Document 5.9.1

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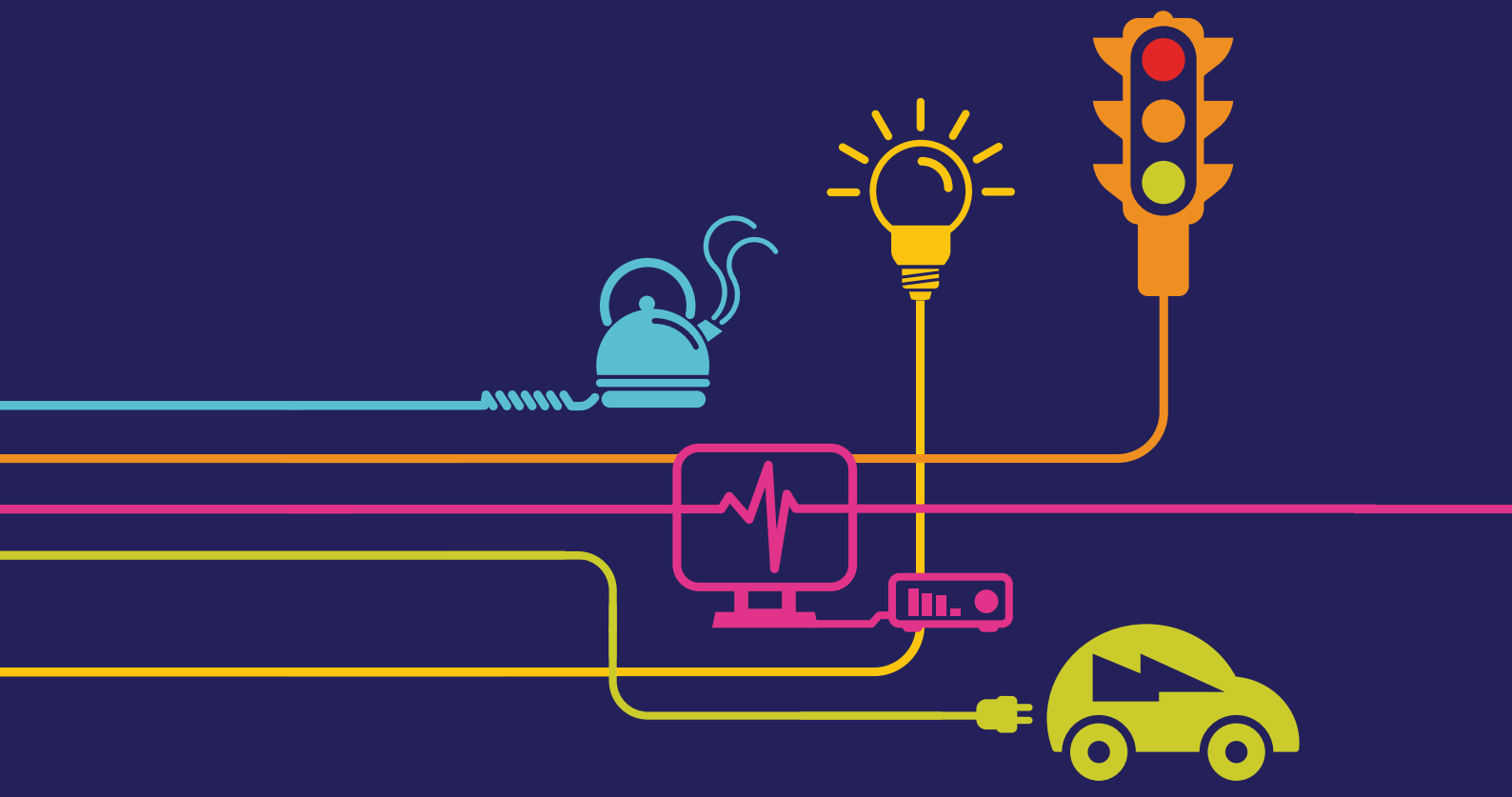
Environmental Statement Ground Environment

Hinkley Point C Connection Project

Regulation 5(2)(a) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



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Hinkley Point C Connection Project

ENVIRONMENTAL STATEMENT – MAY 2014

VOLUME 5.9.1, CHAPTER 9 – GROUND ENVIRONMENT

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9 GROUND ENVIRONMENT

9.1 Introduction

9.1.1 This chapter of the Environmental Statement (ES) considers the likely significant effects on the ground environment of the construction, operation and decommissioning phases of the Proposed Development.

9.1.2 A description of the Proposed Development is provided in **Volume 5.3.1.1** and illustrated at **Volume 5.3.3, Figures 3.1 to 3.6.** This chapter is supported by a number of figures and appendices provided after the main text of this chapter **Volume 5.9.1**. This chapter should be read with these figures and appendices available for reference as they assist the understanding of the descriptions and assessments presented in the text.

9.1.3 The Proposed Development has the potential for significant effects on soils, geology, hydrogeology and ground contamination through activities that would be undertaken primarily during the construction phase of the Proposed Development but also during the operational and decommissioning phases.

9.1.4 Baseline conditions, describing the geology, hydrogeology, ground contamination, history of development including industrial activities, ground stability hazards and geological conservation sites are presented at section 9.4 of this chapter.

9.1.5 The prediction and assessment of the significance of potential effects during the construction and operation of the Proposed Development, as well as during decommissioning phase are described at section 9.5.

9.1.6 Potential cumulative effects of other projects in the general vicinity of the Proposed Development are considered; a summary is presented at section 9.9. Full details of the cumulative effects assessment on the ground environment is provided in **Volume 5.17.1.**

9.1.7 The potential for interaction between effects on the ground environment and other aspects of the environment are described in this chapter, at section 9.6.

9.1.8 Mitigation measures are proposed in section 9.7 of this chapter, which would be applied to minimise potential adverse effects, during construction, operation and decommissioning.

Project Engagement

EIA Scoping

9.1.9 As part of the scoping phase of the Environmental Impact Assessment (EIA), National Grid prepared a Scoping Report (April 2013) setting out the proposed approach to EIA in respect of the Proposed Development, including the identification of assessment methods for each of the EIA topics to be assessed

9.1.10 The Scoping Opinion is provided at **Volume 5.5.2, Appendix 5A**. A table showing the Scoping Opinion representations received (relevant to EIA) and National Grid's responses is provided at **Volume 5.5.2, Appendix 5B**. A summary of the main Scoping Opinion representations received in relation to the ground environment are presented in the table below.

Table 9.1 Summary of the Main Ground Environment Scoping Opinion Representations Received

Representation	Response
There are a number of coal mining legacy issues that can potentially pose a risk to new development and therefore should be considered as part of an Environmental Statement for development proposals within coalfield areas: -The location and stability of abandoned mine entries - The extent and stability of shallow mine workings - Outcropping coal seams and unrecorded mine workings - Hydrogeology, mine water and mine gas	A standalone coal mining risk assessment report has been produced, **Volume 5.9.2, Appendix 9I** to assess potential risks from coal workings. The risk assessment has been undertaken for sections along the Proposed Development, where coal bearing strata are present, and historic coal workings have been recorded.
Various sources of evidence will be consulted on as part of the Desk Based Assessment. The Applicant is advised to liaise with the EA, Bristol City Council and the Joint Somerset Councils to ensure that they utilise all relevant data and address the correct issues in the ES.	Data to inform the establishment of baseline conditions and the assessment of effects has been sourced from a number of different places, including the EA and the relevant local authorities. These sources are described in **Volume 5.9.1** in the section 'Method'.

Statutory Stage 4 Consultation

9.1.11 Statutory Stage 4 Consultation took place over a period of eight weeks between 3 September and 29 October 2013 in accordance with the Planning Act 2008. Statutory and non-statutory consultees and members of the public were included in the consultation. Various methods of consultation and engagement were used in accordance with the Statement of Community Consultation (SoCC) including letters, website, public exhibitions, publicity and advertising, inspection of documentation at selected locations and parish and town council briefings.

9.1.12 National Grid prepared a Preliminary Environmental Information Report (PEIR) which was publicised at this consultation stage. National Grid sought feedback on the environmental information presented in that report. Feedback received during Statutory Stage 4 Consultation was considered by National Grid and incorporated where relevant in the design of the project and its assessment and presentation in this ES.

9.1.13 A summary of the Statutory Stage 4 Consultation representations received (relevant to EIA) and National Grid's responses are summarised at **Volume 6.1** (Consultation Report). A summary of the main Statutory Stage 4 Consultation representations received in relation to the ground environment is presented in the table below.

Table 9.2 Summary of the Main Ground Environment Statutory Stage 4 Consultation Representations Received

Representation	Response
The mitigation is generic for the construction phase, and specific details of the mitigation proposed for each of the potential effects should be provided. In addition, the proposed development has been selected to avoid mineral extraction sites. However, no details of mitigation measures that will be used when the development does cross these sites have been given. There is also no mention of mitigation measures during operation or decommissioning phases, which are required to have a full understanding of the project's environmental effects.	**Volume 5.9.1** has identified mitigation measures for the construction, operation and decommissioning phases of the Proposed Development. A Draft Construction Environmental Management Plan (CEMP) (**Volume 5.26**) has been produced to specifically address required mitigation measures and should be read in conjunction with **Volume 5.9.1**.

Draft ES and Supporting Documents

9.1.14 The Draft ES and a large number of the ES supporting documents were provided to a number of statutory and non-statutory bodies over a period of two weeks between 3 and 17 February 2014. This process of engagement (over and above that required by the statutory consultation process) was undertaken to provide an opportunity for these bodies to influence the assessment documents prior to their finalisation to accompany the DCO application.

9.1.15 A summary of the Draft ES representations received (relevant to EIA) and National Grid's responses are summarised at **Volume 5.5.2, Appendix 5C.** A summary of the main Draft ES representations received in relation to the ground environment are presented in the table below.

Table 9.3 Summary of the Main Ground Environment Draft ES Representations Received

Representation	Response
Volume 5.9.1	
The proposal to appoint an agricultural liaison officer or soil specialist during construction stated in the PEIR is no longer included. However, a "Soil Management Plan and a Drainage Management Plan would be prepared and implemented".	There will be Draft DCO Requirements for a Soil Management Plan and a Drainage Management Plan, including that these will be provided to the Local Planning Authority (LPA) for comment, review and approval. This chapter includes a statement to this effect in the mitigation section (section 9.7)

Representation	Response
No reference is made to the crossing of the government oil pipeline which runs along Severn Road. Pylon LD129 could potentially be sited on or very close to the way leave.	An assessment of existing oil pipelines in Section E, F and G have been added for soil contamination; incorrect pylon number referenced, it should be LD125 amongst others.
Current and disused land drains are frequently encountered in Avonmouth, some investigation into their location and/or a proposed method of dealing with them should be included. A cautionary note should be added to this section with regards to made ground/landfill in Section G. The location of mine entries shown on available drawings my not be accurate. Investigations should be undertaken to confirm the absence of workings that could affect the stability of the proposed developments.	There will be a DCO Requirement for a written scheme of ground investigation, to be approved by the LPAs, and to be carried out prior to construction. A statement for additional site investigation (SI) prior to construction has been added to the mitigation section. Also, National Grid has designed its proposals to avoid all third party services wherever possible. Where third party services cannot be avoided, National Grid has worked closely with the organisations responsible for their operation or maintenance to minimise effects on operations and future development aspirations. This engagement will continue during the construction phase.
The assessment of negligible risk for Section G is queried. Avonmouth has significant made ground and alluvial deposits (tidal flats or river deposits). These range from anything up to 10 – 15 metres below ground level. For instance when the M49 was constructed the additional loading caused an older landfill site on the other side of the M5 to produce methane levels of over 60%	A separate assessment for Tidal Flat Deposits (TFD) within Section G has been undertaken where landfills are located close to TFD and compression could result in release of ground gas and leachate.
Risk of ground gas associated with peat deposits should be considered.	An additional assessment for ground gas from natural peat deposits has been included in section 9.5.

Representation	Response
Consideration should be given towards gas monitoring at T-Farm. T-Farm was a vast landfill site and was tipped in the 1940's – 1960's, given the historical landfilling that has occurred in Avonmouth it is advisable to consider investigation of gas issues at this landfill site. The Crooks Marsh landfill received both hazardous and non-hazardous wastes, it is known to have been gassing and have issues with leachates (leachate is not really mentioned here. It is not clear what mitigation measures will be used to control gas migration pathways.	There will be a DCO Requirement for a written scheme of ground investigation, to be approved by LPAs, and to be carried out prior to construction. A statement for additional SI prior to construction has been added to the mitigation section 9.7. The risk rating for Crooks Marsh Landfill has been changed to reflect moderate risk.
The standard depth of 1.8metres for undergrounding is queried. • Made ground particularly to the north of Avonmouth Way is likely to be of smelter residues/wastes. • Reuse of arising's may not be possible if soils are contaminated. • Concrete class selection for this area is important as buildings have suffered with chemical attacks. • No information regarding integrity of the rhines to be crossed has been prepared yet. • Limited detail about undergrounding beneath M49 and associated landfill/made ground.	There will be a DCO Requirement for a written scheme of ground investigation, to be approved by LPAs, and to be carried out prior to construction. A statement for additional SI prior to construction has been added to the mitigation section 9.7. The integrity of rhines in this area will be investigated during the development of the Drainage Management Plan.
Pre-construction ground investigations should include the investigation and characterisation of potentially contaminated sites. The ground investigation information should be used to inform risk assessments and where necessary remedial strategies. The investigations should also inform the foundation risk assessments.	There will be a DCO Requirement for a written scheme of ground investigation, to be approved by LPAs, and to be carried out prior to construction. A statement for additional SI prior to construction has been added to the mitigation section 9.7.
Volume 5.9.2, Appendix 9G 1/5 Preliminary Risk Assessment (PRA)	

Representation	Response
Specific measures to mitigate ground gas will be required, particularly at Crooks Marsh Landfill and will need to be secured by Requirement	This will be dealt with as part of the site investigation and risk assessment process that will be secured by DCO Requirement
Leachates from Crooks Marsh Landfill need to be considered. Perched water is often found to be contaminated along this section of the route.	This will be dealt with as part of the site investigation and risk assessment process that will be secured by DCO Requirement
Volume 5.9.2, Appendix 9G 4/5 and 5/5 Unexploded Ordnance Reports	
A new updated report is required (this is proposed within the CEMP). This report looks at the existing route only and not the proposed new route through Avonmouth Docks which was subject to intense bombing in WWII.	Statement for additional SI including the requirement for up to data UXO study prior to construction within mitigation section.

9.2 Policy and Legislation

National Policy

National Policy Statements

9.2.1 The assessment of potential effects has been made with specific reference to relevant National Policy Statements (NPS); these form the principal policy framework within which decisions on Nationally Significant Infrastructure Projects (NSIP) are made.

9.2.2 The principal guidance for determination of the application is that provided by Overarching National Policy Statement for Energy (EN-1) (Ref 9.1) and National Policy Statement for Electricity Networks Infrastructure (EN-5) (Ref 9.2).

9.2.3 The table below identifies the requirements related to the Ground Environment in EN-1 and provides details as to where in this chapter, and how, the requirements are addressed.

9.2.4 There are no sites of geological conservation importance within the Order Limits; this point is made clear in the table for EN-1. As such, EN-5 (Part 2.7, Biodiversity and Geological Conservation) is not applicable and has not been included in this policy analysis.

Table 9.4 Summary of NPS EN-1 Requirements Relevant to the Ground Environment

Para	Requirement	ES Section	Compliance
5.3.3	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, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity.	For species and habitats, this is provided at **Volume 5.8.1, section 8.5** and **Volume 5.20** (Applicant's Report to Support Habitats Regulations Assessment); there are no sites of geological conservation importance.	There are no sites of geological conservation importance within the Order Limits. In **Volume 5.8.2**, effects on designated sites are set out in **Appendix 8A**. Effects on protected species, habitats and other species of principal importance are discussed in the noted sections. **Volume 5.20.1, section 3** also discusses effects on designated sites and protected species.
5.3.4	The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.	Embedded mitigation for biodiversity is described in **Volume 5.8.1, section 8.7 and 8.9** and the Biodiversity Mitigation Strategy (BMS), **Volume 5.26.3**	There are no sites of geological conservation importance within the Order Limits. In **Volume 5.8.1**, opportunities to conserve and enhance biodiversity are described throughout the chapter, specifically within the mitigation sections. The Off-site Planting and Enhancement Scheme (OSPES) (**Vol. 5.25**) details a package of enhancement measures for off-site planting. The BMS (**Volume 5.26.3**) also describes habitat reinstatement and enhancement measures.
5.3.4	As a general principle, and subject to the specific policies in Part 5.3 of NPS EN-1, development should aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives; where significant harm cannot be avoided, then appropriate compensation measures should be sought.	Mitigation for biodiversity is described in **Volume 5.8.1, section 8.7 and 8.9** and the BMS (**Volume 5.26.3)**	There are no sites of geological conservation importance within the Order Limits. The mitigation sections of **Volume 5.8.1** detail the mitigation measures proposed in order to avoid significant harm to biodiversity. Section 8.9 also details proposals for compensatory offsetting measures. The BMS (**Volume 5.26.3**) describes how the mitigation measures will be implemented.

Para	Requirement	ES Section	Compliance
5.3.9	For the purposes of considering development proposals affecting them, as a matter of policy the Government wishes pSPAs to be considered in the same way as if they had already been classified. Listed Ramsar sites should, also as a matter of policy, receive the same protection	Sites included in the assessment are described at **Volume 5.8.1, section 8.4**	All proposed or candidate designated sites have been considered as fully designated in **Volume 5.8.1**. Further, in line with local draft planning policy, the proposed offsetting of land for development at Avonmouth & Severnside (Hallen Marsh) as equivalent status to the Severn Estuary SPA Ramsar has been considered.
5.3.18	The applicant should include appropriate mitigation measures as an integral part of the proposed development	Mitigation for biodiversity is described in **Volume 5.8.1, section 8.7and 8.9** and the BMS (**Volume 5.26.3)**	The mitigation measures are discussed in detail in the BMS.
5.3.18	The applicant should demonstrate that during construction, they will seek to ensure that activities will be confined to the minimum areas required for the works;	Controls and mitigation for construction works are provided in the BMS, **Volume 5.26.3**	These sections set out the modifications which have been incorporated into the engineering design as the Proposed Development has evolved, in order to avoid or minimise potential effects on ecological receptors.
5.3.18	The applicant should demonstrate that during construction and operation best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised, including as a consequence of transport access arrangements	Controls and mitigation for construction works are provided in the BMS, **Volume 5.26.3**	The BMS details best practice methods that will be followed to minimise risk of disturbance or damage to species or habitats.
5.3.18	The applicant should demonstrate that habitats will, where practicable, be restored after construction works have finished	Restoration measures are described in **Volume 5.8.1, section 8.7** and the BMS **Volume 5.26.3**	The BMS details the habitat restoration which will be undertaken following completion of construction works. The section also details habitat restoration proposals following completion of construction works.
5.3.18	The applicant should demonstrate that opportunities will be taken to enhance existing habitats and, where practicable, to create new habitats of value within the site landscaping proposals	Restoration measures are described in **Volume 5.8.1, section 8.7** and the BMS **Volume 5.26.3**; also reference OSPES, **Volume 5.25**	There are proposals to enhance existing habitats by introducing greater biodiversity as part of the habitat reinstatement process, and in new habitats created in site landscaping for the cable sealing end (CSE) compounds and Sandford Substation.

Para	Requirement	ES Section	Compliance
5.10.7	Applicants should also identify any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed.	This is addressed in **Volume 5.9.1, sections 9.5, 9.7 and 9.8**	The potential loss of, or damage to, the structure of topsoil as a result of the construction of the Proposed Development, for example, during soil stripping operations and reinstatement, which could lead to poor crop establishment or significant changes in soil drainage parameters has been assessed.
5.10.7	For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination.	This is addressed in **Volume 5.9.1, section 9.5**	The potential risks associated with previously developed land and historic land use within and adjoining the Order Limit have been assessed including the potential for: remobilisation of contamination in groundwater by on site activities; residual contaminated soils at the surface following on site activities; and accidental import or spreading of contaminated material within the working area during on site activities. Technical baseline reports (Preliminary Risk Assessments) have been undertaken for each section of the Proposed Development in accordance with the "Model Procedure for the Management of Contaminated Land, Contaminated Land Report 11".
5.10.8	Applicants should safeguard any mineral resources on the proposed site as far as possible; taking into account the long-term potential of the land use after any future decommissioning has taken place.	This is addressed in **Volume 5.9.1, Section 9.5**	The potential for the Proposed Development to result in the sterilisation of areas of mineral resources (both current and future) has been assessed. There are no mineral safeguard areas (MSAs) within or adjoining the Order Limit.

National Planning Policy Framework (NPPF)

9.2.5 The NPPF does not set policy for testing the acceptability of NSIPs. However , NPPF paragraph 120 states:

"To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or

proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner".

9.2.6 The technical baseline reports (PRAs) presented within **Volume 5.9.2, Appendices 9A to 9H**, referenced below and this chapter have been undertaken in accordance with Contaminated Land Report CLR11, and identified potential source, pathway and receptor linkages relating to contaminated land. There may be the requirement to undertake further site-specific ground investigation following any granting of the Development Consent Order (DCO).

9.2.7 Paragraph 121 of NPPF states that planning policies and decisions should also ensure that:

- *"the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation";*
- *"after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990"; and*
- *"adequate site investigation information, prepared by a competent person, is presented".*

9.2.8 In general paragraphs 120 to 125 of the NPPF set out the need for local planning authorities to consider the direct and indirect impacts of potentially polluting development on health, general amenity and the environment.

9.2.1 The NPPF Planning Practice Guidance for land affected by contamination (March 2014), was published recently to provide a degree of technical grounding to the policies described in the NPPF. The Planning Practice Guidance mirrors much of the policies and guidance introduced in EN-1 (see **Table 9.4**) and on which this assessment is founded.

National Legislation

9.2.2 Relevant National legislation include the following. Where relevant, the guidance contained therein has been used to inform this document and the technical baseline reports (PRAs):

- Environmental Protection Act 1990 Part IIA;
- Water Resources Act 1991 Section 24;
- Water Resources Act 1991 Section 85;
- Water Framework Directive (2000);
- Groundwater Regulations 1998; and
- The Control of Pollution (Oil Storage) (England) Regulations 2001.

General Guidance

9.2.3 Relevant guidance includes the following. Where relevant, the guidance contained therein has been used to inform this document and the technical baseline reports (PRA's):

- British Standards Institution (2011), 'BS 10175:2011. Investigation of potentially contaminated sites: Code of practice';
- Environment Agency (2004a), Model Procedures for the Management of Contaminated Land. Contaminated Land Report Number 11 (CLR11), September (Bristol: Environment Agency); and
- Environment Agency (2010a), 'GPLC1 – Guiding Principles of Land Contamination', 'GPLC2 – Frequency Asked Questions, Technical Information, Detailed Advice and References', and 'GPLC3 – Reporting Checklists', all March 2010.

Local Policy

9.2.4 A summary of relevant local planning policy is provided below and is presented within **Volume 5.4.2, Appendix 4A**. It should be noted that local planning policy does not set policy for testing the acceptability of Nationally Significant Infrastructure Projects.

9.2.5 General themes in the local planning policies of West Somerset District Council, Sedgemoor District Council, North Somerset Council, South Gloucestershire Unitary Authority, Bristol City Council and Somerset County Council, have been identified that relate to the ground environment. These general themes have been summarised below:

- policies to ensure that potential effects to local nature conservation/geological interests or designated sites are appropriately assessed for all development proposals;
- policies to ensure that groundwater source protection areas, groundwater aquifers and groundwater resources including the quality and quantity of water in water courses or aquifers used to maintain public supply are appropriately assessed for all development proposals;
- policies to ensure that all development proposals on or in proximity to land known to be, or which maybe or have the potential to be, contaminated would include appropriate assessment including where relevant, measures designed to prevent an unacceptable risk to public health and the environment;
- policies for the minimisation of waste and the sustainable management of waste, reducing reliance on landfill. That includes reduction, re-use, recycling and composting of waste, and recovery of materials and energy from waste;
- policies to ensure that unstable land is appropriately assessed for all development proposals; and
- policies relating to mineral safeguarding and with aims to safeguard opportunities for future mineral extraction.

9.2.6 This chapter of the ES has taken into account relevant local policies by identifying ground environment features and receptors within or within close proximity to the Proposed Development as required by the local policies. 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.

9.2.7 This ES chapter has identified Mineral Safeguarding Areas (MSAs) and areas of potential unstable ground in close proximity to the Proposed Development. These features have been identified as receptors and are included in the baseline of this chapter. Appropriate mitigation measures to minimise or mitigate potential impacts to these ground environment receptors have been included, where relevant.

9.3 Method

9.3.1 The potential effects from the construction, operation and decommissioning of the Proposed Development on the ground environment have been identified based on a detailed understanding of the local geological and regional hydrogeological regimes. This was obtained by carrying out a site visit, review of a commercially available environmental database including historical maps, review of readily available environmental third party information, such as the Environment Agency (EA) website and collation of information obtained from relevant consultees.

9.3.2 Following the collation and review of the available information, a Conceptual Site Model (CSM) for each Section of the Proposed Development has been developed. These are presented as **Figure 4** within the PRAs referenced previously within this document and presented within **Volume 5.9.2, Appendices 9A to 9H**. The CSM provides a representation of the behaviour of the natural system and is used to assess the likely impact of the Proposed Development. With regard to potential

contamination issues a PRA has been incorporated in accordance with government guidelines Model Procedures for the Management of Land Contamination (CLR11).

9.3.3 The background data, CSM (**Figure 4** within each PRA report) and PRA (see **Volume 5.9.2, Appendices 9A to 9H**) are presented as a series of technical baseline reports on each area of the Proposed Development Sections as defined at **Volume 5.3.1**.

Base Case

9.3.4 A description of the baseline environment at the point when the potential effects of the Proposed Development are expected to occur may differ from that as identified in the baseline assessment. No differences between the baseline and base case ground environments are expected.

9.3.5 A sensitivity analysis has been undertaken to take account that the start date of the construction programme may change. Changes to the construction programme will not have an effect on the base case. The assessments are presented in section 9.5.

Desk-based Assessment

9.3.6 A desk-based geo-environmental study has been undertaken to collect baseline data for the study area utilising a radius search buffer of up to 2km. A 2km 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 the ground environment. The desk-based review has been undertaken using information from the following sources:

- Ordnance Survey (OS) mapping;
- a commercially available environmental database report, including historical maps, designated geological sites and public water supplies;
- British Geological Survey (BGS) maps and data;
- Environment Agency (EA) website, including online aquifer designation and groundwater source protection zone (SPZ) maps, hydrogeological maps and landfill maps;
- EA groundwater vulnerability maps;
- direct enquiries as described above to the Local Authority Environmental Health Departments and EA; and
- where available and appropriate, details of existing intrusive site investigations would be considered.

Site Assessment

9.3.7 A site walkover survey was undertaken to identify important geological features and evaluate the existing site setting, significant surface watercourses and any potentially contaminated land.

9.3.8 Site walkovers surveys comprising a visual inspection and assessment of the land for pertinent issues relating to the ground environment, such as potential sources of contamination were restricted in their extent owing to land access issues. Where private land access was not granted, the Proposed Development was viewed from the closest publically accessible area and using online aerial photography.

9.3.9 The chemicals of potential concern (COPC) associated with electrical transmission sites are known and have been identified within the technical baseline reports (**Volume 5.9.2, Appendices 9A to 9H**) and therefore it was not necessary to enter the existing substation sites associated with the Proposed Development as part of the field surveys; also, the COPC would not have been visually observed beneath the standing cover of gravel, buildings and roadways. A combination of professional experience of undertaking detailed site-specific intrusive ground investigations on substation sites and knowledge of the COPC associated with these sites has informed the technical baseline reports and PRAs, which have contributed to the completion of the risk assessments within this ES chapter.

9.3.10 Potential effects in relation to ground contamination and land quality have 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'. The assessment of significance within the PRA has been based on the risk assessment process and has taken account of the different sensitivities of the identified receptors.

Study Area

9.3.11 For the purpose of the ground environment assessment, the Proposed Development comprises the components described in **Volume 5.3.1**, contained within the extent of the Order Limits shown at **Volume 5.1.3, Figure 1.1** and **Volume 5.3.3, Figures 3.1** and **3.2.**

Assessment of Effects

9.3.12 The significance of likely effects arising from the Proposed Development on ground conditions has been determined by identifying the magnitude of the potential effect and the sensitivity of the receptor.

Magnitude of Effect

9.3.13 The magnitude of potential effects (both beneficial and adverse) on environmental baseline conditions is identified in **Table 9.5** below.

Table 9.5 Magnitude of Effect

Magnitude	Definition
Major	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. Short term (acute) risk to human health likely to result in 'significant harm' as defined in guidance provided in CIRIA C552 (Ref 9.3).
Moderate	Loss or alteration to one or more key elements/ features of the baseline conditions such that post development character, composition or attributes of the baseline will be materially changed. Chronic damage to human health ('significant harm' as defined in guidance provided in CIRIA C552 (Ref 9.3).

Magnitude	Definition
Minor	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. Non-permanent human health effects easily prevented by use of personal protective equipment, as defined in guidance provided in CIRIA C552 (Ref 9.3).
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation. No impact to human health as presented within guidance provided in CIRIA C552 (Ref 9.3).

Sensitivity of Receptor

9.3.14 A judgement has been made on the sensitivity of the receptors involved, as indicated in **Table 9.6** below.

Table 9.6 Method for Determining Sensitivity/Importance of the Environment

Receptor Sensitivity	Description
High	Areas of critical topography, including steep slopes Inner groundwater source protection zones (SPZ 1) Areas of high groundwater vulnerability Principal aquifers Areas of known/confirmed contaminated land/groundwater Landfill sites Rivers with a Grade A water classification Areas of flood risk (Flood Zone 3 (highly probable)) Potable water abstractions Human end users of the site specifically residential dwellings with private garden Neighbouring properties and residents Designated areas (Sites of Special Scientific Interest (SSSI), RAMSAR sites, Special Areas of Conservation (SAC), Special protection Areas (SPA)) Designated mineral safeguarded areas (MSAs) and sites with existing planning permission
Medium	Outer groundwater source protection zones and total catchment areas (SPZ 2 and SPZ 3) Secondary aquifers (A, B and undifferentiated) Flood zone 2 (medium probability)) Areas with intermediate groundwater vulnerability Rivers with a Grade B water classification Human receptor – workforce and operators with prior knowledge of site conditions Sites with lapsed planning permission for mineral extraction. This includes former quarries which may be inactive (including yet to be worked), worked-out and/or restored (not MSAs)

Receptor Sensitivity	Description
Low	Industrial site topography Rivers with a Grade C or D water classification Unproductive strata Areas with low groundwater vulnerability

9.3.15 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.

Significance of Effect

9.3.16 The categories used when classifying the overall significance of potential effects (both beneficial and adverse) by considering the sensitivity of receptor and the magnitude of effect, are shown in **Table 9.7** below which is based on the Institute of Environmental Management and Assessment's 'State of Environmental Impact Assessment in the UK' which states that the most common methodology used to evaluate significance is to compare the magnitude of the predicted effect with the sensitivity of the receiving environment. In this approach 'magnitude' and 'sensitivity' are used as descriptors of a wide range of different factors. 'Magnitude' includes the spatial extent of the effect; the time period over which the effect will occur; and whether the effect is permanent or reversible.

Table 9.7 Significance of Effect Matrix

Magnitude	Sensitivity of Receptor		
	High	Medium	Low
Major	Major	Moderate	Minor
Moderate	Moderate	Moderate	Minor
Minor	Minor	Minor	Negligible
Negligible	Negligible	Negligible	Negligible

Consideration of Likelihood

9.3.17 A qualitative assessment of likelihood is considered appropriate, for selected effects to the ground environment. There are scenarios where the likelihood of an effect is certain, for instance for changes to physical soil parameters arising from construction activities or where effects would definitely not occur (e.g. impact to designated sites because the Proposed Development avoids them through design).

9.3.18 Where the certainty of the effect could be variable, professional judgement, an understanding of the ground conditions and the nature of the Proposed Development has been used in assessing the likelihood of the effect occurring.

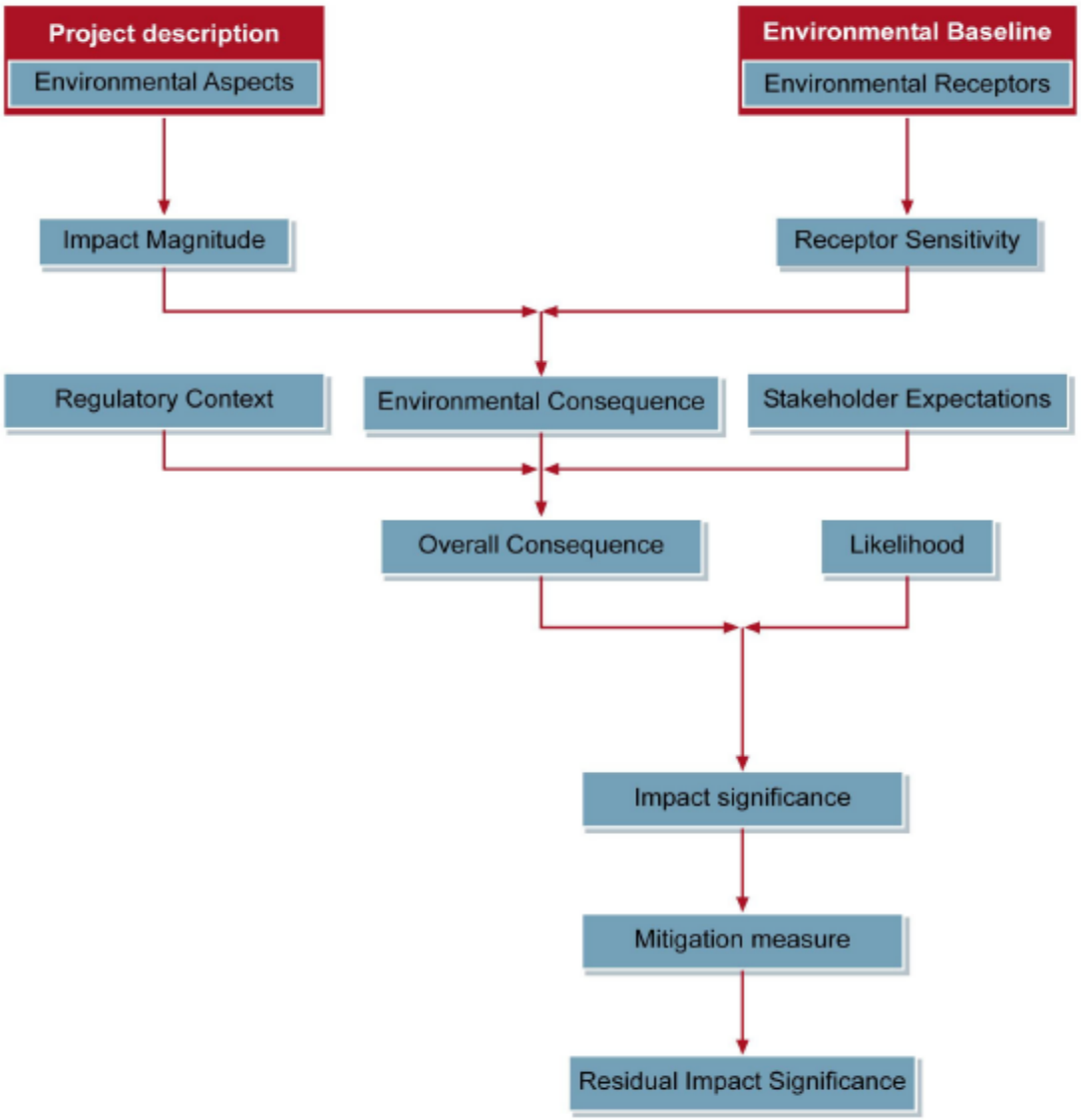
9.3.19 The likelihood of the potential significance of effect occurring is then explicitly taken into account to derive the overall significance of effect for those potential effects on the ground environment for the construction, operation and decommissioning phases where applicable. The likelihood has been assessed prior to the implementation of mitigation measures to determine the significance of effect.

9.3.20 The levels of likelihood have been considered as highly likely, likely, low likelihood and unlikely as shown in **Table 9.8** and the method for assessing the likelihood is set out in the IEMA quality mark article presented within **Inset 9.1.**

9.3.21 Table 9.8 Definition of Likelihood

Likelihood	**Definition**
Highly likely	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
Likely	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
Low likelihood	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
Unlikely	Circumstances are such that it is improbable the event would occur even in the long term

Inset 9.1: IEMA Quality Mark Article; Impact Significance – Risk Based Approach Flow Chart



9.3.22 The overall ssignificance of effect is a judgement about the combination of the magnitude of effect and the sensitivity of the receiving environment/receptor. This ES records judgements about the likely significance of effects arising from the Proposed Development.

Limits of Deviation (LoD) and Order Limits

9.3.23 In accordance with **Volume 5.5.1**, the Proposed Development would be subject to LoD and Order Limits which provide a necessary and proportionate degree of flexibility as to the final alignment of the works. The LoD and Order Limits identify a maximum distance or measurement of variation within which these works must be constructed. Both lateral and longitudinal changes in LoD and Order Limits have been considered in the assessment in accordance with the methodology set out in **Volume 5.5.1.**

9.3.24 Longitudinal and lateral changes within the LoD and Order Limits and have been considered where the overall significance of effect would be higher following a longitudinal movement of the development component.

Mitigation and Residual Effects

9.3.25 The assessment has sought to identify suitable mitigation to avoid, reduce or remove significant adverse effects identified. Where appropriate, opportunities to enhance beneficial effects are also identified. The residual effect expected following mitigation is identified.

9.4 Baseline Environment

9.4.1 A desk-based assessment was undertaken between May 2013 and August 2013, of the existing physical and environmental setting of the study area. This involved a review of data for the site including topography, soils, superficial and solid geology, minerals, hydrogeology, history of potentially contaminative site uses, site sensitivity to contamination and ground stability. Hydrology and flood risk are mentioned in brief to provide a complete overview but are specifically dealt with in more detail at **Volume 5.10.1.**

9.4.2 Site visits were undertaken during the period from 30 May 2013 to 5 June 2013 to supplement this work, the results of which are described below for each Section and/or component of the Proposed Development.

9.4.3 Section D – Somerset Levels and Moors North incorporates an additional standalone area defined as the existing Churchill Substation, which is located geographically separate to the majority of the Proposed Development within this Section

9.4.4 Section H – Hinkley Line Entries incorporates a standalone area defined as the Hinkley Line Entries modification, which is located geographically separate to the majority of the Proposed Development.

Section A – Puriton Ridge

Site Description

9.4.5 Section A - Puriton Ridge comprises the southern-most part of the Proposed Development between Bridgwater 275/132kV Substation and the southern extent of Puriton Ridge at Woolavington. The area generally comprises low-lying, flat open fields used for agricultural purposes. Isolated hamlets and villages are located along the route, primarily consisting of Slape Cross, Bawdrip, Horsey, Knowle and Woolavington. See **Volume 5.9.3, Figure 9.1** (Site Geology) and **Volume 5.9.2, Appendix 9A** (PRA). The technical base line report (Ref 9.4), provides further site-specific details for this Section of the Proposed Development and its development components and should be read in conjunction with the ES.

Topography

9.4.6 The regional topography ranges between approximately 6-8m Above Ordnance Datum (AOD) on the low-lying areas including the Chedzoy Levels, Horsey Levels and Bawdrip Levels, rising gently at Puriton Ridge to approximately 50m AOD.

Puriton Ridge forms an elevated section of land trending west to east at the northern extent of this Section.

Superficial Geology

9.4.7 Superficial deposits comprising Alluvium are located along sections of the Proposed Development (400kV overhead line and existing F route), predominantly located south of Slape Cross and close to the King's Sedgemoor Drain.

9.4.8 Tidal Flat Deposits are located on the Horsey Levels.

9.4.9 The Burtle Formation comprising superficial sands and gravels is located between Slape Cross and Knowle on the Bawdrip Levels.

9.4.10 Puriton Ridge is generally absent of superficial deposits.

Solid Geology

9.4.11 Bedrock beneath the southern part of Section A consists of Mercia Mudstone Group (MMG) (mudstones). North of the King's Sedgemoor Drain on Puriton Ridge, bedrock is identified as the Blue Anchor Formation (mudstones), Westbury Formation and Cotham Member (interbedded mudstone and limestone) and the Langport Member, Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated mudstones).

Radon and Ground Gas

9.4.12 Areas south of Slape Cross are defined as not being within an 'Affected Area' as defined by the NRPB Document, NRPB-W26-2002 (Ref 9.5). The guidance presented within the NRPB-W26-2002 document states that no radon protection measures are necessary in the construction of new dwellings or extensions as less than 1% of properties are above the Action Level.

9.4.13 Areas south of Slape Cross are defined as not being within an 'Affected Area' as defined by the NRPB Documents of the Radon Atlas of England and Wales, NRPB-W26-2002. The guidance presented within the NRPB-W26-2002 (Ref 9.5) document states that no radon protection measures are necessary in the construction of new dwellings or extensions as less than 1% of properties are above the Action Level.

9.4.14 Given the anticipated ground conditions the risk associated with ground gas (methane and carbon dioxide) is considered low to moderate in accordance with CIRIA C665 (Ref 9.8). It is noted that peat deposits may be present within superficial Alluvial deposits.

Mineral Sites

9.4.15 A review of information available on the BGS website relating to designated mineral resource sites within Somerset was undertaken. This included review of any recorded valid or expired planning permissions for both surface and underground mineral extraction activities as recorded by the Mineral Planning Authority. This data specifically relates to planning permissions dated on or before 1 October 2004 (Ref 9.6) and includes information on the mineral resource extracted. This is the most up to date data set presented by the Mineral Planning Authority.

9.4.16 Three mineral designation sites have been identified within the general vicinity of the Proposed Development within Section A. These are all recorded as inactive (including yet to be worked), worked-out and/or restored site and include:

- Dunwear Works (South) site: Surface extraction of clay and/or shale;
- Bath Road site: Surface extraction of clay and/or shale; and
- Fourteen Acre site: Surface extraction of limestone and clay and/or shale. The proposed 400kV overhead line passes through the eastern-most part of this designated area; however the existing F Route falls outside of the designated area.

Ground Stability

9.4.17 Potential ground stability hazards arising from landslide are classed as moderate within the vicinity of Puriton Ridge.

9.4.18 Potential ground stability hazards arising from compressible ground and running sand are classed as moderate on the flat low-lying areas including the Bawdrip, Horsey and Chedzoy Levels. This is owing to the composition of the superficial deposits including the potential for peat deposits.

9.4.19 Potential ground stability hazards arising from collapsible ground, ground dissolution and shrinking or swelling clay are considered as very low to low.

Landfilling

9.4.20 There are four identified landfills located within 1km of the Proposed Development. It is noted that no registered landfills are located beneath existing or proposed infrastructure.

- former ponds off Westonzoyland Road, located within 250m distance and infilled with inert waste;
- East Bower, M5 motorway, located 1km distance and infilled with inert and non-hazardous waste;
- a historic landfill site close to the M5 motorway, located 450m distance and infilled with inert waste; and
- a landfill at a disused former quarry east of Puriton Park on Puriton Ridge. Located within 400m distance and infilled with waste included inert and household waste.

Mining

9.4.21 Several historic quarries are identified on Puriton Ridge. The mined commodity is identified as clay or limestone. Cat's Quarry on Puriton Ridge is located in close proximity (within 25m to 50m) of the proposed 400kV overhead line, specifically at pylon locations ZGA7 and ZGA8.

9.4.22 The area is not at risk from below ground coal mining.

Designated Sites

9.4.23 No geologically related SSSI were identified within the environmental database report. The site does not lie within a designated European Geopark defined as places with outstanding geology where special effort is made to make the most of Earth heritage through interpretation, education, conservation and nature-based tourism. There were no records within the Joint Nature Conservation Committee (JNCC) database that relate to the site or the immediately surrounding area.

Soil

9.4.24 The majority of Section A is underlain by soils comprising naturally wet loamy and clayey soils of the coastal flats. On the southern side of Puriton Ridge they comprise slightly acid loamy and clayey soils with impeded drainage. The majority of the Puritan Ridge is underlain by shallow lime rich soils over limestone.

Groundwater

9.4.25 The superficial deposits are variably classified as a secondary A aquifer where Alluvium or the Burtle Formation is recorded.

9.4.26 Superficial deposits comprising Tidal Flat Deposits are designated as a secondary undifferentiated aquifer.

9.4.27 The Triassic bedrock comprising MMG beneath the site has been classified by the EA as a secondary B aquifer.

9.4.28 The Blue Lias Formation, Langport Member and Charmouth Mudstone on Puriton Ridge are designated secondary aquifers.

9.4.29 There are approximately 21 groundwater abstraction points within 1km of the Proposed Development. All of the groundwater abstractions relate to general farming and domestic use at farms. No potable water abstraction points are noted within 1km of the Proposed Development.

9.4.30 Information available on the EA website indicates that the Proposed Development does not lie within a currently designated groundwater SPZ.

Hydrology

9.4.31 Numerous interconnected surface water features such as ponds, drainage ditches and rhynes cross the Horsey and Bawdrip Levels.

9.4.32 The primary surface water features within Section A along the proposed 400kV overhead line include the King's Sedgemoor Drain, Park Wall Rhyne, Horsey Rhyne and the Bath Road Rhyne.

9.4.33 There are 11 surface water abstractions within 1km of the proposed 400kV overhead line. The specified uses for the abstractions includes spray irrigation, evaporative and general cooling.

Flooding

9.4.34 The majority of the Proposed Development is located within a zone 2 and zone 3 flood risk area. This includes the location of the Bridgwater 275kV/132kV Substation, the existing F Route and the route along the Proposed Development between the Bridgwater Tee connection on the Horsey Levels and the base of

Puriton Ridge at King's Sedgemoor Drain and Knowle. Puriton Ridge is not shown to fall within an area prone to flooding.

9.4.35 Further details on the baseline flood risk for the Proposed Development location is provided in the Flood Risk Assessments, **Volume 5.23**.

Historical Context

9.4.36 The site historic land use within the low-lying parts of the site including the Levels has predominantly consisted of rural undeveloped agricultural land use.

9.4.37 Puriton Ridge has been subject to historic quarrying for clay and limestone. A general rural agricultural land use also applies to the ridge.

9.4.38 An abandoned medieval village is located on the Horsey Level.

Potential Contaminant Sources (On/Off Site)

9.4.39 Sedgemoor District Council does not hold any records to indicate that the Proposed Development crosses any areas which are contaminated under the definitions of Part IIA of the Environmental Protection Act 1990.

9.4.40 Several pollution incidents to controlled waters are recorded within 250m of the Proposed Development (proposed 400kV overhead line and existing F Route. These were classed by the EA as minor incidents (category 3) to both land and water resulting from the discharge or fly tipping of various wastes including sewage materials, household waste and vehicle parts. Given the minor incident (category 3) nature of these incidents and their localised nature, these are unlikely to significantly impact the development.

9.4.41 The following potential on site sources of contamination have been identified within Section A – Puriton Ridge:

- general made ground (if present);
- infilled ponds and quarries;
- minor hydrocarbon spills from farming equipment and tanks at farms;
- PCBs associated with Bridgwater 275/132kV Substation and other electrical equipment;
- herbicides and pesticides associated with the agricultural use;
- peat deposits; and
- Bridgwater 275/132kV Substation.

9.4.42 The following potential off site sources of contamination have been identified within Section A – Puriton Ridge:

- sewage treatment works – 320m east of the F Route close to the Huntspill River;
- former railway sidings – beneath the proposed 400kV overhead line and F Route, north of the Huntspill River;
- depots – 350m east of the F Route close to the Huntspill River;
- rifle range – 500m distance west of the proposed 400kV overhead line on the Horsey Levels;
- pump houses – within 500m distance, along primary surface water courses along the route; and
- landfills – between 250m and 1,000m from the proposed 400kV overhead line at the Puriton Ridge and BAE Systems site.

Potential Chemicals of Concern

9.4.43 The following potential chemicals of concern have been identified within Section A – Puriton Ridge. These potential chemicals are likely to be localised to the vicinity of the source and are not anticipated to be wide spread:

- potential made ground (including heavy metals, polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCB), asbestos, herbicides and pesticides;
- ground gases including carbon dioxide and methane; and
- leachate from landfills.

Existing Ground Investigation Data

9.4.44 The results of an intrusive ground investigation undertaken within Section A – Puriton Ridge are presented within **Volume 5.9.2, Appendix 9J**.

9.4.45 The ground investigation covered areas within other sections along the Proposed Development. The relevant information for Section A – Puriton Ridge has been summarised within the following paragraphs. The purpose of the ground investigation was to assess ground conditions for geotechnical and environmental purposes. No chemical laboratory testing of soil or groundwater samples for environmental purposes was undertaken as part of the scope of assessment. Groundwater and ground gas monitoring was not undertaken as part of the assessment. The report provides a factual assessment of ground conditions encountered.

9.4.46 The ground investigation was focused within Section A – Puriton Ridge on the Horsley Levels at the Bridgwater Tee between an existing 400kV overhead line and the proposed 400kV overhead line replacement for the existing F route.

9.4.47 Two boreholes were drilled using a cable percussion drilling technique until refusal was met. Upon refusal, the boreholes were advanced using a rotary with air-mist flush drilling method to a maximum depth of 26.30m bgl.

9.4.48 A series of dynamic cone penetrometer (DCP) tests were undertaken throughout Section A – Puriton Ridge along the proposed 400kV overhead line. These tests provide a depth versus California Bearing Ratio (CBR) for the vertical stratigraphy. The results presented as a percentage CBR value are presented within **Volume 5.9.2, Appendix 9J**.

9.4.49 A summary of boreholes completed within Section A – Puriton Ridge is presented in **Table 9.9** and shown on **Volume 5.9.3, Figure 9.1**.

Table 9.9 Summary of Boreholes Completed within Section A – Puriton Ridge

Borehole Reference	General Geology Encountered
BHVQ43R	Made Ground was encountered to a thickness of 0.50m and comprised grass over very stiff dark grey brown slightly sandy slightly gravelly clay with rare fragments of clinker. This was underlain by Tidal Flat Deposits of firm to stiff slightly sandy clay and silty sand with occasional lenses up to 100mm-thickness of organic content and bands of dark brown fibrous peat towards the base of the sequence up to 200mm-thickness. The Tidal Flat Deposits were up to 18m in thickness. This was underlain by MMG ranging from a weathering zone IVb to grade II with depth.
BHBWT1	Tidal Flat Deposits of interbedded clays, silts and sands with occasional pseudo fibrous peat was countered to a depth of 15.00m bgl. This was underlain by MMG ranging from a weathering zone IVb to grade II with depth.

Section B – Somerset Levels and Moors South

Site Description

9.4.50 Section B - Somerset Levels and Moors South comprises the areas between the northern edge of Puriton Ridge and the southern-most extent of the Mendip Hills. The area generally comprises low-lying, flat open fields used for agricultural purposes. Isolated hamlets and villages are located along the route, primarily Woolavington, East Huntspill, Southwick, Vole, Mark, Rooks Bridge, Tarnock, Biddisham and Webbington. See **Volume 5.9.3, Figure 9.2** (Site Geology) and **Volume 5.9.2, Appendix 9B** (PRA). The technical base line report (Ref 9.7), provides further site-specific details for this Section of the Proposed Development and its development components and should be read in conjunction with the ES.

Topography

9.4.51 The topography ranges between approximately 6-8m AOD on the low-lying areas including the Woolavington Levels, Puriton Levels, Huntspill Moor and Mark Moor. Puriton Ridge is approximately 50m AOD and forms an elevated section of land trending west to east at the southern extent of this Section. The Mendip Hills are at approximately 35m AOD (along the route) and form an elevated section of land trending west to east, rising to in excess of 150m.

Superficial Geology

9.4.52 Superficial deposits are shown to underlie the majority of the Proposed Development and are shown to comprise Tidal Flat Deposits.

9.4.53 Superficial deposits are generally absent on Puriton Ridge and the Mendip Hills.

Solid Geology

9.4.54 Puriton Ridge comprises the Langport Member, Blue Lias Formation and Charmouth Mudstone Formation consisting of undifferentiated mudstones and limestone. These extend north to approximately East Huntspill.

9.4.55 North of East Huntspill the bedrock comprises the Charmouth Mudstone consisting of mudstone described as dark grey laminated shales, and dark, pale and bluish grey mudstones.

9.4.56 North of Biddisham the bedrock is identified as MMG comprising mudstone.

Radon and Ground Gas

9.4.57 Areas north of Puriton Ridge along the Proposed Development are defined as not being within an 'Affected Area' as defined by the NRPB document NRPB-W26-2002 (Ref 9.5). The guidance presented within the NRPB-W26-2002 document states that no radon protection measures are necessary in the construction of new dwellings or extensions as less than 1% of properties are above the Action Level.

9.4.58 The area in the vicinity of the Mendip Hills along the proposed underground route is defined as being within an 'Affected Area' as defined by the NRPB document, NRPB-W26-2002 (Ref 9.5). The guidance presented within the NRPB-W26-2002 document states that basic radon protection measures are necessary in the construction of new dwellings or extensions as between 5 and 10% of properties are above the Action Level.

9.4.59 Given the anticipated ground conditions the risk associated with ground gas (methane and carbon dioxide) is considered low to moderate in accordance with CIRIA C665 (Ref 9.8). It is noted that peat deposits may be present within the Tidal Flat Deposits.

Mineral Sites

9.4.60 A review of information available on the British Geological Survey (BGS) website relating to designated mineral resource sites within Somerset was undertaken. This included review of any recorded valid or expired planning permissions for both surface and underground mineral extraction activities as recorded by the Mineral Planning Authority. This data specifically relates to planning permissions dated on or before 1 October 2004 (Ref 9.6) and includes information on the mineral resource extracted. This is the most up to date data set presented by the Mineral Planning Authority.

9.4.61 There are no recorded mineral sites along the Proposed Development within Section B – Somerset Levels and Moors South.

Ground Stability

9.4.62 Potential ground stability hazards arising from landslide are classed as moderate within the vicinity of Puriton Ridge and the Mendip Hills.

9.4.63 Potential ground stability hazards arising from compressible ground and running sand are classed as moderate on the flat-low lying areas. This is owing to the nature of the superficial deposits of clays and silt.

9.4.64 Potential ground stability hazards arising from collapsible ground, ground dissolution and shrinking or swelling clay are considered as negligible/null to low.

Landfilling

9.4.65 There are three identified landfills located within 1km of the Proposed Development.

9.4.66 The closest landfill is located 250m from the Proposed Development at the former Royal Ordnance factory within the BAE Systems site on Puriton Ridge. The specified waste deposited at these landfills is not recorded.

9.4.67 It is noted that no registered landfills are located beneath existing or proposed infrastructure within Section B – Somerset Levels and Moors South.

Mining

9.4.68 No shallow mining hazards are identified within the immediate vicinity of the Proposed Development within Section B – Somerset Levels and Moors South.

9.4.69 The site is not located within an area likely to be influenced by coal mining activities. The site is not located within a brine compensation area.

Designated Sites

9.4.70 No geologically related SSSI were identified within the environmental database report. The site does not lie within a designated European Geopark, and there were no records within the JNCC database that relate to the site or the immediately surrounding area.

Soil

9.4.71 The whole of Section B is underlain by soils comprising naturally wet loamy and clayey soils of the coastal flats.

Groundwater

9.4.72 Superficial deposits comprising Tidal Flat Deposits are designated as a secondary undifferentiated aquifer.

9.4.73 The Blue Lias Formation between Puriton Ridge and East Huntspill along the proposed 400kV overhead line and existing F Route has been classified by the EA as a secondary A aquifer.

9.4.74 The Charmouth Mudstone Formation between East Huntspill and Biddisham along the proposed 400kV overhead line and existing F route has been designated an unproductive aquifer.

9.4.75 The MMG between Biddisham and the Mendip Hills at Webbington has been classified by the EA as a secondary B aquifer.

9.4.76 There are three groundwater abstractions within 1km of the development route. All of the groundwater abstractions relate to general farming and domestic use at farms.

9.4.77 No potable water abstractions are noted within 1km of the Proposed Development within Section B – Somerset Levels and Moors South.

9.4.78 Information available on the EA website indicates that the site does not lie within a currently designated groundwater SPZ.

Hydrology

9.4.79 There are numerous interconnected small surface water courses, drainage ditches and rhynes within the low-lying flat areas between Puriton Ridge and the Mendip Hills.

9.4.80 The primary surface water features along the Proposed Development within Section B include the Huntspill River, Cripps River, River Brue, Mark Yeo, Old River Axe and the Old Lox Yeo. The major rhynes include Stoningpound Rhyne, Pyde Rhyne, Westhill Rhyne, Northwick Rhyne, and the Blind Pill Rhyne.

9.4.81 There are 11 surface water abstractions within 1km of the Proposed Development within Section B. The specified uses for the abstractions includes spray irrigation, evaporative and general cooling.

Flooding

9.4.82 The majority of the Proposed Development is located within a zone 2 and zone 3 flood risk area. Puriton Ridge and the Mendip Hills are not shown to fall within an area prone to flooding.

Historical Context

9.4.83 The predominant site history along the Proposed Development has comprised rural, agricultural land use. Other historic land uses have included a railway line, close to the Huntspill River and a foundry/works at Mark. The channel for the Huntspill River was constructed during the 1950s. The BAE Systems site on Puriton Ridge was constructed during the 1970/1980s.

Potential Contaminant Sources (On/Off Site)

9.4.84 Sedgemoor District Council does not hold any records to indicate that the Proposed Development crosses any areas which are contaminated under the definitions of Part IIA of the Environmental Protection Act 1990.

9.4.85 Several pollution incidents to controlled waters are recorded within 250m of the Proposed Development. These were classed by the EA as minor incidents (category 3) to both land and water resulting from the discharge or fly tipping of various wastes including sewage materials, household waste and vehicle parts. Given the minor incident (category 3) nature of these incidents and their localised nature, these are unlikely to significantly impact the Proposed Development.

9.4.86 The following potential on site sources of contamination have been identified within Section B – Somerset Levels and Moors South:

- general made ground (if present);
- infilled ponds and quarries;
- minor hydrocarbon spills from farming equipment and tanks at farms; and
- herbicides and pesticides associated with the agricultural use.

9.4.87 The following potential off site sources of contamination have been identified within Section B – Somerset Levels and Moors South:

- former foundry – located 400m west of the F Route at Mark;
- former railway line– located beneath the existing F Route located immediately north of King's Sedgemoor Drain at Knowle;
- waste treatment, transfer or disposal site – located 450m distance from the Proposed Development relates to Mark Moor Motors, Northwick Road, Mark and comprises a scrapyard handling 'difficult' material with no recorded restriction on the source of waste; from the F Route at Huntspill River;
- factory/depot – greater than 500m distance from the proposed 400kV overhead line at East Huntspill;
- munitions site (BAE Systems site) – located within 200m west of the proposed 400kV overhead line on the Puriton Ridge; and
- landfills – located within 200m west of the proposed 400kV overhead line on the Puriton Ridge.

Potential Chemicals of Concern

9.4.88 The following potential chemicals of concern have been identified within Section B – Somerset Levels and Moors South. These potential chemicals are likely to be localised to the vicinity of the source and are not anticipated to be wide spread:

- potential made ground (including heavy metals, PAH, TPH, asbestos, herbicides and pesticides;
- ground gases including carbon dioxide and methane; and
- leachate from landfills.

Existing Ground Investigation Data

9.4.89 The results of an intrusive ground investigation undertaken within Section B – Somerset Levels and Moors South are presented within **Volume 5.9.2, Appendix 9J**.

9.4.90 The ground investigation covered areas within other Sections along the Proposed Development. The relevant information for Section B – Somerset Levels and Moors South has been summarised within the following paragraphs. The purpose of the ground investigation was to assess ground conditions for geotechnical and environmental purposes. No chemical laboratory testing of soil or groundwater samples for environmental purposes was undertaken as part of the scope of assessment. Groundwater and ground gas monitoring was not undertaken as part of the assessment. The report provides a factual assessment of ground conditions encountered.

9.4.91 The ground investigation was focused within Section B – Somerset Levels and Moors South within geographically distinct areas including the Woolavington Levels, south of the Huntspill River at the proposed tee between the existing ZG 400kV overhead line and the proposed 400kV replacement of the F route; on the Huntspill Moors at Huntspill; at the proposed South of the Mendip Hills CSE compound, adjoining the M5 motorway west of Biddisham and at the crossing of the proposed 400kV overhead route with the Old River Axe.

9.4.92 Nine boreholes were drilled using a cable percussion drilling technique until refusal was met. Upon refusal, the boreholes were advanced using a rotary with air-mist flush drilling method to a maximum depth of 33.50m bgl.

9.4.93 A series of DCP tests were undertaken throughout Section B – Somerset Levels and Moors South along the proposed 400kV overhead line. These tests provide a depth versus CBR for the vertical stratigraphy. The results presented as a percentage CBR value are presented within **Volume 5.9.2, Appendix 9J**.

9.4.94 A summary of boreholes completed within Section B – Somerset Levels and Moors South is presented within **Table 9.10** and shown on **Volume 5.9.3, Figure 9.2**.

Table 9.10 Summary of Boreholes Completed within Section B – Somerset Levels and Moors South

Borehole Reference	**General Geology Encountered**
BHLD1	Woolavington Levels: Tidal Flat Deposits comprising interbedded slightly sandy clay and silt with narrow lenses of organic material including peat and gravel components was encountered to a depth of 20.10m bgl. A horizon of black to brown fibrous peat was encountered between 4.20m and 5.50m bgl (1.30m thickness). The Tidal Flat Deposits graded into a silty fine SAND with depth. This was underlain by the Lias Group consisting of a firm to very stiff grey variably slightly sandy slightly silt slightly gravelly clay, grading with depth into a laminated mudstone interbeded with narrow horizons (up to 0.50m thickness) of limestone to a depth of 28.10m bgl.
BHLD23	Huntspill Moors: Tidal Flat Deposits comprising interbedded slightly sandy clay, silt and sand with narrow lenses of organic material including peat and gravel components was encountered to a depth of 23.80m bgl. Horizons of black to brown fibrous peat were encountered between 11.20m and 12.00m (0.80m thickness) and 22.90m and 23.00m bgl (0.10m thickness). This was underlain by the Charmouth Mudstone Group consisting of a firm to very stiff dark grey slightly sandy slightly gravelly clay, grading with depth into a very weak, locally weak laminated mudstone to a depth of 33.50m bgl.
BHC1A to BHC1C	CSE Compound: Made Ground was encountered at BHC1A comprising dark brown slightly sandy clay. Boreholes BHC1B and BHC1C encountered topsoil of clayey sand and sandy clay to a thickness of 0.30m. This was underlain by up to 16.70m of Tidal Flat Deposits variably comprising interbedded clay, silt and sand with occasional peat deposits. This was in turn underlain by MMG of weathering zone IVb grading to zones II and I with depth.

Borehole Reference	General Geology Encountered
BHC2A to BHC2D	Old River Axe Crossing: Topsoil comprising topsoil of clayey sand and sandy clay to a thickness of 0.30m. This was underlain by up to 16.70m of Tidal Flat Deposits variably comprising interbedded clay, silt and sand with occasional peat deposits. BHC2A encountered a horizon of 2.10m thickness of peat between 12.20m and 14.30m depth with 1m thickness of peat and clay within BHC2B between 13.50m and 14.50m depth. BHC2C encountered 1.15m thickness of peat between 4.95m and 6.10m depth with further peat between 12.70m and 13.30m depth (0.60m thickness) and 16.40m to 16.90m depth (0.4m thickness). Peat was encountered within BHC2D between 5.70m to 6.50m (0.70m thickness) and 13.80m to 14.70m (0.90m thickness). This was in turn underlain by MMG of weathering zone IVb grading to zones II and I with depth.

Section C – Mendip Hills

Site Description

9.4.95 Section C - Mendip Hills comprises the areas between the southern edge of the Mendip Hills at Webbington and the northern edge of the hills at Sandford. The Proposed Development passes through a small valley between the hills. This comprises open fields used for agricultural purposes with numerous interconnected drains and small rivers. Isolated farmsteads are located at the base of the valley, which is used predominantly for animal grazing.

9.4.96 Smaller hamlets and villages are located on the gently sloping sides of the valley and include Webbington, Luxton, Yarberry, Christon, Barton and Sandford Batch. These areas are used predominantly for arable farming and orchards. Larger population centres include Banwell, Winscombe and Sandford are located on higher ground within the Mendip Hills.

9.4.97 The M5 motorway passes through the Mendip Hills, close to the Proposed Development. See **Volume 5.9.3, Figure 9.3** (Site Geology) and **Volume 5.9.2, Appendix 9C** (PRA). The technical base line report referenced (Ref 9.9), provides further site-specific details for this Section of the Proposed Development and its development components and should be read in conjunction with the ES.

Topography

9.4.98 The area comprises the Mendip Hills rising to in excess of 120m AOD and forming a shallow valley feature at between 12m to 30m AOD, through which the proposed 400kV underground cable through Section C would proceed. The valley is formed by gently sloping sides. The Mendip Hills are steeply inclined in places.

Superficial Geology

9.4.99 Superficial deposits within Section C of the Proposed Development include Tidal Flat Deposits described as consolidated soft silty clay, with layers of sand, gravel and peat. These deposits are predominantly located at the base of the valley and are not found north of Banwell Road.

9.4.100 Alluvium is present within Section C. These deposits are present close to the Lox Yeo River, north of Max Mill Lane only.

9.4.101 Head Deposits, are predominantly located either side of the valley, close to upslope areas of the Mendip Hills.

Solid Geology

9.4.102 Superficial deposits are absent from the steeply sloping parts of the hills. Superficial deposits are not located beneath all parts of the Proposed Development within Section C.

9.4.103 The base of the valley through the Mendip Hills is underlain by the Mercia Mudstone Group (MMG) comprising mudstone.

9.4.104 The Mendip Hills comprise the older Clifton Down Limestone Formation, the Burrington Oolite Subgroup, the Black Rock Limestone Subgroup and the Avon Group. These predominantly consist of limestone with dolomite and interbedded mudstone.

Radon and Ground Gas

9.4.105 The Proposed Development is located within an 'Affected Area' as defined by the NRPB documentNRPB-W26-2002 (Ref 9.5). The guidance presented within the NRPB-W26-2002 document states that basic radon protection measures are necessary in the construction of new dwellings or extensions as between 5 and 10% of properties are above the Action Level.

9.4.106 Given the anticipated ground conditions the risk associated with ground gas (methane and carbon dioxide) is considered low to moderate in accordance with CIRIA C665 (Ref. 9.8).

Mineral Sites

9.4.107 To determine whether sites with current or future mineral value are located in close proximity to the Proposed Development within Section C, a review of information available on the BGS website relating to designated mineral resource sites within Somerset was undertaken. This included review of any recorded valid or expired planning permissions for both surface and underground mineral extraction activities as recorded by the Mineral Planning Authority. This data specifically relates to planning permissions dated on or before 1 October 2004 (Ref 9.6) and includes information on the mineral resource extracted. This is the most up to date data set presented by the Mineral Planning Authority.

9.4.108 Two mineral designation sites have been identified within the general vicinity of the Proposed Development within Section C. These are recorded as inactive (including yet to be worked), worked-out and/or restored site and include:

- Webbington (North): Located within 100m east of the Proposed Development: surface extraction of limestone; and
- Sandford: Located at least 250m east of the Proposed Development. Surface extraction of limestone.

Ground Stability

9.4.109 Potential ground stability hazards arising from compressible ground are classed as moderate for the base of the valley, where Tidal Flat Deposits are recorded.

9.4.110 A moderate risk rating has been assigned to the Alluvium from running sand ground stability hazards. Alluvium is restricted in extent to between Castle Hill Road and Max Mill Lane in the central part of the base of the valley.

Landfilling

9.4.111 There are no recorded historic landfills, operational landfills or other waste sites within 480m of the site.

9.4.112 The closest landfill is located 480m north-west of the Proposed Development at Banwell Quarry and received inert and industrial waste.

Mining

9.4.113 Numerous historic quarries are located on the Mendip Hills. These relate to the extraction of limestone via surface mining methods. These quarries are located within 100m of the Proposed Development.

9.4.114 No shallow mining hazards are identified within the immediate vicinity of the Proposed Development within Section C.

9.4.115 The site is not located within an area likely to be influenced by coal mining activities. The site is not located within a brine compensation area.

Designated Sites

9.4.116 The following designated geological sites are located within approximately 2km of the Proposed Development:

- Crooks Peak Site of Special Scientific Interest (SSSI) – located 500m west of the Proposed Development and designated for outcropping bedrock;
- Sandford Quarry regionally important geological site (RIGS) – located 465m east of the Proposed Development and designated for outcropping bedrock;
- Banwell Bone Cave geological conservation review site (GCR) – located 2km west of the Proposed Development and designated for Pleistocene vertebrate fossils;
- Banwell Cave geological conservation review site (GCR) – located 1,850m west of the Proposed Development and designated for mineralogical interest;
- Banwell Ochre Caves geological conservation review site (GCR) – located 660m west of the Proposed Development and designated for mineralogical interest;
- Picken's Hole and Beeche's Hole geological conservation review site (GCR)at grid reference ST397550, approximately 2km east of the southern end of the Section and designated for Pleistocene vertebrate fossils;
- Sandford Quarry RIG site, at a distance of 465m east of the 400kV underground cable at Sandford Batch; and
- Crooke Peak SSSI, at a distance of greater than 500m east of the Proposed Development and designated for carboniferous outcrops.

9.4.117 There are currently no European designated Geoparks within Section C, although it is understood that interest in registering the Mendip Hill as a European Geopark has been expressed. Comments received from consultees during the Statutory Stage 4 Consultation stated the following: "*On-going consultation is required in relation to the impact of the scheme on the proposed Mendip Hills Geopark*". At present the Mendip Hills within Section C have not been assigned Geopark status and therefore cannot be assessed as such. Further, the underground cable is to be placed below ground through a relatively low lying part of the Mendip Hills, where bedrock comprises the MMG. The MMG would be of low sensitivity. Any future geological designations would apply to the bedrock of Carboniferous Age (limestone), through/over which the underground cable does not pass. Therefore the Proposed Development (underground cable route) is unlikely to impact significantly on any geological features.

Soil

9.4.118 In the south of Section C the low-lying areas are underlain by naturally wet, loamy and clayey floodplain soils. To the north, soils comprise a mix of slightly acid loamy and clayey soils with impeded drainage; and freely draining slightly acid but base rich soils.

Groundwater

9.4.119 The Tidal Flat Deposits at the base of the valley within Section C are designated a secondary undifferentiated aquifer.

9.4.120 The Head Deposits at the base of the Mendip Hills are designated as a secondary B aquifer.

9.4.121 The Alluvium located close to the Lox Yeo River, between Banwell Road and Max Mill Lane is designated as a secondary A aquifer.

9.4.122 The MMG between the Mendip Hills has been classified by the EA as a secondary B aquifer.

9.4.123 The limestone bedrock on the Mendip Hills has been classified by the EA as a principal aquifer.

9.4.124 There are four recorded groundwater abstractions within 1km of the Proposed Development within Section C. Two of these are used for potable water use.

9.4.125 The Mendip Hills and in particular the limestone bedrock has been designated by the EA as a SPZ zone 2 (outer catchment).

9.4.126 The limestone bedrock at Banwell and Sandford have been designated a SPZ zone 1 (inner catchment).

Hydrology

9.4.127 There are numerous interconnected small surface water courses and drainage ditches in the valley between the Mendip Hills.

9.4.128 The primary surface water features within Section C - Mendip Hills along the proposed 400kV underground cable include the Old Lox Yeo, Lox Yeo River and Towerhead Brook.

Flooding

9.4.129 The base of the valley between the Mendip Hills has been designated by the EA as flood zone 2 and 3.

9.4.130 The majority of the Proposed Development does not fall within these flood zones. The exception is where the Proposed Development crosses the base of the valley and the primary water features.

Historical Context

9.4.131 The valley and base of the valley has generally comprised open fields used for agricultural purposes. The sides of the valley and the Mendip Hills have been subject to historic mining.

9.4.132 No significant industrial land uses have been identified. Several sites of historic importance are located within the vicinity of the Proposed Development within Section C. These have been further discussed at **Volume 5.11.1**.

Potential Contaminant Sources (On/Off Site)

9.4.133 Sedgemoor District Council does not hold any records to indicate that the Proposed Development crosses any areas which are contaminated under the definitions of Part IIA of the Environmental Protection Act 1990.

9.4.134 Several pollution incidents to controlled waters are recorded within 250m of the Proposed Development. These are unlikely to significantly impact the Proposed Development.

9.4.135 The following potential on site sources of contamination have been identified within Section C – Mendip Hills:

- general made ground (if present);
- sewage works;
- infilled ponds and quarries;
- minor hydrocarbon spills from farming equipment and tanks at farms; and
- herbicides and pesticides associated with the agricultural use.

9.4.136 The following potential off site sources of contamination have been identified within Section C – Mendip Hills:

- former railway line – within 100m east of the underground cable at Sandford Batch;
- depot of unspecified use – within 25m to 100m from the underground cable at Towerhead;
- quarries and pits – within 25m and 250m along the underground cable through Section C;
- historic smithy – greater than 250m west of the underground cable at Loxton; and
- garage/MOT centre – greater than 250m west of the underground cable at Loxton.

Potential Chemicals of Concern

9.4.137 The following potential chemicals of concern have been identified within Section C – Mendip Hills. These potential chemicals are likely to be localised to the vicinity of the source and are not anticipated to be wide spread:

- Potential made ground (including heavy metals, PAH, TPH, asbestos, bacterial coliforms, herbicides and pesticides, di-isocyanate, and cyanide.

Existing Ground Investigation Data

9.4.138 The results of an intrusive ground investigation undertaken within Section C – Mendip Hills are presented within **Volume 5.9.2, Appendix 9J**.

9.4.139 The ground investigation covered areas within other Sections along the Proposed Development. The relevant information for Section C – Mendip Hills has been summarised within the following paragraphs. The purpose of the ground investigation was to assess ground conditions for geotechnical and environmental purposes. A total of three chemical laboratory tests of soil samples for environmental purposes was undertaken as part of the scope of assessment. Groundwater and ground gas monitoring was not undertaken as part of the assessment. The report provides a factual assessment of ground conditions encountered.

9.4.140 The ground investigation was focused within Section C – Mendip Hills between the southern-most area of Section C at Webbington Road at Webbington and Towerhead Road (A368) at Sandford at the northern-most extent of Section C.

9.4.141 A series of DCP tests were undertaken throughout Section C – Mendip Hills along the proposed 400kV underground cable route. These tests provide a depth versus CBR for the vertical stratigraphy. The results presented as a percentage CBR value are presented within **Volume 5.9.2, Appendix 9J**.

9.4.142 A series of shallow machine and hand excavated trial pits were undertaken within Section C – Mendip Hills along the proposed 400kV underground cable route. The encountered ground conditions correlate with BGS records of superficial deposits and ground conditions identified from boreholes as summarised in Table 9.8. The trial pit logs are presented within **Volume 5.9.2, Appendix 9J**.

9.4.143 Twenty-two boreholes were drilled using a cable percussion drilling technique until refusal was met. Upon refusal, the boreholes were advanced using a rotary with air-mist flush drilling method to a maximum depth of 21.70m bgl.

9.4.144 A summary of boreholes completed within Section C – Mendip Hills is presented within **Table 9.11** and shown on **Volume 5.9.3, Figure 9.3**.

Table 9.11 Summary of Boreholes Completed within Section C – Mendip Hills

Borehole Reference	General Geology Encountered
BHC3A to BHC3D	Typically topsoil consisting of firm brown slightly sandy clay with rootlets (0.30m to 0.55m thickness). This was underlain by superficial deposits consisting of Alluvium comprising firm to stiff grey slightly sandy clay. Occasional gravel content and peaty silt was noted. Alluvial thickness ranged between 0.40m and 3.45m and was absent at BHC3D. The Alluvium was underlain by MMG typically of weathering zone IVa and IVb at shallow depth, encountered predominantly as clay, grading with depth into MMG weathering grades III and II, often recovered as a gravel of mudstone with frequent zone of core losses. Made Ground was encountered at BHC3C and BHC3D ranging in thickness between 0.30m and 0.60m and comprising firm brown slightly sandy gravelly clay with fragments of ceramic.
BHC4	Made Ground was encountered comprising firm brown slightly sandy gravelly clay with fragments of ceramic and of 0.30m thickness. No Alluvial deposits were present. The Made Ground was underlain by MMG generally grading from weathering zone IVa to III and II with depth.
BHC5	Topsoil typically consisting of red brown sand, gravelly clay (0.20m to 0.60m thickness) underlain by MMG grading from weathering zone IVb to grade II with depth.
BHC6	
BHC7	
BHC8A to BHC8D	Made Ground was encountered at BHC8A only consisting of dark brown slightly gravelly sand. Gravel is flint and brick underlain by red brown slightly sandy slightly gravelly clay with brick (1.20m thickness). BHC8B to BHC8D typically comprised topsoil of gravelly sand and sandy clay with rootlets between 0.50m and 0.65m thickness. Both the Made Ground and topsoil was underlain by MMG typically grading from weathering zone IVb/IVa to grades II and I with depth.

Borehole Reference	General Geology Encountered
BHC9A to BHC9D	Made Ground was encountered at BHC9A only consisting of dark brown gravelly sand. Gravel is flint, sandstone and brick (0.50m thickness). BHC9B to BHC9D typically comprised topsoil of slightly clayey sand, gravelly sand and sandy clay with rootlets between 0.20m and 0.40m thickness. Both the Made Ground and topsoil was underlain by MMG typically grading from weathering zone IVb/IVa to grades II and I with depth.
BHC10	Topsoil of soft to firm slightly gravelly sandy clay with roots (0.40m thickness) underlain by MMG typically grading from weathering zone IVb/IVa to grades II and I with depth.
BHC11	Topsoil of soft to firm slightly gravelly sandy clay with roots (0.40m thickness) underlain by MMG typically grading from weathering zone IVb/IVa to grades II and I with depth and including horizons of sandstone and siltstone.
BHC12A to BHC12D	Topsoil of brown clayey silty sandy clay with roots (0.15m to 0.40 thickness) underlain by MMG typically grading from weathering zone IVb/IVa to grades II and I with depth. Borehole BHC12B encountered Alluvium comprising brown red grey and yellow slightly sandy slightly gravelly clay with dead plant matter (0.80m thickness).

9.4.145 Three soil samples were tested for environmental purposes for boreholes BHC3A, BHC3C and BHC4. Soil samples were tested for a range of determinants including pH, sulphate, cyanide, total phenols, heavy metals (suit of 13), organic matter, moisture and stone content, speciated TPH, BTEX and MTBE and speciated PAH.

9.4.146 Concentrations of PAH, TPH, BTEX and MTBE were below the laboratory method detection limit for all samples tested. Slightly alkaline soil pH conditions were measured. Concentrations of heavy metals were generally consistent with natural background levels and no significantly elevated concentrations were measured. Testing for the presence of asbestos was not undertaken.

Section D – Somerset Levels and Moors North

Site Description

9.4.147 The topography ranges between approximately 6-8m AOD on the levels including Puxton Moors, Biddle Street at Yatton, Kenn, Nailsea and Tickenham Moors and approximately 25m AOD on the northern-most edge of the Mendip Hills, and the southern-most edge of Tickenham Ridge at Nailsea. See **Volume 5.9.3, Figure 9.4** (Site Geology) and **Volume 5.9.2, Appendix 9D** (PRA). The technical baseline report (Ref 9.10), provides further site-specific details for this Section of the Proposed Development and its development components and should be read in conjunction with the ES. The baseline report is presented within **Volume 5.9.2, Appendix 9D**.

Superficial Geology

9.4.148 Tidal Flat Deposits are typically located beneath the entire route between the northern edge of the Mendip Hills at Sandford to Yatton and Kenn Moor.

9.4.149 Head Deposits are principally located at the northern edge of the Mendip Hills at Sandford and around North End, Yatton.

9.4.150 Peat is described as an organic-rich clay. Extensive areas of peat are located on Kenn Moor north east of Yatton, Nailsea Moor and Tickenham Moor, to the base of the Tickenham Ridge. These were formed up to 3 million years ago during the Quaternary Period through accumulation of organic material under anaerobic conditions within mires, bogs and swamps. BGS borehole records for the area indicate the presence of interbedded horizons of peat up to several metres in thickness and bands of brown/grey clay and silt. No surface peat is identified along the Proposed Development route on the Kenn, Nailsea and Tickenham Moors. When referring to peat within Section D, peat is defined as comprising an organic-rich clay, with narrow horizons or lenses of peat that are buried and consolidated.

Solid Geology

9.4.151 Superficial deposits are generally absent on the Mendip Hills and Tickenham Ridge and over Nailsea.

9.4.152 The northern edge of the Mendip Hills comprises MMG described as dominantly red, less commonly green-grey, mudstones and subordinate siltstones. This extends from Sandford to West, End Nailsea.

9.4.153 At West End and Nailsea the bedrock is identified as the Down End Member comprising sandstone. This member forms part of the Pennant Series, the Upper Coal Measures of Carboniferous Period. These are described as sandstone with some conglomerate and pebbly sandstones.

9.4.154 At the northern end of Nailsea, the bedrock comprises the South Wales Lower Coal Measures Formation and South Wales Middle Coal Measures Formation. These comprise undifferentiated sedimentary bedrock with coal bearing seams.

9.4.155 The area is generally heavily faulted with significant faults identified as the Tickenham Fault and Naish House Fault.

9.4.156 Coal bearing strata are identified within the Down End Member, the South Wales Lower Coal Measures Formation and South Wales Middle Coal Measures Formation in the vicinity of Nailsea.

Radon and Ground Gas

9.4.157 The Proposed Development between Sandford and Nailsea is not located within an ‘Affected Area’ as defined by the NRPB documents, NRPB-W26-2002 (Ref 9.5). The guidance presented within the NRPB-W26-2002 document states that no radon protection measures are necessary in the construction of new dwellings or extensions as less than 1% of properties are above the Action Level.

9.4.158 Areas around Nailsea, located over the South Wales Middle and Lower Coal Measures Formation are defined as not being within an ‘Affected Area’ as defined by the NRPB document, NRPB-W26-2002 (Ref 9.5). The guidance presented within the NRPB-W26-2002 document states that no radon protection measures

are necessary in the construction of new dwellings or extensions as less than 1% of properties are above the Action Level.

9.4.159 The area in the vicinity of Tickenham Ridge is defined as being within an 'Affected Area' as defined by the NRPB document, NRPB-W26-2002 (Ref 9.5). The guidance presented within the NRPB-W26-2002 document states that full radon protection measures are necessary in the construction of new dwellings or extensions as between 10 and 30% of properties are above the Action Level. This relates to the presence of limestone on the ridge.

9.4.160 Given the anticipated ground conditions the risk associated with ground gas (methane and carbon dioxide) is considered low to moderate in accordance with CIRIA C665 (Ref 9.8). It is noted that peat deposits are present on the Nailsea and Tickenham Moors.

9.4.161 Landfills are also located on the Nailsea Moors at North Drove. The risk rating for ground gas is considered moderate to high for this section of the route.

Mineral Sites

9.4.162 To determine whether sites with current or future mineral value are located in close proximity to the Proposed Development, a review of information available on the BGS website relating to designated mineral resource sites within Somerset was undertaken. This included review of any recorded valid or expired planning permissions for both surface and underground mineral extraction activities as recorded by the Mineral Planning Authority. This data specifically relates to planning permissions dated on or before 1 October 2004 (Ref 9.6) and includes information on the mineral resource extracted. This is the most up to date data set presented by the Mineral Planning Authority.

9.4.163 There are no recorded mineral sites along the Proposed Development.

9.4.164 Deposits of peat are located on Kenn Moor, Nailsea Moor and Tickenham Moor. These have the potential to be a future resource.

9.4.165 The northern-most part of Section D is located within an area designated under the petroleum exploration and development licence, issued under the Petroleum (Production) Act 1934 (repealed in full 1998 and replaced by the Petroleum Act 1998) (Ref 9.11). This incorporates areas including the northern half of Nailsea, Tickenham Moors and the southern part of Tickenham Ridge.

Landfilling

9.4.166 The historic/former North Drove Landfill is located on the Nailsea Moors within very close proximity of the proposed 400kV overhead line at pylon location LD75 and LD76 and the proposed associated access tracks. The recorded waste materials deposited include inert and non-hazardous waste described as waste, which remains largely unaltered once buried such as glass, concrete, bricks, tiles, soil and stones. The landfill operated between circa 1976 and 1992. No known restriction on the source of waste is recorded.

9.4.167 A second recorded non-operational landfill is located at approximate NG reference 345500 170600, close to the proposed access track and pylon LD75-LD76 on the Nailsea Moor. The precise site boundary is not provided. The deposited waste included non-hazardous material.

Mining

9.4.168 The route passes through the Nailsea Coalfield, which ranges from West End and Nailsea to Tickenham Ridge and east towards Wraxhall. Historic below ground mining of coal seams is known to have occurred in the vicinity of Nailsea and Tickenham Ridge.

9.4.169 A former colliery (West End Colliery) is located within West End and Nailsea and included a mineshaft, spoil heap and associated processing buildings.

Coal Mining

9.4.170 A coal mining risk assessment report presented within **Volume 5.9.2, Appendix 9I** has been prepared for the Proposed Development between West End and Nailsea to the base of the Tickenham Ridge at Stone-edge Batch. This corresponds with the proposed route crossing coal bearing geology of Carboniferous Age. The assessment was undertaken through a detailed review of historic OS maps, BGS borehole records, BGS geological maps and commercially available mining records for the area.

9.4.171 The historic OS maps indicate that coal mining activities occurred at West End and Nailsea, south of the Tickenham Ridge and included numerous coal pits and mineshafts within the Nailsea area. These were generally located greater than 800m east of the proposed 132kV underground cable through Nailsea. The West End Colliery was located at the western edge of Nailsea and included a mineshaft, spoil heap, kiln and associated buildings and tanks. The proposed underground cable route passes in very close proximity to the former colliery.

9.4.172 The BGS geological maps indicate that West End and Nailsea are underlain by the Down End Member, forming part of the Pennant Series which comprises mudstone, siltstone and sandstone. This member is described as sandstone with some conglomerate and pebbly sandstone and sporadic fissile mudstone beds. Some workable coal seams are also present. Sandstone is typically a coarse-grained lithic arenite. This geological member is approximately 660m in thickness within the Somerset Coalfield. The Down End Member is underlain by the South Wales Lower Coal Formation and the South Wales Middle Coal Formation. These consist of undifferentiated sedimentary bedrock described as grey, (productive) coal-bearing mudstones and siltstones, with seat earths and minor sandstones.

9.4.173 The bedrock beneath Nailsea and the Tickenham Ridge of Carboniferous Age form a syncline oriented east north east to west south west with the main axis dipping to the west south west. The limbs of the syncline dip at approximately 30 degrees to the north west and south east.

9.4.174 The BGS map (Sheet ST47SE) shows the former West End Colliery to be located over the Grace's Seam, which is located approximately 82m below ground level. The seam is shown to be approximately 1m in thickness and discontinuous within the Pennant Series sandstone. The same seam is shown to have been worked within a shaft located 500m east north east of the colliery, at a depth of 11m below ground level (bgl), and within a shaft located 750m east south east of the collier at a depth of 47m bgl.

9.4.175 The axis of the syncline runs east north east to west south west dipping to the west south west; and is located south/south east of the former colliery and the proposed

underground cable. Coal seams outcrop in the nose of the syncline east north east of the colliery at approximately 3km distance. As a result, coal seams within the Coal Measures geology located north of the former colliery would be at shallower depth. This includes White's Top (WT) Vein at approximately 1.15m in thickness, and the Golden Valley Top (GVT) and Golden Valley Under (GVU) at approximately 0.5m in thickness and 0.85m in thickness, respectively.

9.4.176 The proposed 400kV overhead line would be located west of the Coal Measures outcrop at Nailsea and cross coal bearing strata, which is likely to be present at depth.

9.4.177 The existing F and W Routes, the proposed 132kV underground cable and associated lay down area at the road junction between the Causeway and Watery Lane cross the conjectured position of the outcrop of a number of coal seams including the WT Vein, GVT and GVU. In addition the proposed underground cable would pass through the former West End Colliery.

9.4.178 Additional minor seams of coal may be located between Grace's Seam and WT Vein within the vicinity of the proposed 132kV underground cable, and both the existing F and W Routes. These include Thin Coal (unknown thickness), Little Top (Rock) at 0.25m thickness and Red Ash Coal at 0.3m thickness, although these may not be continuous.

9.4.179 Information held by the Coal Authority indicates that there are six identified mine entries located within, or within 20m of, the Proposed Development boundary. One record (345170-004) relates to an area approximately 160m north from the former colliery, currently occupied by residential dwellings and within 50m of the existing conductor for the W Route. The shaft/pit is located approximately 140m from an existing pylon along the W Route and was formerly located close to North Lane, Nailsea.

9.4.180 Another recorded mineshaft (345169-001) is located within a field west from the former colliery. The distance of the mineshaft from the former colliery is approximately 160m. The mineshaft is located within 35m of an existing pylon for the W Route, west of the Nailsea rugby and football grounds.

9.4.181 The remaining four mineshaft (345170-001, 345170-002, 345170-003 and 345170-005) records are located beneath a trading estate, close to the road junction between Engine Lane and Blackfriars Road. The proposed underground cables would pass through fields located immediately west of Engine Lane between the road junctions of Engine Lane/Worcester Gardens and Engine Lane/Blackfriars Road. Between the road junctions of Engine Lane/Blackfriars Road and Engine Lane/West End Lane, the underground cable is proposed to pass along beneath Engine Lane. The underground cable would pass at a distance from between 20m and 40m of these mineshafts.

9.4.182 Information held by the Bristol Coal Mining Archives indicates that coal workings dating between the 17th and 18th centuries are located between Pound Lane, Nailsea and Watery Lane, Nailsea. The Golden Valley seams outcrop across the Proposed Development within this area, approximately 180m south of Pound Lane and dips to the south. Watery Lane is located approximately 100m north of the closest section of the proposed underground cable that would follow Hanham Way.

9.4.183 The Dog Vein of the Nailsea Coal Basin is situated approximately 400m south of Pound Lane in Nailsea, east of the underground cable of the Proposed

Development. This seam dips south away from the Tickenham Ridge and would be absent beneath the site.

9.4.184 Nailsea Heath Pit worked the Golden Valley seams from 1786 until 1877. The exact position of this pit is not described, however is inferred to be located east/south east of the underground cable of the Proposed Development. Abandonment plans of the colliery show that these workings stop 450m to the south of the Proposed Development and are unlikely to impact the Proposed Development.

9.4.185 The Golden valley seams were worked from New Pit, located approximately 400m south east of the existing W Route. The pit is believed to have been worked for a limited period, from circa 1872 and 1876. Consequently, the workings would not extend west.

9.4.186 The White Tops Vein, the main coal seam in the Nailsea group was worked wherever it was found. This vein outcrops further south, approximately 215m to the south of Fryth Way. The seam was worked along the crop from an early date and workings cannot be discounted beneath both the existing F and W Routes and the underground cable of the Proposed Development between Fryth Way and Watery Lane. This has the potential to impact the decommissioning of the existing W Route.

9.4.187 Workings at outcrop were carried out in linear quarries from which the most accessible coal was extracted, down to a depth of 3m. Once these were exhausted, they were backfilled and the land returned to agriculture. Within the residential areas of Nailsea, these areas were redeveloped for residential end use. This corresponds with former quarries identified on historic maps, located 800m east the underground cable of the Proposed Development.

9.4.188 This seam was worked at depth from Lucas Pit, located 620m east of the existing W Route and underground cable of the Proposed Development. These depths are likely to range between 18m to 36m depth at Watery Lane, Nailsea.

9.4.189 The area between Watery Lane, Nailsea and Netherton Wood, south of Nailsea and the Proposed Development was worked for coal between the 17th and 19th centuries.

9.4.190 The Whites Top Vein is located at depths ranging between 30m bgl at Watery Lane and 180m at Netherton Wood. This was worked from Kingshill Pit, located 250m east of the proposed underground cable along Queens Road, Nailsea. This pit collapsed in 1920 and was filled with material of an unknown specification.

9.4.191 The Grace's Seam is believed to outcrop to the south of Watery Lane and dips in a southerly direction. This seam was worked by Tall Cottage Pit, to the east of Queens Lane and approximately 170m to 240m east of the proposed underground cable. This pit struck the seam at approximately 102m depth.

9.4.192 The North Lane Pit was one of the last pits to close in the Nailsea Coalfield. The engine house has been converted to a residential property. The pit, which closed in the late 1860s, worked the Grace's Seam at approximately 36m depth. This pit corresponds with mineshaft 345170-004, located 160m north of the former colliery.

9.4.193 Three pits/mineshafts are identified within the site boundary of the former West End Colliery. These pits had many names including Grace's No. 3, 60 Fathom Pit and Nailsea Pit. This colliery operated between 1800s and closed in 1880. These pits

are likely to correspond to mineshafts 345170-001, 345170-002 and 345170-003 identified within the Coal Authority records.

9.4.194 The precise depths of the coal workings are unknown but are believed to lie at a depth of between 60m and 90m. The BGS 10,560 scale map suggests a depth of approximately 82m bgl.

9.4.195 A second seam was developed in the 1820s, said to have been 1.5m in thickness and at a depth of 140m. This may correspond to mineshaft 345170-005, located within the trading estate.

9.4.196 The extent of the workings from North Lane Pit and West End Colliery are unknown.

9.4.197 The depths of the shafts within West End Colliery are unknown.

9.4.198 The North Lane Pit is believed to have been utilised as a pumping shaft for West End Pit after the closure of that venture. It is likely that the shaft was filled and capped, but no further details are provided. The Coal Authority data holds no records to any backfilling of this pit.

9.4.199 A shaft within West End Colliery is believed to have had a 2.5m wide diameter opening, which was capped during construction of the trading estate. A methane vent is believed to have been incorporated in the capping. It is unclear as to which shaft these records relate to.

Ground Stability

9.4.200 Potential ground stability hazards arising from ground dissolution is generally null/negligible for the route. However a moderate risk has been identified on Tickenham Ridge. This is likely to be associated with the limestone bedrock.

9.4.201 Where peat deposits are found between east of Yatton and the base of Tickenham Ridge, north of Nailsea, a high risk potential has been identified. This is owing to the compressible nature of peat.

9.4.202 Potential ground stability hazards arising from compressible ground are classed as moderate on the flat-low lying areas, where the superficial deposits comprise either Head Deposits or tidal flat deposits between the Mendip Hills and West Yatton.

9.4.203 Potential ground stability hazards could arise on the Nailsea Coalfield where historic below ground coal working has been undertaken.

Designated Sites

9.4.204 No geologically related SSSI have been identified within Section D. The site does not lie within a designated European Geopark, and there were no records within the JNCC database that relate to the site or the immediately surrounding area.

Soil

9.4.205 A large part of Section D is underlain by soils comprising naturally wet loamy and clayey soils of the coastal flats and around Nailsea freely draining acid loamy soil.

9.4.206 Slightly acid loamy and clayey soils with impeded drainage; and loamy and sandy soils with a peaty surface are also present to a lesser extent.

Groundwater

9.4.207 The Head Deposits close to the Mendip Hills at Sandford and around Yatton are designated a secondary undifferentiated aquifer.

9.4.208 The Tidal Flat Deposits and peat deposits along the remaining Proposed Development are designated as unproductive.

9.4.209 Strata beneath a short section of the proposed 132kV overhead line at Churchill 132/33kV Substation is designated as a secondary B aquifer.

9.4.210 The MMG between the Mendip Hills at Sandford and Nailsea is also classified by the EA as a secondary B aquifer.

9.4.211 The South Wales Middle and Lower Coal Measures Formations have been designated as secondary A aquifers.

9.4.212 The Down End Limestone Formation on Tickenham Ridge has been designated a principal aquifer.

9.4.213 There are four potable water abstractions within 1.5km of the Proposed Development And relate to:

- 890m north east of Churchill Substation for use as bottled water;
- 1,255m south west of Sandford for use as direct potable water;
- 1,632m north west of Yatton for use as direct potable water; and
- 1,662m south east of Yatton for use as direct potable water.

9.4.214 Information available on the EA website indicates that the majority of the Proposed Development does not lie within a currently designated groundwater SPZ.

9.4.215 The notable exception is Tickenham Ridge. The Down End Limestone Member has been designated a SPZ 1 (inner zone).

Hydrology

9.4.216 There are numerous interconnected small surface water courses, drainage ditches and rhynes within the low-lying flat areas between the Mendip Hills and Tickenham Ridge.

9.4.217 The primary surface water features within Section D along the Proposed Development include the Oldbridge River, Congresbury Yeo, Little River, River Kenn and the Land Yeo.

Flooding

9.4.218 The majority of the Proposed Development is located within a zone 2 and zone 3 flood risk area.

9.4.219 Both the Mendip Hills in the southern part of Section D and Tickenham Ridge in the northern part of Section D – Somerset Levels and Moors North are absent of flood risks.

9.4.220 Churchill Substation is not shown to lie within an area prone to flooding, although land 60m north is situated within a zone 2 and 3 flood area.

Historical Context

9.4.221 The general site history along the Proposed Development has comprised rural and agricultural land use since prior to the 1880s. This includes fields with hedgerow and drainage ditches and occasional small wooded areas or orchards. Commercial and industrial land uses have been identified where the Proposed Development passes closer to residential population centres such as Yatton and Nailsea.

9.4.222 West End Colliery was located at West End and operated between prior to 1880 and 1970, when it was redeveloped as a trading estate.

Potential Contaminant Sources (On/Off Site)

9.4.223 North Somerset Council does not hold any records to indicate that the Proposed Development crosses any areas which are contaminated under the definitions of Part IIA of the Environmental Protection Act 1990.

9.4.224 Several pollution incidents to controlled waters are recorded within 250m of the Proposed Development. These are unlikely to significantly impact the development.

9.4.225 The following potential on site sources of contamination have been identified within Section D, Somerset Levels and Moors North:

- general made ground (if present);
- infilled ponds and workings;
- minor hydrocarbon spills from farming equipment and tanks at farms;
- PCBs associated with the existing CSE compound, Churchill Substation and other electrical equipment;
- herbicides and pesticides associated with the agricultural use; and
- natural geology (peat deposits).

9.4.226 The following potential off site sources of contamination have been identified within Section D, Somerset Levels and Moors North: former railway line – located 150m north of the Churchill Substation:

- Smithy – located within 25m of the underground cable through Nailsea;
- scrap yard and metal recycling sites – within 50m of the F Route at Hewish;
- pump houses – within 250m of the F Route on the levels;
- former sewage works and ancillary buildings – within 50m of the proposed underground cable (the W Route) west of Nailsea and beneath the W Route;
- gas works – located 550m east of the proposed 400kV overhead line at Yatton;
- Trading Estate – the underground cable at Nailsea passes through this estate;
- West End Colliery including tanks, buildings of unspecified use, kiln, spoil heap and shaft – the underground cable at Nailsea passes through this former colliery;
- two landfills at North Drove, West End – located within 25m distance from the proposed 400kV overhead line; and
- high pressure gas/oil pipe at Tickenham Ridge – the underground cable route over the Tickenham Ridge crosses this pipeline.

Potential Chemicals of Concern

9.4.227 The following potential chemicals of concern have been identified within Section D – Somerset Levels and Moors North. These potential chemicals are likely to be localised to the vicinity of the source and are not anticipated to be wide spread:

- potential made ground (including heavy metals, PAH, PCB, asbestos, herbicides and pesticides;
- ground gases including carbon dioxide and methane. Leachate derived from landfills;
- cyanide, spent oxides, gas works wastes;
- acids and alkalis, heavy metals, PAH, ash, TPH, asbestos and general colliery spoil; and
- methane and natural gas or oils and petroleum compounds.

Existing Ground Investigation Data

9.4.228 The results of an intrusive ground investigation undertaken within Section D – Somerset Levels and Moors North are presented within **Volume 5.9.2, Appendix 9K**.

9.4.229 A further generic intrusive ground investigation was undertaken within Section D – Somerset Levels and Moors North. The ground investigation was undertaken by Structural Soils Limited on behalf of National Grid. The report is presented within **Volume 5.9.2, Appendix 9J**.

9.4.230 A series of DCP tests were undertaken throughout Section D – Somerset Levels and Moors North along the proposed 400kV overhead line. These tests provide a depth versus CBR for the vertical stratigraphy. The results presented as a percentage CBR value are presented within **Volume 5.9.2, Appendix 9J**.

9.4.231 A series of shallow machine and hand excavated trial pits were undertaken within Section D – Somerset Levels and Moors North along the proposed 400kV underground route between Towerhead Road (A368) at Sandford and the proposed Sandford Substation at Nye Lane, Sandford. The encountered ground

conditions correlate with BGS records and ground conditions identified from boreholes as summarised in Table 9.9. The trial pit logs are presented within **Volume 5.9.2, Appendix 9J**.

9.4.232 The purpose of the ground investigation was to assess ground conditions for geotechnical purposes. The chemical laboratory testing of soil and groundwater samples, for environmental and geotechnical purposes, was not undertaken as part of the scope of assessment. Groundwater and ground gas monitoring was not undertaken as part of the assessment. The report provides a factual assessment of ground conditions encountered.

9.4.233 Three cable percussion boreholes referenced SWA-BH2, SWA-BH6A and SWA-BH7 were completed during July 2013. Boreholes were commenced using a cable percussion drilling technique until refusal was met. Upon refusal, the boreholes were advanced using a rotary-drilling method using an air-mist flush medium to a maximum depth of 21.70m below ground level. Standard penetration tests (SPTs) were undertaken at regular intervals and undisturbed U100 samples and small disturbed bulk samples were collected.

9.4.234 All boreholes were installed as monitoring wells using 50mm-diameter monitoring pipe to a maximum depth of 3.5m bgl. All wells were installed to allow a response zone between 1.5m bgl and 3.5m bgl. On completion of borehole installation, well locations were positioned using global positioning system (GPS) equipment.

9.4.235 Groundwater levels were recorded form within the monitoring wells on four separate occasions. Groundwater levels for borehole SWA-BH2 was measured as 2.49m below the top of casing (TOC). Groundwater levels ranged between 0.86m and 0.99m below TOC for SWA-BH6A and between 0.94m and 1.30m below TOC for SWA-BH7.

9.4.236 A summary of boreholes completed within Section D – Somerset Levels and Moors North is presented within **Table 9.12** and shown on **Volume 5.9.3, Figure 9.4**.

Table 9.12 Summary of Boreholes Completed within Section D – Somerset Levels and Moors North

Borehole Reference	General Geology Encountered
SWA-BH2 SWA6A SAW-BH7	Proposed Sandford Substation site: Topsoil ranged in thickness between 0.20m and 0.80m and typically comprised light greyish brown gravelly sand with occasional plant rootlets. Gravel is fine to coarse subangular to subrounded sandstone and limestone. This was underlain by superficial deposits typically consisting of orangish greyish brown mottled black, slightly sandy slightly gravelly clay with occasional fragments of coal. Gravel is fine to coarse subangular to subrounded sandstone and mudstone. These ranged in thickness between 0.40m and 0.95m. The superficial deposits were underlain by bedrock comprising the MMG. This was generally encountered as a firm to stiff brownish red mottled grey slightly sandy slightly gravelly clay with pockets of greenish grey silt. Gravel is fine to coarse sub-angular mudstone and sandstone. The upper parts of the MMG were logged as MMG weathering zone IVb, IVa and III, grading into a more competent mudstone with depth comprising a weak reddish brown mottled green silty mudstone with occasional greenish grey mottling bands of greenish grey siltstone crumbles or breaks up into fine to coarse angular blocks of weak mudstone up to 50mm diameter. The MMG graded from a weathering zone III to a zone II with depth, often being recovered as gravel with short sections of zone of core loss.
BHC13 BHC14 BHC-LD39	Sandford: Topsoil was 0.50m in thickness and typically comprised light brown sandy clay. This was underlain at BHC13 by Head Deposits comprising clayey sand and silty clay of 6m thickness. Superficial deposits were absent at BHC14. The MMG graded from a weathering zone IVa to a zone II with depth, often being recovered as gravel with short sections of zone of core loss.
CPTLD67, CPTLD73, CPTLD77 and CPTLD77A	Kenn, Nailsea and Tickenham Moors: Shallow trial pits identified peat deposits described as firm locally spongy dark brown black pseudo fibrous to fibrous and locally amorphous peat. The peat was saturated with shallow groundwater. The peat thickness generally ranged between 0.40m and 0.55m and was buried beneath the surface by approximately 0.15m and 0.30m thickness of topsoil.

Section E – Tickenham Ridge

Site Description

9.4.237 Section E - Tickenham Ridge comprises the areas between the southern edge of the ridge at Stone-edge Batch, marked by Clevedon Road (B3130) and the M5 motorway at the northern extent, in the Gordano valley.

9.4.238 Land use on the ridge predominately comprises wooded areas, particularly where the relief is steep, or open agricultural fields used for arable farming and grazing. Residential properties are also located on the ridge including Stone-edge on Batch,

West Hill, Wraxall (Upper), properties along Cadbury Camp Lane, Clapton in Gordano and Portbury.

9.4.239 The M5 motorway follows the northern edge of the ridge and trends west to east. See **Volume 5.9.3, Figure 9.5** (Site Geology) and **Volume 5.9.2, Appendix 9E** (PRA). The technical base line report (Ref 9.12), provides further site-specific details for this Section of the Proposed Development and its development components and should be read in conjunction with the ES.

Topography

9.4.240 The ridge trends west to east with the topography rising steeply up from Stone-edge Batch to circa 130m AOD, forming a narrow plateau along the centre line of the ridge before falling steeply down to the north and the low-lying areas of the Gordano valley.

Superficial Geology

9.4.241 Alluvium is located close to the Land Yeo, south of the Stone-edge Batch.

9.4.242 Head Deposits are restricted to a narrow gorge at Bullock's Bottom within the north eastern part of Tickenham Ridge and to the residential town of Portbury.

Solid Geology

9.4.243 Bedrock on the ridge predominantly comprises the Carboniferous Limestone Series including limestone, dolomite and interbedded mudstones. The Carboniferous age Upper Coal Measures are represented by the Pennant Series sandstone close to Clapton in Gordano.

9.4.244 The MMG is found at the southern and northern-most extents of the ridge.

Radon and Ground Gas

9.4.245 The Proposed Development is located within an 'Affected Area' as defined by the NRPB document, NRPB-W26-2002 (Ref 9.5). The guidance presented within the NRPB-W26-2002 document states that full radon protection measures are necessary in the construction of new dwellings or extensions as between 10 and 30% of properties are above the Action Level.

9.4.246 Given the anticipated ground conditions the risk associated with ground gas (methane and carbon dioxide) is considered low to moderate in accordance with CIRIA C665 (Ref 9.8). The risk rating for ground gas is considered low to moderate for this Section of the route.

Mineral Sites

9.4.247 To determine whether sites with current or future mineral value are located in close proximity to the Proposed Development, a review of information available on the BGS website relating to designated mineral resource sites within Somerset was undertaken. This included review of any recorded valid or expired planning permissions for both surface and underground mineral extraction activities as recorded by the Mineral Planning Authority. This data specifically relates to planning permissions dated on or before 1 October 2004 (Ref 9.6) and includes information on the mineral resource extracted. This is the most up to date data set presented by the Mineral Planning Authority.

9.4.248 The superficial Alluvium south of Tickenham Ridge and associated with the Land Yeo is an inferred potential resource for sand and gravel.

9.4.249 High quality limestone deposits (>97% $CaCO_3$) are present on the ridge.

9.4.250 No designated mineral extraction sites are shown on the ridge.

9.4.251 This Section is located within an area designated under the petroleum exploration and development licence, issued under the Petroleum (Production) Act 1934 (repealed in full 1998 and replaced by the Petroleum Act 1998) (Ref 9.11).

Ground Stability

9.4.252 Potential ground stability hazards arising from compressible ground are classed as low on Tickenham Ridge.

9.4.253 A low to moderate ground stability hazard from landslide and ground dissolution is applicable to Tickenham Ridge owing to the topography and limestone bedrock geology.

Landfilling

9.4.254 A single historic landfill is recorded within this Section and is located off Cuckoo Lane, 230m west of the Proposed Development. The landfill received inert and industrial waste.

Mining

9.4.255 Numerous historic quarries, pits and cuttings are located on Tickenham Ridge. These relate to the extraction of limestone via surface mining methods and are often associated with lime kilns. Many former quarries are located within 100m of the Proposed Development; however have not been identified beneath the Proposed Development.

9.4.256 Section E is located within an area that is potentially influenced by coal mining. There are several historic coal mining shafts, air shafts and a coal pit shown on the northern face of Tickenham Ridge at Clapton in Gordano, within the Gordano valley. These are generally located at a distance of greater than 750m from the Proposed Development.

9.4.257 The Section does not fall within an area influenced by brine.

Coal Mining

9.4.258 A review of coal mining data has been undertaken for the Proposed Development between the southern face of the Tickenham Ridge at Stone-edge Batch to the northern face at the M5 motorway. The assessment was undertaken through a detailed review of historic OS maps, BGS borehole records, BGS geological maps and commercially available mining records for the area.

9.4.259 The Tickenham Ridge is formed by the Carboniferous Limestone Series and is dominated by the Clifton Down Limestone Formation. This consists of splintery dark grey calcite and dolomite mudstones, pale grey oolitic, dark grey bioclastic and oncolitic limestones and some mudstones. Sandy limestone is found at base in Bristol area. These materials were deposited in a barrier/back barrier/shelf lagoon

setting. This bedrock is not coal bearing, as such risks from coal mining are considered to be not plausible.

Designated Sites

9.4.260 The following geologically designated sites have been identified:

- Court Hill GCR site located 2km south of the Proposed Development, designated for the Quaternary geology of Somerset;
- Wellhouse Farm RIG site located 350m south of the Proposed Development, designated for the Carboniferous geology;
- Lime Beech Wood RIG site located 330m north of the Proposed Development, designated for the Carboniferous geology;
- Baye's Wood Quarry RIG site located approximately 1.5km west of the Proposed Development, designated for the Carboniferous geology;
- Tickenham Hill Col RIG site located approximately 1.95km west of the Proposed Development, designated for the Carboniferous geology; and
- Naish Hill RIG site located 240m west of the Proposed Development, designated for the Carboniferous geology.

9.4.261 There are currently no designated European Geoparks within this Section.

Soil

9.4.262 Section E is underlain, passing from south to north, by soils comprising slightly acid loamy and clayey soils with impeded drainage; freely draining slightly acid but base rich soils; and freely draining acid loamy soil.

Groundwater

9.4.263 The Head deposits within a narrow gorge at Bullock's Bottom on the ridge are designated as a secondary undifferentiated aquifer.

9.4.264 The Alluvium located in close proximity of the Land Yeo at Stone-edge Batch, are designated as a secondary A aquifer.

9.4.265 The MMG has been classified by the EA as a secondary B aquifer.

9.4.266 The Pennant Sandstone and Avon Group have been classified by the EA as a secondary A aquifer.

9.4.267 The limestone bedrock on Tickenham Ridge has been classified by the EA as a principal aquifer.

9.4.268 There are two recorded groundwater abstractions in the general vicinity of the Proposed Development. However, there are no public potable water abstractions within 1,500m of the Proposed Development.

9.4.269 The Black Rock Limestone Formation on Tickenham Ridge has been designated by the EA as a SPZ zone 1 (inner catchment). This inner catchment area provides groundwater for a potable water abstraction at Tickenham Road Well, Clevedon, located circa 3km west of the nearest component of the Proposed Development consisting of the proposed underground cable (W Route) at Tickenham Court, Stone-edge Batch. The potable water abstraction is operated by Bristol Water Plc.

Hydrology

9.4.270 Significant surface water courses are generally absent from Tickenham Ridge.

9.4.271 The primary surface water features within this Section include the Land Yeo at Stone-edge Batch, the southern margin of the ridge.

Flooding

9.4.272 The base of Tickenham Ridge, south of Clevedon Road is located within a zone 2 and 3 flood risk. The ridge itself is not located within a flood zone.

Historical Context

9.4.273 The site has historically comprised wooded areas or open agricultural fields. Several historic quarries, pits and lime kilns were present. These are not located beneath the Proposed Development.

9.4.274 Several earthworks, a marl pit and areas of historic interest including a deserted medieval village are located in the immediate vicinity of the Proposed Development.

Potential Contaminant Sources (On/Off Site)

9.4.275 North Somerset Council does not hold any records to indicate that the Proposed Development crosses any areas which are contaminated under the definitions of Part IIA of the Environmental Protection Act 1990.

9.4.276 Several pollution incidents to controlled waters are recorded within 250m of the Proposed Development. These are unlikely to significantly impact the development.

9.4.277 The following potential on site sources of contamination have been identified within Section E – Tickenham Ridge:

- general made ground (if present);
- infilled ponds and quarries;
- minor hydrocarbon spills from farming equipment and tanks at farms; and
- herbicides and pesticides associated with the agricultural use.

9.4.278 The following potential off site sources of contamination have been identified within Section E – Tickenham Ridge:

- general made ground (if present);
- minor hydrocarbon spills from farming equipment and tanks at farms;
- herbicides and pesticides associated with the agricultural use;
- ironmonger and garage/MOT centre – 100m east of the proposed underground cable at Stone-edge Batch and the 400kV overhead line;
- former quarries, pits and lime kilns – between 25m and 100m distance along the F and W Routes and proposed underground and overhead line routes north of Stone-edge Batch;
- historic Landfill – 230m east of the W Route off Cuckoo Lane; and
- coal shafts and pit – in excess of 750m west of the 400kV overhead line and underground route at Naish House.

Potential Chemicals of Concern

9.4.279 The following potential chemicals of concern have been identified within Section E – Tickenham Ridge. These potential chemicals are likely to be localised to the vicinity of the source and are not anticipated to be wide spread:

- potential made ground (including heavy metals, PAH, TPH, asbestos, herbicides and pesticides industrial waste (unspecified), mine gases;
- ground gases including carbon dioxide and methane; and
- leachate derived from landfills.

Existing Ground Investigation Data

9.4.280 The results of an intrusive ground investigation undertaken within Section E – Tickenham Ridge are presented within **Volume 5.9.2, Appendix 9J**.

9.4.281 A series of DCP tests were undertaken throughout Section E – Tickenham Ridge along the Proposed Development. These tests provide a depth versus CBR for the vertical stratigraphy. The results presented as a percentage CBR value are presented within **Volume 5.9.2, Appendix 9J**.

9.4.282 A series of shallow machine and hand excavated trial pits were undertaken within Section E – Tickenham Ridge along the Proposed Development. The encountered ground conditions correlate with BGS records and ground conditions.

9.4.283 No boreholes were completed within this Section. No environmental chemical laboratory testing or groundwater/ground gas monitoring was completed within this Section.

<u>Section F – Portishead</u>

Site Description

9.4.284 The area comprised the northern-most part of Tickenham Ridge at Clapton in Gordano and Portbury to Portishead and the Severn Estuary in the north. In the east, this Section is bounded by Royal Portbury Docks. The M5 motorway has been cut into the northern side of Tickenham Ridge. The central part of this Section comprises low-lying open fields used for agricultural purposes. The town of Portishead is located within this area and extends to the Severn Estuary. See **Volume 5.9.3, Figure 9.6** (Site Geology) and **Volume 5.9.2, Appendix 9F** (PRA). The technical base line report (Ref 9.13), provides further site-specific details for

this Section of the Proposed Development and its development components and should be read in conjunction with the ES.

Topography

9.4.285 The southern part of this Section on Tickenham Ridge is in excess of 70m AOD, sloping steeply down towards the north and the Gordano valley, which is located at between 8m and 12m AOD. The Gordano valley extends north to the Severn Estuary and east towards Royal Portbury Docks.

Superficial Geology

9.4.286 Tidal Flat Deposits are located on the low-lying areas in the Gordano valley, between Portishead to the west and Sheepway to the east. These deposits are not located beneath Sheepway.

9.4.287 River Terrace Deposits are found beneath Sheepway and may extend to beneath the preferred route Option A of the Proposed Development.

9.4.288 Head Deposits are predominantly located along the northern side of Tickenham Ridge.

9.4.289 Peat is restricted in extent to between The Portbury Hundred (A369) and the M5 motorway, beneath proposed pylon LD96 and LD97 along preferred route (Option A). A small area of peat is also potentially located beneath or very close to proposed pylon LD100of the preferred route (Option A).

Solid Geology

9.4.290 The base of the Gordano valley is underlain by the MMG comprising mudstone.

9.4.291 The Pennant Sandstone Formation is located on the northern side of Tickenham Ridge, in the vicinity of Clapton in Gordano. This comprises sandstone with thin mudstone/siltstone and thin coal seams.

Radon and Ground Gas

9.4.292 This Section is located within an ‘Affected Area’ as defined by the NRPB document, NRPB-W26-2002 (Ref 9.5). The guidance presented within the NRPB-W26-2002 document states that areas in the Gordano valley, overlying the MMG require basic radon protection measures are necessary in the construction of new dwellings or extensions as between 5 and 10% of properties are above the Action Level.

9.4.293 Given the anticipated ground conditions the risk associated with ground gas (methane and carbon dioxide) is considered moderate to high in accordance with CIRIA C665 (Ref 9.8) due to the presence of Tidal Flat Deposits including peat deposits and landfills.

Mineral Sites

9.4.294 To determine whether sites with current or future mineral value are located in close proximity to the Proposed Development, a review of information available on the BGS website relating to designated mineral resource sites within Somerset was undertaken. This included review of any recorded valid or expired planning permissions for both surface and underground mineral extraction activities as recorded by the Mineral Planning Authority. This data specifically relates to

planning permissions dated on or before 1 October 2004 (Ref 9.6) and includes information on the mineral resource extracted. This is the most up to date data set presented by the Mineral Planning Authority.

9.4.295 Two mineral designation sites are located within the vicinity of the Proposed Development. These include:

9.4.296 Portishead: located 500m west of the existing F Route of the Proposed Development is a mineral designation area for clay and shale. This former quarry extracted clay or shale via surface mining. The quarry is recorded as inactive (including yet to be worked), worked-out and/or restored site.

9.4.297 River Terrace Deposits are shown to underlie Sheepway, located north of the preferred route (Option A), south of the alternative route (Option B) and the existing G and BW Routes; and east of the existing W and F Routes and proposed underground cable route. These are not currently designated a mineral resource; however have the future potential to be a resource.

9.4.298 This is located within an area designated under the petroleum exploration and development licence, issued under the Petroleum (Production) Act 1934 (repealed in full 1998 and replaced by the Petroleum Act 1998 (Ref 9.11).

Ground Stability

9.4.299 Potential ground stability hazards arising from landslides have been designated as low to moderate risk for Tickenham Ridge.

9.4.300 Potential ground stability hazards arising from compressible ground are classed as high for the base of the Tidal Flat Deposits and peat deposits.

9.4.301 A moderate risk from running sand has been identified. This relates to the Tidal Flat Deposits.

9.4.302 Ground stability hazards can arise from historic shallow below-ground coal working, although it is recognised that coal bearing strata do not occur in the close proximity to the Proposed Development including the existing F and W Routes, the underground cable route and the preferred route (Option A) within this Section.

Landfilling

9.4.303 A historic landfill lies beneath the western part of the Portishead 132/33kV Substation and received industrial waste;

9.4.304 A historic landfill is located directly north of Portishead 132/33kV Substation. Waste was deposited included inert, industrial and special waste. The special waste is defined as waste that has hazardous properties and is defined in the Special Waste Regulations 1996. Such properties may be flammable, irritant, toxic, harmful, carcinogenic or corrosive.

9.4.305 A local authority landfill is shown adjoining the substation site. Historic mapping indicates it was in used during the mid to late 1960s. No further details are provided.

9.4.306 Prior Farm Landfill is located beneath part of the preferred route (Option A) of the Proposed Development. Deposited waste included inert, industrial, commercial and household waste, including putrescible waste.

9.4.307 Elm Tree Farm Landfill is located within 250m of the preferred route (Option A) of the Proposed Development and included inert and non-hazardous waste.

Mining

9.4.308 No significant historic mining is shown to have occurred within this Section.

9.4.309 It is noted that historic below ground coal mining has been undertaken at Clapton in Gordano, south within this Section; however not in close proximity to the existing F and W Routes, the underground cable route and the preferred route (Option A) of the Proposed Development.

Coal Mining

9.4.310 A review of coal mining data has been undertaken for the Proposed Development (including existing F, W, G and BW Routes, Portishead 132/33kV Substation, preferred route (Option A) and alternative route (Option B) and the underground cable route between the northern edge of the Tickenham Ridge at Clapton in Gordano and the Portishead substation. The assessment was undertaken through a detailed review of historic OS maps, BGS borehole records, BGS geological maps and commercially available mining records for the area.

9.4.311 The historic OS maps for Section F - Portishead indicate that coal mining activities are recorded along the northern face of the Tickenham Ridge, west of Clapton in Gordano and included several recorded mineshafts, a coal pit and several air shafts. These were generally located within wooded areas on the ridge, located at distances between 750m and 1,000m west of the proposed 400kV overhead line and 132kV underground cable.

9.4.312 The BGS geological maps indicate that north of the Tickenham Ridge at Clapton in Gordano the Pennant Sandstone Formation outcrops. This consists of green-grey and blue-grey, feldspathic, micaceous, lithic arenites of southerly provenance, with thin mudstone and siltstone and seat earth interbeds and mainly thin coal seams; the lithologies are commonly arranged in fining-upwards channel-fill sequences. Some workable coal seams are present. This area forms a small faulted block of Upper Coal Measures strata.

9.4.313 On the north of the Tickenham Ridge, the coal bearing strata have been thrust into place as a thrust fault block.

9.4.314 Several mineshafts, airshafts and coal pits are located north of the Naish House Fault, south west of Clapton in Gordano. These are located over the Pennant Series sandstone. This sandstone series is known to have workable seams of coal, however none is identified as significant and none has been named. The geological map does not show the presence of any significant seams of coal within this area. It is considered that coal working within this area comprised localised small-scale working of lower quality coal seams. Any below ground workings are likely to be localised in nature in addition the proposed development is located at a distance of greater than 750m east of these workings.

9.4.315 Borehole records for the area in the vicinity of Clapton in Gordano indicate the presence of Coal Measures geology as sandstones and mudstones with calcareous clays. No coal seams were recorded, although ‘coal streaks’ and ‘coal partings’ are recorded at between 5.5m and 25m depth. These boreholes were drilled during the 1960s, associated with the construction of the M5 motorway.

9.4.316 Information from the Bristol Coal Mining Archives indicates that no coal bearing strata are identified between the Portishead 132/33kV Substation and the Portbury Hundred (A369), in the Gordano valley.

9.4.317 Coal seams outcrop west of the proposed development on the Tickenham Ridge, west of Clapton in Gordano. The coal seam dips to the west. The seam was worked along the crop, by bell pits and later by deeper shafts around Brook Farm. Brook Farm is located 365m west of the western-most part of the Proposed Development comprising the existing F Route, to be removed. Other components of the Proposed Development including the underground cable and 400kV overhead line are located at a greater distance east from Brook Farm. Further coal workings are located at New Farm, further west.

9.4.318 One or more, possibly deeper, un-worked coal seams are likely to exist along the northern edge of the Tickenham Ridge. A boring at Sperrrings Farm to the north west of the development identified a thin coal seam at a depth of 51m bgl. Owing to the dip angle and direction of the bedrock, these would outcrop west of the site and therefore not impact any parts of the Proposed Development.

9.4.319 There are no recorded shafts or adits within the Gordano valley.

9.4.320 There are several shafts recorded west of Clapton in Gordano and further west. The closest is located 800m west of the development and would not impact or be impacted by any parts of the Proposed Development.

9.4.321 There has been no mining along the Proposed Development between the Portishead substation and Pound Lane at Nailsea that is likely to result in subsidence.

Designated Sites

9.4.322 There are a number of designated geological sites (GCR's) associated with the coastal outcrop at Portishead (ST461770) approximately 750m to the north west of Portishead Substation. Interest in the sites comprises Non-Marine Devonian strata, Silurian-Devonian Chordata, Westphalian strata and Variscan structures of South Wales and the Mendip Hills. There are two RIG sites located north west of the M5 motorway located at a distance of 1.5km west of the Proposed Development.

Soil

9.4.323 The majority of Section F is underlain by soils comprising naturally wet loamy and clayey soils of the coastal flats with subordinate amounts of slightly acid loamy and clayey soils with impeded drainage.

Groundwater

9.4.324 The Tidal Flat Deposits and Peat in the Gordano valley within Section F are designated as unproductive strata.

9.4.325 The Head Deposits at the base of Tickenham Ridge are designated as a secondary undifferentiated aquifer.

9.4.326 The River Terrace Deposits located beneath Sheepway are designated as a secondary A aquifer.

9.4.327 The MMG has been classified by the EA as a secondary B aquifer.

9.4.328 There are no recorded groundwater abstractions within this Section.

9.4.329 There are no potable water abstractions within this Section.

9.4.330 Information within the environmental database indicates that Section is not located above a groundwater SPZ.

Hydrology

9.4.331 There are numerous interconnected small surface water courses and drainage ditches in the Gordano valley, on the low-lying flat areas. The area also includes un-named primary features, which predominantly consist of drains.

9.4.332 There are no surface water abstractions within 500m of the Proposed Development within Section F.

Flooding

9.4.333 The low-lying area within this Section is shown to be located within a zone 2 and 3 flood risk area.

9.4.334 None of the proposed infrastructure at the base of the Tickenham Ridge lies within an area at risk from flooding. This includes the majority of the preferred route (Option A), parallel to the M5 motorway the existing F and W Routes, the underground cable route and the start of alternative route (Option B).

Historical Context

9.4.335 The area within this Section has predominantly comprised open low-lying fields used for agricultural purposes. Several historic landfills have been identified within this area. Commercial properties have been associated with the main population centres within this Section.

Potential Contaminant Sources (On/Off Site)

9.4.336 North Somerset Council does not hold any records to indicate that the Proposed Development crosses any areas which are contaminated under the definitions of Part IIA of the Environmental Protection Act 1990.

9.4.337 Several pollution incidents to controlled waters are recorded within 250m of the Proposed Development. These are generally located within 250m of the alternative route (Option B), the existing Portishead Substation and the existing G and BW Routes. These are unlikely to significantly impact the development.

9.4.338 The following potential on site sources of contamination have been identified within Section F – Portishead:

- general made ground;
- infilled ponds and cuttings;
- minor hydrocarbon spills from farming equipment and tanks at farms;
- PCBs associated with the existing CSE compound and other electrical equipment;
- herbicides and pesticides associated with the agricultural use; and
- natural geology (peat deposits).

9.4.339 Landfills have been identified at the following locations within Section F – Portishead:

- beneath the western part of Portishead Substation and west of the site (Central Electricity Generating Board Landfill);
- north of Portishead 132/33kVSubstation (Portishead Power Station Landfill); and
- a historic landfill having received putrescible waste at pylon LD99 (Prior Farm Landfill) and close to pylon LD100. No further details are provided.

9.4.340 The following potential off-site sources of contamination have been identified within Section F – Portishead:

- smithy – located 150m south of the preferred route (Option A) at Portbury;
- landfills – located within 250m of the preferred route (Option A) and alternative route (Option B) and Portishead 132/33kV Substation;
- high pressure oil/gas pipeline – crosses beneath the F and W Routes, and proposed underground cable and 400kV overhead lines;
- trade entries – located within 250m east of the alternative route (Option B);
- sewage works – located within 250m of Portishead 132/33kV Substation, existing G and BW Routes and alternative route (Option B);
- car depots – located beneath the alternative route (Option B); and
- former railway line – located beneath the preferred route (Option A) and alternative route (Option B).

Potential Chemicals of Concern

9.4.341 The following potential chemicals of concern have been identified within Section F – Portishead. These potential chemicals are likely to be localised to the vicinity of the source and are not anticipated to be wide spread:

- potential made ground (including heavy metals, PAH, TPH, asbestos, polychlorinated bi-phenyls, chlorinated compounds, methane, cyanide, bacterial coliforms, cyanide, PCBs;
- ground gases including carbon dioxide and methane; and
- leachate derived from landfills.

Existing Ground Investigation Data

9.4.342 The results of an intrusive ground investigation undertaken within Section F – Portishead are presented within **Volume 5.9.2, Appendix 9J**.

9.4.343 A series of DCP tests were undertaken throughout Section F – Portishead along the Proposed Development. These tests provide a depth versus CBR for the vertical stratigraphy. The results presented as a percentage CBR value are presented within **Volume 5.9.2, Appendix 9J**.

9.4.344 A series of shallow machine and hand excavated trial pits were undertaken within Section F – Portishead along the Proposed Development. The encountered ground conditions correlate with BGS records and ground conditions.

9.4.345 No boreholes were completed within this Section. No environmental chemical laboratory testing or groundwater/ground gas monitoring was completed within this Section.

Section G – Avonmouth

Site Description

9.4.346 Section G - Avonmouth comprises the areas between Royal Portbury Docks in the west, west of the River Avon and Seabank 400/132kV Substation at Avonmouth in the east.

9.4.347 The Proposed Development is predominantly located within a commercial and industrial setting, including the port of Royal Portbury and Avonmouth. Avonmouth is a heavily industrialised zone with numerous manufacturing and process industries, marine port and docks, depots and works and incorporates the coastline between Avonmouth and Severn Beach. Hallen and Crook's marshes generally comprise low-lying fields used for agricultural purposes.

9.4.348 The main population centres within this Section of the route include Portbury, Easton in Gordano, Pill, Shirehampton, Lawrence Weston, Avonmouth Village and Hallen. See **Volume 5.9.3, Figure 9.7** (Site Geology) and **Volume 5.9.2, Appendix 9G** (PRA). The technical base line report (Ref 9.14), provides further site-specific details for this Section of the Proposed Development and its development components and should be read in conjunction with the ES. The baseline report is presented within **Volume 5.9.2, Appendix 9G**.

Topography

9.4.349 The area comprises generally flat lying ground between 6m and 8m Above Ordnance Datum (AOD). This is located between the M5/M49 motorways to the south and the Severn Estuary to the north. The River Avon is located within the western part of Section G.

Superficial Geology

9.4.350 Superficial deposits predominately comprise Tidal Flat Deposits beneath the majority of the Proposed Development. Small areas of Head Deposits, River Terrace Deposits 1 and peat are also located along the Proposed Development within Section G.

Solid Geology

9.4.351 Bedrock comprises MMG consisting of mudstone.

Radon and Ground Gas

9.4.352 This Section is shown to be an area not 'Affected by' radon as defined by the NRPB document, NRPB-W26-2002 (Ref 9.5). The guidance presented within the NRPB-W26-2002 document states that no radon protection measures are necessary in the construction of new dwellings or extensions as less than 1% of properties are above the Action Level.

Mineral Sites

9.4.353 To determine whether sites with current or future mineral value are located in close proximity to the Proposed Development, a review of information available on the BGS website relating to designated mineral resource sites within Somerset was undertaken. This included review of any recorded valid or expired planning

permissions for both surface and underground mineral extraction activities as recorded by the Mineral Planning Authority. This data specifically relates to planning permissions dated on or before 1 October 2004 (Ref 9.6) and includes information on the mineral resource extracted. This is the most up to date data set presented by the Mineral Planning Authority.

9.4.354 An area of peat is present within the south western corner of the Proposed Development, and two areas of River Terrace Deposits are present further north. These areas do not have historic or current mineral planning permission; however have the future potential to be resources of interest.

9.4.355 Two areas of inactive mineral workings are present to the south and east of Seabank Substation; the working adjacent to the east of the substation, known as Severn Valley or Crooks Marsh, had clay and shale extracted. This working has since been infilled with landfill. The working further south and east of the substation, known as Philblack Works, also extracted clay or shale.

9.4.356 The Avonmouth Wharf, located within 100m of the Proposed Development is an active marine wharf handling marine sand and gravel.

Ground Stability

9.4.357 It is likely that the moderate running sand and compressible ground hazards are related to the areas of the site underlain by Tidal Flat Deposits. It is possible that the high compressible ground hazard in the south west of the site is related to the peat deposits.

Landfilling

9.4.358 The following historic landfills are recorded approximately within 500m of the Proposed Development within Section G, although it is noted that areas of unrecorded landfill are present within Avonmouth that may be encountered during construction phase activity:

- Future Development Area Royal Portbury Dock Landfill historic landfill. The landfill received inert and industrial, non-hazardous waste between 1982 and 1992;
- Royal Portbury Dock Landfill. The landfill received inert waste from 1969, however no closure date is provided;
- Dock Entrance Landfill, located within 100m of the Proposed Development (400kV overhead line) within Avonmouth Docks, this facility received inert waste and operated between 1976 and 1983;
- the Farm Landfill is located centrally within Avonmouth. The landfill is shown to have a complex site boundary and a number of landfill boundaries overlap, however the landfill's southern boundary roughly corresponds with the M5 and M49, with the northern boundary defined by Avonmouth Way. In the west the landfill is bounded by Crowley Way and Lawrence Weston Road in the east. The proposed 400kV overhead line would pass through the landfill, which received inert waste from 1959 onwards. No end date is supplied;
- Britannia Zinc Factory Landfill, Kingweston Lane – industrial waste, commenced 1978. No end date is supplied;
- Britannia Zinc Slag Tip, Kingweston Lane - industrial waste, commenced 1986. No end date is supplied;
- Commonwealth Smelting Ltd Landfill, St Andrew's Road – waste described as difficult, operation commenced 1995, no further details are provided;
- Old VR Tip Landfill, I S C Chemicals – inert, industrial, non-hazardous waste, operated between 1982 and 1994;
- Churngold University Playing Fields Landfill – accepted non-biodegradable wastes. No end date is supplied;
- Kinsweston Landfill – inert waste, commenced 1978. No end date is supplied;
- Saltmarsh Drive, Kingsweston Lane Lawrence Weston – commercial and household waste received between 1950 and 1974;
- Crooks Marsh Farm Landfill – received inert and industrial waste from 1986. No end date is supplied;
- Crooks Marsh Farm Sevalco Landfill – received inert, industrial and commercial waste between 1977 and 1979;
- Crooks Marsh Landfill Site – no further details provided;
- Berwick Farm Landfill Site – no further information is supplied; and
- land at Fisher's Farm – received commercial, industrial household and inert waste. Control measures for ground gas and leachate generation have been incorporated into the landfill.

9.4.359 The following operational landfills are recorded within 250m of the site:

- Kingweston Lane Landfill – accepted waste described as difficult, first date of waste received was 1997. No further details are provided;
- Old VR Tip Landfill, I S C Chemicals – inert, industrial, non-hazardous waste, operated between 1982 and 1994, with the licence modified during 1994. No further details are provided; and
- Commonwealth Smelting Ltd Landfill, St Andrew's Road – waste described as difficult, operation commenced 1995, no further details are provided.

9.4.360 The following components of the Proposed Development would pass directly over/adjoining the following landfills:

- Future Development Area Royal Portbury Dock Landfill. The landfill operated between 1982 and 1992 and received inert and industrial waste. The landfill is located within Royal Portbury Docks and bounded to the south by Portbury Way, to the west by The Drove and in the east by First Avenue. An existing wildlife corridor forms the northern boundary. The existing BW Route is located along the northern boundary of this landfill;
- The Farm Landfill: The proposed 400kV overhead line would pass through the landfill along a short section south of Third Way and include proposed pylons LD 117 with possibly pylons LD116 and LD120 located over or very close to the landfill. The Avonmouth 132/33kV Substation and short sections of the G Route directly west and east of the Avonmouth Substation are also located over the historic landfill. The proposed underground cable leaving the Avonmouth Substation to the east would pass through the landfill until crossing beneath Avonmouth Way to the north and would then adjoin the landfill until Kings Weston Rhyne. At the crossing beneath the rhyne, the underground cable would pass again through the landfill until reaching pylon designation G31R of the existing G route. The G route UGC (east of M49) compound associated with the construction and located in the vicinity of pylons LD121 and LD122 of the 400kV overhead would also be located over the landfill. The landfill received inert waste;
- Crooks Marsh Farm Landfill (inert and industrial waste). This landfill is located immediately south east of the Seabank Power Station on Crook's Marsh. The site boundary of the landfill overlaps with two other landfills identified as the Crooks Marsh Farm Sevalco Landfill and the Crooks Marsh Landfill. Components of the Proposed Development that cross over or through these landfills include the existing BW, DA and G Routes, proposed overhead and underground modifications to these routes entering the proposed Seabank 400/132kV Substation, proposed temporary overhead line modifications to the existing DA Route and the proposed 400kV overhead line including pylon LD131 and LD132 and proposed pylons BW2R, DA2R, G42R;
- Crooks Marsh Farm Sevalco Landfill – inert, industrial and commercial waste; and
- Crooks Marsh Landfill Site – no further details provided.

Mining

9.4.361 The environmental database indicates that there are no coal mining or brine affected areas within 75m of the site boundary, and that there is a negligible hazard of subsidence relating to shallow mining within 150m of the site boundary.

9.4.362 A 12m deep pit was excavated into the estuarine Alluvium (Tidal Flat Deposits) at the Severn Valley brick works, to the east of Seabank Substation. It was noted that the pit had since been infilled with landfill material.

Designated Sites

9.4.363 A 1.15km stretch of Mere Bank and its flanking ditches (including Mere Bank Rhyne), are a scheduled monument. The St Georges Hill RIG site is located 780m south of the Proposed Development at Easton in Gordano and the Kings Weston Lane Cutting is located 800m south east of the Proposed Development within Lawrence Weston. The Severn Valley Brickworks Clay Pit is a RIG site and is located adjoining Seabank Substation.

Soil

9.4.364 The majority of Section G is underlain by soils comprising naturally wet loamy and clayey soils of the coastal flats with subordinate amounts of slightly acid loamy and clayey soils with impeded drainage.

Groundwater

9.4.365 The River Terrace Deposits underlying a small area beneath Royal Portbury Docks are classified by the EA as a secondary A aquifer.

9.4.366 The Head Deposits close to Portbury and Pill/Easton in Gordano are designated a secondary undifferentiated aquifer.

9.4.367 The Tidal Flat Deposits underlying the majority of the Proposed Development within Section G - Avonmouth are classified as unproductive strata.

9.4.368 The MMG bedrock underlying the majority of the Proposed Development within Section G - Avonmouth has been designated as a secondary B aquifer.

9.4.369 There are six groundwater abstractions for industrial use within Section G. There are no potable water abstractions within this Section.

9.4.370 Section G is not located within a groundwater SPZ.

Hydrology

9.4.371 Numerous surface water courses are recorded within this Section. The primary features are the River Avon and the Severn Estuary; however there are several larger named rhynes present as well.

Flooding

9.4.372 The majority of the Proposed Development within Section G - Avonmouth is located within either a zone 2 or zone 3 flood risk area. The notable exception is the area in the general vicinity of Royal Portbury Docks, between The Drove in the west, Royal Portbury Dock Road in the east and Portbury Way in the south. This covers an area of the alternative route (Option B), in particular pylons P-LD102B to P-LD106 and is shown to not be at risk from flooding.

Historical Context

9.4.373 The general area remained undeveloped and comprised agricultural fields with isolated farms from prior to 1880s until circa the 1950s. The exception is the

Avonmouth area, which comprised a dock with associated buildings and infrastructure from prior to the 1880s. This area continued developing from the 1900s until present, with frequent changes in land use including petroleum hydrocarbon depots, landfills, wharfs and warehouses. The wider area was subject to significant development in the 1950s and included residential development at villages and further commercial/industrial development around Avonmouth.

Potential Contaminant Sources (On/Off Site)

9.4.374 Bristol City Council does not hold any records to indicate that the Proposed Development crosses any areas which are contaminated under the definitions of Part IIA of the Environmental Protection Act 1990.

9.4.375 Several pollution incidents to controlled waters are recorded within 250m of the Proposed Development. These are unlikely to significantly impact the Proposed Development or be impacted by the Proposed Development.

9.4.376 The following potential on site sources of contamination have been identified within Section G - Avonmouth:

- general made ground (if present);
- infilled ponds and clay pits;
- minor hydrocarbon spills from farming equipment and tanks at farms;
- herbicides and pesticides associated with the agricultural use;
- PCBs associated with the existing Avonmouth and Seabank substations;
- natural geology (peat deposits); and
- historic landfills.

9.4.377 The following potential off site sources of contamination have been identified within Section G - Avonmouth:

- general made ground (if present);
- minor hydrocarbon spills from farming equipment and tanks at farms;
- herbicides and pesticides associated with the agricultural use;
- Avonmouth and Royal Portbury Docks including wharfs, quays and jetties – within 50m of the proposed overhead lines;
- waste treatment, handling and transfer sites – between 50m and 250m of the 400kV overhead line;
- petroleum depots (historic and current) – between 50m and greater than 500m of the 400kV overhead line;
- general depots, warehouses and works – within 50m of the 400kV overhead line;
- carbonisation and gasification plants – within 500m of the 400kV overhead line;
- bulk storage sites (fertilisers, gas, petroleum, food items, other mineral items):
- mineral processing sites – between 50m and greater than 500m of the 400kV overhead line;
- sewage works – within 250m of the 400kV overhead line and underground cable;
- railway sidings – within 250m of the 400kV overhead line;
- historic landfills – within 250m of the 400kV overhead line on Hallen Marsh; and
- high pressure gas/oil pipeline through Avonmouth – crosses beneath the BW and G Routes and the underground cable.

Potential Chemicals of Concern

9.4.378 The following potential chemicals of concern have been identified within Section G – Avonmouth. These potential chemicals are likely to be localised to the vicinity of the source and are not anticipated to be wide spread:

- potential made ground (including heavy metals, PAH, PCBs, TPH, fuel oils, asbestos, herbicides and pesticides, chlorinated compounds, cyanide, spent oxides, chlorinated compounds, cyanide, bacterial coliforms;
- ground gases including carbon dioxide and methane; and
- leachate derived from landfills.

Existing Ground Investigation Data

9.4.379 The results of an intrusive ground investigation undertaken within Section G – Avonmouth are presented within **Volume 5.9.2, Appendix 9J**.

9.4.380 A series of DCP tests were undertaken throughout Section G - Avonmouth along the Proposed Development. These tests provide a depth versus CBR for the vertical stratigraphy. The results presented as a percentage CBR value are presented within **Volume 5.9.2, Appendix 9J**.

9.4.381 A series of shallow machine and hand excavated trial pits were undertaken within Section G - Avonmouth along the Proposed Development. The encountered ground conditions correlate with BGS records and ground conditions.

9.4.382 No boreholes were completed within this Section. No environmental chemical laboratory testing or groundwater/ground gas monitoring was completed within this Section.

Section H - Hinkley Line Entries

Site Description

9.4.383 The site of the Proposed Development is south and south east of the Hinkley Point 275kV and 400kV Substations. The majority of the site is occupied by agricultural land, crossed by various tracks, drains and brooks. The northernmost tip of the site includes the southern end of the Hinkley Point 400kV Substation. See **Volume 5.9.3, Figure 9.8** (Site Geology) and **Volume 5.9.2, Appendix 9H** (PRA). The technical base line report (Ref 9.15), provides further site-specific details for this Section of the Proposed Development and its development components and should be read in conjunction with the ES.

Topography

9.4.384 The site is at an approximate elevation of 25m AOD in its north western corner, but predominantly undulates between 5m and 15m AOD.

Superficial Geology

9.4.385 Head Deposits are located at the south eastern end of the Proposed Development.

9.4.386 Alluvium is located at the south eastern end of the site and in a band across the centre of the western part of the Proposed Development.

9.4.387 Tidal Flat Deposits are located in the central and northern part of the Proposed Development.

Solid Geology

9.4.388 The north western edge and the south of the Proposed Development (with the exception of the south eastern end) are not covered by superficial deposits.

9.4.389 The majority of the Proposed Development is underlain by the Langport Member, Blue Lias Formation and Charmouth Mudstone Formation. These comprise calcareous mudstones, limestones, siltstones and shales.

9.4.390 In the north west of the Proposed Development is a fault-bounded block of Triassic age strata. The strata forming this block are the Blue Anchor Formation, MMG, and the Westbury Formation and Cotham Member comprising mudstone and siltstone with thin limestone and sandstone units.

9.4.391 Made ground deposits are present beneath the far north eastern part of the Proposed Development.

Radon and Ground Gas

9.4.392 This Section is shown to be an area not ‘Affected by’ radon as defined by the NRPB document, NRPB-W26-2002 (Ref 9.5). The guidance presented within the NRPB-W26-2002 document states that no radon protection measures are necessary in the construction of new dwellings or extensions as less than 1% of properties are above the Action Level.

9.4.393 Given the presence of possible peat-bearing Alluvium beneath the south eastern end of the Proposed Development and in a band across the centre of the western part of Proposed Development, and landfills in the north eastern corner of the Proposed Development, the risk associated with ground gas (methane and carbon dioxide) is considered moderate in accordance with CIRIA C665 (Ref 9.8).

Mineral Sites

9.4.394 To determine whether sites with a current or future mineral value are located in close proximity to the Proposed Development, a review of information available on the BGS website relating to designated mineral resource sites within Somerset was undertaken. This included review of any recorded valid or expired planning permissions for both surface and underground mineral extraction activities, as recorded by the Mineral Planning Authority. This data specifically relates to planning permissions dated on or before 1st October 2004 (Ref 9.6), and includes information on the mineral resource extracted. This is the most up to date data set presented by the Mineral Planning Authority.

9.4.395 No mineral designation sites are recorded within Section H.

Ground Stability

9.4.396 A moderate compressible ground and running sand hazard is related to the areas of the Proposed Development underlain by Alluvium and Tidal Flat Deposits.

9.4.397 A moderate ground stability hazard applies to the Proposed Development.

Landfilling

9.4.398 There are six records of historic landfills which encroach onto the north eastern corner of the Proposed Development. These include:

- landfill at Hinkley Point B Power Station and accepted industrial waste;
- landfill at (Hinkley Point Power Station and accepted industrial and household waste;
- landfill at Hinkley Point Landfill Site and accepted inert and special waste;
- landfill at Hinkley Point B Landfill Site and accepted industrial waste;
- landfill at Hinkley Point Power Station Extension and accepted difficult waste; and
- landfill at Hinkley Point Power Station and accepted putrescible waste.

Mining

9.4.399 There are no mining records within Section H. The site does not fall within a coal or brine affected area.

Designated Sites

9.4.400 No geologically related SSSI were identified within Section H. The Proposed Development does not lie within a designated European Geopark, and there were no records within the JNCC database that relate to the site or the immediately surrounding area.

9.4.401 The EA website indicates that the Proposed Development is located within in a surface water nitrate vulnerable zone.

Soil

9.4.402 In the northern part of the Proposed Development area soils comprise naturally wet loamy and clayey soils of the coastal flats, in the south soils comprise lime rich loams and clays with impeded drainage.

Groundwater

9.4.403 The Head Deposits and Tidal Flat Deposits underlying the Proposed Development are classified by the EA as secondary (undifferentiated) aquifers.

9.4.404 The Alluvium and the Langport Member, Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated) are classified as secondary A aquifers.

9.4.405 The Blue Anchor Formation, MMG, and the Westbury Formation and Cotham Member (undifferentiated) are classified as secondary B aquifers.

9.4.406 There are no groundwater abstractions within 500m of the Proposed Development within Section H.

9.4.407 Information available on the EA website indicates that the Proposed Development does not lie within a currently designated groundwater SPZ.

Hydrology

9.4.408 Numerous interconnected surface watercourses cross the Proposed Development. Including East Brook (the only Primary River) crosses the site.

9.4.409 There are no recorded surface water abstractions on or within 1km of the Proposed Development within Section H.

Flooding

9.4.410 The indicative floodplain map for the area and information from the EA website show that the majority of the Proposed Development has a significant chance of fluvial and/or tidal flooding and is located within a flood zone 2 and 3. The area does not benefit from flood defences.

Historical Context

9.4.411 The Proposed Development and wider surrounding area has predominantly comprised a rural agricultural setting. Isolated farmsteads and small hamlets are located within the area. The Hinkley power stations and associated infrastructure is the notable exception.

Potential Contaminant Sources (On/Off Site)

9.4.412 West Somerset District Council does not hold any records to indicate that the Proposed Development crosses any areas which are contaminated under the definitions of Part IIA of the Environmental Protection Act 1990.

9.4.413 Several pollution incidents to controlled waters are recorded within 250m of the Proposed Development. These are unlikely to significantly impact the Proposed Development or be impacted by the Proposed Development.

9.4.414 The following potential on site sources of contamination have been identified within Section H – Hinkley Line Entries:

- general made ground;
- minor hydrocarbon spills from farming equipment and tanks at farms;
- landfills;
- herbicides and pesticides associated with the agricultural use; and
- natural geology (peat deposits).

9.4.415 The following potential off site sources of contamination have been identified within Section H – Hinkley Line Entries:

- general made ground (if present);
- landfills – located 30m east of the line entries;
- sewage works – located adjacent to the eastern edge of the line entries; and
- infilled ponds.

Potential Chemicals of Concern

9.4.416 The following potential chemicals of concern have been identified within Section H – Hinkley Line Entries. These potential chemicals are likely to be localised to the vicinity of the source and are not anticipated to be wide spread:

- potential made ground (including heavy metals, PAH, TPH, oils and mineral oils, PCBs, asbestos, herbicides and pesticides, industrial waste (unspecified);
- ground gases including carbon dioxide and methane; and
- leachate derived from landfills.

Existing Ground Investigation Data

9.4.417 No existing intrusive ground investigation data is available for Section H.

9.5 Prediction and Assessment of Significance of the Potential Effects

9.5.1 The prediction of the effects considers the details and nature of the Proposed Development and uses a reasonable worst case in terms of potential effects to the ground environment.

9.5.2 The receptor sensitivities have been designated in accordance with the method in section 9.3. The assessment considers effects prior to the implementation of any mitigation. The assessment of the significance of the potential effects considers each potential effect on or to the ground environment for the Proposed Development as a whole and in general terms. Where higher sensitivity receptors are identified along the Proposed Development (within each Section), these are then further discussed in detail.

9.5.3 The assessment considers that each component of the Proposed Development, be it an access track, underground cable, pylon, cable sealing end compound or substation, would result in the same effect on or to the ground environment (i.e. the effect on the structure of soil would be the same regardless of specific development components) and therefore the worst case scenario has been assessed. Therefore an assessment of each individual component and its potential effect on the ground

environment has not been undertaken unless a receptor particularly sensitive to an element of the Proposed Development has been identified.

Construction Effects

Identification of Potential Effects on the Ground Environment

9.5.4 The majority of potential effects to the ground environment are predicted to occur during the construction phase of the Proposed Development. These are considered possible in the absence of implementation of appropriate mitigation measures.

9.5.5 Potential effects on the ground environment, common to all aspects of the Proposed Development, are outlined below:

- damage to SSSI designated because of their geology, to regional important geological or geomorphological sites (RIGS), or to geological conservation review sites (GCRs);
- sterilisation of areas of mineral resources (both current and future);
- collapse of unstable or undermined ground activated by construction works;
- creation of additional ground migration pathways for mine gas, ground gas or landfill gas;
- loss of or damage to structure of topsoil during soil stripping operations and reinstatement, leading to poor crop establishment and lower yields;
- loss of or damage to structure of topsoil during soil stripping operations and reinstatement, leading to significant changes in soil drainage parameters;
- ingress of sediment or silts into surface water courses arising through construction, operation or decommissioning phase activities;
- contamination of soils during construction, operation or decommissioning phases by on site activities;
- contamination of groundwater aquifers during construction, operation or decommissioning phases by on site activities;
- remobilisation of contamination in groundwater by on site activities;
- residual contaminated soils at the surface following on site activities; and
- accidental import or spreading of contaminated material within the working area during on site activities.

9.5.6 Each of these potential effects is considered in more detail in the following paragraphs.

Damage to Designated Geological Sites

9.5.7 The presence of any component of the Proposed Development close to a designated geological site could have the potential to damage or have an adverse effect to the site. The route of the Proposed Development avoids designated geological sites. The nearest designated geological site is located 240m west of the Proposed Development (existing F route) within Section E – Tickenham Ridge at Naish Hill RIG site. All other designated geological sites identified along the Proposed Development are located a distances greater than this. Consideration has been given to assigning Geopark status to the Mendip Hills (Section C), however at present, the Mendip Hills have not been designated as such.

9.5.8 The magnitude of impact would be negligible owing to the distance of these designated geological sites from the Proposed Development.

9.5.9 The potential significance of effect of the Proposed Development on designated geological sites would be **negligible**.

Sterilisation of Areas of Mineral Resources (Current and Future)

9.5.10 A qualitative assessment of likelihood has been undertaken to determine the significance of effect of the Proposed Development on the sterilisation of areas of mineral resource.

9.5.11 The presence of the Proposed Development within or close proximity to, areas of mineral resources could have the potential to sterilise these resources in terms of their current or future availability. The presence of the Proposed Development could impact future mineral planning consents in the study area and result in total loss or substantial alteration to the key elements or features of the baseline condition. As per the Mineral and Waste Development Framework, January 2013, Somerset County, two separate designations are used for mineral safeguarding: Mineral Safeguarding Areas and Minerals Consultation Areas, which are defined as:

- Mineral Safeguarding Areas – designated proven economic mineral resources so they are not needlessly sterilised by non-mineral development; and
- Mineral Consultation Areas – identify the areas within Somerset County Council where the district and borough authorities are required to consult the Mineral Planning Authority over non-minerals development.

9.5.12 There are no identified mineral safeguarding areas (MSAs) within Somerset County Council, North Somerset Council, South Gloucestershire County Council and Bristol City Council boundaries through which the Proposed Development would pass, or pass in close proximity to.

9.5.13 There are several areas within the order limit that have been recorded as sites where minerals have been previously extracted and for which planning permission for mineral extraction 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. These sites are not designated as MSAs. The Proposed Development either passes through these areas or in close proximity to these areas. These have been further discussed below:

9.5.14 There is a site identified as an inactive and restored (including yet to be worked), worked-out and/or a restored site, within Section A - Puriton Ridge, located beneath the proposed 400kV overhead line. This site corresponds to the Fourteen Acre Quarry and consists of a series of former quarries for clay and limestone extraction. The 400kV overhead line and three associated access tracks would cross the eastern-most part of this site. Pylon ZGA8 would be located along the eastern-most part of this site. Pylon ZGA7 would be located 180m south/south west of the former quarry boundary. The existing F route is located east of the site and does not cross through the site. Components of the Proposed Development (one pylon and three access tracks) would be located in the eastern-most part of this site and would sterilise a small area of the former quarry for future use, if applicable. The magnitude of effect would be minor as the former quarry has been worked out and/or restored. This site currently comprises agricultural fields. The receptor

sensitivity would be medium. The significance of effect of the Proposed Development on this mineral resource area would be a **minor adverse** effect.

9.5.15 There is a site identified as an inactive and restored (including yet to be worked), worked-out and/or a restored site, within Section G - Avonmouth, located immediately south-east of the Seabank Substation beneath the proposed line modifications to the existing BW, DA and G Routes and the proposed 400kV overhead line including pylon LD132. This site corresponds to the Severn Valley (Crooks Marsh) Quarry used for clay extraction. The 400kV overhead line and associated pylons LD131 and LD132 would be located within this former quarry. Pylon LD130 would be located close to the former quarry's boundary. The magnitude of effect would be minor as the former quarry has been worked out and/or restored and has been backfilled with landfill material. The likelihood of future extraction of commodities from this site would be unlikely as the former quarry has been worked out and/or restored and has been backfilled with landfill material. This site currently comprises agricultural fields. The receptor sensitivity would be medium. The significance of effect of the Proposed Development on this mineral resource area would be a **minor adverse** effect.

9.5.16 The Proposed Development (existing F and W Routes, proposed 400kV overhead line and proposed underground cable between Nailsea and Portishead Substation) within the northern-most part of Section D, and Sections E and F, pass through an area [or areas] confirmed to be designated under the petroleum exploration and development licence, issued under the Petroleum (Production) Act 1934 (repealed in full 1998 and replaced by the Petroleum Act 1998) (Ref 9.11). The magnitude of effect is considered minor owing to the likely depth at which any potential petroleum hydrocarbons are located within these Sections. Components of the Proposed Development are unlikely to sterilise the resource owing to the likely depth of the resource (shale gas or coal) below ground level and the large geographic area that the designation relates to. No mineral planning permissions have been recorded for the future exploration of petroleum hydrocarbons within this area. The receptor sensitivity would be medium. The significance of effect of the Proposed Development would be a **minor adverse** effect.

9.5.17 The Proposed Development in the vicinity of West End and Nailsea (Section D) crosses the North Somerset Coalfield (Nailsea Coalfield). Within this area coal has historically been worked. Coal seams remain present within the area including beneath the Proposed Development including the existing F and W Routes and the proposed underground cable route and as such must be considered a potential future resource, although it is noted that the Coal Authority indicates that current coal working within the area has ceased and that there are no current plans to recommence below ground coal mining. It is noted that the proposed 400kV overhead line would not be located over shallow coal seams. Coal seams beneath the proposed 400kV overhead line would be located at significant depth and unlikely to impact this infrastructure. The receptor sensitivity would be medium owing to the future potential of the coal as a resource. The magnitude of effect of the proposed 400kV overhead line sterilising the buried coal deposits would be **negligible**. The significance of effect of the proposed 400kV line on buried coal deposits would be **negligible**.

9.5.18 The existing F and W Routes and the proposed underground cable route between Nailsea and the base of the Tickenham Ridge would cross coal deposits that are located at shallow depth. The receptor sensitivity would be medium owing to the

future potential of the coal as a resource. The magnitude of effect of these components sterilising the buried coal deposits would be minor. This is also in consideration that the components of the Proposed Development (removal of the existing F and W Routes and construction of the proposed underground cable route would result in the sterilisation of small areas of the resource compared to the overall resource area. The significance of effect of these Proposed Development components on the potential future coal resource would be a **minor adverse** effect.

9.5.19 It is noted that the geology that has coal bearing strata at shallow depth is predominantly located beneath the residential population centre of Nailsea, therefore any future below ground working of coal within the area is very unlikely.

Collapse of Unstable or Undermined Ground Activated by Construction Works

9.5.20 Where relevant, a qualitative assessment of likelihood has been included in determining the significance of effect of the Proposed Development on the collapse of unstable or undermined ground. Definitions of likelihood are presented within section 9.3.

9.5.21 The presence of the Proposed Development within or within close proximity to, areas of shallow underground mine workings could result in the collapse of surface overburden through the collapse of unstable or undermined ground. This could result in a loss of, or damage to, nearby properties and buildings or the proposed infrastructure. It is noted that the majority of the components of the Proposed Development are not located within areas subject to historic below ground mining. Therefore the magnitude of the effect is considered minor owing to the absence of significant below ground mining activity along the majority of the route. The receptor sensitivity would be medium.

9.5.22 The significance of effect of the Proposed Development on the collapse of unstable or undermined ground would be a **minor adverse** effect.

9.5.23 There are notable exceptions to this along selected short sections of the Proposed Development. These are summarised below.

9.5.24 A coal mining risk assessment has been undertaken for the Proposed Development between West End and Nailsea to Stone-edge Batch within Section D, which is presented within **Volume 5.9.2, Appendix 9I** and should be read in conjunction with the ES.

9.5.25 The Proposed Development in Sections D, E and F, and in particular in the immediate vicinity of West End and Nailsea within the northern-most part of Section D, passes close to or over geology that is coal bearing. These strata have been historically worked below ground, with mine shafts, pits and adits recorded. The former West End Colliery is located along the route of the Proposed Development within Section D. Infrastructure of the Proposed Development that has the potential to impact former below ground coal workings includes the proposed underground cable route through the existing West End Trading Estate at Nailsea, the existing F and W Routes, associated access tracks (both permanent and temporary) and a proposed laydown area/compound at the road junction between The Causeway and Watery Lane, west Nailsea. The former colliery, now houses the West End Trading Estate, and included several recorded mine shafts, a spoil heap and ancillary buildings associated with colliery activities.

9.5.26 Parts of the proposed underground cable replacing the W route in the vicinity of West End Trading Estate (Section D) would pass directly through the former colliery and along its northern boundary along West End Lane, its eastern boundary along Queens Road and Hannah More Road, its southern boundary along Blackfriars Road and its western boundary along Engine Lane.

9.5.27 The Proposed Development (Section D) crosses the conjectured outcrops of the GVU, GVT, Grace's Seam and WT Vein. This includes the existing F and W Routes and the proposed underground cable route between West End and the north western part of Nailsea. There may be shallow surface mining/bell pits associated with former coal workings that have not been identified within the Coal Authority or Bristol Coal Mining Archives data. Such historic workings may have been poorly backfilled or in the case of bell pits, voids may remain. Construction work may activate subsidence and collapse of near surface overburden where loose ground and voids are present. The magnitude of effect of the Proposed Development including the underground cable route and decommissioning of the existing F and W Routes activating subsidence and collapse of undermined or unstable ground through construction work would be major. The receptor sensitivity would be high due to potential damage to the surrounding buildings including residential properties at Nailsea along Queens Road, Hanham Way and North Street. The initial assessment of significance of effect would be a major adverse effect. However, the likelihood of construction activity activating subsidence and collapse of shallow overburden would be of low likelihood. Therefore the significance of effect in the vicinity of residential properties would be a **moderate adverse** effect. The receptor sensitivity of commercial properties on the West End Trading Estate would be medium. The initial assessment of significance of effect would be a moderate adverse effect. However, the likelihood of construction activity activating subsidence and collapse of shallow overburden would be of low likelihood. Therefore the significance of effect in the vicinity of commercial properties would be a **minor adverse** effect.

9.5.28 The recorded below ground working of Grace's Seam (coal seam) beneath the former colliery (West End Colliery) occurred at a depth of between 60m and 90m bgl (82m bgl) beneath the current trading estate. Components of the Proposed Development passing through the former colliery and therefore directly over Grace's Seam at this location, include the proposed underground cable route through Nailsea. The magnitude of effect of the collapse of unstable or undermined ground activated through construction work would be negligible owing to the depth of workings to Grace's Seam at this location. Any ground movement at the surface would generally have since ceased. The receptor sensitivity would be medium owing to the presence of commercial properties on the trading estate. The likelihood of ground movement associated with construction activity and Grace's Seam would be unlikely. The significance of effect would be **negligible**.

9.5.29 The dangers from abandoned shafts are discussed in CIRIA guidance. The principal risk of the collapse of unstable or undermined ground is sudden loss of the overlying superficial deposits or overburden into a void in the shaft. In loose granular superficial deposits a conical depression equivalent in diameter to twice the thickness of superficial deposits can be formed, though in cohesive materials, the collapse is usually steeper sided and smaller in diameter.

9.5.30 The BGS geological maps do not indicate the presence of superficial deposits beneath the West End Trading Estate. Sandy clay deposits may encroach upon the

underground cable route along Queens Road, to the immediate north of the West End Trading Estate. Superficial deposits are shown to be present along the proposed underground cable route north of the West End Trading Estate including pebbly grit and yellow-grey clays. No recorded mine workings are located in the vicinity of these superficial deposits.

9.5.31 The presence of made ground at the West End Trading Estate is probable owing to the historic use of the site as a colliery. Historic plans show a spoil heap to have been located on site. Colliery spoil generally comprises varying proportions of sandstone, mudstone, shale and coal fragments. This material may have been burnt owing to the presence of a kiln on site. The made ground beneath the trading estate is therefore inferred to be predominantly granular in composition.

9.5.32 Ground collapse associated with a mineshaft at the West End Trading Estate may result in a large conical collapse within the made ground, centred on the shaft location.

9.5.33 It has been established that three out of four mineshafts within the West End Trading Estate (former colliery) are located within 20m of the proposed underground 132kV cable passing through the estate. These mineshafts are located at the road junction between Engine Lane and Blackfriars Road.

9.5.34 Two of these mineshafts are recorded to have been remediated, which included backfilling with colliery spoil and the placement of a reinforced concrete cap at the surface and founded on bedrock, to a specification approved by the National Coal Board (NCB). This work was undertaken during 1968. These remediated mineshafts are currently located beneath a commercial building at the corner of Blackfriars Road and Engine Lane. Data obtained from the Bristol Coal Mining Archives suggests that a methane vent has been incorporated into the cap. The magnitude of effect of the collapse of unstable or undermined ground arising through construction would be negligible owing to the remedial work undertaken and the location of the mineshafts beneath the existing commercial development. The receptor sensitivity would be medium owing to the commercial nature of the properties. The significance of effect would be **negligible**.

9.5.35 A third mineshaft is shown to have been potentially remediated. The Coal Authority report indicates that this mineshaft was backfilled with shale. The records do not indicate whether the remedial works included the placement of a reinforced concrete cap keyed into bedrock. A commercial building on the trading estate is shown to be located over this mineshaft. It is therefore considered likely that this mineshaft has been remediated, with a similar specification to the previous mineshafts. The magnitude of effect of the collapse of unstable or undermined ground arising through construction would be minor owing the unknown nature of remedial works undertaken. The receptor sensitivity would be medium owing to the commercial nature of the property. The significance of effect would be a **minor adverse** effect.

9.5.36 There is an identified mineshaft located between 40m and 50m distance from the Proposed Development (Section D); and one further mineshaft at greater than 150m that are un-remediated. One of these mineshafts is shown to be located 40m north of the proposed underground cable along Blackfriars Road, within the West End Trading Estate. This mineshaft is not recorded to have been subject to remedial work. The mineshaft is currently located beneath either a commercial

building, or an associated access road. The magnitude of effect of the collapse of unstable or undermined ground arising through construction activity would be major. The receptor sensitivity would be medium owing to the commercial setting. The initial significance of effect of the Proposed Development activating ground stability would be a moderate adverse effect. In accordance with Table 9.5, the likelihood of an event occurring has been considered, it is concluded that there is a low likelihood that the proposed excavation for the cable trench through the West End Trading Estate would cross, or pass in very close proximity to, this mineshaft owing to a distance of between 40m to 50m between the mineshaft and proposed cable trench. Therefore the significance of effect following consideration of likelihood, would be a **minor adverse** effect.

9.5.37 A further mineshaft is located within a field approximately 50m west of an existing pylon associated with the existing W Route (Section D). This mineshaft is not recorded to have been subject to remedial work. The pylon is located within the grounds of the Nailsea rugby and football club, to the east of the mineshaft and is surrounded by concrete parking spaces/access tracks. The magnitude of effect from ground collapse resulting through decommissioning works would be moderate. The receptor sensitivity would be medium. The initial significance of effect would be a moderate adverse effect. However, the likelihood of ground collapse of this mineshaft activated through decommissioning works of the Proposed Development would be of low likelihood owing to the geographic separation. The significance of effect following consideration of likelihood would be a **minor adverse** effect.

9.5.38 A recorded mineshaft at the former North Lane Pit at Nailsea (Section D) is located beneath a housing estate, at a distance greater than 160m north from the West End Trading Estate and 140m east of the nearest pylon associated with the W route at Nailsea. The magnitude of effect of ground collapse resulting from decommissioning works associated with the W route would be moderate. The receptor sensitivity would be high owing to the presence of residential properties in the close vicinity. The initial significance of effect would be a moderate adverse effect. However, the likelihood of ground collapse of this mineshaft activated through decommissioning works of the Proposed Development would be of low likelihood owing to the geographic separation. The significance of effect following consideration of likelihood would be a **minor adverse** effect.

9.5.39 A review of coal mining records has been undertaken for Proposed Development between Stone-edge Batch and the Portishead Substation within Section E – Tickenham Ridge and Section F - Portishead. The findings of the data review indicates that the bedrock geology on the Tickenham Ridge (Section E) is not coal bearing, therefore risks of the Proposed Development activating ground instability associated with unstable or undermined ground is not possible.

9.5.40 Potentially coal bearing geology is located beneath the northern face of the Tickenham Ridge at Clapton in Gordano (Section F). Historic below ground coal workings are located between 750m and 1,000m west of the Proposed Development (proposed 400kV overhead line, proposed underground cable and exiting F and W Routes). The receptor sensitivity would be low owing to the absence of residential receptors close to the Proposed Development within this section and the general rural setting. The magnitude of effect of the collapse of unstable or undermined ground arising through construction activity would be moderate. The initial significance of effect would be a minor adverse effect.

However, the likelihood of ground collapse of this mineshaft activated through decommissioning works of the Proposed Development would be of unlikely owing to the geographic separation. The significance of effect following consideration of likelihood would be **negligible**.

9.5.41 Peat deposits are recorded within Section D – Somerset Level and Moors North, between east of Yatton on the Kenn Moor and close to the base of the Tickenham Ridge (Section E) at Stone-edge Batch on the Nailsea and Tickenham Moors. These peat deposits may be compressible over the long term and could result in consolidation, however permanent structures such as pylons would be supported on appropriate foundations therefore minimising the effect to the ground environment (consolidation of superficial deposits (peat)). The receptor sensitivity of the peat would be medium and the magnitude of effect of consolidation of peat deposits would be minor. The significance of effect would be a **minor adverse** effect.

9.5.42 Tidal Flat Deposits are recorded along much of the Proposed Development (Sections A, B, D and F.), especially within topographically low lying areas. Tidal Flat Deposits are considered to have a minor to moderate potential for compression resulting through surface loading during the construction phase. The receptor sensitivity would be low for the route alignment as a whole and the magnitude of effect would be minor. The significance of effect would be a **negligible**.

9.5.43 Within Section G, Tidal Flat Deposits are present and recorded to be between 10m and 15m in thickness. Numerous landfill sites are recorded within this Section. Compression of these Tidal Flat Deposits activated by the Proposed Development may result in the release of ground gases or leachate from adjoining landfill sites. The receptor sensitivity of the Tidal Flat Deposits in close proximity to landfill sites is considered to be high for Section G. The magnitude of effect is considered to be major. The initial significance of effect is considered to be a major adverse effect. The likelihood for the construction of the Proposed Development to activate the release of ground gases and leachate from nearby landfills, resulting through compaction of Tidal Flat Deposits is considered to be low. The significance of effect is considered to be a **moderate adverse** effect for short sections of the Proposed Development (such as within Section G) that adjoin landfill sites.

Creation of Additional Ground Migration Pathways for Mine Gas, Ground Gas or Landfill Gas

9.5.44 Where relevant, a qualitative assessment of likelihood has been undertaken to determine the significance of effect of the Proposed Development on the creation of migration pathways for ground gases. Definitions of likelihood are presented within **Table 9.5**.

9.5.45 The presence of the Proposed Development could result in the creation of preferential migration pathways for mine gas, ground gas or landfill gas, especially along underground cable routes where trenches could act as preferential migration pathways for ground gases. Ground gases have the potential to adversely impact receptors through accumulation of ground gases within voids and/or confined spaces resulting in potential risks from explosion and/or asphyxiation. The receptor sensitivity would be high for residential properties, medium for commercial properties and low for rural agricultural settings. The magnitude of the effect is considered minor for the majority of the route owing to the geographic separation

between source and receptor and low potential for ground conditions to result in significant concentrations of ground gases and associated ground gas flow rates. The significance of effect of the Proposed Development for the creation of migration pathways would be a **negligible** to **minor adverse** effect for the majority of the route.

9.5.46 It should be noted that there are short sections along the Proposed Development where the potential magnitude of effect and receptor sensitive are higher owing to differing ground conditions and proximity to receptors. These are summarised below.

9.5.47 All Tidal Flat Deposits within the LoD of the Proposed Development have been considered to contain peat bearing horizons. These natural deposits of peat may give rise to ground gases. Previous intrusive ground investigations within Section D identified buried peat deposits on the Kenn, Nailsea and Tickenham Moors. Components of the Proposed Development including overhead pylons will be absent of confined spaces and subject to outdoor air exposure. The receptor sensitivity is considered to be low. The magnitude of effect is considered to be minor. The significance of effect is considered to be **negligible**.

9.5.48 Short sections of underground cable cross Tidal Flat Deposits, particularly within Section D at Nailsea and within Section F and G. Underground cables may have associated confined spaces and therefore potential risks from ground gases are considered to be higher. The receptor sensitivity is considered to be low. The magnitude of effect is considered to be minor .The significance of effect is considered to be **minor adverse** effect.

9.5.49 The proposed underground cable route at West End, Nailsea (Section D) crosses a former colliery. Mineshafts within this area have the potential to act as conduits for mine gas. Mine gases have the potential to adversely impact receptors through accumulation within voids and/or confined spaces resulting in potential risks from explosion and/or asphyxiation. The magnitude of effect for the creation of preferential migration pathways resulting through the construction of an underground cable trench would be major where the Proposed Development (underground cable route) passes through the West End Trading Estate and Nailsea. The receptor sensitivity would be high where residential properties are located close to the underground cable route within Nailsea, such as along Queens Road, North Street and Hanham Way, Nailsea. The initial significance of effect for the Proposed Development (underground cable route) creating preferential migration pathways for mine gases to nearby residential properties would be a major adverse effect. However, the likelihood for the creation of migration pathways would be low. The significance of effect for the Proposed Development (underground cable) creating preferential migration pathways for mine gases to residential properties following the assessment of likelihood would be a **moderate adverse** effect.

9.5.50 The receptor sensitivity of existing infrastructure and commercial properties on the West End Trading Estate would be medium. The initial significance of effect for the Proposed Development (underground cable route) creating preferential migration pathways for mine gases to nearby commercial properties would be a moderate adverse effect. However, the likelihood of the creation of migration pathways would be low. The significance of effect for the Proposed Development (underground cable) creating preferential migration pathways for mine gases to nearby

industrial/commercial units following the assessment of likelihood would be a **minor adverse** effect.

9.5.51 The presence of shallow coal seams may result in the creation of migration pathways for mine gas should the Proposed Development components intersect these. The magnitude of effect would be minor where outdoor air exposure applies, such as at the existing F and W route pylons and access tracks in the vicinity of Nailsea. The receptor sensitivity (human health) would be low (for construction workers). The significance of effect for outdoor air would be **negligible**.

9.5.52 The magnitude of effect would be moderate where manned entry into trenches is required in the vicinity of Nailsea. The receptor (human health) sensitivity would be medium. The initial significance of effect would be a moderate adverse effect. However the likelihood would be low. Therefore the significance of effect following consideration of likelihood, for manned entry into excavations would be a **minor adverse** effect.

9.5.53 There is an identified mineshaft located between 40m and 50m distance from the Proposed Development (underground cable route) at West End Trading Estate (Section D) along Blackfriars Road. This mineshaft is not recorded to have been subject to remedial work. The mineshaft is currently located beneath either a commercial building, or an associated access road. Mine gas emissions could migrate to the proposed development (underground cable route trench) through granular made ground. The receptor sensitivity would be medium owing to the commercial setting. The magnitude of effect would be moderate with the initial significance of effect considered to be a moderate adverse effect. However the likelihood would be low owing to the distance between the proposed underground cable route and the mine shaft and the absence of previous recorded issues relating to mine gas emissions. Therefore the significance of effect following consideration of likelihood would be a **minor adverse** effect.

9.5.54 A further mineshaft is located within a field approximately 50m west of an existing pylon associated with the W Route (Section D). This mineshaft is not recorded to have been subject to remedial work. The pylon is located within the grounds of the Nailsea rugby and football club, to the east of the mineshaft and is surrounded by concrete parking spaces/access tracks. The receptor sensitivity would be medium owing to the recreational land use. The magnitude of effect on the Proposed Development would be minor owing to the outdoor exposure in the vicinity of the rugby and football club. The significance of effect considered to be a **minor adverse** effect.

9.5.55 The Coal Authority report states that there is no record of mine gas emissions requiring action by the Coal Authority in close proximity to the Proposed Development (underground cable route) at West End Trading Estate, although it is noted that at least one former mineshaft along Blackfriars Road has been remediated with a methane vent.

9.5.56 Three mineshafts located close to the road junction of Engine Lane and Blackfriars Road within the West End Trading Estate are considered to have been remediated including the incorporation of a methane vent into the mine cap and therefore would not act as conduits for mine gases. The magnitude of effect would be negligible owing to the remedial works undertaken. The receptor sensitivity would

be medium owing to commercial setting. The significance of effect considered to be **negligible**.

9.5.57 The Proposed Development passes close to or through known landfill sites within Sections D, F and G. This includes the 400kV overhead line including pylons LD76 and LD77 passing over, or within 50m of a recorded landfill at North Drove, West End, Nailsea within Section D; the preferred route Option A passes through a landfill within the Gordano valley between Sheepway and the M5 motorway and the existing F and W Routes and the proposed 132kV underground cable (the W route) pass through a landfill at the Portishead Substation within Section F. There are numerous landfills within Avonmouth including at Seabank Substation, through which the 400kV overhead line, the proposed underground cable connecting the Avonmouth Substation to the G Route, the existing G and BW Routes and associated access tracks cross within Section G. These landfills have the potential to generate ground gases depending upon the deposited wastes. Several of these landfills are recorded as having received putrescible household waste.

9.5.58 The Proposed Development consisting of the proposed 400kV overhead line would pass close to a historic landfill at North Drove, Nailsea (Section D). This includes a section of the 400kV overhead line between pylons LD 75 and LD76. The pylons are not identified to be located over the landfill; these pylons adjoin within 50m (LD75) and 150m (LD76) of the landfill boundary. These pylons would have piled foundations. The surrounding area comprises agricultural fields with no residential properties located within the immediate vicinity. The geology comprises Tidal Flat Deposits underlain by MMG, therefore the magnitude of effect for through-ground migration of grasses would be minor. The sensitivity of the receptor has been assessed as low owing to the agricultural setting in the immediate vicinity. The significance of effect would be **negligible**.

9.5.59 Parts of the existing F and W Routes and the proposed underground cable route within Section F – Portishead, in the close proximity to the Portishead Substation, would pass over/through a historic landfill beneath the western part of the Substation. The historic landfill is identified as the former Central Electricity Generating Board Landfill, having received industrial waste. The proposed underground cable route has a higher potential to result in preferential gas migration pathways due to trenching work required as part of the development. Residential properties are located circa 75m west of the Portishead Substation along Wren Gardens Road. No residential properties are located north, east or west of the substation, an area which comprises a nature reserve. The receptor sensitivity would be high for residential properties and low for the nature reserve. The magnitude of effect would be major for residential properties owing to the distance of the underground cable from the residential area (75m distance and greater) and minor for the nature reserve. The initial significance of effect would be a major adverse effect for areas of the Proposed Development (underground cable route) in the general vicinity of residential properties of Wren Gardens Road. However, the likelihood for the creation of migration pathways to off-site residents would be low owing to the geographical separation and cohesive nature of natural soils (Tidal Flat Deposits). Therefore, the significance of effect following consideration of likelihood would be a **moderate adverse** effect.

9.5.60 The receptor sensitivity of the adjoining nature reserve would be low. The magnitude of effect would be minor. The significance of effect would be **negligible**.

9.5.61 Within Section G – Avonmouth, parts of the existing G Route cross the T Farm Landfill between the M5 motorway at junction 18A and the Avonmouth Substation. The proposed 400kV overhead line including pylon LD117 would be located over this landfill and the proposed underground cable between the Avonmouth Substation and junction 18 of the M5/M49 motorways would pass through the T Farm Landfill. The landfill is recorded to have received inert waste. The components of the Proposed Development pass through a heavy industrial and commercial setting of Avonmouth and are located within close proximity to depots, warehouses and other commercial buildings. The proposed underground cable between the north eastern corner of the Avonmouth Substation and pylon G31R of the G Route would have the highest potential to create preferential migration pathways for landfill gases owing to trenching although piled foundations for pylon located over the landfill may also create migration pathways. The receptor sensitivity of the commercial/industrial setting would be medium. The magnitude of effect would be moderate with the initial significance of effect considered to a moderate adverse effect. However the likelihood for the creation of migration pathways for landfill gases would be low owing to the inert nature of the fill material. Therefore the significance of effect following consideration of likelihood would be a **minor adverse** effect.

9.5.62 The proposed overhead 400kV line between pylons LD131 and LD132 close to the Seabank Substation crosses over the former Crooks Farm Landfill, which received inert and industrial waste including hazardous and non-hazardous waste. This landfill has the potential to release ground gas and leachate. Other components of the Proposed Development over this landfill include pylons DA2R, BW2R, G42R and temporary overhead infrastructure works. The surrounding land use comprises agricultural fields, with the Seabank Substation located to the north. The receptor sensitivity would be medium for the agricultural fields and high for the adjoining Seabank Substation. The magnitude of effect would be moderate. The initial significance of effect of creation of migration pathways for landfill gases to the agricultural fields would be a minor adverse effect. The likelihood of piled foundations creating landfill gas migrations would be likely. Therefore the overall significance of effect following consideration of likelihood would be a **moderate adverse** effect.

Loss of or Damage to Structure of Topsoil/Subsoil during Soil Stripping Operations and Reinstatement, Leading to Poor Crop Establishment and Lower Yields

9.5.63 It is proposed to strip topsoil/subsoil on agricultural land to allow for the construction of both temporary and permanent access tracks to the Proposed Development locations. Tracks would be installed using crushed stone (MOT Type 1 or similar) with a reinforcing geotextile membrane to protect soils. These access tracks would be approximately 4m wide and 300mm to 500mm deep.

9.5.64 Underground cable sections would be laid within trenches that are approximately 1.8m (400kV cables) and 1.2m (132kV cables) deep. A working width would be required (see **Volume 5.3.3, Figure 3.17**), although where there are 'pinch points' along the cable route where the LoD would be reduced. The topsoil/subsoil would be stripped across the working width and stored along the working area so that it can be replaced once the installation of the underground infrastructure is complete. The widths of the working areas will vary depending upon the proposed cable

voltage (400kV and 132kV). The proposed working areas for both the 400kV and 132kV underground cables are described in **Volume 5.3.1**. Within Section G, the underground cable would pass through areas of landfill or made ground. Detailed site specific ground investigation would be required to assess reuse of the material and concrete classification.

9.5.65 There is the potential for the loss of or damage to, the structure of topsoil/subsoil during the development of the Proposed Development, leading to poor crop establishment and lower yields. This is particularly relevant where mass excavation of shallow soils are undertaken such as along underground cable sections within Section C – Mendip Hills and Sections D, E and F, between Nailsea and the Portishead Substation.

9.5.66 Soil excavation for the creation of access tracks is also considered to have a potential effect on the ground environment. The effect will be less for access tracks than for soil excavations associated with sections of underground cable owing to the lateral extent of the proposed excavations. Soil excavations for the creation of access tracks for the majority of the Proposed Development are considered to have a minor magnitude of effect of owing to the potential for a minor shift away from the baseline conditions. The receptor sensitivity would be medium owing to the general agricultural nature of the land use along much of the Proposed Development. The significance of effect would be a **minor adverse** effect.

9.5.67 Soil excavations for construction of the proposed underground cable routes (Section C, D, E, F and G) would be of greater duration and vertical/lateral extent than access tracks and are therefore considered to have a magnitude of effect of moderate. The receptor sensitivity would be medium owing to the general agricultural nature of the land use. The significance of effect would be a **moderate adverse** effect.

9.5.68 Peat deposits are identified on the Kenn, Nailsea and Tickenham Moors (Section D). The proposed 400kV overhead line, and the decommissioning of the existing F and W Routes between Yatton and the base of the Tickenham Ridge at Stone-edge Batch and the proposed undergrounding of the W Route between Nailsea and Stone-edge Batch has the potential to damage these deposits through compaction, oxidation or drying when excavated. The magnitude of effect would be moderate, owing to the potential loss of peat deposits as a resource. The receptor sensitivity would be medium. The significance of effect would be a **moderate adverse** effect.

Loss of or Damage to Structure of Topsoil during Soil Stripping Operations and Reinstatement, Leading to Significant Changes in Soil Drainage Parameters

9.5.69 There is the potential for changes to the drainage parameters of soils resulting from the Proposed Development as a result of poor re-compaction processes and trafficking. It is noted that drainage improvement works would also be implemented along sections of underground cable to ensure that the site of the cables is free from risk of flooding. These have the potential to have an impact on soil parameters off site and hydraulically down-gradient of the proposed underground cables.

9.5.70 The majority of the Proposed Development crosses general agricultural land use. Within these areas the receptor sensitivity would be medium owing to the agricultural land use. The magnitude of effect would be minor owing to the potential

minor shift away from baseline conditions. The significance of effect would be a **minor adverse** effect.

9.5.71 Where peat deposits are present, the receptor sensitivity would be high, owing to the permeable nature of the material although it is recognised that peat, where identified along the Proposed Development, comprises buried material that has already undergone some consolidation. The description of peat encountered during recent ground investigations on the Kenn, Nailsea and Tickenham Moors (Section D) identified the peat as comprising a firm, locally spongy dark brown black pseudo fibrous to fibrous, locally amorphous peat. A copy of the ground investigation is included within **Volume 5.9.2, Appendix 9J**. The description of the peat encountered suggests consolidation has occurred resulting in peat of a firm strength. This indicates that the peat is not a recent deposit.

9.5.72 Peat deposits consisting of buried and consolidated material are recorded on the Kenn, Nailsea and Tickenham Moors between Yatton and Stone-edge Batch. Components of the Proposed Development most likely to have an impact on the soil structure of the peat are the construction of the underground cable route between Nailsea and Stone-edge Batch across the Tickenham Moor (Section D) and access tracks for pylons of the proposed 400kV overhead line and existing F and W Routes across the Kenn and Nailsea Moors. The receptor sensitivity would be high owing to the higher permeability of this medium compared to other soil types along the Proposed Development. The magnitude of effect would be moderate owing to the difficulty in re-establishing peat deposits to pre-excavation condition once removed from the ground. The significance of effect would be a **moderate adverse** effect.

9.5.73 It is noted that active, living peat mires are not located along or beneath components of the Proposed Development. The nearest recorded peat mire/bog is identified as Max Bog located within Section C – Mendip Hills at a distance of greater than 300m from the proposed underground cable route through this Section. The peat mire is located hydraulically up-gradient of the underground cable route and therefore the development is unlikely to significantly impact the drainage parameters of Max Bog. Max Bog has been further discussed at **Volume 5.8.1.**

9.5.74 Where components of the Proposed Development cross designated sites such as SSSI, the loss or damage to the soil structure of peat arising from the construction of the Proposed Development may impact other receptors such as ecology and hydrology. Within these areas, such as on the Kenn, Nailsea and Tickenham Moors designated SSSI, the presence of peat within the superficial geology influences the ecology found within drainage ditches on the moors. The receptor sensitivity is therefore considered to be high within these areas. The magnitude of effect would be moderate owing to the potential for loss or alteration to the designated site. The significance of effect would be a **moderate adverse** effect.

9.5.75 Potential impacts on site drainage and hydrology are discussed in further detail at **Volume 5.10.1.**

Ingress of Sediment or Silts into Surface Water Courses Arising Through Construction, Operation or Decommissioning Phase Activities

9.5.76 The Proposed Development passes close to or crosses numerous interconnected drainage ditches, rhynes and primary surface water receptors including rivers. There is the potential for overland sediment transportation arising from construction activities into these surface water receptors.

9.5.77 Transportation of sediment to surface waters has been further discussed and assessed within at **Volume 5.10.1**.

Contamination of Soils by on Site Activities

9.5.78 The Proposed Development has the potential to result in contamination of soils through the accidental release of petroleum hydrocarbons, oil or lubricants from construction related equipment. The Proposed Development also has the potential to generate litter or other debris that could be worked into site soils. Anticipated volumes of pollutants including hydrocarbons, oils and lubricants are considered to be low. Hydrocarbons may contaminate the soil through leaks from fuel tanks, hydraulic hoses and lines and engines of machinery and heavy plant. These are generally of low volume and of temporary duration. The magnitude of effect would be minor as a small leak of hydrocarbons from machinery would result in a minor shift from baseline conditions. The receptor sensitivity for the majority of the Proposed Development would be medium. The significance of effect would be a **minor adverse** effect.

9.5.79 Where soils are free draining, such as where peat deposits are present within Section D or where the soil medium is predominantly granular in matrix such as over River Terrace Deposits at Sheepway, Section F, migration of liquid contaminants would be quicker and more widespread. The receptor sensitivity is considered to be medium, and the magnitude of effect would be moderate owing to the potential for the contaminant to impact a larger geographic area. The significance of effect would be a **moderate adverse** effect.

9.5.80 It is noted that proposed underground cables to be used within Section C – Mendip Hills and between Nailsea (Section D) and the Portishead Substation (Section F) would not contain fluids such as mineral oils or hydrocarbons as insulation. There is no potential for these components of the Proposed Development to cause any contamination via leaks.

Contamination of Groundwater Aquifers by on Site Activities

9.5.81 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. Anticipated volumes of potential contaminants (hydrocarbons) are considered to be low. The principal source of hydrocarbons during the construction operation and decommissioning phases is likely to be the fuel tanks, hydraulic lines and engines of machinery and heavy plant.

9.5.82 The Proposed Development generally passes across secondary aquifers (within both the superficial and bedrock geology) along the route. These are variably designated secondary undifferentiated to secondary A aquifers depending upon the geology. The magnitude of effect is considered minor based on the likely small volumes involved and resulting minor changes to the ground environment. The

receptor sensitivity for the route as a whole would be medium. The significance of effect would be a **minor adverse** effect.

9.5.83 It is noted that there are areas along the Proposed Development that have a greater sensitivity. These are discussed below.

9.5.84 The Proposed Development passes across, or within close proximity to groundwater aquifers designated as principal aquifers. Areas along the route influenced by these include Section C - Mendip Hills, where it is proposed to construct a 400kV underground cable, associated compounds and access tracks. The proposed infrastructure avoids passing directly over bedrock designated as a principal aquifer. The limestone bedrock within this Section is generally located at greater than 100m distance from the underground cable and at higher elevation than the Proposed Development. Section E - Tickenham Ridge also has limestone bedrock, of which the Blackrock Limestone Formation is designated as a principal aquifer and groundwater SPZ 1. This principal aquifer forms the SPZ I for the public water supply of Tickenham Road Well, Clevedon, operated by Bristol Water Plc. The Proposed Development within this Section includes a new 400kV overhead line, the construction of an underground cable and removal of existing F and W Routes. These cross directly across the principal aquifer and SPZ I at the eastern-most extent of this designated area on the Tickenham Ridge, between Stone-edge Batch and Cadbury Camp Lane on the Tickenham Ridge. Within these sections along the Proposed Development, the receptor sensitivity would be high. The magnitude of effect would be minor owing to small volumes of potential contaminants including hydrocarbons arising from construction associated with the Proposed Development. The significance of effect would be a **moderate adverse** effect.

9.5.85 The Proposed Development (400kV underground cable) also passes within 50m of a groundwater SPZ I within Section C - Mendip Hills at Towerhead, Sandford. The underground cable generally passes the SPZ I between 250m and 500m distance and also passes 500m east of a groundwater SPZ II at Loxton. The magnitude of effect would be negligible because the Proposed Development does not cross these SPZ's. The receptor sensitivity would be high given the EA designation. The significance would be **negligible**.

9.5.86 There are several groundwater abstractions within 1,500m of the Proposed Development, along the whole length of the route. These are generally used for agricultural purposes and industrial processes. There are however, four groundwater abstractions used for potable water. These are located within Section C - Mendip Hills, close to Winscombe and located within 270m south east of the 400kV underground cable, and Section D - Somerset Levels and Moors North, located within 880m from the Churchill Substation. The magnitude of effect would be moderate and the receptor sensitivity would be high given potential human health implications. The significance of effect would be a **moderate adverse** effect.

9.5.87 Proposed underground cables to be used within Section C – Mendip Hills and between Nailsea (Section D) and the Portishead Substation (Section F) would not contain fluids such as mineral oils or hydrocarbons as insulation. There is no potential for these components of the Proposed Development to cause any contamination via leaks.

Remobilisation of Contamination in Groundwater by On Site Activities

9.5.88 The Proposed Development has the potential to result in remobilisation of existing contaminants to groundwater through construction activities. This could result from the creation of migration pathways along piled foundations or ground disturbance via large-scale ground excavations. The magnitude of effect ranges from minor to major, depending upon the potential for, and the type of, contamination potentially present beneath the Proposed Development. The receptor sensitivity ranges between low and high depending upon the location.

9.5.89 In general, the Proposed Development proceeds through predominantly agricultural/rural settings with a low potential for existing significant ground/groundwater contamination. The general historic land use along the Proposed Development suggests a low likelihood for significant contamination. The technical baseline reports (PRAs) for each Section of the Proposed Development as presented within **Volume 5.9.2, Appendices 9A to 9H**, indicate that there are no identified sites within or within close proximity to, the LoD of the Proposed Development that are defined as Contaminated Land under Part IIA of the Environmental Protection Act, 1990. There is the potential for existing contamination on sites beneath the Proposed Development arising from historic land uses and minor hydrocarbon spills from framing machinery, however this would be considered to be localised in extent and of low concentration. The magnitude of effect would be minor and the receptor sensitivity would be medium. The significance of effect would be a **minor adverse** effect covering the majority of the Proposed Development.

9.5.90 There are however, sections along the Proposed Development that have a greater likelihood for contamination, and therefore the greater chance that construction activities might lead to remobilisation of contaminants.

9.5.91 The Proposed Development passes through, or within 50m distance to historic land uses with the potential to have resulted in contamination of the land: within Section D at Nailsea; within Section F at Portishead; and within Section G at the Royal Portbury Docks, Avonmouth Docks, Avonmouth industrial/commercial area and the Seabank Substation.

9.5.92 At Nailsea (Section D), the historic land use included a landfill (50m distance off North Drove from the proposed 400kV overhead line) on the Nailsea Moors, former sewage works (beneath the existing W Route) on the Nailsea Moors and a former colliery (beneath the proposed 132kV underground cable (the W Route) through the West End Trading Estate at Nailsea), all of which are crossed by the Proposed Development.

9.5.93 The preferred route (Option A) within Section F – Portishead passes over the historic Prior Farm landfill and pylon LD99 would be located over the landfill. The landfill received commercial, industrial and household waste, including putrescible waste. The receptor sensitivity of the hydrogeology would be medium owing to the secondary A and B aquifer designations of the superficial and bedrock geology within the area. The magnitude of effect would be moderate owing to the potential for landfill contaminants including leachate and landfill gases, to be remobilised to the surrounding area through construction activity. Remobilisation and migration may occur should foundations result in the creation of preferential migration pathways (such as along piled foundations). The significance of effect would be a **moderate adverse** effect.

9.5.94 The existing F and W Routes and the proposed 400kV underground cable would pass over/through the historic Central Electricity Board Landfill located beneath the western part of the existing Portishead Substation (Section F). A historic landfill is also recorded immediately north of the Portishead Substation, having received hazardous waste. No recorded issues relating to leachate are identified for the area beneath and adjoining the Portishead Substation. The component of the Proposed Development with the highest potential to result in remobilisation of contaminants would be the underground cable route at the Portishead Substation, although extensive soil excavations are not anticipated owing to the use of HDD. Any waste materials arising will be controlled through the CEMP. The magnitude of effect would be moderate owing to the potential for the proposed underground cable route to remobilise contaminants from the historic landfill beneath the Portishead Substation. The receptor sensitivity of the hydrogeology would be medium owing to the secondary A and B aquifer classifications of the superficial and bedrock geology within the area. The significance of effect would be a **moderate adverse** effect.

9.5.95 The decommissioning of the pylons for the existing F and W Routes would be unlikely to result in the significant remobilisation of contaminants. A worst case assessment to include the removal of the whole length of piled foundations has been assessed.The magnitude of effect would be minor for the removal of existing piled foundationsto remobilise contaminants from the historic landfill beneath the Portishead Substation. The receptor sensitivity of the hydrogeology would be medium owing to the secondary A and B aquifer classifications of the superficial and bedrock geology within the area. The significance of effect would be a **minor adverse** effect.

9.5.96 The alternative route (Option B) would pass immediately north of the historic Royal Portbury Dock Landfill at Portbury Docks between proposed pylons P-LD102C to P-LD103. The existing BW and G Routes are also located immediately north of the historic landfill. It is noted that both the alternative route (Option B) and the existing BW and G Routes are not located over the historic landfill. The decommissioning of the G Route and construction of the alternative route (Option B) is therefore unlikely to result in result in significant remobilisation of landfill contaminants from the historic Royal Portbury Docks Landfill. The receptor sensitivity of the hydrogeology would be medium owing to the secondary A and B aquifer classifications of the superficial and bedrock geology within the area. The magnitude of effect would be negligible owing to the absence of landfills beneath proposed components of alternative route Option B and existing G Route. The significance of effect would be **negligible**.

9.5.97 The historic land use between the Royal Portbury Docks, west of the River Avon, Avonmouth and Seabank Substation (Section F and G) has had a long history of industrial land use including heavy engineering, manufacturing and processing. This wider area within Section G - Avonmouth is affected by known ground and groundwater contamination from historic industrial activity including along the route of the proposed 400kV overhead line, the existing G and BW Routes and a short section of 132kV underground cable (the G Route) between the north eastern corner of the Avonmouth Substation and the existing G Route at junction 18 of the M5/M49 motorways. These components of the Proposed Development also pass over or through the T Farm Landfill, which received inert waste. It is noted that

unexpected/unrecorded made ground or fill material can also be encountered within Avonmouth (Section G). The removal of the existing G Route infrastructure is unlikely to remobilise significant contamination due to the removal of the all piled foundations (worst case scenario). The magnitude of effect would be minor owing to the removal of the whole of the piled foundations. Receptor sensitivity of the hydrogeology within the area would be medium owing to the secondary A and B aquifer classifications of the superficial and bedrock geology within the area. The significance of effect would be a **minor adverse** effect.

9.5.98 The proposed underground cable and piling of foundations for the proposed 400kV overhead line are wouldl have a higher potential to remobilise contamination due to below ground construction activities. The receptor sensitivity of the hydrogeology within the area would be medium owing to the secondary A and B aquifer classifications of the superficial and bedrock geology within the area. The magnitude of effect would be moderate owing to the potential for contaminants to be remobilised by construction activity. The significance of effect would be a **moderate adverse** effect.

9.5.99 A worst case scenario has been assessed for the removal of existing piled foundations from beneath existing pylons. The piled foundations where removed would be replaced with inert engineered fill before being reinstated with topsoil and subsoil. As a whole, the Proposed Development generally proceeds through an area with a low likelihood for significant contamination due to the agricultural and rural site history along much of the Proposed Development. As a result, there is low potential for existing piled foundations being completely removed and suitably reinstated, following decommissioning of pylons, to act as preferential pathways for significant concentrations of contaminants. The magnitude of effect is considered minor given the potential for ground contamination, and the receptor sensitivity for the Proposed Development as a whole would be low. The significance of effect would be **negligible**.

Residual Contaminated Soils at the Surface Following On Site Activities

9.5.100 The Proposed Development has the potential to result in residual contaminated soils being left at the surface through construction activities such as piling, excavation of trenches and excavation for mass concrete foundations. Should piles be driven through contaminated ground, there is the potential that contaminated soils may reach the surface. The magnitude of effect would be considered moderate (depending upon type and volume of contamination) and the receptor sensitivity would range from low to high depending upon location.

9.5.101 As a whole, the Proposed Development generally proceeds through an area with a low likelihood for significant contamination due to the agricultural and rural site history along much of the Proposed Development. As a result, there is low potential for significantly contaminated arisings to be encountered and left at the surface during construction activities. The magnitude of effect is considered minor given the potential for ground contamination, and the receptor sensitivity for the Proposed Development as a whole would be medium. The significance of effect would be a **minor adverse** effect.

9.5.102 There are however, areas along the Proposed Development that have a greater likelihood for ground contamination, or that have a greater sensitivity, such as designated SSSI. There is a greater likelihood of encountering ground contamination within areas with historic or current commercial and industrial land

uses such as within Section D at Nailsea and within Sections F and G, especially between Royal Portbury Docks, Avonmouth and the Seabank Substation. In addition, contamination by hydrocarbons, fuel oils, heavy metals, chlorinated solvents and asbestos has been identified by the Local Planning Authority (LPA) within Avonmouth along areas of the proposed 400kV overhead line and existing G and BW Routes within Section G. Further specific information relating to identified ground and groundwater contamination within Section F and Section G is summarised within the PRA reports for the relevant Sections presented within **Volume 5.9.2, Appendices 9F and 9G**. There is the potential for contaminated arisings to be encountered within these areas during construction of the proposed 400kV overhead line and underground cable between the Avonmouth Substation and the existing G Route at Junction 18 of the M5/M49 motorway. The magnitude of effect would be minor, and the receptor sensitivity of human health (public, off site workers within Avonmouth) and the environment including controlled waters (rhynes) would be high. The significance of the effect would be a **minor adverse** effect for these areas of the Proposed Development.

9.5.103 Pylon LD10 of the proposed 400kV overhead line on the Huntspill Moor at East Huntspill (Section B) is located approximately 115m north of the a dismantled railway line. Localised soil contamination may be associated with the former land use (railway line). Residual contaminated soils may be left at the surface following construction activities. A longitudinal movement of the pylon to the south/south west along the alignment of the proposed 400kV overhead line would position pylon LD10 closer to the former railway line. The sensitivity of the land use in the area would be low, owing to a predominantly rural/agricultural setting. The magnitude of effect of residual contaminated soils left at the surface following construction activity would be high. The significance of effect of the longitudinal movement of pylon LD10 south/south west towards the dismantled railway line would be a **minor adverse** effect.

9.5.104 Pylons LD31 and LD32 of the proposed 400kV overhead line at Rooks Bridge (Section B) are located approximately 170m south (pylon LD31) and 90m north (pylon LD32) of a former petrol station/garage, currently a car sales garage. Localised soil contamination may be associated with the former land use (petrol station/garage). Residual contaminated soils may be left at the surface following construction activities should a longitudinal movement of the pylons closer to the potential source of contamination (petrol station) occur. The sensitivity of the land use in the area would be low, owing to a predominantly rural/agricultural setting. The magnitude of effect of residual contaminated soils left at the surface following construction activity would be high. The significance of effect of the longitudinal movement of pylons LD31 and LD32 closer to the former petrol station/garage would be a **minor adverse** effect.

9.5.105 The longitudinal movement of either pylon LD75 by 50m north east or pylon LD76 by 150m south west in the proximity to North Drove Landfill on Nailsea Moors (Section D) would result in the pylons being located directly over a landfill. The sensitivity of the receptor has been assessed as low owing to the agricultural setting in the immediate vicinity. The magnitude of effect of residual contaminated soils being left at the surface would be moderate. The significance of effect of a longitudinal movement of either pylons LD75 or LD 76 would be a **minor adverse** effect.

9.5.106 Potential risks to construction and maintenance workers may arise from contamination within soil and groundwater during the construction, operation and decommissioning phases of the Proposed Development.The receptor sensitivity of human health of workers would be medium. The magnitude of effect to human health would be moderate. The significance of effect would be a **moderate adverse** effect.

9.5.107 There are SSSI designated areas along the Proposed Development, especially on the Kenn, Nailsea and Tickenham Moors (Section D). These have a high receptor sensitivity. The magnitude of effect would be minor owing to the likely absence of significant concentrations of contamination within these areas (absence of a source of contamination). The significance of effect would a **minor adverse** effect.

Accidental Import or Spreading of Contaminated Material within the Working Area during On Site Activities

9.5.108 As part of the Proposed Development, import of construction material would be undertaken. This includes MOT Type 1 or similar stone for proposed access tracks. There is therefore the potential to accidentally import or spread contaminated material within the working area. This would predominantly be associated with the construction of access tracks and pads at existing or proposed pylon locations. The magnitude of effect would be minor to moderate, depending upon the volume and type of contaminant imported onto site. The receptor sensitivity would range between low and high, depending upon the locations.

9.5.109 For the Proposed Development as a whole, the magnitude of effect would be minor. The receptor sensitivity would be medium, with the significance of effect considered to be a **minor adverse** effect.

9.5.110 There are however areas of greater sensitivity along short sections of the Proposed Development. This includes designated sites or areas close to population centres such as SSSI on the Kenn, Nailsea and Tickenham Moors (Section D), or close to residential properties at Mark, Webbington, Sandford, Yatton, Nailsea and Avonmouth Village. Surface water receptors such as rhynes and rivers would also be considered particularly sensitive, including rhynes crossings. The SSSI on Kenn, Nailsea and Tickenham Moors is assigned to the drainage ditches and rhynes and would be of high sensitivity. For these areas, the receptor sensitivity would be considered high and the magnitude of effect to be moderate due to the potential loss or alteration of baseline conditions. The significance of effect would be considered to be a **moderate adverse** effect.

Operational Effects

9.5.111 There would be few potential effects predicted to occur to the ground environment as a result of the operation of the Proposed Development.

9.5.112 Any repair works on the Proposed Development or maintenance works carried out during the operation phase could have similar effects to those identified during the construction phase, albeit at a highly localised level and in the short-term only.

9.5.113 The potential for the operation of the proposed underground cable across the Tickenham Moor within Section D to affect peat deposits within this area through the heating, and subsequent drying, of peat in the immediate vicinity of the underground cable has been assessed. The underground cable would be located within a trench of approximately 1.10m depth with the cables laid within a 3mm-

diameter to dust-sized dust stone matrix. Well compacted thermally suitable indigenous backfill would be placed over this. The design of the cable would include XLPE insulation (or similar) surrounding the conductor. Existing ground investigation data for the Kenn, Nailsea and Tickenham Moors shows that the peat deposits within these areas are saturated with shallow groundwater. The peat deposits are generally buried between 0.15m and 0.30m depth and consist of a horizon circa 0.50m in thickness comprising firm locally spongy dark brown to black, pseudo fibrous to fibrous, locally amorphous peat. The presence of shallow groundwater surrounding the proposed underground cable is likely to result in high rates of heat dissipation. The heating effect from underground cables would be restricted in extent to the immediate vicinity around the cable component. The receptor sensitivity of the peat, especially on the Tickenham Moor would be high. The magnitude of effect would be moderate owing the presence of shallow groundwater and anticipated high heat dissipation rates. The significance of effect would be a **moderate adverse** effect.

9.5.114 Further impacts to ecological receptors arising from ground heating from the underground cables are discussed at **Volume 5.8.1**.

9.5.115 The proposed underground cable route may result in the creation of confined spaces. Where the underground cable route passes peat bearing geology such as on Tidal Flat Deposits, the ingress of ground gases could result in the potential risks of asphyxiation (should manned entry for maintenance into manhole chambers) and/or explosion. The receptor sensitivity of maintenance workers is considered to be high. The magnitude of effect is considered to be major. The significance of effect is considered to be a **major adverse** effect.

Indicative Access for Future Maintenance

9.5.116 National Grid would require infrequent access to ensure the Proposed Development could be appropriately maintained. The access would typically be made by foot, 4x4 or tractor and trailer and would not typically require any new temporary accesses; however access to tension pylons may require temporary stone roads or aluminium trackway to be laid. Upon completion of any maintenance works, surfaces would be restored to their condition at the commencement of the works. The indicative accesses for future maintenance are shown at **Volume 5.3.3, Figure 3.5 – 3.6**.

9.5.117 Access made on foot, 4x4 vehicle; tractor and trailer; or where aluminium trackway is used are considered to have a negligible magnitude of effect of owing to the potential for a negligible shift away from the baseline conditions. The receptor sensitivity would be medium owing to the general agricultural nature of the land use along much of the Proposed Development that might require such temporary access. The significance of effect would be **negligible**.

9.5.118 There is the potential for loss of or damage to structure of topsoil and subsoil affecting crop growth and drainage, where soil requires excavation to allow stone to be placed for the creation of access tracks. As with soil excavations for the creation of access tracks for the majority of the Proposed Development during construction there is considered to be a minor magnitude of effect of owing to the potential for a minor shift away from the baseline conditions. The receptor sensitivity would be medium owing to the general agricultural nature of the land use along much of the Proposed Development. The significance of effect of the

construction of temporary access tracks for maintenance purposes would be a **minor adverse** effect.

Decommissioning Effects

9.5.119 The decommissioning of the Proposed Development would have similar effects on the ground environment as to those outlined during the construction phase. However, the impacts to the ground environment are considered to be of shorter duration and of limited extent compared to the construction phase.

Damage to Designated Geological Sites

9.5.120 The nearest designated geological site is located 240m west of the Proposed Development (existing F Route and proposed 400kV overhead line) within Section E – Tickenham Ridge at Naish Hill RIG site. All other designated geological sites identified along the Proposed Development are located a distances greater than this. The receptor sensitivity of designated geological sites would be high. The magnitude of effect would be negligible due to the distance of designated geological sites from existing overhead lines of the Proposed Development. The significance of effect of the decommissioning of the existing overhead lines would be **negligible**.

Sterilisation of Areas of Mineral Resources (Current and Future)

9.5.121 There are no identified MSAs within Somerset County Council, North Somerset Council, South Gloucestershire County Council and Bristol City Council boundaries through which the Proposed Development would pass, or pass in close proximity to. Therefore decommissioning effects on the ground environment are not possible for this potential effect.

9.5.122 There are several areas within the order limit that have been recorded as sites where minerals have been previously extracted and for which planning permission for mineral extraction 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. These sites are not designated as MSAs. The Proposed Development either passes through these areas or in close proximity to these areas. These have been further discussed below:

9.5.123 There is a site identified as an inactive and restored (including yet to be worked), worked-out and/or a restored site, within Section A - Puriton Ridge, located beneath the proposed 400kV overhead line. This site corresponds to the Fourteen Acre Quarry and consists of a series of former quarries for clay and limestone extraction. The 400kV overhead line and three associated access tracks would cross the eastern-most part of this site. Pylon ZGA8 would be located along the eastern-most part of this site. Pylon ZGA7 would be located 180m south/south west of the former quarry boundary. . Components of the Proposed Development (one pylon and three access tracks) would be located in the eastern-most part of this site and would sterilise a small area of the former quarry for future use, if applicable. The magnitude of effect would be minor as the former quarry has been worked out and/or restored. The future extraction of commodities would be unlikely because this site has been worked out, infilled and restored to agricultural use. This site currently comprises agricultural fields. The receptor sensitivity would be medium. The significance of effect of the decommissioning of the Proposed Development on

this mineral resource area would be a **minor beneficial** effect through the removal of the proposed components.

9.5.124 There is a site identified as an inactive and restored (including yet to be worked), worked-out and/or a restored site, within Section G - Avonmouth, located immediately south-east of the Seabank Substation beneath the proposed line modifications to the existing BW, DA and G Routes and the proposed 400kV overhead line including pylon LD131 and 132. This site corresponds to the Severn Valley (Crooks Marsh) Quarry used for clay extraction. The 400kV overhead line and associated pylons LD131 and LD132 would be located within this former quarry. Pylon LD130 would be located close to the former quarry boundary. The magnitude of effect would be minor as the former quarry has been worked out and/or restored and has been backfilled with landfill material. The likelihood of future extraction of commodities from this site would be unlikely as the former quarry has been worked out and/or restored and has been backfilled with landfill material. This site currently comprises agricultural fields. The receptor sensitivity would be medium. The significance of effect of the decommissioning of the Proposed Development on this mineral resource area would be a **minor beneficial** effect through the removal of the proposed components.

9.5.125 The Proposed Development (proposed 400kV overhead line and proposed underground cable between Nailsea and Portishead Substation) within the northern-most part of Section D, and Sections E and F, pass through an area [or areas] confirmed to be designated under the petroleum exploration and development licence, issued under the Petroleum (Production) Act 1934 (repealed in full 1998 and replaced by the Petroleum Act 1998) (Ref 9.11). The magnitude of effect is considered minor owing to the likely depth at which any potential petroleum hydrocarbons are located within these Sections. Components of the Proposed Development are unlikely to sterilise the resource owing to the likely depth of the resource (shale gas or coal) below ground level and the large geographic area that the designation relates to. No mineral planning permissions have been recorded for the future exploration of petroleum hydrocarbons within this area. The receptor sensitivity would be medium. The significance of effect of the decommissioning of the Proposed Development would be a **minor beneficial** effect through the removal of the proposed components.

9.5.126 The Proposed Development in the vicinity of West End and Nailsea (Section D) crosses the North Somerset Coalfield (Nailsea Coalfield). Within this area coal has historically been worked. Coal seams remain present within the area including beneath the Proposed Development including the proposed underground cable route and as such must be considered a potential future resource, although it is noted that the Coal Authority indicates that current coal working within the area has ceased and that there are no current plans to recommence below ground coal mining. It is noted that the proposed 400kV overhead line would not be located over shallow coal seams. Coal seams beneath the proposed 400kV overhead line would be located at significant depth and unlikely to impact this infrastructure. The receptor sensitivity would be medium owing to the future potential of the coal as a resource. The magnitude of effect of the proposed 400kV overhead line sterilising the buried coal deposits would be negligible. The significance of effect of the decommissioning of the proposed 400kV overhead line on buried coal deposits would be **negligible**.

9.5.127 The magnitude of effect of the proposed underground cable route sterilising the buried coal deposits would be minor. The significance of effect of the decommissioning of the proposed underground cable route on buried coal deposits would be a **minor beneficial** effect.

Collapse of Unstable or Undermined Ground Activated by Construction Works

9.5.128 Where relevant, a qualitative assessment of likelihood has been included in determining the significance of effect of the decommissioning of the Proposed Development on the collapse of unstable or undermined ground. Definitions of likelihood are presented in section 9.3.

9.5.129 The significance of effect of the decommissioning of the Proposed Development on the collapse of unstable or undermined ground would be a **minor adverse** effect for the majority of the route.

9.5.130 There are notable exceptions to this along selected short sections of the Proposed Development. These are summarised below.

9.5.131 The Proposed Development (Section D) crosses the conjectured outcrops of the GVU, GVT, Grace's Seam and WT Vein. This includes the existing F and W Routes and the proposed underground cable route between West End and the north western part of Nailsea. There may be shallow surface mining/bell pits associated with former coal workings that have not been identified within the Coal Authority or Bristol Coal Mining Archives data. Such historic workings may have been poorly backfilled or in the case of bell pits, voids may remain. Decommissioning work may activate subsidence and collapse of near surface overburden where loose ground and voids are present. The magnitude of effect of the decommissioning of the Proposed Development would be major. The receptor sensitivity would be high due to potential damage to the surrounding buildings including residential properties at Nailsea along Queens Road, Hanham Way and North Street. The initial assessment of significance of effect would be a major adverse effect. However, the likelihood of decommissioning activity activating subsidence and collapse of shallow overburden would be of low likelihood. Therefore the significance of effect of decommissioning the Proposed Development in the vicinity of residential properties would be a **moderate adverse** effect. The receptor sensitivity of commercial properties on the West End Trading Estate would be medium. The initial assessment of significance of effect would be a moderate adverse effect. However, the likelihood of decommissioning activity activating subsidence and collapse of shallow overburden would be of low likelihood. Therefore the significance of effect of decommissioning the Proposed Development in the vicinity of commercial properties would be a **minor adverse** effect.

9.5.132 The recorded below ground working of Grace's Seam (coal seam) beneath the former colliery (West End Colliery) occurred at a depth of between 60m and 90m bgl (82m bgl) beneath the current trading estate. Components of the Proposed Development passing through the former colliery and therefore directly over Grace's Seam at this location, include the proposed underground cable route through Nailsea. The magnitude of effect of the collapse of unstable or undermined ground activated through decommissioning work would be negligible owing to the depth of workings to Grace's Seam at this location. Any ground movement at the surface would generally have since ceased. The receptor sensitivity would be medium owing to the presence of commercial properties on the trading estate. The

likelihood of ground movement associated with decommissioning activity and Grace's Seam would be unlikely. The significance of effect of decommissioning the Proposed Development would be **negligible**.

9.5.133 It has been established that three out of four mineshafts within the West End Trading Estate (former colliery) are located within 20m of the proposed underground 132kV cable passing through the estate. These mineshafts are located at the road junction between Engine Lane and Blackfriars Road.

9.5.134 Two of these mineshafts are recorded to have been remediated, which included backfilling with colliery spoil and the placement of a reinforced concrete cap at the surface and founded on bedrock, to a specification approved by the National Coal Board (NCB). This work was undertaken during 1968. These remediated mineshafts are currently located beneath a commercial building at the corner of Blackfriars Road and Engine Lane. Data obtained from the Bristol Coal Mining Archives suggests that a methane vent has been incorporated into the cap. The magnitude of effect of the collapse of unstable or undermined ground arising through decommissioning would be negligible owing to the remedial work undertaken and the location of the mineshafts beneath the existing commercial development. The receptor sensitivity would be medium owing to the commercial nature of the properties. The significance of effect of decommissioning the Proposed Development would be **negligible**.

9.5.135 A third mineshaft is shown to have been potentially remediated. The Coal Authority report indicates that this mineshaft was backfilled with shale. The records do not indicate whether the remedial works included the placement of a reinforced concrete cap keyed into bedrock. A commercial building on the trading estate is shown to be located over this mineshaft. It is therefore considered likely that this mineshaft has been remediated, with a similar specification to the previous mineshafts. The magnitude of effect of the collapse of unstable or undermined ground arising through decommissioning would be minor owing the unknown nature of remedial works undertaken. The receptor sensitivity would be medium owing to the commercial nature of the property. The significance of effect of decommissioning the Proposed Development would be a **minor adverse** effect.

9.5.136 There is an identified mineshaft located between 40m and 50m distance from the Proposed Development (Section D); and one further mineshaft at greater than 150m that are un-remediated. One of these mineshafts is shown to be located 40m north of the proposed underground cable along Blackfriars Road, within the West End Trading Estate. This mineshaft is not recorded to have been subject to remedial work. The mineshaft is currently located beneath either a commercial building, or an associated access road. The magnitude of effect of the collapse of unstable or undermined ground arising through decommissioning activity would be major. The receptor sensitivity would be medium owing to the commercial setting. The initial significance of effect of the Proposed Development activating ground stability would be a moderate adverse effect. In accordance with **Table 9.5,** the likelihood of an event occurring has been considered, it is concluded that there is a low likelihood that the proposed excavation for the cable trench through the West End Trading Estate would cross, or pass in very close proximity to, this mineshaft owing to a distance of between 40m to 50m between the mineshaft and proposed cable trench. Therefore the significance of effect of decommissioning the Proposed

Development following consideration of likelihood would be a **minor adverse** effect.

9.5.137 A review of coal mining records has been undertaken for Proposed Development between Stone-edge Batch and the Portishead Substation within Section E – Tickenham Ridge and Section F - Portishead. The findings of the data review indicates that the bedrock geology on the Tickenham Ridge (Section E) is not coal bearing, therefore risks of the Proposed Development activating ground instability associated with unstable or undermined ground during the decommissioning is not possible.

9.5.138 Potentially coal bearing geology is located beneath the northern face of the Tickenham Ridge at Clapton in Gordano (Section F). Historic below ground coal workings are located between 750m and 1,000m west of the Proposed Development (proposed 400kV overhead line and proposed underground cable). The receptor sensitivity would be low owing to the absence of residential receptors close to the Proposed Development within this Section and the general rural setting. The magnitude of effect of the collapse of unstable or undermined ground arising through decommissioning activity would be moderate. The initial significance of effect would be a minor adverse effect. However, the likelihood of ground collapse of this mineshaft activated through decommissioning works of the Proposed Development would be of unlikely owing to the geographic separation. The significance of effect of decommissioning the Proposed Development following consideration of likelihood would be **negligible**.

9.5.139 Peat deposits are recorded within Section D – Somerset Level and Moors North, between east of Yatton on the Kenn Moor and close to the base of the Tickenham Ridge (Section E) at Stone-edge Batch on the Nailsea and Tickenham Moors. These peat deposits may be compressible over the long term and could result in consolidation, however permanent structures such as pylons would be supported on appropriate foundations and dedicated access tracks would be used, therefore minimising the effect to the ground environment (consolidation of superficial deposits (peat)). The receptor sensitivity of the peat would be medium and the magnitude of effect of consolidation of peat deposits would be minor. The significance of effect of decommissioning the Proposed Development would be a **minor adverse** effect.

9.5.140 Tidal Flat Deposits are recorded along much of the Proposed Development (Sections A, B, D, F and G), especially within topographically low lying areas. Tidal Flat Deposits are considered to have a minor to moderate potential for compression resulting through surface loading during the construction phase. The receptor sensitivity would be low for the route alignment as a whole and the magnitude of effect would be minor. The significance of effect of decommissioning the Proposed Development would be a **negligible**.

Creation of Additional Ground Migration Pathways for Mine Gas, Ground Gas or Landfill Gas

9.5.141 Where relevant, a qualitative assessment of likelihood has been included in determining the significance of effect of the Proposed Development on the creation of migration pathways for ground gases. Definitions of likelihood are presented within section 9.3.

9.5.142 The presence of the Proposed Development could result in the creation of preferential migration pathways for mine gas, ground gas or landfill gas, especially along underground cable routes. Ground gases have the potential to adversely impact receptors through accumulation within voids and/or confined spaces, resulting in potential risks from explosion and/or asphyxiation. The receptor sensitivity would be high for residential properties. The magnitude would be major. The likelihood of the proposed underground cable route resulting in the creation of ground gas migration pathways is low. Therefore the decommissioning and removal of these underground cables would result in a **moderate beneficial** effect.

9.5.143 The receptor sensitivity would be medium for commercial properties. The magnitude would be major. The magnitude would be major. The likelihood of the proposed underground cable route resulting in the creation of ground gas migration pathways is low. Therefore the decommissioning and removal of these underground cables would result in a **minor beneficial** effect.

9.5.144 The receptor sensitivity would be low for rural agricultural settings. The magnitude of the effect is considered minor for the majority of the route owing to the geographic separation between source and receptor and low potential for ground conditions to result in significant concentrations of ground gases and associated ground gas flow rates. The significance of effect of the decommissioning of the Proposed Development for the creation of migration pathways would be a **negligible** for the majority of the route.

9.5.145 It should be noted that there are short sections along the Proposed Development where the potential magnitude of effect and receptor sensitive are higher owing to differing ground conditions and proximity to receptors. These are summarised below.

9.5.146 All Tidal Flat Deposits within the LoD of the Proposed Development should be considered to contain peat bearing horizons. These natural deposits of peat may give rise to ground gases. Previous intrusive ground investigations within Section D identified buried peat deposits on the Kenn, Nailsea and Tickenham Moors. Components of the Proposed Development including overhead pylons will be absent of confined spaces and subject to outdoor air exposure. The receptor sensitivity is considered to be low. The magnitude of effect is considered to be minor. The significance of effect of decommissioning the overhead pylons is considered to be **negligible**.

9.5.147 Short sections of underground cable cross Tidal Flat Deposits, particularly within Section D at Nailsea and within Section F and G. Underground cables may have associated confined spaces and therefore potential risks from ground gases are considered to be higher. The receptor sensitivity is considered to be low. The magnitude of effect is considered to be minor .The significance of effect of decommissioning the underground cable routes is considered to be **minor beneficial** effect owing to the removal of the potential confined spaces associate with the development.

9.5.148 The proposed underground cable route at West End, Nailsea (Section D) crosses a former colliery. Mineshafts within this area have the potential to act as conduits for mine gas. Mine gases have the potential to adversely impact receptors through accumulation within voids and/or confined spaces resulting in potential risks from explosion and/or asphyxiation. The magnitude of effect for the creation of

preferential migration pathways resulting through the decommissioning of an underground cable trench would be major where the Proposed Development (underground cable route) passes through the West End Trading Estate and Nailsea. The receptor sensitivity would be high where residential properties are located close to the underground cable route within Nailsea, such as along Queens Road, North Street and Hanham Way, Nailsea. The initial significance of effect of the decommissioning of the Proposed Development (underground cable route), creating preferential migration pathways for mine gases to nearby residential properties would be a major adverse effect. However, the likelihood for the creation of migration pathways during decommissioning would be low. The significance of effect of the decommissioning of the Proposed Development (underground cable), creating preferential migration pathways for mine gases to residential properties following the assessment of likelihood would be a **moderate adverse** effect.

9.5.149 The receptor sensitivity of existing infrastructure and commercial properties on the West End Trading Estate would be medium. The initial significance of effect of the decommissioning of the Proposed Development (underground cable route), creating preferential migration pathways for mine gases to nearby commercial properties would be a moderate adverse effect. However, the likelihood of the creation of migration pathways during decommissioning would be low. The significance of effect of the decommissioning of the Proposed Development (underground cable), creating preferential migration pathways for mine gases to nearby industrial/commercial units following the assessment of likelihood would be a **minor adverse** effect.

9.5.150 The presence of shallow coal seams may result in the creation of migration pathways for mine gas should the Proposed Development components intersect these. The magnitude of effect during decommissioning would be minor where outdoor air exposure applies, such as at the proposed 400kV pylons and access tracks. The receptor sensitivity (human health) would be low (for construction workers). The significance of effect for outdoor air would be **negligible**.

9.5.151 The magnitude of effect would be moderate where manned entry into trenches is required in the vicinity of Nailsea. The receptor (human health) sensitivity would be medium. The initial significance of effect would be a moderate adverse effect. However the likelihood would be low. Therefore the significance of effect of decommissioning the Proposed Development following consideration of likelihood, for manned entry into excavations would be a **minor adverse** effect.

9.5.152 There is an identified mineshaft located between 40m and 50m distance from the Proposed Development (underground cable route) at West End Trading Estate (Section D) along Blackfriars Road. This mineshaft is not recorded to have been subject to remedial work. The mineshaft is currently located beneath either a commercial building, or an associated access road. Mine gas emissions could migrate to the proposed development (underground cable route trench) through granular made ground. The receptor sensitivity would be medium owing to the commercial setting. The magnitude of effect during decommissioning would be moderate with the initial significance of effect considered to be a moderate adverse effect. However the likelihood would be low owing to the distance between the proposed underground cable route and the mine shaft and the absence of previous recorded issues relating to mine gas emissions. Therefore the significance of effect of the decommissioning of the Proposed Development following consideration of

likelihood would be a **minor beneficial** effect owing to the removal of the potential pathway.

9.5.153 Three mineshafts located close to the road junction of Engine Lane and Blackfriars Road within the West End Trading Estate are considered to have been remediated including the incorporation of a methane vent into the mine cap and therefore would not act as conduits for mine gases. The magnitude of effect during decommissioning would be negligible owing to the remedial works undertaken. The receptor sensitivity would be medium owing to commercial setting. The significance of effect of the decommissioning of the Proposed Development would be **negligible**.

9.5.154 The Proposed Development consisting of the proposed 400kV overhead line would pass close to a historic landfill at North Drove, Nailsea (Section D). This includes a section of the 400kV overhead line between pylons LD 75 and LD76. The pylons are not identified to be located over the landfill; these pylons adjoin within 50m (LD75) and 150m (LD76) of the landfill boundary. These pylons would have piled foundations owing to the recorded geology. The surrounding area comprises agricultural fields with no residential properties located within the immediate vicinity. The geology comprises Tidal Flat Deposits underlain by MMG, therefore the magnitude of effect during decommissioning, for through-ground migration of grasses would be minor. The sensitivity of the receptor has been assessed as low owing to the agricultural setting in the immediate vicinity. The significance of effect of the decommissioning of the Proposed Development would be **negligible**.

9.5.155 The preferred route Option A consisting of the 400kV overhead line at pylon LD99 within Section F – Portishead would pass over the Prior Farm Landfill. Deposited waste included inert, industrial, commercial and household waste, including putrescible waste. Pylon LD99 would be located over the landfill and therefore could create preferential gas migration pathways. Pylon LD100 would be located within 50m of the landfill and pylon LD98 is located 130m west of the landfill. It is assumed that a piled foundation option would be required for these pylons. No confined spaces are proposed to be constructed as part of this section of the proposed 400kV overhead line and pylon design. There are no residential receptors in the immediate vicinity of this landfill and the M5 motorway bounds the landfill to the south. The receptor sensitivity would be low and the magnitude of effect during decommissioning would be minor. The significance of effect of the decommissioning of the Proposed Development would be **negligible**.

9.5.156 Parts of the proposed underground cable route within Section F – Portishead, in the close proximity to the Portishead Substation, would pass through an historic landfill beneath the western part of the substation. The historic landfill is identified as the former Central Electricity Generating Board Landfill, having received industrial waste. The proposed underground cable route has a potential to result in preferential gas migration pathways. Residential properties are located circa 75m west of the Portishead Substation along Wren Gardens Road. No residential properties are located north, east or west of the substation, an area which comprises a nature reserve. The receptor sensitivity would be high for residential properties and low for the nature reserve. The magnitude of effect during decommissioning would be moderate for residential properties owing to the distance of the underground cable from the residential area (75m distance and greater) and minor for the nature reserve. The likelihood for the creation of

migration pathways during decommissioning, to off-site residents would be low owing to the geographical separation and cohesive nature of natural soils (Tidal Flat Deposits). Therefore, the significance of effect of the decommissioning of the Proposed Development following consideration of likelihood would be a **minor beneficial** effect owing to the removal of the potential pathway.

9.5.157 The receptor sensitivity of the adjoining nature reserve would be low. The magnitude of effect during decommissioning would be minor. The significance of effect of the decommissioning of the Proposed Development would be **negligible**.

9.5.158 Within Section G – Avonmouth, the proposed 400kV overhead line including pylon LD117 would be located over the T Farm Landfill and the proposed underground cable between the Avonmouth Substation and junction 18 of the M5/M49 motorways would pass through the T Farm Landfill. The landfill is recorded to have received inert waste. The components of the Proposed Development pass through a heavy industrial and commercial setting of Avonmouth and are located within close proximity to depots, warehouses and other commercial buildings. The proposed underground cable between the north eastern corner of the Avonmouth Substation and pylon G31R of the G Route would have the highest potential to create preferential migration pathways for landfill gases owing to trenching although piled foundations for pylon LD117 located over the landfill may also create migration pathways. The receptor sensitivity of the commercial/industrial setting would be medium. The magnitude of effect during decommissioning would be moderate with the initial significance of effect considered to a moderate effect. However the likelihood for the creation of migration pathways for landfill gases would be low owing to the inert nature of the fill material. Therefore the significance of effect of the decommissioning of the Proposed Development following consideration of likelihood would be a **minor beneficial** effect owing to the removal of the potential pathway.

9.5.159 The proposed overhead 400kV line between pylons LD131 and LD132 close to the Seabank Substation crosses over the former Crooks Farm Landfill, which received inert and industrial waste. Other components of the Proposed Development over this landfill include pylons DA2R, BW2R, G42R and temporary overhead infrastructure works. The surrounding land use comprises agricultural fields, with the Seabank Substation located to the north. The receptor sensitivity would be low for the agricultural fields and medium for the adjoining Seabank Substation. The magnitude of effect during decommissioning would be minor. The initial significance of effect of creation of migration pathways for landfill gases to the agricultural fields would be a minor effect. The likelihood of piled foundations creating landfill gas migrations would be likely. Therefore the overall significance of effect of the decommissioning of the Proposed Development following consideration of likelihood would be a **minor beneficial** effect.

9.5.160 The initial significance of effect of creation of migration pathways for landfill gases to the Seabank Substation would be a moderate effect. The likelihood of piled foundations creating landfill gas migrations would be likely. Therefore the significance of effect following consideration of likelihood would be a **minor beneficial** effect owing to the removal of the potential pathway.

Loss of or Damage to Structure of Topsoil/Subsoil during Soil Stripping Operations and Reinstatement, Leading to Poor Crop Establishment and Lower Yields

9.5.161 There is the potential for the loss of, or damage to, the structure of topsoil/subsoil during the decommissioning of the Proposed Development, leading to poor crop establishment and lower yields. This is particularly relevant where mass excavation of shallow soils are undertaken such as along underground cable sections within Section C – Mendip Hill and Sections D, E and F, between Nailsea and the Portishead Substation.

9.5.162 Soil excavation for the removal of access tracks is also considered to be sensitive, although less sensitive than soil excavations for underground cable routes owing to the lateral and vertical extent of the proposed excavations. Soil excavations for the creation of access tracks for the majority of the Proposed Development are considered to have a minor magnitude of effect of owing to the potential for a minor shift away from the baseline conditions. The receptor sensitivity would be medium owing to the general agricultural nature of the land use along much of the Proposed Development. The significance of effect of the decommissioning of the Proposed Development would be a **minor adverse** effect.

9.5.163 Soil excavations for construction of the proposed underground cable routes (Section C, D, E and F) would be of greater duration and vertical/lateral extent than access routes and are therefore considered to have a magnitude of effect of moderate. The receptor sensitivity would be medium during the decommissioning owing to the general agricultural nature of the land use. The significance of effect of the decommissioning of the Proposed Development would be a **moderate adverse** effect.

9.5.164 Peat deposits are identified on the Kenn, Nailsea and Tickenham Moors (Section D). The proposed 400kV overhead line between Yatton and the base of the Tickenham Ridge at Stone-edge Batch and the proposed undergrounding of the W Route between Nailsea and Stone-edge Batch has the potential to damage these deposits through compaction, oxidation or drying when excavated. The magnitude of effect during decommissioning would be minor, owing to the excavation of previously disturbed material. The receptor sensitivity would be medium. The significance of effect of the decommissioning of the Proposed Development would be a **minor adverse** effect.

Loss of or Damage to Structure of Topsoil during Soil Stripping Operations and Reinstatement, Leading to Significant Changes in Soil Drainage Parameters

9.5.165 The majority of the Proposed Development crosses general agricultural land use. Within these areas the receptor sensitivity would be medium owing to the agricultural land use. The magnitude of effect during decommissioning would be minor owing to the potential minor shift away from baseline conditions. The significance of effect of the decommissioning of the Proposed Development would be a **minor adverse** effect.

9.5.166 Where peat deposits are present, the receptor sensitivity would be high, owing to the permeable nature of the material although it is recognised that peat, where identified along the Proposed Development, comprises buried material that has

already undergone some consolidation. The description of peat encountered during recent ground investigations on the Kenn, Nailsea and Tickenham Moors (Section D) identified the peat as comprising a firm, locally spongy dark brown black pseudofibrous to fibrous, locally amorphous peat. A copy of the ground investigation is included within **Volume 5.9.2, Appendix 9J**. The description of the peat encountered suggests consolidation has occurred resulting in peat of a firm strength. This indicates that the peat is not a recent deposit.

9.5.167 Peat deposits consisting of buried and consolidated material are recorded on the Kenn, Nailsea and Tickenham Moors between Yatton and Stone-edge Batch. Components of the Proposed Development most likely to have an impact on the soil structure of the peat are the decommissioning of the underground cable route between Nailsea and Stone-edge Batch across the Tickenham Moor (Section D) and access tracks for pylons of the proposed 400kV overhead line across the Kenn and Nailsea Moors. The receptor sensitivity would be high owing to the higher permeability of this medium compared to other soil types along the Proposed Development. The magnitude of effect during decommissioning would be moderate owing to the difficulty in re-establishing peat deposits to pre-excavation condition once removed from the ground. The significance of effect would be a **moderate adverse** effect.

9.5.168 Where components of the Proposed Development cross designated sites such as SSSI, the loss or damage to the soil structure of peat arising from the construction of the Proposed Development may impact other receptors such as ecology and hydrology. Within these areas, such as on the Kenn, Naislea and Tickenham Moors designated SSSI, the presence of peat within the superficial geology influences the ecology found within drainage ditches on the moors. The receptor sensitivity is therefore considered to be high within these areas. The magnitude of effect during decommissioning would be moderate owing to the potential for loss or alteration to the designated site. The significance of effect of the decommissioning of the Proposed Development would be a **moderate adverse** effect.

Contamination of Soils by on Site Activities

9.5.169 The Proposed Development has the potential to result in contamination of soils through the accidental release of petroleum hydrocarbons, oil or lubricants from construction related equipment. The Proposed Development also has the potential to generate litter or other debris that could be worked into site soils. Anticipated volumes of pollutants including hydrocarbons, oils and lubricants are considered to be low. Hydrocarbons may contaminate the soil through leaks from fuel tanks, hydraulic hoses and lines and engines of machinery and heavy plant. These are generally of low volume and of temporary duration. The magnitude of effect during decommissioning would be minor as a small leak of hydrocarbons from machinery would result in a minor shift from baseline conditions. The receptor sensitivity for the majority of the Proposed Development would be medium. The significance of effect during the decommissioning of the Proposed Development would be a **minor adverse** effect.

9.5.170 Where soils are free draining, such as where peat deposits are present within Section D or where the soil medium is predominantly granular in matrix such as over River Terrace Deposits at Sheepway, Section F, migration of liquid contaminants would be quicker and more widespread. The receptor sensitivity would be medium, and the magnitude of effect would be moderate owing to the

potential for the contaminant to impact a larger geographic area. The significance of effect during the decommissioning of the Proposed Development would be a **moderate adverse** effect.

9.5.171 It is noted that proposed underground cables to be used within Section C – Mendip Hills and between Nailsea (Section D) and the Portishead Substation (Section F) would not contain fluids such as mineral oils or hydrocarbons as insulation. The potential for these components of the Proposed Development to cause significant contamination via leaks is therefore not possible.

9.5.172 Several components of the Proposed Development cross beneath or are located in close proximity to existing high pressure government oil or gas pipelines. This includes components of the Proposed Development within Section E – Tickenham Ridge, Section F – Portishead and Section G – Avonmouth.

9.5.173 At the southern base of the Tickenham Ridge within Section E, a government oil pipeline is identified at Stone-edge-Batch in the close proximity to pylon LD81,the proposed underground cable route that would pass beneath the pipeline. This proposed infrastructure has the potential to damage the government pipeline resulting in contamination of soils through the release of hydrocarbons. The receptor sensitivity is considered to be high and the magnitude of effect is considered to be major owing to the potential volume of contaminants released from a high pressure oil pipeline. The significance of effect is considered to be a major adverse effect. An assessment of likelihood of damaging the existing oil pipeline has been undertaken. The likelihood of damaging the pipeline is considered to be of low likelihood. As such, the overall significance of effect is considered to be a **moderate adverse** effect.

9.5.174 Within Section F – Portishead, the Alternative Route Option B passed a below ground oil/gas pipeline south of Sheepway in close proximity to proposed pylon P-LD97. In addition, the underground cable route would pass beneath the existing pipeline. The receptor sensitivity is considered to be high and the magnitude of effect is considered to be major owing to the potential volume of contaminants released from a high pressure oil pipeline. The significance of effect is considered to be a major adverse effect. An assessment of likelihood of damaging the existing oil pipeline has been undertaken. The likelihood of damaging the pipeline is considered to be of low likelihood. As such, the overall significance of effect is considered to be a **moderate adverse** effect.

9.5.175 Within Section G – Avonmouth, components of the Proposed Development are located in very close proximity to a below ground oil/gas pipeline at proposed pylons BW29A and BW28R, the BW UGC Route East Compound at Portbury Docks west of the River Avon. Pylon LD-119 and G31 and the proposed underground cable east of the Avonmouth Substation are located close to or cross beneath the same pipeline. Pylon LD-125 is also located close to a high pressure oil and gas pipeline on Crooks Marsh. The receptor sensitivity is considered to be high and the magnitude of effect is considered to be major owing to the potential volume of contaminants released from a high pressure oil pipeline. The significance of effect is considered to be a major adverse effect. An assessment of likelihood of damaging the existing oil pipeline has been undertaken. The likelihood of damaging the pipeline is considered to be of low likelihood. As such, the overall significance of effect is considered to be a **moderate adverse** effect.

Contamination of Groundwater Aquifers by on Site Activities

9.5.176 The Proposed Development generally passes across secondary aquifers (within both the superficial and bedrock geology) along the route. These are variably designated secondary undifferentiated to secondary A aquifers depending upon the geology. The magnitude of effect during decommissioning is considered minor based on the likely small volumes involved and resulting minor changes to the ground environment. The receptor sensitivity for the route as a whole would be medium. The significance of effect of the decommissioning of the Proposed Development would be a **minor adverse** effect.

9.5.177 It is noted that there are areas along the Proposed Development that have a greater sensitivity. These are discussed below.

9.5.178 The Proposed Development passes across, or within close proximity to groundwater aquifers designated as principal aquifers. Areas along the route influenced by these include Section C - Mendip Hills. The proposed infrastructure avoids passing directly over bedrock designated as a principal aquifer. The limestone bedrock within this Section is generally located at greater than 100m distance from the underground cable and at higher elevation than the Proposed Development. Section E - Tickenham Ridge also has limestone bedrock, of which the Blackrock Limestone Formation is designated as a principal aquifer and groundwater SPZ 1. This principal aquifer forms the SPZ I for the public water supply of Tickenham Road Well, Clevedon, operated by Bristol Water Plc. The Proposed Development within this Section includes a new 400kV overhead line and the construction of an underground 132kV cable. These cross directly across the principal aquifer and SPZ I at the eastern-most extent of this designated area on the Tickenham Ridge, between Stone-edge Batch and Cadbury Camp Lane on the Tickenham Ridge. Within these sections along the Proposed Development, the receptor sensitivity would be high. The magnitude of effect during decommissioning would be minor owing to small volumes of potential contaminants including hydrocarbons arising from construction associated with the Proposed Development. The significance of effect of the decommissioning of the Proposed Development would be a **minor beneficial** effect owing to the removal of the potential source of contamination.

9.5.179 The Proposed Development (400kV underground cable) also passes within 50m of a groundwater SPZ I within Section C - Mendip Hills at Towerhead, Sandford. The underground cable generally passes the SPZ I between 250m and 500m distance and also passes 500m east of a groundwater SPZ II at Loxton. The magnitude of effect during decommissioning would be negligible because the Proposed Development does not cross these SPZ's. The receptor sensitivity would be high given the EA designation. The significance of effect of the decommissioning of the Proposed Development would be **negligible**.

9.5.180 There are several groundwater abstractions within 1,500m of the Proposed Development, along the whole length of the route. These are generally used for agricultural purposes and industrial processes. There are however, four groundwater abstractions used for potable water. These are located within Section C - Mendip Hills, close to Winscombe and located within 270m south east of the 400kV underground cable, and Section D - Somerset Levels and Moors North, located within 880m from the Churchill Substation. The magnitude of effect during decommissioning would be moderate and the receptor sensitivity would be high given potential human health implications. The significance of effect of the

decommissioning of the Proposed Development would be a **moderate beneficial** effect owing to the removal of a potential source of contamination.

9.5.181 Proposed underground cables to be used within Section C – Mendip Hills and between Nailsea (Section D) and the Portishead Substation (Section F) would not contain fluids such as mineral oils or hydrocarbons as insulation. The potential for these components of the Proposed Development to cause significant contamination via leaks is therefore not possible.

Remobilisation of Contamination in Groundwater by On Site Activities

9.5.182 The Proposed Development has the potential to result in remobilisation of existing contaminants to groundwater through decommissioning activities. This could result from the creation of migration pathways along piled foundations or ground disturbance via large-scale ground excavations. The magnitude of effect ranges from minor to major, depending upon the potential for, and the type of, contamination potentially present beneath the Proposed Development. The receptor sensitivity ranges between low and high depending upon the location.

9.5.183 In general, the Proposed Development proceeds through predominantly agricultural/rural settings with a low potential for existing significant ground/groundwater contamination. The general historic land use along the Proposed Development suggests a low likelihood for significant contamination. The technical baseline reports (PRAs) for each Section of the Proposed Development as presented within **Volume 5.9.2, Appendices 9A to 9H**, indicate that there are no identified sites within or within close proximity to, the LoD of the Proposed Development that are defined as Contaminated Land under Part IIA of the Environmental Protection Act, 1990. There is the potential for existing contamination on sites beneath the Proposed Development arising from historic land uses and minor hydrocarbon spills from framing machinery, however this would be considered to be localised in extent and of low concentration. The magnitude of effect during decommissioning would be minor and the receptor sensitivity would be medium. The significance of effect of the decommissioning of the Proposed Development would be a **minor adverse** effect covering the majority of the Proposed Development.

9.5.184 There are however, sections along the Proposed Development that have a greater likelihood for contamination, and therefore the greater chance that construction activities might lead to remobilisation of contaminants.

9.5.185 The Proposed Development passes through, or within 50m distance to historic land uses with the potential to have resulted in contamination, within Section D at Nailsea, within Section F at Portishead and within Section G at the Royal Portbury Docks, Avonmouth Docks, Avonmouth industrial/commercial area and the Seabank Substation.

9.5.186 At Nailsea (Section D), the historic land use included a landfill (50m distance off North Drove from the proposed 400kV overhead line) on the Nailsea Moors and a former colliery (beneath the proposed 132kV underground cable (the W Route) through the West End Trading Estate at Nailsea), all of which are crossed by the Proposed Development.

9.5.187 The preferred route Option A within Section F – Portishead passes over the historic Prior Farm landfill and pylon LD99 would be located over the landfill. The landfill

received commercial, industrial and household waste, including putrescible waste. The receptor sensitivity of the hydrogeology would be medium owing to the secondary A and B aquifer designations of the superficial and bedrock geology within the area. The magnitude of effect would be moderate owing to the potential for landfill contaminants to be remobilised to the surrounding area through construction activity. The significance of effect of the decommissioning of the Proposed Development would be a **moderate adverse** effect.

9.5.188 The proposed 400kV underground cable would pass over/through the historic Central Electricity Board Landfill located beneath the western part of the existing Portishead Substation (Section F). A historic landfill is also recorded immediately north of the Portishead Substation, having received hazardous waste. No recorded issues relating to leachate are identified for the area beneath and adjoining the Portishead Substation. The magnitude of effect during decommissioning would be moderate owing to the potential for the proposed underground cable route to remobilise contaminants from the historic landfill beneath the Portishead Substation. The receptor sensitivity of the hydrogeology would be medium owing to the secondary A and B aquifer classifications of the superficial and bedrock geology within the area. The significance of effect of the decommissioning of the Proposed Development would be a **moderate adverse** effect.

9.5.189 The alternative route (Option B) would pass immediately north of the historic Royal Portbury Dock Landfill at Portbury Docks between proposed pylons P-LD102C to P-LD103. It is noted that the alternative route (Option B) is not located over the historic landfill. The decommissioning of the alternative route (Option B) is therefore unlikely to result in result in significant remobilisation of landfill contaminants from the historic Royal Portbury Docks Landfill. The receptor sensitivity of the hydrogeology would be medium owing to the secondary A and B aquifer classifications of the superficial and bedrock geology within the area. The magnitude of effect would be negligible owing to the absence of landfills beneath proposed components of the alternative route (Option B). The significance of effect of the decommissioning of the Proposed Development would be **negligible**.

9.5.190 The historic land use between the Royal Portbury Docks, west of the River Avon, Avonmouth and Seabank Substation (Section F and G) has had a long history of industrial land use including heavy engineering, manufacturing and processing. This wider area within Section G - Avonmouth is affected by known ground and groundwater contamination from historic industrial activity including along the route of the proposed 400kV overhead line and a short section of 132kV underground cable (the G Route) between the north eastern corner of the Avonmouth Substation and the existing G Route at junction 18 of the M5/M49 motorways. These components of the Proposed Development also pass over or through the T Farm Landfill, which received inert waste. The proposed underground cable and piling of foundations for the proposed 400kV overhead line could remobilise contamination due to below ground decommissioning activities. The receptor sensitivity of the hydrogeology within the area would be medium owing to the secondary A and B aquifer classifications of the superficial and bedrock geology within the area. The magnitude of effect during decommissioning would be moderate owing to the potential for contaminants to be remobilised by decommissioning activity. The significance of effect of the decommissioning of the Proposed Development would be a **moderate adverse** effect.

9.5.191 Where feasible, the piled foundations for the proposed 400kV overhead line would be removed in their entirety. As a whole, the Proposed Development generally proceeds through an area with a low likelihood for significant contamination due to the agricultural and rural site history along much of the Proposed Development. As a result, there is low potential the decommissioning of pylons to act as preferential pathways for significant concentrations of contaminants. The magnitude of effect is considered minor given the potential for ground contamination, and the receptor sensitivity for the Proposed Development as a whole would be low. The significance of effect would be **negligible**.

Residual Contaminated Soils at the Surface Following On Site Activities

9.5.192 The Proposed Development has the potential to result in residual contaminated soils being left at the surface through decommissioning activities of piling, excavation of trenches and excavation for mass concrete foundations. Should piles be driven through contaminated ground, there is the potential that contaminated soils may reach the surface from depth. The magnitude of effect would be considered moderate (depending upon type and volume of contamination) and the receptor sensitivity would range from low to high depending upon location.

9.5.193 As a whole, the Proposed Development generally proceeds through an area with a low likelihood for significant contamination due to the agricultural and rural site history along much of the Proposed Development. As a result, there is low potential for significantly contaminated arisings to be encountered and left at the surface during decommissioning activities. The magnitude of effect is considered minor given the potential for ground contamination, and the receptor sensitivity for the Proposed Development as a whole would be medium. The significance of effect of the decommissioning of the Proposed Development would be a **minor adverse** effect.

9.5.194 There are however, areas along the Proposed Development that have a greater likelihood for ground contamination, or that have a greater sensitivity, such as designated SSSI. There is a greater likelihood of encountering ground contamination within areas with historic or current commercial and industrial land uses such as within Section D at Nailsea and within Sections F and G, especially between Royal Portbury Docks, Avonmouth and the Seabank Substation. In addition, contamination by hydrocarbons, fuel oils, heavy metals, chlorinated solvents and asbestos has been identified by the Local Planning Authority (LPA) within Avonmouth along areas of the proposed 400kV overhead line within Section G. Further specific information relating to identified ground and groundwater contamination within Section F and Section G is summarised within the PRA reports for the relevant Sections presented within **Volume 5.9.2, Appendices 9F and 9G**. There is the potential for contaminated arisings to be encountered within these areas during decommissioning of the proposed 400kV overhead line and underground cable between the Avonmouth Substation. The magnitude of effect would be minor, and the receptor sensitivity of human health (public, off site workers within Avonmouth)and the environment including controlled waters (rhynes) would be high. The significance of the effect of the decommissioning of the Proposed Development would be a **minor adverse** effect for these areas of the Proposed Development.

9.5.195 Potential risks to construction and maintenance workers may arise from contamination within soil and groundwater during the decommissioning phase of the Proposed Development. The receptor sensitivity of human health of workers would be medium. The magnitude of effect to human health would be moderate. The significance of effect would be a **moderate adverse** effect.

9.5.196 There are SSSI designated areas along the Proposed Development, especially on the Kenn, Nailsea and Tickenham Moors (Section D). These would be considered to have a high receptor sensitivity. The magnitude of effect would be considered to be minor owing to the likely absence of significant concentrations of contamination within these areas (absence of a source of contamination). The significance of effect of the decommissioning of the Proposed Development would a **minor adverse** effect.

Accidental Import or Spreading of Contaminated Material within the Working Area during On Site Activities

9.5.197 As part of the Proposed Development, import of backfill material for trench excavations would be undertaken during decommissioning to infill excavations. There is therefore the potential to accidentally import or spread contaminated material within the working area. This would also be associated with the construction of access tracks and pads at existing pylon locations to allow for decommissioning. The magnitude of effect would be minor to moderate, depending upon the volume and type of contaminant imported onto site. The receptor sensitivity would range between low and high, depending upon the locations.

9.5.198 For the Proposed Development as a whole, the magnitude of effect would be minor. The receptor sensitivity would be medium, with the significance of effect during decommissioning considered to be a **minor adverse** effect.

9.5.199 There are however areas of greater sensitivity along short sections of the Proposed Development. This includes designated sites or areas close to population centres such as SSSI on the Kenn, Nailsea and Tickenham Moors (Section D), or close to residential properties at Mark, Webbington, Sandford, Yatton, Nailsea and Avonmouth Village. Surface water receptors such as rhynes and rivers would also be considered particularly sensitive, including rhynes crossings. The SSSI on Kenn, Nailsea and Tickenham Moors is assigned to the drainage ditches and rhynes and would be of high sensitivity. For these areas, the receptor sensitivity would be considered high and the magnitude of effect to be moderate due to the potential loss or alteration of baseline conditions. The significance of effect during the decommissioning of the Proposed Development would be considered to be a **moderate adverse** effect.

9.5.200 Potential risks to construction and maintenance workers may arise from contamination within soil and groundwater during the decommissioning phase of the Proposed Development. The receptor sensitivity of human health of workers would be medium. The magnitude of effect to human health would be moderate. The significance of effect would be a **moderate adverse** effect.

9.5.201 The most up to date guidance and best practice would be used during the decommissioning phase.

Construction Programme Sensitivity Analysis

9.5.202 A high level sensitivity analysis has been undertaken on the environmental effects that would arise from changes to the preliminary construction programme (**Volume 5.3.1, Table 3.3**). Three scenarios of construction programme change have been considered as set out below and discussed further at **Volume 5.5.1, section 5.6:**

- Programme 1: Commencement March 2016, completion October 2019;
- Programme 2: Commencement October 2018, completion October 2022; or
- Programme 3: Commencement March 2016, completion October 2019

9.5.203 The potential impacts to the ground environment have been considered in light of the potential programme changes described above. It is considered that given the enduring nature of the ground environment, changes to the baseline assessment within the relatively short time frames would be negligible. The assessment of effect would not change as a result of a change to the programme.

Climate Change Effects

9.5.204 Climate refers to the average weather experienced over a long period, typically 30 years or greater. The Earth's climate has changed many times in response to natural causes – the term climate change usually refers to changes that have occurred since the early 1900s.

9.5.205 NPS EN-1 references climate change in two sections. Section 4.5 of EN-1 describes criteria for the "good design" of energy infrastructure, including the requirement that projects be efficient it their use of energy during construction and operation.

9.5.206 Section 4.8 of EN-1 discusses climate change adaptation. This policy requires applicants to take into account potential climate change impacts and ensure that their projects are resilient to these impacts, over their lifetimes.

9.5.207 Policies within NPS EN-5 require applicants to assess the vulnerability of their projects to the potential effects of climate change and set out how their projects would be resilient to:

- flooding, particularly for substations that are vital for the electricity transmission and distribution network;
- effects of wind and storms on overhead lines;
- higher average temperatures leading to increased transmission losses; and
- earth movement or subsidence caused by flooding or drought (for underground cables).

9.5.208 Potential impacts to the ground environment from climate change during the construction, operation and decommissioning phases of the Proposed Development may include:

- increased or decreased chemical weathering (including erosion) of soils and bedrock resulting in changes to soil parameters, including drainage parameters, earth movements (such as increased hillwash and soil creep) and loss of designated geological sites/geomorphological features; and
- rising groundwater levels resulting in remobilisation of contaminants.

9.5.209 National Grid's design of assets/components include resilience and mitigation measures to address potential effects from climate change therefore the effects from a changing climate to the Proposed Development should be minimal.

9.5.210 The magnitude of effect would be negligible over the operational lifetime of the Proposed Development. The receptor sensitivity ranges between low and high depending upon the geological receptor. The sensitivity of a designated geological site would be high. The overall significance of effect of climate change to the Proposed Development would be **negligible** over the operational lifetime of the Proposed Development.

9.5.211 Potential climate change effects to hydrology (flooding) and ecology (habitat loss) are considered to be long term effects that may occur during the operational lifetime of the Proposed Development. These have been further discussed at **Volume 5.8.1** and **Volume 5.10.1**.

9.6 Inter-relationship of Potential Effects

9.6.1 The potential for interaction between effects on the ground environment and other aspects of the environment are identified in other technical chapters and also described.

9.6.2 Possible inter relationships could occur between the ground environment and ecology such as direct and indirect effects on protected species and habitats and designated areas of ecological interest, through contact with contaminated soils and groundwater; effects upon water quality through sediment or contamination ingress during construction activity; changes in soil parameters affecting crop establishment, yield and drainage properties and migration/remobilisation of contaminants to surface water courses and groundwater aquifers, effecting biodiversity.

9.6.3 Contact by ecological receptors with significant concentrations of contaminants within soil or groundwater via direct contact including dermal contact, ingestion and inhalation of particulates or plant uptake could result is a reduction of biodiversity and habitat diversity. Areas designated for ecological interest are located along the Proposed Development, such as the Kenn, Nailsea and Tickenham Moors which are designated as SSSI relating to surface water ditches/rhynes and associated aquatic ecological habitats. These would be considered to be of higher sensitivity than land along the majority of the Proposed Development that comprises agricultural land and rural areas. The receptor sensitivity of agricultural land would be medium. The sensitivity of designated areas would be high. The magnitude of effect for interactions between the ground environment and ecological receptors on agricultural land where contamination is identified, would be moderate. The significance of effect is considered to be a **moderate adverse** effect.

9.6.4 Contamination within designated ecological sites is unlikely. Therefore the magnitude of effect for interactions between the ground environment and ecological receptors within designated ecological sites would be moderate resulting in a significance of effect of a **moderate adverse** effect.

9.6.5 It is noted that there are no identified sites defined as Contaminated Land under Part IIA of the Environmental Protection Act, 1990 along the Proposed Development.

9.6.6 Inter-relationships would occur between the ground environment and hydrology (surface waters). The ground environment interacts with the hydrology principally through groundwater and the hydrogeological environment. The hydrology can also be affected through changes in soil drainage parameters, which has implications on flooding patterns; via sediment ingress or migration of contamination to surface water courses. Groundwater within permeable superficial and bedrock strata provides base flow of water to surface water courses and rivers on a local and regional scale. Contamination within groundwater has the potential to migrate within the aquifer to surface water courses. The receptor sensitivity would be medium for surface waters with moderate water quality, although surface water courses with good water quality or that have been designated for other parameters would be considered to be of high sensitivity. Potential interaction pathways include leaching and migration of contaminants to surface waters, or the ingress of contaminated soils, surface water silt run off into water courses. The magnitude of effect of interactions between the ground environment and the hydrology would be moderate owing to the potential for loss or alteration to one or more key elements/features of the baseline condition. The overall significance of effect cannot be readily determined based on theoretical assumptions on water quality and contamination concentrations.

9.6.7 Inter relationships are possible between the ground environment and archaeological assets, in particular where designated sites or sites of interest are located close to the Proposed Development. For instance, changes in soil drainage parameters within saturated ground or the excavation and exposure of peat rich deposits resulting through construction, operation or decommissioning activities for the Proposed Development may result in an adverse effect on preserved archaeological remains within those settings via desiccation and/or oxidation of the surrounding ground environment.

9.7 Mitigation

9.7.1 The mitigation described below will be secured via DCO Requirements or via the Draft CEMP **(Volume 5.26)** which will be the subject of a DCO Requirement.

9.7.2 The following measures will be implemented during the construction of the Proposed Development to reduce the risk of contamination cause by construction activities.

9.7.3 The following Environment Agency Pollution Prevention Guidance (PPGs) will be adhered to 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;
- 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;
  - 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.

Pre-Construction

Contaminated Land

9.7.4 Technical baseline investigations have been undertaken during the design phase of the Proposed Development in line with the Model Procedures for the Management of Land Contamination (CLR11) (Ref 9.16). The results of the investigation will be provided to the contractor(s) and have informed the ES. Site-specific intrusive ground investigation will be undertaken to inform whether remedial or mitigation works are required. The following actions shall be undertaken on a site-specific basis in line with CLR11 (Ref 9.16):

- review of existing PRA data to identify areas that require further detailed assessment;
- obtain updated unexploded ordnance survey for relevant sections of the Proposed Development (see also the Draft CEMP **(Volume 5.26.1)**;
- 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) will be undertaken where identified through site specific ground investigation;
- undertake remedial action, options appraisal and/or design where identified through ground investigation;
- implement the detailed mitigation measures or remedial works; and
- verify the implemented mitigation measures or remedial works.

9.7.5 Site-specific intrusive ground investigation will be undertaken to inform geotechnical, ground stability and civil engineering assessments. A review of existing baseline data will be undertaken to identify areas that require further detailed assessment as required. The results of the investigations will be used to inform foundation design and design of temporary works to ensure the stability of the Proposed Development.

9.7.6 In accordance with Schedule 3, Requirement 18 of the DCO, all proposed remediation and detailed mitigation measures will be presented in detail to the local authority and other appropriate regulators for approval prior to implementation. Following completion of measures identified in the approved remediation scheme, a verification report that demonstrates the effectiveness of the remediation carried out will be produced, and be approved by the Environment Agency and relevant Local Authority.

9.7.7 Professional advice will only be sought from those with demonstrable specialist competency in risk-based management of land contamination.

9.7.8 Work will 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 Draft CEMP **(Volume 5.26.1)**.

9.7.9 The detailed ground investigations and design of detailed mitigation measures would be undertaken by National Grid prior to the commencement of construction phase works, however post submission of the ES

Utilities and Services

9.7.10 National Grid has designed its proposals to avoid all Third Party services wherever possible. Where Third Party services cannot be avoided, National Grid has worked closely with the organisations responsible for their operation or maintenance to minimise effects on operations and future development aspirations. This engagement will continue during the construction phase.

9.7.11 Prior to intrusive investigations commencing appropriate service clearance surveys and utility searches will be undertaken to identify below ground services and utilities to avoid damage to third party property. This will include liaison with the relevant owner/operator to accurately identify the precise location of services/utilities.

Soil Management Plan

9.7.12 Prior to each stage of the construction of the Proposed Development, ground and soil surveys will be undertaken to identify the nature of the soil, areas of potential difficulty arising from the nature of the soil, such as poor trafficability, excavatability and soil handling properties. The results of the surveys will be detailed in a soil management plan (SMP). The SMP will include information on how to undertake the following works:

- site preparation;
- soil stripping;
- soil storage;
- soil erosion and siltation prevention;
- soil re-instatement; and
- cropping and aftercare.

Piling Risk Assessment

9.7.13 Boreholes will be drilled at each pylon location. The result of the borehole analysis will determine where piling will be required. Site specific piling risk assessments

would be undertaken to consider the hazards associated with the piling method in potentially contaminated ground and in relation to the ground and groundwater environment. The piling risk assessment and any subsequent mitigation will be agreed with the EA prior to construction commencing.

9.7.14 Prior written permission from the Coal Authority would be sought for any works that would disturb former coal workings or require entry to coal seams, coal mine workings or coal mine entries (shafts and adits). Advice from the Coal Authority would be followed.

During Construction

9.7.15 National Grid has designed its proposals to avoid all Third Party services wherever possible. Where Third Party services cannot be avoided, National Grid has worked closely with the organisations responsible for their operation or maintenance to minimise effects on operations and future development aspirations. This engagement will continue during the construction phase.

9.7.16 A Pollution Incident Control Plan (PICP) will be prepared and will be held on all construction sites to follow in the event of an environmental emergency. The PICP identifies how the risk of pollution due to construction works, materials and extreme weather events will be controlled and identifies the remedial actions in the event of an incident.

Import and Use of Materials

9.7.17 Where there is a suitable recycled or otherwise sustainable material which can be cost-effectively used, it will be preferred. Good practice in design and procurement will be adopted to keep stocks of materials to a minimum.

Storage and Handling Requirements

9.7.18 The proposals for the storage of waste on site are detailed in the Outline Waste Management Plan (Outline WMP) **(Volume 5.26.2).** Details will also be provided in the Site Waste Management Plans. Facilities will be provided for the collection, segregation, treatment and disposal of solid and liquid waste in accordance with the Outline WMP.

9.7.19 The following measures must be implemented on site for the storage of materials:

- all oil and diesel storage facilities will be at least 30m from any watercourse and at least 50m from any borehole or well;
- spill kits and drip trays will be provided for all equipment and at locations where any liquids are stored and dispensed;
- storage facilities will be provided for solid materials to prevent deterioration of the materials and their escape;
- storage facilities will be kept secure to prevent acts of vandalism that could result in leaks or spills; and
- all containers of any size will be correctly labelled indicating their contents and any hazard warning signs.

Fuel Tanks, Mobile Bowsers and Bunds

9.7.20 In accordance with the Oil Storage Regulations (2001) (Ref 9.17) 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) will have a secondary containment, for example, double skinned tanks. All tanks and mobile bowsers will be located in a sealed impervious bund;
- fill pipes will not extend beyond the bund wall and will have a lockable cap secured with a chain;
- any tap or valve permanently attached to a tank or bowser through which fuel can discharge, will be fitted with a lock;
- where fuel is delivered through a pipe permanently attached to a tank or bowser:
  - the pipe will be fitted with a manually operated pump or a valve at the delivery end which closes automatically when not in use;
  - the pump or valve will be fitted with a lock;
  - the pipe will be fitted with a lockable valve at the end where it leaves the tank or bowser;
  - the pipework will pass over and not through bund walls;
  - tanks and bunds will be protected from vehicle impact damage; and
  - tanks will be labelled with contents and capacity information.
- all valves, pumps and trigger guns will be turned off and locked when not in use. All caps on fill pipes will be locked when not in use.

9.7.21 Suitable precautions will be taken to prevent spillages from equipment containing small quantities of hazardous substances (for example, chainsaws and jerry cans) including:

- each container or piece of equipment will be stored in its own drip tray made of a material suitable for the substance being handled; and
- containers and equipment will be stored on a firm, level surface.

Drum Storage

9.7.22 Where oil drums are over 200 litres (in accordance with the Oil Storage Regulations 2001) (Ref 9.17) it will be ensured that:

- multiple drums and containers 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 will be covered to prevent rainwater getting into bunds and drum pallets;
- drums will be labelled and positioned such that leaks cannot overshoot the bund or drip tray wall; and
- all containers will be stored securely when the site is unattended.

Flammable and Hazardous Substances

9.7.23 All flammable and hazardous substances will be kept in a secure bunded cupboard, cabinet or tank constructed of materials which are chemically resistant to its contents.

Deliveries and Dispensing

9.7.24 For deliveries and dispensing activities it will 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 used during dispensing activities; and
- all spillages occurring during dispensing and handling activities are cleared up and reported via the SHESQ Manager and are dealt with in accordance with the Draft CEMP **(Volume 5.26.1)**.

Vehicles and Plant

9.7.25 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. The following measures will be implemented to reduce this risk:

- vehicles and plant provided for use on the site will be in good working order to ensure optimum fuel efficiency, and are free from leaks. Plant with integral bunding and/or drip trays will be specified;
- sufficient spill kits will be carried on all vehicles;
- any hired vehicles and plant will be checked on delivery and not accepted if they are not in good working order for example, leaking, excessive fumes, excessive noise and/or smoke;
- company-owned vehicles and plant will 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 will not park near or over drains and will be washed in accordance with the commitments in the Draft Construction Traffic Management Plan (Draft CTMP) (**Volume 5.26.5**);
- employee-owned vehicles will not be driven or parked in construction areas or cable swathe unless authorised to do so;
- topping up of vehicles and plant will 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 covers will be used to reduce the risk of spills;
- vehicles and plant will not be overfilled with fuel; and
- plant containing oils will be inspected daily and maintained to both prevent and identify leaks.

Soil Management Plan

9.7.26 Measures to protect soils will be set out in a Soil Management Plan (SMP) and will include, but not be restricted to, the following measures:

- construction traffic will be restricted to operating on the designated access roads and not on the unprotected peaty soils;
- topsoil stripping will be restricted to the width of the permanent and temporary elements of the Proposed Development, thereby minimising disturbance to the integrity of the biomass;
- the use of appropriate geotextile membranes, wooden matting or aluminium trackways will be used over particularly sensitive areas;
- in peaty and soft saturated clay soils, where the use of geotextile membranes are not appropriate, wheeled vehicles may be fitted with low ground pressure bearing pneumatic tyres to allow a greater distribution of weight;
- soil loosening techniques such as deep-tine cultivation will be used, where required, to break up any compaction, which has occurred;
- subsoil and different superficial deposits will be stored separately to prevent mixing and will be reinstated in reverse order of excavation;
- topsoil and subsoil movements will only be undertaken in suitable conditions, for example, when it is not too wet, in accordance with DEFRA guidance (Ref 9.18);
- soil stabilising methods will be undertaken in accordance with the SMP to reduce the risk of erosion, the creation of leachate and potential water quality issues;
- early re-seeding of the reinstated ground will be undertaken to help re-establish and stabilise the structure of the topsoil; and

- soils will not be stockpiled close to surface water features. Stockpiled soils will be stored on an appropriate impermeable surface material and covered to reduce the risk of windblown dust, surface water run-off and reduce the risk of overland migration of silt and sediment to surface waters.

9.7.27 The SMP will be approved by the consenting authority prior to the commencement of any stage of construction works.

De-watering

9.7.1 Deep excavations may require de-watering. Water pumped or removed from excavations will be passed through a silt-separator tank or equivalent, and discharged to ground or surface water. A permit would be sought from the EA prior to undertaking such operations. Details would be provided in a Drainage Management Plan (DMP).

Drainage

9.7.2 Extended excavations will be arranged so as not to create preferential drainage pathways with the potential to cause flooding of lower land. Appropriate measures will be implemented such as the introduction of baffles or creation of sumps to reduce the risk of preferential drainage paths being created. This will be detailed and implemented via a DMP.

Coal

9.7.3 National Grid has completed a coal risk assessment for works in the area of Nailsea (Section D – Somerset Levels and Moors North) at the former coal working site at West End Trading Estate. It identifies that the construction of the Proposed Development should not disrupt the site. The assessment has been agreed with North Somerset Council and Coal Authority. During construction, the contractor will be aware of any disturbances to the area. All construction workers will be briefed via toolbox talks on the site history; the potential for the presence of below ground mining features; and to remain vigilant for any sudden or unexpected changes in ground conditions. The contractor(s) will undertake gas monitoring in excavations. If high levels of methane or carbon dioxide are encountered or former coal workings and associated voids are encountered works will stop immediately and the incident procedure will be followed (as described in the Draft CEMP at **Volume 5.26.1**.

9.7.4 Where intact coal seams are exposed in excavations, it is considered that there is a potential risk for combustion. Should these be encountered, exposed sections will be covered (blinded) with a suitable material such as a weak mix concrete.

Road Sweeping

9.7.5 Road sweeping will be undertaken where required and in accordance with the Draft CTMP **(Volume 5.26.5),** to remove deposits of silt from roads and reduce the risk of silt being washed into surface water gullies and watercourses.

Monitoring

9.7.6 Monitoring will be undertaken in accordance with the Draft CEMP **(Volume 5.26.1)**. In particular monitoring will be undertaken of:

- ground and surface water conditions for spills or uncontrolled tipped surface spoil;
- oil tanks and associated bunds for leaks; and
- plant containing oils will be inspected daily and maintained to both prevent and identify leaks.

During Operation

9.7.7 Embedded mitigation measures within the design of the Proposed Development and its component parts would minimise potential impacts to the ground environment.

9.7.8 During the operational phase potential effects will be limited to:

- contamination of soils during, operation via on site activities; and
- contamination of groundwater aquifers during operation via on site activities.

9.7.9 These potential impacts to the ground environment would be principally mitigated through the appropriate design of Proposed Development components. Appropriate use and storage of potential contaminants (including hydrocarbons) would be undertaken in accordance with statutory guidance and best working practice described above. Maintenance work on Proposed Development components would be undertaken in accordance with statutory guidance and best practice. The work would be undertaken in accordance with component specific method statements and risk assessments and in line with the design specification for individual components of the proposed Development.

9.7.10 To avoid any incidents which may give rise to contamination of the ground and/or pollution of groundwater, sites would be managed according to existing best practice such as, the Environment Agency's PPG1 General Guide to the Prevention of Pollution.

During Decommissioning

9.7.11 National Grid has designed its proposals to avoid all Third Party services wherever possible. Where Third Party services cannot be avoided, National Grid has worked closely with the organisations responsible for their operation or maintenance to minimise effects on operations and future development aspirations. This engagement will continue during the construction phase.

9.7.12 Mitigation measures applied during the decommissioning phase are considered to be similar to those applicable for the construction phase. It is noted that the decommissioning phase would be of shorter duration and lesser extent, therefore the magnitude of effect of proposed decommissioning activities on the ground environment are likely to be lower.

Indicative Access for Future Maintenance

9.7.13 Mitigation measures applied during future maintenance operations are considered to be similar to those applicable for the construction phase. It is noted that the maintenance operations would be of considerably shorter duration and lesser

extent, therefore the magnitude of effect of proposed decommissioning activities on the ground environment are likely to be lower.

9.8 Residual Effects

Damage to Designated Geological Sites

9.8.1 The Proposed Development does not pass through any currently designated geological site. The nearest designated geological sites are situated within Section E - Tickenham Ridge, located within 240m west of the existing F Route and Section C - Mendip Hills, located 660m west of the Proposed Development at the Banwell Ochre Caves. The route of the Proposed Development has been selected to avoid these site and other designated geological sites in proximity to the Proposed Development.

9.8.2 The Mendip Hills are currently not designated as a European Geopark; despite interest in registering this area having been lodged. As such, assessment of the Mendip Hills as a Geopark cannot be undertaken. It is however noted that the Proposed Development within Section C is to comprise construction of underground cables, which is likely to result in a beneficial effect to any future designations.

9.8.3 Owing to the absence of designated geological sites within close proximity to the Proposed Development, the magnitude of the effect would be negligible. The receptor sensitivity would be high owing to the designated status. The overall significance of effect following implementation of mitigation measures previously identified, of the Proposed Development on designated geological sites would be **negligible**.

Sterilisation of Areas of Mineral Resources (Both Current and Future)

9.8.4 The Proposed Development does not cross, or pass in close proximity to, MSAs. C. Therefore magnitude of effect would be negligible. The receptor sensitivity would be high. The overall significance of effect following implementation of mitigation measures previously identified, of the Proposed Development on MSAs would be **negligible**.

9.8.5 The Proposed Development crosses the eastern-most corner of the former Fourteen Acre Quarry within Section A – Puriton Ridge. The site is recorded to have had mineral extraction undertaken in the past and for which planning permission may still be extant, or may have lapsed. The site is recorded as inactive (including yet to be worked), worked-out and/or restored. One proposed pylon (ZGA7) and three access tracks for the proposed 400kV overhead line are located within this site. Pylon ZGA8 is located within 180m south/south east of the former quarry boundary. The magnitude of effect would be minor. The receptor sensitivity would be medium. The overall significance of effect of the Proposed Development on the Fourteen Acre mineral resource area would be **negligible**.

9.8.6 There is a site identified as an inactive and restored (including yet to be worked), worked-out and/or a restored site, within Section G - Avonmouth, located immediately south-east of the Seabank Substation. The 400kV overhead line and associated pylons LD131 and LD132 would be located within this former quarry. Pylon LD130 would be located close to the former quarry's boundary. The magnitude of effect would be minor. This site currently comprises agricultural fields.

The receptor sensitivity would be medium. The significance of effect following implementation of mitigation measures, of the Proposed Development on this mineral resource area would be **negligible**.

9.8.7 The Proposed Development within the northern-most part of Section D, and Sections E and F, passes through an area [or areas] confirmed to be designated under the petroleum exploration and development licence, issued under the Petroleum (Production) Act 1934 (repealed in full 1998 and replaced by the Petroleum Act 1998) (Ref 9.11). The magnitude of effect is considered negligible owing to the likely depth at which any potential petroleum hydrocarbons are located and the very low potential for petroleum hydrocarbon exploration within these sections given the general land use and the presence of residential population centres within the wider surrounding area. The receptor sensitivity would be medium. The overall significance of effect of the Proposed Development on the petroleum designated area would be **negligible**.

9.8.8 The Proposed Development in the vicinity of West End and Nailsea (Section D) crosses the North Somerset Coalfield (Nailsea Coalfield). The receptor sensitivity would be medium owing to the future potential of the coal as a resource. The magnitude of effect would be negligible due to the very low likelihood that coal extraction within the area including beneath the residential population centre of Nailsea would be undertaken in the future. The overall significance of effect following implementation of mitigation measures previously identified, of the Proposed Development on the coal deposits as a potential future resource would be **negligible**.

Collapse of Unstable or Undermined Ground Activated by Construction Works

9.8.9 The majority of the Proposed Development is not located within, or in close proximity to areas at risk from shallow mine working and ground collapse. Owing to the absence of shallow mine workings, the magnitude of effect is considered negligible. The sensitivity would be medium and the overall significance of effect following implementation of mitigation measures previously identified, of the Proposed Development on unstable or undermined ground activated by construction works would be **negligible**.

9.8.10 A coal mining risk assessment has been undertaken for the Proposed Development between West End and Nailsea to Stone-edge Batch within Section D. The assessment indicates a **negligible** overall significance of effect following implementation of mitigation measures, of the Proposed Development (both existing overhead lines and the proposed 132kV underground cable through Nailsea) on ground stability arising from large scale open cast surface mining practices.

9.8.11 The depth of former below ground coal workings at Grace's Seam at the former West End Colliery (Section D, West End Trading Estate at Nailsea) would have a negligible magnitude of effect on the underground cable route of the Proposed Development, as any ground movement at the surface would generally have since ceased. The receptor sensitivity would be medium owing to the commercial setting. The overall significance of effect following implementation of mitigation measures previously identified, of the Proposed Development on the ground stability

associated with working of Grace's seam at depth beneath the former colliery would be **negligible**.

9.8.12 The magnitude of effect of the Proposed Development (underground cable route) activating ground collapse induced at mineshafts at West End Trading Estate (Section D, Nailsea) are considered to be negligible, owing to the remedial works undertaken on these mineshafts and their location beneath an existing commercial development. The receptor sensitivity would be medium owing to the commercial setting. The overall significance of effect following implementation of mitigation measures previously identified, of the Proposed Development on the ground stability would **negligible**.

9.8.13 A third mineshaft located on the West End Trading Estate is shown to have been potentially remediated. It is therefore considered likely that this mineshaft has been remediated, with a similar specification to the previous mineshafts. The magnitude of effect of the collapse of unstable or undermined ground arising through construction would be negligible. The receptor sensitivity would be medium owing to the commercial nature of the property. The overall significance of effect would be **negligible**.

9.8.14 There is an identified mineshaft located between 40m and 50m distance from the proposed underground cable route at West End Trading Estate, Nailsea (Section D). The receptor sensitivity would be medium owing to a commercial setting. The magnitude of effect of the Proposed Development activating ground collapse at the mineshaft would be minor owing to the geographical separation. The overall significance of effect following implementation of mitigation measures , of the Proposed Development activating ground instability associated with the mineshaft would be a **minor adverse** effect.

9.8.15 A mineshaft is located within a field approximately 50m west of an existing pylon associated with the existing W route at Nailsea (Section D). This mineshaft is not recorded to have been subject to remedial work. The pylon is located within the grounds of the Nailsea rugby and football club, 50m to the east of the mineshaft and is surrounded by concrete parking spaces/access tracks. The magnitude of effect of the collapse of unstable or undermined ground arising through decommissioning activity would be minor owing to the geographical separation. The receptor sensitivity would be medium. The overall significance of effect following implementation of mitigation measures, of the Proposed Development activating ground instability associated with this mineshaft would be a **minor adverse** effect.

9.8.16 A recorded mineshaft at the former North Lane Pit at Nailsea (Section D) is located beneath a housing estate, at a distance greater than 160m north from the West End Trading Estate and 140m east of the nearest pylon associated with the W route at Nailsea. The magnitude of effect of ground collapse resulting from decommissioning works associated with the W route would be negligible. The receptor sensitivity would be high owing to the presence of residential properties in the close vicinity. The overall significance of effect following implementation of mitigation measures, of the Proposed Development activating ground instability associated with this mineshaft would be **negligible**.

9.8.17 A review of coal mining records has been undertaken for Proposed Development including the proposed 400kV overhead line, proposed underground cable route and decommissioning of the existing F and W Routes between Stone-edge Batch

and the Portishead Substation within Sections E and F. The findings of the data review indicates that the bedrock geology on the Tickenham Ridge (Section E) is not coal bearing, therefore risks of the Proposed Development activating ground instability of unstable or undermined ground are not possible. Therefore the overall significance of effect would be **negligible**.

9.8.18 Potentially coal bearing geology is located beneath the northern face of the Tickenham Ridge at Clapton in Gordano. Historic coal works are located between 750m and 1,000m west of the existing F Route at its closest extent. The receptor sensitivity would be low owing to the absence of residential receptors close by and the general rural land use in the vicinity. The magnitude of effect would be negligible owing to the distance between the Proposed Development and the coal working area. The overall significance of effect would be **negligible**.

9.8.19 Peat deposits are recorded within Section D – Somerset Level and Moors North, between east of Yatton on the Kenn Moor and close to the base of the Tickenham Ridge (Section E) at Stone-edge Batch on the Nailsea and Tickenham Moors. These peat deposits may be compressible over the long term and could result in consolidation, however permanent structures such as pylons would be supported on appropriate foundations therefore minimising the effect to the ground environment (consolidation of superficial deposits (peat)). The receptor sensitivity would be medium and the magnitude of effect would be minor. The overall significance of effect following implementation of mitigation measures would be a **minor adverse** effect.

9.8.20 Tidal Flat Deposits are recorded along much of the Proposed Development (Sections A, B, D and F), especially within topographically low lying areas. Tidal Flat Deposits are considered to have a minor to moderate potential for compression resulting through the surface loading during the construction and decommissioning phases. However permanent structures such as pylons would be supported on appropriate foundations therefore minimising the risk to the structure from consolidation. The receptor sensitivity would be low for the route alignment as a whole and the magnitude of effect would be minor. The overall significance of effect following implementation of mitigation measures would be a **negligible**.

9.8.21 Within Section G, Tidal Flat Deposits are recorded between 10m and 15m thickness. In addition, numerous landfill sites are recorded within this Section. Compression of these Tidal Flat Deposits activate by the Proposed Development may result in the release of ground gases or leachate from adjoining landfill sites. It is noted that components of the Proposed Development will generally be supported by piled foundations within this area owing to highly compressible superficial deposits. Therefore anticipated loading pressures are unlikely to be high. The receptor sensitivity of the Tidal Flat Deposits in close proximity to landfill sites is considered to be medium for Section G. The magnitude of effect is considered to be moderate. The overall significance of effect following implementation of mitigation measures is considered to be a **minor adverse** effect.

Creation of Additional Ground Migration Pathways for Mine Gas, Ground Gas or Landfill Gas

9.8.22 In general, the Proposed Development passes through areas that are considered to have low to moderate potential to generate ground gas from natural deposits. The receptor sensitivity would be low owing to the general absence of sensitive

residential receptors close to the Proposed Development over much of the route. The magnitude of effect would be minor. The overall significance of effect following application of mitigation measures, of the Proposed Development for the creation of gas migration pathways would be **negligible**.

9.8.23 All Tidal Flat Deposits within the LoD of the Proposed Development should be considered to contain peat bearing horizons. These natural deposits of peat may give rise to ground gases. Components of the Proposed Development including overhead pylons will be absent of confined spaces and subject to outdoor air exposure. The receptor sensitivity is considered to be low. The magnitude of effect is considered to be minor. The overall significance of effect is considered to be **negligible**.

9.8.24 Short sections of underground cable cross Tidal Flat Deposits, particularly within Section D at Nailsea and within Section F and G. Underground cables may have associated confined spaces and therefore potential risks from ground gases are considered to be higher. The receptor sensitivity is considered to be low. The magnitude of effect is considered to be minor .The overall significance of effect following implementation of mitigation measures is considered to be **negligible**.

9.8.25 The proposed underground cable route at West End and Nailsea (Section D) crosses a former colliery. The magnitude of effect following implementation of mitigation for the creation of preferential migration pathways resulting through the construction of an underground cable trench would be negligible where the Proposed Development (underground cable route) passes through the West End Trading Estate at Nailsea owing to the depth of Grace's seam beneath the trading estate (60m to 90m depth). The receptor sensitivity would be medium owing to the commercial setting. The overall significance of effect following implementation of mitigation measures, of the proposed underground cable route at West End Trading Estate creating migration pathways for mine gases would be **negligible**.

9.8.26 The proposed underground cable route at West End and Nailsea (Section D) passes through a residential area. The magnitude of effect following implementation of mitigation measures for the creation of preferential migration pathways resulting through the construction of an underground cable trench would be minor and the receptor sensitivity would be high owing to the close proximity of residential properties. The overall significance of effect following implementation of mitigation measures, of the proposed underground cable route at West End Trading Estate creating migration pathways for mine gases would be a **minor adverse** effect.

9.8.27 The presence of shallow coal seams may result in the creation of migration pathways for mine gas should the Proposed Development components intersect these. The magnitude of effect would be minor where outdoor air exposure applies, such as at the existing F and W route pylons and access tracks in the vicinity of Nailsea. The receptor sensitivity would be low. The overall significance of effect for outdoor air following implementation of mitigation measures, would be **negligible**.

9.8.28 The magnitude of effect would be negligible where manned entry into trenches is required in the vicinity of Nailsea, following implementation of mitigation measures. The receptor sensitivity (human health) would be medium. The overall significance of effect following implementation of mitigation measures, for manned entry into excavations would be **negligible**.

9.8.29 There is an identified mineshaft located between 40m and 50m distance from the Proposed Development (underground cable route) at West End Trading Estate (Section D) along Blackfriars Road. This mineshaft is not recorded to have been subject to remedial work. The mineshaft is currently located beneath either a commercial building, or an associated access road. Mine gas emissions could migrate to the proposed development (underground cable route trench) through granular made ground. The receptor sensitivity would be medium owing to the commercial setting. The magnitude of effect following implementation of mitigation measures would be minor. The overall significance of effect following implementation of mitigation measures, would be a **minor adverse** effect.

9.8.30 Three mineshafts located close to the road junction of Engine Lane and Blackfriars Road within the West End Trading Estate are considered to have been remediated including the incorporation of a methane vent into the mine cap and therefore would not act as conduits for mine gases. The magnitude of effect would be negligible owing to the remedial works undertaken. The receptor sensitivity would be medium owing to commercial setting. The overall significance of effect following implementation of mitigation measures would be **negligible**.

9.8.31 The Proposed Development consisting of the proposed 400kV overhead line would pass close to a historic landfill at North Drove, Nailsea (Section D). This includes a section of the 400kV overhead line between pylons LD75 and LD76. The pylons are not identified to be located over the landfill; these pylons adjoin the landfill boundary. The surrounding area comprises agricultural fields with no residential properties located within the immediate vicinity therefore the magnitude of effect would be negligible following implementation of mitigation measures. The sensitivity of the receptor has been assessed as low owing to the agricultural setting in the immediate vicinity. The overall significance of effect following implementation of mitigation measures would be **negligible**.

9.8.32 The preferred route Option A consisting of the 400kV overhead line at pylon LD99 within Section F – Portishead would pass over the Prior Farm Landfill. Pylon LD99 would be located over the landfill and therefore could create preferential gas migration pathways. The receptor sensitivity would be low owing to the absence of sensitive receptors in the immediate vicinity. The magnitude of effect would be negligible following implementation of mitigation measures. The overall significance of effect following implementation of mitigation measures would be **negligible**.

9.8.33 Parts of the existing F and W Routes and the proposed underground cable route within Section F – Portishead, in the close proximity to the Portishead Substation, would pass over/through a historic landfill beneath the western part of the Substation. The historic landfill is identified as the former Central Electricity Generating Board Landfill, having received industrial waste. The proposed underground cable route has a higher potential to result in preferential gas migration pathways due to trenching work required as part of the development. Residential properties are located circa 75m west of the Portishead Substation along Wren Gardens Road. No residential properties are located north, east or west of the substation, an area which comprises a nature reserve. The receptor sensitivity would be high for residential properties and low for the nature reserve. The magnitude of effect would be minor following implementation of mitigation measures, the distance of the underground cable from the residential area (75m distance and greater) and the likely cohesive nature of natural superficial deposits

(Tidal Flat Deposits, which would reduce the migration of ground gases. The overall significance of effect following consideration of likelihood would be a **minor adverse** effect.

9.8.34 The receptor sensitivity of the adjoining nature reserve would be low. The magnitude of effect would be minor. The significance of effect would be **negligible**.

9.8.35 Within Section G – Avonmouth, parts of the existing G Route cross the T Farm Landfill between the M5 motorway at junction 18A and the Avonmouth Substation. The proposed 400kV overhead line including pylon LD117 would be located over this landfill and the proposed underground cable between the Avonmouth Substation and junction 18 of the M5/M49 motorways would pass through the T Farm Landfill. The proposed underground cable between the north eastern corner of the Avonmouth Substation and pylon G31R of the G Route would have the highest potential to create preferential migration pathways for landfill gases owing to trenching for the underground cable, although piled foundations for pylon located over the landfill may also create migration pathways. The receptor sensitivity of the commercial/industrial setting would be medium. The magnitude of effect would be minor following implementation of mitigation measures and in light of the inert nature of the fill material. The overall significance of effect following implementation of mitigation, would be a **minor adverse** effect.

9.8.36 The proposed overhead 400kV line between pylons LD131 and LD132 close to the Seabank Substation crosses over the former Crooks Farm Landfill, which received inert and industrial waste. Other components of the Proposed Development over this landfill include pylons DA2R, BW2R, G42R and temporary overhead infrastructure works. The surrounding land use comprises agricultural fields, with the Seabank Substation located to the north. The receptor sensitivity would be medium for the agricultural fields. The magnitude of effect would be minor following implementation of mitigation measures. The overall significance of effect following implementation of mitigation measures, would be **negligible**.

9.8.37 The receptor sensitivity would be high for the Seabank Substation. The magnitude of effect would be minor following implementation of mitigation measures. The overall significance of effect following implementation of mitigation measures, would be a **minor adverse** effect.

Loss of or Damage to Structure of Topsoil/subsoil During Soil Stripping Operations and Reinstatement, Leading to Poor Crop Establishment and Lower Yields

9.8.38 Soil excavation for the creation of access tracks for construction, maintenance and decommissioning purposes would be sensitive, although less sensitive than soil excavations for underground cable routes owing to the lateral and vertical extent of the proposed excavations. Soil excavations for the creation of access tracks for the majority of the Proposed Development are considered to have a minor magnitude of effect of owing to the potential for a minor shift away from the baseline conditions. The receptor sensitivity would be medium owing to the general agricultural nature of the land use along much of the Proposed Development. The overall significance of effect following implementation of mitigation measures previously identified, of the Proposed Development on the loss of or damage to the structure of the soil would be a **minor adverse** effect.

9.8.39 Soil excavations for construction of the proposed underground cable routes would be of greater duration and vertical/lateral extent than access routes and are therefore considered to have a magnitude of effect of minor following implementation of mitigation measures previously identified. The receptor sensitivity would be medium owing to the general agricultural nature of the land use. The overall significance of effect following implementation of mitigation measures previously identified, of the Proposed Development on the loss of or damage to the structure of the soil would be a **minor adverse** effect.

9.8.40 Peat deposits are identified on the Kenn, Nailsea and Tickenham Moors (Section D). The Proposed Development has the potential to damage these deposits through compaction, oxidation or drying when excavated. The magnitude of effect would be minor, owing to the potential loss of peat deposits as a resource. The receptor sensitivity would be medium. The overall significance of effect following implementation of mitigation measures previously identified, of the Proposed Development on the loss of or damage to the structure of the soil would be a **minor adverse** effect.

Loss of or Damage to Structure of Topsoil/subsoil During Soil Stripping Operations and Reinstatement, Leading to Significant Changes in Soil Drainage Parameters

9.8.41 The majority of the Proposed Development crosses general agricultural land use. Within these areas the receptor sensitivity would be medium owing to the agricultural land use. The magnitude of effect would be minor owing to the potential minor shift away from baseline conditions. The overall significance of effect following implementation of mitigation measures previously identified, of the Proposed Development on the loss of or damage to the structure of the soil would be a **minor adverse** effect.

9.8.42 Peat deposits consisting of buried and consolidated material are recorded on the Kenn, Nailsea and Tickenham Moors between Yatton and Stone-edge Batch (Section D). The receptor sensitivity would be high owing to the higher permeability of this medium compared to other soil types along the Proposed Development. The magnitude of effect would be minor owing to the difficulty in re-establishing peat deposits to pre-excavation condition once removed from the ground. The overall significance of effect following implementation of mitigation measures previously identified, of the Proposed Development on the loss of or damage to the structure of the soil would be a **minor adverse** effect.

9.8.43 Where components of the Proposed Development cross designated sites such as SSSI, the loss or damage to the soil structure of peat arising from the construction of the Proposed Development may impact other receptors such as ecology and hydrology. Within these areas, such as on the Kenn, Nailsea and Tickenham Moors (Section D) designated SSSI, the presence of peat within the superficial geology influences the ecology found within drainage ditches on the moors. The receptor sensitivity is therefore considered to be high within these areas. The magnitude of effect would be minor owing to the potential for loss or alteration to the designated site. The overall significance of effect following implementation of mitigation measures previously identified, of the Proposed Development on the loss of or damage to the structure of the soil would be a **minor adverse** effect.

9.8.44 Potential impacts on site drainage and hydrology are discussed in further detail at **Volume 5.10.1**.

Ingress of Sediment or Silts into Surface Water Courses Arising Through Construction, Operation or Decommissioning Phase Activities

9.8.45 The Proposed Development passes close to or crosses numerous interconnected drainage ditches, rhynes and primary surface water receptors including rivers. There is the potential for overland sediment transportation arising from construction activities into these surface water receptors.

9.8.46 Transportation of sediment to surface waters has been further discussed and assessed at **Volume 5.10.1**.

Contamination of Soils by On Site Activities

9.8.47 The Proposed Development has the potential to result in contamination of soils through the accidental release of pollutants. Embedded mitigation measures within the machinery and heavy plant to be used on site further reduces the potential of leaks from this equipment. The magnitude of effect following implementation of mitigation measures would be negligible. The receptor sensitivity for the majority of the Proposed Development would be medium. The overall significance of effect following implementation of mitigation measures, of the Proposed Development on the contamination of soils by on site activities would be **negligible**.

9.8.48 Where soils are free draining, such as where peat deposits are present within Section D or where the soil medium is predominantly granular in matrix, migration of liquid contaminants may be quicker and more widespread. The receptor sensitivity would be considered to be medium, the magnitude of effect would be considered to be negligible following implementation of mitigation measures. The overall significance of effect following implementation of mitigation measures, of the Proposed Development on the contamination of soils by on site activities would be **negligible**.

9.8.49 It is noted that proposed underground cables to be used within Section C – Mendip Hills and between Nailsea (Section D) and the Portishead Substation (Section F) would not contain fluids such as mineral oils or hydrocarbons as insulation. The potential for these components of the Proposed Development to cause significant contamination via leaks is therefore not possible.

9.8.50 Where components of the Proposed Development are located close to the presence of below ground high pressure oil and gas pipelines, the potential for significant soil contamination is possible. This includes existing oil and gas pipelines within Sections E, F and G. The receptor sensitivity of these pipelines is considered to be high and the magnitude of effect is considered to be major owing to the potential volume of contaminants released from a high pressure oil pipeline. The significance of effect is considered to be a major adverse effect. The likelihood of damaging the pipeline is considered to be of low likelihood. The overall significance of effect following implementation of mitigation measures, of the Proposed Development on existing oil and gas pipelines would be **minor adverse** effect.

Contamination of Groundwater Aquifers by On Site Activities

9.8.51 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.

9.8.52 The Proposed Development generally passes across secondary aquifers (within both the superficial and bedrock geology) along the route. These are variably designated secondary undifferentiated to secondary A aquifers depending upon the geology. The magnitude of effect is considered negligible following implementation of mitigation measures. The receptor sensitivity for the route as a whole would be medium. The overall significance of effect following implementation of mitigation measures, of the Proposed Development on the contamination of groundwater aquifers by on site activities would be **negligible**.

9.8.53 The Proposed Development passes through, or within close proximity to groundwater aquifers designated as principal aquifers within Section C - Mendip Hills and Section E – Tickenham Ridge. The receptor sensitivity would be high. The magnitude of effect following implementation of mitigation measures would be negligible. The overall significance of effect following implementation of mitigation, of the Proposed Development on the contamination of groundwater aquifers by on site activities would be **negligible**.

9.8.54 There are several groundwater abstractions within 1,500m of the Proposed Development, along the whole length of the route. The Proposed Development may have an impact on these potable water abstractions should a contamination incident occur. The magnitude of effect following implementation of mitigation measures would be negligible and the receptor sensitivity would be high given potential human health implications. The overall significance of effect following implementation of mitigation measures, of the Proposed Development on the contamination of groundwater aquifers by on site activities would be **negligible**.

9.8.55 It is noted that proposed underground cables to be used within Section C – Mendip Hills and between Nailsea (Section D) and the Portishead Substation (Section F) would not contain fluids such as mineral oils or hydrocarbons as insulation. The potential for these components of the Proposed Development to cause significant contamination via leaks is therefore not possible.

Remobilisation of Contamination in Groundwater by On Site Activities

9.8.56 In general, the Proposed Development proceeds through predominantly agricultural/rural settings with a low potential for existing significant ground/groundwater contamination. The general historic land use along the Proposed Development suggests a low likelihood for significant contamination. The magnitude of effect would be negligible following implementation of mitigation measures and the receptor sensitivity would be medium. The overall significance of effect following implementation of mitigation measures, of the Proposed Development on the remobilisation of contamination in groundwater by on site activities would be **negligible**.

9.8.57 The preferred route (Option A) within Section F – Portishead passes over the historic Prior Farm Landfill. The magnitude of effect would be minor following implementation of mitigation measures. The overall significance of effect following implementation of mitigation measures, of the Proposed Development on the

remobilisation of contamination in groundwater by on site activities would be a **minor adverse** effect.

9.8.58 The existing F and W Routes and the proposed 400kV underground cable would pass over/through the historic Central Electricity Board Landfill located beneath the western part of the existing Portishead Substation (Section F). The magnitude of effect would be minor following implementation of mitigation measures. The receptor sensitivity of the hydrogeology would be medium owing to the secondary A and B aquifer classifications of the superficial and bedrock geology within the area. The overall significance of effect following implementation of mitigation measures, of the Proposed Development on the remobilisation of contamination in groundwater by on site activities would be **a minor adverse** effect.

9.8.59 The alternative route (Option B) would pass immediately north of the historic Royal Portbury Dock Landfill at Portbury Docks (Section F). The receptor sensitivity of the hydrogeology would be medium owing to the secondary A and B aquifer classifications of the superficial and bedrock geology within the area. The magnitude of effect would be negligible owing to the absence of landfills beneath proposed components of the alternative route (Option B) and existing G Route. The overall significance of effect following implementation of mitigation measures, of the Proposed Development on the remobilisation of contamination in groundwater by on site activities would be **negligible**.

9.8.60 This wider area within Section G - Avonmouth is affected by known ground and groundwater contamination from historic industrial activity including along the route of the Proposed Development. The Proposed Development passes over or through the T Farm Landfill, which received inert waste. The receptor sensitivity of the hydrogeology within the area would be medium owing to the secondary A and B aquifer classifications of the superficial and bedrock geology within the area. The magnitude of effect would be minor following implementation of mitigation measures. The overall significance of effect following implementation of mitigation measures, of the Proposed Development on the remobilisation of contamination in groundwater by on site activities would be a **minor adverse** effect.

9.8.61 Where feasible, the piled foundations for the existing pylons of the F, W and G Routes and the proposed 400kV overhead line would be removed in their entirety. As a whole, the Proposed Development generally proceeds through an area with a low likelihood for significant contamination due to the agricultural and rural site history along much of the Proposed Development. As a result, there is low potential for existing piled foundations that would be removed in their entiretyfollowing decommissioning of pylons, to act as preferential pathways for significant concentrations of contaminants. The magnitude of effect is considered minor given the potential for ground contamination, and the receptor sensitivity for the Proposed Development as a whole would be low. The overall significance of effect would be **negligible**.

9.8.62 Where the historic land use suggests the potential for contaminants within soil and groundwater, piled foundations could act as migration pathways. There is low potential for existing piled foundations that would be removed in their entirety following decommissioning, to act as preferential pathways for significant concentrations of contaminants. The receptor sensitivity would be medium and the magnitude of effect would be negligible. The significance of effect of removing piled foundations following decommissioning of the pylons would be a **negligible**.

Residual Contaminated Soils Left at the Surface Following On-Site Activities

9.8.63 As a whole, the Proposed Development generally proceeds through an area with a low likelihood for significant contamination due to the agricultural and rural site history along much of the Proposed Development. As a result, there is low potential for significantly contaminated arisings to be encountered and left at the surface during construction activities. The magnitude of effect is considered negligible following implementation of mitigation measures. The overall significance of effect following implementation of mitigation measures, of the Proposed Development resulting in residual contaminated soils left at the surface following site activities would be **negligible**.

9.8.64 There is the potential for contaminated arisings to be encountered within these areas during construction of the proposed 400kV overhead line and underground cable between the Avonmouth Substation and the existing G Route at Junction 18 of the M5/M49 motorway (Section G). The magnitude of effect would be minor, and the receptor sensitivity of human health (public, off site workers within Avonmouth) and the environment including controlled waters (rhynes would be high. The overall significance of the effect following implementation of mitigation measures, of the Proposed Development resulting in residual contaminated soils left at the surface following site activities would be a **minor adverse** effect.

9.8.65 Potential risks to construction and maintenance workers arising from contamination within soil and groundwater during the construction, operation and decommissioning phases of the Proposed Development would be controlled under the CDM Regulation, 2007 and include embedded mitigation measures detailed in this chapter and the Draft CEMP, **Volume 5.26.1**, the requirement to work in accordance with best practice and statutory guidance and the requirement for PPE as standard working practice. The receptor sensitivity of human health of workers would be high. The magnitude of effect to human health in consideration of the embedded mitigation measures required under CDM, statutory guidance and the Draft CEMP would be negligible. The overall significance of effect would be **negligible**.

9.8.66 There are SSSI designated areas along the Proposed Development, especially on the Kenn, Nailsea and Tickenham Moors (Section D). These would be considered to have a high receptor sensitivity. The magnitude of effect would be considered to be negligible following implementation of mitigation measures. The overall significance of effect following implementation of mitigation measures, of the Proposed Development resulting in residual contaminated soils left at the surface following site activities would **negligible**.

Accidental Import or Spreading of Contaminated Material within the Working Area during On Site Activities

9.8.67 For the Proposed Development as a whole, the magnitude of effect would be negligible. The receptor sensitivity would be medium, with the overall significance of effect following implementation of mitigation measures, of the Proposed Development resulting in accidental import or spreading of contaminated material within the working area would be **negligible**.

9.8.68 There is however areas of greater sensitivity along short sections of the Proposed Development. This includes designated sites or areas close to population centres

such as SSSI on the Kenn, Nailsea and Tickenham Moors (Section D), or close to residential properties at Mark, Webbington, Sandford, Yatton, Nailsea and Avonmouth Village. Surface water receptors such as rhynes and rivers would also be considered particularly sensitive, including rhynes crossings. The SSSI on Kenn, Nailsea and Tickenham Moors is assigned to the drainage ditches and rhynes and would be of high sensitivity. For these areas, the receptor sensitivity would be considered high and the magnitude of effect to be negligible following implementation of mitigation measures. The overall significance of effect following implementation of mitigation measures, of the Proposed Development resulting in accidental import or spreading of contaminated material within the working area would be considered to be **negligible**.

9.8.69 Risks to construction and maintenance workers arising from contamination within soil and groundwater during the construction, operation and decommissioning phases of the Proposed Development would be controlled under the Construction, Design and Management (CDM) Regulation, 2007 and include embedded mitigation measures detailed in this chapter and the Draft CEMP, **Volume 5.26.1**, the requirement to work in accordance with best practice and statutory guidance and the requirement for personal protective equipment (PPE) as standard working practice. The receptor sensitivity of human health of workers would be high. The magnitude of effect to human health in consideration of the embedded mitigation measures required under CDM, statutory guidance and the Draft CEMP would be negligible. The overall significance of effect would be **negligible**.

9.9 Cumulative Effects

9.9.1 The cumulative assessment is provided at **Volume 5.17.1** and includes potential cumulative effects of the Proposed Development together with other major development proposals.

9.9.2 The primary cumulative effects identified for the ground environment from the Proposed Development and other nearby major development proposals are as follows:

- loss of or damage to structure of topsoil during soil stripping operations and reinstatement, leading to poor crop establishment and lower yields;
- loss of or damage to structure of topsoil during soil stripping operations and reinstatement, leading to significant changes in soil drainage parameters;
- ingress of sediment or silts into surface water courses arising through construction, operation or decommissioning phase activities;
- contamination of soils during construction, operation or decommissioning phases by on site activities;
- contamination of groundwater aquifers during construction, operation or decommissioning phases by on site activities;
- remobilisation of contamination in groundwater by on site activities;
- residual contaminated soils at the surface following on site activities; and
- accidental import or spreading of contaminated material within the working area during on site activities.

9.9.3 These effects to the ground environment may occur as a result of Proposed Development and other major development proposals being in close proximity to one another.

9.9.4 The assessment of cumulative effects has identified that the combination of the Proposed Development and other major development proposals would have a **negligible** to **minor adverse** residual significance of effect on the ground environment following implementation of appropriate mitigation measures identified within section 9.7 of this chapter. This is predominantly due to the geographic separation and the localised physical impacts to the ground environment that the major developments are likely to have cumulatively.

9.9.5 It is considered that no additional mitigation measures in addition to those identified within this chapter would be required to mitigate potential cumulative residual effects.

9.10 Conclusions

Construction Effects

9.10.1 Overall, the majority of the Proposed Development would have a **negligible** significance of effect on the ground environment, following implementation of mitigation appropriate to each potential environmental impact during the construction phase.

9.10.2 There are however areas of greater sensitivity along the route of the Proposed Development where the residual significance of effect to the ground environment has been assessed as having a minor adverse effect following the implementation of mitigation measures. These include:

- the activation of unstable or undermined ground particularly within Section D at the West End Trading Estate at Nailsea where former below ground coal mining, coal mineshafts and pits are recorded;
- the creation of preferential migration pathways for ground gas/landfill gas or mine gas resulting from the construction of the Proposed Development, particularly within Section D at Nailsea where the Proposed Development

passes across former coal workings and is in close proximity to residential and commercial properties. Minor adverse effects are also identified where the Proposed Development passes across landfill sites, such as within Section F-Portishead and Section G – Avonmouth;

- the loss of soil structure leading to changes in soil drainage parameters and crop establishment has been identified as a minor adverse effect, particularly where larger scale excavations are proposed, such as along the proposed underground cable routes within Section C, D, E and F; and
- the remobilisation of contaminants within groundwater from the construction of the Proposed Development, particularly close to areas of industrial land use such as within Section G – Avonmouth or close to landfills would result in a minor adverse effect to the ground environment following implementation of mitigation measures.

Operational Effects

9.10.3 The residual significance of effect to the ground environment, following implementation of mitigation measures during the operational phase of the Proposed Development would to be **negligible**.

Decommissioning Effects

9.10.4 The residual significance of effect to the ground environment, following implementation of mitigation measures during the decommissioning phase of the Proposed Development would be similar to those identified for the construction phase and would be **negligible** to a **minor adverse** effect.

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