East Anglia TWO Offshore Windfarm

Chapter 18

Ground Conditions and Contamination

Environmental Statement
Volume 1

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Glossary of Acronyms

AIS	Air Insulated Switchgear
BGS	British Geological Survey
CoCP	Code of Construction Practice
CCS	Construction Consolidation Site
CDM	Construction Design Management
CGS	County GeoSite
CIA	Cumulative Impact Assessment
CIRIA	Construction Industry Research and Information Association
CLR	Contaminated Land Report
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DM	Development Management
EIA	Environmental Impact Assessment
ES	Environmental Statement
ESC	East Suffolk Council
ETG	Expert Topic Group
GIS	Gas Insulated Switchgear
GPP	Guidance for Pollution Prevention
ha	hectares
HDD	Horizontal Directional Drilling
LNR	Local Nature Reserve
LPA	Local Planning Authority
MMP	Materials Management Plan
MPS	Minerals Policy Statement
MW	Megawatt
NPPF	National Planning Policy Framework
NPS	National Policy Statements
NSIP	Nationally Significant Infrastructure Project
OCoCP	Outline Code of Construction Practice
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
PCOC	Potential Contaminants of Concern
PEIR	Preliminary Environmental Information Report
PID	Public Information Day
PRA	Preliminary Risk Assessment
RIGS	Regionally Important Geological Sites
SCDC	Suffolk Coastal District Council
SNCI	Site of Nature Conservation Interest
SP	Strategic Policies
SPA	Special Protection Area
SPR	ScottishPower Renewables
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SVOCs	Semi-Volatile Organic Compounds

UK	United Kingdom
VOCs	Volatile Organic Compounds
WDC	Waveney District Council
WFD	Water Framework Directive

Glossary of Terminology

Applicant	East Anglia TWO Limited.
Cable sealing end compound	A compound which allows the safe transition of cables between the overhead lines and underground cables which connect to the National Grid substation.
Cable sealing end (with circuit breaker) compound	A compound (which includes a circuit breaker) which allows the safe transition of cables between the overhead lines and underground cables which connect to the National Grid substation.
Construction consolidation sites	Compounds which will contain laydown, storage and work areas for onshore construction works. The HDD construction compound will also be referred to as a construction consolidation site.
Development area	The area comprising the onshore development area and the offshore development area (described as the 'order limits' within the Development Consent Order).
East Anglia TWO project	The proposed project consisting of up to 75 wind turbines, up to four offshore electrical platforms, up to one construction, operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
East Anglia TWO windfarm site	The offshore area within which wind turbines and offshore platforms will be located.
European site	Sites designated for nature conservation under the Habitats Directive and Birds Directive, as defined in regulation 8 of the Conservation of Habitats and Species Regulations 2017 and regulation 18 of the Conservation of Offshore Marine Habitats and Species Regulations 2017. These include candidate Special Areas of Conservation, Sites of Community Importance, Special Areas of Conservation and Special Protection Areas.
Horizontal directional drilling (HDD)	A method of cable installation where the cable is drilled beneath a feature without the need for trenching.
HDD temporary working area	Temporary compounds which will contain laydown, storage and work areas for HDD drilling works.
Jointing Bay	Underground structures constructed at regular intervals along the onshore cable route to join sections of cable and facilitate installation of the cables into the buried ducts.
Landfall	The area (from Mean Low Water Springs) where the offshore export cables would make contact with land and connect to the onshore cables.
Link boxes	Underground chambers within the onshore cable route housing electrical earthing links.
Mitigation areas	Areas captured within the onshore development area specifically for mitigating expected or anticipated impacts.
National electricity grid	The high voltage electricity transmission network in England and Wales owned and maintained by National Grid Electricity Transmission

National Grid infrastructure	A National Grid substation, cable sealing end compounds, cable sealing end (with circuit breaker) compound, underground cabling and National Grid overhead line realignment works to facilitate connection to the national electricity grid, all of which will be consented as part of the proposed East Anglia TWO project Development Consent Order but will be National Grid owned assets.
National Grid overhead line realignment works	Works required to upgrade the existing electricity pylons and overhead lines (including cable sealing end compounds and cable sealing end (with circuit breaker) compound) to transport electricity from the National Grid substation to the national electricity grid.
National Grid overhead line realignment works area	The proposed area for National Grid overhead line realignment works.
National Grid substation	The substation (including all of the electrical equipment within it) necessary to connect the electricity generated by the proposed East Anglia TWO project to the national electricity grid which will be owned by National Grid but is being consented as part of the proposed East Anglia TWO project Development Consent Order.
National Grid substation location	The proposed location of the National Grid substation.
Natura 2000 site	A site forming part of the network of sites made up of Special Areas of Conservation and Special Protection Areas designated respectively under the Habitats Directive and Birds Directive.
Onshore cable corridor	The corridor within which the onshore cable route will be located
Onshore cable route	This is the construction swathe within the onshore cable corridor which would contain onshore cables as well as temporary ground required for construction which includes cable trenches, haul road and spoil storage areas.
Onshore cables	The cables which would bring electricity from landfall to the onshore substation. The onshore cable is comprised of up to six power cables (which may be laid directly within a trench, or laid in cable ducts or protective covers), up to two fibre optic cables and up to two distributed temperature sensing cables.
Onshore development area	The area in which the landfall, onshore cable corridor, onshore substation, landscaping and ecological mitigation areas, temporary construction facilities (such as access roads and construction consolidation sites), and the National Grid Infrastructure will be located.
Onshore infrastructure	The combined name for all of the onshore infrastructure associated with the proposed East Anglia TWO project from landfall to the connection to the national electricity grid.
Onshore preparation works	Activities to be undertaken prior to formal commencement of onshore construction such as pre–planting of landscaping works, archaeological investigations, environmental and engineering surveys, diversion and laying of services, and highway alterations.
Onshore substation	The East Anglia TWO substation and all of the electrical equipment within the onshore substation and connecting to the National Grid infrastructure.

Onshore substation location	The proposed location of the onshore substation for the proposed East Anglia TWO project.
Transition Bay	Underground structures at the landfall that house the joints between the offshore export cables and the onshore cables.

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18 Ground Conditions and Contamination

18.1 Introduction

1. This chapter of the Environmental Statement (ES), prepared by Royal HaskoningDHV, provides a description of the anticipated physical environment (soils, geology, hydrogeology and contamination) for the proposed East Anglia TWO project. It provides an assessment of the potential impacts of the construction and decommissioning of the proposed East Anglia TWO project on these conditions. Operational impacts were scoped out of the assessment as detailed in the Scoping Report (ScottishPower Renewables (SPR) 2017) and are not considered further in this chapter.

2. The focus of this chapter is on ground conditions and contamination and specifically considers the physical elements of the ground conditions, and potential impacts of the proposed East Anglia TWO project on hydrology (surface water quality) and hydrogeology (groundwater quality and levels), mineral resources, as well as the potential interrelationship with potential contamination and how this could affect the health of construction site workers, future site users and off-site workers/residents during the construction phase of the proposed East Anglia TWO project. Wider land use impact considerations are considered in ***Chapter 21 Land Use***, including soils as a resource.

3. It should be noted that the East Anglia ONE North offshore windfarm project (the proposed East Anglia ONE North project) is also in the application stage. The proposed East Anglia ONE North project has a separate Development Consent Order (DCO) process which has been submitted at the same time as the proposed East Anglia TWO project. This assessment considers the cumulative impact of the proposed East Anglia TWO project with the proposed East Anglia ONE North project (***Appendix 18.2***) and subsequently with other proposed developments (***section 18.6***).

4. The findings of this assessment have the potential to influence other topics within the ES; reference should be made to ***Chapter 20 Water Resources and Flood Risk*** and ***Chapter 21 Land Use***. ***Chapter 20 Water Resources and Flood Risk*** includes assessments of the effects of surface water run-off arising from the proposed East Anglia TWO project on the integrity and quality of local surface water bodies and on the quality of local groundwater; the risk of pollution from discharges of waste water and spillages; and effects on flood risk.

5. A desk based Preliminary Risk Assessment (PRA) has been undertaken for the proposed East Anglia TWO project and is presented in ***Appendix 18.3***.

18.2 Consultation

6. Consultation is a key feature of the Environmental Impact Assessment (EIA) process, and continues throughout the lifecycle of a project, from its initial stages through to consent and post-consent.

7. To date, consultation with regards to ground conditions and contamination has been undertaken via Expert Topic Group (ETG) meetings, described within ***Chapter 5 EIA Methodology***, with meetings held in April 2018 and January 2019, through the East Anglia TWO Scoping Report (SPR 2017) and the Preliminary Environmental Information Report (PEIR) (SPR 2019). Feedback received through this process has been considered in preparing the ES where appropriate and this chapter has been updated for the final assessment submitted with the draft DCO. The responses received from stakeholders with regards to the Scoping Report, PEIR, as well as feedback to date from the Ground Conditions and Contamination ETG, are summarised in ***Appendix 18.1***, including details of how these have been taken account of within this chapter.

8. Ongoing public consultation has been conducted through a series of Public Information Days (PIDs) and Public Meetings. PIDs have been held throughout Suffolk in November 2017, March 2018, June / July 2018 and February / March 2019. A series of stakeholder engagement events were also undertaken in October 2018 as part of phase 3.5 consultation. Details of the consultation phases are discussed further in ***Chapter 5 EIA Methodology***.

9. No public consultation feedback specific to ground conditions and contamination have been raised during any public consultation undertaken to date. Full details of the proposed East Anglia TWO project consultation process are presented in the Consultation Report (document reference 5.1), which is provided as part of the DCO application.

18.3 Scope

18.3.1 Study Area

10. The onshore infrastructure for the proposed East Anglia TWO project will include the following elements:

- Landfall;
- Onshore cable corridor;
- Onshore substation; and
- National Grid infrastructure.

11. A full description of the above infrastructure is provided in ***Chapter 6 Project Description***.

12. For the purpose of the assessment, and to aid baseline descriptions, study areas have been determined by a number of factors such as distribution of receptors, footprint of potential impact, or political/management boundaries. These were agreed, during an ETG with regulatory authorities.

13. The onshore development area, as outlined in ***Chapter 6 Project Description***, is the largest area over which direct impacts could be experienced. The study area for geology and ground conditions considered the onshore development area and a 1km buffer. Contaminant sources have only been considered in detail for a 250m buffer from the onshore development area. The rationale for the study area is based on professional judgement taking into consideration the spatial extent across which potential hazards could have unacceptable risks. This is presented in ***Figure 18.1***.

18.3.1.1 Offsite Highway Improvements

14. Offsite highway improvements may take place at three locations; the A1094 / B1069 junction, the A12 / A1094 junction and Marlesford Bridge. These works are part of the onshore preparation works which may take place prior to the commencement of main construction. Therefore, detailed assessment of these works does not form part of the assessment of construction impacts presented in ***section 18.5.*** These works are to allow larger construction vehicles to access and navigate certain parts of the public road network. Any modifications to roads would be undertaken in consultation with and in accordance with the requirements of the local Highways Authority in accordance with the requirements of the draft DCO. Further details of the works required are presented in ***Chapter 6 Project Description.***

15. The offsite highway improvements at the A1094 / B1069 and A12 / A1094 junctions would involve the temporary moving of street furniture and temporary local widening of the highway (or creation of overrun areas). Offsite highway improvements at Marlesford Bridge would additionally require temporary laydown areas for structural works to accommodate abnormal indivisible loads.

16. The offsite highway improvements will not require a large quantity of plant and equipment and the works will have a small footprint, mostly within the existing highway boundary. Given the small footprint and temporary nature of these works, and the limited intrusive elements, along with adherence to best practice detailed in ***section 18.3.3,*** it is considered that the offsite highway improvements will not give rise to any impacts to human health, groundwater, surface water or mineral resources.

18.3.2 Worst Case Scenarios

17. This section identifies the realistic worst-case scenarios associated with the proposed East Anglia TWO project alone. This includes all onshore infrastructure

for the proposed East Anglia TWO project and the National Grid infrastructure that the proposed East Anglia TWO project will require for ultimate connection to national electricity grid. Areas provided for onshore infrastructure are maximum footprints with indicative dimensions provided in brackets.

18. ***Chapter 6 Project Description*** details the project parameters using the Rochdale Envelope approach for the ES.

19. ***Table 18.1*** identifies those realistic worst-case parameters of the onshore infrastructure that are relevant to potential impacts on ground conditions and contamination during construction, operation and decommissioning phases of the proposed East Anglia TWO project. Please refer to ***Chapter 6 Project Description*** for more detail regarding specific actvities and their durations, which fall within the construction phase.

20. As described in ***Chapter 5 EIA Methodology,*** there are two co-located onshore substation locations for either the proposed East Anglia TWO project or the proposed East Anglia ONE North project. It should be noted that the draft DCOs for both the proposed East Anglia TWO and East Anglia ONE North projects have the flexibility for either project to use either onshore substation location. There is no difference in the scoped in and assessed impacts between the two onshore substation locations, therefore the 'project alone' assessment in ***section 18.5,*** and associated chapter figures***,*** have been presented on the intended development strategy of the proposed East Anglia TWO project using the eastern onshore substation location.

Table 18.1 Realistic Worst Case Scenarios

Impact	Parameter	Notes
Construction		
Impacts related to the landfall	HDD temporary working area: 7,000m^2 (70m x 100m) Transition bay temporary working area (for 2 transition bays): 1,554m^2 (37m x 42m) Landfall Construction Consolidation Site (CCS) (x1): 7,040m^2 (88m x 80m)	
Impacts related to the onshore cable route	Onshore cable route: 290,912m^2 (9,091m x 32m) Jointing bay temporary working area: 570m^2 (30.6m x 18.6m). Total for 38 jointing bays: 21,660m^2 (570m^2 x 38) HDD (retained as an option to cross SPA / SSSI):	

Impact	Parameter	Notes
	Entrance pit temporary working area (x1): 6,300m^2 (90m x 70m) Exit pit temporary working area (x1): 2,700m^2 (90m x 30m) Onshore cable route large CCS (1): 16,500m^2 (165m x 100m). Onshore cable route medium CCS (2): 14,080m^2 total (88m x 80m per each medium CCS) Onshore cable route small CCS (2): 6,000m^2 total (60m x 50m per each small CCS) Total footprint of all onshore cable route CCS: 36,580m^2 Onshore cable route laydown area: 1,000m^2 Onshore cable route haul road between landfall and Snape Road (7,331m in length x 4.5m wide with additional 4m for passing places at approximately 90m intervals): 40,435m^2 Onshore cable route and substation access haul road (1,570m in length x 9m wide): 14,130m^2 Temporary access roads (957m in length x 4.5m wide with additional 4m for passing places at approximately 90m intervals): 5,231m^2	
Impacts related to the onshore substation	Onshore substation CCS: 17,100m^2 (190m x 90m) Permanent footprint (used as CCS during construction): 36,100m^2 (190m x 190m) Substation operational access road: 13,600m^2 (1,700m x 8m)	
Impacts related to the National Grid Infrastructure	National Grid CCS: 23,350m^2 National Grid operational substation (AIS technology) (used as a CCS during construction): 44,950m^2 (310m x 145m) Temporary pylon/mast temporary working area (x4): 10,000m^2 (2,500m^2 per each temporary pylon) Permanent pylon permanent footprint (x4): 1,600m^2 (400m^2 per each permanent pylon) Permanent pylon temporary working area (x4): 8,400m^2 (2,100m^2 per each permanent pylon)	Air Insulated Switchgear (AIS) technology is assessed as the worst case due to a larger footprint. Futher detail regarding Gas Insulated Switchgear (GIS) technology is provided in ***Chapter 6 Project Description***

Impact	Parameter	Notes
	Overhead line realignment temporary working area: 5,000m^2 Cable sealing end/Cable sealing end (with circuit breaker) compounds permanent footprint: 10,000 m^2 (total for three compounds) Cable sealing end/Cable sealing end (with circuit breaker) compounds temporary working area: 30,000m^2 (for three compounds) Temporary access road (for pylon works): (1,100m in length x 4.5m wide with additional 4m for passing places at approximately 90m intervals): 5,629m^2 Permanent access road to sealing end compound: 1,850m^2 (500m x 3.7m)	
Operation		
Operational phase ground conditions and contamination impacts have been scoped out as detailed in the Scoping Report (SPR 2017).		
Decommissioning		
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.		

18.3.3 Embedded Mitigation and Best Practice

21. All construction work has the potential to impact on land and water quality and human health, through spillages, mobilisation of sediment and contaminants by surface run-off or disturbance of contaminated ground. To minimise the risk of such impacts, all construction phase activities would be carried out in accordance with the embedded mitigation outlined in ***Table 18.2***.

Table 18.2 Embedded Mitigation and Best Practice for Ground Conditions and Contamination

Parameter	Mitigation Measures Embedded into the Project Design
General	
Code of Construction Practice (CoCP)	Environmental best practice would include both the now revoked Environment Agency best practice guidelines (e.g. Environment Agency's Guidance for Pollution Prevention Note (GPP) series) and current best practice guidelines avalible here: https://www.gov.uk/government/collections/groundwater-protection. Adherence to an Pollution Prevention Response Plan which will be drafted in advance of any construction works, as secured under the requirements of the draft DCO. The CoCP will provide a protocol under which the environmental risk mitigation and other specific remedial measures will be defined and executed. An Outline CoCP (OCoCP) has been submitted with this DCO application and is secured under the requirements of the draft DCO, The final CoCP developed post-consent will be based on this OCoCP.
Health and Safety	Health and safety procedures will be controlled under Construction Design Management Regulations (CDM-2015)
Contaminated land and groundwater draft DCO requirement	A requirement of the draft DCO secures the post-consent production of a Pollution Prevention Response Plan detailing the measures used to mitigate the potential for release of contaminants for the construction and operational stage of the proposed East Anglia TWO project.
CL:AIRE Industry Code of Practice for waste management	Adoption of a CL:AIRE Industry Code of Practice to manage excavated soils on site, thereby maximise sustainability and providing an audit trail to demonstrate the appropriate use of materials. A Materials Management Plan (MMP) will be drafted in advance of any construction works. Validation of materials imported to site in line with pre-agreed assessment criteria to ensure they are suitable for proposed end use. A Site Waste Management Plan for the proposed East Anglia TWO project will be developed post-consent. This is detailed further within the OCoCP submitted with this DCO application.
Environment agency groundwater protection pollution prevention guidance	Best practice guidance including the Environment Agency's GPP series and guidance from the Construction Industry Research and Information Association (CIRIA). As well as, Environment Agency's Groundwater technical guidance covering: requirements, permissions, risk assessments and controls (previously covered in GP3). Available here: https://www.gov.uk/government/collections/groundwater-protection.
General best practice	Store oils and fuel within designated areas above ground in impervious storage bunds with a minimum of 110% capacity to contain any leaks or spillages; Carry out regular inspection of oil and fuel storage areas; Restrict refuelling activities to designated areas were impermeable surfaces and drip trays are utilised; Have spill kit available for use on site at all times; All staff to have site inductions were appropriate use of chemical and fuels on site are discussed.

Parameter	Mitigation Measures Embedded into the Project Design
	A Pollution Prevention and Response Plan will be incorporated into the CoCP. This is to be agreed with the Environment Agency and follow industry best practice; Storage of hazardous materials will be done with due care and if adequate store locations cannot be identified within the site compound these materials will be stored off-site in a secure location; and A protocol for dealing with potentially contaminated materials will be utilised during the construction works.
Landfall and Onshore Cable Corridor	
Land Quality	Avoidance of construction in areas of historic development. Including all historic pits and areas of infill land identified. Should any unanticipated contamination be encountered during the work, work should be halted in that area and a written statement on how contamination will be dealt with should be agreed with the Local Planning Authority.
Groundwater Quality	A hydrogeological risk assessment will be produced pre-construction to ensure protection of abstractions of water where construction activity including HDD and piling is in hydraulic continuity. A Landfall Construction Method Statement including a detailed hydrogeological risk assessment of the effects of pilling and HDD activities will be produced. This assessment and the proposed methods used to avoid contamination of the groundwater and will be agreed with the Environment Agency.
Onshore Substation and National Grid Infrastructure	
Land Quality	Avoidance of construction in areas of historic development. Including all historic pits and areas of infill land identified. Should any unanticipated contamination be encountered during the work, work should be halted in that area and a written statement on how contamination will be dealt with should be agreed with the Local Planning Authority and Environment Agency.
Groundwater Quality	A hydrogeological risk assessment will be produced pre-construction to ensure protection of abstractions of water where construction activity including HDD and piling is in hydraulic continuity to Secondary Aquifers within the Superficial deposits. A Groundwater Protection Method Statement including detailed hydrogeological risk assessment of the effects of pilling activities will be produced. This assessment and the proposed methods used to avoid contamination of the groundwater and will be agreed with the Environment Agency

18.3.4 Monitoring

22. Post-consent, the final detailed design of the proposed East Anglia TWO project will refine the worst-case parameters assessed in this ES. It is recognised that monitoring is an important element in the management and verification of the

actual impacts based on the final detailed design. Where monitoring is proposed for ground conditions and contamination, this is described in the OCoCP submitted with this DCO application (document reference 3.1). Final details of monitoring will be agreed post-consent with the Local Planning Authority and relevant stakeholders.

18.3.5 Legislation, Guidance and Policy

23. The following sections provide detail on key pieces of UK legislation, policy and guidance which are relevant to this chapter.

18.3.5.1 Legislation and Guidance

24. The following UK legislation and guidance is considered the most relevant legislation to ground conditions and contamination and is considered in this chapter:

- The Environmental Permitting (England and Wales) Regulations (2010);
- The Water Resources Act 1991, as amended by the Water Act (2003);
- Environmental Protection Act (1990) Part 2A;
- Environment Act (1995);
- The Water Environment (Water Framework Directive) (England and Wales) Regulations (2017);
- Environmental Damage (Prevention and Remediation) (England) Regulations (2015), and
- HSE Construction Design and Management (CDM) Regulations (2015).

25. The following UK guidance is considered the most relevant to ground conditions and contamination and is considered in this chapter:

- Environment Agency and Department for Energy and Climate Change (DEFRA) Pollution Prevention for businesses (2016);
- Environment Agency Model Procedures for the Management of Land Contamination, Contaminated Land Report 11 (CLR11);
- CIRIA publication C532 Control of water pollution from construction sites (2001);
- CIRIA publication C650 Environmental good practice on site (2005);
- CIRIA publication C503 Environmental good practices working on site (2000);
- CIRIA publication C502 Environmental good practices on site (2000);
- CIRIA publication C665 Assessing risks posed by hazardous ground gases to buildings (2007);

- DEFRA Construction Code of Practice for the Sustainable Use of Soil on Construction Sites (2009);
- British Standard BS10175 Investigation of Potentially Contaminated Sites;
- British Standard BS5930 Code of Practice for Site Investigations, and
- British Geological Survey Report Mineral safeguarding in England: good practice advice, OR/11/046 (2011).

18.3.5.2 Policy

18.3.5.2.1 National Policy Statements

26. This assessment has been made with specific reference to the relevant National Policy Statements (NPS). NPS (the principal decision-making documents for Nationally Significant Infrastructure Projects (NSIPs)), of relevance to the proposed East Anglia TWO project are:

- Overarching NPS for Energy (EN-1) (Department of Energy and Climate Change (DECC) 2011a);
- NPS for Renewable Energy Infrastructure (EN-3) (DECC 2011b); and
- NPS for Electricity Networks Infrastructure (EN-5) (DECC 2011c).

27. The specific requirements of the NPS in relation to soils, geology and ground conditions in the NPS are summarised in ***Table 18.3***. This table addresses where in this chapter specific requirements from the NPS are addressed. Where any part of the NPS has not been followed within the assessment an explanation as to why the requirement was not deemed relevant, or has been met in another manner, is provided.

Table 18.3 NPS EN-1 Guidance Relevant to Ground Conditions and Contamination

NPS Reference	NPS Requirement	ES Reference
EN-1 Section 5.3.3	Where the development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance.	The existing environment is discussed in ***section 18.4***. Impacts are set out in ***sections 18.5*** and ***18.6.*** There are no designated sites of geological importance and any impacts upon ecology are assessed in ***Chapter 22 Onshore Ecology*** and ***Chapter 23 Onshore Ornithology***

18.3.5.2.2 National Planning Policy Framework Guidance

28. The National Planning Policy Framework (NPPF 2019) and associated guidance provide guidance to Local Planning Authorities on how to assess planning

applications. Sections relevant to this aspect of the ES are summarised in ***Table 18.4***.

Table 18.4 NPPF Relevant to Ground Conditions and Contamination

NPPF Reference	NPPF Requirement	ES Reference
NPPF15-170	The planning system should contribute to and enhance the natural and local environment by inter alia preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.	The existing environment is discussed in ***section 18.4***. Impacts are set out in ***sections 18.5*** and ***18.6***.
NPPF15-171	In preparing plans to meet development needs, the aim should be to distinguish between the hierarchy of international, national and locally designated sites and minimise adverse effects on the local and natural environment. Plans should allocate land with the least environmental or amenity value, where consistent with other policies in the Framework, and take a strategic approach to maintaining and enhancing networks of habitats and green infrastructure, planning for the enhancement of natural capital at catchment or landscape scales.	The existing environment is discussed in ***section 18.4***. Impacts are set out in ***sections 18.5*** and ***18.6***.
NPPF15-178	Planning policies and decisions should also ensure that: • The site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation; • After remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and • Adequate site investigation information, prepared by a competent person, is presented.	The existing environment is discussed in ***section 18.4***. Impacts are set out in ***sections 18.5*** and ***18.6***. A Phase 1 Land Quality Preliminary Risk Assessment is provided in ***Appendix 18.3***
NPPF15-179 and NPPF15-180	To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.	The existing environment is discussed in ***section 18.4***. Impacts are set out in ***sections 18.5*** and ***18.6***.

NPPF Reference	NPPF Requirement	ES Reference
NPPF 15-183	In doing so, Local Planning Authorities should focus on whether the development itself is an acceptable use of the land, and the impact of the use, rather than the control of processes or emissions themselves where these are subject to approval under pollution control regimes. Local Planning Authorities should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.	The existing environment is discussed in ***section 18.4***. Impacts are set out in ***sections 18.5*** and ***18.6***.

18.3.5.3 National Mineral Policy

29. The Minerals Policy Statement 1: Planning and Minerals (MPS1) aims to secure adequate and steady supplies of the minerals needed by society and the economy. This publication has been incorporated into the NPPF (2019) however, is also deemed relevant in the context of this assessment.

18.3.5.4 Local Planning Policy

30. The NPS EN-1 states that the Planning Inspectorate will consider Development Plan Documents or other documents in the Local Development Framework to be relevant to its decision making. The onshore development area also falls within the administrative area of East Suffolk Council Local Planning Authority (LPA). East Suffolk Council (ESC) is the merger of Suffolk Coastal District Council (SCDC) and Waveney District Council (WDC), which became effective from 1st April 2019.

31. ESC published their Suffolk Coastal Final Draft Local Plan for a final stage of consultation in January 2019 (ESC 2019). This plan sets out strategic planning policies within East Suffolk and how the Local Planning Authorities address the NPPF on a local basis. The Suffolk Coastal Final Draft Local Plan incorporates 'saved' polices from the 2006 and 2013 revisions of the Local Plan and includes core strategies such as the Suffolk Minerals Core Strategy and Suffolk Waste Core Strategy, Strategic Policies (SP), Development Management Policies (DM) and Objectives from this plan.

18.3.5.5 Assessment Guidance

32. The assessment methodology used in this chapter follows the methodology set out in ***Chapter 5 EIA Methodology.*** There is no specific assessment guidance to reference in relation to this topic.

18.3.6 Data Sources

33. A contaminated land Phase 1 desk-based study was produced for the site (***Appendix 18.3***). Site walkovers were made for geomorphology and ecology and from the results of these surveys, assessments were made to determine any

obvious signs of contamination. The data sources that were used to further inform the baseline knowledge of ground conditions and contamination are provided in ***Table 18.5.***

Table 18.5 Data Sources Features

Data	Source	Year	Confidence[1]
ESC (2019) Suffolk Coastal Final Draft Local Plan	East Suffolk Council	2019	High
Private licensed groundwater abstractions	East Suffolk Council	2019	High
Private Water Supplies	Suffolk Coastal District Council	2018	High
Private licensed groundwater abstractions	Environment Agency	2019	High
Historical Maps	Landmark Envirocheck	2017	High
Radon Gas Risk	Public Health England UK radon affected areas: http://www.ukradon.org/information/ukmaps	2018	High
Historic landfills	Environment Agency: www.environemnt.data.gov.uk	2018	High
Pollution incidents	Environment Agency: https://data.gov.uk/dataset/f/environmental-pollution-incidents	2018	High
Solid Geology	British Geological Survey (BGS) Onshore Geoindex: http://www.bgs.ac.uk/GeoIndex/	2018	High
Superficial Geology	British Geological Survey Onshore Geoindex: http://www.bgs.ac.uk/GeoIndex/	2018	High
Regionally Important Geological / Geomorphological Sites (RIGS)	Suffolk County Council Geosuffolk and Suffolk Biodiversity Information Service DEFRA Magic Map SSSI geological sites	2018	Low
Ground water Source Protection Zones	www.environemnt.data.gov.uk/catchment-planning	2018	High
Nitrate Vulnerable Zones	DEFRA Magic Map	2018	High

[1] Confidence level based upon the organisation responsible for collating data source (high = regulatory, low = non-regulatory)

18.3.7 Impact Assessment Methodology

34. The generic assessment methodology that is applied throughout the ES is explained in detail in ***Chapter 5 EIA Methodology***. The following sections describe more specifically the methodology used to assess the potential impacts of the proposed East Anglia TWO project on ground conditions and contamination, following the characterisation of the existing environment.

18.3.7.1 Sensitivity

35. Definitions of the different sensitivity levels for the receptors are presented in ***Table 18.6*** below.

Table 18.6 Sensitivity Criteria for Ground Conditions and Contamination Receptors

Sensitivity	Definition
High	Human Health Construction workers Future site end-users General Public (off-site) Principal Aquifers Secondary A Aquifers Licensed and unlicensed groundwater and surface water abstractions Surface waters – supporting internationally or nationally important sites Site of Special Scientific Interest (SSSI) Receptor is Internationally or Nationally important / rare with limited potential for offsetting / compensation.
Medium	Surface water – supporting regionally important sites (Local Nature Reserves - LNR, Site of Nature Conservation Interest (SNCI)) Mineral Resources Mineral Safeguard Zones Receptor is regionally important / rare with limited potential for offsetting / compensation.
Low	Secondary B – water bearing unproductive strata (resource potential) Surface waters supporting locally important wildlife or amenities Receptor is locally important / rare
Negligible	Surface waters not associated with locally important sites Receptor is not considered to be particularly important / rare Unproductive Strata

18.3.7.2 Magnitude

36. Potential effects may be adverse, beneficial or neutral. The magnitude of an effect is assessed qualitatively, according to criteria set out in ***Table 18.7.*** The following definitions apply to time periods used in the magnitude assessment:

- Long-term: >5 years;
- Medium-term: 1 to 5 years, and
- Short-term: <1 year.

37. For human health, magnitude reflects the likely increase or decrease in exposure risk for a particular receptor. For controlled waters, magnitude represents the likely effect that an activity would have on resource usability or value, at the receptor. Magnitude is therefore affected by the distance and connectivity between an impact source and the receptor.

Table 18.7 Effect Magnitude and Definition

Magnitude Definition	Examples
High Permanent or large-scale change affecting usability, risk, value over a wide area, or certain to affect regulatory compliance	Human Health Risk • Permanent or major change to existing risk of exposure (Adverse / Beneficial) • Unacceptable risks to one or more receptors over the long-term or permanently (Adverse) • Prosecution under health and safety legislation (Adverse) • Remediation and complete source removal (Beneficial) • Construction workers at risk due to lack of appropriate personal protective equipment (Adverse)
	Controlled Waters • Permanent, long-term or wide scale effects on water quality or availability (Adverse / Beneficial) • Permanent loss or long-term derogation of a water supply source of a water supply source resulting in prosecution (Adverse) • Change in Water Framework Directive (WFD) water body status / potential or its ability to achieve WFD status objectives in the future (Adverse / Beneficial) • Permanent habitat loss or creation (Adverse / Beneficial) • Measurable habitat change that is sustainable / recoverable over the long-term (Adverse / Beneficial)
Medium Moderate permanent or long-term reversible	Human Health Risk • Medium-term or moderate change to existing risk of exposure (Adverse / Beneficial) • Unacceptable risks to one or more receptors over the medium-term (Adverse)

Magnitude Definition	Examples
change affecting usability, value, risk, over the medium-term or local area; possibly affecting regulatory compliance	Controlled Waters • Medium-term or local scale effects on water quality or availability (Adverse / Beneficial). • Medium-term derogation of a water supply source, possibly resulting in prosecution (Adverse). • Observable habitat change that is sustainable / recoverable over the medium-term (Adverse / Beneficial). • Temporary change in status / potential of a WFD waterbody or its ability to meet objectives (Adverse / Beneficial)
Low Temporary change affecting usability, risk or value over the short-term or within the site boundary; measurable permanent change with minimal effect usability, risk or value; no effect on regulatory compliance	Human Health Risk • Short-term temporary or minor change to existing risk of exposure (Adverse / Beneficial). • Unacceptable risks to one or more receptors over the short-term (Adverse)
	Controlled Waters • Short-term or very localised effects on water quality or availability. (Adverse / Beneficial). • Short-term derogation of a water supply source (Adverse). • Measurable permanent effects on a water supply source that do not impact on its operation (Adverse). • Observable habitat change that is sustainable / recoverable over the short-term (Adverse / Beneficial). • No change in status / potential of a WFD waterbody or its ability to meet objectives (Neutral).
Negligible Minor permanent or temporary change, undiscernible over the medium- to long-term short-term, with no effect on usability, risk or value	Human Health Risk • Negligible change to existing risk of exposure • Activity is unlikely to result in unacceptable risks to receptors (Neutral)
	Controlled Waters • Very minor or intermittent impact on local water quality or availability (Adverse / Beneficial). • Usability of a water supply source will be unaffected (Neutral) • Very slight local changes that have no observable impact on dependent receptors (Neutral) • No change in status / potential of a WFD waterbody or its ability to meet objectives (Neutral).

18.3.7.3 Impact Significance

38. Following the identification of receptor sensitivity and magnitude of the effect, it is possible to determine the significance of the impact.

39. The matrix which will be used as a tool to aid this assessment is presented in ***Table 18.8.*** The assessment of impact significance is qualitative and reliant on professional experience, interpretation and judgement. The matrix should therefore be viewed as a framework to aid understanding of how a judgement has been reached, rather than as a prescriptive tool.

Table 18.8 Impact Significance Matrix

		Negative Magnitude				Beneficial Magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	High	*Major*	*Major*	*Moderate*	*Minor*	*Minor*	*Moderate*	*Major*	*Major*
	Medium	*Major*	*Moderate*	*Minor*	*Minor*	*Minor*	*Minor*	*Moderate*	*Major*
	Low	*Moderate*	*Minor*	*Minor*	*Negligible*	*Negligible*	*Minor*	*Minor*	*Moderate*
	Negligible	*Minor*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Minor*

40. Following initial assessment, if the impact does not require additional mitigation (or none is possible) the residual impact will remain the same. If, however, additional mitigation is proposed there will be an assessment of the post-mitigation residual impact.

41. As with the definitions of magnitude and sensitivity, the matrix used for a topic is clearly defined by the assessor within the context of that assessment. The impact significance categories are divided as shown in ***Table 18.9.***

Table 18.9 Impact Significance Definitions

Value	Definition
Major	Very large or large changes in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or, could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate changes in receptor condition, which are likely to be important considerations at a local level.
Minor	Small changes in receptor condition, which may be raised as local issues but are unlikely to be important in the decision making process.
Negligible	No discernible change in receptor condition.
No change	No impact, therefore no change in receptor condition.

42. Note that for the purposes of the EIA, major and moderate impacts are deemed to be significant. In addition, whilst minor impacts are not significant in their own right, it is important to distinguish these from other non-significant impacts as they may contribute to significant impacts cumulatively or through interactions.

43. Embedded mitigation should be referred to and included in the initial assessment of impact. If the impact does not require mitigation (or none is possible) the residual impact will remain the same. If, however, mitigation is required there should be an assessment of the post-mitigation residual impact.

18.3.8 Cumulative Impact Assessment

44. The proposed East Anglia TWO project Cumulative Impact Assessment (CIA) will initially consider the cumulative impact with only the proposed East Anglia ONE North project against two different construction scenarios. The worst case scenario of each impact is then carried through to the full CIA which considers other developments which have been screened into the CIA.

45. For a general introduction to the methodology used for the CIA please refer to ***Chapter 5 EIA Methodology***. Further detail of the CIA in regard to ground conditions and contamination is given in ***section 18.5.***

18.3.9 Transboundary Impact Assessment

46. There are no transboundary impacts with regard to ground conditions and contamination as the onshore development area is not sited in proximity to any international boundaries. Therefore, transboundary impacts on ground conditions and contamination are scoped out of this assessment and will not be considered further.

18.4 Existing Environment

47. The characterisation of the existing environment is undertaken using the data sources listed in ***Table 18.5*** plus other relevant literature.

18.4.1 Site Setting

48. The onshore study area **(*Figure 18.1*)** is largely agricultural in nature, which represents potential for both diffuse and point sources of pollution to be present in relation to current agricultural activities. Settlements within or adjacent to the onshore development area include Leiston, Aldringham, Friston, Knodishall and Coldfair Green – developed areas also have the potential for historic sources of ground contamination.

18.4.2 Geology

49. The underlying geology across the onshore study area comprises superfical deposits (Till) of varying lithologies overlaying the Crag Group comprising sands, as summarised in ***Table 18.10*** and presented in ***Figure 18.2*** and ***Figure 18.3.***

50. Thorpeness Cliffs are identified as a County GeoSite (CGS) – a non-statutory designation reflecting its value as the most southerly exposure of glacial till in the cliffs of East Anglia – and fall within the onshore development area and onshore study area. No statutory RIGS are known to be present within the onshore study area. Given that the only identified statutory designated feature is located some distance beyond the onshore development area, the feature is considered to be a negligible sensitivity receptor in the context of the proposed East Anglia TWO project and is therefore not considered further within the assessment.

Table 18.10 Geology under the Onshore Development Area

Stratum	Unit Name	Description
Superficial deposits	Alluvium	Clay, silt, sand and gravel.
	Till – Diamicton	Variable lithology, usually sandy, silty clay with pebbles, but can contain gravel-rich, or laminated sand layers; varied colour and consistency.
	Till – Lowersoft formation	Sands and gravels, Clay and silts, and sands.
Bedrock	Crag Group – Crag Formation	Sands

18.4.3 Hydrology

51. The nearest water course to the onshore development area is the Hundred River and the nearest water body is the Suffolk coast, with several smaller unnamed rivers all of which discharge into the Suffolk Coast. The Hundred River is hydrologically connected with Aldeburgh SSSI and Sandlings Special Protection Area (SPA). The sensitivity of the Hundred River is therefore considered High.

18.4.4 Hydrogeology

52. The Environment Agency's groundwater vulnerability data indicates parts of the onshore development area are designated as having a high groundwater vulnerability (overlying a permeable aquifer). This indicates soils which may be able to transmit a wide range of pollutants into any groundwater stored in strata beneath them. Where present the superficial deposits are classified as predominantly Secondary Undifferentiated Aquifers, with areas classified as Secondary A, Secondary B, and unproductive strata. Where present low permeability strata are likely to minimise the flow of contamination and therefore provide a degree of protection to underlying water resources. The onshore development area is within the Crag Formation, which is designated as a Principle Aquifer. There is also the London Clay Formation which is designated as Unproductive Strata and the Thanet Sand Formation which is designated as Secondary A Aquifer.

53. There are two groundwater Source Protection Zones (SPZs) identified within the onshore development area and onshore study area. These are the Leiston (AN307) and Coldfair Green (ANO34) public water supply abstractions, shown in ***Figure 18.4.***

54. SPZs are defined around abstraction wells, boreholes and springs used for public water supply, to delineate the area where release of a contaminant into the aquifer could impact on the abstraction, shown in ***Figure 18.4***. There are three types of SPZ:

- The Inner Zone (Zone 1) is the most sensitive and some activities with the potential to pollute groundwater are restricted in this area;
- The Outer Zone (Zone 2) is less sensitive, and there are fewer restrictions; and
- Outside Zone 2 is the Total Catchment (Zone 3), which indicates the recharge area that contributes to that water supply.

55. In addition to SPZs within the onshore study area there are several private potable water abstractions within the superfical deposits and Secondary Aquifers contained within them. Consultation with East Suffolk Council and the Environment Agency for public water supplies and other significant sources. For potable abstractions without published SPZs there is a default Inner Zone of 50m radius and, an Outer Zone of 250m or 500m radius (depending on the size of the abstraction). Additional data from the Environment Agency identifies three abstraction licences within the study area. There are two groundwater abstractions and a surface water abstraction, all of which are for agricultural use (irrigation).

56. The sensitivity of groundwater as a receptor in the onshore study area is considered to be High.

18.4.5 Land Quality

57. A review of contaminated land sources and land quality was undertaken for the onshore study area, detailed assessment of potential sources of contamination is outlined below for the onshore development area and a 250m buffer. The majority of the onshore development area is located in agricultural land, where significant contamination is not anticipated. There is the potential for agrochemical wastes and asbestos containing materials to be encountered during the works. Areas of made ground were identified in the PRA (***Appendix 18.3***). Former sand and gravel pits are also present in various locations within the onshore development area, that have been infilled, and may contain unknown and potentially contaminated fill material due to the nature of their infilling.

Specifically the following potential sources of contamination within the onshore development area were identified:

- Agricultural land which can be associated with some contaminative activities including use/storage of fertilisers, pesticides and herbicides and burial of wastes (including asbestos);
- A number of historical clay and shale pits and sand and gravel pits present in various locations within the survey area have been infilled and may contain unknown and potentially contaminated fill material. This could include potential contaminants of concern;
- Waste management facilities could be associated with numerous contaminant sources such as: Volatile Organic Compound (VOCs), semi-volatile Organic Compound (SVOCs), heavy metals, cyanides,ammonium, chlorides, sulphates and polycyclic aromatic hydrocarbons (PAHs) (DoE-industry profile); and
- Former railways and tramways present on the onshore cable route and landfall area. These activities are historically associated with herbicides, metals, hydrocarbons, sulphates, polychlorinated biphenyls (PCBs) and PAHs (DoE-industry profiles).

58. In addition to the sources identified above the following potential sources of contamination have been identified within 1km of the onshore development area:

- Sizewell A Nuclear Power Station;
- Historic Landfill and sewage treatment works; and
- Areas of made ground.

59. ***Figure 18.5*** shows sensitive land uses.

18.4.6 Mineral Safeguarding

60. The onshore development area contains glaciofluvial superficial deposits which provide sand and gravel resources. The onshore development area crosses a number of Mineral Safeguard Areas, these are shown in ***Figure 18.6.*** A mineral safeguard area is an area designated by a Mineral Planning Authority and are areas of a known deposit of mineral which are desired to be kept safe from unnecessary sterilisation by non-mineral development. Mineral resources are considered of importance at a regional scale and therefore the sensitivity of them as a receptor is considered to be medium.

18.4.7 Anticipated Trends in the Baseline Condition

61. This section discusses the likely future evolution of the existing baseline environment according to known trends in the base condition without implementation of the proposed East Anglia TWO project.

18.4.7.1 Geology

62. No major changes to the geology of the onshore development area are anticipated to occur.

18.4.7.2 Hydrology

63. Predicted climate changes are likely to result in wetter winters, drier summers and a greater number of convectional rain storms. This means that the hydrology of the surface drainage network could change, with higher winter flows, lower summer flows and a greater number of storm-related flood flows. This means that the surface drainage network is unlikely to remain stable and is likely to become more typical of the natural river types in the future. The risk of flooding will be amplified as a result of the predicted increase in rainfall associated with climate change, with an increase in peak river flows and an increase in the magnitude of surface water flooding. Detailed information on the anticipated trends associated with surface water is provided in ***Chapter 20 Water Resources and Flood Risk section 20.5.4.1.***

18.4.7.3 Hydrogeology

64. As part of DEFRA's Water Abstraction Plan (2017), the Environment Agency will review and amend all existing abstraction licenses by 2027. It is anticipated that abstraction will decrease. Pressures on groundwater levels from abstractions are therefore likely to decrease in the future. Detailed information on the anticipated trends associated with groundwater is provided in ***Chapter 20 Water Resources and Flood Risk section 20.5.4.2.***

18.4.7.4 Land Quality

65. The desk based study and land quality and PRA (***Appendix 18.3***) provides a comprehensive review of the anticipated land quality and potential contaminant sources likely to be present. The relevant environmental baseline from this assessment is discussed in ***section 18.4.5.*** This suggests that the onshore development area is located in an area with few existing potential sources of contamination. The assessment of contaminated land considers the risk from historical land uses as a source of potential contaminants of concern as regulatory regimes of the past were less stringent than modern requirements.

66. Given that we now have a more stringent regulatory regime and permitting requirements for activities associated with potential contaminants of concern, it is therefore unlikely that a significant source of contamination will be introduced within the onshore development area.

18.5 Potential Impacts

18.5.1 Potential Impacts during Construction

67. Full details of construction activities are outlined in ***Chapter 6 Project Description*** and those which are relevant in ***section 18.3.2*** of this chapter. The proposed construction activities include excavation, specifically surface excavation and earth moving during cable laying and site preparation for the substation and other onshore infrastructure. There is also the potential for piling of foundations for the onshore substation and for the National Grid substation. These activities have the potential to disturb potential contaminants of concern in soil and groundwater (and designated geological features if present) and create preferential pollutant pathways. This could result in potential human health impacts to construction workers and pollution risks to controlled waters (including groundwater).

68. Each area of the onshore development area has different proposed construction activities and therefore different potential impacts could occur.

69. A summary of the identified features which could be associated with sources of contamination with migration pathways to the onshore development area are as follows:

- Agricultural land;
- Historic clay, sand and gravel pits;
- Dismantled railways and tramways;
- Roads; and
- Waste management facilities.

18.5.1.1 Impact 1: Impact to Human Health Including Construction Workers and Public During Any Construction Related Excavations

70. The excavation of the cable trench, earthworks and piling for the onshore substation and National Grid substation construction, movement and stockpiling of soils have the potential to mobilise existing ground contamination (where present), which could result in impacts on human health through dermal contact, inhalation and ingestion. In addition, the disturbance of potential contamination could result in pollution of controlled waters.

71. The desk-based assessment of land quality (***Appendix 18.3***) showed that the majority of the onshore development area crosses agricultural land where areas of significant contamination are not anticipated. However, potential sources of contamination were identified within the onshore development area and within potential migration pathways (>250 m) including, former buildings, clay, sand and

gravel pits, roads, dismantled railways, waste management facilities and contemporary trades (e.g. dry cleaners).

72. Potential Contaminants of Concern (PCOC) could be present in the onshore development area and represent a risk to construction workers, the public, and future site end-users. Construction activities and specifically earthworks associated with the proposed East Anglia TWO project could disturb contamination sources.

73. Additionally, the risk associated with soil contamination sources to human health could be altered by a change in the migration pathways by construction activities. A specific risk of concern is ground gases. The nature of ground gas conditions for onshore development area is unknown and therefore, the ground gas risks of the onshore development area are uncertain. Consideration of the potential risk from ground gas, including the potential risk of ground gas accumulation in confined spaces could represent a risk to human health through asphyxiation and explosion.

74. Construction workers are considered to be the most sensitive receptors as the activities they are engaged in constitute more direct exposure routes over longer periods of time. Potential impacts to construction workers are however the most manageable as how they conduct their work can be controlled. Adequate construction methodologies will comply with CDM (2015) regulations will address the risk posed from contaminated land, as detailed in the OCoCP submitted with this DCO application. In addition, a Pollution Prevention and Response Plan for dealing with unexpected contamination will be developed as part of the CoCP. An OCoCP has been submitted with this DCO application, as secured under the requirements of the draft DCO, which will be further developed post-consent. This plan will incorporate the updated Environmental Agency best practice guidelines for pollution prevention.

75. Potential impacts as a result of incidental releases of contaminants will be managed through the adoption of a CoCP and adherence to the contaminated land and groundwater draft DCO requirement. This will include measures for dust suppression and monitoring, as required. These impacts would be temporary and considered a short-term exposure. Therefore, the magnitude is considered to be low.

76. The sensitivity of all human health receptors is considered to be high. The magnitude of effect from exposure to contamination will vary depending on the exposure scenario e.g. duration of exposure, proximity to contamination. Best practice will control the majority of impacts associated with ground contamination. The magnitude of effect has been assessed as low for construction workers and low for the public. It is anticipated that after adopting embedded mitigation

measures, including the incorporation of best practice mitigation measures as outlined in the proposed embedded mitigation in ***section 18.3.3***, the magnitude of effect would become negligible to human health and therefore given the sensitivity of human health is considered high, the impact is considered to be of **minor adverse** significance.

18.5.1.2 Impact 2: Impact on Groundwater Quality of the Secondary and Principle Aquifers from General Construction Activity

77. Construction activities will likely involve the direct disturbance of superficial deposits and soils during trenching and temporary compound set-up. Secondary A, B and Undifferentiated Aquifers within the superficial deposits could therefore be affected by the removal of soils and alteration of groundwater flow by exposure. Superficial deposits are not present across all of the onshore development area and therefore there is a possibility of direct impacts to the Principal Aquifer within the Crag Formation. An approximate 696,642m^2 will be affected by construction. This accounts for approximately 0.05% of the total groundwater body which will be affected by construction.

78. Removal of superficial deposits could alter the surface hydrology and disrupt infiltration rates and alter surface runoff interactions with the subsurface. This could alter pathways and allow the mobilisation of sources of contamination within superficial deposits and allow the migration of contaminants into strata containing the underlying superficial aquifer. There is the potential for hydraulic continuity between aquifers within the superficial deposit and that of the underlying Principal Aquifer within the Crag Formation.

79. The sensitivity of the Secondary A, B and Undifferentiated aquifers are considered to be High. Considering the few identified potential contaminant sources in the onshore development area and the embedded mitigations proposed for construction activities to avoid accidental discharge of contaminants of concern into the environment, it is anticipated that the magnitude of effect would be negligible and therefore the impact would be of **minor adverse** significance.

80. Where present, superficial deposits cover the principal aquifer, superficial deposits are not present across the whole of the onshore development area and where present are considered to be high vulnerability for groundwater migration and likely to have hydraulic continuity and be connected to the Principal Aquifer within the Bedrock geology. The sensitivity of the receptor is therefore considered to be high.

81. The onshore development area crosses SPZs as shown in ***Figure 18.4***. If works are required within or close to the identified SPZ, then it may be appropriate for consultation with the Environment Agency to ensure that any adverse effects are

minimised. Prior to construction, this will include the development of a hydrogeological risk assessment meeting the requirements of Groundwater Protection Technical Guidance (Environment Agency 2017) and The Environment Agency's Approach to Groundwater Protection (Environment Agency 2018) for this area of the works. The potential magnitude of these effects is however, considered to be low. The sensitivity of SPZs is high.

82. It is anticipated that after adopting embedded mitigation measures (***Table 18.2***) the magnitude would be considered negligible. Considering the sensitivity of the receptor groundwater receptor is high and the magnitude of impacts are negligible, the anticipated significance of the development of a new contaminant pathway from an existing contaminant source, and the accidental release of contamination during construction is therefore, considered to be of **minor adverse** significance**.**

18.5.1.3 Impact 3: Impact on Groundwater Quality of Secondary and Principal Aquifers from Trenchless Crossing and Piling Activities

83. Direct impacts to the Secondary A Aquifers within the Superficial deposits and underlying Bedrock Principal Aquifer may occur from deep ground workings related to trenchless crossing techniques for cable installation. beneath surface infrastructure and watercourses and HDD at the landfall and SPA crossing (open-cut or HDD crossing methodologies may be employed to cross the SPA). There is potential for drilling mud to leak along the drill path, or from the immediate area of the mud pits or tanks which could cause contamination of groundwater. The volume of drilling fluid that could be released is dependent on a number of factors, including the size of the fracture, the permeability of the geological material, the viscosity of the drilling fluid, and the pressure of the hydraulic drilling system. Piling may be required for the foundations of substations. Piling has the potential to create preferential pathways through a low permeability layer allowing potential contamination of an underlying aquifer.

84. Areas of the onshore development area do occur in SPZ2 and SPZ3, as shown in ***Figure 18.4***. The sensitivity of groundwater is therefore considered to be high.

85. The impacts are predicted to be localised in occurrence. Any impacts would be managed by embedded mitigation measures. Specifically, the identified required adherence to Environment Agency groundwater protection and pollution prevention guidance and adherence to a CoCP and the contaminated land and groundwater draft DCO requirement. The magnitude of effect is therefore considered to be low.

86. The magnitude of effect on public and private water supplies from trenchless crossing works within SPZ2 areas is considered to be low. In order to ensure this level of impact the use of an inert drilling fluid for HDD is required. Any drilling

fluids and HDD methodologies should be agreed with the Environment Agency when working within or close to SPZ1, an appropriate risk assessment and consultation with the Environment Agency will be undertaken to ensure that any adverse effects are minimised.

87. Secondary Aquifers within the Superficial Deposits and the Bedrock Principal Aquifer (which underlies the superficial deposits) beneath the whole of the onshore development area is deemed to be of high vulnerability. The sensitivity of these receptors is considered to be high. For works in SPZ1 and SPZ2 areas, the aquifer and surface water sensitivities are considered to be high. When working within or close to SPZ1 and licenced/unlicensed private and public water supplies, an appropriate risk assessment and consultation with the Environment Agency will be undertaken to ensure that any adverse effects are minimised. It is anticipated that after adopting embedded mitigation measures the magnitude of effect will be reduced to negligible and therefore given the sensitivity of the groundwater receptors is high, the impact would be of **minor adverse** significance.

18.5.1.4 Impact 4: Impact on Surface Water Quality from Contamination of Groundwaters And Subsequent Discharge

88. The accidental release of contamination into ground or surface waters either via the creation of new exposure pathways or the accidental discharge of contaminants during construction, could lead to a reduction in water quality. ***Figure 18.7*** shows potential sources of contamination.

89. Given that surface waters in the area are associated with designated sites (i.e. SSSI and SPA) it is considered that surface waters represent a high sensitivity receptor. It is anticipated that after adopting the outlined embedded mitigation measures, specifically the adherence to the Environment Agency pollution prevention guidance, the magnitude of effect will be negligible and therefore given the sensitivity of the receptor is high, the impact would be of **minor adverse** significance.

18.5.1.5 Impact 5: Sterilisation of Mineral Resources

90. There are mineral resource areas within the onshore development area. The works proposed have the potential to prevent future resource utilisation and over the full onshore development area could restrict future mineral resource development for a relatively large area of the Mineral Planning Authority's jurisdiction. The impacts are predicted to be permanent and relatively large scale. The magnitude is therefore considered to be high**.** Mineral resources are considered to be regionally important and the sensitivity of the receptor is therefore considered to be medium.

91. It is anticipated that after adopting embedded mitigation measures, in particular the development of an MMP, CoCP and adherence to the contaminated land and groundwater draft DCO requirement which included the reuse of materials on site and, where possible, the avoidance of Mineral Safeguard Areas within the onshore development area would reduce / avoid the effect. is considered that with these appropriate embedded mitigation measures the magnitude of effect would be reduced to negligible and therefore given the sensitivity of the receptor is medium the overall impact would be of **minor adverse** significance.

18.5.2 Potential Impacts during Operation

92. This was scoped out of the assessment, as agreed with stakeholders and stated in the Scoping Report (SPR 2017).

18.5.3 Potential Impacts during Decommissioning

93. No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.

18.6 Cumulative Impacts

18.6.1 Cumulative Impact with proposed East Anglia ONE North Project

94. The East Anglia ONE North offshore windfarm project (the proposed East Anglia ONE North project) is also in the application phase. The proposed East Anglia ONE North project has a separate Development Consent Order (DCO) which has been submitted at the same time as the proposed East Anglia TWO project. The two projects share the same landfall location and onshore cable corridor and the two onshore substations are co-located, and connect into the same National Grid substation.

95. The proposed East Anglia TWO project CIA will therefore initially consider the cumulative impact with only the East Anglia ONE North project.

96. The CIA considers the proposed East Anglia TWO project and the proposed East Anglia ONE North project under two construction scenarios:

- Scenario 1 - the proposed East Anglia TWO project and proposed East Anglia ONE North project are built simultaneously; and
- Scenario 2 - the proposed East Anglia TWO project and the proposed East Anglia ONE North project are constructed sequentially.

97. The worst case (based on the assessment of these two construction scenarios) for each impact is then carried through to the wider CIA which considers other developments which have been screened into the wider CIA (***section 18.6.2***). The operational phase impacts will be the same irrespective of the construction scenario. For a more detailed description of the assessment scenarios please refer to ***Chapter 5 EIA Methodology***.

98. Full assessment of scenario 1 and scenario 2 can be found in ***Appendix 18.2*** The assessment concluded that the worst case construction scenario for impacts on ground conditions and contamination was scenario 2. A summary of the potential cumulative impacts can be found in ***Table 18.11***.

Table 18.11 Summary of Potential Impacts Identified for Ground Conditions and Contamination Under Scenario 2

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation Measures	Residual Impact
Cumulative Construction Impacts with the Proposed East Anglia ONE North Project						
Impact 1: Impacts to human health, including construction workers and public during any excavations associated with construction.	Human Health.	High	Negligible	Minor	n/a	**Minor Adverse**
Impact 2: Impact on Groundwater Quality of the Secondary and Principle Aquifers from General Construction Activity	Principal Aquifer, Secondary A, B and Undifferentiated Aquifers Surface water	High	Negligible	Minor	n/a	**Minor Adverse**
Impact 3: Impact on Groundwater Quality of Secondary and Principal Aquifers from Trenchless Crossing and Piling Activities	Principal Aquifer, Secondary A, B and Undifferentiated Aquifers	High	Negligible	Minor	n/a	**Minor Adverse**
Impact 4: Impact to surface water quality from the contamination of groundwater and discharge to the surface.	Principal Aquifer, Secondary A, B and Undifferentiated Aquifers	Low	Negligible	Minor	n/a	**Minor Adverse**
Impact 5: Sterilisation of mineral resources.	Mineral safeguard areas	Medium	Negligible	Minor	n/a	**Minor Adverse**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation Measures	Residual Impact
Cumulative Operational Impacts with the Proposed East Anglia ONE North Project						
Operational impacts were scoped out of the assessment (SPR 2017).						
Cumulative Decommissioning Impacts with the Proposed East Anglia ONE North Project						
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.						

18.6.2 Cumulative Impact Assessment with Other Developments

99. The assessment of cumulative impacts has been undertaken here as a two stage process. Firstly, all impacts from ***section 18.5*** have been assessed for potential to act cumulatively with other projects. This summary assessment is set out in ***Table 18.12.***

Table 18.12 Potential Cumulative Impacts

Impact	Potential for Cumulative Impact	Rationale
Construction		
Impact 1: Impacts to human health, including construction workers and public during any excavations associated with construction.	Yes	Impacts to human health are likely to be highly localised.
Impact 2: Impact on Groundwater Quality of the Secondary and Principle Aquifers from General Construction Activity	Yes	There are pathways for other developments to affect the same receptors.
Impact 3: I Impact on Groundwater Quality of Secondary and Principal Aquifers from Trenchless Crossing and Piling Activities	Yes	There are pathways for other developments to affect the same receptors.
Impact 4: Impact to surface water quality from the contamination of groundwater and discharge to the surface.	Yes	There are pathways for other developments to affect the same receptors.
Impact 5: Sterilisation of mineral resources.	Yes	Impacts to Mineral Safeguard Areas may be exacerbated by other projects.
Operation		
Operational impacts were scoped out of the assessment (SPR 2017), therefore there is no pathway for cumulative impact.		
Decommissioning		
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.		

100. The second stage of the CIA is an assessment of whether there is temporal or spatial overlap between the extent of potential effects of the onshore infrastructure and the potential effects of other projects scoped into the CIA upon the same receptors. To identify whether this may occur, the potential nature and extent of effects arising from all projects scoped into the CIA have been identified and any overlaps between these and the effects identified in ***section 18.5.*** Where there is an overlap, an assessment of the cumulative magnitude of effect is provided.

101. Following a review of projects which have the potential to overlap temporally or spatially with the proposed East Anglia TWO project, two developments have been scoped into the CIA.

102. ***Table 18.13*** provides detail regarding the projects.

103. The full list of projects for consideration has been developed in consultation with the Local Planning Authority. The remainder of the section details the nature of the cumulative impacts against all those receptors scoped in for cumulative assessment.

Table 18.13 Summary of Projects Considered for the CIA in Relation to Ground Conditions and Contamination

Project Name	Status	Development Period	[2]Distance from East Anglia TWO Onshore Development Area	Project Definition	Level of Information Available	Included in CIA	Rationale
Sizewell C New Nuclear Power Station	PEIR formally submitted 04.01.19.	Application expected in 2020. Construction expected to commence in 2021.	1.4km	A new nuclear power station at Sizewell in Suffolk. Located to the north of the existing Sizewell B Power Station Complex, Sizewell C New Nuclear Power Station would have an expected electrical capacity of approximately 3,260 megawatts (MW). Full PEIR available: https://www.edfenergy.com/download-centre?keys=&tid=1380&year%5Bvalue%5D%5Byear%5D=	Tier 5[3]	Yes	The close proximity of the project to the propsoed East Anglia TWO project may result in impacts of a direct or indirect nature.

[2] Shortest distance between the considered project and East Anglia TWO– unless specified otherwise
[3] Based on criteria set out in ***section 5.7.2*** of ***Chapter 5 EIA Methodology***

Project Name	Status	Development Period	[2]Distance from East Anglia TWO Onshore Development Area	Project Definition	Level of Information Available	Included in CIA	Rationale
Sizewell B Power Station Complex	Planning application formally submitted 18.04.19. Awaiting Decision.	Construction expected to commence in 2022. Expected construction timetable of 53 months. Peak construction is expected in 2022, completion of construction expected in 2027.	1.4km	The demolition and relocation of facilities at the Sizewell B Power Station Complex. In outline, demolition of various existing buildings (including the outage store, laydown area, operations training centre and technical training facility), and erection of new buildings, including a visitor centre, and the construction of new access road, footpath and amended junction at Sizewell Gap; and associated landscaping and earthworks/recontouring. Full planning application available: https://publicaccess.eastsuffolk.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=PQ5NVGQXJJ100	Tier 4[4]	Yes	The close proximity of the project to the proposed East Anglia Two Project may result in impact of a direct or indirect nature.

[4] Based on the definition of Tier 4 outlined in ***section 5.7.2*** of ***Chapter 5 EIA Methodology***

18.6.2.1 Cumulative Impact during Construction

18.6.2.1.1 Cumulative Impact 1: Impact to Human Health Including Construction Workers and the Public During Construction Stage Activities

104. Given the likely embedded mitigation measures for both the proposed East Anglia TWO and East Anglia ONE North projects and Sizewell C New Nuclear Power Station (which will be subject to an EIA) and Sizewell B Power Station Complex and considering that any alteration to land quality would be highly localised it is considered that no cumulative impacts are likely to occur. Therefore, the residual impact to human health is not considered to increase from the **minor adverse** impact predicted for the proposed East Anglia TWO project.

18.6.2.1.2 Cumulative Impact 2: Impact on Groundwater Quality of the Secondary and Principle Aquifers from General Construction Activity

105. Sizewell C New Nuclear Power Station construction and development, as well as Sizewell B Power Station Complex's decommissioning and relocation of facilities will not be located within any SPZs or other identified public and private groundwater abstractions therefore, there is no pathway for cumulative impacts with the proposed East Anglia TWO and East Anglia ONE North projects. The potential cumulative impacts to aquifers would likely occur as a result of accidental spillages during construction. However, given the likely embedded mitigation measures and considering that any effect would be highly localised it is considered that no cumulative impacts are likely to occur. Therefore, the residual impact to aquifers is not considered to increase from the **minor adverse** impact predicted for the proposed East Anglia TWO project.

18.6.2.1.3 Cumulative Impact 3: Impact on Groundwater Quality of Secondary and Principal Aquifers from Trenchless Crossing and Piling Activities

106. Sizewell C New Nuclear Power Station construction and development, as well as Sizewell B Power Station Complex's decommissioning and relocation of facilities will not be located within any SPZs or other identified public and private groundwater abstractions therefore, there is no pathway for cumulative impacts with the proposed East Anglia TWO and East Anglia ONE North projects. The potential cumulative impacts to aquifers would likely occur as a result of accidental spillages during construction. However, given the likely embedded mitigation measures and considering that any effect would be highly localised it is considered that no cumulative impacts are likely to occur. Therefore, the residual impact to aquifers is not considered to increase from the **minor adverse** impact predicted for the proposed East Anglia TWO project.

18.6.2.1.4 Cumulative Impact 4: Impact on Surface Water Quality from Direct and Indirect Contamination of Surface Water Bodies

107. Direct cumulative impacts on surface water quality are likely to occur if there are spatial or temporal overlaps with the proposed East Anglia TWO project, the proposed East Anglia ONE North project and the Sizewell C New Nuclear Power Station.

108. The cumulative direct impacts to surface water from accidental discharge would be likely to occur as a result of accidental spillages during construction. Given the nature of the likely embedded mitigation however, it is unlikely to cause an alteration in the magnitude of impacts on surface waters from the proposed developments.

109. The cumulative indirect impacts to groundwater and subsequent surface water discharge is likely to be highly localised and will be unlikely to have long term impacts on groundwater discharge to surface waters as the proposed East Anglia TWO project has limited spatial overlap of groundwater areas with the Sizewell C New Nuclear Power Station.

110. Therefore, the residual cumulative impact is not considered to increase from the **minor adverse** impact predicted for the proposed East Anglia TWO project alone.

18.6.2.1.5 Cumulative Impact 5: Impact to Strategic Mineral Resources

111. The proposed East Anglia TWO project, proposed East Anglia ONE North project and the Sizewell C New Nuclear Power Station will likely have increased cumulative impacts on strategic mineral resources. Additional area will be utilised and there would be an increase in the potential loss of strategic resource through mineral sterilisation of different areas (assuming that this resource cannot be avoided). This would likely cause the impact to be major adverse significance. With the application of current embedded mitigation, such as the requirement for a MMP, as secured under the requirements of the draft DCO, the impact would be reduced.

112. Therefore, the residual cumulative impact is not considered to increase from the **minor adverse** impact predicted for the proposed East Anglia TWO project alone.

18.6.3 Cumulative Impacts during Decommissioning

113. No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that

the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.

18.7 Inter-relationships

114. Inter-relationships address situations where a number of parameters, or 'sources', interact to affect a single receptor. Those sources that are considered to interact with receptors identified in this chapter are listed in ***Table 18.14.***

Table 18.14 Inter-relationships with Ground Conditions and Contamination

Inter-relationship all Phases and Linked Chapter	Section where Addressed	Rationale
Chapter 7 Marine Geology, Oceanography and physical processes	***Sections 18.5*** and ***18.6.***	Changes to marine physical process could impact on geologically designated sites.
Chapter 8 Water and Sediment Quality	***Sections 18.5*** and ***18.6.***	Changes to ground condition and contamination could impact water quality
Chapter 20 Water Resource and Flood Risk	***Sections 18.5*** and ***18.6.***	Changes in ground condition and contamination could impact water resources and therefore have implications in terms of flood risk
Chapter 21 Land use	***Sections 18.5*** and ***18.6.***	Changes in ground condition and contamination could impact on soil quality and potential future land uses
Chapter 27 Human Health	***Sections 18.5*** and ***18.6.***	Changes in ground condition and contamination could impact on health

18.8 Interactions

115. The impacts identified and assessed in this chapter have the potential to interact with each other, which could give rise to synergistic impacts as a result of that interaction. The areas of interaction between impacts are presented in ***Table 18.15,*** along with an indication as to whether the interaction may give rise to synergistic impacts. This provides a screening tool for which impacts have the potential to interact. ***Table 18.16*** then provides an assessment for each receptor (or receptor group) related to these impacts in two ways. Firstly, the impacts are considered within a development phase (i.e. construction, operation or decommissioning) to see if, for example, multiple construction impacts could combine. Secondly, a lifetime assessment is undertaken which considers the potential for impacts to affect receptors across development phases. The

significance of each individual impact is determined by the sensitivity of the receptor and the magnitude of effect; the sensitivity is constant whereas the magnitude may differ. Therefore, when considering the potential for impacts to be additive it is the magnitude of effect which is important – the magnitudes of the different effects are combined upon the same sensitivity receptor. If minor impact and minor impact were added this would effectively double count the sensitivity.

116. The receptors considered in the ground conditions and contamination assessment are:

- Human health;
- Aquifer and surface water; and
- Mineral safeguard area.

Table 18.15 Interactions Between Impacts

Potential interaction between Impacts Construction	Impact 1 – Impact to Human Health including construction workers and public during any construction related excavations	Impact 2- Impact on Groundwater Quality of the Secondary and Principle Aquifers from General Construction Activity	Impact 3 - Impact on Groundwater Quality of Secondary and Principal Aquifers from Trenchless Crossing and Piling Activities	Impact 4 - Impact on surface water quality from contamination of groundwaters and subsequent discharge	Impact 5 – Sterilisation of Mineral Resources
Impact 1 – Impact to Human Health including construction workers and public during any construction related excavations		No	No	No	No
Impact 2- Impact on Groundwater Quality of the Secondary and Principle Aquifers from General Construction Activity	No		Yes	Yes	No
Impact 3 - Impact on Groundwater Quality of Secondary and Principal Aquifers from Trenchless Crossing and Piling Activities	No	Yes		Yes	No
Impact 4 - Impact on surface water quality from contamination of groundwaters and subsequent discharge	No	Yes	No		No
Impact 5 – Sterilisation of Mineral Resources	No	No	No	No	
Operation					
Operational impacts were scoped out of the assessment (SPR 2017).					

Decommissioning
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.

Table 18.16 Potential Interactions Between Impacts on Ground Conditions and Contamination

Receptor	Construction	Operational	Decommissioning	Phase Assessment	Lifetime Assessment
Human Health	Minor	Scoped Out	Minor	n/a There is only a single impact (*Impact 1Impact to Human Health including construction workers and public during any construction related excavations*) for the receptor, therefore no potential interactions	**No greater than individually assessed impact** Given that there are no operational impacts, the time between the construction and decommissioning phases is too great for there to be a pathway of interaction between construction and decommissioning impacts.
Aquifer and surface waters	Minor	Scoped Out	Minor	**No greater than individually assessed impact** For these receptors the impacts (*Impacts 2-4*) are considered to have low or negligible magnitude of effect, with impact significance dependent upon the sensitivity of the receptor. Given that the magnitudes are low or negligible and that each impact will be managed with standard and best practice methodologies it is	**No greater than individually assessed impact** Given that there are no operational impacts, the time between the construction and decommissioning phases is too great for there to be a pathway of interaction between construction and decommissioning impacts.

Receptor	Construction	Operational	Decommissioning	Phase Assessment	Lifetime Assessment
				considered that there would either be no interactions or that these would not result in greater impact than assessed individually.	
Mineral safeguard areas	Minor	Scoped Out	Minor	n/a There is only a single impact (*Impact 5 sterilisation of mineral resources*) for the receptor, therefore no potential interactions	**No greater than individually assessed impact** Assuming there was any take of Mineral Safeguard Areas this would be a permanent effect but there would be no further land take after construction

18.9 Summary

117. A summary of the anticipated impacts is set out in ***Table 18.17***.

Table 18.17 Potential Impacts Identified for Ground Conditions and Contamination

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation Measures	Residual Impact
Construction						
Impact 1: Impacts to human health, including construction workers and public during any excavations associated with construction.	Human Health.	High	Negligible	Minor	n/a	**Minor Adverse**
Impact 2: Impact on Groundwater Quality of the Secondary and Principle Aquifers from General Construction Activity	Principal Aquifer Secondary A, B and Undifferentiated Aquifers Surface waters	High	Negligible	Minor	n/a	**Minor Adverse**
Impact 3: Impact on Groundwater Quality of Secondary and Principal Aquifers from Trenchless Crossing and Piling Activities	Principal Aquifer including SPZ areas and Secondary A Aquifer.	High.	Negligible	Minor	n/a	**Minor Adverse**
Impact 4: Impact to surface water quality from the contamination of groundwater and discharge to the surface.	Principal Aquifer including at SPZ areas and Secondary A Aquifer.	Low.	Negligible	Minor	n/a	**Minor Adverse**
Impact 5: Sterilisation of mineral resources.	Mineral safeguard areas	Medium.	Negligible	Minor	n/a	**Minor Adverse**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation Measures	Residual Impact
Operation						
Operational impacts were scoped out of the assessment (SPR 2017).						
Decommissioning						
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.						
Cumulative Construction Impacts with Other Developments						
Impact 1: Impacts to human health, including construction workers and public during any excavations associated with construction.	Human Health.	High	Negligible	Minor	n/a	**Minor Adverse**
Impact 2: Impact on groundwater quality of the Secondary and Principal Aquifers and source protection zones from general construction activity	Principal Aquifer Secondary A, B and Undifferentiated Aquifers Surface water	High	Negligible	Minor	n/a	**Minor Adverse**
Impact 3: Impact on Groundwater Quality of Secondary and Principal Aquifers from Trenchless Crossing and Piling Activities	Principal Aquifer Secondary A, B and Undifferentiated Aquifers.	High.	Negligible	Minor	n/a	**Minor Adverse**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation Measures	Residual Impact
	Potable Water supplies					
Impact 4: Impact to surface water quality from the contamination of groundwater and discharge to the surface.	Principal Aquifer and Secondary A, B and Undifferenced Aquifers. Potable Water supplies.	Low.	Negligible	Minor	n/a	**Minor Adverse**
Impact 5: Sterilisation of mineral resources.	Mineral safeguard areas	Medium.	Negligible	Minor	n/a	**Minor Adverse**
Cumulative Operation Impacts with Other Developments						
Operational impacts were scoped out of the assessment (SPR 2017).						
Cumulative Decommissioning Impacts with Other Developments						
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. An Onshore Decommissioning Plan will be provided, as secured under the requirements of the draft DCO. The onshore substation will likely be removed and be reused or recycled. It is anticipated that the onshore cable would be decommissioned (de-energised) and either the cables and jointing bays left *in situ* or removed depending on the requirements of the Onshore Decommissioning Plan approved by the Local Planning Authority. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.						

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