

8. Soils, Hydrogeology and Ground Conditions

8.1. Introduction

- 8.1.1. This chapter of the ES has been prepared by PJA and reports the likely significant effects of the Proposed Development in terms of soils, hydrogeology and ground conditions in the context of the Site and surrounding area. In particular it considers the potential for significant effects associated with changes in ground stability and soil erosion, effects on geology as a valuable resource, effects associated with existing soil and groundwater contamination, effects associated with the introduction of new contaminative substances and/or migration pathways and effects associated with re-use of soils and generation of waste soils.
- 8.1.2. This Chapter (and its associated figures and appendices) is not intended to be read as a standalone assessment and reference should be made to Chapters 1 – 4 as well as the final chapter, ‘Summary of Proposed Mitigation and Residual Effects’ (Chapter 14). In addition, reference should be made to the Coed Darcy Phase 1 Geo-environmental Desk Study¹ for the Proposed Development, included as Appendix 8.1, which provides further detail on current Site conditions.
- 8.1.3. Consistent with the Phase 1 geo-environmental desk study and where required for clarity, the two main proposed areas of development at the Site are referred to in this chapter as ‘North Site’, to the north of the railway cutting, and ‘Central Site’, to the south of the railway cutting.

8.2. Assessment criteria & methodology

Scope of the Assessment

- 8.2.1. The following potential environmental effects have been considered:
- (a) Physical effects of the Proposed Development; e.g. changes in topography, soil compaction, soil erosion, ground stability, etc.
 - (b) Effects on geology as a valuable resource; e.g. mineral resource sterilisation, loss or damage to local geological sites (LGS), geological Sites of Special Scientific Interest (SSSI), etc.
 - (c) Effects on soil as a valuable resource; e.g. loss or damage to soil of good agricultural quality.
 - (d) Effects associated with ground contamination that may already exist on Site; e.g. introducing / changing pathways and receptors.
 - (e) Effects associated with the potential for polluting substance used (during construction/operation) to cause new ground contamination issues on Site; e.g. introducing/changing the source of contamination and/or pathways.

¹ Coed Darcy Phase 1 Geo-environmental Desk Study, PJA, October 2021

- (f) Effects associated with re-use of soils and generation of waste soils; e.g. re-use of site-sourced materials on-site or off-site, disposal of Site-sourced materials off-site, importation of materials to the Site, etc.

8.2.2. The relevant environmental effects are considered to comprise physical effects of the scheme (a), effects on geology as a valuable resource (b), effects associated with existing contamination and contamination which may be introduced to the Site (d, e), and effects associated with reuse of soils and generation of waste soils (f). For the purposes of the Ground Conditions chapter, hydrogeology has been considered only in terms of a pathway and receptor for contamination. Non-contaminative impacts on the hydrogeological regime are covered in more detail in Chapter 9 – Water and Flood Risk.

Effects Not Considered within the Scope

8.2.3. Effects on soil as a valuable resource have been scoped out of this chapter on the basis that the Site is not in agricultural use, in line with the scoping chapter.

Previous Assessment

8.2.4. A soils, hydrogeology and ground conditions ES Chapter was prepared by Parsons Brinkerhoff as part of the 2005 planning application for the Site. However, given the changes in policy and guidance since 2005, the revised masterplan and the additional data now available, an updated Environmental Impact Assessment is considered to be appropriate.

Legislative Context

8.2.5. The key documents forming the legislative framework for the soils, hydrogeology and ground conditions topic comprise:

- The Contaminated Land (Wales) Regulations 2006;
- The Environment Act 2005;
- Part 2A of the Environmental Protection Act 1990;
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017;
- The Water Resources Act, 1991 (as amended);
- The Waste Framework Directive, 2008 and Waste Management (England and Wales) Regulations, 2016 (as amended);
- The Environmental Permitting (England and Wales) Regulations, 2016;
- The Control of Substances Hazardous to Human Health Regulations, 2002 (as amended) (COSHH Regulations).

Planning Policy and Guidance

8.2.6. The relevant planning policy and guidance is summarised below:

National Planning Policy

- Planning Policy Wales (11th Edition, February 2021);
- Future Wales The National Plan 2040, September 2020;
- Environment (Wales) Act 2016;
- Natural Resources Policy Wales 2017;
- Minerals Planning Policy Wales 2000;
- South East Wales Aggregates Safeguarding Map of Wales Scale 1:100,000, British Geological Survey and Welsh Government, Published 2012;
- Minerals Technical Advice Note (Wales) 1: Aggregates, 2004; and
- Minerals Technical Advice Note 2: Coal, 2009.

Local Planning Policy

- Neath Port Talbot County Borough Council Local Development Plan 2011-2026, adopted 2016;
- Neath Port Talbot County Borough Council Local Development Plan 2011-2026 Minerals Topic Paper August 2013;
- Neath Port Talbot County Borough Council Biodiversity and Geodiversity Supplementary Planning Guidance May 2018;
- Neath Port Talbot County Borough Council Pollution Supplementary Planning Guidance October 2016; and
- Neath Port Talbot County Borough Council Contaminated Land Inspection Strategy 2015.

Guidance/ Best Practice

8.2.7. Relevant industry guidance and best practice includes:

- Welsh Government Contaminated Land Statutory Guidance 2012;
- Land Contamination Risk Management, Environment Agency (2020);
- R and D Publication 66: Guidance for the Safe Development of Housing on Land Affected by Contamination, Environment Agency, 2008; and

- C552 Contaminated Land Risk Assessment - A Guide to Good Practice, CIRIA, 2001.

Scoping Opinion

- 8.2.8. Scoping opinions have been received from statutory consultees in response to the EIA scoping report, as summarised in Table 8.1.

Table 8.1 – Summary of Scoping Opinions

Consultee	Comment	Response
Coal Authority	There are a number of coal mining legacy issues that can potentially pose a risk to new development and therefore should be considered as part of an ES for development proposals within coalfield areas: • The location and stability of abandoned mine entries • The extent and stability of shallow mine workings • Outcropping coal seams and unrecorded mine workings • Hydrogeology, mine water and mine gas	Noted. These issues have been considered in Sections 8.3, 8.5.5, 8.5.10, 8.6.8 and 8.6.14 of the ES chapter and in the coal mining risk assessment which is included in the desk study presented in Appendix 8.1.
	In addition, consideration should be afforded as part of development proposals and the ES to the following: • If surface coal resources are present, whether prior extraction of the mineral resource is practicable and viable • Whether Coal Authority permission is required to intersect, enter, or disturb any coal or coal workings during site investigation or development work	Noted. These issues have been considered in Section 8.5.13 and 8.6.8 of the ES chapter, in the desk study presented in Appendix 8.1 and as part of the wider development proposals.
	The Coal Authority recommends that land instability and safety issues arising from coal mining legacy should be addressed within the Ground Conditions chapter of the Environmental Statement.	Noted. These issues have been considered in the ES in Section 8.5.5 and 8.7.4.
	We wish to advise that any Coal Mining Risk Assessment, or equivalent report, prepared in relation to the Proposed Development should utilise up-to-date coal mining and geological information to assess the extent to which past mining activity poses any risk to the development proposal and, where necessary, propose mitigation measures to address any issues of land instability. This should include further intrusive investigations to establish the exact situation regarding coal mining legacy affecting the site, as necessary.	Noted. An up-to-date coal mining report has been obtained for the Site and has been used to inform preparation of the coal mining risk assessment included in the desk study which is presented as Appendix 8.1, and the ES chapter and to establish the requirement for further assessment and/or investigation of coal mining legacy at the Site.

Consultee	Comment	Response
	The Coal Authority takes this opportunity to highlight that any form of development over or within the influencing distance of a mine entry can be dangerous and raises significant safety and engineering risks and exposes all parties to potential financial liabilities. The Coal Authority has adopted a policy where, as a general precautionary principle, the building over or within the influencing distance of a mine entry should wherever possible be avoided.	Noted.
	Under the Coal Industry Act 1994 any intrusive activities, including initial site investigation boreholes, and/or any subsequent treatment of coal mine workings/coal mine entries for ground stability purposes require the prior written permission of The Coal Authority.	Noted – Coal Authority permission will be sought prior to intrusive investigation and/or treatment of coal mine workings.
Natural Resources Wales	We note that the document refers to a Section 106 Planning Obligation deed from 2008, with a specification for a RAP (Remedial Action Plan), which specifies RBSL (Risk Based Screening Levels). These were derived for human health risk assessments only and on the basis that the site was to be developed as a country park. The standards that these were based on have been updated in the 15+ years that this was written.	Noted. Updates are proposed to the RBSL and separate risk assessment will be undertaken for controlled waters.
	Monitor Certificates were provided in 2015, and should be supplied, if they are to be used as part of the evidence for this new application. However, as was specified to Neath Port Talbot Council, URS (as the Monitor) and St Modwen's at the time, this did not pre-empt any site-specific risk assessments that may be required for groundwater.	Noted. Separate risk assessment will be undertaken for controlled waters.
	In reference to the site wide site investigation, a very limited amount of this information has been supplied to NRW for comment, whether under a planning permission condition or a voluntary submission. We would welcome the submission of this information as part of the planning process in order to understand the conceptual site model of the wider site.	Noted, a summary of pertinent information has been included in the desk study and the source reports appended to the desk study, presented in Appendix 8.1.
	With regards to the treatment of contaminated material on site, if there is a stockpile of material, treated or otherwise on site, this may warrant a discussion with our South West Waste Team with regards to the need for a permit.	Noted.
	Any submission under Planning Permissions should seek to use current guidelines under WFD, using the Land Contamination Risk	Noted. The desk study, presented in Appendix 8.1, has been prepared in accordance with Land

Consultee	Comment	Response
	Management document. For each phase of development that has not already been through the full steps of land contamination risk assessment, we would ask for conditions to address this.	Contamination: Risk Management. Future planning submissions will be prepared in accordance with the Land Contamination: Risk Management guidance.
	We agree that due to the changes in policy and guidance that an updated assessments on the impact of the Proposed Development on soils, hydrogeology and ground conditions is required.	Noted.
	Our published Open Data can be downloaded from Lle Geoportal. This is the data portal for Wales, Natural Resources Wales / Access our data, maps and reports. DEFRA Magic maps are now out of date for the site. We would expect all the reports that the planning submission is to be based on to be supplied as part of the application.	Noted. We have used Lle where necessary to supplement/verify information in the Landmark Envirocheck report.
	As previously stated, the RAP standards are for human health and each plot requires a site-specific risk assessment. Not all of the site for controlled waters has had a regulatory review via the planning process and it needs to be clear which area of the site that this statement refers to. For example, the North site tank farm (from the EIA Location plan) has been included but NRW have not commented on its remediation. We welcome the submission of the process (a map), but also it would be helpful if one was also provided for those area that have been through the planning process.	Noted. Separate risk assessment will be undertaken for controlled waters. The desk study, included as Appendix 8.1, provides information on investigation and risk assessment carried out at the Site to date. The previous work carried out was related to the overarching requirements of the Section 106 Agreement (both RAP and Development Remediation). However, it is acknowledged that separate submissions would be required as part of the Reserved Matters planning process.
	We agree with the comments in this section regarding envisaged Mitigation.	Noted.
	Groundwater as a resource... needs consideration, dependant on which catchment area that this falls within.	Noted. Separate risk assessment will be undertaken for controlled waters.
	We welcome the proposal in this section which includes the preparation of a Construction Environmental Management Plan (CEMP). Due to the close proximity of Crymlyn Bog, the large area to be developed and the previous land use a CEMP is extremely important for this site. Pollution from runoff containing eroded soil during the construction phase is a very likely source of pollution from this site.	The sensitivity of Crymlyn Bog and the importance of good construction practice is acknowledged. Details on likely contents of the CEMP are presented in Section 8.6.18.
	There is a very high possibility of erosion or loss of soil during construction which will need to be addressed by the CEMP.	Noted. Details on likely contents of the CEMP are presented in Section 8.6.18 of the ES chapter.

Consultee	Comment	Response
	With regard to programming of earth works we would expect to see phased areas of construction in smaller blocks to enable effective management of risk associated with soil runoff. It would be preferable if the SUDS features (e.g. attenuation basins) were built in advance of significant areas of construction to assist with managing surface runoff from the site.	Programming of earthworks is beyond the scope of this ES chapter; however this comment is acknowledged and an overview of likely measures to mitigate sediment-laden run-off is presented in Section 8.6.18 of the ES chapter.
	Waste produced during the construction phase of your development must be dealt with appropriately and be in line with all relevant waste legislation including Duty of Care Regulations and Hazardous Waste Regulations.	Noted.
Neath Port Talbot County Borough Council	The site has previously been subject to significant site investigation and remedial works to address contamination associated with the former use of the site. An essential element of the ES will be to collate and present this information in a clear and transparent way to update and inform future work on site.	Noted. This information has been summarised in and appended to the Phase 1 geo-environmental desk study, included in Appendix 8.1.
	We note the proposal for additional ground investigation as part of the ES and welcome an updated assessment of the site due to the age of some investigation and remedial works.	The volume of existing ground investigation and laboratory analytical data is considered sufficient to inform preparation of this ES chapter. As stated in Section 8.6 of this ES chapter, additional assessment and ground investigation will be undertaken post-submission where necessary to define the risk to end receptors and define works required.
	The report states that RAP works have been completed, however, it is my understanding that formal sign off of the RAP works has not taken place and the applicant is required to provide evidence that the RAP works have been completed... The proposed application will need to carry out a full assessment of the status of any relevant RAP works and conditions may be required to secure any outstanding works if this site will no longer be delivered with the existing Section 106.	Noted. Discussion of the RAP works is presented in the desk study, included as Appendix 8.1.
	We are in negotiation with the applicant about the possible updates to the Risk Based Screening Levels (RBSL) to replace those within the Section 106 RAP works. It is expected that these screening levels will form part of the submission with the ES in order that they can be included within the decision notice for the application.	Noted. Additional information is provided in the desk study, included in Appendix 8.1 .

Consultee	Comment	Response
	As stated in the Scoping Report there are two elements of the remediation the first being those required under the RAP works and the second those required during redevelopment. The later has proved difficult to track and a clear mechanism will be required to ensure that redevelopment remediation is completed.	Noted.
	As part of the proposed CEMP we recommend the reinstatement of vapour and dust monitoring during remedial works on the site due to the proximity to sensitive receptors that have now occupied earlier phases of Coed Darcy.	Noted, and this is addressed in Section 8.6.18 of the ES chapter.

Extent of the Study Area

- 8.2.9. Effects have been assessed from both within the red line Site boundary and areas external to those being developed to a distance of 500m, in accordance with industry practice.
- 8.2.10. The study area for the purposes of assessing physical effects of the Proposed Development, effects on geology as a valuable resource, and reuse of soils and generation of waste soils is the area within the red line Site boundary. For the purposes of assessing effects associated with ground contamination that may already exist on Site and effects associated with the potential for the Proposed Development to cause new ground contamination at the Site, the study area comprises the area within the red line Site boundary and adjacent land to a distance of 500m, in accordance with industry practice. A larger study area is required for assessing ground contamination effects to allow for consideration of migration pathways from on-site and off-site sources of contamination to identified receptors.

Assessment Methodology

Physical Effects of the Proposed Development

- 8.2.11. Physical effects can include changes in topography, soil compaction, soil erosion and ground stability. A qualitative approach will be used for the assessment of physical effects, assessing the potential impact on the baseline conditions as a result of earthworks, foundation solutions, and construction methods associated with the Proposed Development.

Effects on Geology as a Valuable Resource

- 8.2.12. Effects on geology as a valuable resource may include the sterilisation or severance of mineral resources and loss of or damage to geological SSSI or LGS. The impact assessment will follow a qualitative approach based on the type and distribution of geological resource and its associated value, and the extent to which it will be sterilised, lost or damaged as a result of the Proposed Development.

Effects Associated with Contamination

- 8.2.13. Effects associated with existing residual soil and groundwater contamination, potential contamination associated with the Proposed Development and re-use of soil/generation of waste soil will be assessed

using a two-stage risk-based approach. The risk-based approach is in accordance with industry guidance set out in Land Contamination: Risk Management. For the purposes of the Ground Conditions chapter, hydrogeology is considered only as a receptor to and pathway for the migration of contamination, rather than as a resource.

8.2.14. The first stage typically comprises a land contamination risk assessment. A Phase 1 geo-environmental desk study has been completed to determine the baseline ground conditions at the Site, identifying plausible sources of contamination, receptors to contamination and pathways between the two. The sources, pathways and receptors will be presented in a Preliminary Conceptual Site Model with a qualitative risk assessment of each potential contaminant linkage which forms the baseline land contamination risk assessment. The large amount of historical laboratory analytical data and field data will be used to inform the baseline land contamination risk assessment.

8.2.15. The qualitative risk assessment is based on consideration of probability and consequence and the associated risk matrix presented in Table 8.2, in accordance with CIRIA C552² and R&D 66³.

Table 8.2 – Estimation of the Level of Risk Based on Probability and Consequence

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High likelihood	Very high risk	High risk	Moderate risk	Moderate/low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

8.2.16. Definitions of probability, consequence and risk, as specified in CIRIA C552², are presented in Appendix 8.2.

8.2.17. The second stage comprises the impact assessment. Land contamination risk assessments will be completed for the construction phase and the operation phase, using the same qualitative risk assessment approach as at baseline. The baseline land contamination risk assessment will then be compared with the construction phase land contamination risk assessment and with the occupation phase land contamination risk assessment to enable changes in risk to be determined as a result of construction and operation of the Proposed Development. This will allow for impacts to be identified which range from very high to negligible magnitude and either negative or positive.

² C552 Contaminated land risk assessment. A guide to good practice, CIRIA, 2001

³ R&D Publication 66 Guidance for the Safe Development of Housing on Land Affected by Contamination, Environment Agency and Chartered Institute for Environmental Health, 2008

Significance Criteria

- 8.2.18. The impact assessment requires consideration of the sensitivity or value of the identified receptors for physical effects, geology as a valuable resource, ground contamination, soil reuse and waste soil arisings. The criteria for determining the sensitivity of receptors are presented in Appendix 8.3. The magnitude of impacts is also relevant, and the criteria used are presented in Appendix 8.3.
- 8.2.19. Significance of effects ranging from major to neutral and either beneficial or adverse will be determined based on the sensitivity or importance of the receptor and the nature of potential impact. The classification of significance of effects is presented in Appendix 8.3. Effects that are deemed to be significant for the purposes of this assessment are those that are described as moderate and major adverse or beneficial.

Assumptions/Information Gaps

- 8.2.20. Ground investigation has not been carried out as part of preparation of this Ground Conditions chapter; however there is a significant body of existing data for the Site to inform the baseline environment. The baseline land contamination risk assessment is based on a reasonably likely worst case scenario when considering the residual sources of contamination and the plausibility of migration pathways to identified receptors.

8.3. Baseline environment

Topography

- 8.3.1. The Site is characterised by varied topography which is partly attributable to the underlying geology, and partly to the series of terraces that were formed to facilitate construction of the former oil refinery. The topographical high of the Site is the south of Central Site at an elevation of 80 metres above Ordnance Datum (AOD). The Site elevation falls away in all directions, and the topographical low of 9 AOD is in the far south west of the Site which is occupied by Crymlyn Tip (discussed in further detail in Section 8.3.19).
- 8.3.2. Near vertical slopes are present to the north of the existing Phase 1 residential development, and towards the west of Central Site. In other areas of the Site, the topographical gradient is shallower.

Geology

- 8.3.3. Made Ground is present across the majority of the Site associated with historical cycles of development, and subsequent demolition and earthworks. A notable exception is the fields in the eastern area of North Site which are understood to have never been developed.
- 8.3.4. Published British Geological Survey records⁴ indicate that Till (Diamicton) is present across the majority of the Site, comprising a heterogeneous mix of clay, silt, sand and gravel, although it is noted to be

⁴ British Geological Survey Map Sheet 247 Swansea Bedrock 2011

absent in the south of Central Site where bedrock outcrops at or close to current ground level. Peat encroaches on the south western part of the Site, beyond the area proposed for development.

8.3.5. Underlying the Site is bedrock of the Hughes Member, Brithdir Member and Swansea Member of the Pennant Sandstone Formation, described as green-grey, lithic arenites with thin mudstone/siltstone and seatearth interbeds, and mainly thin coals. Published BGS mapping indicates that two geological faults are recorded on Site. A fault is present trending north - south through the Site, at the eastern end of the Tip, in the west of South Site and a second fault is recorded trending north east – south west, at the southern edge of the Contractors Yard.

8.3.6. The regional bedrock geology forms part of the South Wales Upper Coal Measures Formation and the Site is located in a Coal Mining Reporting Area. Coal seams sub-cropping in the far south of the Site have historically been mined and abandoned mine entries are recorded by the Coal Authority in the south and east of Central Site.

Ground Stability

8.3.7. A Landmark Envirocheck Report obtained for the Site, included in the Phase 1 geo-environmental desk study¹, indicates the following on-site ground stability hazards:

- Collapsible ground hazard potential – very low to no hazard;
- Compressible ground hazard potential – high to no hazard;
- Ground dissolution hazard potential – no hazard;
- Landslide hazard potential – moderate to very low hazard;
- Running sand hazard potential – very low to no hazard; and
- Shrinking or swelling clay hazard potential - very low to no hazard.

8.3.8. Areas of high compressible ground hazard potential coincide with Crymlyn Tip, the existing Contractors Yard and land in the proximity of South Site Reservoir and Crymlyn Bog. Areas of moderate landslide ground hazard potential are located in the central south of the Site, towards the west and south west of the Site and in the far north east of the Site.

Mineral Resources

8.3.9. A Category 1 Aggregates Safeguarding Area for sandstone surrounds the Site to the north, east and west, and encroaches on the north eastern, north western and south western areas of the Site⁵.

⁵ South East Wales Aggregates Safeguarding Map of Wales Scale 1:100,000, British Geological Survey and Welsh Government, Published 2012

- 8.3.10. Hughes and Bodwr coal seams located within a 'Tertiary Zone' for mineral extraction, defined in the Minerals Topic Paper⁶ as '*smaller areas of thin coal*', sub-crop at the southern extent of the Site. Mine entries are recorded in the Coal Authority Report¹ in the far south of Central Site; however previous investigations and earthworks cut which extended into bedrock across this area have found no evidence of mining features.

Geological SSSI and Local Geological Sites

- 8.3.11. There are no geological SSSI or Local Geological Sites (LGS) on the Site or in the surrounding area.

Hydrogeology

- 8.3.12. Natural Resources Wales (NRW) classifies Till (Diamicton) as a Secondary (Undifferentiated) Aquifer, and the Pennant Sandstone Formation as a Secondary A Aquifer. Peat is classified as Unproductive Strata⁷.

- 8.3.13. The Site is not located in a groundwater source protection zone.

Hydrology

- 8.3.14. South Site Reservoir is located in the west of the Site. Tal-y-fedw stream is present immediately north of South Site Reservoir and flows into Crymlyn Bog, a designated SSSI, located directly to the west of the Site. North Site Reservoir is located directly to the north of the Site. A series of lagoons forming a wetland area is located in the far south west of the Site, to the south of Crymlyn Tip. Various other informal ditches and drainage channels are present across the Site.

- 8.3.15. The Tennant Canal is located 680m to the east of the Site, and the River Neath lies approximately 880m to the east of the Site.

Ecological Receptors

- 8.3.16. Crymlyn Bog is a SSSI of international significance, Special Area of Conservation and Ramsar site, located directly to the west of the Site. It is understood that recharge of Crymlyn Bog includes surface water and groundwater from the Site.

Potentially Contaminative Land Uses

- 8.3.17. The Site is located at the former BP Llandarcy Oil Refinery which commenced operation in 1921. The purpose of the refinery was to produce motor spirit, kerosene, gas fuel oil, fuel residue and lubricating oil and wax from imported crude oil. Between the wars, the oil industry developed rapidly and by 1939,

⁶ Neath Port Talbot County Borough Council Local Development Plan 2011-2026 Minerals Topic Paper August 2013

⁷https://maps.cyfoethnaturiolcymru.gov.uk/Html5Viewer210/Index.html?configBase=https://maps.cyfoethnaturiolcymru.gov.uk/Geocortex/Essentials/REST/sites/External_Map_Browser/viewers/EMB_Address/virtualdirectory/Resources/Config/Default&locale=en-gb

the refinery had undergone significant development and expansion. In the mid-1980s a number of rationalisations occurred and the closure of the refinery was announced in 1997.

- 8.3.18. During operation of the oil refinery the Site was formally occupied by a range of storage and process infrastructure. A tankfarm for the storage of intermediate and finished products and recovered oil was located to the north of the railway cutting. Fields located in the eastern portion of North Site have never been developed and are currently used for occasional grazing of horses. Central Site was formally occupied by various infrastructure including lube oil and gasoline barrelling plants, kerosene treatment area, the DiMe plant, dewaxing plants, a sulphur recovery unit, a bitumen plant, crude distillation plants, catalytic reformers, and associated aboveground and buried pipework, electricity substations, boiler houses and workshops. Following rationalisation and closure of the oil refinery, demolition of above ground infrastructure was largely complete by 2008.
- 8.3.19. Crymlyn Tip is located in the far south west of the Site, beyond and down-hydraulic gradient of the main area of Proposed Development in an area of proposed ecological mitigation. The Tip was used during operation of the oil refinery for the disposal of a range of wastes including asbestos, boiler cleanings, sludges, bitumens and waxes, ion exchanges resin, spent clay, pyrophoric material and contaminated debris. Work is ongoing to remediate the landfill and ultimately surrender the Environmental Permit. The Tip is not destined for development.
- 8.3.20. The Contractors Yard is located in the far south east of the Site, beyond and down-hydraulic gradient of the main area of Proposed Development. This area of the Site includes various commercial and light industrial units and areas of open storage. Material stockpiles are present in the north and west of the Contractors Yard and plant is currently stored in the southern portion. It is understood that the Contractors Yard will remain in its current use.
- 8.3.21. Following transfer of the Site to St. Modwen Developments, phases of ground investigation and characterisation of soil and groundwater contamination have been undertaken at the Site and in the locations of the Proposed Development. Further details are provided in the Phase 1 geo-environmental desk study, included in Appendix 8.1.
- 8.3.22. Localised remediation has also been undertaken to target and remove identified sources of gross contamination, together with implementation of a series of remedial measures at Site boundaries to mitigate the risk of off-site migration of mobile contamination. Remediation standards protective of human health were set within a Section 106 Agreement for the original Coed Darcy development. Areas of the Site underwent remediation to address potentially unacceptable risks to human health to either residential, commercial or public open space standards.
- 8.3.23. Following the first stages of remediation, residual contamination at the Site was noted to include petroleum hydrocarbons, polycyclic aromatic hydrocarbons, asbestos and chlorinated solvents, and to a lesser extent metals. Based on the developable areas proposed as part of this outline planning application and the development ground levels, further stages of remediation and risk management are likely to be required in some areas, together with risk assessment for controlled waters.

Radon

- 8.3.24. The Landmark Envirocheck Report included in the desk study indicates that generally the Site lies within a lower probability radon area as 1% of homes are estimated to be at or above the Action Level. Adjacent areas appear to lie in an intermediate probability radon area meaning that 3 to 5% of home are estimated to be at or above the Action Level. No radon protection measures are necessary in the construction of new dwellings or extensions in lower probability areas.

Unexploded Ordnance

- 8.3.25. An unexploded ordnance (UXO) risk assessment carried out for the former oil refinery concluded that although the refinery would have been a primary target and is known to have been hit, bomb strikes are likely to have been accurately recorded because of the nature of its operations. However, the potential for UXO at the Site cannot be ruled out.

Sensitive Receptors

- 8.3.26. The current ground conditions at the Site comprising the topography, soil condition and ground stability have the potential to affect and be affected by the Proposed Development. There is assessed to be a medium to low sensitivity associated with ground stability at the Site, a medium sensitivity associated with soil condition, and a low sensitivity associated with topography.
- 8.3.27. The aggregates safeguarding area for sandstone which encroaches on the Site is classified as a Category 1 resource of national importance in Wales⁵. Coal seams sub-cropping at the southern extent of the Site are located in a tertiary resource area for opencast coal mining with no associated Mineral Safeguarding Area. Geology as a valuable resource is assessed to be of overall medium sensitivity.
- 8.3.28. The identified receptors associated with ground contamination and soil reuse and waste soil arisings, and their respective sensitivities are summarised in Table 8.3.

Table 8.3 – Identified Receptors Relevant to Contamination

Receptor Type	Description	Sensitivity
Human	Future on-site and current off-site residents	High
	Current and future workers in on-site and off-site commercial properties	Medium
	Members of the public using future on-site and current off-site areas of open space	Medium
	Construction and maintenance workers	Medium
Controlled Waters	Groundwater in Secondary A Aquifer and Secondary (Undifferentiated) Aquifer	Medium
	Surface water in South Site Reservoir, Tal-y-Fedw, wetland lagoons, North Site Reservoir, Tennant Canal and River Neath	Medium
Controlled Waters and Ecological	Surface water in Crymlyn Bog	High
Property	Current and future on-site buildings, foundations and services	Medium
	Current and future off-site buildings, foundations and services	Medium

8.3.29. Construction and maintenance workers are not considered as a further receptor for the purposes of this chapter because the impact assessment relates to long-term (chronic) exposure to contamination rather than short-term (acute) exposure which is characteristic of these types of receptor.

8.3.30. The baseline conceptual site model (CSM) is presented in Appendix 8.4.

8.4. Inherent design mitigation

8.4.1. No inherent design mitigation has been identified for the soils, hydrogeology and ground conditions chapter. Further details on mitigation are included in section 8.6 – additional mitigation, compensation and enhancement.

8.5. Potential environmental impacts & effects

Physical Effects of the Proposed Development

Construction

8.5.1. Topography of the Site is varied, and changes to the topography are proposed to prepare development plots at the Site. There is considered to be a low sensitivity associated with topography, and the impact magnitude during construction is assessed as negligible. The effects associated with topography during construction of the Proposed Development are assessed to be of permanent **neutral** significance.

8.5.2. There is at most a very low potential for ground stability hazards associated with collapsible ground, running sand and shrinking or swelling clay at the Site based on the Envirocheck Report. There is no potential for ground dissolution hazards at the Site. With a low sensitivity, and an impact magnitude assessed as negligible, the effects associated with collapsible ground, running sand, shrinking or swelling clay and ground dissolution during construction of the Proposed Development are assessed to be of permanent **neutral** significance.

8.5.3. The Envirocheck Report indicates that in localised areas of the Site there is a high potential for compressible ground hazards. There is considered to be a medium site sensitivity associated with compressible ground hazards. The areas of the Site in question are beyond the areas proposed for development and the magnitude of impact is assessed to be negligible. Therefore the effects during construction associated with compressible ground are assessed to be of permanent **neutral** significance.

8.5.4. In localised areas of the Site the Envirocheck Report indicates that there is a moderate potential for landslide hazards. There is considered to be a medium Site sensitivity associated with landslide hazards. Construction will include completion of the earthworks needed to prepare development plateaus at the site. This will mean that where areas of residential and commercial development coincide with steep topography where landslides may occur, the earthworks will render the topography suitable for subsequent construction. The magnitude of impact during construction is assessed to be negligible. The effects during construction associated with landslide hazard potential are assessed to be of permanent **neutral** significance.

- 8.5.5. Coal seams sub-cropping at the southern extent of the Site are recorded to have historically been worked and mine entries may be located in the south of the Site in an area of residential development, although no evidence of these has been encountered during intrusive investigation and earthworks. The main workings are therefore assumed to be beyond the area of the Proposed Development. Further information is provided in the coal mining risk assessment, included as part of the desk study in Appendix 8.1. There is considered to be a low Site sensitivity associated with mining instability and without mitigation, the magnitude of impact is assessed as low negative. Therefore the effects from construction associated with mining instability are assessed to be of permanent **minor adverse** significance.
- 8.5.6. The Site is known to have been bombed and the potential presence of UXO cannot be ruled out. There is considered to be a low Site sensitivity in relation to physical effects associated with UXO. Without mitigation, the magnitude of impact of construction of the Proposed Development is assessed to be low negative. Therefore, the physical effects associated with UXO during construction of the Proposed Development are predicted to be of temporary **minor adverse** significance.
- 8.5.7. Without mitigation, it is considered likely that soil erosion and compaction will occur during construction. The sensitivity of the Site in relation to soil erosion and compaction is considered to be medium, and the magnitude of impact during construction of the Proposed Development is assessed to be medium negative. There is therefore predicted to be an effect of permanent **moderate adverse** significance. This is assessed as a significant effect.

Operation

- 8.5.8. Impacts relating to physical effects are considered to predominantly relate to the construction phase of the Proposed Development and impacts on topography, ground stability and UXO during operation are therefore negligible and the effects of permanent **neutral** significance.
- 8.5.9. Earthworks will have been completed during construction to prepare development plateaus at the Site. The magnitude of impact during operation associated with landslide hazards is therefore assessed as negligible and the effects of permanent **neutral** significance.
- 8.5.10. During the operation phase the magnitude of impact associated with potential mining instability without mitigation is assessed to be low negative and the effects of permanent **minor adverse** significance.
- 8.5.11. With placement and maintenance of vegetation in areas of soft landscaping and the presence of hardstanding and buildings as part of the Proposed Development, the magnitude of impact during operation of the Proposed Development on soil erosion and compaction is considered to be medium positive. The sensitivity of the Site in relation to soil erosion and compaction is assessed to be medium and the effects of permanent **moderate beneficial** significance. This is assessed as a significant effect.

Effects on Geology as a Valuable Resource

Construction and Operation

- 8.5.12. A Category 1 Aggregates Safeguarding Area for sandstone encroaches on the north eastern, north western and south western areas of the Site and extends regionally a significant distance to the east and north west beyond the Site boundary. The Proposed Development would result in minor sterilisation

of this category 1 aggregates safeguarding area. Earthworks cut is required as part of the Proposed Development which is anticipated to generate approximately 150,000m³ surplus sandstone bedrock from outside of the aggregates safeguarding area.

- 8.5.13. Coal seams located in a tertiary resource area for opencast coal mining sub-crop at the southern extent of the Site. The coal seams in this area are understood to have historically been worked. They are relatively thin and are located within 500m of an existing residential development which means that coal working will generally not be acceptable⁶. It is therefore considered unlikely to be practicable or viable for prior extraction of coal to be completed in advance of the Proposed Development.
- 8.5.14. The sensitivity of geology as a valuable resource is considered to be medium. The magnitude of impact of the Proposed Development is considered to be low and the overall effect of construction and operation of the Proposed Development on geology as a valuable resource is assessed to be of permanent **minor adverse** significance.

Effects Associated with Contamination, Reuse of Soil, Generation of Waste Soil Arisings

Construction

- 8.5.15. Without mitigation, construction of the Proposed Development has the potential to:
- disturb and mobilise existing/residual soil and groundwater contamination, for example via generation of soil-derived dust and run-off from stockpiles and open excavations.
 - create new migration pathways between sources of contamination and receptors, for example during foundation works and service installation;
 - introduce new sources of contamination such as fuels and oils associated with mechanical plant which may be released to ground via spills or leaks; and
 - generate soil arisings which may not be suitable for reuse within the Proposed Development or for which there may be no scope for reuse.
- 8.5.16. The construction phase impact assessment for contamination has been undertaken by comparing the baseline risks associated with contamination to the predicted risks during construction of the Proposed Development. The construction phase CSM, risk assessment and impact assessment are presented in Appendix 8.4.
- 8.5.17. The sensitivity of identified receptors ranges from medium to high.
- 8.5.18. Without mitigation and with reference to the risk assessment in Appendix 8.4, the predicted magnitude of construction impacts on on-Site and off-Site human receptors and surface water in Crymlyn Bog SSSI are medium negative and the associated effects are of temporary **moderate adverse** significance. These are assessed as significant effects.

8.5.19. Without mitigation and with reference to the risk assessment in Appendix 8.4, the predicted magnitude of construction impacts on groundwater, surface water and on-Site property are low negative and the associated effects are of temporary **minor adverse** significance.

8.5.20. Without mitigation and with reference to the risk assessment in Appendix 8.4, the predicted magnitude of construction impacts on off-Site property is negligible and the associated effects are of temporary **neutral** significance.

Operation

8.5.21. The Proposed Development will be characterised by building cover and external hardstanding such as roads, pavements, residential driveways and yard areas of commercial properties, and areas of soft landscaping and woodland. This will reduce the potential for surface water infiltration and mobilisation of residual contamination at the Site compared to current baseline conditions. It will also minimise the potential for generation of soil-derived dust and for users of the Proposed Development to come into contact with residual contamination.

8.5.22. The Proposed Development will introduce new human receptors that are not present at baseline.

8.5.23. The operation phase impact assessment for contamination has been undertaken by comparing the baseline risks associated with contamination to the predicted risks during operation. The operation phase CSM, risk assessment and impact assessment are presented in Appendix 8.4.

8.5.24. The sensitivity of identified receptors ranges from medium to high.

8.5.25. Without mitigation and with reference to the risk assessment in Appendix 8.4, the predicted magnitude of operation impacts on on-Site human receptors is medium negative and the associated effects are of permanent **moderate adverse** significance. These are assessed as significant effects.

8.5.26. Without mitigation and with reference to the risk assessment in Appendix 8.4, there are predicted to be no improvements in the risks to off-Site human receptors, groundwater, surface water, on-Site property and off-Site property from contamination by the time of operation, and the predicted magnitude of operation impacts on these receptors are negligible and the associated effects are of permanent **neutral** significance.

8.6. Additional mitigation, compensation & enhancement measures

8.6.1. Additional mitigation measures will be implemented to reduce the identified impacts and effects.

Detailed Design

8.6.2. Supplementary ground investigation, gas monitoring, groundwater sampling and vapour sampling, if required, will be undertaken in accordance with BS5930:2015+A1:2020, BS10175:2011+A2:2017 to establish the contaminant regime at the Site. The scope of investigative works will be agreed with the Local Authority Environmental Health Officer and NRW.

- 8.6.3. Detailed quantitative risk assessment for controlled waters will be completed for the areas of Proposed Development within the Site to establish if unacceptable risks are present which require remediation.
- 8.6.4. Site assessment criteria will be derived for human health to inform the assessment of laboratory analytical data for in situ soils and for use in the validation of remediation.
- 8.6.5. Where exceedances of site assessment criteria indicate the presence of potentially unacceptable risks, remediation in the form of hotspot removal and/or installation of vapour membranes may be required, followed by suitable verification.
- 8.6.6. Ground gas risk assessment will be carried out using monitoring data to identify the Characteristic Situation and to determine the potential requirement for gas protection measures within properties.
- 8.6.7. Ground investigation will also be used in the proposed areas of development to confirm the published and recorded geological sequence, to characterise the geotechnical and engineering properties of the ground and to identify ground stability or ground engineering constraints which need to be considered in the design of the Proposed Development e.g. to inform suitable foundation solutions.
- 8.6.8. Mine abandonment plans will be reviewed to further refine the coal mining risk assessment. As recommended by the Coal Authority in the coal mining report, a Surface Hazard Incident report will be obtained to provide further information on remedial works. Should uncertainties remain following review of the mine abandonment plans and Surface Hazard Incident report, and if substantial changes in current ground level are required as part of the Proposed Development, additional ground investigation will be undertaken to provide the information required to fully characterise and mitigate residual risks. Coal Authority permission will be sought for intrusive investigation in Coal Measures strata.
- 8.6.9. The generation of soil arisings will be minimised. Reuse of soils will be maximised and informed by the findings of the ground investigation.
- 8.6.10. The design of Sustainable Drainage System (SuDS) features will seek to minimise the risk of mobilising residual soil and groundwater contamination at the Site and will incorporate the requirement for lining where residual contamination is anticipated.
- 8.6.11. It is assumed that the necessary ground investigation, human health risk assessment, controlled waters risk assessment and remediation of legacy soil and/or groundwater contamination from historical use of the Site as an oil refinery will be carried out to support the discharge of relevant planning conditions, in accordance with the scoping opinion from NRW and NPTCBC outlined in Table 8.1. Detailed design of the Proposed Development will minimise the potential effects of contamination so that no unacceptable risks remain, and maximise the potential for reuse of soils within the Proposed Development whilst minimising the generation of waste soil arisings.

Construction

- 8.6.12. The earthworks phase of construction will include the completion of all required remediation and verification, such as source removal of contamination hotspots. The installation of any required gas/vapour protection measures and clean cover soils will be completed and verified as part of the build phase of construction.

- 8.6.13. The necessary environmental permit(s) will be obtained to enable remediation, such as ex situ soil bioremediation, to be completed.
- 8.6.14. Should treatment of coal mining legacy features be required to mitigate ground stability hazards, this will be carried out during the construction phase.
- 8.6.15. The earthworks required to prepare development plateaus will include both cut and fill. There is anticipated to be circa 150,000m³ surplus rock generated from outside the aggregates safeguarding area as part of the earthworks. The same bedrock formation is present across the Site and there will therefore be some prior extraction of the aggregate resource in advance of the build phase of construction, albeit not from the area of safeguarding.
- 8.6.16. Earthworks to prepare development plateaus will be completed and validated in accordance with a suitable specification to achieve the required design parameters, such as Series 600 of the Specification for Highway Works.
- 8.6.17. Consideration will be given to the potential for drainage features to be formed early in the construction phase to aid in the management of surface water runoff.
- 8.6.18. A CEMP has been prepared for the Proposed Development to set out the comprehensive mitigation measures to be implemented during construction to reduce the potential risks to identified receptors. It is anticipated that the CEMP will include, but not be limited to, the following requirements which relate to contamination and physical effects:
- Preparation of a materials management strategy;
 - Preparation of a protocol to be followed in the event that unexpected contamination is encountered during construction;
 - Programming of earthworks to avoid periods of inclement weather, as far as possible, to reduce the potential for erosion of soils and an increase in surface water run-off with a high sediment load;
 - Use of sediment management systems at or up-gradient of surface water outfalls from the Site, if required;
 - Careful stripping and storing of topsoil, where present, away from working area to ensure the structure and integrity of the topsoil resource is preserved;
 - Limiting the duration of soil exposure and reinstating vegetation or hardstanding in a timely manner to minimise soil erosion;
 - Practicing good stockpile management, such as sealing to prevent deterioration of soils and to minimise the potential for generation of soil-derived dust;
 - Use of dust suppression across areas of bare ground in dry and/or windy weather conditions;

- Establishing a regime of environmental monitoring which is appropriate for potential nuisance issues, such as dust, vapours and odour and setting threshold/trigger levels for further action to be taken;
- Completion of risk assessments required under the Control of Substances Hazardous to Health (COSHH) Regulations 2002 to determine the necessary Personal Protective Equipment for construction workers;
- Establishing a designated bunded re-fuelling area on hardstanding to reduce the potential for release of contaminants to ground and surface water in the event of a leak or spill;
- Ensuring potentially polluting substances required during construction are stored in bunded containers away from surface waters;
- Deployment of drip trays and spill kits with mechanical plant in use around the Site to reduce the potential for release of contaminants to ground and surface water in the event of a leak or spill.

8.6.19. Any required mitigation in relation to UXO, such as a watching brief, will be implemented during the construction phase to enable works required for the Proposed Development to proceed safely.

8.6.20. Where required, foundation works risk assessments will be completed prior to the commencement of the build phase of construction works to determine the potential risks to controlled waters from possible foundation solutions.

8.6.21. Basic radon protection measures will be incorporated into residential properties, where identified as necessary.

8.6.22. A clean cover system will be included in all areas of the development, the thickness of which will be dependent on the nature of the proposed end use. Import of soils is likely to be required to the Site for use in clean cover systems.

8.6.23. Depending on the findings of ground investigation and risk assessment that will be carried out in the next stages of the planning process, and the requirement to satisfy relevant planning conditions, it may be necessary for longer term monitoring, such as gas monitoring or groundwater monitoring, to be carried out at the Site as a precautionary measure rather than as specific mitigation.

8.6.24. It is assumed that all necessary additional mitigation will have been implemented prior to operation of the Proposed Development and no additional mitigation measures relevant to the operation phase have been identified.

8.6.25. No construction or operation mitigation measures are proposed in relation to changes in topography, collapsible ground, running sand, shrinking or swelling clay, compressible ground, geology as a valuable resource.

8.6.26. No compensation or enhancement measures have been identified.

8.7. Residual environment impacts & effects

8.7.1. Residual effects are those remaining after the additional mitigation has been implemented.

Construction

8.7.2. The impact magnitude associated with topography, collapsible ground, running sand, shrinking or swelling clay, ground dissolution and compressible ground during construction is assessed as negligible. The associated effects during construction of the Proposed Development are predicted to be of permanent **neutral** significance.

8.7.3. With additional mitigation in the form of earthworks completed and validated to an appropriate specification, the magnitude of impact during construction associated with landslide hazard is assessed to be low positive. The effects during construction associated with landslide hazard potential are predicted to be of permanent **minor beneficial** significance.

8.7.4. With additional mitigation, the magnitude of impact during construction associated with coal mining instability is assessed to be negligible with effects of permanent **neutral** significance.

8.7.5. With additional mitigation, the magnitude of impact associated with UXO during construction is assessed as negligible with effects of temporary **neutral** significance.

8.7.6. With the implementation of additional mitigation, the magnitude of impact during construction on soil erosion and compaction is assessed to be low negative. The associated residual effects are predicted to be of permanent **minor adverse** significance.

8.7.7. The magnitude of impact of the Proposed Development on geology as a valuable resource is assessed to be low negative and the overall effect of the Proposed Development is predicted to be of permanent **minor adverse** significance.

8.7.8. With implementation of additional mitigation, the magnitude of impact on on-Site and off-Site human receptors, groundwater, surface water, on-Site property and off-Site property from contamination during construction of the Proposed Development is predicted to be very low negative or negligible and the residual effects of temporary **neutral** significance.

Operation

8.7.9. Impacts relating to physical effects are considered to predominantly relate to the construction phase of the Proposed Development and impacts on topography, ground stability and UXO during operation are therefore predicted to be negligible and the effects of permanent **neutral** significance.

8.7.10. Earthworks will have been completed and validated to an appropriate specification during construction to prepare development plateaus at the Site. The magnitude of impact during operation associated with landslide hazards is therefore assessed as low positive and the effects of permanent **minor beneficial** significance.

- 8.7.11. With additional mitigation carried out as part of the construction phase, the magnitude of impact during operation associated with coal mining instability is assessed to be negligible with effects of permanent **neutral** significance.
- 8.7.12. The magnitude of impact during operation of the Proposed Development on soil erosion and compaction is assessed to be medium positive. Residual effects are predicted of permanent **moderate beneficial** significance. This is assessed as a significant effect.
- 8.7.13. With implementation of additional mitigation, the magnitude of impact on groundwater from contamination is predicted to be medium positive and the residual effects of **moderate beneficial** significance. This is assessed as a significant effect.
- 8.7.14. With implementation of additional mitigation, the magnitude of impact on on-Site and off-Site human receptors, surface waters, on-Site property and off-Site property receptors from contamination is predicted to range from low positive to negligible and the residual effects of **minor beneficial** to **neutral** significance.

8.8. Assessment summary

- 8.8.1. This chapter of the ES has considered the potential for significant effects as a result of the Proposed Development associated with changes in ground stability and soil erosion, effects on geology as a valuable resource, effects associated with existing soil and groundwater contamination, effects associated with the introduction of new contaminative substances and/or migration pathways and effects associated with re-use of soils and generation of waste soils.
- 8.8.2. Without mitigation, construction of the Proposed Development may result in effects of neutral to moderate adverse significance. Significant adverse effects are predicted during construction without mitigation associated with soil erosion and compaction, and risks from contamination to on-Site and off-Site human receptors and surface water in Crymlyn Bog SSSI.
- 8.8.3. Without mitigation, the Proposed Development may result in operation effects ranging from moderate adverse to moderate beneficial significance. Significant effects during operation are predicted associated with soil erosion and compaction (moderate beneficial significance) and risks from contamination to on-Site human receptors (moderate adverse significance).
- 8.8.4. With implementation of the additional mitigation presented in Section 8.6.2 to Section 8.6.22, residual effects of minor adverse to minor beneficial significance are predicted during construction of the Proposed Development which are assessed as not significant. Residual effects of neutral to moderate beneficial significance are predicted during operation, with significant beneficial effects associated with a reduction in risks to groundwater from residual contamination.
- 8.8.5. No compensation or enhancement measures have been identified.

Topic	Mitigation measures	Designed into the Proposed Development	Delivery via condition (outline/RM)	Delivery via legal obligation	Paragraph reference in the ES	Proposed Monitoring Arrangement
Topography	None envisaged	N	It is anticipated that a planning condition will be applied that relates to proposed finished development levels.	N	n/a	None proposed
Ground stability	Ground investigation will be undertaken to characterise the geological profile and engineering properties of the underlying soils and bedrock. Mine abandonment plans will be reviewed to further refine the coal mining risk assessment. As recommended by the Coal Authority in the coal mining report, a Surface Hazard Incident report will be obtained to provide further information on remedial works. Should uncertainties remain following review of the mine abandonment plans and Surface Hazard Incident report, and if substantial changes in current ground level are required as part of the Proposed Development, additional ground investigation will be undertaken to provide the information required to fully	N	A planning condition may be applied in relation to confirmation of ground hazards associated with coal mining legacy.	N	8.6.7, 8.6.8, 8.6.14, 8.6.16	Consultant to be appointed by St. Modwen will be responsible for implementation and completion of ground investigation and monitoring of earthworks

Topic	Mitigation measures	Designed into the Proposed Development	Delivery via condition (outline/RM)	Delivery via legal obligation	Paragraph reference in the ES	Proposed Monitoring Arrangement
	characterise and mitigate residual risks. Engineered fill, where required, will be placed and compacted to an appropriate specification.					
Unexploded ordnance	Any required mitigation in relation to UXO, such as a watching brief, will be implemented during the construction phase to enable works required for the Proposed Development to proceed safely.	N	N/A	N	8.6.19	None proposed
Soil erosion and compaction	Implementation of CEMP, programming of earthworks to avoid inclement weather (where possible), use of sediment management systems, good stockpile management	N	It is anticipated that a planning condition will be applied that requires preparation and submission of a CEMP.	N	8.6.17, 8.6.18	Implementation and adherence to CEMP will be monitored by consultant to be appointed by St. Modwen
Geology as a valuable resource	None within the Category 1 Aggregates Safeguarding Area for sandstone. However, surplus bedrock from the same sandstone geological unit will be generated during earthworks. None proposed for coal.	N	N/A	N	8.6.15	None proposed
Contamination, reuse of soil, gas and groundwater generation of waste soil arising	Ground investigation and monitoring will be undertaken to inform human health risk assessment, gas risk	N	It is anticipated that planning conditions will be applied that require completion of	N	8.6.28.6.3, 8.6.4, 8.6.5, 8.6.6, 8.6.9, 8.6.10, 8.6.12,	Consultant to be appointed by St. Modwen will be responsible for implementation and completion of ground

Topic	Mitigation measures	Designed into the Proposed Development	Delivery via condition (outline/RM)	Delivery via legal obligation	Paragraph reference in the ES	Proposed Monitoring Arrangement
	assessment and controlled waters risk assessment and will determine the requirement for remediation and verification to address risks associated with residual contamination. It is anticipated that clean cover soils will be required in gardens and areas of soft landscaping and gas/vapour-resistant membranes may be used in buildings. Foundation works risk assessments will be completed to determine the potential risks to controlled waters from proposed foundation solution(s). Final drainage features will be used to manage surface water runoff during construction, where possible. A CEMP will be prepared and implemented.		ground investigation, risk assessment, a remediation strategy and remediation verification.		8.6.17, 8.6.18, 8.6.20, 8.6.21, 8.6.22	investigation, risk assessment, identification of the requirement for remediation, and monitoring of remediation. Residential and commercial developers will be responsible for completing foundation works risk assessments which will be specific to their foundation solution. Consultant to be appointed by St. Modwen will monitor and verify placement of clean cover soils and installation of gas membranes. Implementation and adherence to CEMP will be monitored by consultant to be appointed by St. Modwen