14. Freshwater environment: surface water

14.1 Introduction

14.1.1 This chapter presents a preliminary assessment of the likely significant effects on the surface freshwater environment arising from the Moorside Project. Of particular relevance to this chapter are the potential effects on flows and levels, water quality, and hydromorphology in rivers, streams and ponds and on flood risk to people, property and infrastructure due to the Moorside Project. However, the assessment of change to surface water processes is also of relevance to other environmental receptors, which are described in the following sections of the PEIR, notably:

- Soils, geology and land quality (**Chapter 11**);
- Freshwater environment: groundwater (**Chapter 13**);
- Marine water and sediment quality (**Chapter 16**);
- Terrestrial and freshwater ecology (**Chapter 18**);
- Climate change (**Chapter 20**); and
- Radiology (**Chapter 21**).

14.1.2 **Chapter 11** sets out the geological context for the hydrological baseline presented in this chapter, and identifies sources of contamination of relevance to the surface freshwater assessment. The linkage between the ground and surface water assessments relates primarily to the role that groundwater discharge plays in supporting river baseflow. Potential impacts on river flows and water quality arising via a groundwater pathway are assessed in Chapter 13. Water quality issues in rivers at the point they flow into the marine environment could impact on marine water and sediment quality. Any such effects are assessed in **Chapter 16.** Changes in the surface water environment that are assessed in this chapter can give rise to impacts on water-dependent designated conservation sites, habitats and species. Effects on the hydrological conditions supporting aquatic ecology receptors are reported in this chapter, but effects on the ecological receptors themselves are assessed in **Chapter 18**. The background information on climate change presented in **Chapter 20** is also of relevance to this assessment. Some baseline radiological water quality information is presented in this chapter, although the impacts of the development from a radiological point of view are presented in **Chapter 21**.

14.1.3 A separate Water Framework Directive (WFD) compliance assessment and a separate Flood Risk Assessment (FRA) will be prepared to support the final application for development consent. These assessments will be reported as stand-alone documents that will support the findings of the Environmental Statement (ES).

14.2 Limitations of the PEIR

14.2.1 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.

14.2.2 These limitations mean that this preliminary environmental information report (PEIR) has focussed on potential effects on the surface water environment arising from the construction and operation of the Moorside Project. The assessment considers potential effects arising from the Moorside Site, the Accommodation Sites, the Corkickle to Mirehouse Railway Site and the St. Bees Railway Site. Two Study Areas have been used in this assessment and have been defined in terms of the potential for surface freshwater effects to arise from these sites, as defined in **Section 14.4.**

14.2.3 A Study Area has not been defined in relation to the sites for the Highway Improvements. This is because the extent of works at each of these sites is very limited, and is not expected to lead to significant effects on the surface freshwater environment. Consequently, any potential effects associated with the sites for the Highway Improvements have been scoped out from further assessment in this chapter.

14.2.4 The assessments of significance contained within this chapter are based on expert judgement, due to the fact that gathering of baseline information and detailed technical assessments are ongoing. These judgements will be therefore be reviewed and, if necessary, revised within the ES following more detailed analysis and refinements in engineering design.

14.2.5 A preliminary assessment of baseline information on the surface freshwater environment is also provided in this chapter. This is largely based on desktop study of existing third party datasets. However, for the Moorside Site, this has been supplemented by a programme of water quality monitoring that was carried out during 2015 and is now complete. The main area where further detailed assessment is required to define baseline conditions and provide the basis for the subsequent assessment of effects is flood risk. Detailed flood modelling work will be progressed through the course of 2016 to support the FRA and ES.

14.2.6 Information is not yet available regarding proposals for Freshwater Water Supply to the project, nor on the details of sewage effluent treatment and disposal or surface water drainage. A high level assessment of the water quality effects of sewage effluent treatment and disposal and surface water drainage is provided in this chapter, based on assumptions made about levels of treatment and discharge locations. No assessment of effects arising from Freshwater Water Supply to the project is provided in this chapter. However, this will be assessed in full in the ES. The construction and operation of the fish return system could potentially lead to impacts on water quality of the lower Ehen. However, the design and outfall location are not known and as such cannot be assessed at this time. It will be assessed in full in the ES.

14.2.7 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 Accommodation Sites and Additional Sites may see some element of decommissioning activity undertaken once the construction phase of the Moorside Site 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 for these sites. The decommissioning phase of each Moorside Project Site will be assessed in the ES. As discussed in **Chapter 2**, decommissioning of the Moorside Power Station 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.

14.3 Policy and legislative context

14.3.1 The following planning policy and guidance will be used to inform this assessment:

Policy (National and Local):

14.3.2 The overarching National Policy Statement for Energy (Reference 1. DECC) states that the adverse impacts of flooding can be avoided or reduced through good planning and management. Within the lifetime of energy projects, climate change will lead to increased flood risks in areas susceptible to flooding and an increase of the risk of the occurrence of floods in some areas which are not currently considered to be at risk (paragraphs 5.7.1 – 5.7.3 NPS EN-1). Requirements for FRA for energy projects are set out in paragraphs 5.7.4 and 5.7.5.

14.3.3 NPS EN-1 also sets out the generic impacts associated with energy projects during the construction and operation phases. These can include increased demand for water, discharges to water, and adverse ecological effects resulting from physical modifications to the water environment. There may also be an increased risk of spills and leaks of pollutants to the water environment. It also sets out the information that an ES should provide in relation to impacts on water quality and resources (paragraphs 5.15.1 – 5.15.3 EN-1).

14.3.4 The National Policy Statement for Nuclear Power Generation (Reference 2. DECC) recognises that as nuclear power stations need access to large volumes of cooling water, they are most likely to be developed on coastal or estuarine sites, and therefore may be at greater risk of flooding than if they were located inland. The potential effects of climate change may increase these risks further (paragraphs 3.6.1 – 3.6.2 EN-6). Additional specific requirements for FRA for nuclear power stations (above and beyond the generic requirements for energy projects set out in NPS EN-1) are specified in section 3.6 of NPS EN-6.

14.3.5 NPS EN-6 recognises that while the generic impacts of new energy infrastructure projects are set out in EN-1, nuclear power projects can have

adverse effects on water resources through increased demand, particularly during construction, and from the discharge of cooling water (paragraphs 3.7.1 – 3.7.2 NPS EN-6).

14.3.6 The Government's National Planning Policy Framework (NPPF) (Reference 3. DCLG), Department for Communities and Local Government, March 2012) promotes sustainable growth. Key elements which relate to the freshwater environment are summarised below.

- Inappropriate development in areas at risk of flooding should be avoided. Where development in such areas is necessary, the design of the development should make them safe and not increase flood risk elsewhere. Where possible, new development should be used as an opportunity to reduce the causes and impacts of flooding (paragraphs 100 – 104, NPPF).
- The planning system should prevent new development from contributing to water pollution, and protect existing development from being adversely affected by unacceptable levels of water pollution (paragraph 109, NPPF).

14.3.7 The National Policy Statement for National Networks (Reference 4. DT) sets out planning policy with reference to the rail infrastructure aspects of the Project. It refers to NPPF as the main source of guidance with regard to flood risk, before re-stating NPPF requirements in the context of linear infrastructure (paragraphs 5.90 *et seq.*). With regard to water quality and resources, the guidance notes that network infrastructure development can lead to adverse effects on the water environment, including inland surface water *inter alia*, which can result in a failure to meet environmental objectives established under WFD and makes recommendations for assessment of impacts in this context (paragraph 5.219 *et seq.*).

14.3.8 Copeland Local Plan 2013-2028: Core Strategy and Development Management Policies (Reference 5. CBC). Policy ENV1 relates to Flood Risk and Risk Management and states that Copeland Borough Council (CBC) will ensure that development in the Borough is not prejudiced by flood risk through: permitting new build development only on sites located outside areas of risk of flooding; ensuring that new development does not contribute to increased surface water runoff; supporting measures to address the constraints of existing drainage infrastructure and avoiding development in areas where the existing drainage infrastructure is inadequate; and support of new flood defence measures to protect against both tidal and fluvial flooding, including appropriate land management.

14.3.9 Allerdale Local Plan 2014-2029 (Reference 6. ABC): Policy S29 considers flood risk and surface water drainage and states that development will be avoided in locations which are at risk of flooding or would increase flooding elsewhere. The policy resists development in those areas of greatest flood risk. Policy S32 states that proposals will not be supported where they would cause pollution to the water environment, or cause deterioration of WFD status.

Regulatory framework and guidance

14.3.10 The chief custodian of the water environment is the Environment Agency (EA). The EA has a duty under the Water Resources Act 1991 (Section 16) to maintain and, where appropriate, enhance conservation of the surface water environment.

14.3.11 The WFD (the EU Water Framework Directive (2000/60/EC) provides the framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater. The WFD was enacted into domestic law by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003). The EA is the designated 'competent authority' with responsibility for delivering the objectives of the WFD in England.

14.3.12 The principal objective of the WFD requires that all inland and coastal waters must reach at least 'good' status over a sequence of six-year planning cycles, with the current, second cycle ending in 2021, and that the status of all water bodies should not deteriorate. For surface waters there are two separate classifications for water bodies contributing to overall status: ecological and chemical. For a surface water body to be in overall 'good' status both ecological and chemical status must be at least 'good'. Ecological status is recorded on a scale high, good, moderate, poor and bad and is classified by evaluation of the biological, physico-chemical and hydromorphological elements against various standards or benchmarks (e.g. Environmental Quality Standards (EQSs) for water quality). Chemical status is recorded as good or fail, and is evaluated on the basis of meeting EQSs for specific priority substances or priority hazardous substances, such as pesticides and heavy metals. Current EQSs for WFD in England and Wales are specified in the WFD Directions 2015 (Reference 7, DEFRA).

14.3.13 Individual water bodies that have been modified by man to the extent that it will not be possible for them to meet WFD targets are categorised as Heavily Modified Water Bodies (HMWBs). Artificial Water Bodies (AWBs) are also assessed. However HMWBs and AWBs are required to meet good ecological 'potential' rather than 'status'. The ecological potential of a HMWB or AWB represents the degree to which the quality of its aquatic ecosystem approaches the optimum condition it could achieve, given the heavily modified or artificial characteristics of the water body that are necessary for its use or for the protection of the wider environment.

14.3.14 Implementation of the WFD is primarily achieved through river basin management planning which is the responsibility of the EA. Current water body classifications, environmental objectives and proposals for programmes of measures to achieve these objectives are brought together in a river basin management plan (RBMP) for each river basin district. The rivers Calder and Ehen and the tributaries of these rivers are in the North West River Basin District, which is reported in the North West RBMP second cycle (Reference 8. EA).

14.3.15 The EA's duties are set out in its strategy for managing water abstraction (Reference 9. EA). Under this strategy, the EA assesses the availability of both surface water and groundwater resources for abstraction using its Abstraction Licensing Strategy (ALS, formerly called Catchment Abstraction Management Strategy (CAMS)) process. This determines how much water is available for abstraction on a catchment-by-catchment basis, based on the volume of water already licensed for abstraction and taking into account the requirements of the water environment. The Moorside Project is located in the area covered by the Derwent and West Cumbria ALS (Reference 10. EA).

14.3.16 The EA is also responsible for flood defence and drainage for main rivers and estuarine and coastal areas. It regulates works in or near main rivers through issuing Environmental Permits for flood risk activities, in accordance with the Environmental Permitting (England and Wales) (Amendment) (No. 2) Regulations 2016. It must also ensure that channel modifications undertaken as part of works in or near main rivers are compliant with the aims of the WFD. The EA has produced regional management plans and policies for flood risk management relevant to this assessment. The Moorside Project is within the area covered by the South West Lakes Catchment Flood Management Plan (Reference 11. EA).

14.3.17 Cumbria County Council (CCC) is the lead local flood authority and has responsibility for managing flooding from local sources, namely ordinary watercourses, surface water (overland runoff) and groundwater in the administrative area of Cumbria. Part of this responsibility includes the preparation of a Local Flood Risk Management Strategy, which was published March 2015 (Reference 12. CCC). CCC is the flood defence consenting authority for ordinary watercourses and as such regulates work relevant to Section 23 of the Land Drainage Act 1991.

14.3.18 Other general guidance relating to the freshwater environment includes the following:

- Pollution Prevention Guidelines (various dates). These are no longer maintained as officially endorsed Environment Agency guidance in England and have not been replaced, but still provide a useful reference for good practice measures for protection of the water environment;
- Ministry of Agriculture, Fisheries and Food (MAFF): Good Practice Guide for Handling Soils (2000);
- SEPA (June 2000): Ponds, Pools and Lochans. Guidance on good practice in the management and creation of small waterbodies in Scotland (although Scottish guidance, this is considered best practice guidance for developments in England as well). http://www.sepa.org.uk/water/water_regulation/regimes/engineering/habitat_enhancement/best_practice_guidance.aspx;
- Construction Industry Research and Information Association (CIRIA) Report C532: Control of Water Pollution from Construction Sites (2001);

- British Standard 8533:2001: Assessing and managing flood risk in development. Code of practice (2001);
- CIRIA Report C624: Development and Flood Risk – Guidance for the Construction Industry (2004);
- CIRIA Report C698: Site Handbook for the Construction of SuDS (2007);
- BS6031: Code of Practice for Earthworks (2009);
- CIRIA Report C692: Environmental Good Practice on Site (2010);
- Planning Practice Guidance: Flood risk and coastal change (Department for Communities and Local Government, 2014);
- Planning Practice Guidance: Water Supply, wastewater and water quality (Department for Communities and Local Government, 2015).
- CIRIA Report C753: The SuDS manual (revised version, 2015);
- Principles for Flood and Coastal Erosion Risk Management (for new nuclear power stations, Environment Agency and Office for Nuclear Regulation, Version 2, Nov 2015);
- Flood risk assessments: climate change allowances (Environment Agency, 2016)

Legislation

14.3.19 The following legislation will be used to inform the assessments:

- Control of Pollution Act 1974 (as amended);
- Salmon and Freshwater Fisheries Act 1975;
- Wildlife and Countryside Act 1981;
- Environmental Protection Act 1990;
- Water Resources Act 1991;
- Land Drainage Act 1991;
- Countryside and Rights of Way Act 2000;
- Water Act 2003;
- European Union (EU) WFD (2000/60/EC), as enacted into domestic law by the Water Environment (WFD) (England and Wales) Regulations 2003;
- Environmental Damage (Prevention and Remediation) Regulations 2009;
- Private Water Supplies Regulations 2009;
- The European Union (EU) Floods Directive (2007/60/EC), as enacted into domestic law by the Flood Risk Regulations 2009;

- Water Resources Act 1991 (Amendment) (England & Wales) Regulations 2009;
- Flood and Water Management Act 2010;
- Environmental Permitting (England and Wales) Regulations (EPR), 2010;
- Conservation of Habitats and Species Regulations 2010; and
- The WFD (Standards and Classification) Directions (England and Wales) 2015.

14.4 Data gathering methodology

Study areas

14.4.1 Two distinct Study Areas have been identified for the surface freshwater assessments in this chapter. The Study Areas have been defined as the areas over which potential effects on the surface freshwater environment could be experienced, as a result of the Moorside Site, the Accommodation Sites, the Corkickle to Mirehouse Railway Site and the St. Bees Railway Site (as shown on **Figures 14.1** and **14.2**). These areas give consideration to the spatial scope of potential impacts, prospective freshwater receptors (i.e. inland surface water bodies) that could be impacted and the presence of hydrological pathways between the Moorside Project and the defined water bodies. Using the rationale outlined above, the Study Areas for the Moorside Project have been drawn to include all WFD water body catchments that are downstream of, or contain the Moorside Site, the Accommodation Sites, the Corkickle to Mirehouse Railway Site and the St. Bees Railway Site. Those catchment areas located upstream of these sites will not be included within the Study Areas due to the lack of a direct surface water pathway. It is acknowledged that effects could occur on surface water receptors upstream of the site via a groundwater pathway; the potential for such effects is discussed in **Chapter 13** (Freshwater environment: groundwater).

14.4.2 Generally, the Cycle 2 2015 RBMP water body catchments provide the point of reference from which the Study Areas are defined. However, where appropriate, consideration has also been given to Cycle 1 2009 RBMP (Reference 13. EA) water bodies where a particular water body would otherwise be omitted from the study. In particular the Pow Beck (Whitehaven) branch comprises a stand-alone catchment that was assessed under the Cycle 1 2009 RBMP but was de-designated for the Cycle 2 2015 RBMP.

14.4.3 A summary of the identified Study Areas for the Moorside Site, the Accommodation Sites, the Corkickle to Mirehouse Railway Site and the St. Bees Railway Site is provided in **Table 14.1**.

Table 14.1 Surface water Study Areas for the Moorside Project

Study Area Name	Constituent WFD river water bodies	Related Moorside Site
Ehen and Calder	Ehen (Lower) GB112074069980, Kirk Beck GB112074069970 and Calder (Lower) GB112074069730	Moorside Site
		Egremont Site
Pow Becks	Pow Beck (Whitehaven) – non WFD catchment de-designated in Cycle 2 2015 RBMP and Pow Beck (South West Lakes) GB112074069990	Corkickle Site
		Corkickle to Mirehouse Railway Site
		Mirehouse Site
		St. Bees Railway Site

Desk study

14.4.4 Publically available information for the Study Areas defined above has been collected to supplement the data acquired through survey work. Data that have been collected include the following:

- EA river flow data (continuous and periodic spot flows);
- EA river water quality data;
- relevant WFD classifications and associated data;
- Sellafield Ltd Environmental reports (discharge and monitoring information);
- information on licensed and deregulated surface water abstractions;
- private water supply information;
- permitted discharges to surface water;
- EA digital rivers network;
- EA flood mapping, flood defence asset information, recorded historical flood outlines; and
- EA fluvial flood model output from the River Calder and the River Ehen.

Survey work

14.4.5 The EA monitors rivers to test water chemistry and nutrient levels. This is undertaken monthly at locations set to allow compliance assessments for WFD water bodies. Seven EA river monitoring sites were identified as being relevant for the Moorside Project. However, these were mainly located in the lower reaches of the Rivers Ehen and Calder. The EA sampling locations did not cover all of the potential surface waters that could be impacted by the project and were not sampled for all of the potential pollutants that could be discharged

as a result of the construction and operational phases of the Moorside Project. As such an additional suite of monitoring was undertaken by NuGen in 2015 at 27 locations across a range of surface waters in the vicinity of the Moorside Site. The physical and chemical analytical suite for water sampling includes an extensive range of determinands which have been selected on the following basis:

- to allow a broad characterisation of baseline water quality conditions;
- to include supporting elements for ecological status under the WFD;
- to include relevant specific pollutants, priority substances and priority hazardous substances defined by the WFD and its daughter directives; and
- to take account of specific pollutants (including suspended solids and hydrocarbons) which may be discharged as surface water run-off from the Moorside Project during construction and/or operation.

14.4.6 A full year of monthly survey results are available for most locations. These results have been used to augment existing data sets to provide additional detail for the Moorside Site baseline presented later in this chapter. We consider that sufficient water quality data have now been collected to allow for adequate baseline characterisation. The only further survey that is planned for the Moorside Site in 2016 is a walkover to attempt to identify the sources of poor water quality in some of the smaller watercourses and ponds within the Moorside Site, and survey of the lower River Ehen to assess its morphology and sediment dynamics, and to identify the maximum upstream extent of saline influence.

14.4.7 No water quality survey work has been specified for the Accommodation Sites, the Corkickle to Mirehouse Railway Site and the St. Bees Railway Site. Given the less extensive and less intrusive nature of the development proposed for these sites, we consider that existing information is generally sufficient to allow baseline characterisation and impact assessment. However, walkovers of all Accommodation Sites have been completed to supplement the understanding of baseline conditions that we have developed from desk study of third party datasets.

Consultation

14.4.8 Further to the details outlined in **Chapter 3** above regarding the consultation that has taken place to date, it should be noted that consultation received from the following organisations has been used to inform the scope of the assessment; summarised details of which are outlined in **Section 14.5** below.

14.4.9 Organisations relevant to the assessment of the surface freshwater environment have been consulted. To date the consultees have included the following:

- Environment Agency (EA);
- Natural England (NE);

- Lake District National Park (LDNPA);
- Sellafield Ltd.;
- Highways England
- Cumbria County Council (CCC); and
- Copeland Borough Council (CBC).

14.4.10 Comments relating to preliminary versions of this chapter that were received from the consultees noted above are included in **Table 14.2**.

14.4.11 As well as the consultee responses to the PEIR, responses to the EIA Scoping Report have also been collated and reviewed. The key issues raised in response to the EIA in relation to the surface freshwater assessment include the following:

- agreement on the need for a standalone FRA and WFD Compliance Assessment;
- the need for the FRA to consider all forms of flooding, both to the development and to third party receptors. The FRA should also follow the most up to date relevant guidance, and the approach should be developed in consultation with relevant stakeholders (EA, Office for Nuclear Regulation, Lead Local Flood Authority and Local Planning Authorities);
- the WFD Compliance Assessment approach should be developed in consultation with EA;
- acknowledgement that significant uncertainty remains regarding source of Freshwater Water Supply and means of sewage disposal;
- comments on the proposed assessment methodology effects and that on low and very low sensitivity receptors cannot be significant.
- statements that cumulative and inter-topic effects should be assessed.
- statements that the proposed scoping out of water resources and designated sites impacts for the Accommodation Sites was not accepted.

Table 14.2 Consultation responses received in relation to the January 2016 release of the PEIR document.

Issue raised	Consultees	Response
There is a need for consistency between other relevant chapters, most notably Terrestrial and freshwater ecology chapter, Freshwater environment: groundwater chapter and relevant coastal and marine chapters.	Cumbria County Council	Greater clarity on what each chapter includes and links between chapters is now provided and references to other chapters is provided throughout this chapter when required.
One area that may require more robust mitigation than that currently suggested would be the construction of the proposed bridges across the River Ehen and River Calder. This includes assessments on flood risk, ecology and potential scour		There will no longer be a crossing on the Calder so it is not included in the assessments. Potential impacts from the Ehen crossing are noted in **Table 14.10**.
Table 14.1 (now **Table 14.4**) does not discuss the need to provide floodplain compensation for works within the 1 in 100 year fluvial flood extents (allowing for the potential effects of climate change)		This is considered in the measures noted in **Table 14.4.**
No consideration appears to have been given to the potential effects of flooding to the proposed works at all locations, principally from fluvial and tidal sources (including breach, surge or overtopping of defences).		Flood risks to the proposed works will be assessed in the forthcoming FRA that will accompany the DCO. The EIA only reports the effects of the Moorside Project on flood risk to third party receptors.
No consideration appears to have been given to the potential effects of climate change on flood risk, principally the effects of climate change on flooding to the proposed works.		Potential effects from climate change on flood risk have been considered in the impact **Tables 14.10 to 14.15**, and will be considered in full for flood risks to the Moorside Project as well as those arising from the Moorside Project on third party receptors in the FRA.

Issue raised	Consultees	Response
No consideration appears to have been given to the reduction of groundwater base flow to surface water features, caused by a disturbance to hydrogeology. If this is assessed within another chapter, this should be stated within this chapter.		This is covered in **Chapter 13** (Freshwater environment: groundwater).
No consideration appears to have been given to the potential migration of pollutants to surface water features via groundwater base flow (including surface borne contaminants such as oil spills, and ground borne contaminants such as leachate). If this is assessed within another chapter, this should be stated within this chapter.		This is covered in **Chapter 13** (Freshwater environment: groundwater), and this is stated within this chapter.
The assessment considers the potential effects associated with works within tidal/fluvial floodplain and associated with an increase in surface water runoff within the same paragraphs. Although this may be appropriate for the high level assessment at this time, we stress that these two risks must be assessed separately within future, more detailed assessments.		Effects associated with fluvial/tidal flooding and surface water flooding are now assessed separately from those associated with changes in surface runoff in the assessment of effects for the main Moorside Site in **Table 14.10**. This approach will be taken in forthcoming detailed assessments for all relevant Project Sites, which will be reported in the final FRA and ES.
There are apparent discrepancies in assessments of sensitivities and magnitude of impacts for receptors		Further clarification has been added into **Section 14.7** on how sensitivities and magnitudes have been assigned to receptors.
Flood resilience plans and sustainable urban drainage systems will need to developed in more detail and embedded in site designs.		This is acknowledged and will be addressed as site designs and the FRA progress.

Issue raised	Consultees	Response
The Council have previously highlighted the potential need for outflow data from Church Moss SSSI. It is not clear whether this has been taken into consideration.	Copeland Borough Council	This is covered in **Chapter 13** (Freshwater environment: groundwater).
It is not apparent what data will be collected for the AD or 'other' sites, and the Council consider this a matter for further clarification.		This has been explained in **Section 14.8**. We consider that there are sufficient third party data for setting the baseline and assessing potential impacts for the Accommodation Sites, the Corkickle to Mirehouse Railway Site and the St Bees Railway Site.
Further definition is required as to how the significance of impacts upon surface water features will be determined.		Further clarification has been added into **Section 14.7** on how significance of impacts has been assessed.
The Council considers that assessment also needs to include all sources of flooding, including groundwater, surface water, sewer flooding and infrastructure failure.		All sources of flooding will be considered in the final FRA and ES.
Pollution risk from accidental spillage during construction is not explicitly considered, and it is recommended that this be included.		This has been clarified in **Table 14.5** and the impact **Tables 14.10 - 14.15**.
Local water resources are already constrained in West Cumbria, which has significant implications for the potential impact of water extraction on the local water supply.		Information is not yet available regarding proposals for Freshwater Water Supply. As such it is not included in this PEIR but will be addressed in the ES.
The impact of any temporary crossing of the River Ehen on the hydromorphology of this river system will require an understanding of the physical condition of the bed, banks and floodplain, as well		Current design proposals indicate that the Heavy Haul Road crossing of the River Ehen will be a clear span crossing, with the nearest bridge piers set back from the channel. Consequently, no direct impacts on channel morphology are envisaged. However, this will be kept under review as the

Issue raised	Consultees	Response
as of the of the fluvial processes (erosion / deposition etc.) prevalent at this location. This is so that suitable mitigation can be identified to ensure Water Framework Directive compliance (hydromorphology).		crossing design progresses, and proposals for supporting morphological assessments will be developed accordingly.
The Council have not yet been consulted on the data derived from the Flood Risk Assessment, and would expect this assessment to include consideration of all sources of flooding and climate change.		We can confirm that the FRA will consider risks from all sources of flooding and the potential effects of climate change on the Moorside Project throughout its lifetime.
The baseline would benefit from a hydro-morphological survey of the River Ehen to be undertaken.		A walkover and a desk study of historical mapping are proposed to provide further baseline information on the morphology and sediment dynamics of the lower River Ehen.
We advise that the SSSI has wetland habitats that are an interest feature of the site and will, therefore, also need to be considered for construction and operational effects.	Natural England	The assessment in this chapter concentrates only on the effects of changes in surface water runoff pathways on the water balance and level regime of the pond within the SSSI, which is classified as a WFD waterbody in its own right. A full assessment of impacts on the SSSI is presented in **Chapter 18** (Terrestrial and freshwater ecology)
We have concerns about how the level of sensitivity has been applied to non-designated environmental receptors.	Environment Agency	Clarification has been provided on assessments for non-designated features in **Section 14.7**.
It is unclear how surface water quality and quantity impacts and associated mitigation relate to the proposals to be contained in the **Construction Environmental Management Plan (CEMP)**. Suggested solution provide clarification of		Details of environmental measures for protection of the surface freshwater environment during the construction phase of the Moorside Project would be provided in the CEMP.

Issue raised	Consultees	Response
the proposed purpose of the CEMP and whether or not it is intended to apply to Chapter 14.		
The impacts of development in the floodplain on third parties are acknowledged, but the risk to the Moorside Site is not mentioned. The risk of flooding both on and off site must be considered in a Flood Risk Assessment for the Moorside project.		The EIA considers the effects of the Moorside Project on its surroundings, and therefore only considers flooding effects on third party receptors. Flood risks to the Moorside Project itself will be considered, along with the risk to third parties arising as a consequence of the Project in the FRA.
Hydromorphology impacts relate to physical modifications of a watercourse and impacts from sedimentation. Ensure that sediment input is considered in relation to water quality impacts and hydromorphology impacts.		Impacts from sediments have been considered under hydromorphological impacts in **Tables 14.4 and 14.10 to 14.15**.
New sewage discharges will not be permitted where it is practicable for sites to connect to the public sewerage system.		Details of sewage effluent treatment and disposal is not known at this time so all potential options are being considered and are assessed in **Tables 14.10 to 14.15**.
R. Ehen, R. Calder and Kirk Beck have been recorded as having a "low sensitivity" to change (for morphology). All three waterbodies would be sensitive to physical modification.		Text clarifying how sensitivities have been assigned has been added to **Table 14.10 to 14.15.**
The upper River Ehen is a designated SAC/ SSSI so is highly sensitive to pollution or alterations to morphology. Reconsider the sensitivity conclusions and provide further explanation where no changes are proposed.		Cleator Moor is no longer being considered for the Moorside Project. As such, direct surface water effects arising from this site on the Ehen SAC/SSSI are no longer considered in this chapter. Any indirect impacts to the SAC/SSSI arising from fish migration are considered in **Chapter 18** (Terrestrial and freshwater ecology), as noted in **Section 14.5**.
Potential impacts on Ehen SAC interest features may not be assessed in relation to the bridge		As above.

Issue raised	Consultees	Response
crossing, e.g. impacts on salmon and trout and hence on freshwater mussel. Inclusion and appraisal of these additional receptors in to Chapter 14 or provide sufficient cross-referencing if they are considered elsewhere, e.g. Chapters 18.		
Ensure that de-culverting as a mitigation measure on the Corkickle Site is linked to the appropriate environmental receptors.		This is assessed in **Table 14.12**.
It is important to use the correct WFD references to ensure the watercourse's current overall status, status objectives and specific protected designation(s) are considered as part of any impact assessments.		The correct WFD numbers and names have been used where available.
It appears that not all localised impacts of discharges have been factored into assessments.		All localised impacts are included in the assessment and noted where they could cause a deterioration or significant impact on a receptor

14.5 Scope of the assessment

Potential receptors

14.5.1 Three categories of surface water receptor are located within the geographic boundary of the Study Areas for the Moorside Site, Accommodation Sites, the Corkickle to Mirehouse Railway Site and the St. Bees Railway Site and have been considered in this assessment (**Figures 14.1** and **14.2**). These comprise the following:

- aquatic environment: WFD surface water bodies, water-dependent designated nature conservation sites and non-reportable surface freshwater features;
- water resources: surface water abstractions and their associated catchments; and
- flood risk: people, property and infrastructure that could be at risk of flooding.

14.5.2 Under the WFD all designated surface waters are divided into water bodies. Each water body has a distinct geographic boundary which is used to classify the condition of waters and target actions. The basic unit for identification of aquatic environment receptors and assessment of effects upon them will be WFD surface water bodies, as defined in the EA's Cycle 2 2015 RBMP.

14.5.3 When assessing the potential for effects on WFD surface water bodies it is important to stress the difference between the WFD 'blue line' (i.e. the WFD river network, as shown on all figures), and the wider WFD water body catchments, within which the 'blue line' flows. Technically, all land within a WFD water body catchment boundary is a part of that water body. However, in terms of monitoring and assessing the status of that water body, classification data are usually derived from the most significant downstream watercourses within the catchment that are referred to as the WFD 'blue line'. This is important as, although potential effects could propagate downstream from works within the wider catchment, there is a greater likelihood that potential effects could result from works that coincide with the 'blue line' itself.

14.5.4 The surface freshwater assessment will consider potential effects on the water quality and hydromorphology elements of WFD river water body status. There are other elements of WFD characterisation (predominantly biology elements) such as macroinvertebrates and diatoms which are not assessed directly within the surface freshwater topic. However, any changes in these WFD biology elements would occur as an indirect result of changes to the water quality or the hydromorphology of a water feature. Potential effects on fish populations and other water dependent protected species, such as otter, will be addressed within **Chapter 18** (Terrestrial and freshwater ecology).

14.5.5 The potential for effects on the supporting water quality and hydromorphology for surface water dependent sites that are designated for nature conservation purposes (i.e. SAC, SPA, Ramsar, SSSI and NNR, Ancient Woodland, Local

Nature Reserves, County Wildlife Sites) will also be considered. In this context, the potential surface water dependence and consequent impacts on water quality and hydromorphology arising from the Moorside Project will be considered in respect of relevant aspects of the condition and conservation objectives of each site as appropriate.

14.5.6 Water resources receptors are defined within this assessment as surface water abstractions. The EA uses WFD water bodies as the basic unit for assessment of abstraction impacts and water availability in their Abstraction Licensing Strategies, thereby ensuring that spatial scales for assessment are consistent between the aquatic environment and water resources receptors.

14.5.7 Flood risk receptors are defined within this assessment as people, property and infrastructure that could be at risk of flooding. For this preliminary assessment, potential receptors have been identified on the basis of qualitative assessment of potential flood pathways from the Moorside Project. For the purposes of the ES and FRA, this will be supplemented by a model-based quantitative assessment, where significant potential flooding impacts have been identified.

14.5.8 The hydrology and water quality of surface waters can be impacted by groundwater base flow. Groundwater is assessed under the WFD in a similar way to surface water in that it is broken down into water bodies. The assessment for potential impacts on groundwater bodies and of potential impacts on surface water bodies via a groundwater pathway from the Moorside Project is reported in **Chapter 13** (Freshwater environment: groundwater).

Spatial and temporal scope

Spatial scope

14.5.9 The spatial extent of the surface freshwater assessment with respect to the Moorside Project is described in **Section 14.4**. All surface water features within the Study Areas relating to the Moorside Site, the Accommodation Sites, the Corkickle to Mirehouse Railway Site and the St. Bees Railway Site are considered to be potential receptors (**Figures 14.1** and **14.2**).

Temporal scope

14.5.10 The assessment of surface water impacts includes the construction and operational phases of the Moorside Project at this preliminary stage. The eventual decommissioning of the Project will be considered in the ES.

Potentially significant effects

14.5.11 All the receptor groups listed above may be subject to potentially significant effects. These effects may arise from changes in water flows, levels, or quality or from water body morphology as a consequence of the Moorside Project, as summarised in **Table 14.3**.

Table 14.3 Potentially significant surface freshwater effects

Affected receptor group	Potential effect	Relevant development phase
Aquatic Environment	Direct morphological changes to watercourses and ponds arising from construction activities and development of infrastructure, including complete removal of some small watercourses and ponds within the Moorside Site.	Construction
Aquatic Environment and Water Resources	Deterioration in water quality due to elevated concentrations of suspended sediments in runoff arising from ground disturbance.	Construction
Aquatic Environment and Water Resources	Deterioration in water quality due to the transport of contaminants in surface runoff or dewatered groundwater arising from the disturbance of contaminated land.	Construction
Aquatic Environment, Water Resources and Flood risk	Increased stream or river flow rates as a consequence of discharges from dewatering of groundwater from excavations.	Construction
Aquatic Environment and Water Resources	Deterioration in water quality due to accidental release of contaminants into the surface water environment, e.g. leakage or spillage of fuel or lubricants. This could occur as a consequence of runoff from areas where hazardous materials are stored or used, or as a consequence of flooding of these areas.	Construction and Operation
Aquatic Environment and Water Resources	Deterioration in water quality due to discharge of treated sewage effluent to watercourses or storm related overflows from the sewer networks.	Construction and Operation
Flood Risk, Aquatic Environment and Water Resources	Increases in runoff rates arising from ground disturbance, landform changes and the development of impermeable surfaces.	Construction and Operation
Flood Risk	Reduced flood storage arising from construction activities and development of infrastructure in floodplain areas.	Construction and Operation
Flood Risk	Changes in channel conveyance arising from development of infrastructure in and around watercourses, e.g. the installation of temporary or permanent watercourse crossings.	Construction and Operation

14.5.12 The effects summarised in **Table 14.13** occur via surface water pathways from the Moorside Project and are assessed in this chapter. Potentially significant effects arising from the Moorside Project via a groundwater pathway, such as changes in river baseflow arising from changes in groundwater discharge patterns and rates, are assessed in **Chapter 13** (Freshwater environment: groundwater).

14.5.13 It is possible for indirect effects to occur on ecological receptors as a consequence of effects on surface water receptors. For instance, effects on water quality, flows or channel morphology in the River Ehen could lead to effects on migratory fish. Indirect effects on aquatic species and habitats and associated conservation designations arising from effects on surface water receptors are assessed in **Chapter 18** (Terrestrial and freshwater ecology).

14.5.14 Details on potential land contamination that could affect surface freshwater receptors can be found in **Chapter 11** (Soils, geology and land quality).

14.5.15 It is considered that potential effects on the surface freshwater environment could arise from construction and operation of the Moorside Site, the Accommodation Sites, the Corkickle to Mirehouse Railway Site and the St. Bees Railway Site.

14.5.16 As noted in **Section 14.4**, it is considered unlikely that works at the sites for the Highway Improvements would lead to significant surface freshwater effects, and these sites have been scoped out from further assessment.

14.6 Environmental measures incorporated into the proposed development

14.6.1 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 surface freshwater receptors at each of the Moorside Site, Accommodation Sites, the Corkickle to Mirehouse Railway Site and the St. Bees Railway Site are set out in **Table 14.4**. Where environmental measures are currently unknown, or uncertain, they are not included within **Table 14.4**. Further measures will be included in the ES as they are designed and confirmed. Details of how construction phase environmental measures would be implemented will be provided in a Construction Environmental Management Plan (CEMP), which will accompany the ES as part of the DCO Application. For context, WFD water bodies, flood zones and abstractions within the Study Areas are shown in **Figures 14.1** and **14.2**.

Table 14.4 Rationale for incorporation of environmental measures

Potential receptor	Predicted changes and potential effects	Incorporated measure
Moorside Site only		
Aquatic environment – **Ehen (lower) WFD water body GB112074069980 (water quality)**	During the construction and operational phases of the Moorside Site there could be increased concentrations of pollutants such as ammonia and phosphates released into the River Ehen from sewage discharges (should these occur).	Environmental Permits for all relevant water discharges would be sought. Permits for treated sewage effluent discharge would impose conditions on the quality of effluent discharge in order to protect receiving water quality. The use of existing infrastructure at Braystones Wastewater Treatment Works (which discharges to sea) would avoid any effects on the River Ehen.
Aquatic environment – **Ehen (lower) WFD water body GB112074069980 (water quality and quantity)**	The construction and operational phases of the Moorside Site could result in an impact on water quality and quantity in the River Ehen through a potential increase in surface water runoff and dewatering activities. Runoff from areas disturbed by construction could be laden with high concentrations of suspended sediments. Uncontrolled runoff and dewatering discharges from the site could lead to deterioration in the water quality status of the Ehen.	The creation of swales, settlement ponds and other related drainage techniques within the Moorside Site should prevent pollutants from entering the watercourses. Climate change impacts over the lifetime of the development would be factored into the design of permanent drainage infrastructure. It is likely that surface water runoff from the power station site would be discharged directly to sea, in the latter stages of construction and during the operational phase of the Project.
Aquatic environment – **Ehen (lower) WFD water body GB112074069980 (hydromorphology)**	The construction and operation of the bridge crossing the River Ehen could lead to local changes in in-channel morphology, with subsequent implications for riverine habitat availability.	The detailed bridge design process will seek to avoid any impacts on the channel and immediate riparian corridor. If this cannot be avoided, measures would be taken to ensure that alterations to in-channel morphology, and associated bed/bank reinforcement would not have an adverse effect on the overall status of WFD water body. The final bridge design would be subject to agreement with the EA via the Environmental Permitting for flood risk activities process.
Aquatic environment - **Calder (lower) WFD water body GB112074069730 (water quality)**	The Moorside Site includes interim laydown areas and landscaping mounds within the catchment of this waterbody. The construction and operational phases could result	The creation of swales, settlement ponds and other related drainage control techniques within the Moorside Site should prevent pollutants from entering the River Calder. Climate change impacts over

Potential receptor	Predicted changes and potential effects	Incorporated measure
	in an increase in sediments and other pollutants being discharged into the River Calder upstream of the Sellafield site.	the lifetime of the development would be factored into the design of permanent drainage infrastructure.
Aquatic environment - **Kirk Beck (Ehen) WFD water body GB112074069970 (water quality)**	Some construction activities on the Moorside Site (i.e. the creation of the landscaping mound in the northern area of the site) could lead to water quality effects in this water body arising from surface water runoff from the site and potential dewatering activities.	The creation of swales, settlement ponds and other related drainage techniques on the Moorside Site should prevent pollutants from entering this surface water body. Climate change impacts over the lifetime of the development would be factored into the design of permanent drainage infrastructure.
Aquatic environment **- All Water Framework Directive (WFD) freshwater water bodies in the Ehen and Calder Study Area.**	During the construction phase pollution incidents could affect water quality. Pollution incidents could occur as a consequence of runoff from an area affected by spillage or leakage to nearby watercourses. Alternatively, pollution incidents could occur when areas where hazardous materials or stored or used are inundated by flood water.	Good practice environmental measures to minimise the potential for accidental release of harmful substances to the water environment would be implemented during all phases of construction. A pollution incident control plan would be prepared which would specify measures to be taken to minimise the impacts of any pollution incident, should this occur. Details of environmental measures and pollution incident response will be provided in the CEMP. Similar environmental measures and pollution incident control planning would be incorporated into operating procedures for the power station, once commissioned. All areas where potentially hazardous materials are stored or used would be capable of being isolated from the overall drainage system via pollution retention valves and pollution retention basins or tanks. During construction, the potential for flooding to cause pollution incidents would be minimised through ensuring that hazardous materials are stored in areas of low flood risk, and by ensuring measures are in place in a Flood Response plan to evacuate personnel and plant from high risk in the event of flooding. For the operational power station, radioactive waste storage areas would be subject to the strict requirements for flood risk assessment required by Nuclear

Potential receptor	Predicted changes and potential effects	Incorporated measure
		Site Licensing, most notably the requirement to ensure these areas are safe from the 1 in 10,000 per annum probability flood event from all sources. Elsewhere, the site drainage system would be designed to ensure flooding does not occur to at least the 1 in 100 per annum plus climate change event.
Aquatic environment – **Minor surface water features (e.g. drainage ditches, ponds)**	The layout of the Moorside Site during construction and operational of the Moorside Site could lead to the removal of several 'non-reportable' surface water features (i.e. minor ditches, streams and ponds that fall within the catchment of the WFD water body, but are not part of the WFD 'blue line').	It is acknowledged that several existing minor watercourses and ponds could be substantially altered or removed completely as a consequence of construction. Nevertheless, on restoration of temporary working areas and overburden mounds, opportunities would be sought to incorporate morphological improvements and maximise aquatic habitat into the on-site drainage network that would replace the existing ditches and ponds. The change from the existing agricultural land-use and the incorporation of SuDS water treatment into the site drainage system where appropriate should lead to an overall improvement in water quality relative to that currently seen in ditches and ponds across the Moorside Site.
Aquatic environment - **Low Church Moss SSSI including WFD water body**	The construction phase of the Moorside Site could result in an impact on water quality and quantity in the SSSI through potential increase surface water runoff rates from construction areas adjacent to the SSSI. Once completed, part of the surface water catchment of the SSSI pond would be occupied by the power station, and runoff from this area would be directed away from the SSSI, which could affect its water balance.	Measures would be implemented during construction to avoid any discharge from working areas to the SSSI, to ensure that water quality impacts are avoided. During operation, the Moorside Site drainage systems would not discharge to the SSSI, so impacts on water quality would be avoided. Impacts on SSSI water balance arising from the loss of a portion of its surface water catchment remain uncertain, pending completion of further detailed assessment. Further specific mitigation measures may be required to address this issue.

Potential receptor	Predicted changes and potential effects	Incorporated measure
Surface Water Abstractions **- SWL01 and SWL02 (sourced from Ehen (Lower) Water Body)** **- SWL03, SWL04, SWD01 (sourced from Calder (Lower) Water Body)**	During the construction and operational phases of the Moorside Site, increases in pollutants or changes in river flows may have an adverse impact on these abstractions from the Rivers Ehen and Calder.	The measures listed above taken to protect the aquatic environment of the Ehen (Lower) and Calder (Lower) WFD water bodies would also be effective in minimising impacts on abstractions that are sourced from it.
Flood risk - **Property and infrastructure at risk of flooding via a fluvial pathway in the vicinity of the Moorside Site (e.g. properties and roads around Braystones, Beckermet, Calder Bridge and the Sellafield site)**	During the construction and operational phases of the Moorside Site, development in the floodplain could lead to increased risk to third party receptors for fluvial flooding in the vicinity of the Moorside Site.	Built development has mostly been situated away from floodplain areas to avoid loss of floodplain storage. Nevertheless, some construction activities and elements of temporary and permanent infrastructure would need to be located in the Ehen floodplain. Preliminary assessment using the EA's Ehen River Model suggests the effects of the permanent development on flood levels and extents in the Ehen floodplain would be minimal and would not extend to third party flood receptors. However, further assessment is on-going, and mitigation measures will be developed to address any resulting change in flood risk, should this be required. Furthermore, the extent of construction phase activities in the flood plain could be more extensive than the extent of the permanent development. Mitigation measures would take into account climate change effects over the lifetime of the development.
Flood risk - **People, property and infrastructure at risk of flooding via a surface water pathway downstream of the Moorside Site**	Increased downstream flood risk resulting from uncontrolled runoff from disturbed areas during construction and from new impermeable surfaces during construction and operation.	Surface water runoff from the Moorside site to adjacent watercourses to be limited to pre-development rates or rates as agreed with the Lead Local Flood Authority. Measures to restrict runoff to agreed rates would include allowance of the effects of climate change on extreme rainfall intensity over the lifetime of the development. Options for the direct discharge to sea of runoff from the operational power station site are also currently being investigated.

Potential receptor	Predicted changes and potential effects	Incorporated measure
Corkickle Site		
Aquatic environment - **Pow Beck (Whitehaven) not a designated WFD water body in the second cycle RBMP (water quality)**	During both the construction and operational phases there could be increased concentrations of pollutants such as ammonia and phosphates released into the freshwater environment from sewage discharges into the Pow Beck (Whitehaven).	Environmental Permits for all relevant water discharges would be sought. Permits for treated sewage effluent discharge would impose conditions on the quality of effluent discharge in order to protect receiving water quality. Current infrastructure would be used where viable and improved if required to account for higher volumes of sewage.
Aquatic environment - **Pow Beck (Whitehaven) not a designated WFD water body in the second cycle RBMP (hydromorphology)**	The construction and operation of the Corkickle Site could lead to local changes in channel morphology, including removal of existing sections of culvert along the Pow Beck (Whitehaven), with subsequent implications for riverine habitat availability.	Proposals for removal of existing culverts should result in morphological improvements as a consequence of the development. Site design and any potential alterations to culverts would address the need to ensure that alterations to in-channel morphology, and associated bed/bank reinforcement would not have an adverse effect on WFD water body status. An Environmental Permit for flood risk activities would be required for any works in and around the watercourse.
Aquatic environment - **Pow Beck (Whitehaven) not a designated WFD water body in the second cycle RBMP (water quantity and quality)**	The construction and operational phases of the development at this site could result in an impact on water quality and quantity in the Pow Beck (Whitehaven), which runs through the site, through a potential increase in surface water runoff. This could be laden with high concentrations of suspended sediments from disturbed areas during construction. Uncontrolled runoff could lead to deterioration in the water quality status of the Pow Beck.	The creation of swales, settlement ponds and other related drainage techniques within the Corkickle Site should prevent pollutants from entering the watercourses. Climate change impacts over the lifetime of the development would be factored into the design of permanent drainage infrastructure.
Aquatic environment - **Pow Beck (Whitehaven) not a designated WFD water body in the second cycle RBMP (water quality)**	During the construction phase pollution incidents could affect water quality.	Good practice environmental measures to minimise the potential for accidental release of harmful substances to the water environment would be implemented during construction. This would include ensuring that hazardous materials are stored in areas of low flood risk. A pollution incident control plan would be prepared which would specify

Potential receptor	Predicted changes and potential effects	Incorporated measure
		measures to be taken to minimise the impacts of any pollution incident, should this occur. Details of environmental measures and pollution incident response will be provided in the CEMP.
Flood risk - **Property and infrastructure at risk of flooding via a fluvial pathway (i.e. roads and properties in Whitehaven in the vicinity of Pow Beck)**	During the construction and operational phases of the development at this site, development in the floodplain could lead to increased flood risk to third party land downstream in Whitehaven	Built development has been arranged within the Corkickle Site to avoid areas at high risk of flooding from Pow Beck (Flood Zone 3), thereby minimising effects on floodplain storage in and around the site associated with the development. Further modelling work will be carried out to ensure that existing floodplain storage is preserved and the proposed de-culverting of the Pow Beck would not increase flood risk. Any mitigation measures that might be required would take into account the effects of climate change over the lifetime of the development. An Environmental Permit for flood risk activities would be required for any works in and around the watercourse.
Flood risk - **People, property and infrastructure at risk of flooding via a surface water pathway downstream of the site**	Increased downstream flood risk resulting from uncontrolled runoff from disturbed areas during construction and from new impermeable surfaces during construction and operation.	Surface water runoff from the site to be limited to pre-development rates or rates as agreed with the Lead Local Flood Authority. Measures to restrict runoff to agreed rates would include allowance of the effects of climate change on extreme rainfall intensity over the lifetime of the development.
Mirehouse Site		
Aquatic environment - **Pow Beck (SW Lakes) WFD water body GB112074069990 (water quality)**	During both the construction and operational phases there could be increased concentrations of pollutants such as ammonia and phosphates released into the freshwater environment from sewage discharges into the Pow Beck (SW Lakes).	Either new or variation of existing Environmental Permits for water discharge activities would be sought. Permits such as for treated sewage effluent discharge should control the quality of effluent discharge and protect water quality. Current infrastructure would be used where viable.
Aquatic environment - **Pow Beck (SW Lakes) WFD water body GB112074069990 (water quantity and quality)**	The site borders ditches and drains which flow into the Pow Beck (SW Lakes). As such, the construction and operational phases of the development at	The creation of swales, settlement ponds and other related drainage techniques within the Mirehouse Site should prevent pollutants from entering the watercourses. Climate

Potential receptor	Predicted changes and potential effects	Incorporated measure
	this site could result in an impact on water quality and quantity in the Pow Beck (SW Lakes) through a potential increase in surface water runoff. This could be laden with high concentrations of suspended sediments from disturbed areas during construction. Uncontrolled runoff could lead to deterioration in the water quality status of the Pow Beck (SW Lakes).	change impacts over the lifetime of the development would be factored into the design of permanent drainage infrastructure.
Aquatic environment - **Pow Beck (SW Lakes) WFD water body GB112074069990 (water quality)**	During the construction phase pollution incidents could affect water quality.	Good practice environmental measures to minimise the potential for accidental release of harmful substances to the water environment would be implemented during all phases of construction. This would include ensuring that hazardous materials are stored in areas of low flood risk. A pollution incident control plan would be prepared which would specify measures to be taken to minimise the impacts of any pollution incident, should this occur. Details of environmental measures and pollution incident response will be provided in the CEMP.
Aquatic environment - **Pow Beck (SW Lakes) WFD water body GB112074069990 (hydromorphology) AND** Flood risk - **People, property and infrastructure at risk of flooding from the Pow Beck around the site**	The construction and operation of the Mirehouse Site could lead to local changes in channel morphology of the small watercourses running through it, with subsequent implications for riverine habitat availability and flood risk to downstream properties in Mirehouse	Site design and any potential alterations to drainage would address the need to ensure that alterations to in-channel morphology, and associated bed/bank reinforcement would not have an adverse effect on the WFD water body status or flood risk. Land drainage consents from the Lead Local Flood Authority would be required for any works in and around the ordinary watercourses running through the site.
Flood risk - **People, property and infrastructure at risk of flooding from surface water sources around the site.**	Increased downstream flood risk resulting from uncontrolled runoff from disturbed areas during construction and from new impermeable surfaces during construction and operation.	Surface water runoff from the site would be limited to pre-development rates or rates as agreed with the Lead Local Flood Authority. Measures to restrict runoff to agreed rates would include allowance of the effects of climate change on extreme rainfall intensity over the lifetime of the development.

Potential receptor	Predicted changes and potential effects	Incorporated measure
Egremont Site		
Aquatic environment - **Ehen (lower) WFD water body GB112074069980 (water quality)**	During the construction and operational phases of the Egremont Site, there could be increased concentrations of pollutants such as ammonia and phosphates released into the River Ehen from sewage discharges (should these occur).	Either new or variation of existing Environmental Permits for water discharge activities would be sought. Permits such as for treated sewage effluent discharge should control the quality of effluent discharge and protect water quality. The use of current infrastructure such as Braystones wastewater treatment works (which discharges to sea), would avoid impacts on the River Ehen.
Aquatic environment – **Ehen (lower) WFD water body GB112074069980 (water quality and quantity)**	The construction and operational phases of the Egremont Site could result in an impact on water quality and quantity in the River Ehen through a potential increase in surface water runoff. This could be laden with high concentrations of suspended sediments from disturbed areas during construction. An uncontrolled input could lead to deterioration in the water quality status of the Ehen.	The creation of swales, settlement ponds and other related drainage techniques within the Moorside Site should prevent pollutants from entering the watercourses. Oil interceptors would be incorporated into drainage for car and bus parking areas. Climate change impacts over the lifetime of the development would be factored into the design of permanent drainage infrastructure.
Aquatic environment - **Ehen (lower) WFD water body GB112074069980 (water quality)**	During the construction phase pollution incidents could affect water quality.	Good practice environmental measures to minimise the potential for accidental release of harmful substances to the water environment would be implemented during all phases of construction. This would include ensuring that hazardous materials are stored in areas of low flood risk. A pollution incident control plan would be prepared which would specify measures to be taken to minimise the impacts of any pollution incident, should this occur. Details of environmental measures and pollution incident response will be provided in the CEMP.
Flood risk - **People, property and infrastructure at risk of flooding (e.g. properties and roads in Egremont and the lower Ehen valley)**	During the construction and operational phases of the Egremont Site development in the floodplain could lead to increased flood risk to third parties	Although parts of the Egremont Site are in the floodplain of the River Ehen (i.e. in Flood Zones 2 and 3), no development would be located in these areas, thereby ensuring there is no reduction in floodplain storage or channel conveyance

Potential receptor	Predicted changes and potential effects	Incorporated measure
Flood risk - **People, property and infrastructure at risk of flooding from surface water sources around the site.**	Increased downstream flood risk resulting from uncontrolled runoff from disturbed areas during construction and from new impermeable surfaces during construction and operation.	Surface water runoff from the site would be limited to pre-development rates or rates as agreed with the Lead Local Flood Authority. Measures to restrict runoff to agreed rates would include allowance of the effects of climate change on extreme rainfall intensity over the lifetime of the development.
Corkickle to Mirehouse Railway Site and St. Bees Railway Site		
Aquatic environment **(water quantity and quality)** **- Pow Beck (Whitehaven) not a designated WFD water body in the second cycle RBMP** **- Pow Beck (SW Lakes) WFD water body GB112074069990**	Ground disturbance arising from construction activities could lead to increased runoff with elevated concentrations of suspended sediments from the site to nearby watercourses	The extent of ground disturbance associated with construction at this site is expected to be minimal, in comparison with other aspects of the development. Nevertheless, measures would be put in place during construction to control runoff rates from the site and to promote the settlement of suspended sediment before runoff is discharged from the site. Further details will be provided in the CEMP.
Aquatic environment **(water quality)** **- Pow Beck (Whitehaven) not a designated WFD water body in the second cycle RBMP** **- Pow Beck (SW Lakes) WFD water body GB112074069990**	During the construction and operations phase pollution incidents could affect water quality in nearby watercourses.	Good practice environmental measures to minimise the potential for accidental release of harmful substances to the water environment would be implemented during all phases of construction. This would include ensuring that hazardous materials are stored in areas of low flood risk. A pollution incident control plan would be prepared which would specify measures to be taken to minimise the impacts of any pollution incident, should this occur. Details of environmental measures and pollution incident response will be provided in the CEMP. Pollution of prevention during the operations phase will be in accordance with Network Rail environmental guidance[1].
Flood risk - **Property and infrastructure at risk of flooding (i.e. roads and**	Flood risk could increase as a consequence of the construction	Surface water runoff from the site to would be limited to pre-development rates or rates as agreed with the Lead

[1] https://www.safety.networkrail.co.uk/On-site-Solutions/Environment/Environmental-Guidance-Library

Potential receptor	Predicted changes and potential effects	Incorporated measure
properties in Whitehaven St. Bees)	and operation of the development due to: -increased runoff from disturbed areas during construction, and from new impermeable surfaces during operation; - changes to watercourse conveyance as a consequence of works and bridges and culverts; - changes to flood storage as a consequence of the locating temporary or permanent infrastructure in the floodplain.	Local Flood Authority. Measures to restrict runoff to agreed rates would include allowance of the effects of climate change on extreme rainfall intensity over the lifetime of the development. No new watercourse crossings are proposed, and no changes would be made to existing watercourse crossings. No new raised structures would be located in areas of high fluvial flood risk (Flood Zone 3).

14.7 Assessment methodology

14.7.1 **Chapter 3** of this PEIR and **Chapter 9** of the EIA Scoping Report identify relevant details as to the applicable guidance and methodology that have been adopted with respect to the assessment process and the evaluation of the significance of effects which may arise from the Moorside Project. Assessment methodologies will be refined as further baseline data and scheme design information become available. Relevant consultees will be engaged to ensure confirmation and agreement on assessment methodology and scope throughout this evolving project design process.

Methodology for prediction of effects

14.7.2 The general methodology for assessment of effects is described in **Chapter 3.** In this chapter the significance of effects is evaluated as a product of the sensitivity of the receptor and the magnitude of change in water quality, quantity, morphology or flood risk arising from the proposed Moorside Project.

14.7.3 **Table 14.5** provides a summary of the criteria used to classify the sensitivity or value of the water environment and flood risk receptors that could be affected. This is based on an assessment of a number of criteria, including the following:

- the spatial scale of the receptor water feature;
- its WFD ecological status or potential;
- the presence of international or national nature conservations designations (where designations relate specifically to water dependent habitats or interest features);
- use for public or private water supply; and

- for flood risk receptors, sensitivity to flooding, principally as defined by the flood risk vulnerability classification in the National Planning Practice Guidance (NPPG) (Reference 14. DCLG), which accompanies the NPPF.

14.7.4 Assessment of compliance with the WFD is based on the evaluation of individual elements and not just the overall status and condition of receptors. For example a WFD water body might be at high status for water quality and would therefore be classed as being of High sensitivity for changes relating to water quality with reference to **Table 14.5**. However, the morphology of the river might not support good status under the WFD, so the sensitivity for changes to hydromorphological would be classified as Medium with reference to **Table 14.5**. Rationale on the selection of sensitivity for receptors is provided in the residual assessment of effects tables presented in **Section 14.8.**

Table 14.5 Summary of sensitivity (or value) of water features

Sensitivity	Criteria	Receptor type	Examples
Very high	Feature with a very high yield, quality or rarity with little potential for substitution.	Aquatic environment	Conditions supporting sites with international conservation designations (SACs, SPAs, Ramsar sites), where the designation is based specifically on aquatic features. Receptor water body: all relevant WFD elements* at high status/potential.
	Water resources supporting human health and economic activity at a regional scale.	Water resources	Regionally important public surface water supplies.
	Features with a very high vulnerability to flooding.	Flood risk	Land use types defined as 'Essential Infrastructure' (i.e. critical national infrastructure, such as essential transport and utility infrastructure) and 'Highly Vulnerable' (e.g. police/ambulance stations that are required to operate during flooding, mobile homes intended for permanent residential use) in the National Planning Policy Framework (NPPF) flood risk vulnerability classification.
High	Feature with a high yield, quality or rarity with a limited potential for substitution.	Aquatic environment	Conditions supporting sites with national conservation designations (e.g. SSSI, NNR) where the designation is based specifically on aquatic features.

Sensitivity	Criteria	Receptor type	Examples
			Receptor water body: all relevant WFD elements* at least good status/potential. Hydrology and morphology assessments support good status for the WFD
	Water resources supporting human health and economic activity at a local scale.	Water resources	Local public surface water supplies. Licensed non-public surface water supply abstractions which are large relative to available resource, or where raw water quality is a critical issue, e.g. industrial process water.
	Features with a high vulnerability to flooding.	Flood risk	Land use types defined as 'More Vulnerable' in the NPPF flood risk vulnerability classification (e.g. hospitals and health centres, educational institutions, most types of residential development).
Medium	Feature with a moderate yield, quality or rarity with some potential for substitution.	Aquatic environment	Sites with local conservation designations (e.g. LNRs, County Wildlife Sites) where the designation is based specifically on aquatic features. Receptor water body: all relevant WFD elements* at least moderate status/potential. Hydrology and morphology assessments do not support good status for the WFD
	Water resources supporting human health and economic activity at household/individual business scale.	Water resources	Licensed non-public surface water supply abstractions which are small relative to available resource, or where raw water quality is not important, e.g. cooling water, spray irrigation. Unlicensed potable surface water abstractions, e.g. private domestic water supplies.
	Features with a moderate to low vulnerability to flooding	Flood risk	Land use types defined as 'Less Vulnerable' in the NPPF flood risk vulnerability classification (e.g. most types of business premises).

Sensitivity	Criteria	Receptor type	Examples
Low	Commonplace feature with low yield or quality with good potential for substitution.	Aquatic environment	Receptor water body: relevant WFD elements* at less than moderate status/potential. Non-reportable WFD river water body (usually smaller coastal catchments, small drainage ditches etc).
	Water resources do not support human health, and of only limited economic benefit.	Water resources	Unlicensed non-potable surface water abstractions, e.g. livestock supplies.
	Features that are resilient to flooding	Flood risk	Land use types defined as 'Water-compatible development' in the NPPF flood risk vulnerability classification and undeveloped land (e.g. flood control infrastructure; water transmission infrastructure).

*For the purposes of this assessment, 'relevant WFD elements' are taken to mean:
i. all biological quality elements e.g. fish, macrophytes, invertebrates;
ii. all physico-chemical quality elements e.g. dissolved oxygen, phosphate;
iii. hydromorphological supporting elements.

The definition of 'relevant WFD elements' (given the lack of potential for the Project to influence these substances) excludes:
i. Priority Hazardous Substances;
ii. Priority Substances; and
Specific Pollutants.

14.3.7 The magnitude of change on surface water environment receptors is independent of the sensitivity of the feature. At this stage, the assessment of such change is largely qualitative, and hence reliant on professional judgement. **Table 14.6** provides examples of how various magnitudes of change will be determined with respect to surface water features.

Table 14.6 Examples of water environment magnitude of change

Magnitude	Criteria	Receptor type	Examples of negative change
High	Results in major change to feature, of sufficient magnitude to affect its use/integrity	Aquatic environment	Deterioration in river flow regime, morphology or water quality, leading to sustained, permanent or long-term breach of relevant designated site conservation objectives (COs), or downgrading of WFD status (deterioration against current thresholds as defined by current WFD status, including supporting WFD elements).
		Water resources	Complete loss of resource or severely reduced resource availability and/or quality, permanently compromising the ability of water users to exercise licensed rights.

Magnitude	Criteria	Receptor type	Examples of negative change
		Flood risk	Change in flood risk resulting in potential loss of life or major damage to property and infrastructure.
Medium	Results in noticeable change to feature, of sufficient magnitude to affect its use/integrity in some circumstances	Aquatic environment	Deterioration in river flow regime, morphology or water quality, leading to periodic, short-term and reversible breaches of relevant COs, or downgrading of WFD status (deterioration against current thresholds as defined by current WFD status, including supporting WFD elements). Water quality status may change the achievement of potential future thresholds in relation to objective WFD status – potential for prevention of waterbody reaching its future WFD objectives.
		Water resources	Moderate reduction in resource availability and/or quality, which may compromise the ability of water users to exercise licensed rights on a temporary basis or for limited periods.
		Flood risk	Change in flood risk resulting in potential for moderate damage to property and infrastructure.
Low	Results in minor change to feature, with insufficient magnitude to affect its use/integrity in most circumstances	Aquatic environment	Measureable deterioration in river flow regime, morphology or water quality, but remaining generally within COs, and with no change of WFD status (of overall status or supporting element status) or compromise of EQSs.
		Water resources	Minor reduction in resource availability and/or quality, but unlikely to affect the ability of water users to exercise licensed rights.
		Flood risk	Change in flood risk resulting in potential for minor damage to property and infrastructure.
Very Low	Results in little or no change to feature, with insufficient magnitude to affect its use/integrity	Aquatic environment	No measureable deterioration in river flow regime, morphology or water quality, and no consequences in terms of COs or WFD designations.
		Water resources	No measurable change in resource availability or quality and no change in ability of water users to exercise licensed rights.
		Flood risk	Potentially increased frequency of flood flows, but which does not pose an increased risk to people, property and infrastructure.

Significance evaluation methodology

14.7.5 The significance of the magnitude of change of receptors is assessed by relating the magnitude of change to the sensitivity and/or value of the receptor whilst maintaining application of professional judgement. The matrix

shown in **Table 14.7** has been used in the assessments and is based on the methodology and matrix in **Chapter 3.**

14.7.6 In a limited number of cases in the residual effects assessment tables presented in **Table 14.10** onwards, it has been concluded that there would be 'no change' arising from the development, and consequently 'no effect (Not Significant)'. This conclusion is only reached where two options are presented to reflect current uncertainty in Project design, and one of those options leads to an effect on a receptor and the other one does not. If the design option that does not lead to an effect is selected following further feasibility assessment, then the potential effect would be scoped out of the final ES.

Table 14.7 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)

14.8 Preliminary assessment of residual effects

Baseline conditions

Topography and watercourses

14.8.1 All of the water bodies assessed in this chapter are located in the Ehen and Calder Operational Catchment, as defined for the purposes of the North West RBMP.

Ehen and Calder Study Area

14.8.2 This Study Area comprises the catchments associated with three WFD river water bodies: the lower River Ehen, its tributary the Kirk/Black Beck and the lower River Calder (as shown on **Figure 14.1**). It defines the overall area within which surface freshwater effects from the Moorside and Egremont Sites are expected to occur. In general the topography falls from northeast to

southwest, towards the coast. The landscape is largely rural, but is interspersed with several smaller settlements including Thornhill, Braystones, Beckermet and Calder Bridge, plus the town of Egremont.

14.8.3 The Moorside Site occupies a large area adjacent to the existing Sellafield Site, extending over parts of the lower Ehen, Kirk/Black Beck and lower Calder catchments. The River Ehen, Kirk Beck and Black Beck flow through the Moorside Site, and the River Calder forms the boundary of the easternmost part of the site.

14.8.4 The Egremont Site is located on land on the edge of the River Ehen floodplain between Egremont and Thornhill. A small watercourse, Beggar Gill, flows thorough, and is partially culverted beneath the site towards the River Ehen.

14.8.5 The Moorside Site straddles the catchments of the lower River Ehen, the Kirk/Black Beck and the lower River Calder. Consequently, surface freshwater effects from this site could arise in any or all of these catchments. Conversely, the Egremont Site is located entirely within the lower River Ehen catchment, and could therefore only cause effects within that water body.

Pow Becks Study Area

14.8.6 This Study Area comprises the catchments of the Pow Beck (Whitehaven), which flows northwards from Mirehouse Road in the south to Whitehaven Harbour and the Pow Beck (South West Lakes) which flows southwest from Mirehouse Road down to the coast at St. Bees, as shown on **Figure 14.2**. It defines the overall area within which surface freshwater effects from the Corkickle Site, the Mirehouse Site, the Corkickle to Mirehouse Railway Site and the St. Bees Railway Site are expected to occur.

14.8.7 These watercourses are both situated narrow floodplain features located within steep sided valleys. However, whereas the Pow Beck (Whitehaven) is a predominantly urban catchment the Pow Beck (South West Lakes) is predominantly rural.

14.8.8 The lowermost reach of the Pow Beck (Whitehaven) downstream of Coach Road is culverted beneath Whitehaven town centre, before discharging into Whitehaven Harbour. In contrast the channel of the Pow Beck (South West lakes) is mostly open, apart from several road and rail bridges and culverts along its length, and discharges to the sea downstream of St. Bees.

14.8.9 The Corkickle Site is located entirely within the catchment of the Pow Beck (Whitehaven), whereas the Mirehouse Site and the St. Bees Railway Site are located entirely within the Pow Beck (South West Lakes) catchment. Consequently, surface freshwater effects from these sites could only occur in the individual catchment in which they are located. The Corkickle to Mirehouse Railway Site straddles both catchments, and could give rise to effects in either or both catchments in this Study Area.

Rainfall and river flows

Rainfall

14.8.10 The closest UK Met Office weather station to the Moorside Project is at St. Bees. The long term total annual average rainfall for the station (30 year average rainfall values for the period 1981-2010) is given as 1064 mm[2].

14.8.11 It should be noted that the St. Bees weather station is located close to the coast, at relatively low elevation. For this reason, it can be expected that the total annual average rainfall found in the headwaters of the main rivers (e.g. the Ehen) would be significantly higher.

River flows

14.8.12 Summary data from two EA gauges on the Rivers Ehen and Calder in the vicinity of the Moorside Site are provided in **Table 14.8**. These data suggest that the flow regime of both rivers is reasonably responsive to rainfall, however low flows are well supported by upstream lake storage from the Ennerdale Water (on the Ehen only) and groundwater baseflow.

14.8.13 No other continuous flow series are available for other watercourses in either of the Study Areas used in this chapter.

Table 14.8 Summary of river flows

Gauge ref.	Gauge name	Watercourse	NGR	Catchment area (km^2)	Mean flow (m^3/s)	Q10 (m^3/s)[1]	Q95 (m^3/s)[2]	BFI[3]	Period of record
74005	Braystones	River Ehen	NY 009 060	125.5	5.3	11.9	0.9	0.43	1974-2012
74006	Calder Hall	River Calder	NY 035 044	44.8	1.9	4.1	0.3	0.41	1964-2012

Source: National River Flow Archive (http://www.ceh.ac.uk/data/nrfa/index.html)
1 Q10: the flow that is equalled or exceeded 10% of the time – an index of high flow
2 Q95: the flow that is equalled or exceeded 95% of the time – an index of low flow
3 BFI: baseflow index, the proportion of the total river flow that is derived from gradual release from groundwater storage, as opposed to rapid surface or near-surface runoff

Water quality (non-radiochemical)

14.8.14 The Study Areas comprise five WFD freshwater surface water bodies from the Cycle 2 2015 RBMP and one water body from the Cycle 1 2009 RBMP which is not included in the Cycle 2 RBMP.

14.8.15 The Cycle 2 2015 RBMP classifications indicate that only one water body, the Ehen (Lower), complies with all relevant water quality standards (**Table 14.9).** More details, including classifications, on all relevant WFD water bodies to the

[2] Records for St. Bees Station taken from UK Met Office website. Avaialble at: http://www.metoffice.gov.uk/public/weather/climate/gctqjsxwu see 'Averages Table'. Accessed 16/03/16.

Moorside Project will be included in the WFD compliance assessment as part of the 2017 DCO submission.

Table 14.9 The Cycle 2 2015 RBMP classifications for the freshwater surface water water bodies

Water body (plus ID)	Hydromorphological Designation	Overall water body status	Element(s) Not achieving good status	Comments on potential pathways that could affect water body compliance
Ehen (Lower) GB112074069980	None	good	n/a	Surface flow pathway from Moorside and Egremont Sites. Works at Moorside Site within river floodplain.
Kirk Beck (Ehen) GB112074069970	None	moderate	macrophytes	Surface flow pathway from Moorside Site
Calder (Lower) GB112074069730	Heavily Modified	moderate	phosphates and mitigation measures assessments	Surface flow pathway from Moorside Site
Low Church Moss Pond GB31229203	Artificial	moderate	mitigation measures assessment	Surface flow pathway from Moorside Site
Pow Beck (South West Lakes) GB112074069990	None	moderate	macrophytes;	Surface flow pathway from Mirehouse Site and St. Bees Railway Site, and part of Corkickle to Mirehouse Railway Site.
Pow Beck (Whitehaven)[1]	Heavily Modified	moderate	mitigation measures assessment	Surface flow pathway from Corkickle Site and part of Corkickle to Mirehouse Railway Site. Possible direct works on watercourse (de-culverting)

1 = classifications taken from Cycle 1 2014 assessments

14.8.16 As mentioned in **Section 14.4**, additional water quality data were collected for potential receptor watercourses and ponds in and around the Moorside Site during 2015. Results indicated that the main watercourses in and around the site (the Rivers Ehen and Calder and the Kirk Beck) had generally good water quality, with results for relevant physico-chemical determinands generally consistent with good or high WFD status. This correlated well with the EA's WFD classifications for the same watercourses (Cycle 2 2015 classifications).

14.8.17 The ponds and minor watercourses within the Moorside Site had generally poorer water quality, with one of the main differences being seen in the

dissolved oxygen levels which were lower in the ponds. This was expected as small still waters and ditches with low flows generally suffer from low oxygen levels. The low flows and lack of dilution also partly explains the differences in water quality between the water body types.

14.8.18 The monitoring results collected for the surface water features within the Moorside Site displayed water quality impacts which correlated well with the surrounding agricultural land use. In particular this was seen in the non-reportable ponds and drainage ditches which tended to have worse water quality than the main rivers. As well as showing potential links to agricultural runoff, the high phosphate, ammonia and BOD readings taken in the ponds on the Moorside Site showed signs of impacts related to treated sewage effluent discharges.

14.8.19 There was some correlation between sites with high chloride and sodium levels, with the highest levels being recorded during the January monitoring round, which was likely to have resulted from winter road salting.

14.8.20 Zinc and copper occurrence was highest in the River Ehen and Kirk Beck, which may have been related to historical haematite mining in the Egremont and Haile area, with zinc inputs possibly coming from accessory minerals from any historic mine discharges, mine spoil or river sediments (acting as both a sink and a source for metals discharged).

14.8.21 The data collected for the Sellafield Tarn indicated that there were some water quality issues associated with this feature. Metals generally showed similar levels at inlet and outlet indicating that their source is likely to be upstream of the Tarn. The readings for the other determinands taken were generally marginally higher at inlet and were indicative of surface water runoff and potentially a treated sewage effluent discharge.

Water quality (radiochemical – for Moorside Site only)

14.8.22 The radiochemical analysis results for the monitoring programme indicated that the surface water sampled and analysed in April, May and June 2015 was not contaminated with significant levels of man-made radionuclides and would not present a hazard to human health or be a concern based on a comparison against the public dose limit of 1 mSv per annum. These conclusions were based on the following observations:

- no anthropogenic radionuclides measurable by high resolution gamma spectrometry were detected in any samples;
- no positive gross alpha, gross beta, tritium or carbon-14 results were recorded that exceed the screening value derived from the Drinking Water Directive (Council Directive 98/83/EC) and Water Supply (Water Quality) Regulations 2000; and
- the naturally occurring radionuclides detected (lead-212, lead-214 and thorium-208) are decay products from radon-220 and radon-222 and are therefore excluded from the assessment of total indicative dose.

14.8.23 In summary, it is considered very unlikely that the surface waters would exceed the total indicative dose threshold value of 0.1 mSv per annum if they were to be consumed as drinking water. As the radiochemical analysis indicators did not exceed DWI, WHO or literature background levels, sampling and analysis of radiochemicals ceased in June 2015.

14.8.24 More information on and potential environment impacts of radiochemicals can be found in **Chapter 21**.

Abstractions, discharges and water availability

14.8.25 According to EA data, there are four known licensed and deregulated[3] abstractions within the Ehen and Calder Site Study Area, as summarised in **Table 14.10**, and as marked on **Figure 14.1**. CBC and Sellafield Ltd were consulted regarding unlicensed private water supplies from surface water sources. No current private water supplies were identified in the Ehen and Calder Study Area that could be surface water receptors from the Moorside or Egremont Sites. However, because private water supplies are not licensed, they can be difficult to identify and accurately locate. For this reason there may be additional private water supplies that exist but have not been identified in this report. These will be identified as far as possible as part of the ongoing baseline assessment.

14.8.26 No surface water-sourced licensed or deregulated abstractions or private water supplies have been identified within the Pow Becks Study Area.

Table 14.10 Abstractions within the Moorside Project Study Areas

Study Area	Licence holder	Licence No.	Source	Grid reference/s	Max annual authorised quantity (m^3)
Ehen and Calder	Nuclear Decommissioning Authority	2774005004	River Ehen at Braystones (SWL01 on Figure 14.1)	NY010061	18,184
	Nuclear Decommissioning Authority	2774006018	River Calder at Calder Bridge (SWD01 on Figure 14.1	NY039059	Deregulated
	Nuclear Decommissioning Authority	2774006011	River Calder at Calder Bridge (SWL02 on Figure 14.1)	NY041058	32, 73120

[3] Deregulated abstraction licences are abstractions for less than 20 m^3/day that were previously licensed, but became exempt from licensing on 1 April 2005.

Study Area	Licence holder	Licence No.	Source	Grid reference/s	Max annual authorised quantity (m^3)
	Nuclear Decommissioning Authority	2774006006	River Calder at Calder Bridge (SWL03 on Figure 14.1)	NY041058	Unknown
Pow Becks	None				

14.8.27 Known discharges within the Moorside Project Study Areas have been provided by Envirocheck (2015) and are summarised in **Table 14.11**. At the time of writing it has not been possible to ascertain any information on permitted discharge rates or volumes. It should be noted, however, that those discharges that are defined as storm overflows would be intermittent following a storm event.

Table 14.11 Discharges within the Moorside Project Study Areas

Study Area	Discharge type	Reference	Receiving waterbody	Grid reference/s
Ehen and Calder	Sewerage discharge (final treated effluent)	Npswqd005965	River Ehen	NY012098
	United Utilities Water Plc public sewage (storm overflow)	017470089	River Ehen	NY011096
	United Utilities Water Plc public sewage (storm overflow)	01COP0038	River Ehen	NY007088
	Trade discharge	01295*	Black Beck	NY031069
	Trade discharge	017490274	Tributary of the River Calder	NY024055
Pow Becks	United Utilities Water Plc public sewage (storm overflow)	01COP0041	Pow Beck (Whitehaven)	NX978172
	United Utilities Water Plc public sewage (storm overflow)	017480429	Unnamed tributary of the Pow Beck (Whitehaven)	NX978171
	United Utilities Water Plc public	01COP0045	Pow Beck (Whitehaven)	NX980156

Study Area	Discharge type	Reference	Receiving waterbody	Grid reference/s
	sewage (storm overflow)			
	United Utilities Water Plc public sewage (storm overflow)	017480430	Pow Beck (Whitehaven)	NX980159
	United Utilities Water Plc public sewage (storm overflow)	01COP0042	Pow Beck (Whitehaven)	NX980159
	United Utilities Water Plc public sewage (storm overflow)	01COP0043	Pow Beck (Whitehaven)	NX980159
	United Utilities Water Plc public sewage (storm overflow)	01COP0074	Pow Beck (Whitehaven)	NX979160
	United Utilities Water Plc public sewage (storm overflow)	01COP0039	Pow Beck (Whitehaven)	NX983167
	Trade discharge (The Coal Authority)	017490150	Un-Named Trib Of Pow Beck (South West Lakes)	NX983145

14.8.28 The EA's Derwent and West Cumbria Abstraction Licensing Strategy (ALS) assesses water resource availability on a WFD river water body scale, on the basis of the aggregate effect of all upstream artificial influences (abstractions, discharges and impoundments). It concludes that the River Ehen, the River Calder and their tributaries have no water available for licensing and that river flows are below the indicative flow requirement to help support good ecological status (as required by the WFD). In contrast, the catchments of the Pow Beck (Whitehaven) and the Pow Beck (South West Lakes) are identified as having water available for new abstraction.

Water dependent designated conservation sites

14.8.29 There are a range of statutory designated and non-statutory conservation sites in the Study Areas, as identified from the DEFRA Magic map (Reference 15. DEFRA) and as shown on **Figures 14.1** and **14.2**.

14.8.30 In the Ehen and Calder Study Area, two of these sites have been identified as being potentially water dependent and with a direct surface water flow pathway from the Moorside Site and could therefore represent potential

surface water receptors for effects from the Moorside Project. These are Low Church Moss SSSI and Nursery Wood Ancient Woodland, as shown on **Figure 14.1**. Both sites feature wetlands and ponds that appear to have developed in local topographic depressions. Work is on-going to assess the extent to which these sites are dependent on groundwater versus surface water inflows, and therefore what the most likely source and pathway for effects from the Moorside Project might be. However, the fact that both sites are located within the Moorside Site boundary suggests that there is scope for some effect on these features via a surface water pathway, even if they are predominantly groundwater-fed features.

14.8.31 Within the Pow Becks Study Area, a single site, Stanley Pond County Wildlife Site (CWS), has been identified as a potential receptor for surface freshwater effects from the Mirehouse Site (**Figure 14.2**). It appears from OS mapping and aerial photos to be an on-line pond on the Pow Beck (South West Lakes) a short distance downstream of the southern boundary of the Mirehouse Site.

14.8.32 No other water dependent conservation sites have been identified as potential receptors for the Moorside Project.

Flood risk

Ehen and Calder Study Area

14.8.33 The western half of the Moorside Site includes a large area of Flood Zone 3, indicating a high likelihood of flooding from rivers and/or the sea, associated with the Ehen floodplain (**Figure 14.1**). Due to its low elevation and proximity to the coast, this area could also be subject to tidal flooding in addition to fluvial flooding. Smaller areas of Flood Zone 3 and 2 (indicating high and medium likelihood of fluvial flooding, respectively) are also found in the eastern half of the site flanking the channels of the River Calder and the Kirk and Black Becks. Part of the Egremont site is also located within the Ehen floodplain. As this Site is located some distance further upstream, it would only be subject to fluvial flooding.

14.8.34 The EA's updated Flood Map for Surface Water (uFMfSW) (Reference 16. EA) provides an indication of the likely hazard posed in the event of heavy rainfall events (pluvial flooding). It indicates that the Ehen and Calder Study Area is largely at a low risk of flooding from this source, with some discrete areas of low risk flooding across the Moorside Site which are likely to correlate with localised topographic depressions. More notably, some of the identified areas at Starling Castle and to the north of Middlebank respectively coincide with the floodplains of the River Ehen and Kirk Beck. The small watercourse, Beggar Gill, running through the Egremont site is evident from the uFMfSW, although the flood extent associated with it is confined to its immediate vicinity.

14.8.35 BGS data on susceptibility to groundwater flooding included within the Envirocheck dataset (2015) indicates a limited potential for groundwater flooding across the majority of the Ehen and Calder Study Area. The only risk of artificial flooding to the wider area including the Egremont Site and the Moorside Site comes from failure of Ennerdale Water. However this would be

constrained to the floodplain of the River Ehen, and broadly matches the Flood Zone 3 outline described earlier.

14.8.36 Potential flood risk receptors downstream of the Egremont Site could comprise Low Mill and Kersey Bridge, as well as any roads that are located within the floodplain. Around the Moorside Site, receptors could include the settlements of Braystones, Beckermet and Calder Bridge, Braystones WwTW, Mill Farm and the Sellafield Site, as well as roads around the Site.

Pow Becks Study Area

14.8.37 Areas of the valley floor adjacent to the Pow Beck (Whitehaven) are defined as Flood Zones 2 and 3 **(Figure 14.2)**. This includes a proportion of the Corkickle Site. A large area of Flood Zone 3 to the immediate south of the Corkickle Site is a designated flood storage area. Furthermore there is an area of tidal Flood Zone 3 in Whitehaven town centre downstream of the Corkickle site, although the EA Flood Map shows this area to be defended.

14.8.38 The uFMfSW shows that most of the Pow Beck (Whitehaven) valley floor are at low risk of surface water flooding. Nevertheless, discrete areas are shown to be at medium to high flood risk and these correspond to the lowest areas of topography and land adjacent to the Pow Beck (Whitehaven).

14.8.39 CBC's Strategic Flood Risk Assessment (SFRA) (Reference 17. CBC) states that there is generally limited potential for groundwater flooding within the borough but that it can occur in areas where the bedrock geology comprises Carboniferous coal measures, including within the Pow Beck (Whitehaven) catchment.

14.8.40 CBC's SFRA also reports that the sewer network within the Pow Burn (Whitehaven) catchment is also prone to exceedance in conjunction with intense rainfall events. No other artificial sources of flooding have been identified within this catchment.

14.8.41 In terms of flood risk, the Pow Beck (Whitehaven) and local sewer network in and around the Corkickle Site and Corkickle to Mirehouse Railway Site could act as a source pathway. There is also a risk from direct runoff. Specific receptors would primarily consist of development located in the vicinity of the Corkickle Site and Corkickle to Mirehouse Railway Site including the rugby ground, bowling club and properties on Coach Road. There is also potential for flood risk to be propagated further downstream along the Pow Beck (Whitehaven) to Whitehaven town centre.

14.8.42 With regard to the Pow Burn (South West Lakes) catchment, the area of Flood Zones 3 and 2 associated with the main watercourses is well constrained within the valley floor but opens out toward St. Bees in the lower reaches of the catchment. A small band of Flood Zone 2 encroaches on to the western edge of the St. Bees Railway Site. Although, not identified on the EA Flood Map there are several small, unnamed ordinary watercourses within the Mirehouse Site and the southern end of the Corkickle to Mirehouse Railway Site, the channels of which are picked out by the uFMfSW. Associated flood

extents would be confined to the vicinity of the watercourses, as they are well incised into local topography.

14.8.43 Drift deposits within lower catchment area of the Pow Beck (South West Lakes) consist of alluvial and glaciofluvial deposits which are typified by high permeability. The underlying St. Bees Sandstone bedrock could harbour groundwater. However, any groundwater emergence would be constrained along the valley floor of the Pow Beck (South West Lakes).

14.8.44 The only potential for sewer flooding within the Pow Beck (South West Lakes) comes from the sewer network at St. Bees; the remainder of the catchment is largely rural.

14.8.45 The Pow Beck (South West Lakes) would be the primary pathway for flooding to reach third party receptors. These would include the village of St. Bees, its sewage treatment works and golf course.

Predicted residual effects and their significance

14.8.46 The evaluation tables presented below include assessments of residual impacts assuming the environmental measures presented in **Table 14.14** are implemented. The assessments are based on the methodology described in **Section 14.7.**

14.8.47 With respect to the decommissioning of the Moorside Project, potential effects associated with decommissioning are likely to be similar to or less than 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.

Table 14.10 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					
Aquatic Environment - Ehen (lower), GB112074069980 WFD water body					
Deterioration in water quality due to surface water runoff and dewatering discharges from, and flooding of construction areas	Likely	High	Low	Moderate (Potentially Significant)	Sensitivity = High, due to water quality elements being and good or high status. Magnitude of change after mitigation = Low assuming environmental measures proposed in **Table 14.4** are implemented. Runoff and dewatering discharges from construction areas within the Moorside Site to the River Ehen could result in elevated levels of suspended solids and lower dissolved oxygen levels than have been recorded during the 2015 NuGen survey. Water quality in the Ehen could also be affected by pollution incidents associated with construction. Although this is not likely to permanently impact overall water quality classifications it could have a short term impact on the overall WFD classification. There is also the potential for surface water runoff and dewatering water discharge from any localised areas of contaminated land which may need to be addressed during construction work and which may be potential sources of pollutant discharged into surface water. However, implementation of good practice environmental measures for construction will greatly reduce the risk from the potential impacts. All surface water and dewatering discharges from working areas will be subject to Environmental Permit. To minimise the risk of flooding causing a pollution incident, all hazardous materials will be stored in areas of

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					low flood risk and measures will be specified in a Flood Response Plan to evacuate personnel and plant from high risk areas in the event of flooding.
Deterioration in water quality due to increase discharges of treated sewage effluent: Treated effluent discharged into the River Ehen from a new works	Unlikely	High	Medium	Major (Significant)	Sensitivity = High, due to water quality elements being and good or high status. Magnitude of change after mitigation = Medium as water quality elements are at good or high and are therefore at risk of deterioration from significant increase in discharge of treated effluent.
Raw effluent transferred to existing UU infrastructure at Braystones WwTW (discharge to sea)	Likely	High	No change	No effect (Not Significant)	Sensitivity = High, due to water quality elements being and good or high status. Magnitude of change after mitigation = No Change as discharge into the Ehen would be avoided. During the construction phase discharges of treated sewage effluent from the site may be significant, particularly during periodic maintenance outages, when a large workforce may be on site. As water quality elements are currently at good or high status and sensitive to change, any impact from discharges could have a moderate impact upon long term compliance with respect to the WFD status of the River Ehen. Controls on discharges which will be required via the permitting of any

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					discharges into the River Ehen should mitigate against significant impacts but further study would be required to confirm the assessment and the determination of significance. Transferring the onsite sewage to the UU network for treatment and discharge to sea would remove any potential effect on the Ehen from this source.
Alterations to channel morphology resulting from construction activities	Unlikely	High	Low	Moderate (Potentially Significant)	Sensitivity = High, as the morphology of the Ehen supports good status. Magnitude of change after mitigation = Low, due to suitable design and the environmental measures proposed in **Table 14.4**. A clear span design will be adopted for the Heavy Haul Road crossing of the River Ehen, which will avoid any direct impacts on channel morphology. Nevertheless, it is acknowledged that the River Ehen in this reach is quite mobile, and some channel reinforcement may be required to ensure that lateral migration of the river channel does not impinge on bridge piers in the future. If this is the case, scour protection measures will be limited in extent and as sympathetic as possible to the morphology of the watercourse, with the aim of ensuring that they will not have an adverse effect on the overall status of WFD water body. The final bridge design would be subject to agreement with the EA via the Environmental Permitting process for flood risk activities. Nevertheless, further assessment is required to confirm that the effects of this would be Not Significant.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Aquatic Environment - Calder (lower), GB112074069730 WFD water body					
Deterioration in water quality due to surface water runoff and dewatering discharges from, and flooding of construction areas	Likely	Medium	Low	Minor (Not Significant)	Sensitivity = Medium, due to water quality elements being at least moderate status. Magnitude of change after mitigation = Low, assuming environmental measures proposed in **Table 14.4** are implemented. The northern part of the Moorside Site drains into watercourses which feed into the River Calder. As a result, construction phase activities could have an impact on water quality through increased surface water runoff which could potentially release suspended sediments and other pollutants (such as hydrocarbons and metals) in the absence of appropriate control measures. Details of how the measures listed in **Table 14.4** will be implemented will be provided in the CEMP. All surface water and dewatering discharges from working areas will be subject to Environmental Permit. To minimise the risk of flooding causing a pollution incident, all hazardous materials will be stored in areas of low flood risk and measures will be specified in a Flood Response plan to evacuate personnel and plant from high risk in the event of flooding.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Alterations to channel morphology resulting from construction activities	Unlikely	Low	Very Low	Negligible (Not Significant)	Sensitivity = Low, as the morphology of the Calder is heavily modified and does not support good status. Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented. Construction activities will not directly impact the channel of the River Calder. Indirect effects such as scour around discharge locations or increased deposition of sediment due to runoff from areas disturbed by construction will be minimised due to the implementation of runoff control and sediment settlement measures.
Aquatic Environment - Kirk Beck (Ehen) GB112074069970 WFD water body					
Deterioration in water quality due to surface water runoff and dewatering discharges from, and flooding of construction areas	Likely	High	Low	Moderate (Potentially Significant)	Sensitivity = High, due to water quality elements being and good or high status. Magnitude of change after mitigation = Low, assuming environmental measures proposed in **Table 14.4** are implemented. Water quality elements are presently at good status or higher and some construction activities on the Moorside Site (e.g. the creation of the landscape mound in the north of the site) could lead to a minor impact upon water quality in this water body from surface water runoff and potential dewatering activities. Any impacts would be mitigated by permitting controls and standard mitigation measures which would be employed throughout the construction phase.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					To minimise the risk of flooding causing a pollution incident, all hazardous materials will be stored in areas of low flood risk and measures will be specified in a Flood Response plan to evacuate personnel and plant from high risk in the event of flooding.
Alterations to channel morphology resulting from construction activities	Unlikely	Low	Very Low	Negligible (Not Significant)	Sensitivity = Low, as the morphology of the Kirk Beck (Ehen) does support good status. Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented. Construction activities will not directly impact the channel of the Kirk Beck. Indirect effects such as scour around discharge locations or increased deposition of sediment due to runoff from areas disturbed by construction will be minimised due to the implementation of runoff control and sediment settlement measures.
Aquatic environment - Low Church Moss Pond (WFD water body and part of SSSI)					
Alterations to pond catchment, leading to effects on pond water balance and level regime	Uncertain	High	Medium	Major (Significant)	Sensitivity = High, due to support provided to SSSI habitat. Magnitude of change after mitigation = Medium, due to partial loss of surface water catchment area draining to pond feature. Work is on-going to characterise the regime and water balance of the Low Church Moss pond. Consequently, the degree to which it is dependent on surface water inputs versus groundwater inputs has yet to be fully characterised. A quantified assessment of this and the impact of the loss of part of its surface water catchment

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					as a consequence of power station construction will be prepared for the final ES. For the moment, a precautionary assessment of a Major (Significant) effect has been made.
Deterioration in water quality due to increase discharges dewatering and surface water runoff, including sediment runoff	Likely	High	Very Low	Minor (Not Significant)	Sensitivity = High, due to support provided to SSSI habitat. Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented. Construction works will occur in close proximity to the low Church Moss Pond. However, measures will be put in place to ensure that drainage from construction areas will be directed away from the SSSI and pond.
Aquatic environment – ponds in Nursery Wood					
Removal of ponds	Likely	High	High	Major (Significant)	Sensitivity = High, due to ancient woodland designation and support provided to sensitive ecology and habitat. Magnitude of change after mitigation = High, due to loss of features. During the construction phase current proposals will see the loss of the Nursery Wood and its associated ponds due to the site being within the footprint of overburden mounds Moorside Site development. The feature will not exist after construction.
Aquatic environment – Other minor watercourses and ponds within the Moorside site					
Alterations to morphology, water quality and resources	Likely	Low	High	Moderate (Potentially Significant)	Sensitivity = Low, due to not forming part of WFD water body 'blue line', and not offering support to designated nature conservation sites.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					Magnitude of change after mitigation = High, assuming environmental measures proposed in **Table 14.4** are implemented. Several existing minor watercourses and ponds will be substantially altered or removed completely as a consequence of construction. This a potentially significant, albeit temporary, effect during construction. Restoration of temporary working areas and overburden mounds following completion of construction works offers potential for habitat and water quality improvements in the longer term, as discussed below for the operations phase of the development.
Water Resources					
Licensed abstraction from the River Ehen at Braystones – impacts on water quality	Likely	Medium	Low	Minor (Not Significant)	Sensitivity = Medium, licensed industrial abstraction Magnitude of change after mitigation = Low, assuming environmental measures proposed in **Table 14.4** are implemented. Environmental measures put in place to protect water quality in the Ehen (Lower) WFD river water body will also be effective in mitigating impacts on abstractions that are sourced from this water body. Assumes any treated sewage effluent discharge from the Moorside Site would be to the Ehen downstream of Braystones, or direct to sea.
Licensed and deregulated abstractions from the	Unlikely	Medium	Very Low	Negligible (Not Significant)	Sensitivity = Medium, licensed and unregulated industrial abstractions.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
River Calder at Calder Bridge (x3)					Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented. Environmental measures put in place to protect water quality in the Calder (Lower) WFD river water body will also be effective in mitigating impacts on abstractions that are sourced from this water body. Abstractions at Calder Bridge are upstream of most of the Moorside Site, which further limits scope for impact.
Flood risk receptors					
Property and infrastructure at risk of flooding from the River Ehen/Kirk Beck in the vicinity of the Moorside Site (e.g. properties and roads around Braystones and Beckermet): increased flood risk due to reduction in flood storage as a consequence of construction activities and infrastructure in the floodplain.	Uncertain	High	Low	Moderate (Potentially Significant)	Sensitivity = High - residential properties classed as 'More Vulnerable' land use under NPPF flood vulnerability classification. Definition of receptors will be refined as part of ongoing FRA work. Magnitude of change after mitigation = Low, assuming environmental measures proposed in **Table 14.4** are implemented. Built development has mostly been situated away from floodplain areas to avoid loss of floodplain storage. Nevertheless, some construction activities and elements of temporary and permanent infrastructure will need to be located in the Ehen floodplain. Preliminary assessment using the EA's Ehen River Model suggests the effects of the permanent development on flood levels and extents in the Ehen floodplain will be minimal and will not extend to third party flood receptors. However, further assessment is on-going, and mitigation measures will be developed to address any resulting change in flood risk, should this be required. Furthermore, the extent of construction phase

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					activities in the flood plain could be more extensive than the extent of the permanent development. Mitigation measures would take into account climate change effects over the lifetime of the development.
Property and infrastructure in the vicinity of the Moorside Site: increased flood risk due to increases in surface runoff as a result of construction activities	Unlikely	Very High	Very Low	Moderate (Potentially Significant)	Sensitivity = Very High, precautionary assessment due to the presence of the Sellafield Site and key transport routes such as the A595 downstream of parts of the Moorside Site. Definition of receptors will be refined as part of ongoing FRA work. Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented. Surface water runoff from the Moorside site to adjacent watercourses to be limited to pre-development rates or rates as agreed with the Lead Local Flood Authority. Measures to restrict runoff to agreed rates will include allowance of the effects of climate change on extreme rainfall intensity over the lifetime of the development.
Operation					
Aquatic environment - Ehen (lower), GB112074069980 WFD water body					
Deterioration in water quality due to increase discharges of treated sewage effluent: Treated effluent discharged to the River Ehen from a new works	Unlikely	High	Medium	Major (Significant)	Sensitivity = High, due to water quality elements being and good or high status.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Raw effluent transferred to existing UU infrastructure e.g. Braystones WwTW	Likely	High	No change	No effect (Not Significant)	Magnitude of change after mitigation = Medium as water quality elements are at good or high and are therefore at risk of deterioration from significant increase in treated effluent. Sensitivity = High, due to water quality elements being and good or high status. Magnitude of change after mitigation = No effect, as no discharge into the Ehen. During the operational phase discharges of treated sewage effluent from the site may be significant, particularly during periodic maintenance outages, when a large workforce may be on site. As water quality elements are currently at (and are expected to remain at) good or high status and sensitive to change, any impact from discharges could have a moderate impact upon long term compliance with respect to the WFD status of the River Ehen. Controls on discharges which will be required via the permitting of any discharges into the River Ehen should mitigate against significant impacts but further study would be required to confirm the assessment and the determination of significance. Transferring the onsite sewage to the UU network for treatment and discharge to sea would remove any potential effect on the Ehen from this source.
Deterioration in water quality due to increase in suspended solids, oils and metals discharged from site drainage.	Likely	High	Very Low	Minor (Not Significant)	Sensitivity = High, due to water quality elements being and good or high status. Magnitude of change after mitigation = Very Low due to appropriate mitigation and limited potential for impact.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					During operation, it is likely that surface water from the main power station area would be discharged directly to sea. Nevertheless, there would be an increased likelihood of discharges of suspended solids, oils and metals in surface water runoff from any part of the developed site which still drained towards the Ehen. However, incorporation of appropriate treatment measures into site drainage design, such as oil interceptors and pollution retention basins, would minimise the impact. Residual adverse effects from permanent development would also be offset by the beneficial effects of restoration of temporary construction areas and overburden mounds. This would include removing the Moorside Site from agricultural use, with a resultant reduction in the potential for diffuse pollution from this source. The likelihood of a pollution incident due to flooding of the power station site is considered to be extremely low, since it will be designed to be safe from flooding for up to at least the 1 in 100 per annum plus climate change probability event. Nuclear safety critical aspects of the site will be designed to be safe from the 1 in 10,000 per annum probability event.
Alterations to in-channel morphology	Unlikely	High	Low	Moderate (Potentially Significant)	Sensitivity = High, as the morphology of the Ehen supports good status. Magnitude of change after mitigation = Low. Clear span bridge design should reduce the likelihood of morphological impacts on the River Ehen. However, given the mobile nature of the channel in this reach, remedial works to prevent scour of bridge piers due to channel migration cannot be ruled out in the future. If this is the

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					case, scour protection measures would be limited in extent and as sympathetic as possible to the morphology of the watercourse, with the aim of ensuring that they will not have an adverse effect on the overall status of WFD water body. Any such works would be subject to an Environmental Permit for flood risk activities from the EA.
Aquatic environment - Calder (lower), GB112074069730 WFD water body					
Deterioration in water quality due to increase in suspended solids, oils and metals discharged from site drainage.	Likely	Medium	Very Low	Negligible (Not Significant)	Sensitivity = Medium, due to water quality elements being at least moderate status. Magnitude of change after mitigation = Very Low assuming environmental measures proposed in **Table 14.4** are implemented. Most of the permanent infrastructure associated with the power station would be drained towards the River Ehen, with areas draining towards the Calder largely confined to landscaped overburden mounds and access roads. Therefore, once site restoration is complete following construction, and assuming SuDS elements are incorporated into the drainage network, residual effects are predicted to be Negligible (Not Significant). Residual adverse effects would also be offset by the beneficial effect of removing the Moorside Site from agricultural use, with a resultant reduction in the potential for diffuse pollution from this source.
Aquatic environment - Kirk Beck (Ehen) GB112074069970 WFD water body					
Increase in suspended solids, oils and metals	Likely	High	Very Low	Negligible (Not Significant)	Sensitivity = High, due to water quality elements being and good or high status.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
discharged into surface waters					Magnitude of change after mitigation = Very Low assuming environmental measures proposed in **Table 14.4** are implemented. Most of the permanent infrastructure associated with the power station would be drain towards the River Ehen, with areas draining towards the Kirk Beck largely confined to landscaped overburden mounds. Therefore, once site restoration is complete following construction, and assuming SuDS elements are incorporated into the drainage network, residual effects are predicted to be Negligible (Not Significant). Residual adverse effects would also be offset by the beneficial effect of removing the Moorside Site from agricultural use, with a resultant reduction in the potential for diffuse pollution from this source.
Aquatic environment - Low Church Moss Pond (WFD water body and part of SSSI)					
Deterioration in water quality due to increase in suspended solids, oils and metals discharged from site drainage.	Unlikely	High	Very Low	Minor (Not Significant)	Sensitivity = High, due to support provided to SSSI habitat. Magnitude of change after mitigation = No change, as there would be no discharge from the site drainage system to the SSSI, and site layout would be engineered to avoid direct runoff.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Alterations to pond morphology, water balance and level regime	Uncertain	High	Medium	Major (Significant)	Sensitivity = High, due to support provided to SSSI habitat. Magnitude of change after mitigation = Medium, due to partial loss of surface water catchment area draining to pond feature. Work is on-going to characterise the regime and water balance of the Low Church Moss pond. Consequently, the degree to which it is dependent on surface water inputs versus groundwater inputs has yet to be fully characterised. A quantified assessment of this and the impact of the loss of part of its surface water catchment as a consequence of power station construction will be prepared for the final ES. For the moment, a precautionary assessment of a Major (Significant) effect has been made.
Aquatic environment - Minor watercourses and ponds within the Moorside site					
Alterations to morphology, water quality and flows/levels	Likely	Low	Medium	Minor (Not Significant)	Sensitivity = Low, due to not forming part of WFD water body 'blue line', and not offering support to designated nature conservation sites.. Magnitude of change after mitigation = Medium, assuming environmental measures proposed in **Table 14.4** are implemented. It is acknowledged that several existing minor watercourses and ponds will be substantially altered or removed completely as a consequence of construction. Nevertheless, on restoration of temporary working areas and overburden mounds, opportunities will be sought to incorporate morphological improvements and maximise aquatic habitat into the on-site drainage network that will

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					replace the existing ditches and ponds. Furthermore, the change from the existing agricultural land-use and the incorporation of SuDS water treatment into the site drainage system should lead to an overall improvement in water quality relative to that currently seen in ditches and ponds across the Moorside Site.
Water resources - abstractions					
Licensed abstraction from the River Ehen at Braystones – impacts on water quality	Likely	Medium	Very Low	Negligible (Not Significant)	Sensitivity = Medium, licensed industrial abstraction Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented. Environmental measures put in place to protect water quality in the Ehen (Lower) WFD river water body will also be effective in mitigating impacts on abstractions that are sourced from this water body. Assumes any treated sewage effluent discharge from the Moorside Site would be to the Ehen downstream of Braystones, or direct to sea, and that discharge from power station surface water drainage system would be to sea.
Licensed and deregulated abstractions from the River Calder at Calder Bridge (x3) b- impacts on water quality	Unlikely	Medium	Very Low	Negligible (Not Significant)	Sensitivity = Medium, licensed and unregulated industrial abstractions. Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented. Environmental measures put in place to protect water quality in the Calder (Lower) WFD river water body will also be effective in mitigating impacts on abstractions that

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					are sourced from this water body. Abstractions at Calder Bridge are upstream of most of the Moorside Site, which further limits scope for impact.
Flood risk receptors					
Property and infrastructure at risk of flooding from the River Ehen/Kirk Beck in the vicinity of the Moorside Site (e.g. properties and roads around Braystones and Beckermet): increased flood risk due to permanent infrastructure in the floodplain.	Uncertain	High	Very Low	Minor (Not Significant)	Sensitivity = High - residential properties classed as 'More Vulnerable' land use under NPPF flood vulnerability classification. Definition of receptors will be refined as part of on-going FRA work. Magnitude of change after mitigation = Very Low. Preliminary assessment using the EA's Ehen River Model suggests the effects of the power station forebay and Heavy Haul Road crossing on flood levels and extents in the Ehen floodplain will be minimal and will not extend to third party flood receptors. However, further assessment is on-going, and mitigation measures will be developed to address any resulting change in flood risk, should this be required. Mitigation measures would take into account climate change effects over the lifetime of the development. This will be reported in full in the ES and accompanying FRA.
Property and infrastructure in the vicinity of the Moorside Site: increased flood risk due to increases in surface runoff as a result of construction activities	Unlikely	Very High	Very Low	Moderate (Potentially Significant)	Sensitivity = Very High, precautionary assessment due to the presence of the Sellafield Site and key transport routes such as the A595 downstream of parts of the Moorside Site. Definition of receptors will be refined as part of ongoing FRA work. Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					Surface water runoff from the Moorside Site to adjacent watercourses to be limited to pre-development rates or rates as agreed with the Lead Local Flood Authority. Measures to restrict runoff to agreed rates will include allowance of the effects of climate change on extreme rainfall intensity over the lifetime of the development. Surface runoff from the main power station site is likely to be discharged directly to sea.

Table 14.11 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					
Aquatic environment receptors - Ehen (lower), GB112074069980 WFD water body					
Deterioration in water quality due to discharge of surface runoff from construction areas.	Likely	High	Low	Moderate (Potentially Significant)	Sensitivity = High, due to water quality elements being and good or high status. Magnitude of change after mitigation = Low, assuming environmental measures proposed in **Table 14.4** are implemented. Runoff from the construction area within the Egremont Site could result in elevated levels of suspended solids and lower dissolved oxygen levels in the River Ehen immediately downstream of the site. Water quality in the Ehen could also be affected by pollution incidents associated with construction. Although this is not likely to permanently impact overall water quality classifications it could have a short term impact on the overall WFD classification. However, implementation of good practice environmental measures for construction will greatly reduce the risk from the potential impacts. The mobilisation of pollution due to flooding of the site during construction is not considered to be a significant risk at this site, because areas to be developed are located outside the Ehen floodplain.
Alteration to in-channel morphology	Unlikely	High	Very Low	Minor (Not Significant)	Sensitivity = High, due to designation of hydromorphological supporting elements as 'supports good'.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented. Development at the Egremont Site will not impinge directly on the channel of the River Ehen. Indirect effects such as scour around discharge locations or increased deposition of sediment due to runoff from areas disturbed by construction will be minimised due to the implementation of runoff control and sediment settlement measures.
Water resources - abstractions					
Licensed abstraction from the River Ehen at Braystones – impacts on water quality	Likely	Medium	Very Low	Negligible (Not Significant)	Sensitivity = Medium, licensed industrial abstraction Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented, and given location of abstraction almost 5 km further downstream. Environmental measures put in place to protect water quality in the Ehen (Lower) WFD river water body will also be effective in mitigating impacts on abstractions that are sourced from this water body. In addition, any effects are likely to have been diminished by dispersion and dilution in the reach between the site and the abstraction.
Flood risk receptors					
Increased flood risk to people property and infrastructure downstream (Low Mill and Kersey Bridge)	Likely	High	Very Low	Minor (Not Significant)	Sensitivity = High, downstream receptors include residential dwellings and road infrastructure.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented. There will be no development within the Ehen floodplain at this site. Surface runoff from the proposed development would be controlled to pre-development rates using SuDS, including allowance for the impacts of climate change on extreme rainfall intensity over the lifetime of the development. The drainage system would be constructed prior to other aspects of the development and would be sized to meet the requirements of both construction and operation phases.
Operation					
Aquatic environment - Ehen (lower), GB112074069980 WFD water body					
Deterioration in water quality due to increase discharges of treated sewage effluent: Discharged from a new works on the site to the River Ehen	Unlikely	High	Medium	Major (Significant)	Sensitivity = High, due to water quality elements being and good or high status. Magnitude of change after mitigation = Medium as water quality elements are at good or high and are therefore at risk of deterioration from a significant new treated effluent discharge. Effect would be controlled via Environmental Permit conditions, but further study would be required to confirm the assessment and the determination of significance.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Channelled to existing UU infrastructure e.g. Braystones WwTW	Likely	High	No change	No effect (Not Significant)	Sensitivity = High, due to water quality elements being and good or high status. Magnitude of change after mitigation = No effect as no sewage would be discharged into the Ehen.
Deterioration in water quality due to discharge of surface runoff from the developed site.	Likely	High	Very Low	Minor (Not Significant)	Sensitivity = High, due to water quality elements being and good or high status. Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented. The surface water drainage system for the site would incorporate oil interceptors for car and bus parking areas, and appropriate stages of SuDS treatment for access roads.
Flood risk receptors					
Increased flood risk to people property and infrastructure (Low Mill and Kersey Bridge)	Likely	High	Very Low	Minor (Not Significant)	Sensitivity = High, downstream receptors include residential dwellings and road infrastructure. Magnitude of change after mitigation = Very Low. There will be no development within the Ehen floodplain at this site. Surface runoff from the proposed development would be controlled to pre-development rates using SuDS, including allowance for the impacts of climate change on extreme rainfall intensity over the lifetime of the development.

N.B. In this table, the terms 'construction' and 'operation' refer to this site only. In terms of the overall Moorside Project, construction and operation of this site takes place entirely within the period of construction of the power station at the Moorside Site.

Table 14.12 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					
Aquatic environment - Pow Beck (Whitehaven) water body					
Deterioration in water quality due to discharge of surface runoff from construction areas.	Likely	Medium	Low	Minor (Not Significant)	Sensitivity = Medium, the Pow Beck (Whitehaven) was assigned moderate status under the cycle 1 2014 assessment. Magnitude of change after mitigation = Low, assuming environmental measures proposed in **Table 14.4** are implemented. Runoff from the construction areas within the Corkickle Site could result in elevated levels of suspended solids and lower dissolved oxygen levels in the Pow Beck (Whitehaven) immediately downstream of the site. Water quality could also be affected by pollution incidents associated with construction. Although this is not likely to permanently impact overall water quality classifications it could have a short term impact on the overall WFD classification. However, implementation of good practice environmental measures for construction will greatly reduce the risk from the potential impacts. To minimise the risk of flooding causing a pollution incident, all hazardous materials will be stored in areas of low flood risk and measures will be specified in a Flood Response Plan to evacuate personnel and plant from high risk areas in the event of flooding.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Alterations to in-channel morphology	Likely	Low	Medium (beneficial)	Minor (Not Significant)	Sensitivity = Low, Pow Beck (Whitehaven) is designated as a heavily modified water body and is canalised or culverted within the Corkickle Site and downstream. Magnitude of change after mitigation = Medium (beneficial). Proposals for removal of existing culverts should result in morphological improvements as a consequence of the development. Site design and any potential alterations to culverts will address the need to ensure that alterations to in-channel morphology, and associated bed/bank reinforcement will not have an adverse effect on the WFD water body status. An Environmental Permit for flood risk activities will be required for any works in and around the watercourse.
Flood risk receptors					
Increased flood risk to property and infrastructure within the Pow Beck flood plain (the Rugby ground, bowling club and Coach Road) due to reduction in floodplain storage and channel conveyance, and increased site runoff.	Uncertain	High	Low	Moderate (Potentially Significant)	Sensitivity = High, areas of Whitehaven in and around the Corkickle Site are at risk of flooding from the Pow Burn (Whitehaven), and from sewer and surface water flooding Magnitude of change after mitigation = Low, but will need to be reviewed following completion of on-going FRA work. Development will be located so as to avoid any loss of floodplain storage. However construction activities may temporarily be required within the floodplain

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					and channel of the Pow Burn (Whitehaven). Raised structures in the floodplain will be avoided. In-channel works will be limited in duration and subject to Environmental Permit for flood risk activities. A Flood Response Plan will be developed to minimise conveyance effects associated with works, and to ensure plant and personnel are evacuated from high risk areas in the event of a flood event. Surface runoff from the proposed development would be controlled to pre-development rates using SuDS, including allowance for the impacts of climate change on extreme rainfall intensity over the lifetime of the development. The drainage system would be constructed prior to other aspects of the development and would be sized to meet the requirements of both construction and operation phases.
Operation					
Aquatic environment - Pow Beck (Whitehaven)					
Deterioration in water quality due to discharge of treated sewage effluent: Discharged from a new works on the site to the Pow Beck (Whitehaven)	Unlikely	Medium	Medium	Moderate (Potentially Significant)	Sensitivity = Medium, the Pow Beck (Whitehaven) was assigned moderate status under the cycle 1 2014 assessment.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Raw effluent transferred to existing UU infrastructure e.g. Parton WwTW	Likely	Medium	No change	No effect (Not Significant)	Magnitude of change after mitigation = Medium as water quality elements are at good or high and are therefore at risk of deterioration from a significant new treated effluent discharge. Effect would be controlled via Environmental Permit conditions, but further study would be required to confirm the assessment and the determination of significance. Sensitivity = Medium, the Pow Beck (Whitehaven) was assigned moderate status under the cycle 1 2014 assessment. Magnitude of change after mitigation = No effect as no sewage would be discharged into the Pow Beck (Whitehaven).
Deterioration in water quality due to discharge of surface runoff from the developed site.	Likely	Medium	Very Low	Negligible (Not Significant)	Sensitivity = Medium, the Pow Beck (Whitehaven) was assigned moderate status under the cycle 1 2014 assessment. Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in Table 14.4 are implemented. The surface water drainage system for the site would incorporate oil interceptors for car and bus parking areas, and appropriate stages of SuDS treatment for access roads.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Flood risk receptors					
Increased flood risk to property and infrastructure within the Pow Beck flood plain (the Rugby ground, bowling club and Coach Road) due to reduction in floodplain storage and channel conveyance, and increased site runoff.	Uncertain	High	Low	Moderate (Potentially Significant)	Sensitivity = High, areas of Whitehaven in and around the Corkickle Site are at risk of flooding from the Pow Burn (Whitehaven), and from sewer and surface water flooding Magnitude of change after mitigation = Low, but will need to be reviewed following completion of on-going FRA work. Development will be located so as to avoid any loss of floodplain storage. Surface runoff from the proposed development would be controlled to pre-development rates using SuDS, including allowance for the impacts of climate change on extreme rainfall intensity over the lifetime of the development.

N.B. In this table, the terms 'construction' and 'operation' refer to this site only. In terms of the overall Moorside Project, construction and operation of this site takes place entirely within the period of construction of the power station at the Moorside Site.

Table 14.13 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					
Aquatic environment - Pow Beck (SW Lakes) GB112074069990 water body					
Deterioration in water quality due to discharge of surface runoff from construction areas.	Likely	High	Low	Moderate (Potentially Significant)	Sensitivity = High, the water quality elements in Pow Beck (SW Lakes) were assigned good and high status under in the Cycle 2 2015 assessment. Magnitude of change after mitigation = Low, assuming environmental measures proposed in **Table 14.4** are implemented. Runoff from the construction area within the site could result in elevated levels of suspended solids and lower dissolved oxygen levels in the Pow Beck (SW Lakes) immediately downstream of the site. Water quality could also be affected by pollution incidents associated with construction. Although this is not likely to permanently impact overall water quality classifications it could have a short term impact on the overall WFD classification. However, implementation of good practice environmental measures for construction will greatly reduce the risk from the potential impacts. The mobilisation of pollution due to flooding of the site during construction is not considered to be a significant risk at this site.
Alterations to in-channel morphology	Unlikely	High	Very Low	Minor (Not Significant)	Sensitivity = High, the morphology of this water body supports good status.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					Magnitude of change = Very Low, due to the implementation of best practice construction mitigation measures, and because affected watercourses would all be minor tributaries upstream of the WFD 'blue line'. A minimum stand-off distance of 10 m will be maintained between construction areas and the small watercourses running through the site. Indirect effects such as scour around discharge locations or increased deposition of sediment due to runoff from areas disturbed by construction will be minimised due to the implementation of runoff control and sediment settlement measures.
Aquatic environment - Stanley Pond CWS					
Deterioration in water quality due to discharge of surface runoff from construction areas.	Likely	Medium	Low	Minor (Not Significant)	Sensitivity = Medium, due to local conservation designation. Magnitude of change after mitigation = Low, assuming environmental measures proposed in **Table 14.4** are implemented. The environmental measures implemented to protect water quality in the Pow Burn (SW Lakes) would also be effective in protecting water quality in this on-line pond.
Flood risk receptors					
Increased flood risk to people property and infrastructure (several residential properties within the Mirehouse Site	Likely	High	Very Low	Minor (Not Significant)	Sensitivity = High, residential dwellings are vulnerable to flooding. Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Boundary, St. Bees village)					Surface runoff from the proposed development would be controlled to pre-development rates using SuDS, including allowance for the impacts of climate change on extreme rainfall intensity over the lifetime of the development. The drainage system would be constructed prior to other aspects of the development and would be sized to meet the requirements of both construction and operation phases.
Operation					
Aquatic environment - Pow Beck (SW Lakes) GB112074069990 water body					
Deterioration in water quality due to discharge of treated sewage effluent:					
Discharged from a new works on the site to the Pow Beck (SW Lakes)	Unlikely	High	Medium	Major (Significant)	Sensitivity = High, the water quality elements in Pow Beck (SW Lakes) were assigned good and high status under in the Cycle 2 2015 assessment. Magnitude of change after mitigation = Medium as water quality elements are at good or high and are therefore at risk of deterioration from a significant new treated effluent discharge. Effect would be controlled via Environmental Permit conditions, but further study would be required to confirm the assessment and the determination of significance.
Raw effluent transferred to existing UU infrastructure e.g. Parton WwTW	Likely	High	No change		Sensitivity = High, the water quality elements in Pow Beck (SW Lakes) were assigned good and high status under in the Cycle 2 2015 assessment.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
				No effect (Not Significant)	Magnitude of change after mitigation = No effect as no sewage would be discharged into the Pow Beck (SW Lakes).
Deterioration in water quality due to discharge of surface runoff from the developed site.	Likely	High	Very Low	Minor (Not Significant)	Sensitivity = the water quality elements in Pow Beck (SW Lakes) were assigned good and high status under in the Cycle 2 2015 assessment. Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in Table 14.4 are implemented. The surface water drainage system for the site would incorporate oil interceptors for car and bus parking areas, and appropriate stages of SuDS treatment for access roads.
Aquatic environment - Stanley Pond CWS					
Deterioration in water quality due to discharge of treated sewage effluent: Discharged from a new works on the site to the Pow Beck (SW Lakes) upstream of the pond	Unlikely	Medium	Medium	Moderate (Potentially Significant)	Sensitivity = Medium, due to local conservation designation. Magnitude of change after mitigation = Medium as water quality elements of supporting watercourse are at good or high and are therefore at risk of deterioration from a significant new treated effluent discharge. Effect would be controlled via Environmental Permit conditions, but further

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Raw effluent transferred to existing UU infrastructure e.g. Parton WwTW	Likely	High	No change	No effect (Not Significant)	study would be required to confirm the assessment and the determination of significance. Sensitivity = Medium, due to local conservation designation. Magnitude of change after mitigation = No effect as no sewage would be discharged into the Pow Beck (SW Lakes).
Deterioration in water quality due to discharge of surface runoff from the developed site.	Likely	Medium	Very Low	Negligible (Not Significant)	Sensitivity = Medium, due to local conservation designation. Magnitude of change after mitigation = Low, assuming environmental measures proposed in **Table 14.4** are implemented. The environmental measures implemented to protect water quality in the Pow Burn (SW Lakes) would also be effective in protecting water quality in this on-line pond.
Flood risk receptors					
Increased flood risk to people property and infrastructure (several residential properties within the Mirehouse Site Boundary, St. Bees)	Likely	High	Very Low	Minor (Not Significant)	Sensitivity = High, residential dwellings are vulnerable to flooding. Magnitude of change = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented. Surface runoff from the proposed development would be controlled to pre-development rates using SuDS, including allowance for the impacts of climate change on extreme rainfall intensity over the lifetime of the development.

N.B. In this table, the terms 'construction' and 'operation' refer to this site only. In terms of the overall Moorside Project, construction and operation of this site takes place entirely within the period of construction of the power station at the Moorside Site.

Table 14.14 Corkickle to Mirehouse Railway 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					
Aquatic environment - Pow Beck (Whitehaven) water body					
Deterioration in water quality due to discharge of surface runoff from construction areas.	Unlikely	Medium	Very Low	Negligible (Not Significant)	Sensitivity = Medium, the Pow Beck (Whitehaven) was assigned moderate status under the cycle 1 2014 assessment. Magnitude of change = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented, and considering small footprint of construction works. The extent of ground disturbance associated with construction at this site is expected to be minimal, in comparison with other aspects of the development. Nevertheless, measures will be put in place during construction to control runoff rates from the site and to promote the settlement of suspended sediment before runoff is discharged from the site. Standard pollution control and incident response measures will also be implemented. Further details will be provided in the CEMP.
Aquatic environment - Pow Beck (SW Lakes) water body					
Deterioration in water quality due to discharge of surface runoff from construction areas.	Unlikely	High	Very Low	Minor (Not Significant)	Sensitivity = Medium, the Pow Beck (Whitehaven) was assigned moderate status under the cycle 1 2014 assessment. Magnitude of change = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented, and considering small footprint of construction works.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					The extent of ground disturbance associated with construction at this site is expected to be minimal, in comparison with other aspects of the development. Nevertheless, measures will be put in place during construction to control runoff rates from the site and to promote the settlement of suspended sediment before runoff is discharged from the site. Standard pollution control and incident response measures will also be implemented. Further details will be provided in the CEMP.
Aquatic environment - Stanley Pond CWS					
Deterioration in water quality due to discharge of surface runoff from construction areas.	Unlikely	Medium	Very Low	Negligible (Not Significant)	Sensitivity = Medium, due to local conservation designation. Magnitude of change after mitigation = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented, and considering small footprint of construction works. The environmental measures implemented to protect water quality in the Pow Burn (SW Lakes) would also be effective in protecting water quality in this on-line pond.
Flood risk receptors					
Increased flood risk to people property and infrastructure (land adjacent to and downstream of the Corkickle to Mirehouse Rail Loop)	Unlikely	High	Very Low	Minor (Not Significant)	Sensitivity = High, properties and infrastructure at risk of flooding in vicinity of site. Magnitude of change = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented, and considering small footprint of construction works. Surface water runoff from the site (including temporary construction areas) to will be limited to pre-development rates and will incorporate climate change allowances as

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
					required. No new watercourse crossings are proposed, and no changes will be made to existing watercourse crossings. No new structures or temporary construction works will be located in areas of high fluvial flood risk (Flood Zone 3).
Operation					
Aquatic environment - Pow Beck (Whitehaven) water body					
Deterioration in water quality of receiving watercourses from developed areas.	Unlikely	Medium	Very Low	Negligible (Not Significant)	Sensitivity = Medium, the Pow Beck (Whitehaven) was assigned moderate status under the cycle 1 2014 assessment. Magnitude of change = Very Low, given very small extent of new impermeable surfaces and assuming implementation of best practice drainage design for new platform area and access roads. Drainage for bus waiting areas would incorporate an oil interceptor.
Aquatic environment - Pow Beck (SW Lakes) water body					
Deterioration in water quality of receiving watercourses from developed areas.	Unlikely	High	Very Low	Minor (Not Significant)	Sensitivity = High, the water quality elements in Pow Beck (SW Lakes) were assigned good and high status under in the Cycle 2 2015 assessment. Magnitude of change = Very Low, given very small extent of new impermeable surfaces and assuming implementation of best practice drainage design for new platform area and access roads. Drainage for bus waiting areas would incorporate an oil interceptor.

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
Aquatic environment - Stanley Pond CWS					
Deterioration in water quality of receiving watercourses from developed areas.	Unlikely	Medium	Very Low	Negligible (Not Significant)	Sensitivity = Medium, due to local conservation designation. Magnitude of change = Very Low, given very small extent of new impermeable surfaces and the environmental measures implemented to protect water quality in the Pow Burn (SW Lakes) would also be effective in protecting water quality in this on-line pond.
Flood risk					
Increased flood risk to people property and infrastructure (land adjacent to and downstream of the Corkickle to Mirehouse Rail Loop)	Unlikely	High	Very Low	Minor (Not Significant)	Sensitivity = High, residential properties at risk of flooding in vicinity of site. Magnitude of change = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented, and considering small footprint of construction works. Surface water runoff from the site (including temporary construction areas) to will be limited to pre-development rates and will incorporate climate change allowances as required. No new watercourse crossings are proposed, and no changes will be made to existing watercourse crossings. No new structures will be located in areas of high fluvial flood risk (Flood Zone 3).

N.B. In this table, the terms 'construction' and 'operation' refer to this site only. In terms of the overall Moorside Project, construction and operation of this site takes place entirely within the period of construction of the power station at the Moorside Site.

Table 14.15 St. Bees Railway 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					
Aquatic environment - Pow Beck (South West Lakes) GB112074069990 water body					
Deterioration in water quality due to discharge of surface runoff from construction areas.	Unlikely	High	Very Low	Minor (Not Significant)	Sensitivity = Medium, the Pow Beck (Whitehaven) was assigned moderate status under the cycle 1 2014 assessment. Magnitude of change = Very Low, assuming environmental measures proposed in **Table 14.4** are implemented, and considering small footprint of construction works. The extent of ground disturbance associated with construction at this site is expected to be minimal, in comparison with other aspects of the development. Nevertheless, measures will be put in place during construction to control runoff rates from the site and to promote the settlement of suspended sediment before runoff is discharged from the site. Standard pollution control and incident response measures will also be implemented. Further details will be provided in the CEMP.
Flood risk					
Increased flood risk to people property and infrastructure in vicinity of site (roads and residential properties in	Unlikely	High	Very Low	Minor (Not Significant	Sensitivity = High, assumes residential properties are potential receptors: this will be confirmed as part of the FRA. Magnitude of change = Very Low, assuming environmental measures proposed in **Table 14.4** are

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
St. Bees, St. Bees WwTW)					implemented, and considering small footprint of construction works. Surface water runoff from the site (including temporary construction areas) to will be limited to pre-development rates and will incorporate climate change allowances as required. No new watercourse crossings are proposed, and no changes will be made to existing watercourse crossings. No new structures or temporary construction works will be located in areas of high fluvial flood risk (Flood Zone 3).
Operation					
Aquatic environment - Pow Beck (South West Lakes) GB112074069990 water body					
Deterioration in water quality of receiving watercourses from developed areas.	Unlikely	High	Very Low	Minor (Not Significant)	Sensitivity = High, the water quality elements in Pow Beck were assigned good and high status under in the Cycle 2 2015 assessment. Magnitude of change after mitigation = Very Low, since any temporary construction areas will have been removed and land reinstated, and permanent development will be limited to a second track within the existing track-bed.
Flood risk					
Increased flood risk to people property and infrastructure in vicinity of site (roads and residential properties in	Unlikely	High	Very Low	Minor (Not Significant)	Sensitivity = High, assumes residential properties are potential receptors: this will be confirmed as part of the FRA. Magnitude of change after mitigation = Very Low, since any temporary construction areas will have been

Receptor and summary of predicted effects	Probability	Sensitivity/value of receptor	Magnitude of change	Significance of effect	Rationale
St. Bees, St. Bees WwTW)					removed and land reinstated, and permanent development will be limited to a second track within the existing track-bed.

N.B. In this table, the terms ‘construction’ and ‘operation’ refer to this site only. In terms of the overall Moorside Project, construction and operation of this site takes place entirely within the period of construction of the power station at the Moorside Site.

14.9 Whole Moorside Project Assessment

14.9.1 A full assessment of the Moorside Project as a whole will be included in the ES. For the purposes of this PEIR, the Moorside Site, the Accommodation Sites, the Corkickle to Mirehouse Railway Site and the St Bees Railway Site have been considered together at a high level to assess whether there could be any additional, *"accumulated effects"* on specific environmental receptors.

14.9.2 In terms of the spatial scope of the assessment of accumulated effects, the principles have been set out in general terms in **Section 3.4** and summarised in **Table 3.8**. With respect to surface freshwater effects, accumulated effects can only occur where more than one of the Project Sites is located within the same catchment. This principle is reflected in the definition of the two Study Areas used in this assessment, which correspond to the catchments of the WFD water bodies in which the Project Sites are located (as shown in **Table 14.1**).

14.9.3 Effects associated with the whole Moorside Project could arise from the following combination of sites:

- The Moorside Site and the Egremont Site: development at these sites could combine to affect the Ehen (Lower) Water Body;
- The Corkickle Site and most of the Corkickle to Mirehouse Railway Site: development at these sites could combine to affect the Pow Beck (Whitehaven) Water Body; and
- The Mirehouse Site, the southern end of the Corkickle to Mirehouse Railway Site and the St Bees Railway Site: development at these sites could combine to affect the Pow Beck (South West Lakes) Water Body.

14.9.4 A summary of potential accumulated effects based on the assessments carried out for individual Project Sites in **Tables 14.10 to 14.15** is provided below in **Table 14.16**.

Table 14.16 Summary of predicted residual freshwater surface water quality effects – whole project, construction and operational phases

Receptors	Whole Project accumulated effects /Significance of effects*						
	Moorside Site	Corkickle Site	Mirehouse Site	Egremont Site	Corkickle to Mirehouse Railway Site	St. Bees Railway Site	Whole Moorside Project
Aquatic environment: Ehen (Lower) WFD water body	Potentially Significant	No Effects	No Effects	Potentially Significant	No Effects	No Effects	Potentially Significant
Water resources: River Ehen	Not Significant	No Effects	No Effects	Not Significant	No Effects	No Effects	Not Significant
Flood risk receptors: River Ehen	Potentially Significant	No Effects	No Effects	Not Significant	No Effects	No Effects	Potentially Significant
Aquatic environment: WFD water body Pow Beck (SW Lakes) WFD water body	No Effects	No Effects	Potentially Significant	No Effects	Not Significant	Not Significant	Potentially Significant
Aquatic environment Stanley Pond CWS	No Effects	No Effects	Not Significant	No Effects	Not Significant	No Effects	Not Significant
Flood risk receptors: Pow Beck (South West Lakes)	No Effects	No Effects	Not Significant	No Effects	Not Significant	Not Significant	Not Significant
Aquatic environment: Pow Beck (Whitehaven)	No Effects	Not Significant	No Effects	No Effects	Not Significant	No Effects	Not Significant
Flood risk receptors: Pow Beck (Whitehaven)	No Effects	Potentially Significant	No Effects	No Effects	Not Significant	No Effects	Potentially Significant

* The preliminary effects summarised under each Moorside Project Site by receptor are subject to change for individual receptors and groups of receptors as more project design information becomes available and will be reported in the ES that is to be submitted in 2017. Assumes that sewage effluent from all sites is transferred to UU WwTWs for treatment and discharge to sea, rather than on-site treatment and discharge to nearby watercourses.

14.10 Preliminary assessment of cumulative effects

Scope of the assessment

14.10.1 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 the Moorside Project.

14.10.2 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 surface freshwater effects, it is considered appropriate at this stage not to consider the following projects on the basis that they are located outside the Study Area of the Moorside Project Sites:

- 4. Low Level Waste Repository, Drigg (LLWR Ltd)
- 5. West Cumbria Water Supply Pipeline (United Utilities);
- 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).

14.10.3 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 Study Areas.

14.10.4 Of the remaining other developments considered in **Table 3.9**, these are briefly discussed in the context of their likely interaction with respect to surface freshwater in the sub-sections below. However, the sites will be kept under review during the preparation of the EIA, pending the availability of information from the respective developers regarding their own Study Areas.

1. Sellafield Site Decommissioning (Sellafield Ltd/Nuclear Decommissioning Authority)

14.10.5 The Sellafield Site Decommissioning project has the potential to interact with the Moorside Project, particularly with respect to the Moorside Site itself. This would be most likely to occur during the construction phase of the Moorside Site, when potentially significant cumulative effects could occur with respect to water quality and flood risk in the River Calder.

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

14.10.6 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.

14.10.7 It is therefore anticipated that there could be potentially significant cumulative effects to surface freshwater generated during the coincident construction phases of both Moorside and NWCC Projects. These could occur with respect to water quality and quantity and flood risk, and are most likely in the vicinity of the Moorside and Mirehouse Sites, which could lead to combined effects on the Rivers Ehen and Calder, Kirk Beck and Pow Beck (South West Lakes).

3. Whitehaven Coking Coal Project (West Cumbria Mining)

14.10.8 Given that the timescales for the construction of the West Cumbria Mining Project precede the construction of the Moorside Project, it is considered that it is the operational phase of the former, and notably the operation of the proposed railhead, which would be located on the south-western part of the Mirehouse Site, that has the capacity to have potentially significant cumulative effects with the Moorside Project at the Mirehouse Site. This could lead to cumulative effects on water quality and quantity and flood risk in relation to the Pow Burn (South West Lakes)

14.11 Consideration of additional mitigation

14.11.1 At this stage, the environmental measures described in **Table 14.4** are incorporated into the development proposals and are considered in the assessment of effects outlined in **Section 14.8**. It is acknowledged that further mitigation may be required to address effects that are identified in the assessment tables in **Section 14.8** as currently being Significant or Potentially Significant. Additional mitigation will be specified as the Project design evolves and as further detailed impact assessment is carried out, and relevant details will be presented in the ES.

14.12 References

1. DECC (2011a). Overarching National Policy Statement for Energy (EN-1). The Stationary Office, London.
2. DECC (2011b). National Policy Statement for Nuclear Power Generation (EN-6). The Stationary Office, London.
3. DCLG (2012). *National Planning Policy Framework*. Department for Communities and Local Government, London.
4. DT (2014). *National Policy Statement for National Networks.*
5. CBC (2013). Copeland Local Plan 2013-2028 Core Strategy and Development Management Policies: http://www.copeland.gov.uk/sites/default/files/attachments/copeland_local_plan_2013_2028.pdf. Accessed April 2016.
6. ABC (2014). *Allerdale Local Plan. Strategic and Development Management Policies.:* http://www.allerdale.gov.uk/downloads/Adopted_Allerdale_Local_Plan_(Part_1)_-_Final_Version_290714.pdf. Accessed April 2016.
7. DEFRA (2015.) *The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015*.
8. EA (2016). *North West River Basin District River Basin Management Plan. Updated December 2015.* Horizon House, Bristol.
9. EA (2013b). *Managing Water Abstraction.* Horizon House, Bristol.
10. EA (2013b). *Derwent and West Cumbria Abstraction Licensing Strategy.* Rio House, Bristol.
11. EA (2009). *South West Lakes Catchment Flood Management Plan Summary Report*: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/293690/Southwest_Lakes_Catchment_Flood_Management_Plan.pdf. Accessed April 2016.
12. CCC (2015). *Local Flood Risk Management Strategy*.
13. EA (2009). *River Basin Management Plan. North West River Basin District*. Rio House, Bristol.
14. DCLG (2014) *National Planning Practice Guidance*. Web based resource available at: http://planningguidance.communities.gov.uk/blog/guidance/. Accessed April 2016.
15. DEFRA (2016). Magic website. Available at: http://magic.defra.gov.uk/MagicMap.aspx. Accessed April 2016.
16. EA (2016). What's in Your Backyard' online mapping. Available at: http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e. Accessed April 2016.
17. CBC (2007). Copeland Borough Council Strategic Flood Risk Assessment (SFRA): http://www.copeland.gov.uk/content/strategic-flood-risk-assessment. Accessed April 2016.