ELECTRIC ARC FURNACE DEVELOPMENT

Piling Environmental Risk Assessment

Report Number 2547r1v1d0425

Commissioned by

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Table of Contents

1 INTRODUCTION **3**
1.1 Objectives 3

2 EAF DEVELOPMENT **4**

3 GROUND CONDITIONS **5**
3.1 Relevant Ground Conditions 6
3.2 Groundwater 12
3.3 Land Quality 12
3.3.1Aggressive Ground 13
3.4 Ground Gas 13
3.5 Conceptualisation 13

4 ASSESSMENT OF RISKS **15**

5 SELECTED PILING TECHNIQUES **24**

6 MITIGATION AND QA/QC **26**
6.1 CEMP 26
6.2 Arisings management 26
6.3 Noise and Vibration 27

List of Tables

Table 3-1 Summary of Asbestos Results 13
Table 4-1 Evaluation of Pollution Scenario 1 – Groundwater preferential pathways 17
Table 4-2 Evaluation of Pollution Scenario 2 – Driving solids into aquifer 18
Table 4-3 Evaluation of Pollution Scenario 3 – Contamination of Groundwater by turbidity 19
Table 4-4 Evaluation of Pollution Scenario 4 – Degradation of piles 20
Table 4-5 Evaluation of Pollution Scenario 5 – Creation of preferential pathways for gas 21
Table 4-6 Evaluation of Pollution Scenario 6 – Causing off-site migration of ground gas 22
Table 4-7 Evaluation of Pollution Scenario 7 – Contact with arisings 23
Table 6-1 Working Hours 27

List of Figures

Figure 3-1 Site investigation Boreholes (yellow = Area 1, blue = Area 2) 5
Figure 3-2 Trial Pit Locations 6
Figure 3-3 Five areas of different ground conditions 7
Figure 3-4 Ground conditions in Area A2. Note TDF- G is granular and TDF-C is cohesive 8
Figure 3-5 Ground conditions in Area A2 9
Figure 3-6 Ground conditions in Area A3 9
Figure 3-7 Ground conditions in Area A4 10
Figure 3-8 Ground conditions in Area A5 11
Figure 4-1 Examples of pile foundations (reproduced from Claire, 2025) 15
Figure 4-2 Potential hazards from piling 16
Figure 5-1 Selected Pile Types 25

1 INTRODUCTION

Tata Steel UK Ltd (Tata) has secured full planning permission for the demolition of existing buildings and structures, partial infill of the BOS lagoon and construction of a new electric arc furnace (EAF) steel production facility (1 no. arc furnace, 2 no. ladle furnaces) at their existing Port Talbot Steelworks.

Condition 23 of the planning permission, reference P2024/0711, requires the following:

23. Prior to the commencement of any piling or foundation works in a phase approved by Condition 4, a Piling Risk Assessment (PRA) for that phase shall be submitted to and approved in writing by the Local Planning Authority (LPA). The PRA shall assess the potential risks to human health, groundwater, and the stability of the ground, particularly in relation to any known or suspected contamination on the site. The assessment shall include:

i. A detailed review of ground conditions, including existing contamination reports and geotechnical data.
ii. An evaluation of the potential for the migration of contaminants as a result of piling or other intrusive groundworks.
iii. Identification of appropriate piling techniques to mitigate risks to human health, controlled waters, and the wider environment and the reasons for proposing this method.
iv. A strategy for monitoring and mitigating any identified risks during the construction process. All piling works shall be carried out in each construction phase in accordance with the approved PRA and associated mitigation measures.

In this context, Geotechnology Ltd. has been requested by Tata Steel to prepare this assessment based on the available information collected by others on their behalf.

1.1 Objectives

The objective of this report is to address the requirements of Condition 23 with particular focus on the risks to controlled waters and human health associated with the piling activities that are required as an integral part of the approved development. The assessment sets out the potential risks and, by following guidance, aids selection of the appropriate techniques that minimise risks through their design.

The report utilises guidance produced by the UK regulators with particular reference to the principles set out in the recently updated document published by CI:aire titled *Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (Claire, 2025).*

This document was originally published by the Environment Agency in 2001 as Report NC/99/73. The most recent report presents up to date technical guidance on the potential impact that intrusive ground improvement and piling techniques can have on pollution of the groundwater environment and migration of ground gas. The guidance is for use by anyone involved in piling works that may affect groundwater quality with particular focus on their use on land that has been affected by contamination.

2 EAF DEVELOPMENT

The redevelopment of the existing steelworks covered by the full planning permission will comprise:

- Alterations to existing basic oxygen steel making and secondary refining building
- Water cooling systems and water treatment plant (including emergency backup systems and diesel generator rooms)
- Fume and dust extraction systems with stacks
- Lime handling facility
- Storage areas/buildings with material handling system
- Ancillary plant equipment and pipework
- Electrical control rooms with cable carrier systems
- Preparation and storage areas
- Compressor rooms
- Offices and ancillary facilities
- Partial infill of the BOS lagoon
- New and amended roads with gates and parking areas
- New and amended rail track and associated infrastructure
- Landscaping and green infrastructure
- Firefighting pump house
- Oxygen and argon vessels
- Upgraded laboratories
- Lighting
- Hardstanding
- CCTV.

The site of the EAF is approximately 160 hectares (ha) in size and is located at the central and southern areas of the established Port Talbot Steelworks. The majority of the development will take place incorporating the existing areas of the current HARSCO yard, BOS (Basic Oxygen Steelmaking) Plant, HRP-North Slab Yard and Continuous casting plant.

Due to the nature of the superficial deposits at the site, development has relied upon precast concrete and Continuous Flight Auger (CFA) piled foundations for many decades. Piles have proven to be reliable and suitable and, as far is Geotechnology is aware, there have not been any reported incidents relating to their use and increased risk to either human health or the environment.

As there is a clear and proven track record of the satisfactory use of piles it would appear evident that their use in the development of the EAF will also not pose unacceptable risks. Nevertheless, this report evaluates the use of further piles at the site under the existing site conditions.

3 GROUND CONDITIONS

To inform the planning application, assessment and design of foundation solutions and appraisal of geoenvironmental risks, several phases of site investigation have been completed. The latest data and evaluation is reported in the reports listed in the Reference section of the report. Relevant information from these assessments is reproduced in this section. The position of the trial pits and various boreholes are shown in Figures 3-1 and 3-2.

Figure 3-1 Site investigation Boreholes (yellow = Area 1, blue = Area 2)

Figure 3-2 Trial Pit Locations

3.1 Relevant Ground Conditions

Due to the variation of ground conditions, the ground investigators divided the site into the five areas shown on Figure 3-3 to aid evaluation and interpretation. The ground conditions encountered in each of these areas are summarised in the interpretive logs presented in Figures 3-4 to 3-9. The legend used in each plot is shown in Figure 3-4.

As the site investigation was designed to target the areas where proposed construction is to occur, the cross-sections highlight the ground conditions likely to be encountered during piling. The specific boreholes of relevant to specific structure are listed below:

- Consteel Scrap Building – BH307, BH308, BH309, BH310, BH311, BH312
- Consteel Conveyor – BH307, BH308, BH309, BH310, BH311, BH312
- Quench Tower – BH306, BH309
- EAF Foundations, Operating Platform and Roof Canopy – BH301, BH305, BH306
- Charging Bay South Extension – BH301
- MS Power & Control Room – BH302
- Central Meltshop Operators Pulpit – BH303
- LF Power Building – BH313
- Ladle Furnace Foundations – BH313, BH302, BH303
- FEP Stack, Bag Filter and Dust Silos – BH328, BH329
- FEP Electrical Building – BH328, BH329
- FEP Infrastructure – BH311, BH312, BH328, BH329
- MHS Flux & HBI – BH304, BH326
- MHS Lime & Coal Powder Silos – BH326
- MHS Ferro Alloy – BH313
- MHS Electrical Building – BH326
- MS Power Distribution Building – BH313, BH314

- MS Main Compressor House – BH313
- Lagoon Pumphouse – BH314, BH325, BH326
- Green Walkway – BH313, BH330, BH331
- Primary Pumphouse – BH314
- Secondary Pumphouse – BH316
- WTP Electrical Building – BH315
- Firewater Pumphouse – BH314, BH315, BH325
- Emergency Tank – BH314, BH315, BH325
- Main Power Centre – BH318, BH319, BH320, BH321
- Power Compensation Buildings (SVC, F1 and F2) – BH319
- National Grid Substation – BH320
- Pipe Bridge Foundations – BH301, BH304, BH313, BH314, BH315, BH316, BH317, BH318, BH319, BH326
- Amenity Building – BH330, BH331

Figure 3-3 Five areas of different ground conditions

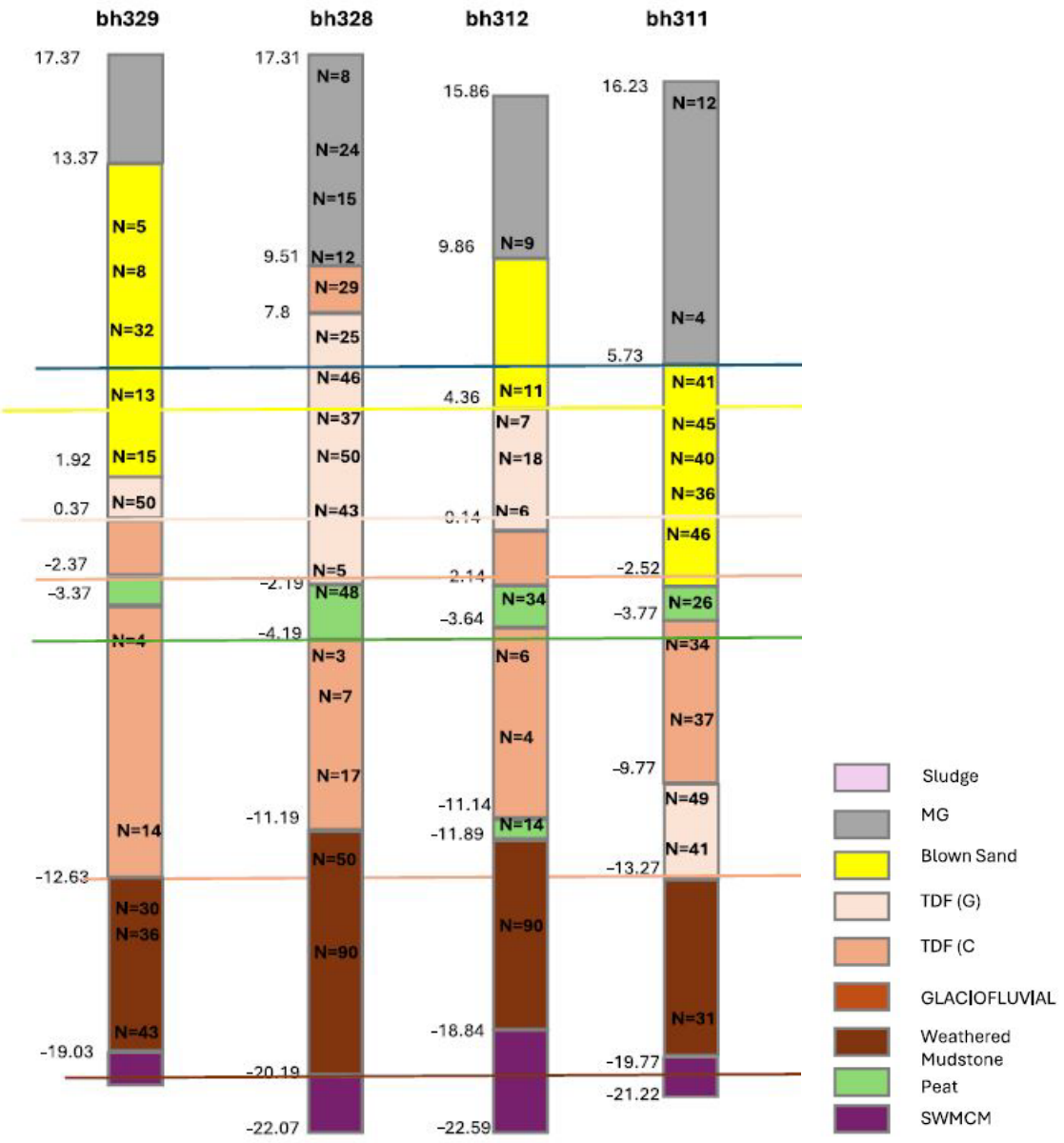


Figure 3-4 Ground conditions in Area A2. Note TDF- G is granular and TDF-C is cohesive

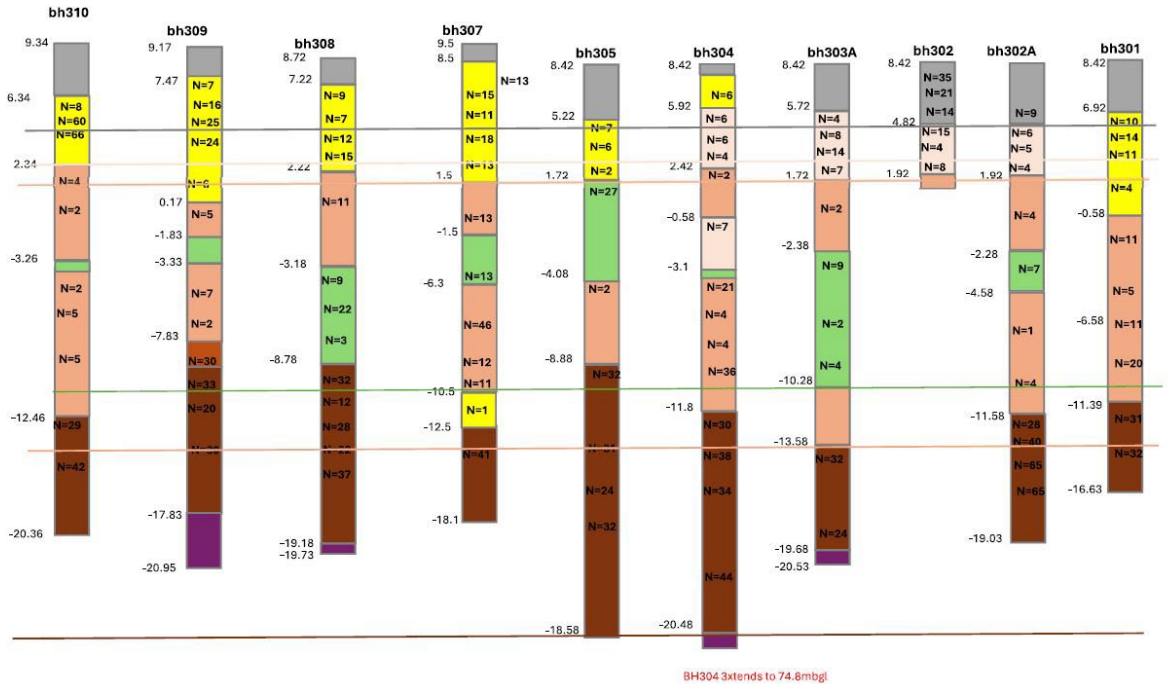


Figure 3-5 Ground conditions in Area A2

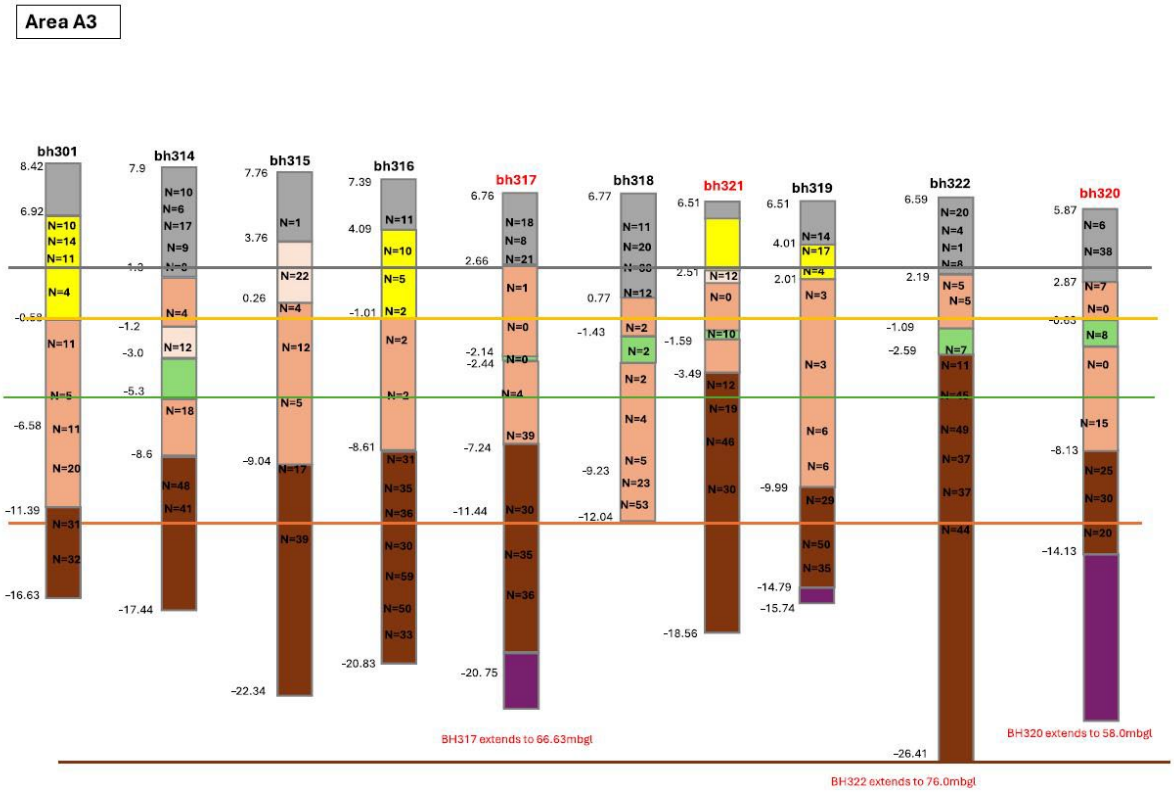


Figure 3-6 Ground conditions in Area A3

Area A4

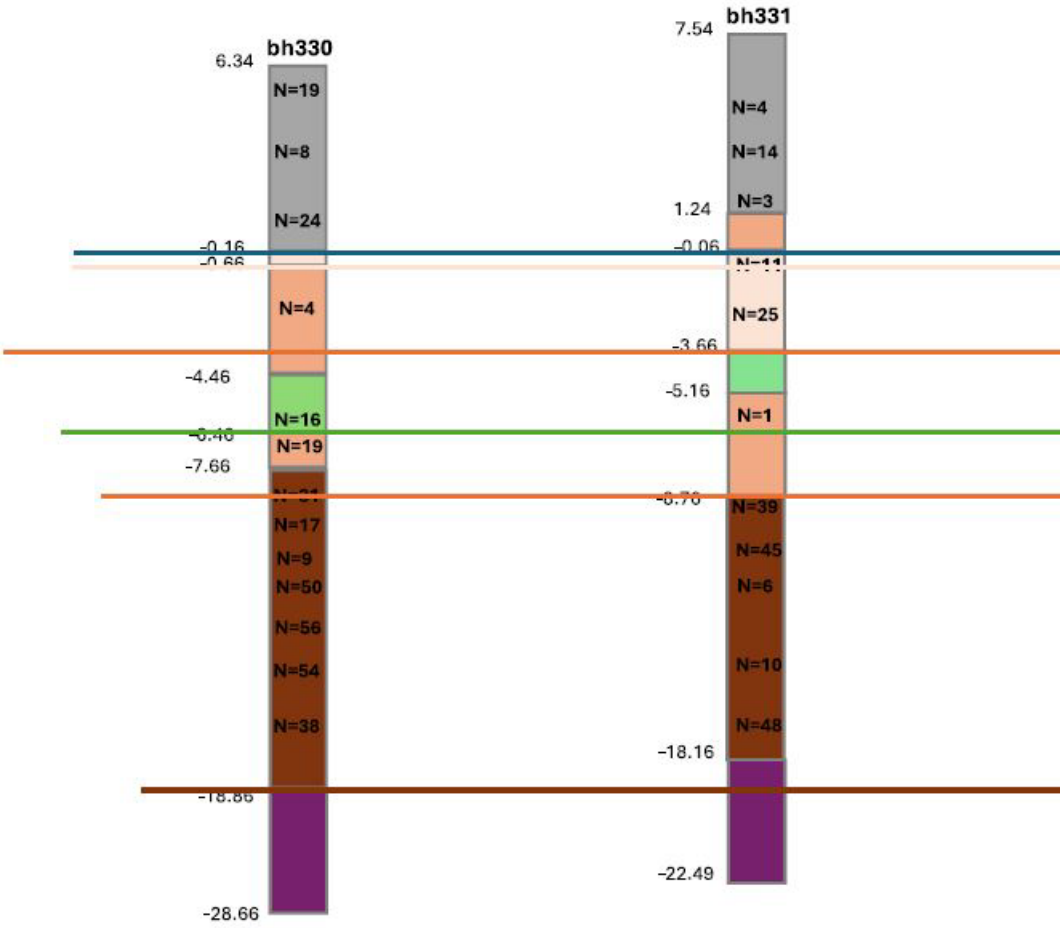


Figure 3-7 Ground conditions in Area A4

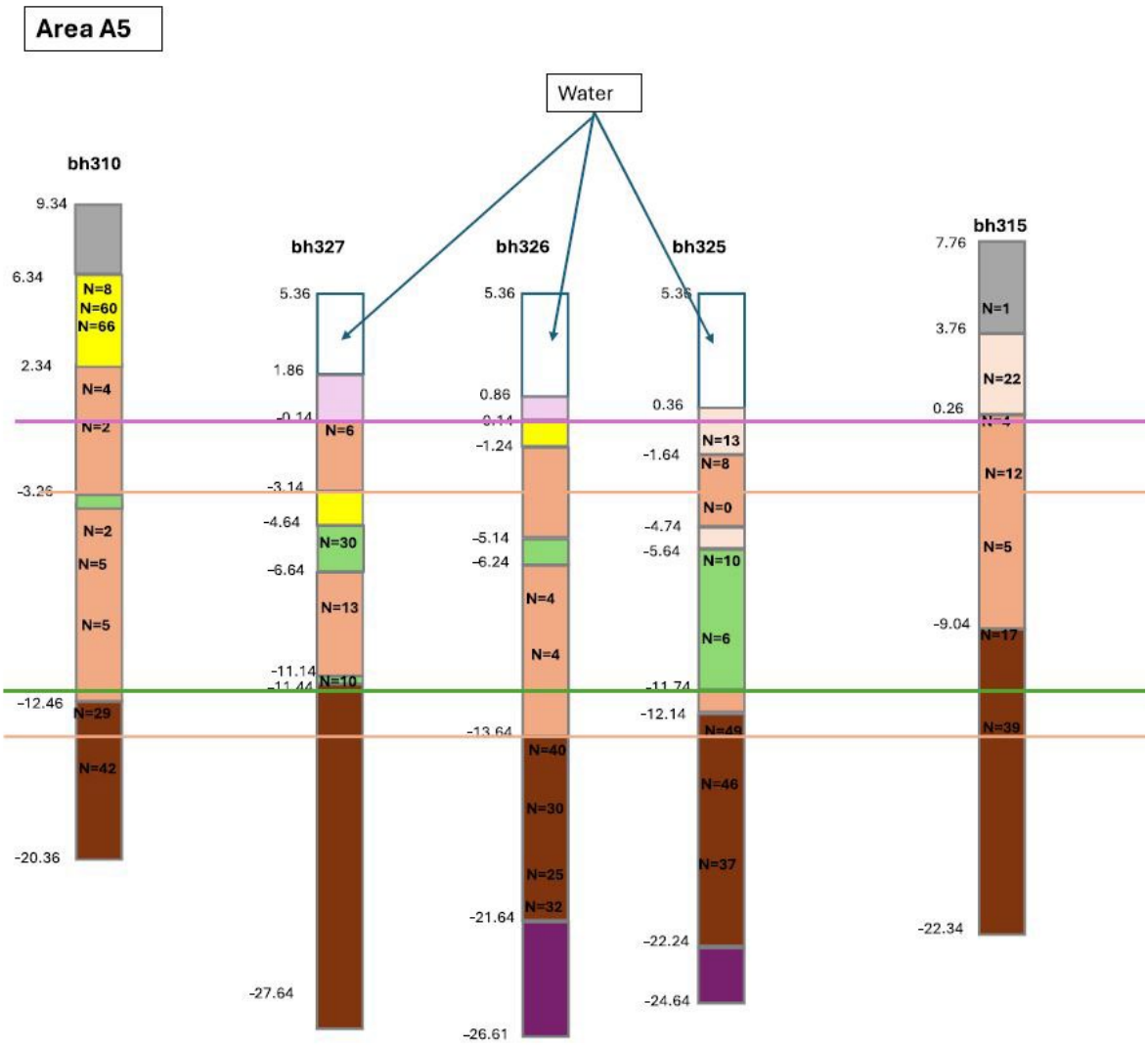


Figure 3-8 Ground conditions in Area A5

As shown in the logged profiles, the ground conditions encountered comprised a top-down sequence of:

- artificial deposits (made ground) that is described as clay, silt, sand and gravel with low to high cobble content, made up of reworked natural and anthropogenic material such as slag, brick, and concrete with metal. Some of the slag is highly fused.
- loose blown sand.
- Tidal Flat Deposits (TFD) comprising unconsolidated sediments, mainly mud and/or sand, and predominantly very soft to soft silty clay, with layers of sand, gravel and peat to an approximate maximum thickness of ~15m. The peat was found to occur as a layer and as pockets.
- Bedrock deposits of the South Wales Middle Coal Measures Formation (SWMCMF) in the north and east and South Wales Lower Coal Measures Formation (SWLCMF) in the west and south of the site location. These comprised mudstone, siltstone and sandstone.

The depth to rockhead is variable across the site, ranging from 15.00 m to 32.00 m below ground level according to these investigations.

Based on the information provided within the exploratory holes and the in situ and lab results, the ground was described by the ground investigators to be comprised of a significant depth of made ground and very soft to soft TDF materials including layers of peat. For the purpose of assessing preliminary pile capacities, the made ground (8.40 m to 0.77 m AOD) and soft materials (TDF and peat up to -5.30 m AOD), make a total thickness of 13.70 m.

Based on the observed ground conditions, the Geotechnical Design Report (GDR) identified the principal risks associated with the proposed development to be the presence of soft ground, recorded and unrecorded mine entries and shallow mine workings within influencing depth of the surface/foundations, the presence of geological faulting and the presence of mine gases.

Interestingly, the ground model identified and described by the ground investigators in these recent investigations is slightly different to that described in some other areas of the site, as documented in the Site Condition Report (SCR). In these earlier investigations, it was noted that a silty clay layer acted as an aquitard, separating upper and lower groundwater bodies in some areas; the upper within the aeolian wind-blown sands and permeable alluvial deposits and the lower within sufficiently permeable horizons of the alluvial deposits. The clay aquitard was not, however, always present and found associated with peat. Rather, pockets of peat were sometimes encountered. Due to the presence of the clay layer, which resulted in a perched upper groundwater body together with an underlying deeper aquifer, the previous investigations utilised drilling techniques that maintained the integrity of the low permeability silty clay horizon, where present. This resulted in separate dedicated groundwater wells being installed to target the upper and lower groundwater bodies.

3.2 Groundwater

Following installation of groundwater monitoring points in the boreholes, groundwater levels and quality were monitored by the site investigation workers. The boreholes installed had long screen lengths, spanning from the base of made ground and terminated either on or in bedrock.

Groundwater strikes were captured from 1.20 to 9.00 mbgl, predominantly within the upper sequence of slag dominated made ground with a few also recorded within the underlying Blown Sand layer. For the preliminary foundation designs, the GDR adopted a groundwater level of 1.2 mbgl. Monitoring also confirmed that some shallow groundwater is tidally influenced.

In the areas of interest, no visual/olfactory evidence of contamination in groundwater was noted during well development monitoring and sampling. Also, screening of the data gathered from analysis of groundwater samples against EQS found no breaches.

In the geoenvironmental risk assessments submitted as part of the approved planning permission, the workers indicated that groundwater was a pathway as opposed to a receptor on account of the historical and current industrial uses across the wider area. As a result, surface water in the Bristol Channel was designated the principle controlled water receptor.

3.3 Land Quality

During the investigations, samples of each of the different ground conditions encountered were collected and submitted for laboratory testing at a UKAS accredited laboratory. When this data was compared against Generic Assessment Criteria (GAC) for commercial land use

only one exceedance was found at TP397 where heavily stained soils were found at surface and also at TP208 and TP61 in an earlier phase of investigation. Geotechnology understands that these areas are outside of the area where piles are to be installed.

According to the ground investigation report, asbestos was detected in 6 out of 126 samples tested from two phases of investigation. This data is summarised in Table 3-1. Asbestos fibres were only detected in made ground, comprising predominantly granular slag.

Table 3-1 Summary of Asbestos Results

Position	Asbestos content (w/w %)	Asbestos description
Current Investigation (Invictus)		
BH304 @ 0.5m	0.002	Free fibres of amosite and chrysotile
TP391 @ 0.5m	0.001	Free fibres of chrysotile
Previous Investigation (Cronus)		
Max in TP53	<0.001 – 0.009	Free fibres
TP4		Cement bonded ACM

3.3.1 Aggressive Ground

The ground investigation classified the ground conditions encountered to determine the concrete class required for the prevailing ground and groundwater conditions. Piles are to be designed in accordance with these findings to ensure that they are not adversely affected by land and groundwater quality.

3.4 Ground Gas

The made ground, which is principally slag, is not considered to be a viable source of ground gases due to the absence of any significant degradable or putrescible material. Similarly, the risk of ground gases potentially associated with any flooded mine workings in the Coal Measures potentially below the site was considered to be low in the GDR due to the age of the coal workings (greater than 50 years) and the presence of shallow groundwater.

During monitoring of the groundwater boreholes for ground gas, the site investigation workers did, however, detect variable levels of methane and carbon dioxide, some of which were considered to be elevated, but accompanied with low steady state flow. This gas was considered to be a consequence of monitoring in groundwater wells, with groundwater present, and the underlying presence of peat within the Tidal Flat Deposits. As such, there is no viable significant advective source of ground gas.

3.5 Conceptualisation

Based on the information provided within the exploratory holes and the in-situ and lab results, the ground was described in the GDR to comprise of a significant depth (up to 13.70 m) of made ground and very soft to soft Tidal Flat Deposits including layers of peat.

Groundwater is shallow and uncontaminated, providing a pathway to the off-site controlled water receptor in the Bristol Channel.

Testing of the land quality has not identified widespread gross mobile contamination but rather localised contamination associated with hydrocarbon stained made ground and asbestos.

Ground gas is naturally present but there is no viable biodegradable source able to sustain large advective flows.

In this scenario, the risks posed by piling appear to be negligible/low as:

- Groundwater is a pathway rather than a receptor
- No significant mobile contamination has been found, either in the soil or groundwater
- Ground gas flux is low

Such conclusions appear to be supported by the successful long-term use of different pile foundations at the site for many decades where ground conditions are very similar. Despite this conclusion, further assessment of a series of potential pollution scenarios has been considered as the pile foundations will need to be deep due to the depth of bedrock.

4 ASSESSMENT OF RISKS

The recently published guidance from CI:aire (Claire, 2025) provides a framework for assessing potential risks posed by piling and helpful descriptions of different pile foundations. This approach is followed with some of the text reproduced here to aid description.

A pile foundation is a type of deep foundation. It comprises a slender column or cylinder made of materials such as concrete or steel which are used to support the structure and transfer the load to competent soils or rock at a desired depth (see Figure 4-1). They are used where the shallow soils are weak and/or compressible and cannot support foundation loads. Piles can support loads by end bearing onto a competent stratum, skin friction between soil and pile shaft or a combination of both.

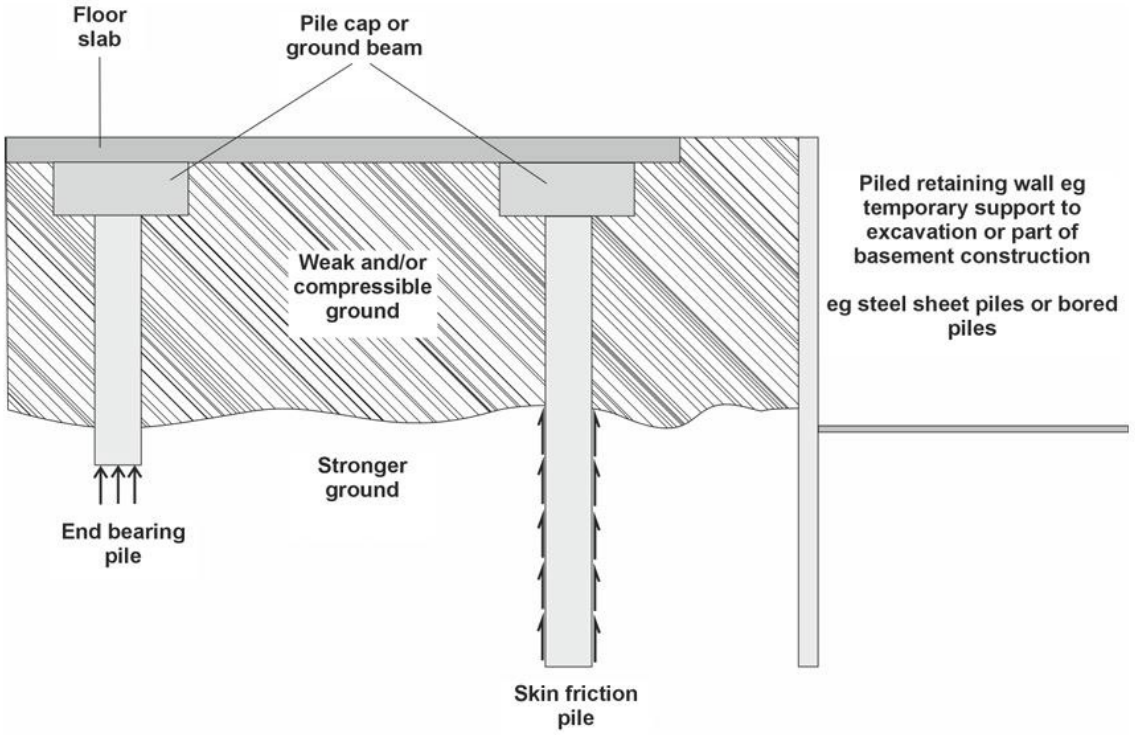
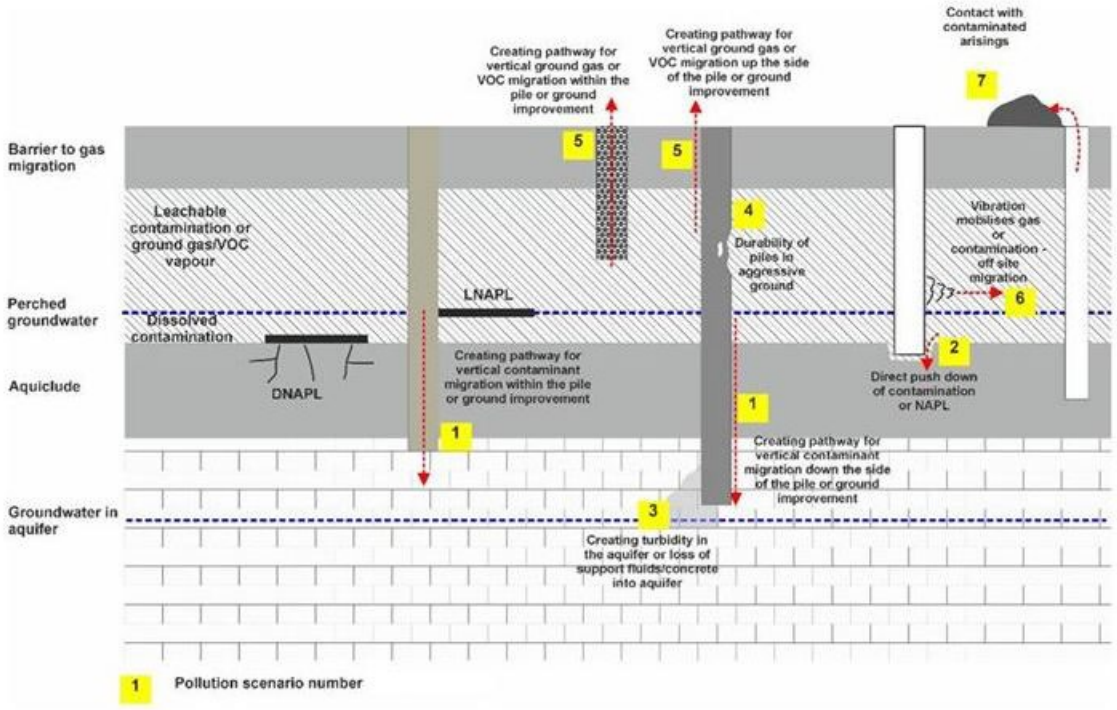


Figure 4-1 Examples of pile foundations (reproduced from Claire, 2025)

Piling, in certain circumstances, has the potential to create adverse environmental impacts when used on land affected by contamination or within groundwater source protection zones, as illustrated in Figure 4-2. There are also potential consequences to surface waters via groundwater.

However, the most recent guidance acknowledges that it is increasingly recognised that on many sites piling does not pose a risk of adverse effects to either groundwater or gas emissions because of site-specific factors. This would appear to be the case at the Port Talbot steelworks as piles have been successfully used for many years without significant incident as far Geotechnology is aware. It is, however, also recognised that the potential risks from piling should be considered from the very beginning of planning for a development.

The approach advocated in the recent guidance, targeted at sites where contamination is present, is to consider seven pollution scenarios as a minimum. These scenarios are conceptually identified in Figure 4-2. For the Port Talbot site, this assessment is summarised in a series of matrices summarised in Tables 4-1 – 4-7.



LNAPL – light non aqueous phase liquid, DNAPL – dense non aqueous phase liquid, VOC – volatile organic compound

Figure 4-2 Potential hazards from piling (adapted and reproduced from Claire, (2025))

Table 4-1 Evaluation of Pollution Scenario 1 – Groundwater preferential pathways

Scenario	Description	Consideration for Piling Technique (adapted from Claire, 2025)	Site Specific Commentary	Overall Risk and Implication for Pile Selection
PS1	Creation of preferential pathways, through a low permeability layer (an aquitard), to allow potential contamination of an underlying aquifer	**DISPLACEMENT PILES** Driven piles and bored piles will not create preferential pathways unless the thickness of a clay layer is less than two pile diameters. Soil surrounding pile is densified and high stresses are induced when driving displacement piles. This increases with size of pile and magnitude of displacement. In most soils these stresses will tend to force the soil to close up around the pile shaft, which means that the development of preferential flow paths around the outside of the piles is, in general, unlikely. A layer of sand above a clay layer can be dragged down to a depth of 5 m and can increase permeability down the side of the pile. Where a pile is installed through a body of contaminated groundwater or leachate it is important that free water cannot flow to the aquifer during pile construction or afterwards. The risk of this occurring is minimised with displacement piles. **REPLACEMENT PILES** Theoretically no disturbance of the surrounding soil and provided that the pile is formed or placed in intimate contact with the surrounding soil, there should be no formation of preferential pathways.	Site specific investigation did not identify separate groundwater bodies or groundwater contamination that could be mobilised due to piling Groundwater considered a pathway Piles used successfully at site for many years	Low Either displacement or replacement piles could be used

Table 4-2 Evaluation of Pollution Scenario 2 – Driving solids into aquifer

Scenario	Description	Consideration for Piling Technique (adapted from Claire, 2025)	Site Specific Commentary	Overall Risk and Implication for Pile Selection
PS2	The driving of solid contaminants down into an aquifer during pile driving	**DISPLACEMENT PILES** Driven displacement piles may potentially drag down contaminated material as they penetrate underlying strata. Drag down may occur by a frictional mechanism along the shaft of the pile, or by pushing material ahead of pile shoe. Risk is low, especially with conical tips. Material dragged down by shaft friction is unlikely to be displaced by more than a few centimetres, and calculations indicate that at most a few kilograms of soil may be pushed ahead of the pile shoe, as the primary mechanism of soil displacement during pile driving is horizontal. However, this would also imply that soft material is carried down with the pile until it achieves set and would bring the load-bearing capacity of the pile into doubt. It is therefore considered unlikely that, in practice, this occurs. Problem minimised by using small displacement piles that tend to cut through or push material aside. It is not a problem with screw piles. Unless a low permeability layer is very thin drag down is not likely to be a significant issue. Open-ended tubular piles may become plugged with soil from the upper layers of the ground through which the piles are driven and this plug of soil may be driven down to the lower levels. The piles can be fitted with a driving shoe to avoid this problem. The volumes of soil are small and unless very heavily contaminated are not likely to pose a risk. The use of conical tips is therefore not required, unless there is a very thin low permeability layer. **REPLACEMENT PILES** In normal circumstances, replacement piles will not lead to soil being dragged downwards. With CFA piling techniques drag down cannot occur as the soil is constantly moved up the auger flights.	Site investigation did not identify significant widespread contamination that could be dragged down. Any soil dragged down will be very small compared to overall ground volume Site specific investigation did not identify separate groundwater bodies or groundwater contamination that could be mobilised due to piling. Groundwater considered a pathway Piles used successfully at site for many years	Negligible Either displacement or replacement piles could be used Conical tips should be considered, where technically appropriate

Table 4-3 Evaluation of Pollution Scenario 3 – Contamination of Groundwater by turbidity

Scenario	Description	Consideration for Piling Technique (adapted from Claire, 2025)	Site Specific Commentary	Overall Risk and Implication for Pile Selection
PS3	Contamination of groundwater and, subsequently, surface waters by turbidity, support fluids, concrete, cement paste or grout	**DISPLACEMENT PILES** Precast concrete pile elements or permanent casings inside which concrete is cast, pose no risk of contamination as all concrete in direct contact with groundwater is hardened before being introduced into the ground. However, if bentonite slurry used as lubricant there is the potential for contamination of fast-flowing groundwater. **REPLACEMENT PILES** Where replacement piling involves the casting of concrete directly against soil, there is the potential for the leaching of wet concrete, cement paste or grout into fast-flowing groundwater. Where a permanent casing protects the wet concrete from contact with the groundwater until it has been allowed to set, this potential is reduced or eliminated. Minimal risk above groundwater or in slowly moving groundwater. To minimise risk where groundwater flow rate is high, temporary or permanent casing may be used to prevent wash out.	Groundwater considered a pathway to surface water receptor Low permeability cohesive deposits encountered along with more permeable horizons. Groundwater gradients low with flow occurring through matrix. Piles used successfully at site for many years	Low Displacement piles should be selected where technically suitable Take site specific ground conditions into account when selecting pile solution, particularly replacement piles

Table 4-4 Evaluation of Pollution Scenario 4 – Degradation of piles

Scenario	Description	Consideration for Piling Technique (adapted from Claire, 2025)	Site Specific Commentary	Overall Risk and Implication for Pile Selection
PS4	Direct contact of the piles or engineered structures with contaminated soil or leachate causing degradation of pile materials (where the secondary effects are to increase the potential for contaminant migration)	Some contaminants or constituents of contaminated soil, groundwater or leachate may be aggressive to materials used in piles. This has the potential to cause degradation to the piles, reducing their load carrying capacity, and possibly creating migration pathways. Foundation designer should consider aggressive properties of the ground in preparing and approving their designs. However, the conclusions from the majority of the research carried out by Claire (2025) indicated that whilst the theoretical possibility of attack on concrete or steel piles has been identified, in practice their confinement in a comparatively stable subsurface environment tends to limit the magnitude of any attack on the piles. Buried concrete in the ground should be designed to take account of sulfate and pH conditions in accordance with current Building Research Establishment (BRE) guidance (BRE, 2017). Mitigation measures to deal with aggressive ground conditions might include the use of permanent casing (displacement and non-displacement piles), the use of protective coatings (displacement non-cast-in-place piles only) and the use of a higher quality of concrete (more easily achieved with preformed concrete piles). The use of partially preformed replacement piles with a bentonite-cement slurry grout might also be considered, although bentonite should not be used where chemicals are present in the subsurface that could affect its performance. Steel piles may be protected by use of anti- corrosion products.	Site investigation did not identify significant widespread contamination in soil or groundwater Site investigation included assessment of samples for concrete aggressiveness. Piles used successfully at site for many years Chemistry of piles compatible with ground based on findings of GDR	Negligible Findings of site investigation to inform selection of appropriate concrete classification

Table 4-5 Evaluation of Pollution Scenario 5 – Creation of preferential pathways for gas

Scenario	Description	Consideration for Piling Technique (adapted from Claire, 2025)	Site Specific Commentary	Overall Risk and Implication for Pile Selection
PS5	Creation of preferential pathways, including through a low permeability layer, to allow upward migration of landfill gas, soil gas, mine gas or contaminant vapours (e.g. Volatile Organic Compounds (VOCs)) to the surface	Normal displacement or replacement piles used for UK built developments will not pose a significant risk of increased gas emissions through low permeability layer. **DISPLACEMENT PILING** In heavily compacted or stiff clay cover, pile driving may cause cracking in the upper levels due to upwards expansion, although less likely where stiff clay is confined by overlying soil. Most sites in UK where diffusive flow of gas through the ground will be dominant, large displacement-driven piles or replacement piles will not cause preferential pathways. This assumes piles are constructed with reasonable standards of workmanship and quality assurance in appropriate ground conditions (e.g. obstructions will not damage driven tube piles). Situation where gas migration may potentially be enhanced is where driven or bored piles penetrate a clay layer that is very thin (thickness less than two pile diameters), very heavily over consolidated (or stiff) and at shallow depth and that covers a gas source that is under pressure. Soil may not close up around piles with re-entrant angles in cross section (e.g. cruciform or H or I section piles) and this can cause a preferential pathway. Risk reduces with increasing thickness of clay. Whether the pathway has any practical impact on the scope of gas protection measures required will depend on the generation rate of the gas source and the number of piles below the building. Sealing of piles into a concrete pile cap will also effectively cut off the pathway. In critical cases gas monitoring can be undertaken around the top of piles after installation. **REPLACEMENT PILES** provided pile is formed or placed in intimate contact with surrounding soil, there should be no formation of preferential pathways for upward gas migration, except where the clay layer is less than two pile diameters in thickness and the gas below is under pressure.	No significant sustainable gassing source identified from Desk Study and Site Investigations to date Piles used successfully at site for many years	Negligible Either displacement or replacement piles could be used

Table 4-6 Evaluation of Pollution Scenario 6 – Causing off-site migration of ground gas

Scenario	Description	Consideration for Piling Technique (adapted from Claire, 2025)	Site Specific Commentary	Overall Risk and Implication for Pile Selection
PS6	Causing off site migration of ground gas or increased vertical emissions as a result of vibration or other effects from the pile installation process	**DISPLACEMENT PILES** If displacement piles are installed into ground with a large reservoir of gas that could also reduce in volume due to vibrations, there may be a risk of gas migration off site. This will be a short term effect. In high risk cases (where there is a large volume of gas and there are receptors within influencing distance and a migration pathway) perimeter gas monitoring and/or mitigation measures such as a vent trench may be appropriate. The number of piles to be installed will also influence risk. The more piles there are, the greater the risk of a large area being densified. **REPLACEMENT PILES** Replacement piling methods will not cause disturbance of the ground sufficient to cause off site migration of gas.	No significant sustainable gassing source identified from Desk Study and Site Investigations to date Piles used successfully at site for many years	Negligible Either displacement or replacement piles could be used

Table 4-7 Evaluation of Pollution Scenario 7 – Contact with arisings

Scenario	Description	Consideration for Piling Technique (adapted from Claire, 2025)	Site Specific Commentary	Overall Risk and Implication for Pile Selection
PS7	Direct contact of site workers and others with contaminated soil arisings which have been brought to the surface.	**DISPLACEMENT PILES** Use of displacement piles eliminates arisings and avoids this risk and the associated cost of disposal of the arisings. **REPLACEMENT PILES** Replacement piling does create arisings which will have to be dealt with in accordance with Waste Management Legislation. Since piling is a development, not a remediation activity, there is no exemption from landfill tax for these contaminated materials. Disposal or reuse will necessitate characterisation of the arisings, which are likely to consist of a mixture of soil types often including cementitious material and grout. Implications of handling this material on site, include possible impacts on development construction workers and the public in the site surroundings. The volume of arisings on a major development may be significant. A single 6 m long 450 mm diameter pile will generate 1 m^3 of arisings. These arisings may be contaminated and their handling, transport and disposal need to be addressed with appropriate care.	Site investigation did not identify significant widespread contamination	Low Either displacement or replacement piles could be used Preference should be given to use of displacement piles where technically suitable to minimise arisings Identification of asbestos and hydrocarbon contamination identified in site investigations should be taken into account. If the soil contains asbestos arisings will require careful management. Good level of housekeeping and hygiene required. All arisings should be managed in accordance with management plans

5 SELECTED PILING TECHNIQUES

At this site, there is a long history of different pile types providing suitable long-term deep foundation solutions. There is a wealth of data, knowledge and experience regarding their installation under QA/QC controls, the ground conditions to be encountered and successful mitigation of risks. This experience will help ensure that there is a negligible/low risk to human health, controlled waters and the wider environment through the continued use of piling techniques.

At this site, the ground investigations and risk assessments have shown that there is no widespread gross contamination of either land or groundwater in the areas of interest and that there is no significant viable gassing source. As a consequence, this risk assessment has shown that both displacement and replacement pile solutions could be suitable for use. In this circumstance, special precautions or design constraints are unlikely to be necessary.

However, the design process has still taken into account the findings of this assessment which has lead to the design team opting for precast concrete driven piles as these have been used extensively at the site previously and will avoid the need for widespread arisings management. Two main pile types are therefore to be used; solid precast driven displacement piles and CFA replacement piles. Secant piles will also be used in one area.

- The precast concrete piles are to be solid, most likely with a steel shoe and a square section of either 275 or 300mm. Each pile will be jointed and installed vertically with a drop hammer. These piles will be a combination of friction and end-bearing.

- The CFA piles will also be concrete and will be installed by positive pressure to keep the hole open. The piles will be reinforced with a steel cage with the majority having a diameter of 900mm, with some 600mm and 750mm depending on capacity requirements.

- The secant piles are proposed for 3No. 9m deep pits for materials storage bunkers. These will be cast in-situ.

The preliminary configuration of pile types is indicated on Figure 5-1.

During replacement pile installation, avoidance of disturbance to the surrounding soil requires a high standard of workmanship in the construction process. Reduced support due to poor working practices, however short term, during boring or augering could lead to collapse of soil or piping into the hole, leading to loss of density in the surrounding soil and possibly void formation. This could create preferential flow pathways. Under-reaming of pile bases has particular potential for the collapse of soil into the bore and the formation of voids if not correctly executed. Appropriate QA/QC methods should be incorporated into the works to enable workmanship to be monitored and verified.

CFAs rely on the retention of soil on the auger flights to provide support to the surrounding soil until the auger is withdrawn and the concrete or grout intruded. It is vital that the intruded material is placed under pressure at a rate consistent with that of the withdrawal of the auger to ensure that the hole is supported.

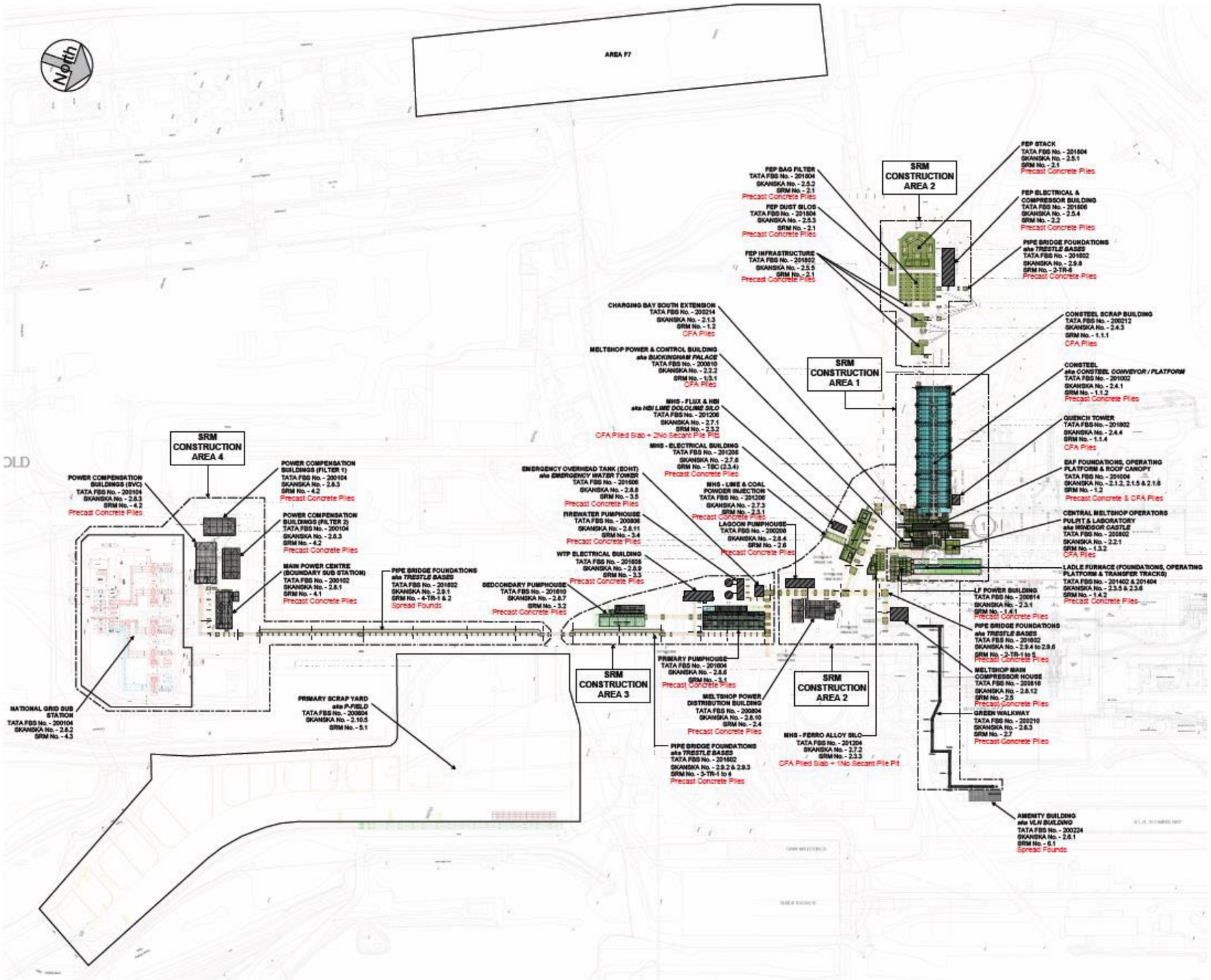


Figure 5-1 Selected Pile Types

6 MITIGATION AND QA/QC

At this site, the assessments have shown that special precautions are not necessary to protect human health, controlled water and the wider environment. The procurement, installation, monitoring and QA/QC checks that would be expected with any piling contract will also ensure that the piles are installed as designed and provide the appropriate foundation solution. This will likely include integrity tests and load tests and verification of materials to ensure piles are not adversely affected by ground conditions.

Pile installation will be undertaken in accordance with site management plans and details RAMS including measures to prevent exposure of workers and the wider environment to asbestos.

6.1 CEMP

The works will be undertaken in accordance with the Construction Environmental Management Plans (CEMP) and incorporate on-going monitoring by the Environmental Clerk of Works throughout the construction phase.

Tata Steel shall have ultimate responsibility for the construction works. It will be the responsibility of the appointed Principal Contractor to ensure that the works are undertaken in accordance with any legal requirements.

The Principal Contractor shall comply as necessary with the Construction (Design and Management) Regulations 2015 (CDM) and shall comply with all applicable pollution control regulations. The Principal Contractor shall obtain and keep current any necessary consent, authorisation, approval or permission.

The Principal Contractor shall, where relevant, undertake construction works in accordance with current guidance and good practice, including:

- Environmental Good Practice on Site Guidance (C811, fifth edition, Ciria, 2023);
- Planning Policy Wales (Llywodraeth Cymru Welsh Government, edition 12, Feb 2024);
- Control of Dust from Construction Sites (BRE DTi Feb 2003);
- British Standards 5228-1:2009+A1:2014: 'Code of Practice for noise and vibration control on construction and open sites – Noise';
- Institute of Lighting Professionals. Guidance Notes for the Reduction of Obtrusive Light. ILP GN01:2011; and
- Relevant pollution prevention guidance, such as set out at https://www.gov.uk/guidance/pollution-prevention-for-businesses

6.2 Arisings management

The Site will operate in full compliance with the Environmental Protection Act 1990, the Environmental Protection (Duty of Care) Regulations 1991, all other relevant legislative requirements and the CEMP. Wherever possible, a principle of reduce-reuse-recycle will be adopted.

All arisings will be managed and re-used on site in accordance with the Materials Management Plan (MMP) and Peat Management Plan. The MMP will include specific measures for management of arisings potentially containing asbestos. The risk of asbestos in

pile arisings will be low. As part of piling enabling works, the top 3m of ground will be turned over to remove obstructions, which will uncover all likely sources of asbestos in the existing made ground near to the surface. During this groundworks activity, operatives will be trained and briefed in the identification of asbestos. Any asbestos encountered during the groundworks or within the pile arisings will be dealt with in accordance with the Materials Management Plan and the Remediation Strategy.

6.3 Noise and Vibration

All works will be undertaken in accordance with the findings of the Construction Noise and Vibration Management Plan.

Piling working hours will be limited to those approved in the Construction Noise and Vibration Monitoring Report, as summarised in Table 6-1.

Table 6-1 Working Hours

Task	Task Description	Core Hours[1]	Evening and Weekends[2]	Public Holiday[2]	Night-time[3]
1	Vegetation Clearance	x	x	x	-
2	Civil Enabling Works, Site Set-up and Deliveries	x	x	x	-
3	Demolition Works (with crusher)	x	-	-	-
3a	Demolition Works (without crusher)	x	x	x	-
4	Earthworks	x	x	x	-
5	Excavation and Drainage Works	x	x	x	-
6	Concreting Works, Structural Steel Works and Mechanical Erection Works	x	x	x	x
7	Piling works (with driven piling rigs only)	x	x	x	-
	Piling works (with CFA piling rigs only)	x	x	x	-
8	Cable Pull	x	x	x	-
9	Decommission and site demobilisation	x	x	x	-

Notes:
1: Monday – Friday 07:00-19:00 and Saturdays 07:00-13:00;
2: Monday – Friday 19.00–23.00, 13.00–23.00 Saturdays and 07.00–23.00 Sundays and Public Holidays; and
3: 23.00–07.00.

Precast concrete driven piles offer benefits in relation to arisings management but are inevitably noisier than the equivalent replacement piles. Mitigation measures for reducing the noise impact of this piling technique will be adopted by the project, including noise dampening at the hammer or pile head during installation.

References

CL:AIRE, 2025. Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention. CL:AIRE, Reading. ISBN 978-1-905046-51-5. Download at https://www.claire.co.uk/piling

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