East Anglia
Offshore Wind

VATTENFALL

SCOTTISHPOWER RENEWABLES

East Anglia THREE

Chapter 19

Soils, Geology and Ground Condition

Environmental Statement
Volume 1
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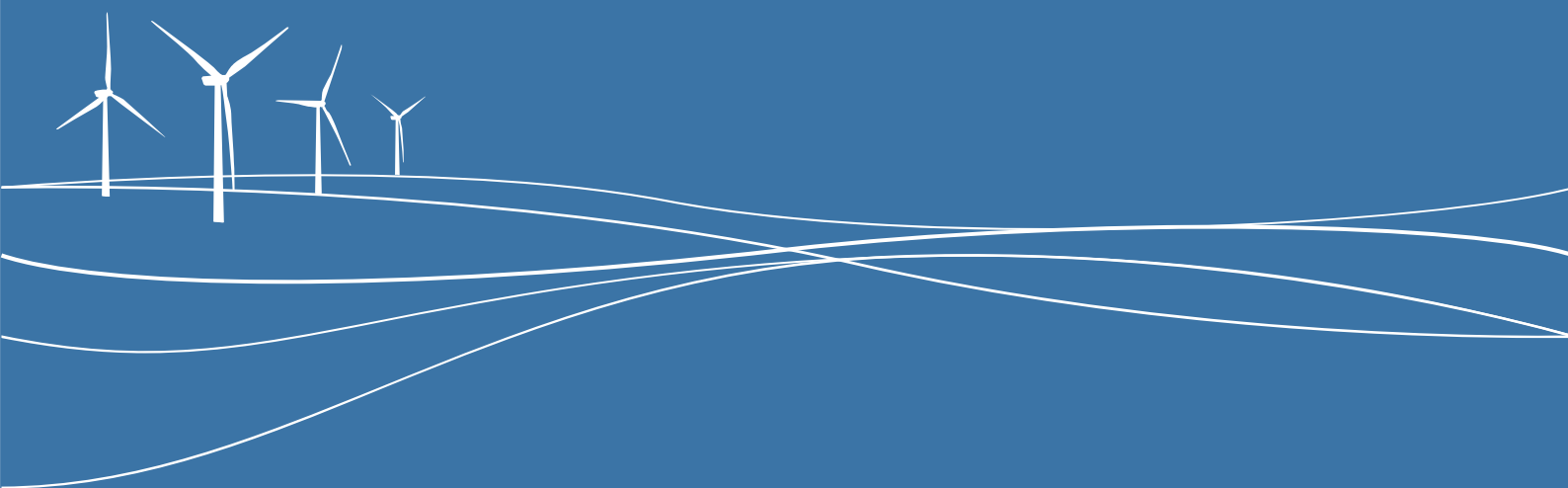

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19 SOILS, GEOLOGY AND GROUND CONDITION

19.1 Introduction

1. This chapter of the Environmental Statement (ES) considers the potential impacts of the proposed East Anglia THREE project on soils, geology and ground conditions. This chapter assesses the potential impacts that the construction, operation and decommission of the proposed East Anglia THREE project may have on existing soil and geological conditions. The assessment focusses on the presence of contamination and the potential for pollutant linkages to exist to sensitive receptors such as site workers, future site users, soils, geology and groundwater from activities proposed in the construction and operation of the proposed East Anglia THREE project. The focus of the soils assessment within this chapter is on the potential for contamination to be present rather than assessing soil quality in the context of an agricultural resource, which is discussed in Chapter 22 Land Use.

2. Land quality is not considered to be a receptor in its own right within this chapter. The focus is on the potential pollutant linkages between contaminated land and / or groundwater and the soil, groundwater environment and other sensitive receptors, such as designated ecological sites. Potential impacts to the groundwater and surface water environments are discussed in Chapter 21 Water Resources and Flood Risk.

3. The chapter provides an assessment of the potential impacts of two approaches for installing the onshore cable for the proposed East Anglia THREE project and considers cumulative impacts of existing and proposed projects. Further information regarding the general approach taken towards impact assessment is discussed in Chapter 6 Environmental Impact Assessment (EIA) Methodology. Consistent with this approach, topic specific receptor sensitivity and magnitude of effect definitions have been provided within section 19.4. This chapter has been prepared by Royal HaskoningDHV.

4. The onshore electrical transmission works for the proposed East Anglia THREE project fall within the same area covered by the assessment of East Anglia ONE. The data collected for the East Anglia ONE project, confirmed as correct through consultation with the relevant Local Authorities in July 2014, informs the baseline for this assessment. The East Anglia ONE Preliminary Risk Assessment for Ground Conditions and Contamination is presented in *Appendix 19.1.*

5. It should be noted that this chapter has the potential to interact with other chapters within the ES and its appendices and supporting documents, these are covered as follows:

- Chapter 7 Marine Geology, Oceanography and Physical Processes;
- Chapter 8 Water and Sediment Quality;
- Chapter 21 Water Resources and Flood Risk;
- Chapter 22 Land Use;
- Chapter 23 Terrestrial Ecology; and
- The Outline Code of Construction Practice (OCoCP).

19.2 Consultation

6. Consultation undertaken to date is provided in *Table 19.1*. The consultation includes responses from consultees in relation to the East Anglia THREE Offshore Windfarm Scoping Report and the Preliminary Environmental Information Report (PEIR). *Appendix 19.2* considers the consultation undertaken for East Anglia ONE PEIR (RSK 2012a) and Phase 2 Consultation (RSK 2012b), which are also considered relevant to the proposed East Anglia THREE project given that the onshore cable route is shared with East Anglia ONE. No specific relevant comments on soils, geology or ground conditions were received as part of the Section 42 Phase III Consultation.

Table 19.1 Consultation Responses

Consultee	Date /Document	Comment	Response / where addressed in the ES
Planning Inspectorate	December 2012 East Anglia THREE Scoping Opinion	The Scoping Report states that the Applicant considers that the data collected for the proposed East Anglia ONE cable route is sufficient for the East Anglia THREE development. The Planning Inspectorate welcomes the statement that the Applicant will consult with the relevant authorities on whether there is any requirement to update this data for the East Anglia THREE EIA. The Applicant should ensure that the ES contains sufficient	Additional consultation is discussed within this table.

Consultee	Date /Document	Comment	Response / where addressed in the ES
		detail and that the extent of the study area is clearly justified.	
Planning Inspectorate	December 2012 East Anglia THREE Scoping Opinion	The Scoping Report states that the coastline geology is vulnerable to erosion; the Planning Inspectorate therefore advises that the potential impacts of landfall works on coastal erosion and deposition should be addressed with appropriate cross reference made to other technical reports including landscape and visual impacts. See also the comments of SCC (Appendix 2 of this Opinion) regarding assessing the impacts on coastal processes of the cabling near the landfall point.	Impacts of erosion at the landfall at Bawdsey are discussed in section 19.6 Impact assessment associated with coastal erosion and coastal processes at the landfall at Bawdsey are discussed in full in Chapter 7 Marine Geology, Oceanography and Physical Processes.
Planning Inspectorate	December 2012 East Anglia THREE Scoping Opinion	The Planning Inspectorate notes that the centreline of the cable route crosses the historical sand pit/landfill at Tuddenham St Martin. The ES should assess the potential impacts on the feature, and impacts that may arise as a result of disturbing the former land fill.	Note that EATL has requested an update to confirm this position (25th February 2014) MSDC and the EA confirmed in 2014 that no further information was available.
Planning Inspectorate	December 2012 East Anglia THREE Scoping Opinion	The ES should quantify the volumes of material imported and exported, if required. Information should be provided on the methods of disposal for spoil from the HDD and trenching operations for the cable.	Volumes and disposal are discussed in *Table 19.2.*
Planning Inspectorate	December 2012 East Anglia THREE Scoping Opinion	Groundwater is the potential pathway for discharge of liquids to surface and coastal waters. The EIA should comprehensively assess the potential impact upon	Impacts on groundwater are discussed in Chapter 21 Water Resources and Flood Risk.

Consultee	Date /Document	Comment	Response / where addressed in the ES
		groundwater during the construction phase and must include, inter alia, the use and storage of hazardous substances, dewatering, discharge, drainage, physical disturbance of sub surface and dealing with sediment fines.	
Planning Inspectorate	December 2012 East Anglia THREE Scoping Opinion	The ES should identify any mitigation measures to reduce potential pollution risks.	Measures to reduce potential pollution are discussed in *Table 19.3* and Chapter 21 Water Resource and Flood Risk.
Planning Inspectorate	December 2012 East Anglia THREE Scoping Opinion	Appropriate cross-reference should be made to the water resources and flood risk assessment and land use sections in the ES in relation to any potential contaminated land and run-off. In the light of the works proposed, cross reference should also be made to the section on marine water and sediment quality in order to address the potential impacts of sediment along the foreshore.	Additional consultation is discussed in Chapter 21 Water Resources and Flood Risk and Chapter 22 Land Use. Foreshore impacts are assessed in Chapter 8 Water and Sediment Quality.
Suffolk County Council (SCC)	December 2012 East Anglia THREE Scoping Opinion	The EIA needs to consider the potential impacts of HDD on the stability of the cliffs at Bawdsey (paragraphs 89/579). It is paramount that any drilling does not destabilise these unconsolidated cliffs and necessitate the need for future coastal protection. To compound this, while the sea off the Bawsdey landfall may appear “relatively sheltered”, this stretch of coastline is in fact one of the fastest eroding in Suffolk and is a predicted area of embayment as a	All HDD works at the landfall will be undertaken as part of East Anglia ONE. There will be no HDD works undertaken as part of the proposed East Anglia THREE project. If access to the beach is required this will be via a ramp over the cliff. This is discussed in more detail in section 19.6.1. Impact assessment associated coastal processes at the landfall at Bawdsey are

Consultee	Date /Document	Comment	Response / where addressed in the ES
		consequence of the sea defences further north. Consequently, it is critical that the impacts on coastal processes of the cabling near the landfall point is understood and that cables do not in the future become exposed and necessitates defending. It is also important that measures to address the risk of tidal inundation during the construction phase need to be considered.	discussed in full in Chapter 7 Marine Geology, Oceanography and Physical Processes.
SCC	December 2012 East Anglia THREE Scoping Opinion	There is a degree of risk with the use of HDD. The EIA needs to cover the eventuality that HDD fails and alternative approaches, such as open trenching, are needed.	Intrusive ground investigation studies have been undertaken by East Anglia Offshore Wind (EAOW) in 2013 concluding the horizontal directional drill (HDD) is possible at all locations indicated. All HDD works will be undertaken as part of East Anglia ONE. There will be no HDD works undertaken as part of the proposed East Anglia THREE project.
SCC	December 2012 East Anglia THREE Scoping Opinion	The proposals do not conflict with any existing or proposed minerals or waste sites.	Noted.
Suffolk Coastal District Council (SCDC)	February 2014 Response via email	Email received stating that it is unlikely that there were new records for contaminated land within the footprint of the proposed development additional to those identified for East Anglia ONE.	This is considered in section 19.5 and 19.6. Note that East Anglia THREE Limited (EATL) has requested an update to confirm this position (25th February 2014) Mid Suffolk District Council (MSDC) and the Environment Agency (EA) confirmed in 2014 that no further information

Consultee	Date /Document	Comment	Response / where addressed in the ES
			was available.
SCC	March 2014 Response via email	Email received confirming that there were no new records for contaminated land within the footprint of the proposed development additional to those identified for East Anglia ONE.	This is considered in section 19.5 and section 19.6.
SCC	July 2014 Response via email	Regarding a request for additional data on landfills and water abstractions, SCC commented that 'SCC has no information on any of these matters….'	No additional data are available from SCC, additional data on abstractions obtained from the Environment Agency and represents the best available baseline. Data used is presented in section 19.5. No further action.
SCC, MSDC, SCDC	July 2014 PEIR Response	With respect to impact on geology at the landfall we note the potential entry and exit positions for the HDD works, and again note that avoiding access over the cliff face where the Red Crag (the purpose of the Site of Special Scientific Interest (SSSI) designation) does not outcrop. Again, please note earlier comments on decommissioning of cables at the landfall (section 19.7.3).	All horizontal directional drilling (HDD) works at the landfall will be completed ahead of this project by East Anglia ONE. There will be no HDD works undertaken as part of the proposed East Anglia THREE project.
SCC, MSDC, SCDC	July 2014 PEIR Response	The LAs consider that the mitigation measures identified within the Outline CoCP would sufficiently address our concerns relating to land contamination and can confirm that no further information exists to indicate the baseline has changed in this regard.	No further action.
Natural England	July 2014 PEIR Response	Mitigation in relation to Bawdsey Cliffs SSSI is as for EA ONE and is adequate. If beach access is needed the area	No further action.

Consultee	Date /Document	Comment	Response / where addressed in the ES
		selected does not support the Crag feature of the SSSI. No issues.	
Babergh and MSDC	October 2015 Response via email	I think that the approach proposed with respect to land contamination is appropriate given the risks along the route. I agree with the report that the landfill areas that need to be crossed all fall within the area covered by SCDC and as such I won't comment on these areas. This basically leaves the areas within the MSDC district as being a "watching brief" approach where we will be contacted in the event of unexpected ground conditions being encountered which seems wholly appropriate to me.	No further action.

19.2.1 Statement of Common Ground (East Anglia ONE)

7. The proposed East Anglia THREE project utilises the same onshore cable route and substation(s) location as East Anglia ONE. A Statement of Common Ground (SoCG) specific to the proposed East Anglia THREE project is to be developed in advance of the Development Consent Order (DCO) Examination. Until this point in time, the East Anglia ONE SoCG will be used as a basis for the East Anglia THREE SoCG, and is used as a reference point for the assessment.

8. The SoCG was produced for East Anglia ONE in July 2013 for Soils, Geology and Ground Condition. Consultees included Suffolk County Council (SCC), Mid Suffolk District Council (MSDC), Suffolk Coastal District Council SCDC, Environment Agency (EA) and East Suffolk Internal Drainage Board (ESIDB). Natural England (NE) and Suffolk Wildlife Trust (SWT) were consulted but had no comments. There were no disagreed matters which related to this chapter. Further details for this SoCG are provided in *Appendix 23.3*. The key points were as follows:

- The parties agreed with the results of the assessment of impacts on Ground Conditions and Contamination on East Anglia ONE.

- It was agreed that adherence to the requirements within the East Anglia ONE Development Consent Order and the documents specified therein would ensure the avoidance of significant impacts on Ground Conditions and Contamination from East Anglia ONE.
- The parties agreed a condition to be inserted into the Deemed Marine Licence (DML) for East Anglia ONE which would facilitate appropriate monitoring and mitigation in relation to cliff stability and coastal processes.
- It was agreed that there were no other outstanding matters to be agreed with respect to Ground Conditions and Contamination in relation to the East Anglia ONE DCO Application.

19.3 Scope

19.3.1 Study Area

9. For the purpose of this assessment, and to frame the baseline descriptions, the following study areas have been defined to assess the direct and indirect impacts associated with the proposed East Anglia THREE project. These areas are shown on *Figure 19.1*, and are described as:

- Onshore electrical transmission works including access – this refers to the development footprint and encompasses the land within the red line boundary consisting of landfall location, onshore cable route and substation(s) location, as outlined in Chapter 5 Description of the Development. This area has been selected to be the largest area over which direct impacts would be experienced.
- Study area – 1km buffer (incorporating a 250m buffer) around the direct impacts footprint where environmental receptors may be present but no physical works would take place therefore only indirect impacts apply.

10. Although potential contaminative sources within 1km of the onshore electrical transmission works have been identified, based on current and historic land uses, it is acknowledged that, depending on the size and nature of the contaminative sources, sources within 250m of the onshore electrical transmission works are considered to be of greater potential risk to human health and the environment as a result of construction and operation of the onshore infrastructure. As such, the potential risks associated with sources within 250m of the onshore electrical transmission works are considered in greater detail than those outside this buffer.

11. The proposed East Anglia THREE project was considered during the initial design of the East Anglia ONE project. For example, the onshore cable route for East Anglia

ONE included space for ducts for two further projects. Therefore, detailed engineering design, route refinement, and additional information sought for the onshore cable route, Construction Consolidation Sites (CCS) and associated temporary works (area / access roads) for East Anglia ONE have been used in this assessment for proposed East Anglia THREE project (see Chapter 5 Description of the Development). The ES for East Anglia ONE identified the converter station / substation(s) locations for the East Anglia ONE project, and the proposed East Anglia THREE and a future East Anglia Offshore Wind (EAOW) project.

19.3.2 Worst Case

12. There are two approaches for the construction of the proposed East Anglia THREE project:

- Single Phase - a single phase (up to 1200MW installed in a single construction period); or
- Two Phased - two phases of up to 600MW each, with the start date of each phase of works separated by no more than 18 months).

13. Ducts (including all horizontal directional drilling (HDD) operations) for the onshore cables for the proposed East Anglia THREE project will be installed during the construction of East Anglia ONE.

14. Therefore, under the Single Phase approach, for construction of the proposed East Anglia THREE project the following works would be required:

- If the short duct method if used at the landfall, a ramp would be required to access the beach;
- Creation of one transition bay compound near to the landfall location;
- Installation of one transition bay compound to connect the offshore shore export cables and the onshore export cables;
- Installation of up to two jointing bays (assuming up to two cables are jointed in each bay) at up to 62 locations along the cable route;
- Creation of one jointing bay construction compound at up to 62 locations along the onshore cable route, each with a hardstanding area of 775m^2 within a compound of 3,740m^2.
- CCS – seven sites covering an aggregated area of up to 1.32ha;

- Access via existing roads and tracks and therefore haul road is required only where joints are placed in remote areas. A maximum of 18.05km of 5.5m width haul road is required. Temporary track matting may be required if ground conditions are very poor;
- Transport to site, cable pulling and jointing at up to 124 (each with 2 cables so 248 joints) jointing bays;
- Installation of up to 248 kiosks for cable maintenance;
- Up to 300m of open trenching for cables from the end of pre-installed ducts to the substation(s);
- One substation within a 3.04ha compound;
- Up to 235m of open trenching for cables from the substation(s) to ducts pre-installed by National Grid; and
- Reinstatement of land.

15. Under a Two Phased approach the following works would be required:

- If the short duct method if used at the landfall, a ramp would be required to access the beach;
- Creation of two transition bay compounds (one during each Phase) near to the landfall location;
- Installation up to two transition bay compounds (one during each Phase) each to house up to two joints between the offshore export cables and the onshore export cables;
- Creation of two jointing bay construction compounds (one during each Phase) at up to 62 locations along the onshore cable route;
- Installation of up to two jointing bays (assuming two cables are jointed in each bay in each in Phase 1 and two jointed in each bay in Phase 2) at up to 62 locations along the cable route, each with a hardstanding area of 775m^2 within a compound of 3400m^2;
- CCS – seven sites covering an aggregated area of up to 1.32ha;
- Access via existing roads and tracks and therefore haul road is required only where joints are placed in remote areas. A maximum of 18.05km (of 5.5m width)

haul road is required. Temporary track matting may be required if ground conditions are very poor. As a worst case scenario, it is assumed that all haul road will be removed and the ground reinstated on completion of Phase 1 and will be replaced and then removed again during Phase 2;

- Transport to site, cable pulling and jointing at up to 124 (62 during Phase 1 and 62 during Phase 2) (each with 2 cables so 248 joints) jointing bays;
- Installation of up to 248 kiosks for cable maintenance;
- Up to 300m of open trenching for cables from the end of pre-installed ducts to the substation(s);
- Up to two substation(s) within a 3.04ha compound;
- Up to 235m of open trenching for cables from the substation(s) to ducts pre-installed by National Grid; and
- Reinstatement of land.

16. Full details of the Single Phase and Two Phased approaches are provided within Chapter 5 Description of the Development.

17. For each impact, the assessment utilises a worst case approach for both the Single Phase and Two Phased approach to construction described above. The design parameters that constitute worst case vary depending on the potential impact under consideration. *Table 19.2* below details the assumptions used.

18. The final routeing of cables connecting into the substation is not known at the current time. Therefore the pre-installed ducts will end just beyond the western boundary of the screening trees and bunding installed by East Anglia ONE to the east of the East Anglia THREE substation. Therefore the final stretch of cables will be open trenched from the end of the ducts to the substation. This will be a maximum distance of 300m. Likewise, National Grid will install ducts to connect into the existing Bramford substation but these will end at the boundary of the National Grid land, therefore EATL will need to open trench up to the end of these ducts, a distance of up to 235m. In both cases the cables would be laid directly into trenches.

19. As discussed in Chapter 5 Description of the Development (section 5.6.6.2.2) East Anglia THREE Limited (EATL) will investigate opportunities to leave haul road in place between projects and/or phases to further minimise impacts, this would be dependent upon the agreement of individual landowners and the approval of the local planning authorities. EATL consider that for soils, geology and ground

conditions it would be more disruptive for all receptors to install and remove haul road twice under the Two Phased approach due to the increased disturbance to the ground, than to leave it in situ. In addition, given that locations where haul road would be left in place is dependent upon individual landowner decisions and local authority approval, at this stage it is not possible to determine where this may occur and which receptors would be affected. Therefore, this potential case is not assessed independently as it is considered that the impacts of leaving the haul road in situ between phases falls within the magnitude of effects assessed under the two construction approaches presented.

20. Only those design parameters with the potential to influence the level of impact are identified here. Therefore, if the design parameter is not described in *Table 19.2*, it is not considered to have a material bearing on the outcome of the assessment.

21. The worst case scenarios identified here are also applied to the cumulative impact assessment (CIA). When the worst case scenarios for the project in isolation do not result in the worst case for cumulative impacts, this is addressed within the cumulative section of this chapter (see section 19.7).

Table 19.2 Worst Case Assumptions

Impact	Key design parameters forming worst case scenario	Rationale
Construction		
All impacts	*Single Phase* • Footprint = area of haul road, maximum 62 x jointing bay construction compounds, 1 x transition bay compound, substation(s) compound and 7 CCS = 37.85ha • Depth of pits to house jointing bays = 2.5m • Permanent area loss at substation(s) compound = 3.04ha • Total spoil = 121,241m^3 from pits to house jointing bays. • Total residual spoil for removal offsite = 4,404m^3 • Material to be stored onsite = 72,480m^3 • Onshore cable route - duration of works = 29 weeks • Substation(s) - duration of works 55 weeks	Values provided within Chapter 5 Description of the Development.

Impact	Key design parameters forming worst case scenario	Rationale
	Two Phased • Footprint = area of haul road (laid twice), maximum 124 x jointing bay construction compounds, 2 x transition bay compounds, substation(s) compound and 7 CCS = 67.05ha • Depth of pits to house jointing bays = 2.5m • Permanent area loss at substation(s) compound = 3.04ha • Total spoil = 215,586m^3 from pits to house jointing bays • Total residual spoil for removal offsite = 4,404m^3 • Material to be stored onsite = 83,547m^3 • Onshore cable route - duration of works = 29 weeks, a gap of up to 49 weeks then further 29 weeks • Substation(s) - duration of works 55 weeks, a gap of up to 24 weeks then further 45 weeks	
Operation		
All impacts	*Both approaches* Maximum total operational land take =3.04ha (at substation(s) compound) No above ground features along the onshore cable route, apart from up to 248 kiosks (each 1m wide × 0.75m × 1m high to access jointing bays.	Values provided within Chapter 5 Description of the Development.
Decommissioning		
All impacts	*Both approaches* • Buried cables remain in-situ • Dismantling and removal of above ground electrical equipment; • Removal of any building services equipment; • Demolition of the buildings and removal of security fences; • Removal of hard standing; • Presence of plant and vehicles (see Chapter 27 Traffic and Transport); and • Landscaping and reinstatement of the site.	Values provided within Chapter 5 Description of the Development.

19.3.3 Embedded Mitigation

22. Mitigation measures which are relevant to soils, geology and ground conditions which have been embedded into the proposed East Anglia THREE project are listed in *Table 19.3*. General mitigation measures are provided first, and apply to all parts of the onshore electrical transmission works. Specific mitigation measures, which apply to the landfall, onshore cable route and the substation(s), are described separately thereafter.

23. Note that the OCoCP and Outline Landscape and Ecological Management Strategy (OLEMS) are included with the application documents for the DCO and are based on those agreed for East Anglia ONE.

Table 19.3 Embedded Mitigation in relation to Soils, Geology and Ground Condition

Parameter	Mitigation measures embedded into the project design
General	
Construction	The construction footprint has been minimised as far as practicable (see Chapter 5 Description of the Development). Land would be reinstated to its pre-construction condition as soon as reasonably possible following cable installation, dependent on weather conditions and excluding the substation(s), jointing bay locations and kiosks.
	All ducts for the onshore cable route for the proposed East Anglia THREE project will be installed during the construction of East Anglia ONE. Therefore there are no HDD or open trenching engineering techniques along the onshore cable route.
	A Code of Construction Practice (CoCP) will be developed in consultation with the contractor and the Environment Agency and local authorities. The CoCP will include measures for avoiding the likelihood of spills and leakages, such as: • Store oils and fuel within designated areas above ground and in impervious storage bunds with a minimum of 110% capacity to contain leakages or spillages, in addition storage areas will be regularly inspected to identify leaks or spills; • Limit refuelling activities to designated, impermeable surfaced areas and use drip traps where possible; • Check and maintain equipment regularly to ensure that leakages do not occur; • Have spill kits available on site at all times; • Ensure site inductions for all staff, to include the above procedures and the locations of spill kits. • The separate storage of topsoil and excavated materials, to prevent mixing of subsoil and topsoil, thus improving reinstatement. • Minimising excavation volumes and disturbance to the surrounding areas, together with the replacement of soils inadvertently disturbed during excavations in general accordance with their original structure and location. • It is likely that soils will be reused on site. Soils that cannot be re-instated would follow a waste hierarchy following the CL:AIRE Code of Practice

Parameter	Mitigation measures embedded into the project design
	(2011). • Temporary ramp construction over the cliffs at landfall, where the Red Crag is absent, will be constructed to an agreed method statement approved by the planning authority in consultation with Natural England.
Onshore cable route	
Project design	Initial cable routeing and site selection to avoid key sensitive land uses where possible e.g. potentially contaminated sites, landfills, mineral extraction areas. (This was undertaken by East Anglia ONE) During detailed design, jointing bays and kiosks will be located where possible to avoid key sensitive land uses where possible e.g. potentially contaminated sites, landfills, mineral extraction areas.

24. In addition to the embedded mitigation outlined above, all construction, operational and decommissioning phase activities would be undertaken in line best working practices, which would include:

- Construction workers including sub-contractors would follow good site practices and hygiene rules as set out in BS5930:1999+A2:2010 and BS10175:2011;
- Appropriate Personal Protective Equipment (PPE) would be worn by construction workers including sub-contractors and health and safety measures undertaken to mitigate short term risks during construction;
- Adherence to best practices and guidance to ensure the risk of pollution is minimised, including best site management practices, such as those set out in the Environment Agency's Pollution Prevention Guidelines (PPG) notes. This would be adopted during the construction and operational phases to prevent such spillages and leaks. These are detailed in section 19.4;
- Adherence to a CoCP and Incident Response Plan; and
- Adherence to the Construction Design and Management (CDM) Regulations 2015 where applicable.

19.4 Assessment Methodology

19.4.1 Guidance

25. This assessment has been made with specific reference to the relevant National Policy Statements (NPS). These are the principal decision making documents for Nationally Significant Infrastructure Projects (NSIP). The specific assessment

requirements for soils, geology and ground conditions in the NPS are detailed in the overarching statement for Energy EN-1 (DECC 2011a) and summarised in *Table 19.4* below.

Table 19.4 NPS assessment requirements

NPS requirement	NPS reference	ES reference
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.	EN-1 Section 5.3.3	Section 19.5 and 19.6
Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the ALC and preferably use land in areas of poorer quality (grades 3b, 4 and 5) except where this would be inconsistent with other sustainability considerations. Applicants should also identify any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination.	EN-1 Section 5.10.8	Section 19.3 See also Chapter 22 Land Use

26. In addition, this assessment has been undertaken in accordance with the following legislation (and amendments), where appropriate:

- Environmental Protection Act 1990;
- Environment Act 1995;
- The Environmental Permitting (England and Wales) Regulations 2010;
- Contaminated Land (England) Regulations 2006 SI 1380;
- Environmental Damage (Prevention and Remediation) Regulations 2009 SI 153;
- Priority substances Directive 2008/105/EC; and
- Environmental Protection (Duty of Care) Regulations 1991 SI 2839 (as amended).

27. This assessment has also been made with reference to the following statutory and non-statutory guidance:

- Department for Communities and Local Government National Planning Policy Framework 2012;
- Environment Agency PPG 1 General guide to the prevention of water pollution;
- Environment Agency PPG2 Above ground oil storage tanks;
- Environment Agency PPG5: Works in, near, or liable to effect watercourses;
- Environment Agency PPG6: Working at construction and demolition sites;

- Environment Agency PPG7: Refuelling activities;
- Environment Agency PPG21: Pollution incident response planning;
- Environment Agency PPG22: Dealing with spills (April 2011);
- 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;
- HSE CDM Regulations (2015);
- Environment Agency, Groundwater Protection: Principles and practice (GP3)(August 2013);
- DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (DEFRA 2000);
- Model Procedures for the Management of Land Contamination (Contaminated Land Report 11) Environment Agency (2004); and
- British Standard BS10175 Investigation of potentially contaminated sites (2013).

19.4.2 Data Sources

28. The data sources in *Table 19.5* have been used to characterise the existing environment and inform the baseline of the impact assessment.

Table 19.5 Data Sources Features

Data	Source	Year	Coverage	Confidence	Notes
Potentially contaminated sites	MSDC	2014	Study area	High	Locations of sites on the MSDC register of Contaminated Land or Potentially Contaminated Land
Land use information	Ordnance Survey	2015	Study area	High	1:25,000 scale OS mapping
	Google Maps	2013	Study area	High	Online aerial photography
Environmental Sensitivity data	Landmark Information Group	2011	Study area	High*	Envirocheck GIS files from RSK Preliminary Risk Assessment
	Environment	2013	Study area	High	'What's in your

Data	Source	Year	Coverage	Confidence	Notes
	Agency				backyard' website
	RSK	2012	Study area	High*	Preliminary Risk Assessment East Anglia ONE onshore cable route and converter station
Geological mapping	British Geological Survey	2001	1:50,000 Woodbridge & Felixstowe	High	Solid and Drift geology sheet 208 &225
		2006	1:50,000 Ipswich	High	Solid and Drift geology sheet 207
Geological memoirs		1961	Study area	High	British Regional Geology, East Anglia and adjoining areas, 4th Edition
Geological and Geomorphological Designated Sites	Joint Nature Conservation Committee	2014	Study area	High	Geological Conservation Review record
	Geosuffolk website		Study area	High	County Geodiversity Sites (CGS), SSSI, Regionally Important Geological (RIG) sites

* Consultation with the Local Authorities confirmed that there have been no data changes since the background checks undertaken in 2011 (see *Table 19.1)*.

19.4.3 Impact Assessment Methodology

19.4.3.1 Introduction

29. Potential impacts arising from the construction and operation of the onshore infrastructure are identified and assessed taking into account the following elements of the environmental baseline and their sensitivities:

- Geology;
- Past or present sources of land contamination;
- The presence of aquifers and potential groundwater flow beneath the site and surrounding area; and

- The presence of groundwater Source Protection Zones (SPZ).

30. In order to fully understand the hazard posed to human health and geology, information from Chapter 21 Water Resource and Flood Risk regarding the presence and sensitivity of groundwater has been used to aid this assessment.

19.4.3.2 Sensitivity

31. The general approach taken towards impact assessment is discussed in Chapter 6 Environmental Impact Assessment Methodology. Consistent with this approach, the sensitivity of each topic specific receptor has been considered based on the criteria presented in *Table 19.6*. The impact assessment has, therefore, been undertaken with reference to the definitions provided in *Tables 19.6, Table 19.7* and Table *19.8*.

Table 19.6 Definitions of Receptor Sensitivity

	Definition			
Sensitivity	**Geology**	**Soils**	**Human Health**	**Hydrogeology (Groundwater)**
High	Deposit rare Deposit/strata value high (national importance/designation)	Deep naturally occurring soils, highly permeable and therefore highly susceptible to mobile contamination	Children present with a risk of long term exposure	Site within a ground-water SPZ 1 Principal Aquifer. Groundwater flow contributes to an internationally designated site. Site within close proximity to a Private Water Supply abstraction (in an area where there are no other sources of potable water). Site within 50m of a major industrial abstraction.
Medium	Deposit localised Deposit/strata value medium (regional importance/designations)	Shallow natural soils. Permeable soils, therefore, susceptible to mobile contamination	Children present with a risk of medium term exposure, or adults present with a risk of long term exposure	Secondary 'A' or undifferentiated Aquifer Groundwater flow contributes to a nationally designated site. Site within a SPZ 2. Close proximity to a Private Water Supply abstraction (but one where there is an alternative potable source)
Low	Deposit moderately widespread Deposit/strata value low (local importance/designation) or no	Made Ground. Some clay content, therefore slightly susceptible to mobile contamination	Only adults present with a risk of short term exposure	Secondary 'B' Aquifer Limited groundwater – surface water interaction. No nearby licensed or un-licensed water abstractions.

	Definition			
Sensitivity	**Geology**	**Soils**	**Human Health**	**Hydrogeology (Groundwater)**
	value			
Negligible	Deposit widespread No deposit/strata value (no designation)	Made Ground containing anthropogenic material. High clay content, therefore not highly susceptible to mobile contamination	No human receptors present or very transient exposure (adults only).	Unproductive Strata No groundwater – surface water interaction. No nearby licensed or un-licensed water abstractions.

19.4.3.3 Magnitude

32. The impact magnitude is assessed by considering the potential consequences (severity) of the impact occurring as detailed in *Table 19.7*.

Table 19.7 Example Definitions of the Magnitude Levels for a Generic Receptor

	Receptor			
Criteria	**Geology**	**Soils**	**Human Health**	**Hydrogeology**
High	Disturbance or loss to protected geological attributes of a designated conservation site	Widespread contamination. Multiple sources of pollution identified and multiple linkages to receptors	Widespread contamination. High risk of exposure. Multiple sources of pollution identified and multiple linkages to receptors	Major change from the baseline conditions. Major permanent or long-term change to groundwater quality or available resource. The quality and / or quantity of the existing resource is impacted beyond repair. Changes to quality or water levels would have a significant impact upon ecological designated sites.
Medium	Minor disturbance or loss to protected geological attributes of a designated conservation site	Localised contamination.	Localised contamination. Unlikely to affect end users but may affect construction workers in close proximity	Changes to the local groundwater regime are predicted to have a slight impact on resource use but not derogate existing abstractions. Minor impacts on local and regionally important ecological sites may result.

	Receptor			
Criteria	**Geology**	**Soils**	**Human Health**	**Hydrogeology**
Low	No changes to protected geological attributes of a designated conservation site	Very localised contamination. No perceptible effect (no pollutant linkages)	Very localised contamination. No perceptible effect (no pollutant linkages)	Changes to groundwater quality, levels or yields would only have minor, short-term impact on existing resource use or ecology.
Negligible	No significant changes or large scale loss of geology	No contamination. No effect on receptors.	No contamination. No effect on receptors.	Negligible change to groundwater baseline conditions approximating to a 'no change' situation.

19.4.3.4 Impact significance

33. Following the identification of receptor sensitivity and magnitude of the effect, it is possible to determine the significance of the impact. A matrix as presented in *Table 19.8* will be used wherever relevant.

34. The impact significance is then determined by considering magnitude in relation to the sensitivity of the receptor impacted, as demonstrated by the matrix presented in *Table 19.8.*

Table 19.8 Impact Significance Matrix

Sensitivity	Magnitude				
	High	**Medium**	**Low**	**Negligible**	**No change**
High	**Major**	**Major**	**Moderate**	**Minor**	**No impact**
Medium	**Major**	**Moderate**	**Minor**	**Negligible**	**No impact**
Low	**Moderate**	**Minor**	**Minor**	**Negligible**	**No impact**
Negligible	**Minor**	**Negligible**	**Negligible**	**Negligible**	**No impact**

35. Where an impact has been assessed as major or moderate, this has been deemed to be significant for the purpose of the EIA. Where an impact has been assessed as minor, negligible or no impact, this has been deemed as not significant in terms of the EIA.

36. Embedded mitigation and existing commitments to good practice are discussed in section 19.3, and are referred to throughout the impact assessment. The impact assessment takes into account the embedded mitigation before coming to a

conclusion of the potential impact to a receptor. If additional mitigation is required, this is included within the impact assessment in section 19.6, and a description of residual impact post-mitigation is provided.

19.4.4 Cumulative Impact Assessment

37. For a general introduction to the methodology used for the Cumulative Impact Assessment, please refer to Chapter 6 Environmental Impact Assessment Methodology. This chapter will focus on those cumulative impacts that are specific to soils, geology and ground conditions.

38. The further details of the methods used for the cumulative impact assessment, see section 19.7.

19.4.5 Transboundary Impact Assessment

39. There are no transboundary impacts in relation to soils, geology and ground conditions.

19.5 Existing Environment

19.5.1 Geology

19.5.1.1 Superficial Geology

40. The presence of superficial deposits to the east of Great Bealings (Grid Ref: 62300, 24900) is sporadic and comprises mainly of the Kesgrave Catchment Subgroup, described as fluvial, lacustrine and organic deposits, mainly comprising fluvial gravels (BGS Lexicon[1]). To the west of Great Bealings, the superficial deposits are more dominant and comprise Lowestoft Formation, described as chalky till[2] overlying the Kesgrave Catchment Subgroup and in places Glaciofluvial Deposits.

41. Within the river valleys the superficial deposits change to reflect the current riverine environment comprising Alluvium or Marine & Coastal Muds (depending on proximity to the coast and intertidal influences), River Terrace deposits and more locally head deposits.

42. The underlying superficial geology is shown on *Figure 19.2* with a summary presented in *Table 19.9* below.

[1] www.bgs.ac.uk viewed on 10 June 2015
[2] www.bgs.ac.uk viewed on 10 June 2015

Table 19.9 Summary of Underlying Superficial Geology[3]

	Stratum	Age	Description	Thickness
River Valley Drift	Alluvium	Quaternary, Holocene	Variably sandy, silty Clay	Unknown
	Marine and Coastal Zone Deposits: Mud	Quaternary, Holocene	Mud, tidal flat, channel and salt marsh deposits (coastal & River Deben zone only)	Unknown
	Head	Quaternary, Pleistocene	Diamicton, stony sandy clay and clayey sand	Unknown
	River Terrace Deposits (undifferentiated)	Quaternary, Pleistocene	Sand and gravel	Unknown
Drift	Lowestoft Formation	Quaternary, Pleistocene	Stony, sandy clay rich in chalk and flint pebbles (diamicton)	8-12m
	Glaciofluvial Deposits	Quaternary, Pleistocene	Sand and gravel	0-8m
	Kesgrave Catchment Subgroup	Quaternary, Pleistocene	Sand and gravel; sand with flint and quartzite pebbles representative of an historical braided river system.	5–10m

19.5.1.2 Bedrock Geology

43. The underlying bedrock geology beneath the onshore electrical transmission works changes as the route moves west, with the exception of the Chalk Group which is prevalent across the entire corridor at depth, outcropping near Claydon (approximate NGR 614000, 249000). In addition, the Lambeth Group and Thanet Sand Formation (undifferentiated) are likely to be prevalent at depth across the entire study area although the lateral extent of these strata may discontinue around Claydon.

44. The bedrock appears at the surface near to the coastline with Red Crag and London Clay apparent in the sea cliffs. These formations, along with the Harwich Formation, overlie the chalk in the east but as the cable route moves west the London Clay and Harwich Formations disappear leaving the Red Crag or superficial drift deposits directly overlying the Chalk Group or the Lambeth Group and Thanet Sand Formation.

[3] After BGS solid and drift geology sheets 207, 208, 225 and British Regional Geology, East Anglia and Adjoining areas

45. A summary of the bedrock geology formations, their descriptions and likely thickness is provided in *Table 19.10* below and in *Figure 19.3*.

Table 19.10 Summary of Underlying Bedrock Geology[4]

	Stratum		Age	Description	Thickness	
Solid	Red Crag Formation		Tertiary, Pliocene	Sand, medium to coarse grained, shelly in lower parts, strongly iron stained at surface, green at depth. Basal beds rich in phosphate pebbles. Horizontal planar bedding indicative of a shallowing basin.	0 to 31m (absent to the west)	
	Coralline Crag Formation		Tertiary, Pliocene	Calcrenite (sand), yellow-brown at surface, green at depth, shelly, partly indurated	0 to 22m	
	Thames Group	London Clay Formation	Tertiary, Eocene	Clay, blue-grey, variably silty with thin sand and pebble beds	0 to 20m	
		Harwich Formation	Tertiary, Eocene	Clay, silty with ash layers and cementstone nodules and beds	0 to 20m	
	Lambeth Group and Thanet Sand Formation (undifferentiated)		Tertiary, Palaeocene	Clay, sand and silt, mottled colour, with a thin flint pebble bed at the base	0 to 19m	
	Chalk Group	Culver Chalk Formation	Upper Cretaceous	Chalk, white, soft, with flint nodules.	0 to 10m	Chalk Group 200m+
		Newhaven Chalk Formation	Upper Cretaceous	Chalk, white, marl, flint free beds.	circa 50m	

[4] After BGS solid and drift geology sheets 207, 208, 225 and British Regional Geology, East Anglia and Adjoining areas

19.5.1.3 Geological Structure

46. At depth the Chalk Group dips gently to the east; sitting approximately 50m below ordnance datum (BOD) at the coast and nearing or at surface level around Claydon. Consequently the overlying formations thin towards the west.

47. A substantial thickness of Lambeth Group and Thanet Sand Formation (undifferentiated) and London Clay Formation overlie the chalk each estimated in excess of 10m thickness in most areas. The Crag Formations are also present from the coast to Tuddenham St Martin in varying thicknesses (circa 5-25m). The exception to this rule is within and around river basin areas, where the banks are cut down through the layers to the underlying chalk. The most exposed chalk areas are in the River Gipping valley around Claydon (Grid Ref: 61350, 24900) and Little Blakenham (Grid Ref: 61170, 24800) at the western end of the cable route. *Figure 19.4* gives an example cross-section of these features.

48. The presence of superficial deposits to the east of Great Bealings is sporadic and comprises mainly of the Kesgrave Catchment Subgroup directly overlying the Red Crag Formation.

49. To the west of Great Bealings, Lowestoft Formation is present overlying the Kesgrave Catchment Subgroup and Red Crag Formation up to Tuddenham St Martin where the crag peters out and leaves the till directly above the Lambeth Group and Thanet Sand Formation (undifferentiated). The Lambeth Group and Thanet Sand Formation (undifferentiated) in turn peters out to the west of Claydon leaving the Lowestoft Formation directly overlying the Chalk Group.

19.5.1.4 Geological Designations

50. The geology at the landfall is designated by Natural England as a Site of Special Scientific Interest (SSSI) and by the Joint Nature Conservation Committee (JNCC) under the Geological Conservation Review (GCR) record 593, known as Bawdsey Cliffs. The designation covers a 1-2km stretch of cliffs from the south of Bawdsey, near Bawdsey Hall, to the eastern side of the mouth of the Deben Estuary, near Bawdsey Manor Dairy and College. The cliffs are designated under Earth Heritage for their geological interest and provide one of the best and largest exposures of the Red Crag, showing its deposition and structure. Ground Investigation work carried out by RSK for East Anglia ONE identified that the structure of interest (Red Crag cliff) is absent from the footprint of the onshore electrical transmission works.

51. Three GCR recorded sites, 602 Great Blakenham, 1758 Orfordness and Shingle Street and 2333 Waldringfield, border the edges of the study area. Two of these, 602 Great Blakenham and 2333 Waldringfield, are designated for their significance to the

geomorphological evolution and Quaternary history of East Anglia. The other, 1758 Orfordness and Shingle Street, is categorised for its important coastal and fluvial geomorphology in terms of modern landforms and processes and large-scale mass-movement features. Further consideration of 1758 Orfordness and Shingle Street is undertaken in Chapter 7 Marine Geology, Oceanography and Physical Processes.

52. Three further non-statutory County Geodiversity sites (CGS) lie within the study area known as Great Pit at Newbourne, which has been given CGS status by GeoSuffolk because it is one of the very few fossiliferous Crag pits in Suffolk with public access. Newbourne Springs also designated for being an outcrop of Red Crag, and Claydon Church Lane Pit is designated for its artificial cliffs of white chalk formed from its previous use as a chalk extraction pit. CGSs are GeoSuffolk designations broadly in line with the RIGs criteria.

53. The location of each designated site is shown in *Figure 19.5* and detailed in *Table 19.11.*

Table 19.11 Summary of Designated Sites

Ref.	Status	Name	Grid Ref	Designation	Approx. Distance to onshore electrical transmission works
DS1	SSSI, GCR 593	Bawdsey Cliffs	6338, 2380	significance to the geomorphological evolution and Quaternary history of East Anglia	0
DS2	GCR 1758	Orfordness and Shingle Street	6358, 2400	important coastal and fluvial geomorphology	1km north
DS3	GCR 602	Great Blakenham	6113, 2500	significance to the geomorphological evolution and Quaternary history of East Anglia	1km north
DS4	CGS	Great Pit, Newbourne	6275,2 433	Exposure of Red Crag with small scale cross bedded units	200m south
DS5	CGS	Newbourne Springs	6270, 2430	Line of natural springs along the boundary of the Red Crag and London Clay. Present all year round.	1km south
DS6	GCR 2333	Waldringfield	6258, 2450	significance to the geomorphological evolution and Quaternary	1km south

Ref.	Status	Name	Grid Ref	Designation	Approx. Distance to onshore electrical transmission works
				history of East Anglia	
DS7	CGS	Claydon Church Lane Pit	6126, 2498	Youngest Chalk exposed at the surface in the county	1km north

19.5.1.5 Mineral Extraction and Quarrying

54. Localised quarrying of shallow superficial sand and gravel deposits is evident in within the study area, although no sites were identified within the onshore electrical transmission works. Information collated by RSK indicate that six extraction sites are present within the study area as detailed in section 3.2.4 in *Appendix 19.1* and the locations within 250m of the onshore electrical transmission works are summarised in *Table 19.12*.

Table 19.12 Summary of Mineral Extraction Sites

Ref.*	Name	Grid Ref	Approx. Distance to Onshore electrical transmission works	Status
38	Blood Hill, Bramford	6112, 2485	200m northwest	
24	Lorraine Way, Bramford	6123, 2482	25m south	To be confirmed during consultation

*Site references 1 to 27 relate to RSK site reference numbers from Table T20-14. Site references 28 to 40 relate to sites referenced in the RSK report without reference numbers (RSK, East Anglia ONE Offshore Wind Farm Environmental Statement, Volume 3, Chapter 20 Ground Conditions and Contamination, November 2012).

19.5.1.6 Ground Stability

55. Envirocheck data (2011) provided to RSK (RSK 2013) indicated that there are localised areas, mainly around the substation(s), that may be subject to ground stability issues, such as:

- Collapsible and compressible ground in and around the area of the substation(s);
- Ground dissolution in the area of exposed chalk or where chalk is close to the ground surface around the area of the substation(s); and
- Landslide and running sands again around the area of the substation(s).

56. The sea cliffs at the landfall are subject to coastal erosion and slippage. Predicted cliff recession rates have been assessed by ABPmer (2012) and are discussed in more detail in Chapter 7 Marine Geology, Oceanography and Physical Processes.

19.5.2 Hydrogeology

19.5.2.1 Aquifer Designations

57. The majority of the superficial drift deposits in the region are defined by the Environment Agency as Secondary A aquifers. These are described as deposits with permeable layers which have the capability to support water supplies at a local rather than strategic scale and provide an important source of base flow to rivers.

58. The Till and Clay formations within the region are defined as unproductive strata. These are deposits with low permeability, and have a negligible significance for water supply or base flow to rivers.

59. The dominant bedrock beneath all areas of site, albeit at depth in most places, is the Cretaceous Chalk which is defined by the Environment Agency as a Principal Aquifer. This rock has secondary permeability (fracture flow), can provide a high level of water storage and supports water supply and base flow to rivers. Its vulnerability to pollution is reduced where it is protected in most areas by the overlying (unproductive) London Clay Formation or Lowestoft Formation. In river valley areas where down cutting has removed the overlying strata and has replaced it with more permeable alluvial deposits, the vulnerability of the aquifer to pollution is increased and is greatest where the Chalk outcrops (with no superficial deposits overlying) especially in the area around Claydon.

60. A summary of the aquifer designations for each stratum is presented in *Table 19.13* below.

Table 19.13 Summary of Environment Agency Aquifer Designations

	Stratum	Description	Aquifer Designations
Drift	Alluvium	Variably sandy, silty Clay	Secondary A Aquifer
	Marine and Coastal Zone Deposits: Mud	Mud	Unproductive Strata
	Head	Stony sandy clay and clayey sand	Secondary A Aquifer
	River Terrace Deposits (undifferentiated)	Sand and gravel	Secondary A Aquifer

	Stratum	Description	Aquifer Designations
	Glaciofluvial Deposits	Sand and gravel	Secondary A Aquifer
	Lowestoft Formation	Stony, sandy clay	Unproductive Strata
	Kesgrave Catchment Subgroup	Sand and gravel	Secondary A Aquifer
Solid	Red Crag Formation	Sand	Secondary A Aquifer
	Coralline Crag Formation	Calcrenite (sand)	Secondary A Aquifer
	London Clay Formation	Clay	Unproductive Strata
	Harwich Formation	Clay	Unproductive Strata
	Lambeth Group and Thanet Sand Formation	Clay, sand and silt	Secondary A aquifer
	Chalk Formation	Chalk	Principal Aquifer

19.5.2.2 Groundwater Abstractions

61. Details on abstraction licenses and groundwater condition are discussed in Chapter 21 Water Resources and Flood Risk and detailed in *Appendix 21.4*. However, it should be noted that three Groundwater SPZs (Zone 1) are crossed by the onshore electrical transmission works at Playford (circa Grid Ref TM 21045 48578), Akenham (circa Grid Ref TM 15284 48977) and north of Bramford (circa Grid Ref TM 10871 47396) (see *Figure 21.3*). The remainder of the onshore electrical transmission works to the west of Great Bealings lies within an Outer zone (Zone 2). There are no SPZs to the east of Woodbridge. These zones are identified to protect active water abstraction points from the impact of contaminative sources. Zone 1 represents a 50 day travel time to the abstraction and Zone 2 is defined by a 400 day travel time.

19.5.3 Potentially Contaminated Sites

19.5.3.1 Potentially Contaminative Land Uses

62. A desk based study carried out by RSK in 2011 (*Appendix 19.1*) commissioned an Envirocheck environmental sensitivity report and consulted with MSDC with regard to sources of potential contamination within the study area. This identified that no sites within the study area were recorded on MSDCs Contaminated Land Register. Subsequent consultation with MSDC and SCC confirmed that there have been no changes to the 2011 data within the RSK report (See *Table 19.1*). Key features within 1km of the onshore electrical transmission route including access with potential

pollutant linkages were identified within the RSK report (refer to *Table 6* in *Appendix 19.1*) and are presented in *Figures 19.6 a-c*. A summary of the information within 250m of the onshore cable route including access are presented in *Table 19.14* below.

Table 19.14 Summary of Potentially Contaminated Sites

Ref.*	Name	Easting / Northing	Approx. distance to onshore electrical transmission works (m)
2	RAF Bawdsey Radar Station	6345, 2389	200 South
4	Electricity substation, north of Middle Barns	6344, 2391	250 South
5	Area of artificial ground on both banks of River Deben (crossed by HDD)	6312, 2398	0
6	Area of artificial ground on both banks of River Deben (crossed by HDD)	6307, 2396	0
7	Decoy Pond, just west of River Deben Crossing	6305, 2394	0
9	Historical Tramway, east of Kirton	6283, 2400	0
11	Area of artificial ground , Kirton Lodge	6281, 2409	0
12	Areas of artificial ground on both banks of Martlesham Creek (crossed by HDD)	6263, 2472	0
13	Areas of artificial ground on both banks of Martlesham Creek(crossed by HDD)	6263, 2475	0
14	The Great Eastern Railway Line, north of Martlesham (crossed by HDD)	6263, 2476	0
19	Gravel Pit, Akenham Hall Farm	6155, 2492	150 North
22	Chalk Pit, north of Mockbeggers Hall, Claydon	6129, 2488	100 South
23	Railway adjacent to River Gipping, west of Claydon (crossed by HDD)	6124, 2490	0
26	Works or Depot, south of Little Blakenham	6113, 2480	200 North

Ref.*	Name	Easting / Northing	Approx. distance to onshore electrical transmission works (m)
27	Electricity substation, adjacent to Substation(s) Compound and Temporary Works Area	6101, 2459	5 Adjacent

*Site references 1 to 27 relate to RSK site reference numbers from Table T20-14 (*Appendix 19.1*).

19.5.3.2 Landfills and Historical Pits

63. Historical pits within the study area, which may have been used for uncontrolled or unlicensed tipping, have been identified within the RSK 2011 desk study and associated Envirocheck environmental sensitivity data. Historical pits within 250m of the onshore cable route including access have been summarised in *Table 19.15* below.

Table 19.15 Summary of Historical Pits

Ref.*	Name	Easting / Northing	Approx. distance to onshore electrical transmission works (m)
3	Old Sand Pit, Bawdsey	6348, 2390	25 South
10	Pit located close to tramway, east of Kirton	6283, 2399	170 West
18	Old Sand Pit, Lark's Hill	6188, 2490	170 South
21	Area of Works, adjacent to A14, west of Claydon	6135, 2490	100 South
32	Old Crag Pit	6296, 2393	170 South
33	Ranglin's Pit	6278, 2425	160 West
34	Sand Pit, Culpho Hall (also used as landfill)	6204, 2486	0
35	Disused pit (used as Tuddenham St Martin Landfill)	6195, 2491	0

*Site references 1 to 27 relate to RSK site reference numbers from Table T20-14. Site references 28 to 40 relate to sites referenced in the RSK report without reference numbers.

64. Landfills located within the onshore electrical transmission route including access and study area identified in the RSK desk study (2012) and associated Envirocheck environmental sensitivity data (2011). Landfills within 250m of the onshore electrical transmission route including access have been identified as they may

provide a potential pollutant linkage and these are detailed in *Table 19.16* below. Consultation with MSDC and SCC confirmed that there have been no material changes to the 2011 data as presented in the RSK report for East Anglia ONE (*Table 19.1*).

Table 19.16 Summary of Landfill Sites within 250m of Onshore Electrical Transmission Works

Ref.*	Name	Easting / Northing	Approx. Distance to Onshore Electrical Transmission Works	Waste Source	Status/ Date
Active Landfills					
42	Bamford Dairy Farm	611496, 248104	0m Within red line boundary	Unknown	Unknown.
25	Blood Hill, Somersham Road, Bramford, SCC	61110, 24840	190m	Non Hazardous landfill	Active license but not operative. Being monitored by SCC.
Historic Landfills					
16	Culpho Hall	620456, 248536	0m Within red line boundary	Unknown	Unknown.
17	Sandpit, Giltex Estates, Tuddenham St Martin	619307, 249146	0m Within red line boundary	Inert, industrial & commercial.	1948-1991.
	Sandpit, Brow Group, Tuddenham St Martin	619330, 249200	0m Within red line boundary	No known restriction of waste.	1978-lapsed.
	Sandpit, Weavers Ltd, Tuddenham St Martin	619372, 249198	0m Within red line boundary	Inert, industrial & commercial.	1948-1991.
20	Rise hall, HW Hall and Son Akenham Ipswich. Hall & son	614409, 248774	Study area: 190m south of red line boundary	Inert & commercial	1990-1995.
	Rise hall, JH Weavers Akenham	614102, 248520	Study area: 190m south of red line boundary	Inert, industrial, commercial & household	1972-null.

Ref.*	Name	Easting / Northing	Approx. Distance to Onshore Electrical Transmission Works	Waste Source	Status/ Date
25	Blood Hill Pit, Somersham Road, Bramford.	61120, 24500	Study area: 190m south of red line boundary	Industrial, commercial & household	1983-1992.

*Site references 1 to 27 relate to RSK site reference numbers from Table T20-14. Site references 28 to 40 relate to site referenced in RSK report without reference numbers. Site References 41 and above relate to sites not referenced in RSK report.

65. Three landfills are shown to potentially cross the onshore electrical transmission works footprint, Culpho Hall, Sandpit and Bramford Dairy, although the exact boundaries and extent of these is not clear. Also the location of the Bamford Dairy landfill could potentially be a mis-located reference point that should refer to another landfill known as Blood Hill, which lies approximately 500m to the north. Further consultation with the MSDC, SCC and the EA (see *Table 19.1*) indicated that no further information was available on these landfills.

66. The landfill known as Sandpit in Tuddenham St Martin which is recorded above to have received inert, industrial and commercial waste with no known restrictions, is also recorded by the British Geological Survey (BGS) as a threat to groundwater and surface water. This site is known to be a Special Site and is under the regulation of the Environment Agency. No further information pertaining to this landfill is available.

19.6 Potential Impacts

67. Reference should be made to Chapter 5 Description of the Development, for full details of the activities proposed during the construction phase of the proposed East Anglia THREE project. However, in summary, the activities considered likely to impact on soils, geology and ground condition are:

- Construction of onshore cable systems including landfall joint transition bay and cable jointing locations – installation techniques include pulling cables through existing ducts;
- Construction of an onshore substation(s), associated infrastructure and landscaping;
- Creation of temporary construction compounds / laydown areas;
- Temporary upgrade of existing access tracks, construction of new access tracks and haul roads;
- Temporary stockpiling of topsoil and subsoil;
- Re-use of excavated soil in jointing bays;
- Disposal of excess spoil offsite to a suitably licenced facility; and
- Removal and reinstatement of existing drainage systems.

19.6.1 Potential Impacts During Construction

19.6.1.1 Impact 1: Impact on Geology

68. There is the potential for the construction activities listed above to impact sensitive geology in a number of ways, however, it is considered that geology will only be affected by direct impacts and that geology is only considered to have a value where statutory or non-statutory designated sites occur. One statutory designated site, Bawdsey Cliffs, lies within the landfall footprint. Potential impacts are as follows:

- Loss of sensitive geology through excavation and removal of superficial or bedrock deposits;
- Loss of slope stability through trafficking, ramp construction, increased loading and excavation;
- Increased erosion through trafficking, excavation and destabilisation; and
- Deterioration of soil quality through spills and leaks.

19.6.1.1.1 Landfall

Single Phase

69. One statutory designated site, Bawdsey Cliffs, lies within the landfall footprint. The sensitivity of the geological receptor at the landfall would be considered to be high, given its status as a designated site. No trenching or HDD works are required as part of the proposed East Anglia THREE project at landfall but should the East Anglia ONE HDD works utilise a short HDD drill, a duct exit point trench will be required in the intertidal zone to enable the cables to be installed within the buried duct. To reach the duct and exit point trench a temporary ramp and haul road down to the base of the sea cliffs will be needed. If required, the temporary access ramp will be constructed over the top of the cliff and will be removable once works are completed. This temporary ramp will be located to the north east of an existing bridleway, where the Red Crag (for which the area is designated a SSSI) does not outcrop. Mitigation through design will mean that there will be no direct impact to the integrity of the SSSI feature. Given that the geological feature will be avoided, the potential to degrade the cliff face by traffic movements, uneven loading and destabilisation during construction of the access ramp is considered to equate to a low magnitude of effect and the significance of the impact is considered to be **moderate adverse.** Additional mitigation is described in *Table 19.17* below.

70. The presence of a mechanical excavator brings with it the hazard of spills and leaks, although these are considered to be temporary (limited to construction period), of

low magnitude (given limited volume of potentially contaminating materials) and reversible (as the temporary ramp/ haul road will be removed following completion of works). Beyond these works the need for excavation and interaction with the geology at the landfall is minimal and considered to be of low magnitude.

Table 19.17 Mitigation measures

Mitigation measures
In order to reduce the impacts to the underlying geology from haul roads, cable pulling and general construction activities including leaks and spills, the following mitigation would be undertaken: • Design and construct free standing ramp to minimise loading and destabilisation of cliff face; • Check and maintain equipment to ensure leaks and spills do not occur; and • Have spill kits available at all times and an incident response plan in place.

71. Following implementation of the mitigation measures described above the magnitude of impact would be reduced to negligible, the overall significance of the impacts to designated geological receptors is considered to be **minor adverse**.

Two Phased

72. As with the Single Phase approach, the need to create a temporary access ramp over the top of the cliff will be dependent upon the necessity to reach a duct exit point within the foreshore area following East Anglia ONE construction. The impact of the temporary access ramp will also remain the same as the ramp will be located to the north east of the existing bridleway, where the Red Crag does not outcrop. Therefore, the location of the ramp will mean that there is no impact on the SSSI feature. However, there still remains the potential to degrade undesignated areas of the cliff face by traffic movements uneven loading, destabilisation during construction of the access ramp and disturbance through the double installation and decommission of the ramp (once for each phase of works). The magnitude of effect for these works would not alter, low magnitude, meaning that the impact significance would remain **moderate adverse.** The additional mitigation measures to be adopted to reduce this impact to **minor adverse** are described in *Table 19.17*.

19.6.1.1.2 Onshore Cable Route and Substation(s)

73. No statutory or non-statutory designated sites are crossed by the cable route, however, the Red Crag present within the eastern half of the onshore cable route (landfall to Tuddenham St Martin) is a reasonably localised stratum and several outcrops in the region are subject to CGS status. The Red Crag in the eastern half of the onshore cable route is therefore considered to have a local value, albeit undesignated, and its sensitivity is considered to be low. The sensitivity of the remainder of the onshore cable route and the substation(s) is considered to be negligible**.**

Single Phase

74. No trenching is required for cable installation along the onshore cable route but localised excavation around jointing bay locations, the upgrade and construction of access tracks, temporary construction compounds, and laydown areas would still be needed. Excavation within these areas will be limited in depth and extent and would equate to a negligible magnitude therefore the significance will be **negligible** for both the Red Crag and the remaining geological strata. No further mitigation is considered necessary.

75. At the substation compound a limited amount of open trenching would be required to connect cables from pre-installed ducts to the substation and from the substation to the existing National Grid ducts. The cables would be laid directly into the ground. Excavated materials would be back-filled into the trenches, and the excavation within these areas will be limited in depth and extent and would equate to a negligible magnitude therefore the significance will be **negligible**. No further mitigation is considered necessary.

Two Phased

76. Within the Two Phased approach the overall area of disturbance will remain the same as within the Single Phase approach, but a slightly smaller area will be disturbed one phase at a time. There will also be an overlap of disturbance where the same soils are dug up and disturbed for each phase. However, the works will still entail the excavation of jointing bays, the upgrade and construction of access tracks, temporary construction compounds, and laydown areas and limited open trenching at the substation(s). The depth of excavation and disturbance will remain limited (to a maximum of 2.5m). In the absence of designated geology the magnitude and significance of these works will be **negligible**. No further mitigation is considered necessary.

19.6.1.2 Impact 2: Impact on Soils

19.6.1.2.1 Landfall, Onshore Cable Route and Substation(s)

77. At the substation compound a limited amount of open trenching would be required to connect cables from pre-installed ducts to the substation and from the substation to the existing National Grid ducts. The cables would be laid directly into the ground. Soils would be back-filled into the trenches, and the excavation within these areas will be limited in depth and extent.

78. No soils of significant environmental value were identified within the landfall and onshore cable route, however, given the fact that the soils are likely to be permeable in places and susceptible to contamination, the sensitivity of soils along the cable

route is considered to range from medium to low. Impacts to soil quality as an agricultural resource are considered within Chapter 22 Land Use.

Single Phase

79. The potential for direct contamination of soils exists as a result of spillages of fuel, oils or chemicals during construction works. The direct impact would be to contaminate the soil thereby reducing the soil quality and rendering soil unsuitable for re-use within excavations. Soils considered unsuitable for use would then require off-site disposal at a suitable licenced facility. Given that the activities on site (machinery on site leading to spills and leaks of oils and fuels) are likely to result in localised, short term impacts, the magnitude of potential impact is considered to be medium to low. On this basis, the impact significance is considered to be **minor adverse**. Mitigation measures (including checking and maintaining equipment to ensure leaks and spills do not occur and having spill kits available at all times) in addition to site workers adhering to the CoCP will reduce this further to a **negligible** significance.

80. The soil excavated and disturbed would be limited to that required for the jointing bays. Due to a small volume of soil excavated by this activity and the short term nature of the works the magnitude of the impact is considered to be low. Therefore, the impact significance is considered to be **minor adverse**. No further mitigation measures are recommended.

Two Phased

81. The potential for direct contamination of soils via leaks and spills during construction works has the ability to reduce the soil quality and render it unsuitable for re-use. Under the Two Phased approach the activities, and therefore the potential for spills and leaks to occur, on site will be increased as there will be two visits to each jointing bay, haul road, compound, substation(s) etc. The duration of each phase of cabling work will be exactly the same (29 weeks) and is the same as the full duration of the Single Phase works, but the duration of the substation(s) works will be reduced by 10 weeks (Phase 1 is up to 55 weeks and Phase 2 is up to 55 weeks). So although the magnitude of a spillage is considered to be low (localised, short term, low volume, reversible) for the Phase 1 works the soils may not have had sufficient time to recover before a second spillage could occur, which would have the effect of doubling the volume and duration of an impact. Also the Phase 1 works will open the soil structure through the process of excavation and replacement meaning that there will be increased voids within the soil that can store and transmit mobile contaminants (such as liquids; fuels and oils etc.) increasing the potential for migration of contaminants spilt within the Phase 2 works.

82. Where the soil structure is more open (either naturally or through disturbance from the Phase 1 works) the magnitude of effect caused is considered to be medium; where the soil structure is more closed (heavy / clay soil or no previous disturbance) the effect is anticipated to be low. On this basis, the impact significance is considered to vary from **moderate adverse** (in the area of more sensitive soils and within the Phase 2 works) to **minor adverse**. Mitigation measures (including checking and maintaining equipment to ensure leaks and spills do not occur and having spill kits available at all times) in addition to site workers adhering to the CoCP will reduce this further to a **negligible** significance.

83. The overall area of soil excavation and disturbance would be limited to that required for the jointing bays. Although the calculated volume of soil is increased through the process of the Two Phased approach, the overall area will not change as the volume variation is due to the re-excavation of some soils. The volume of soils disturbed through the Two Phased approach is still considered to be small and the short term nature of the works means that the magnitude of the impact is considered to be low. Therefore, the impact significance is considered to be **minor adverse**. No further mitigation measures are recommended.

19.6.1.3 Impact 3: Impact on Ground Condition and Human Health

84. During the construction phase, excavation in potentially contaminated soil or waste could impact on the health and safety of construction workers via direct contact, ingestion or inhalation. However, the short term nature of the work and the embedded mitigation measures designed to protect workers as set out in the OCoCP mean that construction workers can be considered to be a receptor of low sensitivity.

85. The majority of the onshore cable route passes through agricultural land which is considered to represent a low risk to the health and safety of construction workers. However, a number of potential sources of contamination have been identified within the study area as detailed in section 19.5.

19.6.1.3.1 Landfall, Onshore Cable Route and Substation(s)

Single Phase

86. As cables are to be installed in ducting, contact with soils would be limited to the areas of the jointing bays, transition bays and the substation(s). The siting of the jointing bays for cable pulling operations will, where possible avoid potential sources of contamination such as landfills with associated potential leachate and gas risks. The siting of excavation works away from contaminative areas will mean that construction workers would not be working in direct contact with affected soils;

however, there may still be a risk from migratory pollution such as leachates and landfill gas. Where pits are located within 250m of a landfill and left open there is the potential for hazardous gas to accumulate. Considering the localised nature of this hazard and the intended siting of pits away from contaminative areas the magnitude of the impact is considered to be negligible for the majority of the onshore electrical transmission works. However, where it is not possible to site jointing bays greater than 250m away from landfills and a potential leachate/ gas hazard, this impact would rise to medium for those affected bays. As such, the impact significance is considered **negligible** for the majority of the onshore electrical transmission works and **minor adverse** in the area surrounding Bramford Dairy, Culpho Hall and Tuddenham St Martin. Avoidance of landfill areas, adherence to the mitigation measures included within the OCoCP and the review and adherence to the East Anglia ONE Specific Contamination Assessment and Mitigation Scheme will reduce this further.

Two Phased

87. The duration of the works will be increased under the Two Phased approach and therefore the potential for construction workers to be exposed to contaminants during the excavation works is increased. However, the initial location of jointing bays away from areas of potential contamination will mean that the risk of exposure can be kept to a minimum. Also the OCoCP states that only soils that are suitable for use (under the CL:AIRE Code of Practice) will be allowed to be replaced on site following excavation. Therefore there is only a very limited opportunity for soils hazardous to health to be present on site during the Phase 2 element of works. As such the impact significance is considered to be **negligible**. No mitigation is considered necessary.

19.6.2 Potential Impacts During Operation

88. This section describes the potential impacts arising during the operational phase of the proposed East Anglia THREE project. Reference should also be made to Chapter 5 Description of the Development for full details of the operational phase.

89. The differences between a Single Phase and Two Phased approach to cable installation are related to the construction phase only, and therefore the impact assessment for operation is the same regardless of installation methodology.

Impact 1: Impact to soils, geology and ground condition

90. There is the potential for some operational activities to impact the soils, geology and ground conditions mainly at the substation(s) through general site activities such as routine monitoring and maintenance. In addition along the onshore cable route three potential landfills were identified which could generate landfill gas. The

presence of landfill gas within the soils could lead to gas build up in confined spaces such as jointing bays.

91. Where maintenance is required below ground there is the potential for hazardous gas to migrate via permeable strata and accumulate in confined spaces and / or buildings on site. Considering the localised nature of this hazard and the intended siting of jointing bays in non-sensitive and/ or non-contaminative areas during the construction phase, the magnitude of the impact is likely to be low in most cases. However, from a precautionary basis, in the areas surrounding the landfills at Culpho and Bramford and at Tuddenham St Martin, the magnitude and likelihood of encountering ground gas is increased the impact is considered to be medium. Adherence to Health & Safety precautions for personnel entering the jointing bays and a review of the CDM hazard log, which will identify jointing bays in areas of risk, and the East Anglia ONE Specific Contamination Assessment and Mitigation Scheme prior to commencement of works will ensure the risk from the build-up of gas will be low to negligible, leading to a **minor adverse** impact for the entire onshore electrical transmission works. Mitigation measures in relation to gas risk at the substation(s) are detailed in *Table 19.18* below.

92. Routine maintenance works would be required during the operational phase; however, this access would be via jointing pits or kiosks. Maintenance may include the excavation of soil in order to access the cables. It is anticipated that these events would be highly localised, temporary and of short duration. Jointing pits will be located be located away from watercourses and adjacent to field boundaries (avoiding rootzone) or roads and appropriate off-road vehicles would be used to access each of these.

93. In the event of a cable failure, it may be necessary to re-excavate the cable trench and replace / repair the faulty cable along limited stretches. If repair works are required, the mitigation measures outlined for the construction phase activities in section 19.6.1 would be adhered to. Any contamination previously identified within the construction phase would be documented within the Health & Safety File under CDM Regulations and retained by the operating company in order to reduce or minimise potential impacts to future works to an acceptable level.

94. It is likely that machinery would be used and would require potentially polluting materials for their operation and maintenance to be stored and used on the substation(s) location during its operation (e.g. fuel and oil). Therefore, there is a risk that leaks and spills could result in pollution of the soil and superficial deposits and groundwater. However, the frequency and duration of such activities is likely to be minimal, the quantities of fuel and oils used would be small and the impacts

unlikely to be sufficient to cause significant deterioration in the quality value of the soil, superficial deposits and groundwater (low magnitude). Taking these factors into account, the significance of the impact is considered to be **minor adverse**.

95. Mitigation measures in relation to general maintenance activities, including the provision of appropriate welfare facilities at the substation(s) are detailed below in *Table 19.18*.

Table 19.18 Mitigation measures

Mitigation measures
• At the substation(s), where it is not possible to store potentially contaminative materials off-site, arrangements would be made for storage in secure, bunded areas above ground level; • A Pollution Prevention Plan and Emergency/Incident Response Plan would be incorporated as part of a CoCP for the proposed East Anglia THREE project, and agreed with the local planning authority prior to construction; • Procedures would be put in place for identifying and reporting spillages or leakages either at the substation(s) or during maintenance activities along the cable routes, and consideration given to the storage of containment equipment (e.g. absorbent matting, plastic sheeting etc.) on site etc.; • Gas risks would be considered for all maintenance workers whenever there is a requirement to enter confined spaces. This should be managed through contractor health and safety risk assessments; • The integrity of hardstanding at the substation(s) and the drainage network would be inspected regularly to ensure that damage to either do not result in the creation of a potential pathway by which contaminants could either enter groundwater or surface waters; and • Oil, water and silt separators will be used where applicable on construction compound surface water management systems to remove oils and fuels accidentally spilled / accumulated during construction.

96. With adherence to the above mitigation, and based on the previously defined magnitude and sensitivity, it is anticipated that there would be a **negligible** residual impact on soil, geology and ground condition during operation.

19.6.3 Potential Impacts During Decommissioning

97. This section describes the potential impacts of the decommissioning of the onshore electrical transmission works with regards to impacts on soils, geology and ground condition. The decommissioning of the project would be subject to a detailed decommissioning programme process controlled by the requirements in the DCO. The approach provided below provides a high level likely approach which could be taken. Further details are provided in Chapter 5 Description of the Development.

19.6.3.1 Landfall and Onshore Cable Route

98. It is anticipated that the onshore cable would be decommissioned (de-energised) and left in-situ, the jointing bays and ducts would also be left in-situ.

19.6.3.2 Substation(s)

99. In relation to the substation(s), the programme for decommissioning is expected to be similar in duration to the construction phase. The detailed activities and methodology would be determined later within the project lifetime, but are expected to include:

- Dismantling and removal of electrical equipment located outside of the substation(s) compound;
- Dismantling and removal of electrical equipment from within the substation(s) compound;
- Removal of main substation(s) compound minor services equipment;
- Demolition of the support buildings and removal of fencing;
- Removal of hard standing
- Landscaping and reinstatement of the site (including land drainage).

100. Whilst details regarding the decommissioning of the substation(s) are currently unknown, considering the worst case scenario, which would be the removal of the substations(s) and reinstatement of the current land use at the site, it is anticipated that the impacts would be similar those during construction, these impacts are listed in *Table 19.21*.

19.7 Cumulative Impacts

101. Potential cumulative impacts to land could arise from interaction with other developments within the vicinity of the proposed East Anglia THREE project either temporally or spatially. Given that the soils, geology and ground condition impacts of the proposed East Anglia THREE project mostly affect receptors within the onshore cable route works, there is limited potential for interaction with developments which do not have direct overlap with the proposed project. With regard to the receptors assessed in this chapter a potential for cumulative impact would only occur if those same receptors are affected. Whilst there may be additive cumulative impacts at the wider regional scale (e.g. several developments may affect the same drainage systems) these activities would be managed and mitigated in a similar way to impacts described above for the proposed East Anglia THREE project and there would be few impacts.

102. A full list of projects that have been scoped into the cumulative impact assessment is provided in *Table 19.19*. These cover major known developments in the vicinity of

the onshore electrical transmission works. The two key projects which have been identified as potentially causing cumulative impacts are the East Anglia ONE and a future EAOW project which share the landfall and onshore cable route with the proposed East Anglia THREE project. These projects also propose to locate converter stations / substation(s) within close proximity of the substation for the proposed East Anglia THREE project.

Table 19.19 Summary of projects considered for the CIA in relation to Soils, Geology and Ground Condition

Project	Status	Construction / Operation period	[5] Approx Distance from East Anglia THREE (km)	Project definition	Project data status	Included in CIA	Rationale
East Anglia ONE	Consented	2018 –2019 / 25 years	0	Offshore Windfarm Project Project description available	Complete/high	Yes	Construction would not overlap. Operational and decommissioning impacts only.
Future EAOW project	Pre-application	Unknown	0	Offshore Windfarm Project Outline project data only	Incomplete/low	Yes	Construction would not overlap. Operational and decommissioning impacts only,
Sizewell C	Pre-application	Unknown	24.7	Nuclear Power Station No project detail available	Low	No	No spatial overlap with onshore electrical transmission works, too distant to impact same receptors.
Bramford-Twinstead	Pre-application	Unknown	0	Outline only	Complete/high	No	No spatial overlap, but may adjoin the same location as the substation(s) location.
SITA (Energy from Waste plant)	Operational	Unknown	0.5	Energy From Waste Plant Project description available	Complete/high	No	Construction would not overlap

[5] Shortest distance between the considered project and the proposed East Anglia THREE project – unless specified otherwise.

Project	Status	Construction / Operation period	[5] Approx Distance from East Anglia THREE (km)	Project definition	Project data status	Included in CIA	Rationale
SnOasis	Planning permission granted	Unknown	0.7	Winter sport centre. Master plans available	Incomplete/low	No	No spatial overlap.
Old Fisons site (land west of Paper Mill Lane)	Planning Application TBD	Unknown	0.7	Business park and housing scheme. Master plans available	Complete/high	No	No spatial overlap.
Adastral park	Planning permission granted	Unknown	0.8	Business park and housing scheme. Master plans available	Complete/high	No	No spatial overlap.
Ipswich Garden Suburb	Identified in adopted Core Strategy	Primarily after 2020	~3	Urban development north of Ipswich. Master Plan at consultation phase.	Incomplete / medium	No	Greenfield site. No overlap with landfall, onshore cable route or substation(s) location. Due to distance recreational pressure will focus on Orwell Estuary and not Deben Estuary.
Progress Power, Eye, Suffolk	Planning permission granted	Construction 2017-18, operation by 2019.	28	Gas fired power station development	Complete/ high	No	No overlap with landfall, onshore cable route or converter station location. Likely to be constructed prior to the proposed

Project	Status	Construction / Operation period	[5] Approx Distance from East Anglia THREE (km)	Project definition	Project data status	Included in CIA	Rationale
							East Anglia THREE project commencement.
Land North Of Woods Lane, Melton, Suffolk	Conditionally Allowed	Unknown	2.7	Outline planning for a residential development for 180 dwellings (8.27ha in size) to include open space and provision of ecological habitat areas.	High	No	No overlap with landfall, onshore cable route or substation(s) location.

19.7.1 Potential Cumulative Impacts During Construction

103. The construction of East Anglia ONE, the proposed East Anglia THREE project and a future EAOW project have the potential to result in cumulative impacts. East Anglia ONE has been granted Development Consent and will be installed. During the construction works, ducts for two future projects will be installed at the same time, followed by reinstatement of ground. The East Anglia THREE onshore cables would then be pulled through the pre-installed ducts, and a future EAOW project cables would be pulled through.

104. East Anglia ONE will undertake preparatory works for the proposed East Anglia THREE project, therefore cumulative impacts would arise from cable pulling and jointing operations (and construction of jointing pits) and the construction of the converter stations / substation(s). Therefore, in terms of the cumulative assessment, East Anglia ONE will have the greatest magnitude of impact with subsequent projects having smaller and more localised overall impact magnitudes (at the jointing pits, access points to these and at the substation(s) location).

105. The onshore footprint, which includes the electrical transmission works and accesses, would be reinstated after construction of East Anglia ONE (with the exception of the permanent structures at the converter station / substation(s) location).

106. In summary, it is expected that the cumulative impacts of construction would be similar for both Single Phase and Two Phased approach.

107. The majority of major schemes listed in *Table 19.19* have no spatial overlap with the East Anglia THREE onshore electrical transmission works including access.

19.7.1.1 Cumulative Impact 1: Impact on Geology

19.7.1.1.1 Landfall

108. The worst case at landfall, is if a short HDD in undertaken as part of East Anglia ONE, access will be required to the shore on three separate occasions, i.e. three ten week periods during constructions. Mitigation applied (as per section 19.6.1.1) would in each case reduce the impact to **minor adverse** significance. Given the small area of the landfall and limited potential for location of access ramp, it is considered that the cumulative impact under this option would be **moderate adverse**.

109. If the long HDD option is used for East Anglia ONE, there will be no requirement for the proposed East Anglia THREE project or a future EAOW project to access the beach from the cliff, and therefore there will be **no impact.**

19.7.1.1.2 Onshore Cable Route and Substation(s)

110. No statutory or non-statutory sites are crossed by the onshore cable route or substation. The impacts under both the Single Phase and Two Phased approaches are considered negligible (see section 19.6.1.1.). Subsequent projects would also have impacts of **negligible** significance although the magnitude of those impacts would be lower. Overall the cumulative impact is considered to be **negligible**. Due to the absence of designated sites within the onshore cable route and substation there is **no pathway** for cumulative impacts with any other development.

19.7.1.2 Cumulative Impact 2: Impacts on Soils

111. No soils of significant environmental value were identified at the landfall, onshore cable route or substation (see section 19.6.1.2). Under the Single Phase or Two Phased approach, the impacts are considered to be **minor adverse**. Subsequent cable installation operations for future projects would also have minor adverse impacts, although of a lower magnitude. Overall it is considered that cumulative impacts would be **minor adverse**.

19.7.1.3 Cumulative Impact 3: Impact on Ground Condition and Human Health

112. East Anglia ONE will undertake the majority of the excavations required for future projects. It is intended that where the onshore cable route crosses potentially contaminated sites, such as historic landfills, jointing bay excavations undertaken during construction of the proposed East Anglia THREE project would be located away from these sensitive areas. Therefore any potential impact would largely be caused and experienced by East Anglia ONE and would only relate to East Anglia ONE construction. Given that subsequent projects would not need to undertake major excavations and jointing bays would be located sensitively as described above, their impacts would be negligible. The overall cumulative impact therefore is not considered to be above **minor adverse**.

19.7.2 Potential Cumulative Impacts During Operation

19.7.2.1 Cumulative Impact 1: Impacts to Soils, Geology and Ground Conditions

113. As discussed in section 19.6.2 potential impacts come from the requirement for maintenance activity along the onshore cable route during the life of the projects. It

is not possible to say where or when failures of the infrastructure requiring maintenance will occur, however, it is likely that maintenance activities would be focused upon the jointing bay locations (which would be sensitively located) and therefore the magnitude of impact would be low and be highly localised. It is unlikely that failures would occur across multiple projects simultaneously and, therefore, it is considered that cumulative impacts during operation would not be above the **minor adverse** significance predicted in section 19.6.2.

19.7.3 Potential Impacts During Decommissioning

Landfall and Onshore Cable Route

114. The onshore cables for East Anglia ONE, the proposed East Anglia THREE project and a future EAOW project would be decommissioned (de-energised) and the cables left in-situ. Jointing and transition bays will also be left in-situ. Therefore there would be **no impacts** at the landfall or along the onshore cable route.

Substation(s)

115. The details regarding the decommissioning of the substation are currently unknown. The worst case scenario is considered to be sequential removal and reinstatement as this would lead to sequential disturbance impacts. Impacts would be similar to but of lower magnitude for construction as discussed in section 19.6.1.

116. Decommissioning would be undertaken in line with legislation, policy and best-practice guidance current at the time.

19.8 Inter-relationships

117. Parameters or "sources" that are considered to interact with receptors identified in this chapter are listed in *Table19.20* below.

Table 19.20 Inter-relationships with soils, geology and ground conditions

Inter-relationship All Phases	Section where addressed	Linked Chapter
Marine Geology, Oceanography and Physical Processes	19.5, 19.6, 19.7	7
Water and Sediment Quality	19.5, 19.6, 19.7	8
Water Resources and Flood Risk	19.5, 19.6, 19.7	21
Land Use	19.5, 19.6, 19.7	22
Terrestrial Ecology	19.5, 19.6, 19.7	23

19.9 Summary

118. This section summarises the main findings from the impact assessment. This is outlined in *Table 19.21.*

119. The landfall footprint lies within a statutory designated site (Bawdsey Cliffs SSSI) which could potentially lead to impacts such as loss of or damage to sensitive geological features through excavation, increased erosion and deterioration of soil quality through spills and leaks. For Single Phase and Two Phased approach, the potential for degradation of the cliff is considered to be of moderate adverse impact with a high sensitivity. In particular where the SSSI is to be crossed with beach access ramps the significance is considered to be moderate adverse. This impact can be reduced to **minor adverse** following the implementation of suggested mitigation measures.

120. No statutory or non-statutory designated sites are crossed by the onshore cable route, however, the Red Crag present within the eastern half of the onshore cable route (landfall to Tuddenham St Martin) is a reasonably localised stratum and several outcrops in the region are subject to CGS status. The potential impact to sensitive sites for the remainder of the onshore cable route and the substation is considered to be **negligible**.

121. There are no soils of significant environmental value identified within the landfall and cable route. The sensitivity of these areas is considered low and the likelihood of direct contamination to soils caused by spillages during construction, following cable installation, is considered to be medium to low magnitude and **minor adverse** impact.

122. The onshore cable route passes across agricultural land which presents a low risk to the health and safety of construction workers and a number of potential contaminant issues have been identified within the study area as outlined in section 19.5.

123. Three landfill sites encroach the onshore cable route at Culpho Hall, Bramford Dairy and Tuddenham St Martin. The exact content of the landfills is unrecorded and a variety of contaminants may be present with the potential to produce leachate and landfill gases. As this hazard is considered to be local in nature, a **minor adverse** impact is possible during construction.

124. Operationally, where maintenance is required there is the potential for hazardous gas to migrate via permeable strata and accumulate in confined spaces and / or buildings on site. However this is considered localised in nature and will be of low magnitude. Jointing bays located within 250m of a landfill that may be at risk of gas build up will be included within the CDM hazard log. The adherence to standard Health & Safety requirements for working within confined spaces will reduce the likelihood of impact from the build-up of gas to low to negligible. This would lead to a **minor adverse impact** for the entire onshore electrical transmission works. Additional mitigation measures are provided in *Table 19.18*.

125. Adhering to the mitigation outlined in this chapter and set out in the OCoCP, and based on the previously defined magnitude and sensitivity, it is anticipated that there would be a **minor adverse** to **negligible** residual impact on soil, geology and ground condition during operation.

126. It is anticipated that the onshore cable would be decommissioned (de-energised) and cables left in-situ. Whilst details regarding the decommissioning of the substations are currently unknown, considering the worst case scenario, which would be the removal and reinstatement of the current land use at the site, it is anticipated that the impacts would be similar to those during construction.

Table 19.21 Potential Impacts Identified for Soils, Geology and Ground Condition

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Construction						
Geology	Landfall	High	Low	Moderate adverse	Embedded mitigation (*Table 19.3*) and additional mitigation in *(Table 19.17)*	Minor adverse Not significant
	Onshore cable route	Low	Negligible	Negligible	No additional mitigation	Not significant
	Substation(s)	Low to Negligible	Negligible	Negligible	No additional mitigation	Not significant
Soils – Single Phase	Landfall / onshore cable route / substation(s)	Medium to Low	Medium to Low	Minor adverse to Negligible	Maintaining equipment and CoCP	Minor adverse - Negligible Not significant
Soils – Two Phase	Landfall / onshore cable route / substation(s)	Medium to Low	Medium to Low	Moderate adverse to Negligible	Maintaining equipment and CoCP	Minor adverse – Negligible Not significant
Ground condition and human health	Landfall / onshore cable route / substation(s)	Low	Minor	Minor adverse to Negligible	Avoidance of landfill, CoCP and use of East Anglia ONE Specific Contamination Assessment and Mitigation Scheme.	Negligible Not significant
Operation						
Soils, geology and ground condition	Landfall / onshore cable route / substation(s)	Low	Medium to Low	Minor adverse	Mitigation measures *Table 19.18*	Negligible

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Decommissioning						
As per construction						

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Chapter 19 Ends Here