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## 12 Geology, Hydrogeology and Ground Conditions

### 12.1 Introduction

- 12.1.1 The purpose of this chapter is to provide an understanding of the baseline geology, hydrogeology and ground conditions on and adjoining the Proposed Development.
- 12.1.2 This chapter provides an assessment of the consequence of impact to the geology, hydrogeology and ground conditions as a result of the construction and decommissioning phases of the Proposed Development. No impacts to the geology, hydrogeology and ground conditions will occur during the operation and maintenance phase of the Proposed Development.
- 12.1.3 A description of the Proposed Development is presented within Volume 6.2 Chapter 2.
- 12.1.4 This chapter includes details relating to geology, hydrogeology and ground conditions including designated geological sites, topography and ground stability, superficial and bedrock geology, hydrogeology (groundwater aquifers) and potential historic contamination.
- 12.1.5 The assessment of the consequence of impact considers the possible direct or indirect effects that construction and decommissioning of the Proposed Development could have on geology, hydrogeology and ground conditions; and to set out measures by which these potential impacts can be mitigated or monitored.
- 12.1.6 The Secretary of State (SoS) set out in the scoping opinion his agreement with the conclusions of the scoping report that no consequence of impact to geology, hydrogeology and ground conditions are likely to occur during the operational and maintenance phase. Therefore these aspects have been scoped out from further assessment with the exception of an assessment of the maintenance of underground cables in the vicinity of surface water courses.

- 12.1.7 The hydrology, drainage and flood risk conditions are briefly discussed within this chapter to provide a complete overview, however it is recognised that a detailed assessment of the consequence of impact to hydrology, drainage and flood risk as a result of the Proposed Development has been undertaken and is reported as a separate chapter presented within Volume 6.2 Chapter 13 ‘Hydrology, Drainage and Flood Risk’.
- 12.1.8 An assessment of the consequence of impact to land use, agriculture and forestry (including an impact on soils) is undertaken within a separate chapter presented within Volume 6.2 Chapter 8 ‘Land Use, Agriculture and Forestry’.
- 12.1.9 The following sections of this chapter include:
- a summary of relevant planning policy relating to geology, hydrogeology and ground conditions;
  - a description of the methodology for the assessment of the consequence of impact, including details of the study area and the approach to the assessment;
  - a summary of consultation with relevant stakeholders;
  - a review of baseline (existing) geology, hydrogeology and ground conditions on and adjoining the Proposed Development;
  - details of the measures proposed as part of the Proposed Development to avoid, mitigate or reduce environmental impacts;
  - an assessment of the likely consequence of impact for the construction and decommissioning phases of the Proposed Development, taking into account embedded mitigation measures proposed; and
  - an assessment of any cumulative effects with other proposed developments.

## 12.2 Legislation and policy context

12.2.1 A summary of relevant legislation, criteria and standards as well as national, regional and local policy is included here. Further discussion on policy is provided within Chapter 7 (Volume 6.2).

### National Policy

#### *National Policy Statements*

12.2.2 The Planning Act 2008 requires that when deciding an application the decision-maker must have regard to the relevant National Policy Statement (NPS) (in addition to the local impact report and other matters). NPS provide the primary policy basis for the consideration of Nationally Significant Infrastructure Projects (NSIPs). National Policy Statement EN-1 is the overarching national policy statement for energy whilst National Policy Statement EN-5 is specific to Electricity Networks Infrastructure.

#### *Overarching National Policy Statement for Energy (EN-1)*

12.2.3 Parts 5.3, 5.7, 5.10 and 5.12, provide policy and guidance on geology, hydrogeology and ground conditions.

#### *Geology and Ground Conditions*

12.2.4 Part 5.3 of the NPS states, at paragraph 5.3.3 that “*where development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, ...*” Furthermore it requires the applicant to demonstrate how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.

12.2.5 Such information is included within the scope of the assessment presented within this chapter along with the measures taken to conserve and enhance such geological interests.

- 12.2.6 Paragraph 5.3.8, states that the decision-maker will ensure that appropriate weight is attached to designated sites of international, national and local importance, protected species, habitats and biodiversity and geological interests within the wider environment. This is highlighted further through section 5.3.9 to 5.3.17, which describes the above, their different levels of importance and how the decision-maker should decide on applications which impact different types of sites, species and habitats.
- 12.2.7 In relation to mitigation 5.3.18 states that appropriate mitigation measures should be an integral part of the Proposed Development. This includes ensuring activities are confined to minimum areas and demonstrating during construction and operation that best practice is followed to ensure that the risk of disturbance or damage is minimised.
- 12.2.8 Furthermore, in relation to ground conditions, the NPS states that the applicants should identify any effects and seek to minimise the impacts on soil quality. Paragraph 5.10.8 highlights that applicants should ensure that they have considered the risk posed by land contamination. In relation to mineral resources the NPS states applicants should safeguard any mineral resources and take into account the long-term potential of the land use after any future decommissioning has taken place.

*National Policy Statement for Electricity Networks Infrastructure (EN-5)*

- 12.2.9 The National Policy Statement for Electricity Networks Infrastructure EN-5 provides technology-specific guidance in relation to biodiversity and geological conservation, although Part 2.7 Biodiversity and Geological Conservation does focus primarily on biodiversity. EN-5 requires that in terms of decision making the decision-maker should ensure that issues have been taken into consideration and appropriate mitigation measures taken.

### *Hydrogeology*

- 12.2.10 Section 5.15 of the NPS states, at paragraph 5.15.2 that “where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of and impacts from the proposed development on water quality, water resources and physical characteristics of the water environment.
- 12.2.11 The NPS sets out what an Environmental Statement (ES) should include:
- existing quality of waters affected by the proposed development on water quality and the impact of the proposed development on the water quality, including existing, new and changes to discharges;
  - impacts of the proposed development on water resources, noting relevant existing, new and proposed changes to abstraction rates;
  - existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project and any impact of physical modifications to these characteristics; and
  - impacts of the proposed project on water bodies or protected areas under the Water Framework Directive and source protection zones (SPZs) around potable groundwater abstractions.
- 12.2.12 The hydrogeological implications of the above are considered within this chapter, with the impact related to hydrology, drainage and flood risk reported in Chapter 13 Hydrology, Drainage and Flood Risk (Volume 6.2).
- 12.2.13 Paragraph 5.15.6 states that decision makers ensure that the proposed development has regard to River Basin Management Plans and meets the requirements of the Water Framework Directive (including Article 4.7) and its daughter directives, including those on priority substances and groundwater.
- 12.2.14 In relation to mitigation, paragraph 5.15.8 states that the decision maker should consider whether mitigation measures are needed over and above any which may

form part of the project application.

*Other Planning Policy*

12.2.15 Whilst the NPS provide the primary basis for the determination of applications for development consent, the decision-maker can consider other matters which it considers both important and relevant to its decisions. These may include other national and local planning policy

*Wales Spatial Plan Update 2008*

12.2.16 The Wales Spatial Plan sets out national cross-cutting national spatial priorities and identifies six sub-regions within Wales. Under the topic, ‘Valuing our Environment’ a number of environmental challenges are presented. The Proposed development sits at the eastern edge of the Pembroke – The Haven sub-region.

*Planning Policy Wales (ed7) (July 2014)*

12.2.17 Planning Policy Wales (PPW) contains guidance considered relevant to the scope of the environmental assessment. PPW is supported by a number of Technical Advice Notes (TANs).

12.2.18 Paragraph 5.1.2 sets out the Welsh Government’s objectives for the conservation and improvement of the natural heritage, which includes geology, landforms and biodiversity and Wales’ natural beauty and amenity:

- *“promote the conservation of landscape and biodiversity, in particular the conservation of native wildlife and habitats;*
- *ensure that action in Wales contributes to meeting international responsibilities and obligations for the natural environment;*
- *ensure that statutorily designated sites are properly protected and managed;*
- *safeguard protected species, and to*
- *promote the functions and benefits of soils, and in particular their function as a carbon store.”*

- 12.2.19 Welsh Government states that it is a key role of the planning system to ensure that society’s land requirements are met, whilst all reasonable steps are taken to safeguard or enhance the environment. PPW highlights that there could be issues, which could be minimised, but also there are new opportunities for sustainable development.
- 12.2.20 Section 5.5 refers specifically to development management and the conservation and improvement of the natural heritage. It also states that it is important to ensure all reasonable steps are taken to safeguard or enhance environmental quality of the land.
- 12.2.21 Section 13.10 of PPW highlights the need to improve water and air quality. Paragraph 13.10.1 states that “*The planning system should determine whether a development is an acceptable use of land and should control other development in proximity to potential sources of pollution rather than seeking to control the processes or substances used in any particular development*”.
- 12.2.22 Section 13.12 considers development management and improvements to the quality of water and air. It states that pollution affecting the use of land will be a material consideration and will include location, impact on health and amenity, risk to the surrounding environment, prevention of nuisance, impact on the transport network and the need, where relevant, and feasibility of restoring the land to a standard sufficient for an appropriate use.

*Technical Advice Notes*

*Technical Advice Notes 5: Nature Conservation and Planning (2009)*

- 12.2.23 Technical Advice Note (TAN) 5 provides advice on how the land use planning system should contribute to protecting and enhancing biodiversity and geological conservation.
- 12.2.24 The TAN provides advice for local planning authorities on matters including:
- the key principles of positive planning for nature conservation;

- nature conservation in development management procedures;
- development affecting protected internationally and nationally designated sites and habitats; and
- development affecting protected and priority habitats and species.

12.2.25 Matters listed for possible consideration within PPW and TAN 5, relevant to geological conservation have been included within the scope of the assessment presented within this chapter.

### **Local Policy**

- 12.2.26 NSIPs are not subject to s38(6) of the Planning and Compulsory Purchase Act (2004), which states that determination of planning consent should be in accordance with the local development plan. Local planning policy does not therefore set the tests for the acceptability of NSIPs. However, as previously noted the decision-maker can consider other matters which it considers both important and relevant to its decisions. These matters may include local planning policy.
- 12.2.27 The Proposed Development falls wholly within the boundary of Carmarthenshire County Council (CCC). As such, due consideration has also been given to the relevant policies in the Carmarthenshire Local Development Plan (LDP). Those policies which are considered relevant to the scope of this chapter are listed below and they are summarised in Appendix 7.1 of this ES.

#### *Carmarthenshire Local Development Plan (December 2014)*

12.2.28 The relevant policies are listed below:

- SP1 - Sustainable Places and Spaces;
- SP14 - Protection and Enhancement of the Natural Environment;
- GP1 - Sustainability and High Quality Design;

- EQ3 - Regional and Local Designations;
- EQ4 - Biodiversity; and
- EP1 - Water Quality and Resources.

12.2.29 Local plan policy is consistent with national planning policy in that it provides specific protection geology and the water environment (CLDP EQ3 and EP1).

### **Policy Conclusions**

12.2.30 The Planning Act 2008 requires that the decision-maker must decide an application for energy infrastructure in accordance with the relevant NPSs. NPS EN-1 provides policy and guidance on matters pertaining to the environment and as such has informed both the scope of this chapter and the importance accorded to receptors. The decision-maker may also take into account other matters; these may include national and local planning policy. Relevant national and local planning policy has been reviewed and has informed the scope of the assessment presented within this chapter.

**Table 12.1 – Mineral Policy**

<b>Policy name</b>	<b>Key provisions</b>	<b>Section where comment addressed</b>
Minerals Planning Policy Wales (MPPW) (December 2000)	Sets out the land use planning policy guidance of the Welsh Government in relation to mineral extraction and related development in Wales, which includes all minerals and substances in, on or under land extracted either by underground or surface working.	There are no identified extant mineral planning consents or sites with active mineral extraction close to the Proposed Development, therefore assessment of this has been scoped out as agreed by the SoS.
Minerals Technical Advice Note (MTAN) 1: Aggregates	Sets out detailed advice on the mechanisms for delivering the policy for aggregates extraction by mineral planning authorities and the aggregates industry.	There are no identified extant mineral planning consents or sites with active mineral extraction close to the Proposed Development, therefore assessment of this has been scoped out.

12.2.31 Relevant national and local planning policy has been reviewed and has informed the scope of the assessment presented within this chapter. This chapter has taken into account the provisions of these policies by identifying geology, hydrogeology and ground conditions features (including sites with potential contamination legacies), potential contaminant migration pathways and sensitive receptors within or within close proximity to the Proposed Development. This includes for instance designated geological sites, sites known to be contaminated or with the potential to be contaminated (through historic land use) and aquifer designations and sensitive groundwater resources.

12.2.32 These are further described within section 12.4 of this chapter.

12.2.33 In addition to the national and local policies the guidance documents presented in Table 12.2 have also been taken into account when undertaking the assessment.

**Table 12.2 – Policy and guidance**

<b>Policy name</b>	<b>Key provisions</b>	<b>Section where comment addressed</b>
Natural Resources Wales (NRW), formerly the Countryside Council of Wales (CCW), Assessing the impact of wind farm developments on peatlands in Wales (January 2010)	Guidance for the development close to peat resources.	Mitigation to be protective of peat resources is presented within section 12.9 of this chapter.
NRW formerly the Environment Agency Wales (EAW), Pollution Prevention Guidance (PPGs)	Pollution prevention guidance for a range of activities during construction and decommissioning phases.	Mitigation measures to be protective of the environment are presented within section 12.9 of this chapter.
Construction industry research and information association (CIRIA) 113 Control of Groundwater for Temporary Works, 1988	Guidance for the control of groundwater during construction works.	Mitigation measures to be protective of groundwater resources are presented within section 12.9 of this chapter.
CIRIA 630 Sustainable water management in land use planning, 2006	Guidance on how water related issues may be considered within the land use planning process.	Mitigation measures to be protective of groundwater resources are presented within section 12.9 of this chapter.
CIRIA 692 Environmental Good Practice on Site, 2011	Construction activities have the potential to affect the surrounding environment including neighbours as well as the wider environment.	Assessment of environmental impacts undertaken within section 12.6 and 12.8 of this chapter.
British Standards Institution (2011), 'BS 10175:2011. Investigation of potentially contaminated sites: Code of practice'	Methodology for undertaking appropriate ground investigations for sites with contamination legacies.	Requirement for site investigation presented within section 12.9 of this chapter.

<b>Policy name</b>	<b>Key provisions</b>	<b>Section where comment addressed</b>
Environment Agency (2004a), Model Procedures for the Management of Contaminated Land. Contaminated Land Report Number 11 (CLR11), September 2004 (Bristol: Environment Agency)	Provides a framework for investigating, assessing and remediating contaminated land.	Requirement for site investigation presented within section 12.9 of this chapter.
Environment Agency (2010a), 'GPLC1 – Guiding Principles of Land Contamination', 'GPLC2 – Frequently Asked Questions, Technical Information, Detailed Advice and References', and 'GPLC3 – Reporting Checklists', all March 2010.	The EA guiding principles are their generic guidance for dealing with contaminated land. The principles describe what the EA consider to be good practice.	Requirement for site investigation presented within section 12.9 of this chapter.

### **12.3 Consultation and scoping overview**

- 12.3.1 As part of the scoping phase of the Environmental Impact Assessment (EIA), WPD prepared a scoping report (July 2014) setting out the proposed approach to EIA in respect of the Proposed Development, including the identification of assessment methods for each EIA topic (geology, hydrogeology and ground conditions) to be assessed.
- 12.3.2 The Secretary of State's scoping opinion was received in August 2014. A summary of the main scoping opinion representations received in relation to geology, hydrogeology and ground conditions is presented within Table 12.3, together with a summary of other relevant consultation completed.

**Table 12.3 – Summary of consultation relating to geology, hydrogeology and ground conditions**

<b>Date and consultation phase/type</b>	<b>Consultation and issue raised</b>	<b>Section where comment addressed</b>
Scoping opinion, paragraph 3.28	Advised that the SoS agreed that the aspects of mineral extraction, active or permitted, in relation to the Proposed Development, could be scoped out. This is owing to the absence of extant permissions for mineral extraction or active mineral sites along the Proposed Development, as identified in British Geological Survey (BGS) records or Local Development Plans.	Section 12.5 of this chapter provides baseline information relating to the absence of mineral resource close to the Proposed Development. Owing to the absence of extant permissions for mineral extraction or active mineral sites along the Proposed Development, assessment of these has been scoped out.
Scoping opinion, paragraph 3.29	Advised that the SoS agreed that impacts of the operational and maintenance phases on ground conditions and hydrogeology could be scoped out.	Risks to geology, hydrogeology and ground conditions during the operation and maintenance phase are low and have been scoped out of further assessment.
Scoping opinion, paragraph 3.30	Advised that the SoS did not agree to scope out the preparation of a preliminary risk assessment on ground conditions and hydrogeology.	Inclusion of preliminary risk assessment information has been presented within section 12.5 of this chapter.
Scoping opinion, paragraph 3.30	Advised that the SoS requires assessment of the following potential consequences of impact within the EIA: - the management of unforeseen contamination encountered during the construction or decommissioning phase;	This assessment has been presented within section 12.6 of this chapter.

Date and consultation phase/type	Consultation and issue raised	Section where comment addressed
Scoping opinion, paragraph 3.83	<p>- the direct contamination of soils, surface water or groundwater by accidental import and/or spreading of contaminated material or accidental spillages within the working areas during construction; and</p> <p>- the discharge of liquid wastes and sewage direct to ground and to controlled waters.</p>	<p>Consultation with LPAs and NRW will be undertaken as part of the EIA process.</p>
Scoping opinion, paragraph 3.85	<p>The SoS welcomes the setting out of how the baseline is to be considered within a desk study. The SoS welcomes a qualitative assessment of the likelihood of impact using a risk-based approach.</p>	<p>The baseline environmental setting including details of a site walkover are presented within section 12.5 of this chapter.</p> <p>A qualitative assessment of likelihood has been undertaken, were appropriate, to assess the consequence of impact and is presented within sections 12.4 and 12.5 of this chapter.</p>
Scoping opinion, paragraph 3.86	<p>Any ground investigation would follow the approach described in the Contaminated Land Report CLR11 (EA 2004). This assessment is accepted by the SoS. The SoS recommends consideration of potential</p>	<p>Any ground investigation would follow the approach described in the Contaminated Land Report CLR11 (EA 2004), as presented within section 12.9 of this chapter.</p>

Date and consultation phase/type	Consultation and issue raised	Section where comment addressed
	relationships with other technical chapters such as ecology.	Inter-relationship effects are described within section 12.11 of this chapter.
Scoping opinion, paragraph 3.87	The SoS recommends that the identification of the location of steel pylons, their associated foundation works and the impact of the foundations on sensitive receptors should be considered.	Steel pylons are not proposed as part of the Proposed Development. Wooden poles are buried by 2m to 2.7m depth with the majority not requiring foundations. However it may be necessary (should engineering tests establish that the ground conditions are too soft) to replace the excavated earth with coarse granular material (such as crushed rock), within which the pole can be firmly located. Alternative foundation types may be applied on a site-specific basis as required and depending upon site-specific ground conditions.
Scoping opinion, paragraph 3.88	The SoS recommends that the control of unforeseen contamination, potential for the direct contamination of soils, surface water or accidental spillages and discharge of liquid wastes to ground and controlled waters are assessed for the construction and decommissioning phases.	These potential impacts to ground conditions are presented within section 12.5 and 12.8 of this chapter.
Scoping opinion, paragraph 3.88	During the construction phase, the potential break out of drilling fluids should be	Potential impacts arising during the construction phase as a result of the

Date and consultation phase/type	Consultation and issue raised	Section where comment addressed
	<p>assessed by the ES, especially with regard to potential impacts upon the Afon Tywi SAC and SSSI. Where mitigation is proposed through a Construction Environmental Management Plan (CEMP), details of these should be provided together with evidence as to how these would be secured.</p>	<p>potential break out of drilling fluids has been assessed within section 12.5 of this chapter. Details relating to mitigation measures to prevent the break out of drilling fluids are presented within section 12.9 of this chapter.</p>
<p>Scoping opinion, paragraph 3.89</p>	<p>The SoS recommends that the ES provides consideration of the impacts of maintenance/decommissioning of the underground cable, particularly in the vicinity of the above ground waterbodies.</p>	<p>Assessment of the maintenance and decommissioning of the underground cable is presented within sections 12.7 and 12.8 of this chapter.</p>
<p>CCC response to statutory consultation</p>	<p>...it is noted that contamination could be encountered along the route alignment. There will be a process set out in the CEMP for the proposed development as to how unforeseen contamination, if encountered, will be dealt with, including agreeing a process for agreeing any necessary site investigation, risk assessment and if required remedial measures with relevant regulations.</p>	<p>Detail has been presented in the CEMP (Volume 8.6).</p>
<p>NRW statutory consultation response</p>	<p>We note the content of Chapter 12 and welcome the mitigation measures outlines within paragraph 12.5.37 to 12.5.64.</p>	<p>Noted.</p>
<p>NRW statutory consultation response</p>	<p>We also note the intention to undertake a CEMP. As</p>	<p>The CEMP was submitted to NRW for comment on 3</p>

Date and consultation phase/type	Consultation and issue raised	Section where comment addressed
	highlighted above we would welcome the opportunity to comment on the draft CEMP prior to the submission of the DEC application.	March 2015 and included in Volume 8.6.
CCC statutory consultation response	...it is considered that information stated in this section of the draft ES regarding contamination should be determined to inform the required Habitats Regulation Assessment, The council would also wish to have confirmation of these details prior to the DCO submission.	Site-specific boreholes were undertaken at the River Towy crossing at the proposed underground by HDD and open cut trenching. A summary of encountered geology is presented within the following sections.

## 12.4 Assessment methodology

- 12.4.1 The potential consequence of impact from the construction of the Proposed Development on geology, hydrogeology and ground conditions has been identified based on a detailed understanding of the local geological and regional hydrogeological regimes. This was obtained by carrying out a site walkover visit, and a review of readily available environmental third party information, such as the NRW websites and collation of information obtained from relevant consultees.
- 12.4.2 The collation and review of the available information was used to produce a standalone baseline study for the Proposed Development. This is presented within Volume 6.4, Appendix 12.1.
- 12.4.3 The works boundary is defined as the limits of deviation (LoD) comprising a 25m wide alignment for the Overhead Line (OHL), including a 5m longitudinal LoD for each pole in each direction along the alignment. A 16m wide working corridor (or 8m where crossing a hedgerow) for underground sections (open cut trench) has been assessed, set within a 500m site buffer zone (250m either side of the LoD).

### **Desk-based assessment**

12.4.4 A desk-based geo-environmental study was undertaken to collect baseline data for the study area utilising a radius search buffer of 500m. A 500m buffer was selected, based on professional judgement, considering the context of the Proposed Development and distance over which likely significant effects could occur relating to geology and ground conditions. Owing to potential hydraulic continuity of controlled waters (e.g. groundwater) beyond the buffer zone, potential controlled water receptors (e.g. groundwater abstractions) within a radius of 2km of the buffer zone have also been considered within the assessment.

12.4.5 The desk-based review was undertaken using information from the following data sources:

- mapping including geological maps (both solid and drift geology), hydrogeological maps, and groundwater vulnerability maps;
- publicly available borehole records held by the BGS;
- site-specific boreholes were undertaken by CAT Surveys Group Limited within the underground section at the River Towy crossing;
- an assessment of the environmental sensitivity of the study area, through a review of an environmental database, including the identification of geologically designated sites;
- details of nearby pollution incidents, landfill sites and groundwater SPZs obtained from the NRW; and
- an assessment of BGS minerals data.

### **Site-based assessment**

12.4.6 A walkover survey of the study area was undertaken on 5 and 6 August 2014 to confirm the current status of the study area, surrounding land-use, the potential for contamination from current site activity and to allow identification of any areas of

potential concern. The walkover also assisted in confirming the findings of the desk-based study and to identify any omissions.

- 12.4.7 An updated walkover as a result of subsequent alignment changes was not considered to be necessary. The status of the study area and surrounding land was confirmed during the initial walkover survey.
- 12.4.8 A limited number of intrusive ground investigations (boreholes) have been undertaken at the River Towy crossing. No associated chemical, geotechnical or civil engineering laboratory testing has been undertaken prior to the issue of this ES.

### **Study area**

- 12.4.9 The Proposed Development is shown on Figure 12.1 presented in Volume 6.3 and discussed in detail within Volume 6.2 Chapter 2 ‘Project Description’.
- 12.4.10 The Proposed Development follows a corridor of approximately 28.6km length, commencing approximately 10km south of Carmarthen and 3km east of the Towy estuary, close to Llandyfaelog.
- 12.4.11 The Proposed Development passes east of Carmarthen, crossing the River Towy at approximate National Grid reference (NGR) 243336 220186. North of the River Towy, the Proposed Development proceeds northwards, passing west of Peniel, Rhydargaeau and Pontarsais until reaching the south of Alltwalis before trending east through the Brechfa Forest, north of Llanllawdogg, to the proposed Brechfa Forest West Wind Farm substation.
- 12.4.12 The southern extent of the Proposed Development south of the River Towy, passes through a formerly glaciated area, signified by gently rolling hills created by the harder geological formations and erosion of the glacial deposits.
- 12.4.13 The land use within this southern extent of the route is dominated by agricultural practices, including pasture and arable farming with smaller wooded areas.

- 12.4.14 North of Carmarthen, the general topography increases in height and is dominated by steep hills with sudden changes in local topography. Land use is dominated by upland pasture and highland vegetation. The topography continues to rise to the north towards Brechfa Forest, which is dominated by woodland.
- 12.4.15 Selected photographs taken along the Proposed Development are presented within Annex 2 of Appendix 12.1 presented within Volume 6.4 to give an insight to the landscape that the Proposed Development passes through; particular features and photograph locations are highlighted on Figure 12.3 (Volume 6.3).
- 12.4.16 The potential consequence of impact in relation to geology, hydrogeology and ground conditions including ground contamination and land quality has been assessed using guidance given in the Construction Industry Research and Information Association (CIRIA) document 552 'Contaminated Land Risk Assessment, A Guide to Good Practice'.

#### **Identification and assessment of impacts and mitigation measures**

- 12.4.17 The assessment of the consequence of impacts arising from the Proposed Development on geology, hydrogeology and ground conditions has been determined by identifying the magnitude of impact and the sensitivity of the environment.
- 12.4.18 The sensitivity of the environment is defined within Table 12.4.

**Table 12.4 – Sensitivity of the environment**

<b>Receptor sensitivity/importance</b>	<b>Description</b>
Very high	<p>Land defined as Contaminated Land under Part IIA of the Environmental Protection Act, 1990 (as amended).</p> <p>Human end users of the site– residential dwellings with private garden.</p> <p>Designated geological areas (sites of special scientific interest (SSSI), special areas of conservation (SAC), regionally important geological sites (RIGS), geological conservation review sites (GCRs).</p>
High	<p>Areas of known/confirmed contaminated land/groundwater.</p> <p>Designated mineral and aggregate safeguarded areas (MSAs/ASAs).</p> <p>Inner groundwater source protection zones (SPZ 1).</p> <p>Areas of high groundwater vulnerability.</p> <p>Principal aquifers.</p> <p>Landfill sites.</p> <p>Glacial geomorphological features (pingos)</p> <p>Rivers with a Grade A &amp; B water quality classification.</p> <p>Areas of flood risk (Flood Zone 3 (highly probable)).</p> <p>Potable water abstractions.</p> <p>Residential properties and their occupants.</p> <p>Areas of critical topography, including steep slopes.</p> <p>Sites with existing mineral planning permission.</p> <p>Principal rivers.</p> <p>Peat deposits.</p>
Medium	<p>Outer groundwater source protection zones and total catchment areas (SPZ 2 and SPZ 3).</p> <p>Secondary aquifers (A and B).</p> <p>Flood zone 2 (medium probability).</p> <p>Areas with intermediate groundwater vulnerability.</p> <p>Rivers with a Grade C &amp; D water quality classification.</p> <p>Human receptor – workforce and operators with</p>

Receptor sensitivity/importance	Description
Low	<p>prior knowledge of site conditions.            Sites with lapsed planning permission for mineral extraction, extraction that may still be extant, or may have lapsed. This includes former quarries which may be inactive (including yet to be worked), worked-out and/or restored (not MSAs).            Agricultural land including farm workers.            Secondary rivers.</p> <p>Rivers with a Grade E &amp; F water quality classification.            Areas with low groundwater vulnerability.            Secondary aquifers (undifferentiated).            Tertiary rivers.</p>
Very low	<p>Industrial site topography.            Unproductive strata.            Drains and ditches</p>

12.4.19 Human end users, specifically those occupying residential dwellings with private gardens are considered to be a more sensitive receptor than site workers/operatives due to differences in the way a site is used and the potential exposure pathways created.

12.4.20 The magnitude of impact is defined within Table 12.5.

**Table 12.5 – Magnitude of impact**

<b>Magnitude</b>	<b>Definition</b>
Very high	<p>Total loss or substantial alteration to key elements or features of the baseline (pre-development) conditions such that the post-development character, composition or attributes will be fundamentally changed.</p> <p>Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA and defined in guidance provided in CIRIA C552.</p>
High	<p>Loss or alteration to one or more key elements or features of the baseline conditions such that post-development character, composition or attributes of the baseline will be materially changed.</p> <p>Chronic damage to human health ('significant harm' as defined in guidance provided in CIRIA C552).</p>
Medium	<p>A minor shift away from baseline conditions. Change arising from the loss or alteration will be discernible but not material. The underlying character, composition or attributes of the baseline condition will be similar to the pre-development circumstances or situation.</p> <p>Non-permanent human health effects easily prevented by use of personal protective equipment, as defined in guidance provided in CIRIA C552.</p>
Low	<p>Very little change from baseline conditions. Change barely distinguishable from pre-development baseline.</p> <p>Non-permanent human health effects easily prevented by use of personal protective equipment as presented within guidance provided in CIRIA C552.</p>
Very low	Changes are not discernible compared with

Magnitude	Definition
	<p>the pre-development baseline condition.</p> <p>Impacts to human health are not discernible as presented within guidance provided in CIRIA C552.</p>

12.4.21 The categories used when classifying the overall consequence of impact (either beneficial, negligible or adverse; short, medium or long-term; temporary or permanent; and at a local, district, national or international level) are defined in Table 12.6, by considering the sensitivity of the environment and the magnitude of impact, which is based on the Institute of Environmental Management and Assessment's (IEMA) 'State of Environmental Impact Assessment in the UK' that states that the most common methodology used to evaluate significance (consequence of impact) is to compare the magnitude of the predicted impact with the sensitivity of the receiving environment.

12.4.22 In this approach 'magnitude' and 'sensitivity' are used as descriptors of a wide range of different factors. 'Magnitude' includes the spatial extent of the impact; the time period over which the impact will occur; and whether the impact is permanent or reversible.

12.4.23 Assessment of the significance of potential effect is described in Table 12.6.

**Table 12.6 – Significance of potential effects**

Receptor sensitivity	Magnitude of impact					
		Very High	High	Medium	Low	Very Low
	Very High	Major	Major	Moderate	Minor	Minor
	High	Major	Moderate	Minor	Minor	Negligible
	Medium	Moderate	Minor	Minor	Negligible	Negligible
	Low	Minor	Minor	Negligible	Negligible	Negligible
	Very Low	Minor	Negligible	Negligible	Negligible	Negligible

Note: red shaded cells are defined as significant impacts. Yellow and green shaded cells are defined as not significant.

12.4.24 The assessment of the consequence of impact has been made prior to the implementation of mitigation, however the assessment considers embedded mitigation within the design. Should the assessment (inclusive of embedded mitigation) identify consequences of impact of moderate or greater, then further mitigation is prescribed to reduce the consequence of impact.

12.4.25 A qualitative assessment of likelihood is considered appropriate for selected potential effects to the geology, hydrogeology and ground conditions. There are scenarios where the likelihood of an effect is certain, for instance where effects would definitely not occur (e.g. impact to designated sites because the Proposed Development avoids them through design).

12.4.26 Where the certainty of the effect could be variable, professional judgement, an understanding of the ground conditions and knowledge of the Proposed Development has been used in assessing the likelihood of the consequence of impact.

12.4.27 The likelihood of the potential consequence of impact occurring is then explicitly

taken into account to derive the overall consequence of impact for those potential effects to geology, hydrogeology and ground conditions for the construction and decommissioning phases, where applicable.

12.4.28 The levels of likelihood that have been considered are shown in Table 12.7 and the method for assessing the likelihood as set out in the IEMA quality mark article, Xodus, *Impact Significance - A Risk Based Approach*. IEMA, Date Unknown.

**Table 12.7 – Likelihood of potential effects**

<b>Likelihood</b>	<b>Definition</b>
<b>Highly likely</b>	The event appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution
<b>Likely</b>	It is probable that an event will occur or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term
<b>Low likelihood</b>	Circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term
<b>Unlikely</b>	Circumstances are such that it is improbable the event would occur even in the long term

12.4.29 The overall consequence of impact (significance of effects) is a judgement about the combination of the magnitude of impact and the sensitivity of the environment. This ES records judgements about the likely significance of effects arising from the Proposed Development.

### **Uncertainty and technical difficulties encountered**

- 12.4.30 To date, a limited number of intrusive ground investigations have been undertaken at the River Towy crossing where undergrounding by open cut trench and HDD is proposed. No environmental analysis of soil or groundwater samples has been undertaken. Therefore there is currently no data on soil quality or geotechnical parameters.
- 12.4.31 The reasonable worst case scenario considered for geology, hydrogeology and ground conditions considers that the entire length of the Proposed Development is constructed within a single phase, with multiple starting points along the length of the Proposed Development.
- 12.4.32 Overall, despite the identified uncertainties, it is considered that the available data is sufficient to provide a robust basis for the assessments undertaken.

## **12.5 Baseline conditions**

- 12.5.1 The existing geology, hydrogeology and ground conditions have been comprehensively described within a standalone baseline study, which is presented in Volume 6.4 as Appendix 12.1.
- 12.5.2 A brief summary of the key aspects relating to geology, hydrogeology and ground conditions for the study area pre-construction is presented below.

### **Superficial geology**

- 12.5.3 Published geological data indicate that superficial deposits are generally absent from most of the higher land, north of the River Towy although may be present in the base of valleys, associated with the Afon Gwili and its tributaries in the upland areas. Superficial deposits are also associated with the River Towy in the vicinity of Carmarthen. Unconsolidated superficial deposits comprise clay, silt, sand and gravel in varying proportions dependent upon the depositional environment. All were deposited in the Quaternary period and are variously described as Alluvium, Glaciofluvial Deposits, Head Deposits, Alluvial Fan Deposits, Glaciolacustrine

Deposits, and Hummocky Glacial Deposits.

- 12.5.4 Glacial Till (diamicton) of the Quaternary Period is found sporadically at lower levels within the upland valleys and more extensively within areas south of the River Towy.
- 12.5.5 A number of pingos, a type of glacial geomorphological feature, have been identified in proximity to the Proposed Development close to Allt Galtwalis north of Pontarsais at NGR 243950 230500. These are described as depressions scraped out by the ice which are surrounded by clay and other impervious material forming ‘ramparts’. These may hold water in ponds which infill over time with vegetation and peat so that bog vegetation forms in the hollows.
- 12.5.6 Small pockets of peat are mapped close to the Proposed Development. These occur at the following locations:
- three mapped pockets of peat are located within 100m of the Proposed Development around NGR 244800 217700 to the south-south-west of Nantycaws; and
  - one mapped pocket of peat is located beneath the Proposed Development at NGR 243500 227300 with a further two areas of peat within 100m of that location.
- 12.5.7 The superficial alluvial deposits associated with the River Towy and Afon Gwili are generally designated a secondary A aquifer. Those alluvial deposits associated with the smaller upland tributaries are designated secondary B aquifers.
- 12.5.8 The glacial Till has been designated as a non productive aquifer.
- 12.5.9 Artificial ground is generally absent from beneath the Proposed Development.
- Bedrock geology**
- 12.5.10 Published geological data show that the Proposed Development is underlain by folded and faulted strata of Ordovician, Silurian, and in the southern most extent of

the Proposed Development, Lower Devonian age.

- 12.5.11 The Ordovician strata generally comprise undifferentiated mudstone, siltstone and sandstone and underlie the majority of the Proposed Development to the north and south of Carmarthen. The Silurian strata generally comprise mudstones and turbidite facies (mudstones and sandstones interbedded with conglomerate), these are generally found underlying the northern part of the Proposed Development. The Devonian strata generally comprise interbedded sandstones and conglomerate.
- 12.5.12 The bedrock geology including Ordovician, Silurian and Devonian deposits are highly folded and faulted with numerous inferred and observed normal faults crossing the Proposed Development.
- 12.5.13 In general, the Ordovician and Silurian bedrock strata north of the River Towy are designated a secondary B aquifer, with the exception of the Llandovery age strata to the north of Pontarsais that are designated a secondary A aquifer.
- 12.5.14 Bedrock strata in the southern-most extent of the Proposed Development, south of the River Towy are generally designated as a secondary A aquifer.
- 12.5.15 There are no principal aquifers located beneath the Proposed Development.

#### **Site-specific geology (River Towy area)**

- 12.5.16 Four boreholes have been drilled at the River Towy crossing using a track mounted Dynamic drilling rig. These are referenced boreholes BH1, BH2, BH3, BH4, BH5 and BH6 and ranged in depth between 5m and 15m below ground level (bgl).
- 12.5.17 The following geological stratigraphy was encountered:
- topsoil ranging in thickness between 0.15m and 0.30m, underlain by;
    - either fine to coarse silty sand with occasional narrow horizons of clay and silt, silty sand and gravel and silty sandy fine gravel with occasional boulders,

underlain by siltstone to a maximum proven depth of 15m bgl. The final thickness of these bedrock deposits was not proven;

- groundwater strike was encountered between 1.7m and 3.5m depth, rising to 1m to 1.6m on completion of the borehole; and
- no visual or olfactory evidence of contamination was encountered.

### **Hydrogeological designations**

12.5.18 The Environment Agency website indicates that there are no groundwater SPZs beneath the Proposed Development.

12.5.19 There are seven groundwater abstractions within 2km of the Proposed Development but none closer than 1km.

12.5.20 There are eight surface water abstractions within 2km of the Proposed Development. The closest of which is located at Pontarsais (NGR 243870 228640), used for non potable purposes at an un-named stream at Danfforddgaer.

12.5.21 There are ten private water supply records recorded by CCC that are located within 250m of the Proposed Development and are used for general domestic and potable use.

### **Preliminary flood risk**

12.5.22 The majority of the Proposed Development falls outside of areas defined as being susceptible to flood risk. This is owing to the topographic relief across much of the Proposed Development area. The exceptions to this are where the Proposed Development crosses rivers or tributaries where the route may pass through flood zones 2 and 3. A more detailed assessment of flood risk is presented within Volume 6.2 Chapter 13 'Hydrology, Drainage and Flood Risk'.

### Designated geological sites

- 12.5.23 Two sites designated for their geological sensitivity have been identified within 1,000m of the Proposed Development. Allt Penycoed located to the south of the A48 at NGR 244300 218150 has been designated as a SSSI for the geological stratigraphy of the Ordovician period (Arenig-Llanvirn) geology and fossil bearing strata.
- 12.5.24 A regionally important geological (RIG) site is noted at NGR 243340 222640. The RIG site is located north of Glangwili along the A485 and comprises a rock outcrop along the road cutting for the A485. The RIG designation applies to this exposed bedrock outcrop of the Asaphus Ash Formation (felsic tuff and limestone) formed approximately 461 to 467 million years ago. The formation is rich in shelly fauna, particularly trilobites.

### Radon

- 12.5.25 Miles *et al.* (2007) indicate that the Proposed Development is located in an area where the risk of significant ingress of radon into enclosed structures on-site is considered moderate to high.

### Mining and Quarrying

- 12.5.26 The Proposed Development does not fall within an area that is or has been subject to coal mining; brine or gypsum extraction; or tin mining. There are no extant planning permissions for mineral extraction located within close proximity to the Proposed Development although the route crosses a number of Category 2 and to a lesser extent Category 1 mineral safeguarding areas for sand and gravel. These are associated with the alluvial deposits of the water courses including the Nant Pibwr, River Towy, Afon Gwili (and its tributaries).
- 12.5.27 Historic below ground mining for lead ore is recorded to have been undertaken adjacent to the Proposed Development to the south east of Carmarthen.
- 12.5.28 Quarrying has taken place in a few locations close to the route. These activities

are recorded as having ceased and typically comprised the extraction of sandstone, clay, shale, sand and gravel.

### **Landfill and sites of potential contaminative use**

- 12.5.29 No active landfills have been identified beneath the Proposed Development. However, seven historic and authorised landfills were noted within 1,000m of the Proposed Development. The closest of which is at Penycoed Farm, Nantycaws (NGR 244503 217979), located within 30m of the Proposed Development south-east of Carmarthen, it was noted to receive non-biodegradable wastes.
- 12.5.30 There are no recorded sites located within 500m of the Proposed Development that have been designated as Contaminated Land under Part 2A of the Environmental Protection Act, 1990.
- 12.5.31 A number of land uses in close proximity to the Proposed Development have been identified with the potential to result in contamination of soils or groundwater. These include dairy and livestock farming, vehicle repairs, container storage, tool hire, historic mining and fuel stations. The closest of which are detailed below:
- a fuel service station is located within 240m of the Proposed Development at Uplands, Carmarthen on the A484 (NGR 241151 212919);
  - slurry pits (waste disposal sites) close to Nantycaws (NGR 244046 218203 and 243969 218088) located within 100m of the Proposed Development; and
  - a fuel service station is located within 125m of the Proposed Development at Peniel (NGR 243723 225624).
- 12.5.32 A below ground high-pressure oil or gas pipeline crosses from east to west beneath the Proposed Development close to Allt Penycoed at NGR 244638 217814.

### Land use history

12.5.33 The land use history for the majority of land beneath the Proposed Development has remained rural/agricultural from prior to published OS maps (circa 1885) until the present. Relatively few developments have occurred close to the Proposed Development and land use continues to be dominated by rural and agricultural activities with isolated hamlets, farms and occasional larger population centres such as Carmarthen.

12.5.34 Further details relating to land use are presented within Volume 6.2 Chapter 8 'Land Use, Agriculture and Forestry'.

### Key parameters for assessment

12.5.35 The prediction of the consequence of impact considers the details and nature of the Proposed Development and, where options exist, uses a reasonable worst case in terms of potential effects to the geology, hydrogeology and ground conditions.

12.5.36 The receptor sensitivities have been designated in accordance with the method presented within Table 12.4. The assessment considers effects prior to the implementation of any mitigation (however embedded mitigation that is 'designed in' to the project is considered to form part of the Proposed Development). The assessment of the consequence of impact considers each potential effect on or to geology, hydrogeology and ground conditions for the Proposed Development components. Where higher sensitivity receptors are identified along the Proposed Development, these are then further discussed in detail.

12.5.37 The worst case realistic scenario has been developed by considering the most adverse, yet realistic scenario (i.e. the maximum physical dimensions of the HDD sections or open cut trenches) including all embedded mitigation measures. It is assumed that this scenario is the worst case. All other scenarios for other design components (i.e. wooden poles and temporary access tracks) may be considered to result in less severe significance than is described in the subsequent

assessment.

### **Design envelope assessed**

12.5.38 This section identifies the maximum adverse scenario in environmental terms, defined by the project design envelope. This establishes the maximum potential adverse impact to geology, hydrogeology and ground conditions.

12.5.39 The maximum dimensions and construction scenarios of the different assets forming part of the Proposed Development are described in detail within Volume 6.2, Chapter 2 'Project Description'. The key proposed assets are summarised as follows:

- Wooden pole structures embedded into the ground by between 2m and 2.7m depending upon pole type and secured with timber baulks and steel braces. Wooden poles typically do not need foundations, however it may be necessary (should engineering tests establish that the ground conditions are too soft) to replace the excavated earth with coarse granular material (such as crushed rock), within which the pole can be firmly located. Alternative foundation types may be applied on a site-specific basis as required and depending upon site-specific ground conditions. Steel wire cable stays anchored into concrete or wood cable stay blocks buried more than 1.5m below ground level will be used to support twin poles.
- Cables will be installed in either an open cut trench (typically 1.5m deep and wide), or in ducts within a driven bore (driven by HDD). Open cut trenching will be used to install the majority of the cable in relatively unconstrained areas and HDD would be used to pass under significant environmental and physical features such as main rivers.
- Existing overhead line asset diversions or undergrounding where crossed by the Proposed Development.
- Import of new 'clean' stone to upgrade existing tracks and aprons at gate entrances and compacted to appropriate specifications or to create new

access tracks of approximately 3.5m width and 300mm thickness (length as required) with terram membrane base (as required).

- A main central construction compound located on part of the Carmarthen Showground (west of Carmarthen) adjacent to the A40.
- Two satellite compounds will be used, located south of the A485 and at Brechfa Forest at an existing cleared area, together with a HDD receiving site south of the B4300.
- Installation of infrastructure at the New Lodge substation, Burry Port including:
  - a circuit breaker within the substation compound;
  - underground cable between towers W38, C6 and substation;
  - sealing end platforms and connect underground cable to existing OHL;
  - a new overhead span between towers W38 and C6; and
  - dismantling of a span of conductor between W40/EE5 and B5/C4.

**Table 12.8 – Design envelope scenario assessed**

Potential effect	Maximum adverse scenario assessed	Justification
Encountering unforeseen contamination	Sites with known contamination (such as landfills) have been avoided by careful alignment of the Proposed Development. In the event of encountering contamination, embedded mitigation detailed within subsequent sections would be applied.	Embedded mitigation measures presented within subsequent paragraphs are designed to address unforeseen contamination, should this be encountered. These embedded mitigation measures form part of the CEMP.
Creation of pathways for contaminants to groundwater and surface water resources, including pathways for ground gas or landfill gas	<p>Cable and HDD:</p> <ul style="list-style-type: none"> <li>▪ open cut trenches 1.5m by 1.5m and 500mm length;</li> <li>▪ ducted system, lengths of 40-50m with joint bays every 500m, joint bays are 6m by 2m in plan by 1.5m depth;</li> <li>▪ HDD cables with a minimum depth of 5m below River Towy and 1.5m beneath other tributaries, 50m by 30m launch pit and 60m by 40m reception pit for HDD (Towy crossing) and 30m by 20m launch pit and 20m by 10m reception pit for HDD (other crossings);</li> <li>▪ diversions of existing assets; and</li> <li>▪ undergrounding between towers W38, C6 and New Lodge substation at Burry Port.</li> </ul>	The proposed cable and HDD sections (linear below ground features) have the potential to act as preferential migration pathways for contaminants, such as along granular service backfill material.
Contamination of soils, surface water or groundwater by spillages or through accidental import of	<p>Cable and HDD:</p> <ul style="list-style-type: none"> <li>▪ open cut trenches 1.5m by 1.5m and 500mm length;</li> <li>▪ ducted system, lengths of 40-50m with joint bays</li> </ul>	The proposed cable and HDD sections have the potential to result in contamination of soils, surface water or

Potential effect	Maximum adverse scenario assessed	Justification
contaminated material and spreading during construction/ decommissioning	<p>every 500m, joint bays are 6m by 2m plan by 1.5m depth;</p> <ul style="list-style-type: none"> <li>▪ HDD cables with a minimum depth of 5m below River Towy and 1.5m beneath other tributaries, 50m by 30m launch pit and 60m by 40m reception pit for HDD (Towy crossing) and 30m by 20m launch pit and 20m by 10m reception pit for HDD (other crossings), for HDD;</li> <li>▪ Bentonite mixing areas;</li> <li>▪ diversions of existing assets;</li> <li>▪ undergrounding between towers W38, C6 and New Lodge substation at Burry Port; and</li> <li>▪ import of new material (stone) to upgrade existing tracks, as necessary.</li> </ul>	groundwater owing to the heavy plant required and the import of materials for the build. These sections are also typically located closest to sensitive environmental receptors.
Discharge of liquid wastes to ground or to controlled waters	<p>Cable and HDD:</p> <ul style="list-style-type: none"> <li>▪ open cut trenches 1.5m by 1.5m and 500mlength;</li> <li>▪ ducted system, lengths of 40-50m with joint bays every 500m, joint bays are 6m by 2m plan by 1.5m depth;</li> <li>▪ HDD cables with a minimum depth of 5m below River Towy and 1.5m beneath other tributaries;</li> <li>▪ 50m by 30m launch pit and 60m by 40m reception pit for HDD (Towy crossing) and 30m by 20m launch pit and 20m by 10m reception pit for HDD (other crossings), Diversions of</li> </ul>	The proposed cable and HDD sections have the potential to result in contamination of soils, surface water or groundwater owing to the heavy plant required and the import of materials for the build. These sections are also typically located closest to sensitive environmental receptors.

Potential effect	Maximum adverse scenario assessed	Justification
Direct impact on peat resource and associated glacial geomorphological features	<ul style="list-style-type: none"> <li>existing assets; and</li> <li>▪ undergrounding between towers W38, C6 and New Lodge substation at Burry Port.</li> </ul>	The proposed OHL (wooden poles) pass through/close to areas with peat within upland areas and have potential to impact upon peat masses.
Direct impact on GCR's, geological SSSI, RIGS and Geoparks and Category 1 or Category 2 Aggregate Safeguarding areas	<p>Cable and HDD:</p> <ul style="list-style-type: none"> <li>▪ open cut trenches 1.5m by 1.5m and 500mlength;</li> <li>▪ ducted system, lengths of 40-50m with joint bays every 500m, joint bays are 6m by 2m plan by 1.5m depth;</li> <li>▪ HDD cables with a minimum depth of 5m below River Towy and 1.5m beneath other tributaries;</li> <li>▪ 50m by 30m launch pit and 60m by 40m reception pit for HDD (Towy crossing) and 30m by 20m launch pit and 20m by 10m reception pit for HDD (other crossings);</li> <li>▪ diversions of existing assets; and</li> <li>▪ undergrounding between towers W38, C6 and New Lodge substation at Burry Port.</li> </ul>	There are geologically designated sites along the Proposed Development that may be impacted by the development.
Interruption of, or disturbance to, public water supplies	<p>Cable and HDD:</p> <ul style="list-style-type: none"> <li>▪ open cut trenches 1.5m by 1.5m and 500mlength;</li> <li>▪ ducted system, lengths of</li> </ul>	The cable trenches and HDD sections have the potential to impact public water supplies. This

Potential effect	Maximum adverse scenario assessed	Justification
	<p>40-50m with joint bays every 500m, joint bays are 6m by 2m plan by 1.5m depth;</p> <ul style="list-style-type: none"> <li>▪ HDD cables with a minimum depth of 5m below River Towy and 1.5m beneath other tributaries;</li> <li>▪ 50m by 30m launch pit and 60m by 40m reception pit for HDD (Towy crossing) and 30m by 20m launch pit and 20m by 10m reception pit for HDD (other crossings);</li> <li>▪ diversions of existing assets; and</li> <li>▪ undergrounding between towers W38, C6 and New Lodge substation at Burry Port.</li> </ul>	<p>includes the pollution of surface water courses used for potable abstraction.</p>

### Embedded mitigation

12.5.40 This section describes any elements of the adopted design, materials, and construction approach that is proposed and will be included as part of the Proposed Development either to specifically mitigate anticipated impacts or to avoid or reduce impacts. The subsequent assessment stage of the assessment is based on the ‘mitigated’ design.

12.5.41 Mitigation measures that were identified and adopted as part of the evolution of the project design (and are subsequently embedded into the Proposed Development) and that are relevant to this chapter are presented below. General mitigation measures, which would apply to all parts of the Proposed Development, are set out first. Thereafter mitigation measures that would apply specifically to geology, hydrogeology and ground condition issues associated with the Proposed Development are described separately.

12.5.42 The mitigation described within this chapter will be secured via Requirements in the DCO or via the CEMP (Volume 8.6) and waste management plan (WMP) (Annex 1 to the CEMP), which themselves will be the subject of a Requirement of the DCO.

12.5.43 Embedded mitigation has been assessed with regard to the construction and decommissioning phases only. This is because the operational phase has been scoped out of the assessment, as proposed within the scoping report and agreed within the Secretary of State's scoping opinion (August 2014).

*General*

12.5.44 All aspects of the Proposed Development have mitigation measures embedded into the design to be protective of:

- avoiding key designations wherever possible;
- avoiding settlements;
- avoiding areas of sensitivity;
- avoiding land allocated for significant development;
- use of HDD at appropriate locations;
- compliance with electric and magnetic field (EMF) exposure limits;
- iterative process of assessment, consultation and review regarding alternative routes and sites;
- consideration of timing of all works to reduce impacts;
- upon decommissioning, reinstatement of land to former use;
- use of best practice methods;
- appropriate training of construction and site personnel;
- establishment of project design envelope; and

- ongoing consultation with statutory and non-statutory consultees, other stakeholders and the general public.

### *Contamination*

12.5.45 The following legislation will be adhered to on site to reduce the risk of contamination:

- Environmental Protection (Duty of Care) Regulations 1991;
- Water Resources Act 1991;
- Hazardous Waste Regulations 2005;
- the Control of Pollution (Oil Storage) Regulations 2001;
- Groundwater Regulations 2009; and
- Water Framework Directive 2000.

12.5.46 The following EA Pollution Prevention Guidance (PPGs) will be followed on site to prevent pollution:

- Guidance for storing and handling materials and products:
  - PPG2: Above ground oil storage tanks;
  - PPG 6: Working at construction and demolition sites;
  - PPG 7: Refuelling facilities; and
  - PPG 26: Drums and intermediate bulk containers.
- Guidance for site drainage, dealing with sewage and trade effluents:
  - PPG 3: Use and design of oil separators in surface water drainage systems;
  - PPG 4: Disposal of sewage where no mains drainage is available; and
  - PPG 13: Vehicle washing and cleaning.

- Guidance on general good environmental practice:

PPG 1: General guide to the prevention of pollution;

PPG 5: Works in, near or liable to affect watercourses; and

PPG 21: Pollution incident response planning.

12.5.47 A CEMP has been prepared for the Proposed Development and has been submitted with the DCO application (Volume 8.6).

12.5.48 The Proposed Development alignment has been selected to avoid sites of known contamination, such as historic landfills and areas of industrial activity.

12.5.49 Development of fluid pathways during HDD, between the bore hole and surface may result in the venting, or “Frac-Out”, of drilling fluid. Potential pathways and receptors will be identified for each HDD site and a Frac-Out Contingency Plan has been prepared as part of the CEMP and will be implemented.

*Construction and decommissioning*

12.5.50 Construction equipment will be fitted with standard embedded spill prevention systems and mitigation measures will be applied to prevent spills of oils, hydrocarbons and other contaminants by providing spill response equipment.

12.5.51 The construction and decommissioning phases will not result in the requirement to dispose of, or import, significant volumes of natural inert soils (including topsoil and subsoil) as part of the Proposed Development. Any excavations associated with the pole locations will be backfilled with arisings in reverse order. Any excess natural soil will be spread on the surface in the vicinity of the excavation, or disposed from site.

12.5.52 Embedded mitigation measures within the design, addressing potential contamination issues are described below:

- In addition to ground surveys already undertaken (details presented within paragraphs 12.5.16 and 12.5.17 of this chapter), additional ground

investigation surveys for geotechnical purposes would be undertaken preconstruction where necessary. Investigations may also be required if the Proposed Development encounters any unidentified potential source of contamination during the construction phase.

- Should any unforeseen contamination be encountered during construction of the Proposed Development, work will be stopped; NRW will be contacted and the local planning authority informed as soon as is practicable. A risk assessment will be undertaken to identify additional actions which may be required in line with guidance given in Contaminated Land Report 11 (CLR11), for example further site investigations. Any proposed remedial strategy will be submitted for approval by the LPA, if required.
- Should geotechnical ground investigations for construction design purposes identify contamination, the following actions shall be undertaken on a site-specific basis in line with CLR11:
  - complete preliminary risk assessments to identify areas that require further detailed assessment;
  - design and undertake appropriate site-specific intrusive ground investigation;
  - undertake laboratory chemical and geotechnical/civil engineering soil and groundwater analysis;
  - undertake human health and controlled water generic quantitative risk assessment (GQRA);
  - detailed quantitative risk assessment (DQRA) would only be undertaken where requirement was identified through site specific ground investigation;
  - undertake remedial action, options appraisal and/or design only where identified through site specific ground investigation and risk assessment;

- implement the detailed mitigation measures or remedial works; and
- verify the implemented mitigation measures or remedial works.
- Site-specific intrusive ground investigation would be undertaken to inform geotechnical, ground stability and civil engineering assessments. A review of baseline data would be undertaken to identify areas that require further detailed assessment, as required. The results of the investigations would be used to inform foundation design, design of temporary works and HDD to ensure the stability of the Proposed Development.
- Professional advice would be sought only from those with a demonstrable specialist competency in risk-based management of land contamination.
- Work would stop if any previously unidentified contamination is encountered until the nature and concentration of the contaminant(s) are determined and appropriate risk control measures implemented in accordance with the CEMP.

12.5.53 The above framework to address the potential for encountering unforeseen contamination during the construction phase of the Proposed Development is set out within the CEMP at Volume 8.6, paragraph 5.14.

12.5.54 Embedded mitigation measures within the design, addressing third party utilities and services are described below:

- WPD has designed its proposals to avoid all Third Party services wherever possible. Where Third Party services cannot be avoided, WPD will work closely with the organisations responsible for their operation or maintenance to minimise effects on operations and future development aspirations. This engagement would continue during the construction phase.
- Prior to intrusive investigations commencing appropriate service clearance surveys and utility searches would be undertaken to identify below ground services and utilities to avoid damage to third party property. This would include liaison with the relevant owner/operator to accurately identify the precise location of services/utilities.

- Road sweeping would be undertaken, where required, and in accordance with the CEMP to remove deposits of silt from roads and reduce the risk of silt being washed into surface water gullies and watercourses. Further details of mitigation measures to be protective of hydrological receptors are detailed within Volume 6.2 Chapter 13 ‘Hydrology, Drainage and Flood Risk’.

12.5.55 Embedded mitigation measures within the design, addressing the import and use of materials are described below:

- A pollution prevention and emergency response plan (PPERP) has been prepared and will be held on all construction sites to follow in the event of an environmental emergency. The PPERP identifies how the risk of pollution due to construction works, materials and extreme weather events would be controlled and identifies the remedial actions in the event of an incident.
- Drill fluids for the HDD sections are freshwater based, inert clay suspensions. The drilling fluids will be supplied in powder form.
- Material Data Safety Sheets, (MDSS), will be carried for all chemicals on site and Control of Substances Hazardous to Health (COSHH) regulations shall be complied with.
- Recycled alternative materials would be encouraged to be used on site. The source of the materials would be from a sustainable source. A ‘just-in time’ strategy would be adopted to keep stocks of materials on site to a minimum.

12.5.56 Embedded mitigation measures within the design, addressing storage and handling requirements are described below:

- The storage of waste on site is detailed within the CEMP/WMP. Facilities would be provided for the collection, segregation, treatment and disposal of solid and liquid waste.
- All oil and diesel storage facilities would be located at least 30m from any watercourse and at least 50m from any borehole or groundwater abstraction well.

- Spill kits and drip trays would be provided for all equipment and at locations where any liquids are stored and dispensed.
- Storage facilities would be provided for solid materials to prevent deterioration of the materials and their escape.
- Storage facilities would be kept secure to prevent acts of vandalism that could result in leaks or spills.
- All containers of any size would be correctly labelled indicating their contents and any hazard warning signs.

12.5.57 Embedded mitigation measures within the design, addressing fuel tanks, mobile bowsers and bunds. In accordance with the Oil Storage Regulations (2001) the following measures must be implemented on site for the prevention of spills:

- Fuel tanks and mobile bowsers (and any other equipment that contains oil and other fuels) would have a secondary containment, for example, double skinned tanks. All tanks and mobile bowsers would be located in an area surrounded by a sealed impervious bund.
- Fill pipes would not extend beyond the bund wall and would have a lockable cap secured with a chain.
- Any tap or valve permanently attached to a tank or bower through which fuel can discharge, would be fitted with a lock.
- All valves, pumps and trigger guns would be turned off and locked when not in use. All caps on fill pipes would be locked when not in use.
- Suitable precautions would be taken to prevent spillages from equipment containing small quantities of hazardous substances (for example, chainsaws and jerry cans).
- Each container or piece of equipment would be stored in its own drip tray made of a material suitable for the substance being handled.

- Containers and equipment would be stored on a firm, level surface.
- Where fuel is delivered through a pipe permanently attached to a tank or bowser the pipe would be fitted with a manually operated pump or a valve at the delivery end which closes automatically when not in use.
- The following management controls would be implemented:
  - the pump or valve would be fitted with a lock;
  - the pipe would be fitted with a lockable valve at the end where it leaves the tank or bowser;
  - the pipework would pass over and not through bund walls;
  - tanks and bunds would be protected from vehicle impact damage; and
  - tanks would be labelled with contents and capacity information.

12.5.58 Embedded mitigation measures within the design, addressing drum storage over 200 litres (in accordance with the Oil Storage Regulations 2001) are described below:

- multiple drums and containers will have suitable secondary containment with sufficient capacity to contain at least 25% of the total volume of the containers or 110% of the largest container, whichever is the greatest;
- drum storage areas would be covered to prevent rainwater getting into bunds and drum pallets;
- drums would be labelled and positioned such that leaks cannot overshoot the bund or drip tray wall; and
- all containers are stored securely when the site is unattended.

12.5.59 Embedded mitigation measures within the design, addressing flammable and hazardous substances are described below:

- all flammable and hazardous substances would be kept in a secure bunded

cupboard, cabinet or tank constructed of materials which are chemically resistant to its contents.

12.5.60 Embedded mitigation measures within the design, addressing deliveries and dispensing are described below:

- for deliveries and dispensing activities it would be ensured that site-specific procedures are in place for bulk deliveries;
- delivery points and vehicle routes are clearly marked;
- emergency procedures are displayed and a suitably sized spill kit is available at all delivery points, and staff are trained in these procedures and the use of spill kits;
- suitable facilities (for example, drip trays, drum trolleys, funnels) meet the sites specific dispensing needs and are maintained and used;
- tank capacities and current contents levels are checked prior to accepting a delivery to ensure that they are not overfilled;
- all deliveries are supervised throughout the delivery operation;
- spill prevention equipment is deployed during dispensing activities; and
- all spillages occurring during dispensing and handling activities are cleared up and reported via the appropriate site manager/agent and are dealt with in accordance with the CEMP.

12.5.61 The use of vehicles and plant poses similar risks to those posed by storage of liquids. Fuel and oil may leak from such equipment which may enter drains and/or watercourses, as well as contaminating the ground itself. Embedded mitigation measures within the design, addressing the use of vehicles and plant are described below:

- Vehicles and plant provided for use on the site would be in good working order to ensure optimum fuel efficiency, and are free from leaks. Plant with integral

bunding and/or drip trays would be specified.

- Sufficient spill response equipment would be carried on all vehicles.
- Any hired vehicles and plant would be checked on delivery and not accepted if they are not in good working order for example, leaking, creating excessive fumes, excessive noise and/or smoke.
- Company-owned vehicles and plant would be regularly maintained to ensure that they are working at optimum efficiency and are promptly repaired when not in good working order.
- Vehicles and plant would not park near or over drains and would be washed in accordance with the requirements of the CEMP.
- Employee-owned vehicles would not be driven or parked in construction areas unless authorised to do so.
- Topping up of vehicles and plant would be carried out on hardstanding using drip trays and not over or near drains, or, where this is not reasonably practicable, drip trays and/or drain blockers would be used to reduce the risk of spills.
- Vehicles and plant would not be overfilled with fuel.
- Plant containing oils would be inspected daily and regularly maintained to both prevent and identify leaks.

12.5.62 Embedded mitigation measures within the design, addressing de-watering issues are described below:

- Excavations may require de-watering. Water pumped or removed from excavations would be removed from site using a tanker or discharged when appropriate consents are in place. Further details of mitigation measures to be protective of hydrological receptors are detailed within Volume 6.2 Chapter 13 'Hydrology, Drainage and Flood Risk'.

12.5.63 Embedded mitigation measures within the design, addressing potential risks to construction/decommissioning and maintenance workers are described below:

- Potential risks to construction/decommissioning and maintenance workers arising from contamination within soil and groundwater would be controlled under the Construction Design and Management (CDM) Regulation, 2007, the requirement to work in accordance with best practice and statutory guidance and the requirement for PPE as standard working practice.

12.5.64 Embedded mitigation measures within the design, addressing potential monitoring requirements are described below:

- Monitoring would be undertaken in accordance with the CEMP. Daily inspections would be undertaken by the contractor(s) and weekly inspections would be undertaken by WPD and the contractor(s). Monitoring assessment forms would be completed during the daily and weekly inspections.
- In particular monitoring would be undertaken of ground and surface water conditions to check for spills or uncontrolled tipped surface spoil.
- Oil tanks and associated bunds will be checked daily for leaks.
- Plant containing oils and fuel would be inspected daily and maintained to both prevent and identify leaks.
- Where non-compliance with the CEMP is found, measures would be taken in accordance with the plan. Any damaged fencing would be repaired, replaced and/or re-painted as soon as is reasonably practicable.

*Operation and maintenance (HDD sections)*

12.5.65 Underground cables are not physically inspected as they are below ground but they are tested regularly during their lifespan.

12.5.66 The underground cables do not have internal fluids that could leak into surface water receptors.

12.5.67 No significant maintenance works are anticipated for HDD sections.

## 12.6 Assessment of impacts: Construction phase

12.6.1 This section addresses the potential construction phase impacts. Each potential effect is considered in more detail in the following paragraphs.

12.6.2 The assessments take into account the embedded mitigation measures that are included within the design, as detailed above.

### *Encountering unforeseen contamination*

12.6.3 The baseline conditions presented in this chapter identify that there are no recorded landfills or other waste sites with the significant potential to result in contamination, located beneath the Proposed Development. Numerous sites are recorded at a further distance, particularly in the vicinity of Carmarthen, with the historic potential to have had a contaminative impact to ground and groundwater. This includes former lead ore mining south of the River Towy. There is therefore the possibility of encountering other sources of unforeseen contamination during the construction phase of the Proposed Development.

12.6.4 The process is set out in the CEMP for the Proposed Development as to how unforeseen contamination, if encountered, will be dealt with, including a process for agreeing any necessary site investigation, risk assessment and if required remedial measures with the relevant regulators.

12.6.5 The predominant land use beneath the Proposed Development comprises agricultural fields/rural land that is considered to have a medium sensitivity. The magnitude of impact to agricultural fields as a result of encountering unforeseen contamination is considered to be low owing to very little change from baseline conditions as a result of the Proposed Development (taking into account embedded mitigation measures). The underlying character of the baseline condition would be barely distinguishable from the pre-development conditions.

12.6.6 This gives rise to an overall negligible consequence of impact. The negligible

consequence of impact is considered to be short term and non-permanent, reversible and on a local level.

- 12.6.7 The agricultural fields are predominantly used by farm workers, who represent the principal human health receptor that may come into contact with unforeseen contamination exposed during construction. It is noted that risks to construction and maintenance workers would be addressed under CDMC regulations and have therefore not been assessed further. Farm workers are considered to have a medium sensitivity. The magnitude of impact to human health of farmers as a result of encountering unforeseen contamination is considered to be high magnitude owing to the potential chronic adverse impacts to human health as a result of exposure to contamination.
- 12.6.8 This gives rise to an overall minor adverse consequence of impact. The minor adverse consequence of impact is considered to be long term and permanent, non-reversible and on a local level (farm worker-specific).
- 12.6.9 Potential risks to controlled waters (including surface watercourses) may arise through the leaching or surface run-off of unforeseen contaminants encountered during the construction phase. Controlled waters are considered to have a high to medium sensitivity depending upon their water quality and use for potable water abstraction. This includes a surface water abstraction at NGR 243870 228640, located close to the Proposed Development, which is not used for potable water, located at Danfforddgaer. The impact to controlled waters as a result of encountering unforeseen contamination is considered to be medium magnitude owing to a potential minor shift away from baseline conditions.
- 12.6.10 This gives rise to an overall **minor adverse** consequence of impact. The minor adverse consequence of impact is considered to be short term and non-permanent, reversible and on a local level.

*Creation of pathways for contaminants to groundwater and surface water resources (including sources used for potable water abstraction), and including the creation of pathways for ground gas or landfill gas*

- 12.6.11 There are embedded mitigation measures, set out in this chapter, that are protective against the creation of preferential migration pathways.
- 12.6.12 The maximum adverse scenario assessed comprises the proposed HDD and open cut (trench) sections resulting in the creation of preferential contaminant migration pathways to surface waters or groundwater. These may also act as pathways for ground gas and landfill gas (if present). All other development components are considered to result in a lower significance of potential consequence of impact.
- 12.6.13 In general, the Proposed Development passes through areas where there is an absence of sensitive receptors such as residential dwellings, principal aquifers or groundwater SPZs and an absence of significant sources of ground gas, landfill gas or contamination.
- 12.6.14 It is noted that peat deposits have the potential to release ground gases, however the Proposed Development components that are to be located in proximity to recorded peat deposits will comprise wooden poles, not HDD or open cut trenches. The wooden poles are not considered to result in the creation of preferential migration pathways for contaminants (ground gases) nor create an enclosed space with the potential to allow ground gas to build up.
- 12.6.15 The predominant land use comprises agricultural fields with occasional small surface water receptors that are considered to have a medium sensitivity. The potential impact to agricultural fields and the surface water receptors as a result of the creation of preferential contaminant migration pathways is considered to be of low magnitude owing to very little change from the baseline conditions as a result of the Proposed Development (taking account of embedded mitigation measures). Any change to the underlying character of the baseline condition would be barely distinguishable.
- 12.6.16 This gives rise to an overall negligible consequence of impact. The negligible

consequence of impact is considered to be short term and non-permanent, reversible and on a local level.

- 12.6.17 For short sections of the Proposed Development that pass close to or through high sensitivity areas such as at the River Towy, HDD or open cut trenching is proposed. These areas have the potential for alluvial deposits to be present, which are a potential source of ground gas. Within these areas of the Proposed Development, the potential for the creation of preferential migration pathways for contaminants is greater and the receptor sensitivity is higher.
- 12.6.18 Ground gases have the potential to adversely impact receptors through the migration along open cut trenches and HDD sections, resulting in the potential to accumulate within voids, backfilled granular medium and/or confined spaces and the potential for risks from explosion and/or asphyxiation (with manned entry).
- 12.6.19 Leachate and dissolved-phase contaminants from contaminated soils brought to the surface as a result of the construction phase could migrate along open cut trenches or HDD sections to sensitive surface waters (e.g. River Towy) or infiltrate and reach groundwater aquifers and therefore adversely impact water quality.
- 12.6.20 The most sensitive receptors to be impacted as a result of preferential pathways for contaminant migration are residential dwellings, primary rivers or principal aquifers with a very high or high sensitivity. It is noted that there are no principal aquifers close to the Proposed Development. The potential impact to human health or secondary aquifers is considered to be of low magnitude (taking into account embedded mitigation measures), owing to a minor shift away from baseline conditions or non-permanent human health effects.
- 12.6.21 This gives rise to an overall **minor adverse** consequence of impact. The minor adverse consequence of impact for human health is considered to be very short-term and non-permanent, reversible and restricted to a local level, whereas the minor adverse consequence of impact for groundwater aquifers is considered to be medium-term and temporary owing to potential natural attenuation or remediation of controlled waters and reversible at a district level.

*Contamination of soils, surface water or groundwater by spillages or through accidental import of contaminated material and spreading, or discharge of liquid wastes and sewage during construction*

- 12.6.22 The Proposed Development has the potential to result in the contamination of surface waters through construction activities. This could occur via ground excavations for any open cut trenches and principally for the HDD sections. This includes works that have the potential to cause the ingress of sediment into surface water receptors via accidental tipping, surface water run-off or from inappropriate stockpiling practices in close proximity to surface waters. The potential consequences of impact of silt ingress to surface waters are further assessed within Volume 6.2 Chapter 13 'Hydrology, Drainage and Flood Risk'.
- 12.6.23 The maximum adverse scenario assessed comprises the proposed open cut trenches and HDD sections and the potential contamination of soil and controlled waters, especially as a result of frac-out of drilling fluid within HDD sections. Contamination of soils and controlled waters from HDD compounds, including bunded areas for mixing drill fluids is considered. All other development components including the OHL (wooden poles) and access tracks are considered to result in a lower potential consequence of impact.
- 12.6.24 The Proposed Development has the potential to result in contamination of groundwater aquifers through the accidental release of contaminants to soil, with subsequent leaching and/or remobilisation to groundwater. Construction plant and equipment has the potential to leak or spill hydrocarbons, oils and hydraulic fluids, or the frac-out of drilling fluids from HDD during construction works. Any spillages are anticipated to be of low volume and be localised. Embedded mitigation addressing potential frac-out is included in this chapter.
- 12.6.25 The Proposed Development also has the potential to generate litter or other debris that could be re-worked into site soils. Anticipated volumes of pollutants are low. The accidental import and spreading of contaminated material or the discharge of liquid and sewage has been assessed. Anticipated volumes of pollutants are low.

12.6.26 The Proposed Development generally passes across either secondary A or secondary B aquifers of the Ordovician, Silurian and lower Devonian bedrock. The superficial Alluvium in the vicinity of the River Towy is designated as a secondary A aquifer, with upland Alluvial deposits close to smaller tributaries designated as secondary B aquifers and glacial Till being unproductive. There are no groundwater SPZs along the Proposed Development.

*Consideration of impact to agricultural land*

12.6.27 The majority of the Proposed Development passes over agricultural fields which are considered to have a medium sensitivity. The potential impact to agricultural fields as a result of the contamination resulting from spillages, import and spreading of contaminated material or liquid/sewage discharges is considered to have a medium magnitude (taking into account embedded mitigation measures), owing to a minor shift away from baseline conditions. Change arising from the loss or alteration could be discernible but not material.

12.6.28 This gives rise to an overall **minor adverse** consequence of impact. The minor adverse consequence of impact is considered to be medium-term and temporary as it is reversible through remediation and restricted to a local level.

*Consideration of impact to superficial deposit aquifers*

12.6.29 The majority of the superficial deposits (Alluvium) are classified by NRW as secondary A or secondary B aquifers. Glacial Till is an unproductive stratum. The Alluvium is therefore considered to have a medium sensitivity.

12.6.30 The potential impact on secondary A and B aquifers is considered to have a medium magnitude (taking into account embedded mitigation measures), owing to a minor shift away from baseline conditions such that the post-development character or composition would be similar to the pre-development situation.

12.6.31 This gives rise to an overall **minor adverse** consequence of impact. The minor adverse consequence of impact is considered to be medium-term and temporary

owing to potential natural attenuation of contaminants within soil and groundwater, reversible through remediation and restricted to a local level.

*Consideration of impact to surface waters*

12.6.32 Potential risks to controlled waters including small tributaries as well as rivers such as the River Towy, may arise through the uncontrolled release of drilling fluids, oils, fuels and hydraulic fluid, ingress of accidentally imported contaminated material or liquid/sewage discharges. Controlled waters are considered to have a high to medium sensitivity depending upon their water quality. The potential impact (taking into account embedded mitigation measures), to controlled waters as a result of being impacted by an uncontrolled release is considered to be of medium magnitude owing to a potential minor shift away from baseline conditions.

12.6.33 This gives rise to an overall **minor adverse** consequence of impact. The minor adverse consequence of impact is considered to be medium term and non-permanent, as it is reversible through remediation and restricted to a local level.

*Direct impact on peat resource and associated glacial geomorphological features*

12.6.34 A number of glacial geomorphological features comprising pingos have been identified close to the Proposed Development close to Allt Galtwalis north of Pontarsais. The Proposed Development has avoided direct impact to these geomorphological features as part of the design. Development components to be located close to these features comprise the wooden poles for the OHL.

12.6.35 The sensitivity of the pingo geomorphological features is considered to be high. The magnitude of impact (taking into account embedded mitigation measures including avoidance of the pingos) is considered very low owing to a 'no change' situation to the pre-development baseline condition.

12.6.36 This gives rise to an overall **negligible** consequence of impact. The negligible consequence of impact is considered to be long term (duration of the development) and non-permanent, reversible and restricted to a local level.

- 12.6.37 A number of pockets of peat have been identified within the general vicinity of the Proposed Development. The majority of these fall outside of the Proposed Development with the exception of areas of peat to the west of Rhydargaeau at NGR 243500 227300.
- 12.6.38 Within the peat it is proposed to position a single wooden pole (pole 126) and associated access track (20m length), forming part of the OHL. Owing to the relatively small diameter of the wooden poles and the likely absence of foundation material such as coarse granular material (e.g. crushed rock), the impact of the wooden poles within the wider peat body will be minimal. The sensitivity of the peat deposits are considered to be high. The magnitude of impact (taking into account embedded mitigation measures) is considered very low owing to a non discernible change to the pre-development baseline condition.
- 12.6.39 This gives rise to an overall **negligible** consequence of impact.
- 12.6.40 Access to the intended pole positions will be undertaken using wooden mats covered by metal plates, or inter-linked sections of plastic or metal trackway (worst case scenario for very saturated or waterlogged ground). Access tracks would be temporary and removed following works. The positioning of mats over peat could result in compaction of compressible peat deposits. Micro-siting of the wooden poles and access tracks would be undertaken to minimise peat crossed.
- 12.6.41 The sensitivity of peat is considered to be high. The magnitude of impact (taking into account embedded mitigation measures) is considered to be low owing to very little change to be baseline condition.
- 12.6.42 This gives rise to an overall **minor adverse** consequence of impact. The minor adverse consequence of impact is considered to be short-term (duration of the pole installation anticipated to be one day) and non-permanent, reversible and restricted to a local level.

### Direct impact on GCR's, geological SSSI, RIGS and Geoparks and Category 1 or Category 2 Aggregate Safeguarding areas

- 12.6.43 The Proposed Development design is protective of designated geological sites by avoiding such sites.
- 12.6.44 The presence of any component of the Proposed Development close to a designated geological site would have the potential to damage or have an adverse consequence of impact to the features of the designated site.
- 12.6.45 A RIG site is located at NGR 243340 222640. The RIG site applies to exposed Ordovician bedrock outcropping along a road cutting for the A485 north of Glangwili. The Proposed Development (open cut trench) will pass through this bedrock outcrop albeit below ground level within the existing carriageway of the A485 and an unnamed lane, before cutting into a field that is situated outside of the RIG designated area.
- 12.6.46 The designated geological RIG site is considered to be of very high sensitivity owing to its conservation importance. The potential impact to the designated RIG site is considered to be of low magnitude. The Proposed Development will pass through a small section of the RIG site below ground level within an existing carriageway. A significant section of bedrock outcropping above ground is located to the south west and north east of the unnamed lane along the road cutting for the A485. Very little change from baseline conditions will occur as a result of the alignment of the Proposed Development in relation to the RIG site. Any changes will be barely distinguishable from the pre-development baseline.
- 12.6.47 This gives rise to an overall **minor adverse** consequence of impact. The minor adverse consequence of impact is considered to be long term and permanent, non-reversible and on a local scale owing to the RIG designation.
- 12.6.48 Alluvial deposits located close to surface water receptors such as the River Towy and Afon Gwili have been designated as falling within aggregate safeguarding areas.

- 12.6.49 The presence of any component of the Proposed Development within, or in close proximity to, areas of mineral safeguarding, would have the potential to sterilise these resources in terms of their future availability. The presence of the Proposed Development would impact future mineral planning consents in the development area and result in substantial alteration to, the key elements or features of the baseline condition. This would be restricted to district level, however could be long-term over the anticipated operational life-span of the Proposed Development.
- 12.6.50 The designation of aggregate safeguarding areas is considered to be of high sensitivity owing to its economic importance. The potential impact to the aggregate safeguarding site is considered to be high magnitude. The Proposed Development will pass through the aggregate safeguarding areas and may result in the loss of or alteration to future ability to use these resources. However, the likelihood of the Proposed Development resulting in a loss of this potential future resource is considered to be unlikely. It would be feasible to relocate poles (if required) subject to a future consenting process should extraction of aggregates be required close to poles. Therefore a lower overall consequence of impact is predicted.
- 12.6.51 The initial consequence of impact would be considered to be high adverse, however taking into account the likelihood of the impact occurring, an overall assessment of **minor adverse** consequence of impact is determined. The minor adverse consequence of impact is considered to be long term and non-permanent, reversible and on a local scale to the development component.

## 12.7 Assessment of impacts: Operational phase

- 12.7.1 Potential consequence of impacts to geology, hydrogeology and ground conditions during the operational and maintenance phase of the Proposed Development have been scoped out for the majority of components.
- 12.7.2 In accordance with the scoping opinion, the requirement to assess the consequence of impact during the maintenance phase of underground cables, particularly in the vicinity of surface water receptors, is presented within the

subsequent paragraphs.

- 12.7.3 Routine maintenance of the underground cables in the vicinity of surface water receptors, where below ground cables will be installed using HDD, is not anticipated.
- 12.7.4 The receptor sensitivity of surface water receptors (such as rivers) is considered to be high to medium, depending upon the water quality and river designation. The magnitude of impact is considered to be very low, resulting in a ‘no change’ situation to the pre-development baseline condition.
- 12.7.5 This gives rise to an overall **negligible** consequence of impact. The negligible consequence of impact is considered to be short term and non-permanent, reversible and on a local scale.

## 12.8 Assessment of impacts: Decommissioning phase

- 12.8.1 The decommissioning of the Proposed Development would have similar consequence of impacts on the geology, hydrogeology and ground conditions as to those outlined during the construction phase. However, the consequence of impacts to the geology, hydrogeology and ground conditions are considered to be of shorter duration and of limited extent compared to the construction phase.

## 12.9 Mitigation measures

- 12.9.1 The embedded mitigation measures within the project design are discussed within paragraphs 12.5.37 to 12.5.64 and will be secured via Requirements in the DCO or via the CEMP, WMP, and PPERP which themselves will be the subject of a Requirement of the DCO.
- 12.9.2 An assessment of the consequence of impact on geology, hydrogeology and ground conditions identified that the Proposed Development will not result in a potential consequence of impact with a significance of moderate or above.
- 12.9.3 Therefore, no further additional applied mitigation measures will be required in

respect of geology, hydrogeology and ground conditions.

## 12.10 Residual effects

12.10.1 The assessment of the consequence of impact inclusive of embedded mitigation measures has not identified impacts to the geology, hydrogeology and ground conditions of moderate or above. Therefore there are no significant residual effects.

## 12.11 Cumulative effects and inter-relationships

### Cumulative effects

12.11.1 This section considers the cumulative effects of the project in the context of (a) in-combination effects together with other proposed or consented developments with which the project may interact and (b) interaction effects (e.g. noise and air).

12.11.2 A full description of the methodology for the assessment of cumulative effect and inter-relationship effects is presented within Volume 6.2, Chapter 19 'Cumulative effects and inter-relationships'.

12.11.3 Cumulative effects have been considered for both construction and decommissioning phases.

12.11.4 Potential cumulative effects to geology, hydrogeology and the ground environment between the Proposed Development and other proposed or consented developments are considered plausible only where the development footprint of both developments overlap. It is considered that geographic separation between developments, results in the absence of a cumulative effect to geology, hydrogeology and the ground environment.

12.11.5 Based on geographic separation between the Proposed Development and other proposed or consented developments located within a 3km radius, the majority of other projects have been scoped out of the cumulative assessment.

12.11.6 The following proposed or consented developments that coincide with the Proposed Development area have been identified and have therefore been scoped in for assessment of cumulative effects.

**Table 12.9 – Assessment of potential cumulative effects – geology, hydrogeology and ground environment**

Map ID ref.	Map No.	Application No. (where applicable)	Description of proposal/type of land use allocation
155	19.1.9	W/25504	Erection of a 55kW wind turbine
217	19.1.21	W/29015	Erection of a single 50kW wind turbine
260	19.1.28	W/17938	Refurbishment of approximately 54km of existing 11kV wood pole overhead line
270	19.1.29	26/03/2009	Erection of a 70m tall meteorological mast
275	19.1.29	N/A	Development of a 56 to 84 megawatt wind farm
300	19.1.24	W/31035	Overhead line

12.11.7 Consented developments ID155 and ID217 comprise the erection of a single wind turbine at each application area. It is noted that for both ID155 and ID217, the proposed wind turbine will not be located within the Proposed Development area, however the associated primary access tracks for these developments would cross the Proposed Development.

12.11.8 The Proposed Development at these locations is to comprise small diameter wooden poles with the likely absence of foundation material such as granular material. The components of the consented developments ID155 and ID217 are anticipated to comprise gravel access tracks. The sensitivity of the geology, hydrogeology and ground conditions at these locations are considered to be

medium. The cumulative magnitude of impact (taking into account embedded mitigation measures) of both developments is considered very low owing to a 'no change' situation to the pre-development baseline condition.

- 12.11.9 This gives rise to an overall negligible cumulative consequence of impact to geology, hydrogeology and ground conditions as a result of the Proposed Development and ID155 or ID217.
- 12.11.10 Consented development ID260 is to comprise the refurbishment of an existing 11kV wood pole overhead line. This crosses the Order Limits of the Proposed Development at two locations, close to proposed pole 161 and pole 168.
- 12.11.11 The refurbishment of the existing 11kV wood pole overhead line is anticipated to comprise the replacement of the overhead conductor. The Proposed Development at these locations is to comprise small diameter wooden poles with the likely absence of foundation material such as granular material
- 12.11.12 The sensitivity of the geology, hydrogeology and ground conditions at these locations are considered to be medium. The cumulative magnitude of impact (taking into account embedded mitigation measures) of both developments is considered very low owing to a 'no change' situation to the pre-development baseline condition.
- 12.11.13 This gives rise to an overall negligible cumulative consequence of impact to geology, hydrogeology and ground conditions as a result of the Proposed Development and ID260.
- 12.11.14 Consented development ID 270 comprises the erection of a 70m height mast for meteorological purposes. The Proposed Development overlaps with ID 270 at this location between poles 198 and 199. The Proposed Development at this location is to comprise wooden poles with the likely absence of foundation material such as granular material
- 12.11.15 The sensitivity of the geology, hydrogeology and ground conditions at this location is considered to be medium. The cumulative magnitude of impact (taking into

account embedded mitigation measures) of both developments is considered very low owing to a 'no change' situation to the pre-development baseline condition.

12.11.16 This gives rise to an overall negligible cumulative consequence of impact to geology, hydrogeology and ground conditions as a result of the Proposed Development and ID270.

12.11.17 Consented development ID275 is to comprise the construction of an electricity generating facility comprising wind turbines with a capacity of between 56 to 84 megawatts. The Proposed Development at this location is to comprise small diameter wooden poles with the likely absence of foundation material such as granular material.

12.11.18 The sensitivity of the geology, hydrogeology and ground conditions at this location is considered to be medium. The cumulative magnitude of impact (taking into account embedded mitigation measures) of both developments is considered very low owing to a 'no change' situation to the pre-development baseline condition.

12.11.19 This gives rise to an overall negligible cumulative consequence of impact to geology, hydrogeology and ground conditions as a result of the Proposed Development and ID275.

12.11.20 Consented development ID300 comprises the construction of a new overhead line. The Proposed Development at this location comprises a wooden pole (pole 136) with the likely absence of foundation material such as granular material, and an access track. The sensitivity of the geology, hydrogeology and ground conditions at this location is considered to be medium. The cumulative magnitude of impact (taking into account embedded mitigation measures) of both developments is considered very low owing to a 'no change' situation to the pre-development baseline condition.

12.11.21 This gives rise to an overall negligible cumulative consequence of impact to geology, hydrogeology and ground conditions as a result of the Proposed Development and ID300.

12.11.22 Assessment of the cumulative effect to geology, hydrogeology and ground conditions, resulting from construction and decommissioning of the Proposed Development and other proposed or consented developments, following implementation of embedded mitigation measures, would result in a negligible cumulative consequence of impact.

12.11.23 Mitigation measures in addition to those identified within section 12.9 of this chapter will not be required.

12.11.24 No cumulative impacts to geology, hydrogeology and ground conditions will result during the operation and maintenance phase of the developments.

#### **Inter-relationship effects**

12.11.25 The assessment of potential inter-related effects considers receptor-led effects through an assessment of the scope for all effects to interact spatially and temporally to create inter-related impacts on a receptor. The assessment of inter-related effects considers only those effects produced by the Proposed Development and not from other projects (which are considered via the cumulative assessment process).

12.11.26 Inter-relationships between geology, hydrogeology and ground conditions discussed in this chapter are expected principally with the following ES chapters:

- Volume 6.2, Chapter 8 ‘Land use, agriculture and forestry’
- Volume 6.2, Chapter 10 ‘Ecology’
- Volume 6.2, Chapter 13 ‘Hydrology, flood risk and drainage’
- Volume 6.2, Chapter 17 ‘Socioeconomics, recreation and tourism’

#### *Land use, agriculture and forestry*

12.11.27 Impacts to agriculture and soil (land use and farming practice (crop establishment and yield)) would occur as a result of contamination of shallow soils, or through the

mobilisation of existing or introduced contamination interacting with other potential effects identified Volume 6.2, Chapter 8 ‘Land use, agriculture and forestry’.

### *Ecology*

12.11.28 Impacts to water quality (chemical quality) as a result of sediment or contaminant ingress arising from inappropriate construction activities and contamination of surface waters through the HDD processes. This has the potential to impact aquatic and terrestrial ecology in conjunction with other potential effects identified within Volume 6.2, Chapter 10 ‘Ecology’.

### *Hydrology, flood risk and drainage*

12.11.29 Impacts to surface water drainage parameters (suspended solids) as a result of sediment ingress arising from inappropriate construction activities. This has the potential to result in inter-relationship effects to surface water drainage parameters if combined with other potential effects identified within Volume 6.2, Chapter 13 ‘Hydrology, flood risk and drainage’.

### *Socioeconomics*

12.11.30 Impacts to land use (farming practices) as a result of contamination of shallow soils through the mobilisation of existing or introduced contamination may interact with other potential effects identified within Volume 6.2, Chapter 17 ‘Socioeconomics’ to result in an adverse consequence of impact.

## **12.12 Summary of effects**

12.12.1 The assessment of the consequence of impact to geology, hydrogeology and ground conditions from the Proposed Development, inclusive of embedded mitigation measures, has been undertaken.

12.12.2 The assessment has identified that the potential consequence of impact on geology, hydrogeology and ground conditions will be of a negligible or minor adverse impact; no consequence of impact of moderate or above has been

identified by this assessment. Therefore, long term adverse effects to geology, hydrogeology and ground conditions as a result of the Proposed Development are not expected.

12.12.3 The assessment has identified that the potential cumulative consequence of impact to geology, hydrogeology and ground conditions from the Proposed Development and other proposed or consented developments will be negligible. No additional mitigation measures are required to be protective of geology, hydrogeology and ground conditions.

## 12.13 References

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*Natural England – SSSIs, available at:*

*<http://www.naturalengland.org.uk/ourwork/conservation/designations/sssi/default.aspx>*

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