

11. Soil, Geology, Agricultural Land and Land Quality

11.1 Introduction

11.1.1 This chapter presents a preliminary assessment of potential effects on soils, geology, agricultural land and land quality arising from the Moorside Project. Of particular interest for this chapter are the potential effects on soils and agricultural land at the Moorside Project Sites during the construction and operational phases of the Moorside Project. The assessment also considers the potential effects on receptors (e.g. human beings, livestock, buildings, and groundwater) that might directly come into contact with any non-radiological land contamination during the construction and operational phases of the development. However, the assessment of changes to land quality is also of relevance to other environmental receptors, which are described in the following chapters of the PEIR, notably:

- Freshwater: groundwater (Chapter 13);
- Freshwater: surface water (Chapter 14);
- Terrestrial and Freshwater Ecology (Chapter 18);
- Radiological contamination, which is considered in Chapter 20.

11.2 Limitations of the PEIR

General

11.2.1 The scale and complexity of the Moorside Project means that it is continuing to evolve at this preliminary stage, which presents limitations in terms of programme and phasing. In addition survey work has yet to be undertaken, or fully completed, for some Moorside Project Sites. These limitations has meant that this PEIR chapter has focussed on the Moorside Site and the Accommodation Sites, as there is greater information available for these in order to use in the preliminary assessment. Accordingly the Corkickle to Mirehouse Railway Site; the St. Bees Railway Site; and the proposed Highways Improvement sites are not considered in the PEIR, but will be included in the ES for DCO submission.

11.2.2 In addition, the assessment in this PEIR has focussed on the construction and operational phases of the Moorside Site and Accommodation Sites.

11.2.3 Decommissioning has not been specifically assessed within the PEIR, as it remains uncertain at this point which elements would be decommissioned and when. Each of the Moorside Project Sites may see some element of decommissioning activity undertaken once the construction phase of the MPS itself is complete (demolition or removal of certain features) and the effects of these operations are expected to be no greater than those in the

construction phase assessments (Tables 12.6, 12.7, 12.8 and 12.9) for these sites. The decommissioning phase of each Moorside Project Site will be included in the ES. As discussed in Section 2.6, decommissioning of the MPS itself will also be included within the ES, but at a high level given that these activities will take place around 60 years after operations commence, and they will be covered by a discrete EIA of the activities at that time.

Technical

- 11.2.4 A first phase of intrusive investigations has been undertaken on the Moorside Site in 2015 and a second phase has been implemented and is planned to be completed by the end of July 2016. However, for this report, it has only been feasible to provide a summary of results from the 2015 investigation.
- 11.2.5 Baseline Agricultural Land Classification (ALC) information used for this preliminary assessment is based on the pre-1976 Agricultural Land Classification - Provisional (England) maps and as such does not provide details on whether Grade 3 land is 3a or 3b. This will be addressed as part of planned detailed soil and agricultural land surveys, although these surveys will not be commenced until April 2016 and the results from them will not be available to inform this PEIR.
- 11.2.6 Baseline Best and Most Versatile Land (BMV) information is based on the predictive BMV information provided by Natural England. This information is intended only for strategic planning purposes and is not suitable for use below 1:250 000 scale or for the definitive classification of an area or site. The planned soil and agricultural land surveys will provide site specific information, but the information is not available to inform this PEIR.
- 11.2.7 Desk studies on the Mirehouse Site, Corkickle Site and Egremont Site have been carried out, but intrusive (Phase 2) investigation works have not been completed and therefore the results will not be available to inform this PEIR.
- 11.2.8 The full extent and location of the site infrastructure is yet to be finalised and, as such, the impact assessment is still preliminary.

11.3 Policy and legislative context

- 11.3.1 The following legislation, planning policy and guidance is being used to inform this assessment:

Policy (National and Local)

- National Policy Statement for Energy (EN-1):
 - Paragraph 5.10.8 dissuades developers from developing on, “*the best and most versatile agricultural land*” (land grade 1, 2, 3a) and instead advises developers to build on areas of poor agricultural quality (land grade 3b, 4, 5). In either case, developers must consider how they will mitigate any damage they will cause to soil quality.

- Paragraph 5.10.15 states that applicants should not site their schemes on best and most versatile agricultural land without justification. However, little weight should be given to the loss of poorer quality agricultural land (grades 3b, 4 and 5).
- EN-1 also provides guidance on generic Pollution Control, Biodiversity and Geological Conservation and Land use at Sections 4.10, 5.3 and 5.10.
- National Policy Statement for Nuclear Power Generation (EN-6)
 - Paragraph 3.7.8 states that *“The contamination of soils and water resources can be mitigated through the EIA process and managed through the possible implementation of Environmental Management Plans.”*
 - Paragraph 3.8.3 states that *“applicants should assess the site’s geology, soils and geomorphological processes”*.
- National Planning Policy Framework (NPPF):
 - The NPPF states that the natural environment should be conserved and enhanced by: remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land; and protecting and enhancing geological conservation interest and soils.
 - Paragraph 109 clearly emphasises the need for planning to protect and enhance the natural environment. It is important that planning ensures no undue damage is caused to soils on or around a development. If damage would be caused during development or during the operation of the developed building, mitigation needs to be put in place to ensure there is no net loss of biodiversity.
 - Paragraph 112 states, *“Local planning authorities should take into account the economic and other benefits of the best and most versatile agricultural land. Where significant development of agricultural land is demonstrated to be necessary, local planning authorities should seek to use areas of poorer quality land in preference to that of a higher quality.”*
- Allerdale Local Plan:
 - Policy S35 identifies that soil resources will be protected in line with policy 36. Policy 36 states that development will not be permitted if it impacts on soils or substrata unless adequate mitigation can be secured.
- Copeland Local Plan
 - Strategic Objective 19. Safeguard and where possible enhance the natural (including mineral and soil) resources in the Borough and, in addition, address the impacts of mining, iron working, nuclear energy and other former land uses.

Guidance

- Environment Agency Groundwater Protection: Principle and Practice (GP3) Pollution Prevention Guidance Notes (PPGs) (Reference 14);
- Environment Agency Pollution Prevention Guidelines;
- Environment Agency CLR 11, Model Procedures for the Management of Land Contamination (Reference 12);
- Relevant British Standards (e.g. BS 3882:2007 Specification for topsoil and requirement for use; BS 6031:2009 Code of practice for earthworks; BS10175:2011 Investigation of Potentially Contaminated Sites - Code of Practice) (References 1 to 4);
- Department of Environment. Prioritisation and categorisation procedure for sites that may be contaminated. Contaminated Land Report 6 (Reference 10);
- Guidance on the Safe Development of Housing on land affected by contamination (NHBC, Environment Agency and CIEH) 2008 (Reference 17);
- Guiding Principles for Land Contamination (Environment Agency 2010) (Reference 13);
- Guidance on the Preliminary Inspection of Contaminated Land, DETR 1994 (CLR2) (Reference 11);
- CL:AIRE (2011) The Definition of Waste: Development of Industry Code of Practice (Reference 8);
- Construction Industry Research and Information Association (CIRIA) reports (e.g. CIRIA Report 132: A guide for safe working practices on contaminated sites (1996), CIRIA Report C532: Control of Water Pollution from Construction sites (2001); CIRIA Report C692: Environmental Good Practice on site (3rd Edition) (2010)) (References 5 to 7);
- HSE 1991 Protection of workers and the general public during the development of contaminated land (Reference 15);
- MAFF: Good Practice Guide for Handling Soils (2000) (Reference 16); and
- Codes of practice (e.g. Defra 2009: Construction Code of Practice for the Sustainable Use of Soil in Development sites, Reference 9).

Legislation

- Control of Pollution Act 1974 (as amended);
- Environmental Protection Act 1990 (as amended);
- Contaminated Land (England) Regulations 2006;
- Environmental Damage (Prevention and Remediation) Regulations 2009;
- The Environmental Permitting (England and Wales) Regulations 2010;

- Water Resources Act 1991 and the Anti-Pollution Works Regulations 1999.

11.4 Data gathering methodology

Study Area

- 11.4.1 The Study Area includes the Moorside Site, Mirehouse Site, Corkickle Site, and Egremont Site together with a 1 km 'Zone of Influence' (Zol) around their respective boundaries for land quality assessment purposes.
- 11.4.2 Based on professional judgement, the Zol of a 1 km buffer area is considered to be a maximum distance over which most forms of potential contamination are realistically likely to migrate from the source location. The locations, site boundaries and Zol are defined on **Figure 11.1**. No assessment of the foreshore and coastal/ marine waters is provided in this chapter as this is covered in **Chapter 15**.
- 11.4.3 A number of other sites have been identified as locations for development to improve the transport infrastructure. The sites are:
- Corkickle to Mirehouse Railway Site;
 - St. Bees Railway Site; and
 - Sites for the Highways Improvements.
- 11.4.4 Baseline information for these sites is being collected, but is not available to inform this PEIR. For these sites, a study area of 1 km from the site boundaries will also be adopted for considering effects in relation to soils, geology and land quality. In some cases, such as for Highway Improvement sites, it may be possible to scope out effects.

Desk study

- 11.4.5 Phase 1 desk based assessments have been undertaken on only part of the Moorside Site, together with the Mirehouse Site, Corkickle Site and Egremont Site. The desk study information that is available is presented in this PEIR. The purpose and objectives of these desk studies is to:
- Provide desk based information to characterise and assess the baseline soil, geology and land quality condition of the sites as required by the EIA Regulations;
 - Identify which receptors are present and where;
 - Identify potential geo-environmental constraints, risks and impacts (e.g. the presence of potential land contamination) that may be associated with the potential acquisition and development of the sites;
 - Where necessary, assist in the appropriate scoping and design of subsequent Phase 2 intrusive baseline/ site characterisation surveys; and

- Provide desk based information to assist with the preliminary engineering/ construction design of the proposed sites.

11.4.6 The following key data sources have been used in preparing the desk based assessments:

- Digital GIS based Landmark Envirocheck™ report including historical OS maps;
- Review of current OS plans;
- British Geological Survey (BGS) logs, online mapping and both BGS Geology of Britain and GeolIndex interactive websites;
- Web-based mapping from the Environment Agency's (EA) website ("what's in my back yard?") online mapping;
- Data relating to ecological receptors from the online Multi Agency Geographic Information for the Countryside (www.magic.gov.uk) mapping;
- Current aerial photography and mapping from Google;
- Information from Cumbria GeoConservation on potential non-statutory designated geological conservation sites on or in the vicinity of the Moorside Project Sites;
- Previous site investigation reports and surveys (where relevant and available);
- Site reconnaissance/ walkover information;
- Coal Mining Authority interactive websites;
- Non coal mining reports and associated information where applicable;
- Local Authority/ Cumbria County Council/ Environment Agency environmental information requests;
- Durham Mining Museum website;
- Local Petroleum Officer information searches; and
- Animal and Plant Health Agency information requests.

11.4.7 Desk studies for the Corkickle to Mirehouse Railway Site and St. Bees Railway Site and the sites for the Highway Improvements are planned, but are not yet available to inform this PEIR.

11.5 Survey work

11.5.1 The survey work undertaken to date has consisted of:

- Preliminary Phase 1 geo-environmental desk study on the majority of the Moorside Site;

- Intrusive (Phase 2) investigations on the Moorside Site. Preliminary intrusive works (boreholes trial pits, soil and groundwater sampling and testing) have been undertaken on parts of the Moorside Site to provide initial information on the geology; hydrogeology; geotechnics; and land quality of the site. Further, and more detailed, intrusive works across the whole of the Moorside Site are underway at the time of writing and are planned to be completed by July 2016;
- Phase 1 geo-environmental desk studies of the Mirehouse Site, Corkickle Site and Egremont Site.

11.5.2 The desk studies for the above sites have included site walkovers.

11.5.3 The above surveys have been undertaken in accordance with key relevant guidance, namely:

- Environment Agency CLR 11, Model Procedures for the Management of Land Contamination;
- BS10175:2011 Investigation of Potentially Contaminated Sites - Code of Practice;
- BS5930:2015 Code of practice for ground investigations.

11.5.4 In addition to the above surveys which have been undertaken, the following field surveys will be undertaken during 2016, but unfortunately the results are not available to be included within this PEIR:

- Detailed site specific ALC and Soil Resource Surveys for the Moorside Site, the Mirehouse Site, the Egremont Site and the St. Bees Railway Site. The surveys will be undertaken by a specialist contractor and desk and field surveys are planned to commence in April 2016. For the Corkickle Site, a more limited and targeted survey will be undertaken due to fact that this is mainly an urban area and contains little or no agricultural land. No surveys are proposed for the Corkickle to Mirehouse Railway Site, or the highway improvement sites, as these contain no agricultural land;
- Phase 2 intrusive site investigations (Corkickle Site, Mirehouse Site and Egremont Site).

11.5.5 The soil surveys would comprise augering to a depth of 1.2 m, with soils described according to the Soil Field Handwork. A sampling density of one auger per hectare will be adopted with the exception of the Moorside Indicative Area for Environmental Measures, where an auger density of one for every two hectares would be adopted because there is likely to be limited disturbance of this area.

11.6 Consultation

11.6.1 Further to the details outlined in **Chapter 3** regarding the consultation that has taken place to date, it should be noted that consultation from the following organisations has been used to inform the scope of the assessment. This consultation has included the responses to the regular meetings and

discussions held on the Survey and Monitoring Plans, quarterly update meetings, EIA Scoping Report, along with other discussions and consultations with the organisations directly:

- Environment Agency (EA);
- Natural England (NE);
- Sellafield Ltd.;
- Cumbria County Council (CCC);
- Allerdale Borough Council (ABC); and
- Copeland Borough Council (CBC).

11.6.2 **Table 11.1** provides details of the issues which have been raised during these consultations, and a response on how they are being considered in the EIA process.

Table 11.1 Consultation responses received

Issue raised	Consultees	Response
<p>Recommendation that soil and ALC surveys should follow Defra Construction Code of Practice for the Sustainable Use of Soils on Construction Sites and a sampling density 1 sample per hectare should be used.</p>	<p>Natural England.</p>	<p>Recommendations have been incorporated into soil and ALC surveys. Mitigation measures will reference the Defra Code of Practice.</p>
<p>The ES will need to include information on volumes of soils, soils management including re-use and this should be detailed in a soils management plan.</p>	<p>Natural England, Cumbria County Council</p>	<p>Soils management plans will be developed and agreed with the EA/CCC/CBC and these will cover the re-use of soils. The ES will include information on the volumes of soils that will need to be managed, together with details of temporary stockpiles and restoration. Volumes of soils are not included in this PEIR.</p>
<p>Baseline Best and Most Versatile Land (BMV). Natural England considered that it is rarely possible to improve non BMV land to BMV land and therefore this should not represent a mitigation measure. However Natural England did consider that it might be possible to improve agricultural land of low quality or to rehabilitate/reclaim non -agricultural land using surplus soils.</p> <p>Natural England also considered that an aim for mitigation should be to minimise loss of BMV land, and that this objective should remain irrespective of the Moorside Site being located for new nuclear build.</p> <p>Natural England also flagged that BMV information is at strategic level.</p>	<p>Natural England</p>	<p>Observations noted and will be reviewed once soil and ALC Surveys completed and findings will feed into soil management plans.</p> <p>Point noted.</p>

Issue raised	Consultees	Response
		PEIR document updated to record that available BMV information is at strategic level.
Natural England considered that the predicted effects should include loss of soils due to sealing (e.g. buildings) and use as fill.	Natural England	The predicted assessment Tables 11.6-11.9 have been updated to include to these effects on soils.
PEIR should include additional information on the baseline for the Moorside and Accommodation Sites.	Copeland Borough Council	Available Desk study information for the Moorside Site and Accommodation Sites added. Further information to be added as data from planned surveys becomes available.
<p>Recommendation that the effect of ground gas on human health should be considered in assessment.</p> <p>Duration of ground gas monitoring.</p>	<p>Cumbria County Council</p> <p>Sellafield Ltd</p>	<p>Assessment Tables 11.6-11.9 updated to include ground gas.</p> <p>Monitoring on the Moorside Site will be undertaken for a minimum of 3 months and the results reviewed to determine the need to continue monitoring. The investigations to date have identified limited evidence of made ground or peat deposits and therefore ground gas is not expected to be an issue. Potential sources of ground gas (e.g. former coal workings) have been identified at the Corkickle Site and the Mirehouse Site and this will be assessed as part of future investigations.</p>
Clarification required on whether potential unstable ground had been considered for the built environment / construction workers receptors.	Cumbria County Council	It is considered more appropriate to deal with the effects of unstable ground as part of the engineering design and therefore this will not be covered in the PEIR, but will be addressed in the ES once design details are available.
<p>Comment that mitigation measures for land contamination will need to be developed with design detail.</p> <p>Recommendation for additional mitigation of site security to stop trespassers getting onto site and becoming exposed to potentially contaminated ground.</p>	Cumbria County Council	<p>Agreed these measures will be developed with design detail.</p> <p>Site security now included as a mitigation measure.</p>

Issue raised	Consultees	Response
The assessment methodology including details of how the sensitivity, magnitude and significance of impacts are assessed needs further definition	Copeland Borough Council, Cumbria County Council	Information on sensitivity, magnitude and significance added (Tables 11.3 to 11.5).
<p>Consistency in use of definitions of sensitivity/magnitude and effect in tables and in particular for soils and geological receptors.</p> <p>The assessment tables give no consideration of whether residual significance of effect would be adverse or beneficial.</p>	Cumbria County Council	<p>Tables 11.6-11.9 have been corrected and updated to provide consistency in use of sensitivity and magnitude.</p> <p>The default is that effects are adverse, unless otherwise stated as being beneficial. Further clarification will be provided in the ES, once further information on the design is available (see paragraph 11.8.34).</p>
Clarification required on geological sites that are potential receptors	Cumbria County Council	<p>Geological sites (Moorside Site and the Accommodation Sites) have been identified as part of the desk studies and are dealt with in this PEIR document.</p> <p>Desk studies are still to be undertaken for the Additional Sites, but are only likely to be relevant to the St. Bees Railway Site.</p>
Uncertainty on whether contamination associated with Sellafield Tarn was an issue for the development.	Cumbria County Council, Environment Agency	Although the Sellafield Tarn is located within the Moorside Site, the footprint of the construction activities does not extend to the Tarn. The PEIR document has been updated to screen out contamination related to the Tarn.
The PEIR document should provide clarity on soil / groundwater contamination and where impacts on human health are dealt with (e.g. soils or groundwater chapter).	Cumbria County Council	The effects of groundwater contamination on human health are now covered in this chapter.

11.7 Scope of the assessment

Overview

- 11.7.1 The scope of the assessment as far as land quality (contamination) is concerned is non radiological soil contamination only. Radiological contamination is covered in **Chapter 20**.
- 11.7.2 With respect to non-radiological soil contamination for the Moorside Project, the full range of receptors that could be affected by potential contaminants are considered. The receptors include human beings, other living organisms, controlled waters, physical systems and built structures. The potential effects from non-radiological soil based contamination to controlled waters (i.e. groundwater and surface water) are dealt with in this Chapter, but ecological effects are dealt with in **Chapter 18** (Terrestrial and Freshwater Ecology), which will also deal with the effects to protected species. Further details of groundwater and surface water quality are covered in **Chapters 13 and 14** respectively. The risks considered in this chapter will focus primarily on the health of human receptors, together with the health of stock animals with on-going or future access to parts of the development sites, and retained or future built structures.
- 11.7.3 Geological effects are only considered where potential effects may occur to statutory (e.g. SSSI) and/ or non-statutory (e.g. Local Geology Sites (LGS)) and Regionally Important Geological/ geomorphological Sites (RIGS).
- 11.7.4 In terms of agricultural land, the scope will focus on the Agricultural Land Classification of the sites required for the Moorside Project, together with the soil resources, specifically topsoil and subsoil, which could be subject to loss, damage, impairment and/or disturbance.

Potential receptors

- 11.7.5 The following receptors have been identified as having the potential to be subject to likely significant effects from within the defined Zol:
- Human Health (e.g. construction & maintenance workers; unauthorised site users (trespassers); residents of the Accommodation Sites; future workers and recreational users that have access to the parts of all operational sites (e.g. via footpaths) and potentially adjacent land users);
 - Controlled waters;
 - Property (buildings and services);
 - Property (e.g. crops, livestock, wild and domesticated animals);
 - Geology (SSSIs/ LGS and or RIGS only);
 - Soil resources (i.e. topsoils and subsoils); and
 - Agricultural Land Classification, with specific focus on BMV land.

Spatial and temporal scope

- 11.7.6 The geographical extent of the assessment currently covers the site boundaries of the Moorside Site, together with the Accommodation Sites (Corkickle, Mirehouse and Egremont) as well as the Zols (where these apply) around the site boundaries (as defined in **Figure 11.1**). The Additional Sites, including the Corkickle to Mirehouse Railway Site and the St. Bees Railway Site and the sites for the highway improvements, will also be included in the assessment once the surveys of these areas are completed.
- 11.7.7 For this chapter, the Zol has been set at 1 km from each of the site boundaries for potential land quality effects (including gas and groundwater migration). However, the spatial scope of the assessment would be limited to the boundaries themselves for potential soil resources, geology and agricultural land quality effects, since these receptors would only be subject to direct effects from their disturbance.

Potentially significant effects

- 11.7.8 Potential effects on soil, geology, agricultural land quality and land quality receptors are most likely to occur during the site construction phase, although adverse land quality effects could also occur during decommissioning. The assessment will also cover potential effects arising during the operational phase, as appropriate.
- 11.7.9 With respect to potential significant effects on soil resources, depending on the characteristics of the soil, these could occur as a result of the handling, storage and replacement of the soils, depending on how vulnerable the soils are to having their structure degraded. In this respect, handling soils when wet; mixing soils of different types; and causing over-compaction during storage and restoration, are all examples of changes that might lead to significant adverse effects on soil receptors, which in turn could lead to a deleterious effect on post-construction/ restoration ALC classes.
- 11.7.10 In terms of designated geological sites, potential significant effects are only likely to be associated with the potential direct loss and/or damage or degradation of such sites.
- 11.7.11 For receptors (e.g. human health, property) that may be subject to potentially significant effects from ground contamination, the assessment will consider: the source (contaminated soil, groundwater or gas and the nature of the contaminant); the pathway to the receptor (e.g. dermal contact, inhalation, ingestion etc.), the sensitivity of the receptor to the contaminant and whether a pollutant pathway exists.

11.8 Environmental measures incorporated into the proposed development

- 11.8.1 Details of environmental measures that have been incorporated into the overall design of the Moorside Project are set out in **Chapter 2** of the PEIR.

Specific measures relating to this environmental topic and how these have been targeted to specific Soil, Geology, Agricultural Land and Land Quality receptors at each of the Moorside Project Sites are set out in **Table 11.2**. Where environmental measures are currently unknown, or uncertain, they are not included within **Table 11.2**. Further measures will be included in the ES as they are designed and confirmed.

Table 11.2 Rationale for incorporation of environmental measures

Potential receptor	Predicted changes and potential effects	Incorporated measure
Common to all sites		
Human Health (Construction workers, adjacent site users and potential trespassers during construction works).	Health effects from exposure to contaminated soils and groundwater during excavation of potential contaminated material.	Detailed prior intrusive investigation and assessment of land quality; remediation of the sites as necessary; use of appropriate PPE/ safe working systems/ good hygiene practices; use of good environmental construction practice, e.g. materials management, dust control, bunding of fuel/ chemical storage etc. The site will also be securely fenced to deter unauthorised access.
Human Health (Construction workers, adjacent site users and potential trespassers during construction works).	Health effects from exposure to dangerous levels of mine (and ground) gases, especially if working within confined spaces.	Detailed prior investigation and assessment of gas risks and the implementation of safe working systems during works to ensure gas levels are monitored in at-risk locations. Use of warning signage and measures to restrict unauthorised access to at-risk areas, including confined spaces. The site will also be securely fenced to deter unauthorised access.
Human Health (future site users, adjacent site users - operational phase).	Health effects from exposure to potential contaminated soils and groundwater.	Detailed prior intrusive investigation and assessment of land quality (carried out at the construction phase); remediation of the sites as necessary; good materials management during construction to prevent inadvertent replacement of unsuitable materials on site; incorporation of design/ construction mitigation measures as required (e.g. gas protection measures, clean cover systems, appropriate material specification water pipes etc.) Pollution prevention infrastructure and environmental management systems as required by Environmental Permit.
Property (built environment).	Damage, deterioration, degradation of built environment due to exposure to potential contaminated soils.	Detailed prior intrusive investigation and assessment of land quality; remediation of the sites as necessary; good materials management during construction to prevent inadvertent replacement of unsuitable materials on site; incorporation of design/

Potential receptor	Predicted changes and potential effects	Incorporated measure
		construction mitigation measures as required. Pollution prevention infrastructure and environmental management systems as required by Environmental Permit.
Property (crops, livestock, wild and domestic animals).	Health effects, reduced yield from exposure to potential contaminated soils.	Detailed prior intrusive investigation and assessment of land quality; remediation of the sites as necessary; good materials management during construction to prevent inadvertent replacement of unsuitable materials on site; incorporation of design/ construction mitigation measures as required. Pollution prevention infrastructure and environmental management systems as required by Environmental Permit.
Soil environment.	Impairment, reduction in quality and functionality of soil due to potential contamination.	Detailed prior instructive investigation and assessment of land quality; remediation of the sites as necessary; good materials management during construction to prevent inadvertent replacement of unsuitable materials on site; incorporation of design/ construction mitigation measures as required. Pollution prevention infrastructure and environmental management systems as required by Environmental Permit.
Soil environment.	Damage/ degradation of sub and topsoils during stripping, excavation, handling, stockpiling and replacement etc. (e.g. compaction/ consolidation)	Conduct detailed intrusive/ site specific ALC/ soil resource surveys to characterise and assess soil resource. Careful pre planning and phasing of works to minimise stockpiling of soils where possible. Carry out construction works in accordance with a detailed Soil Management Plan and upkeep of a Site Condition Report. Rehabilitate soils recovered from storage by adoption of best practice (e.g. Construction Code of Practice for the Sustainable Use of Soil on Construction Sites).
Agricultural Land	Permanent and/ or temporary loss of agricultural land as a result of the development.	The examination of ways to avoid and/or minimise permanent loss of BMV land e.g. through re-design and planning of proposed development; rehabilitating areas where possible; and potentially undertaking, for example, works to improve poor quality agricultural land within the offsetting areas by the placement of surplus soils and potentially the provision of other land enhancement techniques including improved drainage provision.
Geological features of Interest.	Damage, destruction, and/or loss of access to	Confirmation of features of interest and design/ planning of proposed development

Potential receptor	Predicted changes and potential effects	Incorporated measure
	geological features of interest as a result of the construction works.	to prevent damage, destruction or loss of feature.

11.9 Assessment methodology

Methodology for prediction of effects

11.9.1 The significance of any effects on the various soils and land quality receptors outlined above is determined through consideration of the ‘*value and sensitivity*’ of each receptor (or receptor group) and the ‘*magnitude of change*’ that would be brought about by the construction and operation of the Moorside Project. The approach accords with the methodology outlined in the Scoping Report (Reference 18, NuGen).

Receptor value and sensitivity

- 11.9.2 The value of the receptor is a function of a range of factors (e.g. environmental value, social/ community value and economic value). In some instances, the inherent value of a receptor has been recognised by experts and Governmental bodies by means of designation. The sensitivity of an environmental receptor is a function of its capacity to accommodate or tolerate change.
- 11.9.3 **Table 11.3** provides a summary of the methodology used to classify the sensitivity or value of soils and land quality receptors that could be subject to potential effects.

Table 11.3 Guidelines for the assessment of soils and land quality value and sensitivity

Sensitivity	Criteria	Examples
Very High	Receptors with very limited potential for substitution/ replacement and very low capacity to accommodate or tolerate contamination.	<ul style="list-style-type: none">) Humans;) Strategically important or very high value buildings and built environment (e.g. the MPS and adjacent buildings within the Sellafield Site).) Irrigated agriculture;) ALC Grades 1 & 2;) Geological site of national importance (e.g. SSSI).
High	Receptors with limited potential for substitution/ replacement and low capacity to accommodate or tolerate contamination.	<ul style="list-style-type: none"> ▪ Important buildings with high value (e.g. listed buildings); ▪ Stock animals; ▪ Non-irrigated agriculture; and both entry level and higher level agri-environment schemes;

Sensitivity	Criteria	Examples
		<ul style="list-style-type: none"> Soils with low or no wetness limitation affecting workability (wetness class II), where drought is not also a limitation; soils with some seasonal susceptibility to structural damage and soil erosion; and soils with a high susceptibility to structural damage and soil erosion throughout the year, including heavily textured, poorly structured soils; ALC grade 3a; Regional designated geological site of interest, protection or conservation (e.g. RIGS).
Medium	Receptors with some potential for substitution/ replacement to accommodate or tolerate contamination.	<ul style="list-style-type: none"> Medium value built environment (e.g. detached house or small office block); Soils with moderate wetness limitation affecting workability (wetness class III or IV); and soils with medium to coarse textures and some resistance to structural damage for most of the year; ALC grade 3b; Locally designated geological site of interest, protection or conservation (e.g. LGS).
Low	Receptor with low value, quality and/ or rarity, at a local scale only, potential for substitution and a high capacity to accommodate or tolerate contamination.	<ul style="list-style-type: none"> Low value building or built environment (e.g. hardstanding, pavement, drains); Soils with high wetness limitation affecting workability; and soils in which droughtiness is a limitation to crop growth, coarse textured and stony soils with little potential for structural damage; ALC grade 4 and 5; No national, regional or locally designated geological site of interest, protection or conservation.

Magnitude

11.9.4 The magnitude of change acting on land quality receptors is independent of the sensitivity and value of the receptor. The assessment of such change is proposed to be largely qualitative, and hence reliant on professional judgement, although it will be informed by quantitative information and analysis. **Table 11.4** provides examples of how various magnitudes of change will be determined with respect to soils and land quality.

Table 11.4 Guidelines for the assessment of soils and land quality magnitude

Magnitude	Criteria	Examples
High	Results in major change to feature of sufficient magnitude to affect its use/integrity	<ul style="list-style-type: none"> ▪ Exposure to soil contamination is considered to pose a potentially high risk to human receptors with one or more contaminant linkages certain to be present as a result of construction or operation of the project. ▪ Built Environment: Irreparable damage to buildings, structures or the built environment resulting from exposure to chemical attack as a result of construction or operation of the project. ▪ Soil: Substantial pollution or structural change to soils from disturbance/handling, such that their use would be totally impaired. ▪ A net reduction in 'best and most versatile' land.
Medium	Results in noticeable change to feature of sufficient magnitude to affect its use/integrity in some circumstances	<ul style="list-style-type: none"> ▪ Exposure to soil contamination is considered to pose a potentially medium risk to human receptors with one or more contaminant linkages likely to be present. ▪ Built Environment: Damage to buildings, structures resulting from exposure to chemical attack. ▪ Soil: Some pollution or structural change to soils from disturbance/handling such that their use would be partially impaired. ▪ Existing land-use would be able to continue, but where changes would cause loss of yield, or the need for additional land management or increased use of fertilisers and herbicides.
Low	Results in minor change to feature with insufficient magnitude to affect its use/integrity in most circumstances	<ul style="list-style-type: none"> ▪ Exposure to soil contamination is considered to pose a potentially low risk to receptors with one or more contaminant linkages possibly present. ▪ Built Environment: Slight and easily repairable effects of damage to buildings or structures resulting from exposure to chemical attack. ▪ Soil: Slight pollution or structural change to soils from disturbance/handling such that their use would only slightly be impaired. ▪ Existing land-use would be able to continue, but with some changes leading to reduced yield, and where additional land management or increased use of fertilisers and herbicides.
Very Low	Results in little or no change to feature with insufficient magnitude to affect its use/integrity	<ul style="list-style-type: none"> ▪ Exposure to soil contamination is considered to pose a potentially negligible risk to receptors with one or more contaminant linkages unlikely to be present. ▪ Built Environment: Very slight non-structural damage or cosmetic harm to buildings or structures from exposure to chemical attack. ▪ Soil: No changes to soil environment or impairment of soil function. ▪ Short-term effects to receptors with no change to integrity. No material change to existing land use.

11.10 Land quality assessment methodology

- 11.10.1 In order to help assess the potential magnitude of change from existing land contamination (where present), the results of intrusive land quality investigations will be assessed in the ES using a tiered approach as advocated in CLR 11 (Reference 12, Environment Agency).
- 11.10.2 The results of the non-radiological soil analysis, groundwater analysis, and ground gas monitoring will be compared to a series of relevant Generic Assessment Criteria (GACs) to assess the potential risk to the different types of receptors being considered.
- 11.10.3 The results of the land quality investigations will be assessed using a tiered approach as advocated in guidance issued by the Department of the Environment and Rural Affairs (Defra) and the Environment Agency (Model Procedures for the Management of Contaminated Land, CLR 11). This guidance requires a tiered approach to be undertaken as follows:

Tier	Assessment Approach
Tier 1: Preliminary Risk Assessment	Development of a conceptual model. Preliminary Risk Assessment examining potential contaminants, pathways and receptors to identify the potential 'pollutant linkages'. Identification of further risk assessment requirements.
Tier 2: Generic Quantitative Risk Assessment (GQRA)	Screening of analytical results against generic assessment criteria (GAC) for soils and groundwater including Soil Guideline Values, Environmental Quality Standards, etc., to identify issues that require more detailed consideration. Identification of further risk assessment or risk management requirements.
Tier 3: Detailed Quantitative Risk Assessment (DQRA)	Refinement of site conceptual model which may require the collection of additional data. Application of detailed quantitative risk assessment procedures in accordance with CLR Guidance to further assess potential pollutant linkages. With respect to human receptors this may involve assessment of site specific exposure scenarios taking into account toxicological properties of substances to derive site specific assessment criteria (SSAC). With respect to controlled water receptors this may involve a numerical assessment taking account of dilution and contaminant attenuation to derive remedial target concentrations as described in GP3 (Environment Agency, 2012). Identification of further risk assessment or risk management requirements.

- 11.10.4 The results of the non-radiological soil and groundwater analysis, and ground gas monitoring will be compared (Tier 2) to relevant Generic Assessment Criteria (GACs) to assess the potential risk to different receptors including human health, controlled waters, the built environment and the soil environment including potential phytotoxic and ecological (i.e. ecotoxicological) effects. The outcome from this assessment will be to determine whether further assessment (Tier 3) is required and whether mitigation is required to reduce or remove the source of contamination or disrupt the pathway to the receptor.

11.11 Soil resources assessment methodology

- 11.11.1 The determination of potential significant effects on soils resources would be on the value of the soil resource, i.e. the quality of the soil to be handled, and the magnitude of change that it is predicted to be subjected to as a result of site operations. In terms of magnitude of change, this is determined by a number of factors, including the extent of any changes to in situ soil texture and structure for any particular soil receptor, which could impair its future restoration use. This would be measured in terms of soil volume affected (in cubic metres) or the extent of the area (measured in hectares) that can be created as part of the restoration.
- 11.11.2 Since ALC Class and therefore ‘*best and most versatile land*’ would be considered as a receptor, the effects on it would be determined by the extent that the development of the Moorside Project Sites affect this agricultural land. The assessment would take into consideration the potential restoration post construction that may be undertaken to replace BMV. In this way the degree of permanent net loss of BMV agricultural land as a result of the development will be ascertained and placed into context with the extent of such land within Cumbria.

11.12 Significance evaluation methodology

- 11.12.1 The significance evaluation methodology for soils, geology, agricultural land and land quality is based on that outlined in Section 3.3. However, given the number of levels of sensitivity/ value and magnitude of change considered in this chapter, a variation of Table 3.3 has been used as the basis of this assessment and this is presented in Table 11.5.

Table 11.5 Significance evaluation matrix

		Magnitude of change			
		High	Medium	Low	Very low
Sensitivity	Very high	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Potentially Significant)
	High	Major (Significant)	Major (Significant)	Moderate (Potentially Significant)	Minor (Not Significant)
	Medium	Major (Significant)	Moderate (Potentially Significant)	Minor (Not Significant)	Negligible (Not Significant)
	Low	Moderate (Potentially Significant)	Minor (Not Significant)	Negligible (Not Significant)	Negligible (Not Significant)

11.13 Preliminary assessment of residual effects

Baseline conditions

Moorside Site

- 11.13.1 The primary land usage is for agriculture (both arable and livestock grazing).
- 11.13.2 In terms of soil resources the soils are mainly classified as Wick 1 (541r) soils with some Fladbury 3 (813d) soils associated with the River Ehen.
- 11.13.3 The area is predominantly Agricultural Land Classification (ALC) Grade 3 (good to moderate) with small areas that are Grade 4 (poor) or urban land (see **Figure 11.2**). Large areas of the Moorside Site are indicated on Natural England's predictive map of Best and Most Versatile land as having a 'High' (>60 % likelihood) of being predictive BMV land (see **Figure 11.3**). However, further assessment will be undertaken to accurately determine the extent of BMV at the Moorside Site.
- 11.13.4 The geology predominantly comprises quaternary superficial deposits (a mixture of alluvium, sand and gravels, and Devensian Till) which overlie the Triassic Sandstone. The thickness of superficial deposits at the Moorside Site range typically from 5 to 50 m in thickness, but can be locally up to 70 m thick. Rockhead is close to the surface (5-10m deep) in the north east and central areas of the site. Made Ground is generally limited and very localised.
- 11.13.5 There are no national, regional or locally designated geological sites of interest, protection on conservation on or within 1 km of the Moorside Site with the exception of one LGS/ RIGS site at Calderbridge, Banks of River Calder Site No. 4/024. This site is designated for exposures of sandstone and for river meanders and terraces. The source of this information (Cumbria Geo Conservation web site) states that this site requires re-assessment, however no further details are given.
- 11.13.6 The following potentially contaminating land uses have been identified:
- Agricultural use including former and current farms;
 - Disused railway land and embankment (within and on the southern and western boundary of the Moorside Site);
 - Potential infilled land;
 - Potential infilled sand pits (north-western edge of Moorside Site);
 - Naturally occurring peat deposits (potential source of ground gases such as methane, carbon dioxide and hydrogen sulphide);
 - Potential soil contamination due to the migration of contaminated groundwater originating up hydraulic gradient of the Moorside Site (e.g. from below the Sellafield Site);

- Potential Made Ground on site. Note that areas of infilling/ mounding could potentially be sources of both soil contamination and ground gas; and
 - Infilled former Sellafield Tarn (south eastern corner of the Moorside Site boundary).
- 11.13.7 Sources of potential contamination that lie outside of, but could affect land quality within the Moorside Site are considered to include:
- Historical contamination within the Sellafield Site;
 - North tip extension landfill (located approximately 550 to 1000 m to the east of the Moorside Site); and
 - Spoil mounds (located approximately 400 m from the south eastern boundary of the Moorside Site).
- 11.13.8 The location of the above potential on and off site sources of contamination are shown on **Figure 11.4**.
- 11.13.9 On the basis of the available land use information and preliminary intrusive investigations conducted in 2014-2015, the likelihood of significant, widespread soil contamination within the Moorside Site is considered to be very low. However, localised soil contamination associated with the above sources could be present. Ground gas monitoring has been implemented, although as the investigations undertaken to date have identified the limited occurrence of Made Ground and peat deposits, ground gas is unlikely to be present at levels of concern (e.g. above assessment criteria).

Accommodation Sites

- 11.13.10 A brief summary of the baseline conditions relevant to soils, geology, agricultural land and land quality for each of the Accommodation Sites is presented below.

Corkickle Site

- 11.13.11 The Corkickle Site currently comprises a mixture of industrial units; a railway line and public passenger railway station; the culverted Pow Beck; scrubland and recreational facilities.
- 11.13.12 Land use for the site is defined as '*urban/ industrial*' (see **Figure 11.3**).
- 11.13.13 The site is underlain by superficial drift deposits which comprise alluvium, river terrace deposits and Glacial Till deposits. Made Ground is present on the site. The underlying solid geology comprises Pennine Middle Coal Measures Formation in the west and the Pennine Lower Coal Measures Formation in the east of the site.
- 11.13.14 The area has a history of coal mining and mine shafts are located on and to the west of the site.
- 11.13.15 There are no national, regional or locally designated geological sites of interest, protection on conservation on or within 1km of the site.

- 11.13.16 The following potentially contaminating land uses have been identified on and/or within 250 m of the site:
- Current and former (disused) railway land and embankments;
 - Current and former commercial and industrial activities including a timber yard;
 - Historical gas works and chemical works;
 - Historical mining and quarrying activities;
 - Landfilling/ infilling; and
 - The presence of Made Ground primarily from historical development, landfilling/ infilling and mining spoil disposal.
- 11.13.17 A summary of the locations of the above potential sources are shown on **Figure 11.5**.

Mirehouse Site

- 11.13.18 The primary land usage of the Mirehouse Site is for agriculture (both arable and livestock grazing). Soils are mainly classified as Wick 1 (541r) and Hollington (811c) soils.
- 11.13.19 The site comprises land of ALC Grade 3 (good to moderate) (see **Figure 11.2**). The Natural England's predictive map (see **Figure 11.3**) of Best and Most Versatile land indicates that the eastern part of the site as having a 'high' (>60 % likelihood) of being predictive BMV land, with 'moderate' (20 to 60% likelihood) of being predictive BMV land mostly in the west and urban/industrial land in the north.
- 11.13.20 The site is mainly underlain by Glacial Till, with alluvium (clay, silt, sand and gravel) present along the lines of water courses. There are also some areas of Glaciofluvial Deposits (sand and gravel) in the south west.
- 11.13.21 The underlying solid geology comprises the Pennine Lower and Middle Coal Measures (sandstone, mudstone and siltstone) with the Stainmore Formation (mudstone, siltstone and sandstone) present below the northern end of the site.
- 11.13.22 Historical coal mining has been undertaken on the site. A former drift mine is located in the south west corner of the site and a number of shafts are located on the eastern half of the site. An infilled lignite quarry is located on the eastern boundary of the site.
- 11.13.23 Made Ground (i.e. artificial ground) is likely to be associated with a former drift mine.
- 11.13.24 There are no national, regional or locally designated geological sites of interest, protection on conservation on or within 1km of the Mirehouse Site.
- 11.13.25 The following potentially contaminating land uses have been identified on and/ or within 250 m of the site:

- Agricultural use including former and current farms;
- Current and former (disused) railway land and embankments;
- Current and former commercial and industrial activities;
- Historical mining and quarrying activities;
- Quarry infilling; and
- The presence of Made Ground primarily from historical development, infilling and mining spoil disposal.

11.13.26 A summary of the locations of the above potential sources are shown on **Figure 11.6**.

Egremont Site

11.13.27 The primary land usage of the Egremont Site is for agriculture (both arable and livestock grazing). Soils are mainly classified as Wick 1 (541r) soils.

11.13.28 The site comprises land of ALC Grade 3 (good to moderate) (see **Figure 11.2**) and the Natural England's predictive map (see **Figure 11.3**) of Best and Most Versatile land indicates the site as having a 'high' (>60 % likelihood) of being predictive BMV land.

11.13.29 The site is underlain by superficial drift deposits which comprise alluvium overlying river terrace sand and gravels along the River Ehen valley, with Devensian Till and Glaciofluvial sand and gravel deposits over the valley sides to the east. The underlying solid geology comprises sandstone of the St. Bees Sandstone Formation. An area of Made Ground is located in the northern part of the site (**Figure 11.7**).

11.13.30 The surrounding area to the northeast has been dominated by iron ore mining (all now ceased). The former Florence Iron Ore mine is located approximately 150 m to the northeast of the site. Iron workings are likely to extend, at depth, below the eastern part of the site.

11.13.31 Florence Mine is recorded as a Site of Special Scientific Interest with respect to geology.

11.13.32 The following potentially contaminating land uses have been identified on and/ or within 250 m of the site:

- Agricultural land use;
- Former (disused) railway land and embankments;
- Current and former commercial and industrial activities (Ennerdale Mill);
- Historical mining and quarrying activities;
- Landfilling/ infilling; and
- The presence of Made Ground primarily from historical development, landfilling/ infilling and mining spoil disposal.

- 11.13.33 A summary of the locations of the above potential sources are shown on **Figure 11.7**.

11.14 Predicted residual effects and their significance

- 11.14.1 A summary of the preliminary assessment of the predicted residual effects (i.e. the effects taking into account the incorporated measures) is provided in **Tables 11.6-11.9** with regard to the various types of effects considered in respect of each of the key receptors or receptor groups at the Moorside Site and the Accommodation Sites. Where insufficient development, and/or baseline information, is available to undertake a prediction of the magnitude of change, and therefore draw preliminary conclusions regarding the significance of effects, the respective column has been populated by an asterisk (*) only. No assessment is given of the effects without mitigation, as the measures that will be adopted (and outlined above) are considered to represent good practice. The evaluation tables generally present a preliminary assessment of the potential adverse effects arising from the Moorside Project unless explicitly stated to be neutral or beneficial in the rationale.
- 11.14.2 At this stage the evaluation tables only specifically deal with the construction and operational phases of the development at the Moorside Site and the Accommodation Sites. It should be noted that following their construction, the Accommodation Sites would be occupied for a period of time when the Moorside Site is under construction. Save in respect of the development identified in **Chapter 2** as likely to remain on the Accommodation Sites, the Accommodation Sites would be decommissioned following the end of the construction activities on the Moorside Site. The effects of the decommissioning of the Accommodation Sites is expected to be no greater than during their construction phases (see **Tables 11.7-11.9**) for details.
- 11.14.3 With respect to the decommissioning of the Moorside Project, potential effects associated with decommissioning are likely to be similar or less than to the effects arising from the construction phase. It is not anticipated that additional receptors would be affected beyond those identified for the construction phase assessment as this assessment has assumed a reasonable worst case. It is anticipated that the decommissioning works would be of shorter duration and would occupy more limited footprints than those currently assumed for construction of the relevant facilities. Subject to further design and delivery details, and for the purposes of this PEIR, a worst case scenario has been applied, i.e. it has been assumed that the effects would be the same (rather than less) as those identified for the construction phase. Decommissioning is therefore not considered further in the assessment tables below that address the construction and operational phases.
- 11.14.4 In addition, it should be noted that as the collection of baseline characterisation data, and/or design information, is on-going at this stage, it has not been possible to undertake an assessment for the following sites and therefore assessment tables for these sites have not been presented in this PEIR:

- Corkickle to Mirehouse Railway Site;
- St. Bees Railway Site; and
- Sites for the Highways Improvements.

Table 11.6 Moorside Site: Summary of predicted residual effects

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Construction					
Geological Features (e.g. Calderbridge, Banks of River Calder LGS/RIG Site No. 4/024))					
Damage, destruction, and/or loss of access to geological features of interest as a result of the construction works.	Unlikely	High	Very Low	Minor (Not Significant)	There are no national, regional or locally designated geological sites of interest, protection and/or conservation on, or within 1 km of the Moorside Site with the exception of one potential LGS / RIG site at Calderbridge, Banks of River Calder Site no. 4/024. The information on Cumbria GeoConservation web site states that this site requires re-assessment, and therefore its status could be subject to change. Its sensitivity is therefore assumed as 'high'. However, magnitude is assessed as 'very low' as the LGS/RIG appears (from the outline development plans) to be outside the area where development and disturbance will occur.
Human Beings (including site workers and people gaining unauthorised access to the Moorside Site)					
Health effects from exposure to existing non radiologically contaminated soils and groundwater as a result of: Construction works e.g. disturbance and mobilisation of contaminated soils during soil stripping, excavation, soil handling/ transport, and stockpiling etc.;	Unlikely	High	Very Low	Minor (Not Significant)	On the basis of the available non radiological soil and groundwater contamination analysis conducted as part of the Site Suitability studies, the probability and magnitude of existing contamination being present on the Moorside Site is considered to be 'unlikely' and 'very low'. In addition, standard good construction environmental management practice (e.g. as outlined in Table 11.1 above) will be adopted during the construction phase, thus reducing or preventing the potential for humans to be exposed to potential existing soil contamination.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Leaks and spills of fuel, oils, chemicals and/or poor waste storage, handling and disposal etc.					
Property (Crops, livestock, wild and domesticated animals) within the boundary of the Moorside Site					
Death, disease, loss of yield, impairment, and health effects etc. as a result of exposure to existing contaminated soils, groundwater and ground gas.	Unlikely	High	Very Low	Minor (Not Significant)	The available non radiological soil contamination and groundwater analysis suggests that the probability and magnitude of existing contamination being present on the Moorside Site is considered to be ' <i>unlikely</i> ' and ' <i>very low</i> '. Ground gas levels are also expected to be very low. In addition, the adoption of standard good construction environmental management practice would minimise the potential for crops, livestock and other animals to be exposed to potential existing soil contamination, and the harvesting and exclusion of livestock during construction works by securing the sites with stockproof fencing would ensure that any effects would be ' <i>Minor</i> ' and ' <i>Not Significant</i> '.
Property (Buildings and infrastructure) within the boundary of the Moorside Site					
Damage, deterioration, degradation of buildings and associated buried infrastructure as a result of contact with and exposure to existing contaminated soils, groundwater and ground gas.	Unlikely	High	Very Low	Minor (Not Significant)	The investigations carried out to date have not encountered widespread and/or significant non radiological soil contamination and groundwater. Ground gas levels are also expected to be very low. There is also very little existing built environment on the Moorside Site, and that which is present and within the development area, is likely to be demolished and removed. Any new built environment will be appropriately designed and constructed with suitable material specification (e.g. sulphate resistant concrete, and appropriate material specification of potable water pipes and ground gas protection measures if required) to resist any

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					contaminative attack / degradation should any contamination be present.
Soil Resources (Topsoil and subsoil) within the boundary of the Moorside Site					
Damage, deterioration, impairment, loss of quality and functionality as a result of exposure to existing contaminated soils.	Unlikely	High	Very Low	Minor (Not Significant)	The sensitivity of the soils is likely to vary across the Moorside Site, but in lieu of detailed soil resource surveys is conservatively assumed to be 'High' all over. Cross contamination is unlikely to occur, as there is little evidence of existing contamination identified to date. Furthermore, any contaminated materials identified will be managed by good construction practice mitigation measures as outlined in Table 11.1.
Damage / degradation of sub and topsoils during stripping, excavation, handling, infilling of voids, stockpiling and replacement etc. (e.g. compaction/ consolidation) and/or loss of soils through construction (e.g. sealing of surfaces (buildings) or infilling of voids.	Likely	High	*	*	The quality of the soils to be disturbed still needs to be verified, but it is assumed that some 'high' sensitivity soils will be present on the Moorside Site. Although the magnitude will be offset by the adoption of best practice via the preparation and adoption of a detailed soil management plan based on good practice guidance, it is inevitable that some soils will require storage over several years prior to re-use. This could potentially lead to a medium magnitude of change, but until further work is undertaken it is not possible to be definitive. The loss of soils is likely to be minimised by stripping, stockpile and re-use which will be an integral component of the soil management plan.
Agricultural Land within the boundary of the Moorside Site					
Permanent loss of agricultural land as a result of the development.	Likely	High	Medium to High	Major (Significant)	Based on the currently available information regarding Agricultural Land Classification (Figure 11.2) and Best and Most Versatile land (Figure 11.3), which indicate that most of the site area lies within the area where 60% of land is

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					predicted by Natural England to be BMV, it is therefore likely that there will be some net reduction in BMV because of the development, (i.e. the Moorside Power Station and accompanying built infrastructure, as well as spoil mound footprints) although options will be considered to offset any reduction by providing, where possible and practicable, compensatory replacement areas and the adoption of best land rehabilitation practice. It also has to be recognised that the Moorside Site has been allocated as a potential site for new nuclear build by NPS EN-6, and the national need (as set out in the NPS) must therefore be balanced against the loss of BMV.
Operation					
Geological Features (e.g. Calderbridge, Banks of River Calder LGS/RIG Site No. 4/024)) within the boundary of the Moorside Site					
Damage, destruction, and /or loss of access to geological features of interest as a result of the operation of the site.	Unlikely	High	Very Low	Minor (Not Significant)	Magnitude of change assessed as 'very low' as location of LGS/RIG appears to be outside of main operational area, and it is considered unlikely that any operational phase's activities will affect this site.
Human Beings (including site workers and people gaining unauthorised access to the Moorside Site)					
Health effects from exposure to non-radiologically contaminated soils/groundwater during the operation of the site, e.g. by direct contact, inhalation or ingestion of	Unlikely	High	Very Low	Minor (Not Significant)	Assumed that pollution prevention infrastructure (e.g. secondary containment, hardstanding, sealed drainage, etc.) and good environmental management in accordance with Environmental Permit and Environmental Management System will prevent, control, mitigate and minimise potential future non radiological soil and groundwater contamination. Good materials management during the construction works will also prevent inappropriate re-use and re-deposit /

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
contaminated soils as a result of leaks, spills or other losses to ground, aerial deposition of non-radiological contaminants from stack emissions, waste storage, handling and disposal, or exposure to historical contamination inappropriately re-used / redeposited / replaced on site during the construction works.					replacement of unsuitable soils in areas where future exposure could occur.
Property (Crops, livestock, wild and domesticated animals) within the boundary of the Moorside Site					
Death, disease, loss of yield, impairment, health effects etc. during the operation of the site e.g. as a result of the activities outlined above.	Unlikely	High	Very Low	Minor (Not Significant)	Subject to the operational requirements of the Moorside Power Station and subject to the details of any agreements with local farmers to return non-operational parts of the Moorside Site to agricultural usage, e.g. the landscaped spoil mounds to grazing, and restore public access to these areas, it is possible that parts of the Moorside Site will be used by livestock, wild and domesticated animals. However, it is 'unlikely' that non radiological contamination of these areas would occur as a result of contaminated material having been placed there during the construction phase because any such material would be identified and appropriately treated as part of the construction phase.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Property (Buildings and infrastructure) within the boundary of the Moorside Site					
Damage, deterioration, degradation of buildings and associated buried infrastructure as a result of contact with non-radiologically contaminated soil, groundwater and ground gas during the operation of the site.	Unlikely	High	Very Low	Minor (Not Significant)	<p>It is assumed that the built infrastructure will be designed and constructed with appropriate materials specification (e.g. sulphate resistant concrete and potable water pipe materials) to resist any potential non radiological soil and groundwater contamination. In addition, pollution prevention infrastructure (e.g. secondary containment, hardstanding, sealed drainage, etc.) and good environmental management in accordance with Environmental Permit and Environmental Management System will prevent, control, mitigate and minimise potential future non radiological soil contamination.</p> <p>Good materials management during the construction works will prevent inappropriate re-use and re-deposit / replacement of unsuitable soils in areas where future exposure could occur.</p>
Soil Resources (Topsoil and subsoil) within the boundary of the Moorside Site					
Damage, deterioration, impairment, loss of quality and functionality as a result exposure to contaminated soils during the operation of the site.	Unlikely	High	Very Low	Minor (Not Significant)	<p>The area of soil resources (topsoils and subsoils) is expected to be significantly reduced on the Moorside Site during the operational stage due to land loss within the hard end use development areas. The potential for non-radiological contamination to occur in areas of soft landscaping, restored areas or to subsoils that may exist below some areas of hardstanding (e.g. roads, pavements) exists. However, the operational phase contamination prevention and mitigation measures outlined above and in Table 11.1 would be very effective and therefore effects are both unlikely to occur and are considered to 'unlikely' and 'very low'.</p>

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Agricultural Land within the boundary of the Moorside Site					
Permanent loss of agricultural land as a result of the development.	Unlikely	High	Very Low	Minor (Not Significant)	It is considered ' <i>unlikely</i> ' that any operational phase activities will lead to further damage or loss of agricultural land. The area of post development agricultural land is likely to be significantly reduced post development and limited to restored areas. Since such areas are likely to be returned to agricultural land use and unlikely to be used operationally, it is considered that effects are ' <i>unlikely</i> ' to occur and would be ' <i>very low</i> ' and ' <i>Not Significant</i> '.

Note: * Denotes where the assessment is incomplete and ongoing and this time and therefore the significance of the effects cannot be accurately predicted. Significance will be identified in the ES at DCO submission.

Table 11.7 Corkickle Site: Summary of predicted residual effects

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Construction					
Geological Features					
Damage, destruction, and / or loss of access to geological features of interest as a result of the construction works.	Unlikely	Low	Very Low	Negligible (Not Significant)	There are no national, regional or locally designated geological sites of interest, protection and / or conservation on or within 1 km of the Corkickle Site.
Human Beings					
Health effects from exposure to ground gas and existing non radiologically contaminated soils and groundwater as a result of: Construction works e.g. disturbance and mobilisation of contaminated soils during soil stripping, excavation, soil handling/ transport, and stockpiling etc. Leaks and spills of fuel, oils, chemicals and/or poor waste storage, handling and disposal etc.	Likely	High	Low to Medium	Major (Significant)	At this stage, desk studies have confirmed the presence of potential sources of contamination on the Corkickle Site as well as the potential for ground gas (former mine workings, former gas works) and therefore the magnitude of change resulting from construction works is considered to be ' <i>low to medium</i> '. Future intrusive investigations will identify and delineate any existing contamination allowing this to either be removed or remediated during the main construction work or managed via an approved Materials Management Plan and by good practice and environmental management as outlined in Table 11.1 . Investigations will also allow the risk from ground gas to be assessed with gas control measures incorporated in building as necessary.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Property (Crops, livestock, wild and domesticated animals)					
Death, disease, loss of yield, impairment, and health effects etc. as a result of exposure to existing contaminated soils and groundwater.	Unlikely	High	Very Low	Minor (Not Significant)	<p>Although crops and stock animals are likely to be present on adjacent areas during the construction period, they would be prevented from accessing the site by stockproof fencing.</p> <p>At this stage, desk studies have confirmed the presence of potential sources of contamination on the Corkickle Site. However, the magnitude of change resulting from construction works is considered to be 'very low' on the assumption that potential contamination from sources identified in desk studies is not expected to be significant or widespread. The proposed environmental measures outlined in Table 11.1 would also minimise the risks.</p>
Property (Buildings and infrastructure)					
Damage, deterioration, degradation of buildings and associated buried infrastructure as a result of contact with and exposure to existing contaminated soils and groundwater.	Unlikely	High	Very Low	Minor (Not Significant)	<p>The desk studies have identified the potential for ground contamination and ground gas (e.g. mine workings). The receptor sensitivity is based on the worst case assumption that some of the temporary worker accommodation and associated infrastructure of high value/ sensitivity will be in use whilst construction works at the sites continue, as other parts of the sites are being built. However, it is assumed that the built infrastructure will be designed and constructed with appropriate materials specification (e.g. sulphate resistant concrete and potable water pipe materials, as appropriate) to resist any potential non radiological soil contamination and that the buildings will incorporate gas control measures.</p>

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Soil Resources (Topsoil and subsoil)					
Damage / degradation of sub and topsoils during stripping, excavation, handling, infilling of voids, stockpiling and replacement etc. (e.g. compaction/consolidation) and/or loss of soils through construction (e.g. sealing of surfaces (buildings) or infilling of voids.	Likely	Low	*	*	It is assumed that the potential effects would be mitigated by careful planning, phasing and management of the soils resources during stripping, excavation, handling, stockpiling and replacement, which may in part be achieved progressively. This would be achieved via the adoption of a detailed soil management plan; based on good practice guidance. However, with the development proposals for the site emerging, it is not possible to be definitive with regard to magnitude, although given the low sensitivity, any adverse effects are likely to be <i>'Not Significant'</i> .
Agricultural Land					
Permanent loss of agricultural land as a result of the development.	Unlikely	Low	Very Low	Minor (Not Significant)	Given that there is no agricultural land present on site apart from a small area of horse pasture, any effects would be <i>'Not Significant'</i> .
Operation					
Geological Features					
Damage, destruction, and/or loss of access to geological features of interest as a result of operation of the site.	Unlikely	Low	Very Low	Negligible (Not Significant)	There are no national, regional or locally designated geological sites of interest, protection and / or conservation on or within 1 km of these sites and there are no major earthworks or construction works planned during the operational phase which could affect the geology.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Human Beings					
Health effects from exposure to potential future non-radiological soil contamination on site as a result of leaks and spills from possible fuel, oil and chemical use, storage and handling, poor waste storage and handling, and/or historical contamination inappropriately re-used / redeposited / replaced on site during the construction works.	Unlikely	High	Very Low	Minor (Not Significant)	Assumed that pollution prevention infrastructure (e.g. secondary containment, hardstanding, sealed drainage, etc.) and good environmental management in accordance with Environmental Permit and Environmental Management System will prevent, control, mitigate and minimise potential future non radiological soil and groundwater contamination. The operational phase is considered unlikely to generate future land contamination. It is assumed that any areas of fuel, oil, chemical and/or waste storage that may be required on site will be in accordance with good practice and relevant regulations (e.g. oil storage regulations). It is assumed that all waste produced on the site will be appropriately stored and managed and disposed of off-site. Gas control measures will also be incorporated within buildings as necessary. Therefore, whilst receptor sensitivity is assumed to be high, the magnitude of change is considered to be 'very low'.
Property (Crops, livestock, wild and domesticated animals)					
Death, disease, loss of yield, impairment, health effects from exposure to potential future contamination on site as a result of leaks and spills from possible fuel, oil and chemical use, storage and handling, poor waste storage and handling and/or historical contamination.	Unlikely	High	Very Low	Minor (Not Significant)	The operational phase is unlikely to generate future land contamination. Furthermore, any areas of fuel, oil, chemical and/or waste storage, which may be required on site, will be managed in accordance with good practice and relevant regulations (e.g. oil storage regulations). It is also assumed that all waste produced on the site will be appropriately stored and managed and disposed of off-site.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Property (Buildings and infrastructure)					
Damage, deterioration, degradation of buildings and associated buried infrastructure as a result of contact with and exposure to existing contaminated soils during the operation of the site.	Unlikely	High	Very Low	Minor (Not Significant)	<p>It is assumed that the built infrastructure will be designed and constructed with appropriate materials specification (e.g. sulphate resistant concrete and potable water pipe materials) to resist any potential non radiological soil and groundwater contamination and that buildings will incorporate gas control measures as necessary. In addition, pollution prevention infrastructure (e.g. secondary containment, hardstanding, sealed drainage, etc.) and good environmental management in accordance with Environmental Permit and Environmental Management System will prevent, control, mitigate and minimise potential future non radiological soil contamination.</p> <p>Good materials management during the construction works will prevent inappropriate re-use and re-deposit / replacement of unsuitable soils in areas where future exposure could occur.</p>
Soil Resources (Topsoil and subsoil)					
Damage, deterioration, impairment, loss of quality and functionality as a result as a result of exposure to existing contaminated soils.	Unlikely	Low	Very Low	Negligible (Not Significant)	<p>The receptor sensitivity is based on available soil resource and BMV information i.e. the majority of soils on the Corkickle Site are indicated as urban soils and therefore very likely to be of 'low' sensitivity.</p> <p>The potential for non-radiological contamination to occur in areas of soft landscaping, restored areas or to subsoils that may exist below some areas of hardstanding (e.g. roads, pavements) exists. However, the operational phase contamination prevention and mitigation measures outlined above and in Table 11.1 would be very effective and therefore effects are both unlikely to occur and are considered to 'unlikely' and 'very low'.</p>

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Agricultural Land					
Permanent loss of agricultural land as a result of the development.	Unlikely	Low	Very Low	Negligible (Not Significant)	Given that there is no agricultural land present on site apart from a small area of horse pasture and operation phase activities are unlikely to lead to further changes, any effects would be ' <i>Not Significant</i> '.

Note: * Denotes where the assessment is incomplete and ongoing and this time and therefore the significance of the effects cannot be accurately predicted. Significance will be identified in the ES at DCO submission.

Table 11.8 Mirehouse Site: Summary of predicted residual effects

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Construction					
Geological Features					
Damage, destruction, and / or loss of access to geological features of interest as a result of the construction works.	Unlikely	Low	Very Low	Negligible (Not Significant)	There are no national, regional or locally designated geological sites of interest, protection and / or conservation on or within 1 km of these sites.
Human Beings					
Health effects from exposure to existing non radiologically contaminated soils as a result of: Construction works e.g. disturbance and mobilisation of contaminated soils during soil stripping, excavation, soil handling/ transport, and stockpiling etc. Leaks and spills of fuel, oils, chemicals and/or poor waste storage, handling and disposal etc.	Likely	High	Very Low	Minor (Not Significant)	Desk studies have confirmed the presence of potential localised sources of contamination on the Mirehouse Site. There is also a potential for ground gas at the Mirehouse Site (former coal mining). However, the magnitude of change resulting from construction works is considered to be 'very low' on the assumption that potential contamination from sources identified in desk studies is not expected to be significant or widespread and the buildings are largely located away from former mine workings. Future intrusive investigations will identify and delineate any existing contamination allowing this to either be removed or remediated during the main construction work or managed via an approved Materials Management Plan and by good practice and environmental management as outlined in Table 11.1 .

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Property (Crops, livestock, wild and domesticated animals)					
Death, disease, loss of yield, impairment, and health effects etc. as a result of exposure to existing contaminated soils and groundwater.	Unlikely	High	Very Low	Minor (Not Significant)	<p>Although crops and stock animals are likely to be present on adjacent areas during the construction period, they would be prevented from accessing the site by stockproof fencing.</p> <p>At this stage, desk studies have confirmed the presence of potential sources of contamination on the Mirehouse Site. However, the magnitude of change resulting from construction works is considered to be 'very low' on the assumption that potential contamination from sources identified in desk studies is not expected to be significant or widespread. The proposed environmental measures outlined in Table 11.1 would also minimise the risks.</p>
Property (Buildings and infrastructure)					
Damage, deterioration, degradation of buildings and associated buried infrastructure as a result of contact with and exposure to existing contaminated soils and groundwater.	Unlikely	High	Very Low	Minor (Not Significant)	<p>The desk studies have identified the potential for ground contamination and ground gas (e.g. mine workings). The receptor sensitivity is based on the worst case assumption that some of the temporary worker accommodation and associated infrastructure of high value/ sensitivity will be in use whilst construction works at the sites continue, as other parts of the sites are being built. However, it is assumed that the built infrastructure will be designed and constructed with appropriate materials specification (e.g. sulphate resistant concrete and potable water pipe materials, as appropriate) to resist any potential non radiological soil contamination and that the buildings will incorporate gas control measures.</p>
Soil Resources (Topsoil and subsoil)					
Damage, deterioration, impairment, loss of	Unlikely	High	Very Low	Minor	<p>The receptor sensitivity is based on the available soil resource and BMV information. The available information shows that land in</p>

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
quality and functionality as a result of exposure to existing contaminated soils.				(Not Significant)	the eastern part of the site has a >60% likelihood ('high') of BMV land being present, in the west, where development will occur, the likelihood of BMV is moderate (20 to 60%) and urban/industrial land is present in the north. The sensitivity of site is conservatively assessed as 'high'. However, the magnitude of change is considered to be 'very low' as the development is mainly in the west ('moderate' BMV) and due to the proposed environmental measures outlined above.
Damage / degradation of sub and topsoils during stripping, excavation, handling, infilling of voids, stockpiling and replacement etc. (e.g. compaction/ consolidation) and/or loss of soils through construction (e.g. sealing of surfaces (buildings) or infilling of voids.	Likely	High	*	*	The receptor sensitivity at the Mirehouse Site is conservatively assessed as 'high' due to the prediction of a high likelihood of BMV land in the eastern part of the site. There is the potential for the development proposals to require soil to be excavated and temporarily stockpiled, it is possible that 'Potentially Significant' effects might result although the main construction activities will be in the west where moderate BMV land is predicted to occur. However, since detailed soil research has not yet been undertaken, no definitive conclusions can be drawn at this stage.
Agricultural Land					
Mirehouse					
Permanent loss of agricultural land as a result of the development.	Likely	High	Low	Minor (Not Significant)	Based on the currently available information regarding BMV land, it is likely that some Grade 3a soils will be present on this site. However the available BMV mapping indicates that development there is only a moderate likelihood of BMV land being present in the area of construction. It is therefore likely that there will be only be a small net reduction in BMV because of the development, although options will be considered to

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					offset any reduction by the providing replacement areas and the adoption of best land rehabilitation practice.
Operation					
Geological Features					
Damage, destruction, and/or loss of access to geological features of interest as a result of operation of the site.	Unlikely	Low	Very Low	Negligible (Not Significant)	There are no national, regional or locally designated geological sites of interest, protection and / or conservation on or within 1 km of these sites and there are no major earthworks or construction works planned during the operational phase which could affect the geology.
Human Beings					
Health effects from exposure to potential future non-radiological soil contamination on site as a result of leaks and spills from possible fuel, oil and chemical use, storage and handling, poor waste storage and handling, and/or historical contamination inappropriately re-used / redeposited / replaced on site during the construction works.	Unlikely	High	Very Low	Minor (Not Significant)	The operational phase is considered unlikely to generate future land contamination. It is assumed that any areas of fuel, oil, chemical and/or waste storage that may be required on site will be in accordance with good practice and relevant regulations (e.g. oil storage regulations). It is assumed that all waste produced on the site will be appropriately stored and managed and disposed of off-site. Gas control measures will also be incorporated within buildings as necessary. Therefore, whilst receptor sensitivity is assumed to be high (as human), the magnitude of change is considered to be 'very low'.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Property					
Death, disease, loss of yield, impairment, health effects from exposure to potential future contamination on site as a result of leaks and spills from possible fuel, oil and chemical use, storage and handling, poor waste storage and handling and/or historical contamination.	Unlikely	High	Very Low	Minor (Not Significant)	The operational phase is unlikely to generate future land contamination. Furthermore, any areas of fuel, oil, chemical and/or waste storage, which may be required on site, will be managed in accordance with good practice and relevant regulations (e.g. oil storage regulations). It is also assumed that all waste produced on the site will be appropriately stored and managed and disposed of off-site.
Property (Buildings and infrastructure)					
Damage, deterioration, degradation of buildings and associated buried infrastructure as a result of contact with and exposure to existing contaminated soils during the operation of the site.	Unlikely	High	Very Low	Minor (Not Significant)	It is assumed that the built infrastructure will be designed and constructed with appropriate materials specification (e.g. sulphate resistant concrete and potable water pipe materials) to resist any potential non radiological soil and groundwater contamination and that buildings will incorporate gas control measures as necessary. In addition, pollution prevention infrastructure (e.g. secondary containment, hardstanding, sealed drainage, etc.) and good environmental management in accordance with Environmental Permit and Environmental Management System will prevent, control, mitigate and minimise potential future non radiological soil contamination. Good materials management during the construction works will prevent inappropriate re-use and re-deposit / replacement of unsuitable soils in areas where future exposure could occur.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Soil Resources (Topsoil and subsoil)					
Damage, deterioration, impairment, loss of quality and functionality as a result of exposure to existing contaminated soils.	Unlikely	High	Very Low	Minor (Not Significant)	The receptor sensitivity is based on the available soil resource and BMV information. The available information shows that land in the eastern part of the site has a >60% likelihood ('high') of BMV land being present, in the west, where development will occur, the likelihood of BMV is moderate (20 to 60%) and urban/industrial land is present in the north. The sensitivity of site is conservatively assessed as 'high'. However, the magnitude of change is considered to be 'very low' as the development is mainly in the west ('moderate' BMV) and due to the proposed environmental measures outlined above.
Agricultural Land					
Permanent loss of agricultural land as a result of the development.	Unlikely	High	Very Low	Minor (Not Significant)	It is considered 'unlikely' that any operational phase activities will lead to further damage or loss of agricultural land. The area of post development agricultural land is likely to be reduced post development and limited to restored areas. Since such areas are likely to be returned to agricultural land use and unlikely to be used operationally, it is considered that effects are 'unlikely' to occur and would be 'very low' and 'Not Significant'.

Note: * Denotes where the assessment is incomplete and ongoing at this time and therefore the significance of the effects cannot be accurately predicted. Significance will be identified in the ES at DCO submission.

Table 11.9 Egremont Site: Summary of predicted residual effects

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Construction					
Geological Features					
Damage, destruction, and / or loss of access to geological features of interest as a result of the construction works.	Unlikely	High	Very Low	Minor (Not Significant)	The Egremont Site is located within 100 m of the Florence Mine Geological SSSI. However, this designated site is not located within the site boundary and is understood to relate to geological features present at depth within the mine. Accordingly it is considered that construction works at the Egremont Site would not affect the deeper geology or the SSSI.
Human Beings					
Health effects from exposure to existing non radiologically contaminated soils as a result of: Construction works e.g. disturbance and mobilisation of contaminated soils during soil stripping, excavation, soil handling/ transport, and stockpiling etc. Leaks and spills of fuel, oils, chemicals and/or poor waste storage, handling and disposal etc.	Likely	High	Very Low	Minor (Not Significant)	Desk studies have confirmed the presence of potential localised sources of contamination on the Egremont Site. However, the magnitude of change resulting from construction works is considered to be 'very low' on the assumption that potential contamination from sources identified in desk studies is not expected to be significant or widespread and the buildings are located away from former shallow mine workings. Workings associated with the iron mine are likely to be at significant depth. Future intrusive investigations will identify and delineate any existing contamination allowing this to either be removed or remediated during the main construction work or managed via an approved Materials Management Plan and by good practice and environmental management as outlined in Table 11.1.
Property (Crops, livestock, wild and domesticated animals)					

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Death, disease, loss of yield, impairment, and health effects etc. as a result of exposure to existing contaminated soils and groundwater.	Unlikely	High	Very Low	Minor (Not Significant)	Although crops and stock animals are likely to be present on adjacent areas during the construction period, they would be prevented from accessing the site by stockproof fencing. At this stage, desk studies have confirmed the presence of potential but localised sources of contamination on the Egremont Site. However, the magnitude of change resulting from construction works is considered to be 'very low' on the assumption that potential contamination from sources identified in desk studies is not expected to be significant or widespread. The proposed environmental measures outlined in Table 11.1 would also minimise the risks.
Property (Buildings and infrastructure)					
Damage, deterioration, degradation of buildings and associated buried infrastructure as a result of contact with and exposure to existing contaminated soils and groundwater.	Unlikely	High	Very Low	Minor (Not Significant)	The receptor sensitivity is based on the worst case assumption that some of the temporary worker accommodation and associated infrastructure of high value/ sensitivity will be in use whilst construction works at the Egremont continue, as other parts of the sites are being built. However, it is assumed that the built infrastructure will be designed and constructed with appropriate materials specification (e.g. sulphate resistant concrete and potable water pipe materials, as appropriate) to resist any potential non radiological soil contamination.
Soil Resources (Topsoil and subsoil)					
Damage / degradation of sub and topsoils during stripping, excavation, handling, infilling of voids, stockpiling and replacement etc. (e.g.	Likely	Low	*	*	It is assumed that the potential effects would be mitigated by careful planning, phasing and management of the soils resources during stripping, excavation, handling, stockpiling and replacement, which may in part be achieved progressively. This would be achieved via the adoption of a detailed soil management plan; based on good practice guidance. However,

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
compaction/ consolidation) and/or loss of soils through construction (e.g. sealing of surfaces (buildings) or infilling of voids.					with the development proposals emerging, it is not possible to be definitive with regard to magnitude, although given the low sensitivity, any adverse effects are likely to be ' <i>Not Significant</i> '.
Damage, deterioration, impairment, loss of quality and functionality as a result of exposure to existing contaminated soils.	Unlikely	High	Very Low	Minor (Not Significant)	The receptor sensitivity is based on the available soil resource and BMV information, which indicates that there is >60% likelihood of BMV land being present at the Egremont Site, which means the soils are likely to have a ' <i>high</i> ' sensitivity. However, the magnitude of change is considered to be ' <i>very low</i> ' due to the proposed environmental measures outlined with respect to the human health effects above.
Damage / degradation of sub and topsoils during stripping, excavation, handling, infilling of voids, stockpiling and replacement etc. (e.g. compaction/ consolidation) and/or loss of soils through construction (e.g. sealing of surfaces (buildings) or infilling of voids.	Likely	High	*	*	Since the receptor sensitivity at the Egremont Site is likely to be high due to the >60% likelihood of BMV land being present, and there is the potential for the development proposals to require soil to be excavated and temporarily stockpiled, it is possible that ' <i>Potentially Significant</i> ' effects might result. However, since detailed soil research has not yet been undertaken, no definitive conclusions can be drawn at this stage.
Agricultural Land					
Permanent loss of agricultural land as a result of the development.	Likely	High	High	Major (Significant)	Based on the currently available information regarding BMV land, it is likely that some Grade 3a soils will be present. It is therefore likely that there will be some net reduction in BMV because of the development, although options will be considered to offset any reduction by the providing

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					replacement areas and the adoption of best land rehabilitation practice.
Operation					
Geological Features					
Damage, destruction, and/or loss of access to geological features of interest as a result of operation of the site.	Unlikely	High	Very Low	Negligible (Not Significant)	The Egremont Site is located within 100 m of the Florence Mine Geological SSSI. However, this designated site is not located within the site boundary and is understood to relate to geological features present at depth within the mine. No major earthworks or construction works planned during the operational phase which could affect the geology.
Human Beings					
Heath effects from exposure to potential future non-radiological soil contamination on site as a result of leaks and spills from possible fuel, oil and chemical use, storage and handling, poor waste storage and handling, and/or historical contamination inappropriately re-used / redeposited / replaced on site during the construction works.	Unlikely	High	Very Low	Minor (Not Significant)	The operational phase is considered unlikely to generate future land contamination. It is assumed that any areas of fuel, oil, chemical and/or waste storage that may be required on site will be in accordance with good practice and relevant regulations (e.g. oil storage regulations). It is assumed that all waste produced on the site will be appropriately stored and managed and disposed of off-site. Gas control measures will also be incorporated within buildings as necessary. Therefore, whilst receptor sensitivity is assumed to be high (as human), the magnitude of change is considered to be 'very low'.
Property (Crops, livestock, wild and domesticated animals)					

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Death, disease, loss of yield, impairment, health effects from exposure to potential future contamination on site as a result of leaks and spills from possible fuel, oil and chemical use, storage and handling, poor waste storage and handling and/or historical contamination.	Unlikely	High	Very Low	Minor (Not Significant)	The operational phase is unlikely to generate future land contamination. Furthermore, any areas of fuel, oil, chemical and/or waste storage, which may be required on site, will be managed in accordance with good practice and relevant regulations (e.g. oil storage regulations). It is also assumed that all waste produced on the site will be appropriately stored and managed and disposed of off-site.
Property (Buildings and infrastructure)					
Damage, deterioration, degradation of buildings and associated buried infrastructure as a result of contact with and exposure to existing contaminated soils during the operation of the site.	Unlikely	High	Very Low	Minor (Not Significant)	It is assumed that the built infrastructure will be designed and constructed with appropriate materials specification (e.g. sulphate resistant concrete and potable water pipe materials) to resist any potential non radiological soil and groundwater contamination and that buildings will incorporate gas control measures as necessary. In addition, pollution prevention infrastructure (e.g. secondary containment, hardstanding, sealed drainage, etc.) and good environmental management in accordance with Environmental Permit and Environmental Management System will prevent, control, mitigate and minimise potential future non radiological soil contamination. Good materials management during the construction works will prevent inappropriate re-use and re-deposit / replacement of unsuitable soils in areas where future exposure could occur.
Soil Resources (Topsoil and subsoil)					

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Damage, deterioration, impairment, loss of quality and functionality as a result of exposure to existing contaminated soils.	Unlikely	High	Very Low	Minor (Not Significant)	The receptor sensitivity is based on the available soil resource and BMV information, which indicates that there is >60% likelihood of BMV land being present at the Egremont Site, which means the soils are likely to have a 'high' sensitivity. However, the magnitude of change is considered to be 'very low' due to the proposed environmental measures outlined with respect to the human health effects above.
Agricultural Land					
Permanent loss of agricultural land as a result of the development.	Unlikely	High	Very Low	Minor (Not Significant)	It is considered 'unlikely' that any operational phase activities will lead to further damage or loss of agricultural land. The area of post development agricultural land is likely to be reduced post development and limited to restored areas. Since such areas are likely to be returned to agricultural land use and unlikely to be used operationally, it is considered that effects are 'unlikely' to occur and would be 'very low' and 'Not Significant'.

Note: * Denotes where the assessment is incomplete and ongoing at this time and therefore the significance of the effects cannot be accurately predicted. Significance will be identified in the ES at DCO submission.

11.15 Preliminary assessment of the Moorside Project as a whole

- 11.15.1 An assessment of the Moorside Project as a whole will be included in the ES. For the purposes of this PEIR, a preliminary assessment of the combined effects of the Moorside Site and the Accommodation Sites has been undertaken in the context of their respective Zols. The assessment has looked at whether there would be any additional, "*accumulated effects*" on specific environmental receptors. The ES will include the Additional Sites in this assessment once the data becomes available.
- 11.15.2 In terms of the spatial scope of the assessment of accumulated effects, the principles have been set out in **Section 3.4** and summarised in **Table 3.8**. With respect to this chapter, it is considered that the spatial scope of the assessments on soil resources, geology and agricultural land quality would be limited to the boundaries of the Moorside Site and the Accommodation Sites and therefore no whole project effects would occur. However, since the Zones of Influence (Zols) with respect to land quality effects relating to ground gas and groundwater migration have been set at 1 km from each of the site boundaries, it is considered that there is some potential for accumulated effects to result from more than one Moorside Project Site.
- 11.15.3 In order to determine the spatial extent of these potential interactions relating to land quality effects, **Figure 11.1** shows the location of the Moorside Site and the Accommodation Sites, together with their respective 1 km Zols. This shows that in terms of potential land quality effects, there is the potential for the Moorside Site itself to interact with the Egremont Site.
- 11.15.4 At this stage it is only possible to undertake a high level assessment of the potential combined land quality effects on receptors from these two sites, and a more detailed assessment is proposed for the ES.
- 11.15.5 For ground gas, accumulated effects are predicted to be minor (i.e. Not significant) as ground gas levels for both the Moorside Site and the Egremont Site are also expected to be minor (**Tables 11.6 and 11.9**). The effects on groundwater quality resulting from disturbance of soil contamination are also expected to be minor (Not significant) as the available information indicates no significant sources of contamination on the southern part of the Egremont Site or the north western corner of the Moorside Site. It is also expected that the 'accumulated' effects of the Corkickle to Mirehouse Railway Site with the Corkickle Site and the Mirehouse Site would be '*minor*' and '*not significant*' based on the likely extent of soil contamination.

11.16 Preliminary assessment of cumulative effects with other developments

Scope of the assessment

- 11.16.1 As outlined in **Section 3.4**, an exercise has been undertaken to determine which other (non-Moorside) developments should be considered in the context of their ability to result in cumulative adverse environmental effects with any of the Moorside Project Sites.
- 11.16.2 Of the other developments described in **Section 3.4**, listed in **Table 3.4** and considered in the context of **Table 3.9** in terms of land quality effects, it is considered appropriate at this stage not to consider the following projects on the basis that they are located outwith the Zones of Influence of the Moorside Project Sites:
- 4. Low Level Waste Repository, Drigg (LLWR Ltd);
 - 6. Walney Extension Wind Farm (Dong Energy);
 - 7. Barrow-in-Furness Site (BAE Systems);
 - 8. Ulverston Biopharmaceutical Manufacturing Facility (GSK);
 - 9. Heysham New Nuclear Power Station (EDF Energy); and
 - 10. Tidal Lagoon West Cumbria (Tidal Lagoon Power).
- 11.16.3 However, it should be noted that the situation with respect to the above sites will be kept under review during the preparation of the EIA, pending the availability of information from the respective developers regarding their own land quality Zols, although given the distances between these sites a change in the situation is not expected.
- 11.16.4 Of the remaining other developments considered in **Table 3.9**, these are briefly discussed in the context of their likely interaction with respect to land quality in the sub-sections below.

11.17 Assessment of land quality effects at other developments

Sellafield Site Decommissioning (Sellafield Ltd/Nuclear Decommissioning Authority)

- 11.17.1 The Sellafield Site Decommissioning project has the potential to interact with the Moorside Project, particularly with respect to the Moorside Site itself. This would notably occur during the construction phase of the Moorside Site, if there was simultaneous disturbance of contaminated soils at both sites and the proposed mitigation measures were ineffective. However, such an eventuality is not considered likely.

North West Coast Connections (NWCC), West Cumbria (National Grid)

- 11.17.2 The North West Coast Connections Project is intimately related to the Moorside Project, since it would provide the connection to the UK national electricity grid for the power generated and therefore the local works would partially take place within the boundary of the Moorside Site.
- 11.17.3 It is therefore anticipated that there could be the potential for cumulative land quality effects generated during the construction phase of the Moorside Project, but the incorporation of appropriate mitigation measures and good management practice should mean that significant effects are unlikely to occur.

Whitehaven Coking Coal Project (West Cumbria Mining)

- 11.17.4 It is noted that the construction of the minehead will take place at the former Marchon Chemical Works, which is located just beyond the 1 km Zols for the Corkickle Site, Mirehouse Site, and Corkickle to Mirehouse Railway Site that has been adopted as the maximum extent to which distance over which most forms of potential contamination are realistically likely to migrate from each source location. However, since it is likely that West Cumbria Mining (WCM) would adopt a similar Zol from the Marchon minehead, it is appropriate to consider the potential for cumulative effects to occur.
- 11.17.5 Furthermore, since the WCM railhead would be located at the southern end of the Mirehouse Site and the Corkickle to Mirehouse Railway Site, and this part of the site was formerly used a drift mine entrance in the past, then cumulative land quality effects could be considered likely to occur.
- 11.17.6 Notwithstanding the above, an important consideration in whether such cumulative effects would be potentially significant will be the relative timing of construction operations at each development. In this respect, it is understood that the timescales for the construction of the WCM project would precede the construction at the Corkickle Site, Mirehouse Site and Corkickle to Mirehouse Railway Site and this, together with the incorporation of appropriate mitigation measures as part of both development proposals, should reduce the likelihood of cumulative land quality effects occurring.
- 11.17.7 However, the situation will need to be kept under review, not least because there is currently insufficient information available in respect of the WCM project at this time to attempt a meaningful cumulative effects assessment in this PEIR regarding cumulative land quality effects.

West Cumbria Water Supply Pipeline (United Utilities)

- 11.17.8 The western end of the preferred route for the West Cumbria Water Supply Pipeline falls just within the eastern edge of the 1 km Zol for the Mirehouse Site. The potential for soil contamination in this area is low and therefore it is unlikely for cumulative land quality effects to occur.

11.18 Assessment of soils, agricultural land and geology effects

- 11.18.1 With respect to the assessment of the effects on soils, agricultural land, and geology, since it is considered that the various boundaries would need to coincide for effects to occur, this factor should reduce the likelihood of cumulative effects occurring. However, since parts of the North West Coast Connections project falls within the Moorside Site boundary, and a small part of the proposed WCM railhead falls within the western part of the Mirehouse Site boundary, cumulative effects are possible. Moreover, since it is reasonable to assume that the respective construction operations of the Moorside Project would be undertaken at different times and co-ordinated between the developers, it is considered likely at this stage that any cumulative effects would be no greater than have been determined in **Tables 11.6** and **11.8** above.

11.19 Consideration of additional mitigation

- 11.19.1 At this stage, all of the mitigation measures, which are anticipated will be required, are incorporated into the development proposals and are considered in the assessment of effects outlined in **Section 11.8**. However, if it emerges during the preparation of the Environmental Statement that additional, non-incorporated measures, need to be considered, the relevant details will be presented in the ES.

11.20 References

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15. HSE (1991). *Protection of workers and the general public during the development of contaminated land*.
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17. NHBC, Environment Agency and CIEH. (2008). *Guidance on the Safe Development of Housing on land affected by contamination Publication 66: 2008*.
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