, which will be referenced throughout this report, are displayed separately in Appendix A. Where the chainage splits over the Margam Moors area, reference is made to Option B (B) or Option C (C) chainage.

This desk study report focuses on the following proposed development options:

- Margam Substation Option 2 and Option 4.
- TATA Substation Option 3
- Cable Route Options B and C

The report has been prepared to identify ground hazards in the area of the proposed Margam GIS Substation options, TATA GIS substation and cable route options, to support the Front-End Engineering and Design (FEED) Study. It summarises the findings of a review of readily available information, presenting a preliminary conceptual ground model and a geotechnical risk register. It also makes recommendations for further ground investigations, where appropriate.

This desk study includes three Envirocheck reports. As mentioned above, Margam Substation Option 4 was not included within the first issue of this desk study report therefore a separate environmental database search (Envirocheck) report was not obtained for this option. However, the proposed Option 4 location is within the proposed cable route between chainages 150m to 325m and therefore the existing database information for Option 4 has been reviewed from the Cable Route Envirocheck report.

The three Envirocheck reports obtained for the Margam GIS Substation Option 2, TATA GIS Substation and cable route are presented within Appendix B, C & D respectively.

Geotechnical, environmental, historical and contamination factors that may affect the development have been identified and considered with the production of a Conceptual Site Model in Section 4.0. This desk study forms the basis for the Geotechnical Risk Register.

1.3. Assumptions and Limitations

BakerHicks is responsible for selecting and summarising the data supplied by the Client or other parties but cannot be held responsible for any mistakes or inaccuracies or the completeness of third-party data on which it has relied.

This desk study report has been prepared solely for National Grid. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party. The report has considered publicly available information and databases, conditions and features may exist that have not been included within such databases, therefore, features may be present that have not been considered as part of the study.

1.4. Site Description

The site is located at various locations both within and immediately adjacent to the TATA Port Talbot Steel Plant. This is located in South Wales in Port Talbot which is approximately 14km Southeast of Swansea. The site is approximately 600m inland from the coastline with the Bristol Channel.

The site is split into four elements: Margam GIS Substation Option 2, Margam GIS Substation Option 4, TATA Steel GIS Substation and HV Cable Routing between substations. These are shown in the site location plan in Figure 1.1.



Figure 1.1. Site Plan showing proposed substation locations and cable route options.

The new proposed Margam GIS Substation Option 2 is 50m north of the existing Margam substation. The National Grid Reference for the centre of this is SS 78479 86562.

The new proposed Margam GIS Substation Option 4 is immediately west of the existing Margam substation. The National Grid Reference for the centre of this is SS 78580 86373.

The new proposed TATA GIS Substation is within the TATA Steel Port Talbot site, the centre of this proposed substation is SS 77592 85879.

Options B and C involve routing from the proposed Margam substation southwards adjacent to the existing Network Rail railway line and crossing under the railway using horizontal directional drilling (HDD) at the junction with the southern entrance to the TATA steel works into the Margam Moors area. The proposed Option B and C routes are subtly different. Option B follows the Heolcaer Bont public right of way and Option C routes through the central area of the Margam Moors. The cable route options then re-join in the western area of the Margam Moors and run north to the proposed TATA substation.

1.5. Geotechnical Category

Eurocode 7 states “in order to establish minimum requirements for the extent and content of geotechnical investigations, calculations and construction control checks, the complexity of each geotechnical design shall be identified together with associated risks”.

To determine the design requirements, the following three categorises are utilised:

- Category 1 – assigned to small and relatively simple structures.
- Category 2 – assigned to conventional types of structures and foundations with no exceptional risk or difficult ground or loading conditions; and
- Category 3 – assigned to complex ground conditions and large complex structures.

This scheme falls into the requirements of a Category 2 scheme, whose designs should use quantitative geotechnical data and analysis to ensure that the fundamental requirements are satisfied with this data being supported by routing procedures for field and laboratory testing.

2. Sources of Information, Desk Study and Review of Findings

2.1. Site Visits

BakerHicks have undertaken 2no. site visits to the proposed development areas on 31/10/23 and 14/11/23. Both site visits were undertaken following periods of heavy rainfall. Due to time limitations only certain parts of the site were visited this included the existing Margam substation, the Heolcaer Bont public right of way (Cable Route Ch. 1100m-2075m) and the access track around the western side of the proposed TATA substation. A summary of the main findings of the visits is shown below:

- The area immediately surrounding the existing Margam GIS station (proposed Cable Route Ch. 150m-300m & Margam Substation Option 4) comprises low-lying marshland, grassland and some areas of reed type vegetation indicating particularly wet ground.
- The railway lines within the southern area of the proposed development between Cable Route Ch. 1125m-1300m of the site were noted to be at grade with no embankment/cutting present.
- Several small watercourses were present within the more heavily vegetated areas between cable route Ch. 1300m-1425m.
- The area forming the Margam Moors between cable route Ch. 1425m-2225m appears overgrown with reed type vegetation indicating particularly wet ground.
- The area south of the proposed TATA substation was observed to be a storage area for coal. Many of the access tracks in this area appeared to have a significant amount of ponded water present.
- Multiple stockpiles of unknown material were present on the northern portion of the proposed TATA substation.

2.2. Topographical maps

An initial assessment of the topography at the 2no. substations and along the route of the proposed cable has been undertaken using freely available online resources including: LIDAR data from the Welsh Government (Ref. [3]); Google Maps (Google Earth); and OS maps.

2.2.1. Proposed Margam GIS Substation Option 2

The area forming the proposed Margam substation Option 2 site is relatively flat with the available LIDAR showing that the site is approximately 3-4m AOD. OS mapping shows that the site is bounded on the northern side by a small watercourse labelled "Upper Mother Ditch". The mapping shows the southern side of the site is bounded by a drain and another drain is shown to be running north to south through the western portion of the site.

The satellite imagery appears to show that the western portion of the site forms a gravel access track/parking area associated with the existing Margam substation. The eastern portion of the site appears to be bounded by larger vegetation associated with the smaller watercourses whilst the central area of the site is formed of grass/shrubbery. The OS mapping indicated this to be marshland.

2.2.2. Proposed Margam GIS Substation Option 4

The area forming the proposed Margam substation Option 4 is relatively flat with the available LIDAR showing that the site is approximately 3m AOD. It was noted that there is an approximate 1m rise in ground level on the eastern boundary of the site likely associated with the existing Margam Substation. The OS and aerial mapping shows 3no. small ditches within the site boundary. One ditch runs approximately north/south splitting the site in the centre, another ditch splits from this at the southern boundary of the site running east. Another ditch feeds into this central ditch from the west towards the north east boundary of the site. Aerial mapping shows much of the site is grassland/marshland, however mature trees are present particularly on the boundary of the main ditch running through the site.

2.2.3. Proposed TATA GIS Substation

The area forming the proposed TATA GIS Substation is relatively flat with LIDAR showing that the site is approximately 5-7m AOD. The OS Mapping and aerial mapping shows a drainage ditch running approximately east/west splitting the site in the centre. The proposed site area is within an active area of the TATA Steel works. The northern portion of the site appears to be used as a storage area with multiple stockpiles of material, whilst the southern portion of the site appears disused currently, formed of grassland with some bracken vegetation. The proposed site is bounded on all sides by access tracks.

2.2.4. Proposed Cable Routing

The proposed Option B and C cable routing crosses relatively flat ground upon review of the LIDAR data. The route was observed to rise gently from approximately 3m AOD at the new proposed Margam GIS to 7m AOD at the new proposed TATA GIS Substation. There was no significant difference in topography between Option B and C.

The OS mapping shows that between chainage 0m and 1050m the proposed route crosses through low lying marshland and grassland areas and makes multiple crossing over small watercourses all of which are labelled as drains. At chainage 1050m it is proposed that the cable route cross under the Network Rail and TATA steel railway lines by HDD.

The HDD for Option B ends at chainage 1475m and runs west following the existing public right of way. This crosses 4no. small watercourses including the middle mother ditch and lower mother ditch. The HDD for Option C ends at chainage 1375m and runs immediately west through the central section of the Margam Moors fields which comprise low lying grassland and marshland. This crosses multiple small watercourses which are all labelled as drains apart from the Middle Mother and Lower Mother Ditch.

Both routes intersect again at chainages 2275m Option B and 2150m Option C. The same route is then followed for both options to connect to the TATA GIS substation. The route crosses marshland up until chainage 2700m where the route crosses a section of roadway and the side of a working area of the TATA substation labelled on the OS mapping as Coal Terminal. Immediately beyond this the cable route enters the proposed TATA GIS Substation.

2.3. Historical maps

Historical Ordnance Survey maps have been obtained for the proposed Margam substation Options, TATA substation, cable route and surrounding areas as detailed within the Envirocheck Reports presented in Appendix B, C & D. 3no. Envirocheck reports were reviewed covering all the proposed development. The historical map review has been split into four tables for each component of the site: Proposed Margam substation Option 2, proposed Margam Substation Option 4, proposed TATA substation and proposed cable routing. It should be noted that some of the features are repeated within the tables due to their close proximity to multiple elements of the proposed works.

The tables below present a summary of the on-site and off-site development within 500m of the sites. The distance and the direction from the site are summarised in the tables. For the proposed cable route distances are given with respect to the chainage presented in Appendix A for the central section of the route where the cable splits the chainage is quoted with B or C to reflect the distance to Option B or C. The historical maps range from 1877 to 2023.

Table 2.1. Proposed Margam Substation Option 2 Historical maps summary.

Map (Date and Scale)	On Site Development	Off Site Development
1876-1877 1:2,500 1885 1:10,560	The site is undeveloped. A ditch is marked running in a north south orientation across the site on the eastern side.	The site is bounded on the southern side by 2no. small ditches and on the northern side by a further ditch. The ditch running within the site boundary forms a link between both ditches. 40m west of the site the Great Western Railway is marked running approximately north south. Most of the area within 500m of the site is undeveloped, with most of the land separated by small drainage ditches. Approximately 500m southwest of the site is the edge of an area of excavated ground associated with the pond related to the Morfa Colliery. Approximately 500m south of the site is a road labelled Heol y Dieliaid which translates to Holder Road. This runs approximately east west from the railway.
1899 1:2,500 1900 1:10,560	No significant change.	The railway line immediately west of the site has been expanded to the west with the addition of another track, named as the Ogmore Valleys Extension. A ditch running from the eastern boundary of the site to the south is now labelled Upper Mother Ditch.
1917-1919 1:2,500 1921 1:10,560	No significant change.	No significant change.
1938-1952 1:10,560	No significant change.	No significant change.
1940 1:2,500	No significant change.	50m to the west of the site a recreation ground is now labelled. 120m to the northwest a small building is now visible labelled Margam Moors Pumping station.

Map (Date and Scale)	On Site Development	Off Site Development
1949 1:10,560 (Aerial Imagery)	No significant change.	The construction of the steel plant appears to have started immediately west of the railway line. This is associated with a large portion of land which has been cleared of vegetation and the outline of buildings with probable foundations installed. Residential properties are shown to be in development approximately 500m north of the site.
1951 1:10,560	No significant change.	Mapping does not present any significant change compared to 1940's mapping. It is noted the mapping information does not reflect 1949 aerial imagery. It is considered that the mapping update may predate 1949 photography.
1952 1:1,250	Overhead (OH) electricity post present on western boundary of site with overhead lines running approximately northwest to southeast.	The ditch that bounds the northern edge of the site is now labelled as Upper Mother Ditch. There has been further development of the railway line immediately west of the site to include additional tracks, signals etc. An electrical substation is marked approximately 160m northwest of the site. A tank is shown approximately 300m west of the site. Approximately 100m west of the site, directly beyond the railway there are several large building and additional railway infrastructure now constructed which are labelled as 'Abbey Works (Steel)'. A large electrical substation, assumed to be associated with the works is present 175m northwest. An unlabelled building is shown approximately 50m east of the site.
1953 1:2,500	No significant change	No significant change
1964 1:2,500 1965 1:10,000	No significant change.	Approximately 100m northwest of the site, the Margam railway station is now labelled. The pumping station has now been replaced by sluices. Further development on buildings within the steel plant to the west of the site. Additional buildings are now present 200-250m north including an unspecified laboratory. A circular tank is present 250m Northwest.

Map (Date and Scale)	On Site Development	Off Site Development
		Residential development to the north of the site has developed further south to approximately 300m of the site boundary. Beyond 500m south of the site there is development of buildings labelled “works”.
1970 1:2,500	Additional OH electricity cables noted on eastern boundary of the site. No other significant changes.	A compound area and buildings are now visible 50m south of the site labelled electrical substation. This correlates to the area of the present day Margam substation. In the field immediately south of the site OH line gantry foundations are now visible. Margam railway station is no longer marked. The main building present within the steel works immediately beyond the railway line has extended southwards. Multiple tanks are now visible approximately 350m west of the site.
1973 1:1,250	No significant change	Tanks present within substation 50m south of the site.
1982 1:10,000	No significant change	No significant change.
1993 1:1,250	The OH cable running within the site boundary is no longer visible.	Immediately north of the site a feature resembling a pond is marked. Additional buildings present 250m to northwest within area of Abbey Works.
1999 1:10,000	No significant change.	The ditch to the west controlled by sluice gates is labelled Middle Mother Ditch. No significant change.
2001 Aerial Mapping	No significant change.	Area immediately north of the site is now a golf course with former pond area transferred to water features.
2003 1:10,000	No significant change.	No significant change.
2006 1:10,000	No significant change.	Building within steel works approximately 150m west is extended further south, over the course of former railway tracks.

Map (Date and Scale)	On Site Development	Off Site Development
2016 1:10,000	No significant change.	Harbour Way Road (A4241) now passes 50m north of the site running approximately east west. Construction of the road has led to the removal of laboratory buildings 250m north. An elongate water feature is now visible approximately 30m north of the site.
2023 1:10,000 2024 Aerial Imagery	No significant change.	Water feature 30m north of the site named as a balancing pond. Power Station and conveyors noted ~300m southeast of the site.

Table 2.2. Proposed Margam Substation Option 4 Historical maps summary.

Map (Date and Scale)	On Site Development	Off Site Development
1876-1877 1:2,500	The site is undeveloped. A ditch is marked running in a north south orientation through the central section of the site. 2no. ditches connect to this central ditch. One on the southern boundary of the site running east west. One on the north eastern boundary of the site running east west.	An area of woodland is recorded approximately 120m east. 80m west of the site the Great Western railway is marked running approximately north-south. Approximately 280m south of the site is a road labelled Heol y Dieliaid which translates to Holder Road. This runs approximately east west, running under the railway. A small track is present running approximately northeast-southwest immediately north of the site. Most of the area within 500m of the site is undeveloped, with most of the land separated by small drainage ditches.
1899 1:2,500 1900 1:10,560	No significant change.	The railway line 80m west of the site has been expanded to the west with the addition of another track, named as the Ogmore Valleys Extension. A ditch present approximately 100m east of the site is now labelled "Upper Mother Ditch". This is labelled flowing to the north.
1917-1919 1:2,500 1921	Small square structure now visible within the central section of the site.	No significant change.

Map (Date and Scale)	On Site Development	Off Site Development
1:10,560		
1940 1:2,500	Small square structure is no longer present.	Margam Moors Pumping Station is now labelled approximately 370m northwest.
1949 1:10,560 (Aerial Imagery)	No significant change	The construction of the steel plant appears to have started immediately west of the railway line. This is associated with a large portion of land which has been cleared of vegetation and the outline of buildings with probable foundations installed.
1951 1:10,560	No significant change	Mapping does not present any significant change compared to 1940's mapping. It is noted the mapping information does not reflect 1949 aerial imagery. It is considered that the mapping update may predate 1949 photography.
1952 1:1,250	No significant change	An electrical substation is now visible approximately 400m north west of the site. Overhead (OH) electricity lines are present running north-south approximately 70m east of the site. A tank is shown approximately 400m west of the site within the steel works.
1953 1:2,500	No significant change	No significant change
1964 1:2,500 1965 1:10,000	No significant change	Approximately 350m northwest of the site, the Margam railway station is now labelled. The pumping station has now been replaced by sluices. Further development on buildings within the steel plant to the west of the site. Approximately 350m south east of the site there is development of buildings labelled "works".
1970 1:2,500	No significant change	A compound area and buildings are now visible on the eastern boundary of the site labelled electrical substation. This correlated to the area of the present day Margam substation. In the fields immediately north and south of the site OH gantry foundations are now visible. Margam railway station is no longer marked. The main building within the steel works immediately beyond the railway line has extended southwards.

Map (Date and Scale)	On Site Development	Off Site Development
		Multiple tanks are now visible approximately 370m west of the site.
1973 1:1,250	No significant change	Tanks present within substation approximately 5m west of the site boundary.
1982 1:10,000	No significant change	No significant change
1991 1:1,250	Mapping partially complete. No significant change	No significant change
1993 1:1,250 1:10,000	No significant change	A pond feature is noted approximately 180m north of the site.
1995 1:1,250	Mapping partially complete No significant change	No significant change
1999 1:10,000	No significant change	A ditch immediately west of the railway line is now labelled Middle Mother Ditch and appears to be connected to sluice gates.
2001 Aerial Mapping	No significant change	Area approximately 180m north of the site is now a golf course with former pond area transferred to water features.
2003 Aerial Mapping	No significant change	No significant change
2006 1:10,000	No significant change.	Building within steel works approximately 170m west is extended further south, over the course of former railway tracks.
2016 1:10,000	No significant change	Harbour Way Road (A4241) now passes 220m north of the site running approximately east west. An elongate water feature is now visible approximately 220m northwest of the site.
2023 1:10,000	No significant change	Water feature 220m northwest of the site named as a balancing pond.

Map (Date and Scale)	On Site Development	Off Site Development
2024 Aerial Imagery		Power Station and conveyors noted 250m east of the site.

Table 2.3: Proposed TATA Substation Historical maps summary

Map (Date and Scale)	On Site Development	Off Site Development
1876-1877 1:2,500 1885 1:10,560	Site area is undeveloped. 3 no. ditches run through the site splitting the site into separate fields. North-western corner of the site is denoted by an area of marshland.	60m east and extending around to the northeast of the site is an area of excavated ground which is likely associated with the Morfa Colliery. The land approximately 130m west of the site forms a large low lying coastal marshland area which extends north and south along the coastline. 160m north of the site an area and number of buildings labelled "Abbot Pit" are recorded which are potentially a part of the Morfa Colliery recorded approximately 420m north of the site. A track runs approximately east west 100m north of the site connecting the Abbot Pit to a building labelled Hen Biniwyn Grange. The land to the south and southeast is recorded as undeveloped which is split by multiple small ditches.
1899 1:2,500 1900 1:10,560	No significant changes	The area of excavated ground which starts 60m east of the site is now labelled as "Pond"
1917-1919 1:2,500 1921 1:10,560	No significant changes.	No significant changes.
1938-1952 1:10,560	No significant changes	Buildings associated with Abbot Pit 160m north are no longer visible and notation as Abbot Pit no longer present. Some Buildings associated with the Morfa Colliery no longer visible.

Map (Date and Scale)	On Site Development	Off Site Development
1940 1:2,500 1949 1:10,560 (Aerial Imagery)	No significant change	All building associated with the Morfa Colliery no longer visible. Morfa Colliery no longer labelled. Old shaft now labelled within former Morfa Colliery area, 420m to the north. Rifle Range now visible approximately 310m south of the site The construction of the steel plant appears to have started 250m west of the site. This is indicated as a large portion of land has been stripped of vegetation and the outline of buildings is visible.
1951 1:10,560	No significant change.	This mapping shows no significant change from the 1940's mapping and does not reflect what is seen in the 1949 aerial imagery. It's likely the mapping was undertaken prior to 1949.
1953-1964 1:2,500 1962 1:1,1250 1964-1965 1:10,000	A section of embankment is now visible which follows the northern edge of the site, prior to advancing more centrally to the eastern portion. The remainder of the site persists as marsh land, with additional watercourses noted to be present, north-south and east-west within the site boundary these are labelled as drains. These changes are associated with the development of the Steel Works. A drain is now denoted running approximately east west across the site.	There is significant development to the east, north and west of the site which appears to be associated with the development of the Steel plant. Buildings are now visible between 50m and 100m east of the site. Development of an extensive rail network to the east has taken place with associated building development within 250m west of the site. Between 250m and 600m west of the site an area is now labelled as Slag heaps with a large pond and associated trackway. Approximately 500m north of the site is a large body of water labelled as a Reservoir. No significant development has been undertaken to the south of the site.
1982-1988 1:10,000	Buildings hopper and conveyor is denoted in the northeast corner of the site.	The rifle range to the south is no longer shown on mapping. The area to the west previously noted as slag heaps are no longer visible, with the area now mapped as open land.
1991 1:2,500	Contour aligns with the mapped embankment, with a level of 5m (1990 mapping)	Approximately 70m north of the site a structure running north south is labelled pipeline.

Map (Date and Scale)	On Site Development	Off Site Development
1990-1993 1:10,000	Mapping from 1993 indicates that the drain is now within a shallow cutting, with the remainder of the area apparently level with the surrounding area. Likely associated with level changes.	Multiple circular structures are shown 60m northwest of the site. These are potential chimneys. A gas holder is shown approximately 80m southwest of the site. A conveyer extends from the eastern boundary of the site approximately 100m south and then is positioned east, this extends over to the area previously denoted as slag heaps. The area between 250m and 500m west of the site is now shown to have multiple buildings with many circular structures denoted as tanks and linear structures denoted as travelling cranes. This general area is labelled as works. Much of the railway approximately 250-500m east of the site has been dismantled. A new railway line has been constructed running within 50m of the eastern boundary of the site.
1995 1:2,500	Drainage associated with ditch slightly realigned	A new track is visible coming from the south and running along the western edge of the site. Additional tank ~ 200m to southwest.
1999 1:10,000 2000 Aerial Mapping	No significant change	No significant change
2003 1:10,000	No significant change	No significant change.
2006 1:10,000	No significant change	A pipeline is noted running approximately north south, 300m west of the site.
2009 1:10,000	No significant change	No significant change
2023 1:10,000 2024	Conveyor, buildings and track no longer visible in north eastern section of the site. Aerial imagery shows the site is operational. Multiple stockpiles of material are	The gas holder 80m southwest of the site is no longer visible on mapping. A circular structure resembling a gas holder is present approximately 150m south of the site.

Map (Date and Scale)	On Site Development	Off Site Development
Aerial Imagery	present on the northern portion of the site as well as some operational plant.	Many of the buildings present immediately north of the site are no longer present, however a new building has been constructed ~ 60m west. A new structure is present approximately 150m south of the site which appears to be a stockpile of dark material, potentially coal.

Table 2.4. Proposed Cable Route Historical maps summary.

Where route splits into Option B and C the distance is given to the closest option, quoting option letter in brackets.

Map (Date and Scale)	On Site Development	Off Site Development
1876-1877 1:2,500 1885 1:10,560	The proposed cable routes typically cross through undeveloped land comprising marshland and grassland which are split by multiple ditches. The cable route crosses a track labelled “Heol y Deiliaid” at chainage 575m. The cable route crosses ditches at the following chainages: 40m, 60m, 175m, 320m, 350m, 400m, 465m, 575m, 600m, 860m, 970m, 1250m (B), 1250 (C), 1375m (B), 1425m (C), 1550(C), “Middle Mother Ditch” at 1625m(C) & 1660m (B), 1825m (B), 1875m(C), 1900m(B), 1900m (C), “Lower Mother Ditch” at 2025m (C) & 2060m (B), 2125m (C), 2260m (B), 2410m, 2610m, 2740m. The cable route crosses The Great Western Railway line (South Wales Division) between Ch. 1125-1145m. This is still present today. A track is recorded crossing east-west between Ch. 1650-2050m (B).	Most of the land surrounding the proposed cable route remains undeveloped and is typically formed of low-lying fields separated by watercourses. Some of these fields are bounded by trees. The cable route runs in parallel with The Great Western railway approximately between Ch. 0 and 1050m where the cable route turns east to cross the railway. An area of woodland is recorded approximately 80m west of Ch. 75m. The track labelled Heoly Deiliaid crosses the railway line approximately 60m west of Ch 575m. This continues to a building labelled “Hen-biniwyn Grange”. This track continues approximately 340m east of Ch 575m where it joins a road which runs south connecting to a road labelled “Heol Cae y bont” which runs west passing the southern extent of the cable route. Approximately 430m southeast of Ch. 2125(B) are a collection of buildings labelled “Morfa-Mawr”. A well is labelled immediately adjacent the buildings. The Abbot Pit is recorded approximately 375m north of the end of the cable route (Ch. 2883m). This Pit is associated with the Morfa Colliery. An area of excavated land is recorded approximately 275m northwest of Ch 2883. A road is labelled “Gwal y Cqrl-newydd” running approximately east west between Abbot Pit and building approximately 430m east of Ch. 575m labelled “Hen-biniwyn Grange”.

Map (Date and Scale)	On Site Development	Off Site Development
1899 1:2,500 1900 1:10,560	The Great Western Railway line expands in width by approximately 20m covering cable route chainage 1125-1165m. It is now labelled "Great Western Railway, Port Talbot Railway Ogmore Valleys Extension" The track recorded crossing the site has changed direction and been developed into a road. This follows the present day Heol Cae'r Bont Road which is followed by cable chainage 1625m(B) to 1975(B). A footpath is recorded crossing the cable route at 1650m(C) & 1675m (B). The Middle Mother Ditch and Lower Mother Ditch are recorded as flowing to the north.	A ditch present running between approximately 80m west of Ch 25m and approximately 100m west of Ch 1050m is now labelled "Upper Mother Ditch". This is labelled flowing to the north. An area of woodland is now marked 25m south of Ch. 1400m. The area of excavated land to the northwest of Ch 2883, is now labelled as "Pond".
1917-1919 1:2,500 1921 1:10,560	No significant change.	The area surrounding the Morfa Colliery approximately 800m north of the site is labelled "Liable to floods". No Significant Changes
1940 1:2,500	A rifle range including 'butts' is now present between chainage 2425m and 2625m. An access track to the range runs crosses the chainage at 2075m (B) & 2050(C).	Abbot Pit and Morfa Colliery are no longer recorded on the mapping. Margam Moors Pumping Station is labelled approximately 270m northwest of Ch 0m. A recreation ground is now labelled approximately 130m northeast of Ch0m.
1949 1:10,560 (Aerial Imagery)	Development of a trackway likely to be infrastructure associated with the development of the steel works crosses the cable route between chainages 1225m and 1300m	The aerial imagery shows that the development of the Steel plant has commenced. Between Ch0m-575m the Steel Plant development has commenced approximately 100m west, on the opposite site of the railway.

Map (Date and Scale)	On Site Development	Off Site Development
1951 1:10,000	Mapping only covers Ch 0-900m and north of the end of the cable routing. No significant changes.	Mapping only covers Ch 0-900m and north of the end of the cable routing. This mapping shows no significant change from the 1940's mapping and does not reflect what is seen in the 1949 aerial imagery. It's considered that mapping may have been undertaken prior to 1949. No significant changes.
1953 1:2,500	Mapping covers Ch 0-575m only. No significant changes	Buildings labelled as "Abbey Works (Steel)" are shown approximately 250m west of Ch 0-325m. Development of the existing Great Western railway line has occurred. This includes the addition of multiple tracks with signal posts and associated infrastructure likely to coincide with the development of the steel plant. Three tanks are shown approximately 400m west of Ch 200m alongside a chimney. An electrical Substation is shown approximately 300m northeast of Ch 0m. An unlabelled building is shown approximately 100m northeast of Ch 0m. The pond to the north of the end of the cable route is no longer evident. Notation of "Remains of Grange" referring to Grange building mentioned earlier in review is shown 450m west of Ch. 550m.
1964 1:2,500 1964-1965 1:10,000	A track crosses the cable route at chainage 1850m (B). There is significant development of multiple railway lines crossing the cable route between chainages 1225m and 1450m. The rifle range between chainage 2425m and 2625m is now labelled as disused.	There has been significant industrial development in the areas surrounding the site. Approximately 150m east between Ch 575m and 900m there has been development of a number of buildings some circular in structure and possible tank structures. The area is labelled as "Works". The area immediately west of the railway line between Ch 575m and 1050m is labelled as "Coal Dump". Immediately west of this there has been significant development of multiple railway lines associated with the Steel works. Approximately 50m north of the end of the cable route is the extent of the development of the Steel works. With some unnamed structures resembling tanks approximately 280m north. Approximately 300m southeast of Ch. 1050m The Eglwys Nynydd Reservoir is now visible.

Map (Date and Scale)	On Site Development	Off Site Development
1970 1:2,500	Mapping only covers chainage 0m to 575m. An OH line crossing runs approximately east – west at chainage 125m. Another OH line is shown crossing at chainage 125m approximately north-south.	Mapping only covers chainage 0m to 575m. The present day Margam substation is present immediately east of chainage 150-300m.
1973 1:1,250	Mapping only covers chainage 0m to 575m. No significant changes.	Mapping only covers chainage 0m to 575m. No significant changes.
1980 1:2,500	Mapping only covers Ch 575-2883m. Mapping shows on OH line crossing chainage 1100m running north-south.	Mapping only covers Ch 575-2883m. 150m east of Ch.650-750m within the “Works” there are 3no. Tanks recorded. An electrical substation is also recorded within the works. A tank is recorded 150m south of Ch. 1200m.
1982 1:10,000	The rifle range between chainage 2425m and 2625m is no longer present.	No significant changes.
1991 1:2,500	This mapping is partially complete. The OH line running north south at chainage 125m is no longer visible.	There has been significant dismantlement of much of the railway associated with the steel works. 2no. new lines now run across the northern extent of the Margam moors to a conveyor approximately 120m west of the end of the cable route. A gas holder is now present approximately 130m west of Ch. 2825m. There has been significant expansion of the steel plant along the coast to the west of the cable route between chainages 2050m and the end of the cable route including: multiple tanks approximately 500m west of Ch. 2750m and an area with multiple travelling cranes for moving stored material.
1993 1:10,000	2no. OH line crossings are shown between chainage 675m and 725m. Building development has taken place immediately adjacent chainage Ch.625m	No significant change

Map (Date and Scale)	On Site Development	Off Site Development
	and Ch.700m associated with the works. A conveyor is marked crossing chainage 2775m. A track is marked running north south immediately adjacent chainage 2675-2750m.	
1995 1:2,500	A track is now shown crossing at chainage 2800m running approximately north south.	This map partially covers the site is missing north of Ch. 400m No significant changes.
1999 1:10,000	The map shows the OH line crossing at 725m chainage now terminates within the site. Track is now shown crossing chainage 2875m approximately east to west.	No significant changes.
2001 Aerial Mapping	No significant changes	No significant changes
2003 1:10,000	No significant changes	A large expansion of a building within the Steel plant has been undertaken approximately 250m West & 250m North of CH. 875m & 1325m respectively. The expansion involves the extension of one of the main buildings associated with the steel plant to the south.
2006 1:10,000	2no. OH lines at 625m and 725m are no longer visible. New OH line crosses at Ch 925m. Immediately east of cable route Ch. 600m and 975m there has been building development within the area labelled as works.	No significant changes
2023 1:10,000	Track now visible crossing chainage route at 925m, associated with access to Margam substation.	The gas holder at approximately 130m west of Ch. 2825m is no longer visible.

Map (Date and Scale)	On Site Development	Off Site Development
2024 Aerial Imagery	Track now visible at Ch 2700m running east to an area which appears to be storing Coal. Aerial imagery shows much of the tracks in this area are dark likely associated with the coal being stored.	A circular building is now present approximately 50m west of Ch. 2675m. A building labelled "Power Station" is now present approximately 250m west of Ch. 275m.

2.4. Geological Maps and Memoirs

The following sources of information have been reviewed and discussed below.

- British Geological Survey, 1:50,000 New Series, Sheet 247 Swansea, Bedrock, 2011 (Ref. [4])
- British Geological Survey, 1:50,000 New Series, Sheet 247 Swansea, Bedrock and Superficial, 2011 (Ref. [5]).
- British Geological Survey, 1:10,000 Series, Sheet SS78NE, Solid and Drift, 1970 (Ref. [6]).
- British Geological Survey GeoIndex (Onshore) (Ref. [7]).

2.4.1. Artificial Geology

There is a large area of artificial ground recorded on the British Geological Survey (BGS) GeoIndex (Ref. [7]), this is mapped as "Landscaped Ground (Undivided) – Artificially modified ground". This artificial ground is associated with the extents of the TATA steel plant. The Margam moors area records no artificial ground.

A summary of recorded Artificial ground is shown below recorded at the following positions within the proposed developments:

- Proposed Margam Substation Option 2- Not recorded,
- Proposed Margam Substation Option 4- Not recorded
- Proposed TATA Substation- Recorded,
- Cable Route Ch. 0m to 1125m- Not recorded,
- Cable Route Ch. 1125m to 1450m- Recorded,
- Cable Route Ch. 1450m to 2760m- Not recorded,
- Cable Route Ch. 2760m to 2883- Recorded.

2.4.2. Superficial Geology

According to the available geological mapping the proposed Margam substation Options 2 & 4, proposed TATA substation and the entire proposed cable route are all underlain by Tidal Flat Deposits (TFD).

This material is described by the BGS Lexicon as “They consist of unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit”.

A summary of the ground stability hazards relating to superficial geology from the Envirocheck reports is shown in Table 2.5 below:

Table 2.5. Summary of ground stability hazards relating to superficial geology recorded in the Envirocheck Reports.

Hazard	Site- Envirocheck Report		
	Margam Substations	TATA Substation	Cable Routes
Compressible Ground	Moderate	Moderate	Moderate
Landslide	Very Low	Very Low	Very Low
Running Sands	Moderate	Moderate	Moderate
Shrink/Swell Clays	Very Low	Very Low	Very Low

The Envirocheck reports indicate that the potential for compressible ground and running sands across the site is moderate. This is likely associated with the Tidal Flat Deposits.

The Envirocheck reports indicate that there is very low potential for landslide ground stability hazards at the site.

2.4.3. Solid Geology

According to the available geological mapping the proposed Margam substation options 2 & 4, proposed TATA substation and the entire proposed cable route are underlain by the South Wales Lower and Middle Coal Measures Formation. The following Coal Seams are shown outcropping across the three site areas: Two Foot Nine, Upper Four Foot, Lower Four Foot, Six Foot, Upper Nine Foot, Lower Nine Foot, Yard, Middle Seven Foot, Upper Five Foot and Gellideg. Figure 2.1 shows the solid geology at the site. The South Wales Coal Measures Formations are described by BGS Lexicon as “coal-bearing mudstones/siltstones, with seatearths and minor sandstones”.

The boundary between the Lower and Middle Coal Measures is the Amman Marine Band. Due to faulting the band is displaced throughout the site. A normal fault runs approximately Northwest to Southeast across the site which intersects the central part of the proposed HDD for the cable routing, the downthrow on the fault is recorded to the east. A thrust fault, downthrown to the south, is shown to run approximately east west across the site directly beneath the proposed TATA substation this fault terminates at the normal fault.

The ground stability hazards from each of the Envirocheck reports relating to solid geology are summarised in Table 2.6.

Table 2.6. Summary of ground stability hazards relating to solid geology recorded in the Envirocheck Reports.

Hazard	Site- Envirocheck Report		
	Margam Substations	TATA Substation	Cable Routes
Collapsible Ground	No hazard	No hazard	No Hazard
Ground Dissolution	No hazard	No hazard	No Hazard

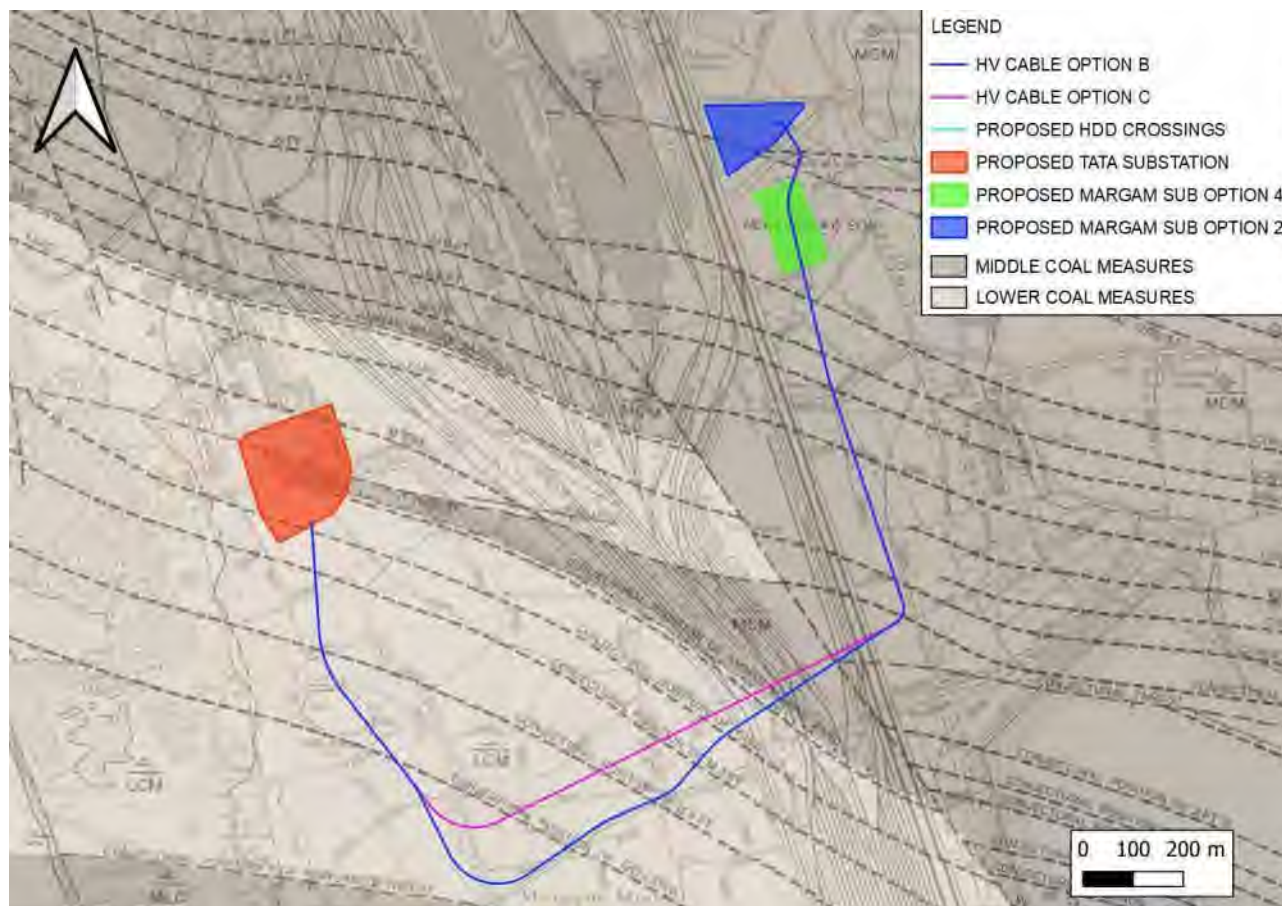


Figure 2.1. Plan showing recorded Solid Geology beneath the site.

2.5. Records of mine and mineral deposits

The proposed substations and cable route lies within a coal mining reporting area. The Envirocheck report records mining instability at the site which is recorded as “Inconclusive Coal Mining”. The Coal Authority Interactive Viewer (Ref. [8]) records parts of the proposed Margam Substation options, TATA substation and cable route within development high risk areas. Mine entries are also recorded approximately 200m north of the proposed TATA substation. Due to this a Coal Mining Risk Assessment (Ref. [9]) has been undertaken.

There are no records in the Envirocheck report of natural cavities within 1km of the sites.

2.6. Land Quality

The Envirocheck report provides a summary of industrial land use and potential contaminative processes within 500m of the site. Noteworthy data sources are discussed in the sections below.

Proposed Margam Substation Option 2 & 4

The land forming both Margam substation Option 2 and Option 4 has remained undeveloped up to the present day. The land immediately surrounding both sites has remained undeveloped typically as low-lying marshland and woodland with multiple small ditches, with the exception of the existing Margam substation which is present approximately 60m south of Option 2 and immediately on the western boundary of Option 4.

The existing TATA steel plant is present to east of the sites across the Great Western Railway which runs beyond the western extent of both Option 2 & 4, running in an approximate north south orientation. Sources of contamination for both Options 2 & 4 are likely to be those associated with the development of the railway infrastructure to the east, and in the case of Option 4, the substation immediately bounding the site to the west.

Proposed TATA Substation

The proposed TATA substation land is currently being used as a storage area for material from the steel works. Historically the site was undeveloped until the development of the Steel Plant. The northern portion of the site had several buildings extending into it and a conveyor system extending on the western boundary of the site. TATA informed BakerHicks via email (Ref. [10]) that the substation area was used as the Grange Coke Ovens which were constructed in 1959 and demolished by 2004. The southern portion of the site (south of the watercourse splitting the substation area) has remained largely undeveloped apart from access tracks running around the boundary of the site.

Sources of contamination on the site are likely to be those associated with the TATA steel plant, these include the unknown material stored presently on the site and the previous uses including the presence of the conveyor (likely transporting coal), coke ovens and the existing storage of coal immediately south of the site. Furthermore, localised contamination may exist from demolishing buildings including the presence of asbestos within the building fabric.

Proposed Cable Route

Most of the proposed cable route has remained undeveloped remaining marsh and farmland. The cable route passes the existing Margam substation between Ch 175m- 300m and the existing Industrial Gas Plant between Ch. 600m-975m. The cable route crosses a significant section of railway line associated with the Steel Plant and Network Rail, the extent of the railway line has varied throughout history and there have been multiple sources of historic contamination identified including coal dumps and tanks.

The cable route then runs through the Margam Moors area which is a low-lying grassland/marshland with multiple small ditches, there was record of a historic shooting range in this between Ch. 2425m and 2625m, however aside from this the area has remained undeveloped. The cable route then runs northwards to the Steel Plant, west of the route is the Coke production area of the steelworks and to the east is a large coal storage area.

The main sources of contamination for the cable route are again likely to be associated with the coke production and coal storage area of the Steel works. Further to this, small scale, highly localised contamination may exist from localised fly tipping- along the public right of way and the potential for asbestos associated with the shooting range buildings demolished on site.

2.6.1. Discharge Consents

The Envirocheck report records give discharge consents within 250m of the sites. These are summarised in Table 2.7.

Table 2.7. Summary of Discharge Consents within 250m of the site.

Property Type and Operator	Discharge Type and recorded receiving water	Approximate distance and direction to site	Date Effective
Undefined or other BOC Ltd	Unspecified Into Mother Ditch	142m East of Cable Route Ch.625m-750m	11/08/1988 – 19/10/1992
Basic Industry, Chemical Inorganic BOC Ltd	Unspecified Into Mother Ditch	152m East of Cable Route Ch.625m-750m	19/04/1978 – 05/03/1998
Basic Industry, Chemical Inorganic BOC Ltd	Unspecified Into Mother Ditch	146m East of Cable Route Ch.625m-750m	11/08/1988 – 19/10/1992
Basic Industry, Chemical Inorganic BOC Ltd	Unspecified Into Mother Ditch	152m East of Cable Route Ch.625m-750m	11/08/1988 – 19/10/1992
Basic Industry, Chemical Inorganic BOC Ltd	Unspecified Into Mother Ditch	155m East of Cable Route Ch.625m-750m	11/08/1988 – 19/10/1992

All entries relate to revoked entries within ~150m of the cable route, however it is noted that the receiving water (Mother Ditch) flows northwards to the area of the proposed Margam Substation- Option 2 & 4. Due to the age of the entries, with the most recent being revoked as of 1998, the distance from site, both laterally over land and along the receiving water, it is considered that the entry does not have the potential to present a significant risk to the site.

2.6.2. Pollution Incident to Controlled Waters

The Envirocheck report records three sites of pollution incidents to controlled waters within 500m of the sites. These are summarised.

Table 2.8. Summary of pollution incidents to controlled waters within 500m of the site.

Pollutant	Property Type	Cause and receiving water	Incident Category	Approximate Distance site	Incident Date
Unknown	Not Given	Unknown Not Given	3 – Minor Incident	91m South Cable Route Ch.2040m (B)	11/04/1991
Crude Sewage	Warehouses	Leakage Not Given	3 – Minor Incident	247m Northeast Cable Route Ch. 800m	10/07/1995
Mud/Clay/Soil	Not Given	Unknown Not Given	3 – Minor Incident	489m West TATA Substation	03/09/1995

The three entries presented above represent minor incidents, in excess of 15 years in age, some distance from the cable route. As a result, none of the entries are considered to represent a risk to the proposed cable route.

2.6.3. Water Abstractions

The Envirocheck report records five water abstraction licenses within 500m of the site. These are summarised in Table 2.9 below:

Table 2.9. Summary of water abstractions recorded within 500m of the site.

Operator	Abstraction and details	Source and rate	Approximate Distance and direction to site	Permit Start Date
BOC Ltd	Other Industrial/Commercial/Public Services: Evaporative Cooling	Groundwater Rate not supplied	86m W Cable Route Ch. 975m	16/01/2009
BOC Ltd	Other Industrial/Commercial/Public Services: Evaporative Cooling	Groundwater Rate not supplied	86m W Cable Route Ch. 975m	Not Supplied

Operator	Abstraction and details	Source and rate	Approximate Distance and direction to site	Permit Start Date
BOC Ltd	Other Industrial/Commercial/Public Services: Evaporative Cooling	Groundwater Rate not supplied	86m W Cable Route Ch. 975m	Not Supplied
BOC Ltd	Other Industrial/Commercial/Public Services: Evaporative Cooling	Groundwater Rate not supplied	234m W Cable Route Ch. 975m	16/01/2009
BOC Ltd	Other Industrial/Commercial/Public Services: Evaporative Cooling	Groundwater Rate not supplied	234m W Cable Route Ch. 975m	Not Supplied
Corus UK Strip Products	Metal: Process Water	Surface	448m N Tata Substation	01/04/2000
TATA Steel UK Limited	Metal: Evaporite Cooling	Surface	453m N Tata Substation	12/11/2010
TATA Steel UK Limited	Metal: Process Water	Surface	453 N Tata Substation	12/11/2010
Corus UK Strip Products	Metal: Evaporite Cooling	Surface	453 N Tata Substation	01/04/2000
TATA Steel UK Limited	Metal: Evaporite Cooling	Surface	453 N Tata Substation	Not Supplied
TATA Steel UK Limited	Metal: Process Water	Surface	453 N Tata Substation	Not Supplied

2.6.4. Source Protection Zones

The Envirocheck report does not record the site being within a source protection zone.

2.6.5. Potentially Infilled Land (non-water)

The Envirocheck report describes one record of potentially infilled land (non-water) within 500m of the sites, located 145m north of the proposed TATA substation site. This record related to unknown filled ground (Pit, Quarry, etc) and the date of mapping is 1993. The historical maps show that this location was the site of the Abbot Pit which was part of the Morfa colliery. It is likely that this record of infilled land is related to levelling of ground associated with this pit as part of development of the Steel Plant which occurred mid-20th century.

2.6.6. Potentially Infilled Land (water)

There are multiple records of infilled land (water) within the site boundaries, but these appear to relate to infilled historical ditches. Most features are recorded towards the end of the cable route (beyond Ch. 2500m) and within the proposed TATA substation. These areas of infilled ground are limited in size and are considered unlikely to pose a significant contamination source therefore the details of these are not reproduced in this report.

The larger areas of potentially infilled land (water) recorded in the Envirocheck reports are summarised in Table 2.10 below.

Table 2.10. Summary of larger areas of potentially infilled land (water) recorded in the Envirocheck reports.

Use	Approximate distance from site	Date Mapped	Comments
Unknown Filled Ground	58m northeast TATA Substation	1951	Historical Mapping shows that this area was a pond likely associated with the Morfa Colliery which was last mapped in 1951.
Unknown Filled Ground	372m southwest TATA Substation/ Cable Route Ch. 2500m-2700m	1965	Historical Mapping shows that these areas of infilled ground were marked as ponds and were immediately south of the slag heaps.
Unknown Filled Ground	387m west Cable Route Ch. 2500m-2700m	1965	
Unknown Filled Ground	388m West Cable Route Ch. 2500m-2700m	1965	
Unknown Filled Ground	455m West Cable Route Ch. 2500m-2700m	1965	
Unknown Filled Ground	456m West Cable Route Ch. 2500m-2700m	1965	
Unknown Filled Ground	499m West Cable Route Ch. 2500m-2700m	1965	

2.6.7. Registered Landfill Sites

The Envirocheck reports do not record any registered landfill sites within 500m of the site.

2.6.8. BGS Recorded Mineral Sites

The Envirocheck reports records 2no. BGS Mineral sites within 500m of the site. These were recorded at 206m and 424m north of the proposed TATA substation and are associated with the Morfa Colliery. The site type is listed as 'underground' and the commodity recorded as 'coal-deep', assumed to be associated with a coal seam at depth Both entries are listed as 'ceased'.

2.6.9. Contemporary Trade Directory Entries

The Envirocheck report records nine Contemporary Trade Entries within 500m of the site. These are summarised in Table 2.11 below.

Table 2.11. Summary of contemporary trade directories within 500m of the site.

Name	Classification	Status	Approximate distance/direction to site
Tata Steel	Steel Manufacturers	Inactive	399m NW Margam Substation Option 2
D B Schenker	Freight Forwarders	Inactive	399m NW Margam Substation
Corus Ltd	Steel Manufacturers	Inactive	399m NW Margam Substation Option 2
O C S Cleaning Ltd	Commercial Cleaning Services	Inactive	399m NW Margam Substation Option 2
Faber Prest Steel Distribution	Road Haulage Services	Inactive	399m NW Margam Substation Option 2
J W Morris	Electrical Engineers	Active	399m NW Margam Substation Option 2
Tech-Print Ltd	Printers	Active	456m N Margam Substation Option 2
B O C Gas & Gear	Gas – Industrial & Medical Suppliers	Inactive	289m NE Cable Route Ch. 650m
B O C Gas & Gear	Gas – Industrial & Medical Suppliers	Active	290m NE Cable Route Ch. 650m

2.6.10. Points of Interest – Commercial Services

The Envirocheck reports do not record any commercial services within 500m of the site.

2.6.11. Points of Interest – Manufacturing and Production

The Envirocheck report records 122No. within 500m of the site. Entries are split between Tanks, unspecified Works and Factories and Energy Production facilities, and discussed further below:

1.2.1.1 Tanks:

Most entries are associated with the steel works, with the closest entries recorded as below:

Table 2.12. Summary of closest recorded Tank entries.

	Margam Substation Option 2	Margam Substation Option 4	TATA Substation	Cable Routing
Closest entry	41m South	5m West	75m North	50m West of Ch. 175m
Entries within 100m	2	2	1	2

The 2no. entries within 100m of both the cable route and Margam substation Option 2 & 4 correspond with the tanks recorded at the existing Margam substation.

1.2.1.2 Unspecified Works and Factories

Most entries are associated with the steel works, with the closest entries recorded as below:

Table 2.13. Summary of closest recorded Unspecified works and factories entries.

	Margam Substation Option 2	Margam Substation Option 4	TATA Substation	Cable Routing
Closest entry	198m North	250m West	151m Southwest	95m West of Ch. 2700m
Entries within 100m	0	0	0	2

Upon review of 2024 aerial imagery the closest entry to the Cable Routing and TATA Substation both corresponds to the area including the existing gas holder.

1.2.1.3 Energy Feature

Table 2.14. Summary of closest recorded Energy Feature entries.

	Margam Substation Option 2	Margam Substation Option 4	TATA Substation	Cable Routing
Closest entry	411m Southeast	210m East	No entries	280m East of Ch. 300m
Entries within 100m	0	0	0	0

The closest entries to the Margam substation and Cable Routing correspond to Margam Green Energy Biomass plant.

2.6.12. Areas of Outstanding Natural Beauty

The Envirocheck reports do not record any areas of outstanding natural beauty within 500m of the site.

2.6.13. Environmentally Sensitive Areas

The Envirocheck reports records 1no. area of ancient woodland 30m East of the proposed Margam substation Option 2 site.

2.6.14. Nature Reserves

The Envirocheck reports do not record any Local or National Nature Reserves within 500m of the site.

2.6.15. Ramsar Sites

The Envirocheck reports do not record any Ramsar sites within 500m of the site.

2.6.16. Sites of Special Scientific Interest

The Envirocheck reports record 2no. Sites of Special Scientific Interest. One of these is within the Margam Moors area which is located immediately south of the proposed Option B cable route beyond Heolcaer Bont road between cable route Ch. 1625m- 2000m (B). The other covers the Eglyws Nunydd Reservoir which lies approximately 260m southeast of cable route Ch. 1050m.

2.6.17. Special Areas of Conservation

The Envirocheck reports do not record any Special Areas of Conservation within 500m of the site.

2.6.18. Special Protection Areas

The Envirocheck reports do not record any Special Protection Areas within 500m of the site.

2.6.19. Protected Species

Review of an Ecological Assessment Report (Ref. [11]) undertaken by Jacobs for National Grid for the proposed Margam substation Option 2 area found that water voles were presented within the ditches surrounding the proposed Margam substation Option 2 and approximately 40m north of Margam substation Option 4. A 10m exclusion zone for any construction related activities was concluded within the report.

From recent discussions with National Grid, it is understood that Stantec will be conducting updated ecological surveys to assess whether protected species are still present on within all of the proposed development areas.

2.7. Services

Not all service drawings have been provided at this stage.

A services search was undertaken using the services search provider Linesearch BeforeUdig (Ref [12]). The search identified the existing OHL power cables that are present across the western portion of the proposed development in the vicinity of the proposed Margam Substation Option 2 & Option 4 and proposed cable route chainage 0m to 1200m. The available service plans have been appended in Appendix E.

The services search also identified the following underground services:

- BOC Ltd. 2no. Active high pressure gas pipelines crossing approximately cable route chainage 575m.
- BOC Ltd. 2no. Active High pressure gas pipelines crossing approximately cable route chainage 600-625m.
- National Grid 11kV underground cable crossing approximately cable route chainage 1300m.

2.8. BGS Records

There are 13no. available online historical exploratory records from the BGS within 100m of the proposed Margam substation options, proposed TATA substation, and proposed cable routing. The location of these presented in Figure 2.2 below and the boreholes are summarised in Table 2.15.

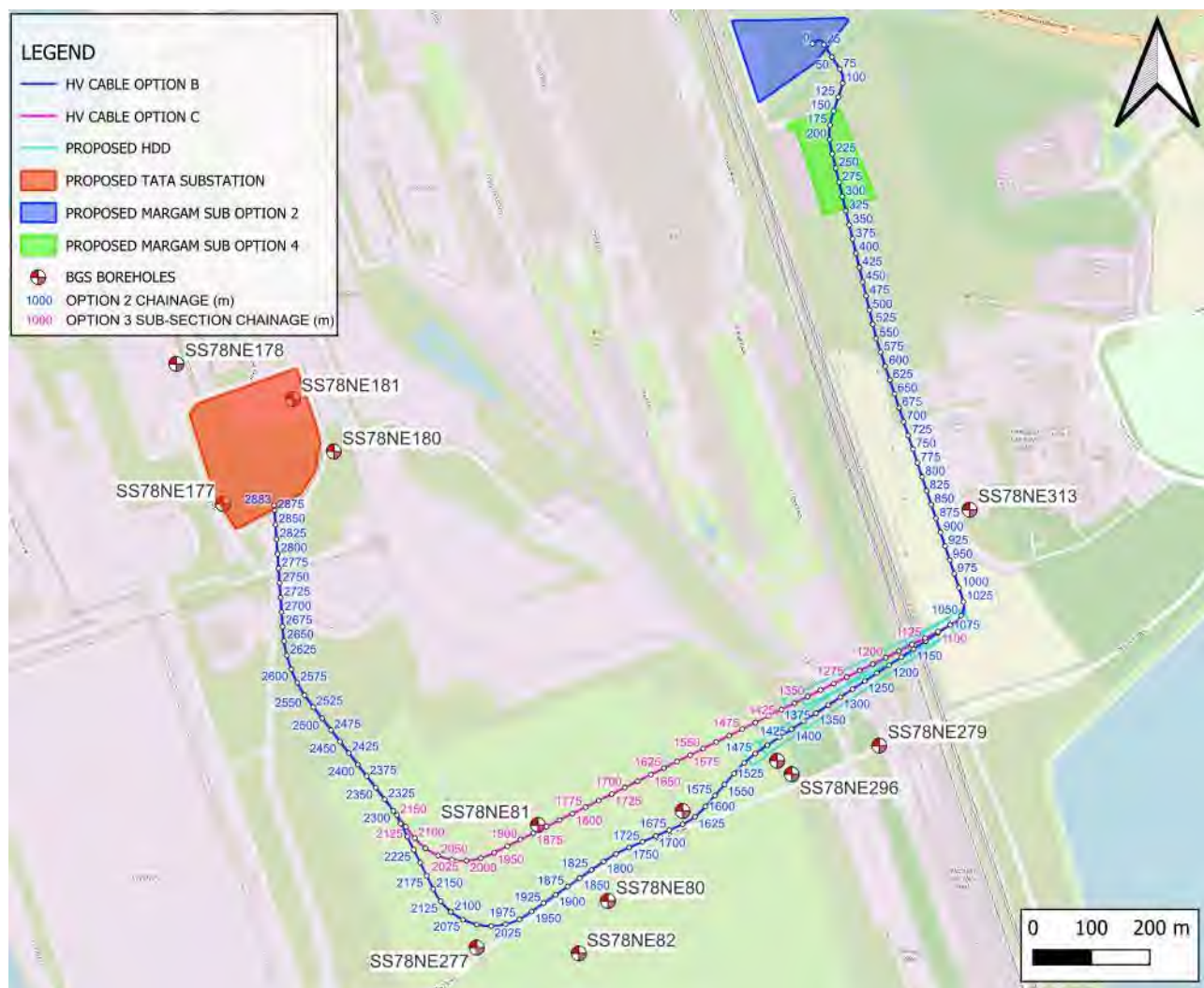


Figure 2.2. Figure showing location of BGS Records within 100m of the proposed substations and cable routing. Cable route chainage is shown for reference.

Table 2.15. Summary of BGS Records

BGS borehole reference	Distance/Direction from site (m)	Depth (m)	Strata
SS78NE181	On site TATA Substation	0.00-2.55 2.55-3.15*	Clay, Shale & Slag (Made Ground) Sandy Clay (Possible TFD)
SS78NE178	75m NW TATA Substation	0.00-1.37 1.37-4.26 4.26-5.48 >5.48*	Soft Clay (Possible Made Ground) Blue Sandy Clay (Possible TFD) Peat Blue Clay (Possible TFD)
SS78NE180	25m W TATA Substation	0.00-1.80 1.80-3.70 3.70-5.35 >5.35*	Brown Clay (Possible Made Ground) Blue Clay (Possible TFD) Peat Blue Clay (Possible TFD)
SS78NE177	On site TATA Substation	0.00-1.50 1.50-3.30 3.30-4.80	Brown Clay (Possible Made Ground) Blue Sandy Clay (Possible TFD) Peat

BGS borehole reference	Distance/Direction from site (m)	Depth (m)	Strata
		>4.80*	Blue Clay (Possible TFD)
SS78NE277	40m S Cable Route Ch. 2050m (B)	0.00-0.80 0.80-5.60 5.60-7.80 7.80-10.00*	Topsoil & Subsoil Soft to firm yellow brown sandy very silty or very sandy Clay with organic matter or clayey very sandy Silt with peat pockets. (TFD) Medium dense Sand and GRAVEL with cobbles (Possible Glacial Till) Firm to stiff dark grey sandy gravelly Clay with cobbles and occasional boulders (Possible Glacial Till) Notes: Chiselling 7.20-7.60mBGL; 9.30-9.80mBGL
SS78NE81	10m N Cable Route Ch. 1875m (C)	0.00-0.3 0.30-3.81 3.81-4.57 4.57-6.40 6.40-16.46 16.46-17.07*	Topsoil Silty Clay (TFD) Peat Soft sandy Clay and silt (TFD) Soft to firm silty Clay with gravel bands (Possible Glacial Till) Blue Shale – Rockhead (Coal Measures Formation)
SS78NE82	100m SE Cable Route Ch. 1925m (B)	0.30-9.45 9.45-13.72 13.72-17.07 17.07-17.99 17.99-18.60*	Soft Clay and silty Sand (TFD) Loose coarse Gravel and Sand (TFD) Boulder Clay with large boulders (Possible Glacial Till) Loose coarse Gravel and Sand (Possible Glacial Till) Soft Shale with hard bands- Rockhead (Coal Measures Formation)
SS78NE80	60m SE Cable Route Ch. 1825m (B)	0.00-8.84 8.84-10.37 10.37-13.72 13.72-21.95 21.95-23.48 23.48-27.44 27.44-30.49*	Soft silty Clay (TFD) Coarse Gravel with sand (Possible Glacial Till) Boulder Clay (Possible Glacial Till) Sand and boulders (Possible Glacial Till) Shale (Coal Measures Formation) Interbedded Coal and Shale (Coal Measures Formation) Shale (Coal Measures Formation)
SS78NE278	20m NW Cable Route Ch. 1650m (B)	0.00-3.70 3.70-4.30 4.30-5.15 5.15-10.00*	Soft to firm laminated silty organic Clay (TFD) Peat Soft silty Clay with peaty pockets (TFD) Soft silty sandy Clay (TFD)
SS78NE84	30m SE Cable Route Ch. 1450m (B)	0.00-2.90 2.90-3.96 3.96-8.84 8.84-13.41* 13.41-17.68	Soft Clay and soft Silt (TFD) Peat Soft silty Clay (TFD) Silt with stones and silty boulder Clay (Possible Glacial Till) Boulder clay with large boulders (Possible Glacial Till) Shale- Rockhead (Coal Measures Formation)

BGS borehole reference	Distance/Direction from site (m)	Depth (m)	Strata
		17.68-18.60*	
SS78NE296	60m SE Cable Route Ch. 1425m (B)	0.00-1.80 1.80-2.40 2.40-4.00*	Black slag & clinker Gravel (Made Ground) Firm grey silty organic Clay (TFD) Soft silty Clay (TFD)
SS78NE279	110m SE Cable Route Ch. 1275m	0.00-2.25 2.25-3.80 3.80-5.55 5.55-6.66 6.66-7.5 7.5-11.66 11.66-12.66 12.66-15.70*	Metalliferous slag with cobbles (Made Ground) Soft to firm silty slightly sandy Clay with wood fragments and copper wire (Made Ground) Soft to firm silty sandy gravelly Clay (TFD) Peat Soft silty laminated Clay (TFD) Soft very silty Clay with organic matter (TFD) Soft to firm silty sandy Clay (TFD) Dense clayey sandy gravel with cobbles and boulders (Possible Glacial Till) Notes: Groundwater Level recorded 3.80mbg Chiselling between 1.2-2.2m;13.2-15.7m
SS78NE313	60m E Cable Route Ch. 875m	0-0.50 0.5-6.00 6.00-11.00*	Hardcore Green Clay (Possible TFD) Sands and Gravels (Possible TFD)

*Base of strata not proven

2.9. Previous Ground Investigation

2.9.1. RSK Ground Investigation 2021/2022

Ground investigation (GI) was undertaken by RSK over two phases between 2021 and 2022 (Ref. [12] & [13]). 19no. boreholes and 76no. trial pits were undertaken. The GI was undertaken within TATA Steel premises and covers parts of the cable route between Ch. 1425m and 2883m and the proposed TATA substation.

The ground investigation typically encountered Made Ground to a maximum depth of 5.9m bgl underlain by superficial material comprising Tidal Flat deposits including Peat, underlain in some locations by Glacial deposits. The superficial deposits were underlain by bedrock of the coal measures formation with rockhead varying from 15.9m to 25.7m depth below ground level. The materials identified within the respective site areas are discussed further in Section 3.

The deep areas of made ground are within the operational part of the TATA steel plant, namely the proposed TATA substation location and near the end of the cable route (beyond Ch. 2500m). The made ground typically included slag material and in some cases a hydrocarbon odour was recorded within the logs. Elevated TPH results were recorded within the made ground for some exploratory holes within the proposed TATA substation. Asbestos fibres were recorded within the made ground in exploratory holes within the GI although these weren't within the proposed site areas.

The geo-environmental assessment included as part of the RSK Phase 2 report (Ref. [12]) concluded the following: "based on the results of the site investigation and GQRA, contaminant linkages have been identified to be potentially complete and require further action. This is as a result of elevated levels of hydrocarbons (both within the soils and groundwater), asbestos and localised lead." It should be noted that this GI was undertaken over a more expansive area within the operational steel works therefore some contaminants may not be present within the development we are considering. However, a full assessment of contaminants should be undertaken as part of the proposed GI for the new development.

2.9.2. Jacobs Ground Investigation 2009

Ground Investigation was undertaken by Jacobs in 2009 (Ref. [14]) within the proposed Margam substation Option 2 area. The GI comprised 8no. Trial pits and 5no. boreholes.

The ground investigation encountered superficial material comprising Tidal Flat deposits including Peat underlain by granular and cohesive Glacial deposits. The superficial deposits were underlain by bedrock of the Coal Measures formation with rockhead varying from 12.7m to 15m depth below ground level. The materials identified within the respective site areas are discussed further in Section 3.

Made Ground was not encountered during the GI. A geo-environmental assessment was undertaken by Jacobs which concluded that the soil samples showed no sign of significant contamination although some of the groundwater results exceeded EQS values for Lead, Zinc and Ammonia.

2.10. Hydrology

The Envirocheck report contains the OS water network map which indicates that there are 28no. watercourses that cross the site area.

Most entries relate to Inland River entries, which appear to be attributed to drainage ditches. All the recorded crossings are summarised in Table 2.16. The most notable water networks include the Upper Mother Ditch which runs north parallel to the cable route between Ch. 1050m and 0m, the ditch then turns and runs northwest along the northern boundary of the proposed Margam substation Option 2. Furthermore, there is a ditch present running approximately east-west through the central section of the proposed TATA substation.

Table 2.16. Summary of OS Water Network recorded crossings.

Site Location	Watercourse and details
Margam Substation Option 2	Upper Mother Ditch (UMD) located on northern boundary.
Margam Substation Option 2	Drain running N/S on western extent of site.
Margam Substation Option 2 Cable Route Ch. 45m	Drain on southern boundary of substation running into UMD.
Cable Route Ch. 60m	Drain
Margam Substation Option 4 Cable Route Ch. 175m	Drain
Margam Substation Option 4	Drain
Margam Substation Option 4 Cable Route Ch. 315m	Drain
Cable Route Ch. 350m	Drain
Cable Route Ch. 400m	Drain
Cable Route Ch. 465m	Drain
Cable Route Ch. 595m	Drain

Site Location	Watercourse and details
Cable Route Ch. 700m	Drain
Cable Route Ch. 865m	Drain
Cable Route Ch. 965m	Drain
Cable Route Ch. 1190m	Drain
Cable Route Ch. 1300m	Drain
Cable Route Ch. 1350m	Drain
Cable Route Ch 1375m (B)	Drain
Cable Route Ch. 1405m (B) & 1405 (C)	Drain
Cable Route Ch 1425m ©	Drain
Cable Route Ch. 1450m (B) & 1450 (C)	Drain
Cable Route 162©(C) & 1660m (B)	Middle Mother Ditch
Cable Route 1875m (C)	Lower Mother Ditch
Cable Route 1900m (B)	Drain
Cable Route 2025m (C) & 2050m (B)	Lower Mother Ditch
Cable Route 2265m (B) & 2125 (C)	Drain
Cable Route 2410m	Drain
TATA Substation	Drain running E-W across central site area.

Other surface water features identified from the OS mapping were 3no. ponds in the field area immediately north of the Margam substation option 2, one of which is labelled as a balancing pond. Furthermore, the Eglwys Nunydd Reservoir was recorded approximately 260m southeast of the cable route at Ch. 1050m.

The coastline runs in a north-west to south-east direction, 630m west of TATA Substation.

2.11. Flood records - Hydrology

The Envirocheck report records areas which are at risk of surface water flooding. Low risk indicates a 1 in 1000-year return period, medium risk indicates a 1 in 100-year return period and high risk indicates a 1 in 30-year return period.

The Envirocheck report records that the northern section of the proposed Margam substation Option 2 is at medium to high risk of surface water flooding. Most of the other parts of the Margam substation Option 2 site is at low risk of surface water flooding. A small area at cable route Ch 1300m is at medium risk of surface water flooding. Other areas are at low risk of surface water flooding are associated with the mapped watercourses these include Cable Route Ch. 700m, 925m, 1200m, 1450m and immediately surrounding the recorded drain within the TATA substation.

The Natural Resources Wales Flood Map for Planning [15] records areas at risk of flooding from: the sea, rivers and surface water & small watercourses. There is no recorded risk of flooding from the sea at the site. The areas are categorised into flood zone 2 and 3 which are defined as:

- Flood Zone 2: Areas with 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from rivers or surface water & small watercourses in a given year, including the effects of climate change.
- Flood Zone 3: Areas with more than 1% (1 in 100) chance of flooding from rivers or surface water & small watercourses in a given year, including the effects of climate change.

A summary of flood risk areas is shown in the table below. Some areas of the site are not listed as they are not recorded as being within Flood Zone 2 or 3.

Table 2.17. Summary of Flood Risk on site

Source	Risk Category	
	Flood Zone 2	Flood Zone 3
Rivers	Margam Substation Option 2 Cable Route Ch. 550m-1125m Cable Route Ch. 1325m- 1425m (B&C) Cable Route Ch. 1450m-1650m (B) Cable Route Ch. 1450m-1600m (C) Cable Route Ch. 1750m-1875m (C)	Cable Route Ch. 50m-550m Margam Substation Option 4 Cable Route Ch. 1600m-1750m (C) Cable Route Ch. 1650m(B) – 2410m Cable Route Ch. 1875m(C) – 2410m
Surface water & small watercourses	Central area of Margam Substation Option 2 Some areas of Margam Substation Option 4 Small area of TATA Substation associated with existing watercourse.	Some areas of Margam Substation Option 4 Most of Cable Route Ch. 50-450m

2.12. Hydrogeology

The Envirocheck report records the superficial deposits of the Tidal Flat Deposits to be a Secondary Aquifer Undifferentiated with high vulnerability. The Coal Measures formation is recorded as a Secondary A Aquifer.

The Envirocheck report records the superficial deposits of the Lowestoft Diamicton to be largely a Secondary Undifferentiated Aquifer with a high vulnerability.

The Envirocheck report records the entire site to have a potential for Groundwater Flooding at surface level.

2.13. Unexploded Ordnance

A pre-desk study assessment was requested from Zetica UXO. This pre-desk study assessment recommended that a detailed UXO assessment is undertaken on the site.

A provisional UXO risk map from 1st Line Defence [17] was included within the TATA information. This showed that the site areas within the TATA land are within a low-medium & medium risk areas. 1st Line Defence recommends that a UXO specialist is present on site during intrusive works and that intrusive magnetometry survey of all boreholes locations is undertaken to maximum bomb penetration depth.

2.14. Archaeology

A search using the Historic Wales interactive map (Ref. [18]) was undertaken. The map records 5no. entries within 250m of the site, Firing range (Cable Route Ch. 2425m and 2625m), Margam Warren (60m South of Cable Route Chainage 2025m (B)). These are summarised in Table 2.18 below.

Table 2.18. Summary of Historic Wales records within 250m of the sites.

Entry	Distance/Direction from site
Firing Range	On site. Cable route Ch. 2425m-2625m
Margam Warren (Rabbit Warren)	60m South of Cable route Ch. 2025m (B)
Abbot Pit (Coal Mining Site)	185m North of TATA Substation
Gas Works (British Oxygen Company Works)	220m East of Cable Route 775m
Margam Castle Middle Lodge (Lodge)	220m East of Cable Route 760m

As part of the information provided by TATA a previous archaeological assessment and geophysical survey was undertaken by Headland Archaeology (Ref. [19]) for the site area within TATA land. The conclusions of the Geophysical survey for the Margam Moors area were that the archaeological potential was low.

2.15. Radon Gas

The proposed route is located within an area where less than 1% of homes are at or above the Action Level. Radon gas is not considered to be a risk.

3. Ground Conditions

3.1. Ground model

A ground model has been derived for each of the site elements: Margam substation Option 2 & 4, Tata substation & Cable Route. This ground model has been derived based on the recent GI undertaken by RSK and Jacobs mentioned in Section 2.9 as well as the historical BGS boreholes detailed in Section 2.8.

Overall, the ground conditions encountered during the recent GI works and historical BGS boreholes reflect the available BGS mapping. Typically made ground is encountered in areas which have been developed including the railway lines that cross the proposed HDD sections of the cable route and the proposed TATA substation areas.

The made ground is typically formed of slag material which is a waste product of the steel production process. The entire site area is then underlain by Tidal Flat Deposits (TFD) which are typically comprised of unconsolidated clays and silts with inclusions of peat. Underlying the TFD deposits are Glacial Deposits which are typically encountered as a sandy gravelly Clay. It is noted that in some areas, particularly the proposed Margam substation Option 2 (and potentially Option 4), the Glacial Deposits are encountered as a granular component comprising dense Gravels underlain by a cohesive component comprising Firm to stiff Clay. Beneath the glacial deposits are the coal measures formation which are encountered as interbedded mudstones, siltstones and sandstone with some recorded coal measures.

It is anticipated that the ground conditions beneath the proposed Margam Option 2 and Option 4 will be similar. Therefore Table 3.1 shows the ground model for the proposed Margam Substation Option 2 & 4. This has been derived based on the GI undertaken by Jacobs in 2008 (Ref. [14]).

Table 3.1. Approximated Ground Model for the proposed Margam Substation Option 2 & 4.

Strata	Description	Top Depth mBGL)	Thickness Range (m)
Tidal Flat Deposits (TFD)	Highly variable material. Typically encountered as a poorly consolidated soft to firm Clay & Silt interbedded with loose gravels and bands of Peat	0	2.2-4.0
Peat Band (Within TFD)	Spongy and plastic pseudofibrous Peat	0.5-2.2	0.3-1.3
Glacial Deposits	Upper section is predominantly granular comprising Dense slightly silty sandy Gravel of sandstone, mudstone & quartzite with medium cobble content. Lower section is predominantly cohesive comprising firm to stiff brown slightly sandy slightly gravelly Clay with low to medium cobble content. Cobbles of sandstone, mudstone & quartzite.	2.2-4.0	7.9-10.1
Weathered Coal Measures	Typically, Stiff dark grey gravelly Clay. Gravel of mudstone.	11.7-14.1	0.4-2.3
Coal Measures	Interbedded weak to medium strong mudstone and medium strong to strong sandstone. One coal band 0.57m thick encountered at 15.55m depth in BH02 (Jacobs GI).	12.7-15.0	Not proven

Much of the cable route between chainage 50m and 1450m does not have any recent or historical GI information. It's likely that this section of the cable route encounters similar materials to those shown in Table 3.1 above, albeit the depth to rockhead may vary slightly.

Table 3.2 shows the ground model for the cable route between chainage 1450m and 2500m which covers the section of cable route running within the Margam Moors Section. This ground model has been developed using the BGS historical boreholes and the RSK GI information.

Table 3.2. Approximated Ground Model for Cable Route Section in Margam Moors

Strata	Description	Top Depth (mBGL)	Thickness Range (m)
Made Ground	Highly variable. Typically encountered as a dark grey sandy GRAVEL with low to medium cobble content. Gravel and cobbles are formed of slag. Inclusions of brick are also mentioned. Encountered around Ch. 1450m. Likely to be present between Ch. 1150 and 1450m due to historical land use and railway line. Depth of this may vary.	0	1.5
Tidal Flat Deposits (TFD)	Highly variable material. Typically encountered as a poorly consolidated soft to firm CLAY & SILT interbedded with loose gravels and bands of PEAT	0-1.5	5.6-8.8
Peat Band (Within TFD)	Spongy and plastic pseudofibrous PEAT	2.9-4.6	0.76-1.06
Glacial Deposits	Typically encountered as a firm to stiff slightly sandy gravelly CLAY. Gravel of sandstone and mudstone. Also encountered as a dense sandy silty GRAVEL. Gravel of sandstone and mudstone.	5.6-9.7	4.57-13.11
Coal Measures	Weak to medium strong laminated Mudstone One coal band 3m thick encountered at 20.5m depth in BH10 (RSK GI)	13.41-21.95	Not Proven

The cable route beyond chainage 2500m is likely to have a similar ground model to that of the proposed TATA substation. The ground model for this is presented in Table 3.3.

Table 3.3. Approximated Ground Model for proposed TATA Substation.

Strata	Description	Top Depth (mBGL)	Thickness Range (m)
Made Ground	Highly variable. Typically encountered as a dark grey sandy GRAVEL with low to medium cobble content. Gravel and cobbles are formed of slag. Hydrocarbon odour is noted in many log entries. Other constituents include clinker, concrete, brick and rubber.	0	3.1-5.9
Tidal Flat Deposits (TFD)	Highly variable material. Typically encountered as a poorly consolidated soft to firm CLAY & SILT interbedded with loose gravels and bands of PEAT	3.1-5.9	11.5-14.5
Peat Band (Within TFD)	Fibrous to pseudofibrous PEAT	6.2-7.8	1.0-1.4
Glacial Deposits	Typically encountered as a soft to firm slightly sandy slightly silty gravelly CLAY. Gravel of sandstone and mudstone. Also encountered as a medium dense sandy silty GRAVEL. Gravel of sandstone and mudstone.	11.5-14.5	6.5-7.5
Weathered Coal Measures	Possible weathered siltstone/mudstone. Recovered as gravelly SILT & gravelly CLAY with angular siltstone & mudstone lithorelics respectively. One coal band 0.5m thick encountered at 24m depth in BH12 (RSK GI)	21.0-22.0	Not Proven

4. Conceptual Site Model

4.1.1. Potential Sources (S)

The Conceptual Site Model has been produced as a combined document covering the three separate development areas. Features listed as onsite have been differentiated between areas.

On-site:

Proposed Margam Substation Option 2

-Current use with areas of informal parking

Proposed Margam Substation Option 4

Undeveloped land - no onsite sources identified.

-Cable Routing

-Railway mainline crossing the site at Ch. 1125m-1175m

-Sidings/ railway route cross cutting the site at Ch. 1225m-1300m

-Presence of drainage ditches,

-Works on the central and western extent at Ch. 2500m to 2883m. Including Coal Terminal at Ch. 2700m

-Former Rifle Range (1940-1982 mapping) at Ch. 2425m-2625m

-Conveyor crossing the route at Ch. 2775m.

-Potential for fly tipping along route of public access (Public Right of Way).

Proposed TATA Sub Station

-Former Site use including:

- Ongoing use with the wider steelworks site, with materials storage areas and plant operational.
- Placement of made ground associated with level raising, evidenced through embankments 1953-1964.
- Area of increased made ground (up to 5.9m bgl) within proximity of the site, and the proposed Tata Substation. Associated concentrations of TPH on site and asbestos fibres in the surrounding area. (RSK GI 2021/2022)
- Anecdotal evidence of former use of the site as the Grange Coke Ovens, constructed 1959 – 2004)
- Building, hopper and conveyor noted on north eastern corner of the site (1982/1988 to 2023 mapping)

-Drainage ditch cross cutting the site from east to west

Off Site

-Former and current uses associated with steel works dating from 1950 to present day including:

- Coal Storage areas, chemical stores, railway sidings and goods yards, chimneys, slag heaps, conveyors
- Existing Margam Substation adjacent to Margam Substation Option 4, including associated tanks and infrastructure.
- Historic infilled Pond 60m to the northeast of the TATA Substation site and series of drainage ditches in the surrounding area within 250m.
- Gas Holder approx. 80m southwest of the TATA Substation site
- Power Station 250m west of Ch. 275
- Abbot Pit and Morfa Colliery 60m-160m north of the TATA Substation
- Contemporary Trade entries within 300m of the site (excluding Steel works)
 - Industrial Facility – Gas, Industrial and medical supplies – 289m northeast of the cable route.
- Above Ground Storage Tanks within 250m of the site
 - 2no. 41m south of Margam Substation Option 2
 - 2no. 5m west of Margam Substation Option 4
 - 2no. 50m west of Ch. 175
 - 1no. 75m north of TATA substation entry

4.1.2. Potential Pathways (P)

- Inhalation and ingestion of impacted soils and dusts.
- Dermal contact with impacted soils.
- Inhalation of vapours.
- Vertical and lateral migration.
- Migration of ground gas into confined spaces; and,
- Inhalation of Fibres.

4.1.3. Potential Receptors (R)

- Future Site Users.
- Controlled Waters:
 - Groundwater in Superficial Deposits - Secondary Undifferentiated Aquifers.
 - Groundwater in Bedrock – Secondary A Aquifer.
 - Surface Water – Inland River Entries (Drainage Ditches) and Upper Mother Ditch. Coastline Bristol Channel - c 750m to west at closest point.

Construction workers are not considered to be a plausible receptor due to management of their exposure through the use of suitable PPE and hygienic working practices as required under HSE/CDM regulations. Furthermore, the length of any exposure is considered to be very short in comparison to the criteria for which the adopted end use has been derived.

The Conceptual Site Model is presented overpage within Table 4.1.

Table 4.1: Preliminary Conceptual Site Model

Source	Contaminant	Potential Migration Pathway	Potential Receptor	Probability	Consequence	Overall Risk Rating	Active / Inactive
On- Site Potential Source							
Proposed Margam Sub Station Option 2							
Area of informal parking and gravel area	Metals (As, B, Cd, Cr, Pb, Hg, Se, Ni, Zn)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Low	Moderate	Low/Moderate	Potentially active – Further investigation required.
		Vertical & Lateral Migration	Controlled Waters	Low	Moderate	Low/Moderate	
	Polycyclic Aromatic Hydrocarbons (PAH)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Low	Moderate	Low/Moderate	
		Vertical & Lateral Migration	Controlled Waters	Low	Moderate	Low/Moderate	
	Total Petroleum Hydrocarbons (TPH)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Medium	Moderate	Moderate	
		Vertical & Lateral Migration	Controlled Waters	Medium	Moderate	Moderate	
	Asbestos within soils	Inhalation of fibres	Future site users	Low	Severe	Moderate	
	Proposed Cable Routing						
Past use of the site comprising Railway mainline; railway sidings at Chainage	Metals (As, B, Cd, Cr, Pb, Hg, Se, Ni, Zn)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Low	Moderate	Moderate/Low	Potentially active – Further investigation required.
		Vertical & Lateral Migration	Controlled Waters	Low	Moderate	Moderate/Low	

Source	Contaminant	Potential Migration Pathway	Potential Receptor	Probability	Consequence	Overall Risk Rating	Active / Inactive
1125m-1175m & 1225m-1300m	Polycyclic Aromatic Hydrocarbons (PAH)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Medium	Moderate	Moderate	Potentially active – Further investigation required.
		Vertical & Lateral Migration	Controlled Waters	Medium	Moderate	Moderate	
	Total Petroleum Hydrocarbons (TPH)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Medium	Moderate	Moderate	
		Vertical & Lateral Migration	Controlled Waters	Low	Moderate	Low/Moderate	
	Asbestos within soils	Inhalation of fibres	Future site users	Low	Severe	Moderate	
Steel Works at Ch. 2500m-2883m Including conveyor crossing the site at Ch.2775.	Metals (As, B, Cd, Cr, Pb, Hg, Se, Ni, Zn)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Medium	Moderate	Moderate	Potentially active – Further investigation required.
		Vertical & Lateral Migration	Controlled Waters	Medium	Moderate	Moderate	
	Polycyclic Aromatic Hydrocarbons Phenols	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Medium	Moderate	Moderate	
		Vertical & Lateral Migration	Controlled Waters	Medium	Moderate	Moderate	
	Total Petroleum Hydrocarbons (TPH), BTEX and MTBE	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Medium	Moderate	Moderate	
		Vertical & Lateral Migration	Controlled Waters	Medium	Moderate	Moderate	
		Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Medium	Moderate	Moderate	
		Vertical & Lateral Migration	Controlled Waters	Medium	Moderate	Moderate	

Source	Contaminant	Potential Migration Pathway	Potential Receptor	Probability	Consequence	Overall Risk Rating	Active / Inactive
	Asbestos within soils	Inhalation of fibres	Future site users	Medium	Severe	High	
	Volatile Organic Compounds / Semi Volatile compounds (VOC/SVOC)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Low	Moderate	Moderate/Low	
		Vertical & Lateral Migration	Controlled Waters	Low	Moderate	Low/Moderate	
	Polychlorinated biphenyls (PCBs)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Low	Moderate	Low/Moderate	Potentially active – Further investigation required.
		Vertical & Lateral Migration	Controlled Waters	Low	Moderate	Low/Moderate	
	Ground Gas (CH ₄ , CO ₂)	Migration into confined spaces	Future site users	Low	Severe	Moderate	
Drainage Ditches (Active and redundant)	Ground Gas (CH ₄ , CO ₂)	Migration into confined spaces	Future site users	Low	Severe	Moderate	
Former Rifle Range at Ch. 2425m-2625m	Heavy Metals (Lead)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Medium	Moderate	Moderate	Potentially active – Further investigation required.
		Vertical & Lateral Migration	Controlled Waters	Low	Moderate	Low/Moderate	
Potential for Fly tipping along route of PROW	Metals (As, B, Cd, Cr, Pb, Hg, Se, Ni, Zn)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Low	Moderate	Low/Moderate	Potentially Active – Further Investigation required if identified on site.
		Vertical & Lateral Migration	Controlled Waters	Low	Moderate	Low/Moderate	

Source	Contaminant	Potential Migration Pathway	Potential Receptor	Probability	Consequence	Overall Risk Rating	Active / Inactive
	Polycyclic Aromatic Hydrocarbons (PAH)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Low	Moderate	Low/Moderate	Potentially Active – Further Investigation required if identified on site.
		Vertical & Lateral Migration	Controlled Waters	Low	Moderate	Low/Moderate	
	Total Petroleum Hydrocarbons (TPH)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Low	Moderate	Low/Moderate	
		Vertical & Lateral Migration	Controlled Waters	Low	Moderate	Low/Moderate	
	Asbestos within soils	Inhalation of fibres	Future site users	Low	Severe	Moderate	
Proposed TATA Sub Station Site							
Current and former site use as a steel works	Metals (As, B, Cd, Cr, Pb, Hg, Se, Ni, Zn)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Medium	Moderate	Moderate	Potentially active – Further investigation required.
		Vertical & Lateral Migration	Controlled Waters	Medium	Moderate	Moderate	
	Polycyclic Aromatic Hydrocarbons Phenols	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Medium	Moderate	Moderate	
		Vertical & Lateral Migration	Controlled Waters	Medium	Moderate	Moderate	
	Total Petroleum Hydrocarbons (TPH), BTEX	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Medium	Moderate	Moderate	

Source	Contaminant	Potential Migration Pathway	Potential Receptor	Probability	Consequence	Overall Risk Rating	Active / Inactive
	and MTBE	Vertical & Lateral Migration	Controlled Waters	Medium	Moderate	Moderate	
	Asbestos within soils	Inhalation of fibres	Future site users	Medium	Severe	High	
	Volatile Organic Compounds / Semi Volatile compounds (VOC/SVOC)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Medium	Moderate	Moderate	
		Vertical & Lateral Migration	Controlled Waters	Medium	Moderate	Moderate	
	Polychlorinated biphenyls (PCBs)	Ingestion, inhalation, and dermal contact with impacted soil and dust	Future Site Users	Medium	Moderate	Moderate	Potentially active – Further investigation required.
		Vertical & Lateral Migration	Controlled Waters	Medium	Moderate	Moderate	
	Ground Gas (CH ₄ , CO ₂)	Migration into confined spaces	Future site users	Low	Severe	Moderate	
Drainage Ditch (Active route and redundant path)	Ground Gas (CH ₄ , CO ₂)	Migration into confined spaces	Future site users	Low	Severe	Moderate	Potentially active – Further investigation required.

Source	Contaminant	Potential Migration Pathway	Potential Receptor	Probability	Consequence	Overall Risk Rating	Active / Inactive
Off Site							
Former and current site uses associated with steel works dating from 1950 to present day	Metals (As, B, Cd, Cr, Pb, Hg, Se, Ni, Zn)	Lateral Migration	Future Site Users	Low	Moderate	Moderate/Low	Potentially Active – Low mobility of metals
	Polycyclic Aromatic Hydrocarbons Phenols	Lateral Migration	Future Site Users	Medium	Moderate	Moderate	Potentially active – Further investigation required.
	Total Petroleum Hydrocarbons (TPH) BTEX and MTBE	Lateral Migration	Future Site Users	Medium	Moderate	Moderate	
	Asbestos within soils	Inhalation of fibres	Future Site Users	Low	Severe	Moderate	
	Volatile Organic Compounds / Semi Volatile compounds (VOC/SVOC)	Lateral Migration	Future Site Users	Medium	Moderate	Moderate	Potentially active – Further investigation required.
	Polychlorinated biphenyls (PCBs)	Lateral Migration	Future Site Users	Low	Moderate	Moderate/Low	
	Ground Gas (CH ₄ , CO ₂)	Migration into confined spaces	Future site users	Low	Severe	Moderate	

Source	Contaminant	Potential Migration Pathway	Potential Receptor	Probability	Consequence	Overall Risk Rating	Active / Inactive
Existing Margam Substation adjacent to Margam Substation Option 4, including associated tanks and infrastructure.	Polycyclic Aromatic Hydrocarbons Phenols	Lateral Migration	Future Site Users	Medium	Moderate	Moderate	Potentially active – Further investigation required.
	Total Petroleum Hydrocarbons (TPH) BTEX and MTBE	Lateral Migration	Future Site Users	Medium	Moderate	Moderate	
	Volatile Organic Compounds / Semi Volatile compounds (VOC/SVOC)	Lateral Migration	Future Site Users	Medium	Moderate	Moderate	
	Polychlorinated biphenyls (PCBs)	Lateral Migration	Future Site Users	Medium	Moderate	Moderate	
Historic infilled pond 60m to the north of the TATA substation site and series of drainage ditches within 250m	Ground Gas (CH ₄ , CO ₂)	Migration into confined spaces	Future site users	Medium	Severe	High	Potentially active – Further investigation required.

Source	Contaminant	Potential Migration Pathway	Potential Receptor	Probability	Consequence	Overall Risk Rating	Active / Inactive
Power Station 250m west of Ch.275m	Polycyclic Aromatic Hydrocarbons	Lateral Migration	Future site users	Low	Moderate	Moderate/Low	Inactive – Recent installation dating from mapping 2023. Assumed to be compliant with Environmental Legislation. When combined with distance not considered a significant risk.
	Total Petroleum Hydrocarbons (TPH)	Lateral Migration	Future site users	Low	Moderate	Moderate/Low	
Former Abbot Pit and Morfa Colliery 60-160m north of TATA substation	Polycyclic Aromatic Hydrocarbons	Lateral Migration	Future site users	Low	Moderate	Moderate/Low	Potentially active – Further investigation required.
	Total Petroleum Hydrocarbons (TPH)	Lateral Migration	Future site users	Low	Moderate	Moderate/Low	
	Mine Gas (CH ₄)	Migration into confined spaces	Future site users	Medium	Severe	High	
Contemporary Trade Entry within 300m of the site (289m northeast of Ch.650m)	Total Petroleum Hydrocarbons (TPH)	Lateral Migration	Future Site Users	Low	Moderate	Moderate/Low	Potentially active – Further investigation required.
Above Ground Storage Tanks within 250m of the site	Total Petroleum Hydrocarbons (TPH)	Lateral Migration	Future Site Users	Medium	Moderate	Moderate	Potentially active – Further investigation required.

5. Preliminary Engineering Assessment

This section provides preliminary advice based only on the available desktop study information for the site, published geological mapping and previous ground investigation undertaken at the site. All advice will need to be validated following the completion of a site-specific investigation targeting at the locations of the proposed development. Therefore, the advice provided below should be used with caution at this stage.

5.1. Cable Route, Joint Bays and HDD

It is anticipated that the majority of the cable route will be underground with the cable being laid in trenches, with joint bays required at various points along the proposed route. There is one site of Horizontal Directional Drill (HDD) proposed along the route underneath the crossing of the existing railway and the assumed length of this is outlined within the Optioneering Study for the project, document reference: 30004240-BHK-XX-XX-RP-HV-0002.03. The site of HDD is at cable route Ch. 1075m. Option B HDD extends for 388m whilst Option C HDD extends for 286m.

The cable routes will be installed in new plastic ducts within trenches approximately 1.3m deep. Ducts will be encased in cement bound sand and buried in 1m of engineered fill. It is anticipated that the cable trenches will be excavated within the superficial deposits, which will likely be within Tidal Flat Deposits underlain by Glacial Till.

The design of joint bays and working platforms for HDD should consider the ground conditions and may require the inclusion of geo grids within its make up. The founding material for these will be confirmed during the ground investigation using in-situ testing. It is likely that the Tidal Flat deposits are not suitable bearing strata.

The HDD design below an active railway line will need to consider the effect on the track alignment and will also require a Basis Asset Protection Agreement (BAPA) with Network Rail.

A ground investigation including both in-situ and laboratory testing, will be required to inform the cable trench, joint bay and working platform design. The aim of which will be to confirm the material parameters and strata thicknesses for material reuse, haul road construction, thermal resistivity of the ground for the cable route, groundwater conditions, the bearing capacity and differential settlement potential for joint bays along with information on working platform foundations.

5.2. Proposed TATA Substation & Proposed Margam Substation Option 2 & 4

It is likely that the foundations for the proposed structures within both substation locations and options will be piled. This is due to presence of a significant depth of compressible superficial deposits at both locations. The proposed TATA substation also has a considerable thickness of Made Ground, which would not be a suitable bearing stratum due to its composition and variable nature.

The Coal Mining Risk Assessment (Ref. [9]) concluded that there is a moderate risk of potential unrecorded shallow mine workings across the site. Therefore, ground investigation is required to determine the presence of shallow mine workings.

It is likely that the existing watercourse running through the proposed TATA substation site will need to be infilled or diverted using a culvert. It's recommended that appropriate civil & drainage design is undertaken to determine whether infilling or installation of a culvert is appropriate. Consideration as to culvert/divert positioning with respect to the proposed layout of the substation will have to be made as the foundations will likely be piled.

A ground investigation including both in-situ and laboratory testing, will be required to inform the foundation design and pavement design for associated roadways. The aim of which will be to confirm the material

parameters and strata thicknesses for material reuse, groundwater conditions, bearing and pile capacity along with understanding any settlement potential for structures within the substation.

5.3. Groundwater

Groundwater was encountered during the recent Jacobs and RSK GI at depths between 0m BGL and 11m BGL. Groundwater is highly likely to be encountered when excavating within the Tidal Flat Deposits especially considering most of the site is within a low-lying area which is bounded and crossed by multiple surface water features. This will have an impact on any excavations during construction, particularly for the cable routing which crosses the Margam Moors area.

A ground investigation will be necessary to confirm the groundwater conditions at the site.

5.4. Flooding

As discussed in Section 2.11, most of the site is at a low risk of surface water flooding, however some areas are recorded as being at medium to high risk of surface water flooding.

This will need to be considered at detailed design. De-watering may be required during the construction phase, and during wet weather.

5.5. Earthworks

Earthworks for the cable trenches are required, alongside the construction of access roads and working platforms for the HDD.

Imported granular fill material will be required to lay the proposed ducted cables on, as it is planned these will be within Cement Bound Sand. Material will also be required to construct access tracks and working platforms for HDD equipment. A risk allowance for disposal of spoil and import of fill should be made by the Contractor. However, where possible, all site generated materials should be retained and processed for reuse on site. Consideration may be required for drying out of material before re-use.

The re-use of site won material within the site, or at an off-site location should be completed in accordance with the waste management regime and guidance set out within the CL:AIRE Definition of Waste: Development Industry Code of Practice (CL:AIRE, 2011). This should be completed in advance of site works starting.

5.6. External areas, Highways and Pavements

Hardstanding areas will be required within the proposed substation hardstanding areas, for the development of the working platforms for HDD, proposed access roads and temporary haul routes. California Bearing Ratio (CBR) testing will be required to determine existing near surface ground conditions.

5.7. Excavations

Excavations will be required as part of construction. Excavations are likely to require battering back for trench stability due to the variability of the ground. The risk of trench collapse will be increased if shallow groundwater is present, and therefore consideration for pumping may be needed. It is expected that the excavations will be formed using conventional excavation plant. No blasting is anticipated to be required.

6. Geotechnical Risk Register

Following a review of the information above a risk register is presented in Table 6.1 below to record the findings and proposed mitigations to manage the risk.

Risk =	Probability (P)		x	Impact (I)		Time	Cost
	Very Likely	5		Very High	5	> 10 weeks on completion	>£1M
	Likely	4		High	4	> 1 week on completion	£100K-£1M
	Probable	3		Medium	3	> 4 weeks on activity; > 1 week on completion	£10K-£100K
	Unlikely	2		Low	2	1-4 weeks on activity; non on completion	£1K-£10K
	Negligible	1		Very Low	1	1 week on activity; non on completion	<£1K

In addition to the risk the appropriate risk owner at this stage is presented as Client (CL), Designer (D) or Contractor (CO).

Total risk matrix

		Impact (I)				
		Very low	Low	Medium	High	Very high
Probability (P)	Negligible	1	2	3	4	5
	Unlikely	2	4	6	8	10
	Probable	3	6	9	12	15
	Likely	4	8	12	16	20
	Very likely	5	10	15	20	25

Table 6.1: Geotechnical Risk Register

Item	Hazard	Risk	P	I	R	Consequence	Mitigation	P	I	R
1	Highly Compressible/Low Strength Ground	Presence of Made Ground and Tidal Flat deposits which are likely to be compressible/poor bearing strata/low strength.	3	4	12	Failure or overturning of platforms and access roads may cause damage to plant and materials that will incur time delays and extra costs.	Ground investigation required to determine strength of materials. (CL)	2	4	8
2	Highly Compressible/Low Strength Ground	Presence of Made Ground and Tidal Flat deposits which are likely to be compressible/poor bearing strata/low strength.	4	4	16	Using standard/Shallow foundations for structures within substations could lead to bearing failure/excessive settlements.	Ground investigation requires to determine strength of materials. Piled foundations for substation structures likely to be required. (CL)	2	4	8
3	Highly Compressible/Low Strength Ground	Presence of Made Ground and Tidal Flat deposits in area of proposed HDD which are likely to be compressible/poor bearing strata/low strength.	4	4	16	Excessive settlements within HDD area resulting in settlements of Network Rail/TATA Railway lines.	Ground investigation requires to determine strength of materials. Settlement assessment to determine HDD depth to be undertaken. Liaison with Network Rail to agree GI locations and to agree Basic Asset Protection Agreement (CL).	2	4	8
4	Potential unrecorded shallow mine workings	Proposed Margam and TATA substation structures founded within influencing distance of an unrecorded worked coal seam.	3	4	12	Excessive settlements of structures and collapse of ground.	Ground investigation required to determine presence of unrecorded mine workings. (CL)	2	4	8
5	Diverting/culverting existing watercourse within proposed TATA Substation	Watercourse diverted beneath proposed structures.	3	4	12	Potential interception of diverted culvert with proposed foundations of structure.	Watercourse diverted around the proposed TATA substation site by an appropriately qualified person (CL)	2	4	8
6	Excavations	Excavations may collapse due to presence of soft superficial material and shallow ground water.	3	4	12	Trench stability may be compromised during construction. If trenches cannot be stabilised the programme will incur time delays and costs.	Ground investigation required to confirm the nature of superficial materials including trial pits to assess stability (CL).	2	4	8

Item	Hazard	Risk	P	I	R	Consequence	Mitigation	P	I	R
							Temporary works to support excavations or battered slopes may be required during construction (CO).			
7	FEED Ground Investigation	FEED Ground investigation locations are generally high level widely spaced, with occasional tighter spacing at geological boundaries or where pits have been recorded.	4	3	12	High level GI is unsuitable for detailed design as the information will be too sparse to represent local ground conditions and assumptions will be required.	Further GI will be required for detailed design once a better understanding of proposed construction is available. Supplementary GI will be determined following the FEED GI, targeting specific areas of interest or higher risk (CL).	2	3	6
8	Variable or unforeseen ground conditions	The ground conditions may be different to those recorded on geological maps. There is also no record of materials used to backfill historical pits. Little is known about the on-site ground conditions.	4	3	12	Unforeseen ground conditions may lead to delays in excavation due to incorrect excavation plant, drilling equipment, or problems with stability of works further down the line. Therefore, delays in cost and time during construction.	Ground investigation required to determine on-site ground conditions and design parameters (CL).	2	3	6
9	Ground contamination and ground gas	Contamination sources set out in the CSM have the potential to present a risk to the site.	3	3	9	Contamination, if identified may pose a hazard for identified receptors, and ground workers during works. Cut material may be unsuitable for re-use on site.	Ground investigation to confirm the presence of made ground, along with laboratory testing will be required to determine the level of contaminants in the soils and groundwater (CL). Materials may need to be imported to site or treated on site (CI).	2	3	6
10	High Pressure Gas Mains	Striking high pressure during GI, construction works.	4	4	16	Explosion with the potential to cause injury to site workers. Cost of diversion of services. Associated remediation costs.	Ground Investigation has been positioned at a suitable distance and in accordance with guidance provided by pipeline owner (D), consultation with pipeline owner should also be considered.	4	2	8

Item	Hazard	Risk	P	I	R	Consequence	Mitigation	P	I	R
							A GPR survey should be undertaken to determine gas main location and ensure suitable clearance box observed.(CL,D)			
11	Unknown Buried Services	Any buried services may need to be diverted as part of enabling works for the scheme. In addition, there is a risk of striking services as the ground is broken. Land drains might also be present due to current landuse.	3	4	12	Cost of diversion of services, safety of site personnel. Potential damage to services on site and associated remedial costs.	Routing and optioneering assessments have been undertaken prior to GI to avoid known services where possible (D). A full set of service drawings for the site should be obtained to identify the location of known services. A GPR survey should be undertaken (CL, D).	1	4	4
12	Clay formation for access roads and working platforms	Clay formations are susceptible to change of properties including CBR with change of moisture content. Low CBRs may be encountered on site	3	4	12	Thicker layers of road construction and/ or the inclusion of geogrids maybe required in the construction of access tracks	Undertake investigations to understand the potential CBR of the route to allow adequate designs to be progressed (CL).	2	4	8
13	Peat	Peat present within the Tidal Flat Deposits likely to have low CBR values.				Thicker layers of road construction, further excavation and/or the inclusion of geogrids maybe required in the construction of access tracks	Undertake investigations to understand the potential CBR of the route to allow adequate designs to be progressed (CL).	2	4	8
14	High thermal resistivity	If high thermal resistivity values are recorded within the soil water migration through the soil will be increased and therefore the current-carrying capacity (CCC) of the cable is reduced. The temperature exchange	3	3	9	Incorrectly sized and installed cables can cause damage and/or failure to the system equipment by overheating.	Cable depth and sizing should be designed in line with the thermal resistivity results and accepted guidance (e.g IEC 60287). (D) A backfill of lower thermal resistivity (1.0 (K. m)/W or less) material, such as cement bound sand (lower	1	3	3

Item	Hazard	Risk	P	I	R	Consequence	Mitigation	P	I	R
		between the cable and the soil will also be increased.					moisture content) surrounding the cables may be required. (D)			
15	Shallow Groundwater	Groundwater level is likely to be shallow and perched water is likely to be present at shallower depths. Perched groundwater may be struck within the Tidal Flat Deposits and Glacial Deposits.	2	4	8	If present below the site, shallow groundwater may influence the design of working platforms, joint bays and structure foundations. If not considered could lead to additional costs and delays. Trench stability may be compromised due to shallow groundwater ingress. If trenches cannot be stabilised the programme will incur time delays and costs.	Ground investigation required to confirm the presence of groundwater and granular strata properties (CL). (CO). De-watering may be required during construction for excavations (CO).	1	4	4
16	Asbestos	Potential for asbestos associated with the steel plant. This is more likely within the TATA Substation site and on the cable route within the TATA premises.	2	4	8	Asbestos in material will mean it is not suitable for reuse. Asbestos is also a health hazard.	Ground investigation & testing will determine the presence of asbestos (CL) During the GI if signs of asbestos are identified work should be stopped, and the investigating supervisor consulted. (CO)	1	4	4
17	Flooding	There are multiple areas which are at medium risk of surface water flooding. There is also an area within the proposed Margam substation that is at high risk of surface water flooding.	2	3	6	Trenches and excavations may flood from surface water flooding. This may lead to collapse and delays.	De-watering may be required during construction for excavations (CO).	1	3	3
18	Materials Reuse	If the material is unsuitable for reuse within the cable trenches, either due to unsuitable thermal resistivity or geotechnical properties, then a large amount	3	3	6	Import of materials will add a large financial and carbon cost to the project. Time delays will be incurred if these allowances are not made before	Undertake in situ testing and geotechnical and chemical laboratory testing in order to confirm the suitability for reuse. (CO, D)	1	3	3

Item	Hazard	Risk	P	I	R	Consequence	Mitigation	P	I	R
		of material will be required for import or treatment may be required.				construction. Waste material may need to be removed which will require waste management and transfer plans, licences and notes etc.	Risk allowance made to include treatment of materials (CL)			
19	Unexploded Ordnance (UXO)	Contact with UXO during GI, construction works.	3	4	12	Preliminary desk top UXO assessment has identified a low to moderate risk of UXO across the site. Contact with UXO could result in a significant health and safety event and could lead to significant costs/ time delays for the project.	UXO specialist to employed to monitor any excavations and shallow boreholes for potential UXO. (CL, CO)	1	4	4
20	Soft/boggy/waterlogged ground.	Lead to equipment undertaking GI and construction works getting stuck.	3	4	12	Leading to delays in the project and significant costs associated with standing time/delays to programme.	Walkout in advance of works to scope conditions. Appropriate plant should be used to undertake GI/construction works. Track matting and appropriate temporary works may be required during GI/construction phase.	1	4	4

7. Conclusion

7.1. Geo-Environmental - Initial Conceptual Site Model

The Initial Conceptual Site Model has identified the presence of a series of potentially active pollution linkages identified during formulation of the Desk Top Study. Potentially active pollution linkages are considered to have the potential to present a significant risk to identified receptors, based on the proposed intended use.

Further assessment should be undertaken through intrusive ground investigation including chemical testing for a suite of determinants representative of the potential sources identified within the CSM alongside ground gas monitoring.

Interpretative reporting should be completed based on the findings of chemical testing, with an initial Tier 1 Risk Assessment completed to determine whether encountered concentrations have the potential to present a significant risk to identified receptors. Should an unacceptable risk be encountered, additional risk assessment may be completed via Tier 2 assessment, or as relevant direct progression to the formulation of mitigation measures through the production of a Remediation Method Statement.

7.2. Recommended Preliminary Ground Investigation Scope

A Ground Investigation should be undertaken with the following objectives:

- To investigate the geology below the site to confirm the ground model and provide material parameters to use in design.
- To investigate the presence of shallow unrecorded mine workings.
- To provide a baseline ground model to enable efficient Horizontal Directional Drilling (HDD), joint bay and cable trench design to be completed.
- To understand the groundwater regime below the site.
- To provide an assessment of potentially active pollution linkages identified within the Conceptual Site Model.

A ground investigation specification has been prepared separately to this report reference: 30004240-BHK-XX-XX-SP-C-0001.

As this investigation is preliminary and will provide a baseline indication of ground conditions, it is envisaged further investigations will be undertaken when the scheme has been developed further.

8. References

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Appendices

ENQUIRY SUMMARY

Received Date

24/11/2023 12:23

Work Start Date

25/11/2023

Your Reference

National Grid Steel Margam FEED

Location

Centre Point: 278263 185096

X Extent:

Y Extent:

Postcode: SA132NS

Map Options

Paper Size: A3

Orientation: LANDSCAPE

Scale: 1:2500

Real World Extents: 1215m x 881m

Enquirer Details

Organisation Name: BakerHicks

Contact Name: Farhan Aslam

Email Address: farhan.aslam@bakerhicks.com

Telephone: 07421234906

Address: Flat1, 162-164, Yardley Road, Acocks green., , West Midlands, B27 6LR

Enquiry Type

Initial Enquiry

Activity Type

Utility Works

Work Types

Horizontal drilling/moling/tunnelling/pipe jacking

Notes/Works Description (if supplied)

Information only for utility works

Site Contact Name (if supplied)

Jose Antonio Urdaneta

Site Contact Number (if supplied)

07575302017

BakerHicks.

OUR OFFICES.

United Kingdom

- Motherwell (Eurocentral) +44 (0)1698 756100
- Manchester +44 (0)161 873 2500
- Derby +44 (0)1332 974398
- Warwick +44 (0)1926 567800
- London +44 (0)20 7549 1300
- York +44 (0)1904 231858

Europe

- Basel +41 61 335 30 30
- Zurich +41 61 335 30 30
- Lausanne +41 61 335 30 30
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