East Anglia ONE North Offshore Windfarm

Appendix 18.2

Ground Conditions and Contamination Cumulative Impact Assessment with the Proposed East Anglia TWO Project

Preliminary Environmental Information
Volume 3
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Glossary of Acronyms

CCS	Construction Consolidation Sites
CIA	Cumulative Impact Assessment
DCO	Development Consent Order
ES	Environmental Statement
HDD	Horizontal Directional Drilling
MMP	Materials Management Plan
MW	Megawatt
NGET	National Grid Electricity Transmission
OHL	Overhead Line
PEIR	Preliminary Environmental Information Report

Glossary of Terminology

Applicant	East Anglia ONE North Limited.
Construction consolidation sites	Compounds which will contain laydown, storage and work areas for onshore construction works. The HDD construction compound will also be referred to as a construction consolidation site.
Development Area	The area comprising the Proposed Onshore Development Area and the Offshore Development Area
East Anglia ONE North project	The proposed project consisting of up to 67 wind turbines, up to four offshore electrical platforms, up to one construction operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
European site	Sites designated for nature conservation under the Habitats Directive and Birds Directive, as defined in regulation 8 of the Conservation of Habitats and Species Regulations 2017 and regulation 18 of the Conservation of Offshore Marine Habitats and Species Regulations 2017. These include candidate Special Areas of Conservation, Sites of Community Importance, Special Areas of Conservation and Special Protection Areas.
Evidence Plan Process	A voluntary consultation process with specialist stakeholders to agree the approach to the EIA and the information required to support HRA.
Horizontal directional drilling (HDD)	A method of cable installation where the cable is drilled beneath a feature without the need for trenching.
Jointing Bay	Underground structures constructed at regular intervals along the onshore cable route to join sections of cable and facilitate installation of the cables into the buried ducts.
Landfall	The area (from Mean Low Water Springs) where the offshore export cables would make contact with land, and connect to the onshore cables.
Link boxes	Underground chambers or above ground cabinets next to the cable trench housing electrical earthing links.
Mitigation areas	Areas captured within the Development Area specifically for mitigating expected or anticipated impacts.
National Grid infrastructure	A National Grid substation, connection to the existing electricity pylons and National Grid overhead line realignment works which will be consented as part of the proposed East Anglia ONE North project Development Consent Order but will be National Grid owned assets.
National Grid overhead line realignment works	Works required to upgrade the existing electricity pylons and overhead lines to transport electricity from the National Grid substation to the national electricity grid
National Grid overhead line realignment works area	The proposed area for National Grid overhead line realignment works.

National Grid substation	The substation (including all of the electrical equipment within it) necessary to connect the electricity generated by the proposed East Anglia ONE North project to the national electricity grid which will be owned by National Grid but is being consented as part of the proposed East Anglia ONE North project Development Consent Order.
National Grid substation location	The proposed location of the National Grid substation.
Natura 2000 site	A site forming part of the network of sites made up of Special Areas of Conservation and Special Protection Areas designated respectively under the Habitats Directive and Birds Directive.
Onshore cable corridor	The corridor within which the onshore cable route will be located
Onshore cable route	This is the construction swathe within the onshore cable corridor which would contain onshore cables as well as temporary ground required for construction which includes cable trenches, haul road and spoil storage areas.
Onshore cables	The cables which would bring electricity from landfall to the onshore substation. The onshore cable is comprised of up to six power cables and two fibre optic cables.
Proposed Onshore Development Area	The area in which the landfall, onshore cable corridor, onshore substation, mitigation areas, temporary construction facilities (such as access roads and construction consolidation sites), and the National Grid Infrastructure will be located.
Onshore infrastructure	The combined name for all of the onshore infrastructure associated with the proposed East Anglia ONE North project from landfall to the connection to the national electricity grid.
Onshore substation	The East Anglia TWO substation and all of the electrical equipment, both within and connecting to the National Grid infrastructure.
Onshore substation location	The proposed location of the onshore substation for the proposed East Anglia ONE North project.
Transition Bay	Underground structures at the landfall that house the joints between the offshore export cables and the onshore cables.

18.2 Cumulative Impact Assessment with the proposed East Anglia TWO Project

18.1 Introduction

1. This appendix covers the cumulative impact assessment of the proposed East Anglia ONE North project with the proposed East Anglia TWO project in relation to ground conditions and contamination.

2. The East Anglia TWO offshore windfarm project (the proposed East Anglia TWO project) is also in the pre-application. The proposed East Anglia TWO project will have a separate Development Consent Order (DCO) application but is working to the same programme of submission as the proposed East Anglia ONE North project. The two projects will share the same landfall location and cable route and the two onshore substations will be co-located, and feed into the same National Grid substation.

3. The ground conditions and contamination proposed East Anglia ONE North project Cumulative Impact Assessment (CIA) will therefore initially consider the cumulative impact with only the East Anglia TWO project against two different construction scenarios (i.e. construction of the two projects simultaneously and sequentially). The realistic worst case scenario of each impact is then carried through to the main body of the CIA assessment which considers other developments which are in close proximity to the proposed East Anglia ONE North project.

4. For a more detailed description of the CIA please refer to ***Chapter 5 EIA Methodology***.

18.2 Construction Scenarios Realistic Worst Case Parameters

5. This appendix considers the proposed East Anglia ONE North project and the proposed East Anglia TWO project under two construction scenarios:

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

6. As discussed in ***section 18.1***, the realistic worst case (based on the assessment of these two construction scenarios) for each impact is then carried through to

the wider CIA which considers other developments, projects or plans which have been screened into the CIA assessment for the proposed East Anglia ONE North project.

7. It should be noted that the operational phase impacts on ground conditions and contamination will be the same irrespective of the construction scenario. Therefore, operational impacts identified in Scenario 1 will be the same as those for Scenario 2.

8. Mitigation measures for the proposed East Anglia ONE North project and proposed East Anglia TWO project will be the same. These are detailed in ***Chapter 18 Ground Conditions and Contamination.***

18.2.1 Scenario 1

9. ***Table A18.1*** presents the realistic worst case parameters of Scenario 1. In this instance, the proposed East Anglia ONE North project and proposed East Anglia TWO project are built simultaneously.

Table A18.1 Scenario 1 Realistic Worst Case

Impact	Parameter	Notes
Construction		
Impacts related to the landfall	HDD temporary works area: 13,300m^2 (70m x 190m) Transition bay excavation footprint (for 4 transition bays): 3,108m^2 (37m x 42m) Landfall CCS: 40,950m^2 (210m x 195m) Landfall transition bays approximate quantity of spoil material (for 4 transition bays): 908m^3	Landfall to be achieved via HDD. No beach access required.
Impacts related to the onshore cable corridor	Onshore cable route: 574,720m^2 (8,980m x 64m) Jointing bay construction excavation footprint: 570m^2 (30.6m x 18.6m). Total for 72 jointing bays: 41,040m^2 (570m^2 x 36) HDD (retained as an option to cross SPA / SSSI): • Entrance pit CCS (x1): 13,650m^2 (195m x 70m) • Exit pit CCS (x1): 5,850m^2 (195m x 30m) Onshore cable route CCS: 40,950m^2 (210m x 195m). Total for 5 CCS: 204,750m^2 (40,950m^2 x 5)	Onshore cable corridor construction footprint may be located anywhere within the proposed onshore development area. The location strategy for access routes, CCS and jointing bays will be to site them near to field boundaries or roads as far as practical. Two link boxes sit underground beside each jointing bay at a depth of approximately 1.2m. The construction footprint of these is included in the jointing

Impact	Parameter	Notes
	Temporary roads: • Onshore cable route haul road between landfall and Snape Road (4.5m wide with additional 4m for passing places at approximately 87m intervals): 41,376m^2 • Onshore cable route and substation access haul road (9m width): 18,675m^2 • Temporary access road: 23,495m^2 Onshore cable trench approximate quantity of spoil material: 26,642m^3	bay construction excavation footprint.
Impacts related to the onshore substation(s)	Onshore substation CCS: 17,100m^2 (190m x 90m). Total for 3 CCS: 51,300m^2 Permanent footprint (used as CCS during construction): 36,100m^2 (190m x 190m). Total for 2: 72,200m^2 Substation operational access road: 12,800m^2 (1,600m x 8m)	Construction access is included above as the onshore cable route and substation access haul road.
Impacts related to the National Grid Infrastructure	National Grid substation CCS: 78,750m^2 (250m x 315m) Permanent footprint (used as CCS during construction): 45,500m^2 (325m x 140m)	Design for the required overhead line (OHL) realignment work (including cable sealing end CCSs and pylon realignment CCS) is currently on going. As more detail is made available, this will be fully assessed and included in the Environmental Statement (ES) and DCO application. However, indicative locations for cable sealing end CCSs and pylon realignment CCS are shown in ***Figure 6.6*** of ***Chapter 6 Project Description***. Construction access is included above as the onshore cable route and substation access haul road. Operational access is included above as the substation operational access road,
Operation		
Impacts related to the landfall	4 transition bays will be installed underground, each with an operational volume of 227m^3	Transition bays will be buried approximately 1.2m underground – there will no above ground infrastructure.

Impact	Parameter	Notes
Impacts related to the onshore cable corridor	72 jointing bays will be installed underground, each with an operational volume of 77m^{3}144 link boxes will be installed underground (2 per jointing bay), each with an operational volume of 3m^3	Jointing bays will be buried approximately 1.2m underground – there will no above ground infrastructure. Link boxes will be located underground immediately adjacent to jointing bays – there will be no above ground infrastructure.
Impacts related to the onshore substation(s)	Operational footprint: 36,100m^2 (190m x 190m). Total for 2: 72,200m^2 Substation operational access road: 12,800m^2 (1,600m x 8m)	The operational footprint does not include the additional landscaping footprint (which will be agreed post-PEIR).
Impacts related to the National Grid Infrastructure	National Grid operational substation: 45,500m^2 (325m x 140m)	The operational footprint does not include the additional landscaping footprint (which will be agreed post-PEIR). Design for the required overhead line (OHL) realignment work (including cable sealing end CCSs and pylon realignment CCS) is currently on going. As more detail is made available, this will be fully assessed and included in the Environmental Statement (ES) and DCO application. However, indicative locations for cable sealing end CCSs and pylon realignment CCS are shown in ***Figure 6.6*** of ***Chapter 6 Project Description***.
Decommissioning		
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. However, the onshore substation will likely be removed and be reused or recycled. It is expected that the onshore cables will be removed and recycled, with the transition bays and cable ducts (where used) left *in situ*. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.		

18.2.2 Scenario 2

10. Scenario 2, and ***Scenario 2*** assumes that when permission is granted, the proposed East Anglia TWO project will be constructed as soon as permission is granted. The proposed East Anglia ONE North project will leave the largest possible gap (between the reinstatement of the proposed East Anglia TWO project and start of construction for the proposed East Anglia ONE North project) to begin construction within the consent period. Further detail regarding the likely construction gap is provided in ***Chapter 5 EIA Methodology***.

11. Table A18.2 represents the realistic worst case scenario in the eventuality that the proposed East Anglia TWO project and proposed East Anglia ONE North project are built with a construction gap. It is intended that the construction of the proposed East Anglia TWO project will be progressed prior to commencing construction of the proposed East Anglia ONE North project.

12. Scenario 2 assumes that when permission is granted, the proposed East Anglia TWO project will be constructed as soon as permission is granted. The proposed East Anglia ONE North project will leave the largest possible gap (between the reinstatement of the proposed East Anglia TWO project and start of construction for the proposed East Anglia ONE North project) to begin construction within the consent period. Further detail regarding the likely construction gap is provided in ***Chapter 5 EIA Methodology***.

Table A18.2 Scenario 2 Realistic Worst Case

Impact	Proposed East Anglia TWO Project Parameters	Proposed East Anglia ONE North Project Parameters (on the assumption that the proposed East Anglia TWO project is post-construction)	Notes
Construction			
Impacts related to the landfall	HDD temporary works area: 7,000m^2 (70m x 100m) Transition bay excavation footprint (for 2 transition bays): 1,554m^2 (37m x 42m) Landfall CCS: 18,400m^2 (160m x 115m) Landfall transition bays approximate quantity of spoil material (for 2 transition bays): 454m^3	HDD temporary works area: 7,000m^2 (70m x 100m) Transition bay excavation footprint (for 2 transition bays): 1,554m^2 (37m x 42m) Landfall CCS: 18,400m^2 (160m x 115m) Landfall transition bays approximate quantity of spoil material (for 2 transition bays): 454m^3	Landfall to be achieved via HDD. No beach access required.

Impact	Proposed East Anglia TWO Project Parameters	Proposed East Anglia ONE North Project Parameters (on the assumption that the proposed East Anglia TWO project is post-construction)	Notes
Impacts related to the onshore cable corridor	Onshore cable route: 287,360m^2 (8,980m x 32m) Jointing bay construction excavation footprint: 570m^2 (30.6m x 18.6m). Total for 36 jointing bays: 20,520m^2 (570m^2 x 36) HDD (retained as an option to cross SPA / SSSI): • Entrance pit CCS (x1): 7,000m^2 (100m x 70m) • Exit pit CCS (x1): 3,000m^2 (100m x 30m) Onshore cable route CCS: 18,400m^2 (160m x 115m). Total for 5 CCS: 92,000m^2 (18,400m^2 x 5) Temporary roads: • Onshore cable route haul road between landfall and Snape Road (4.5m wide with additional 4m for passing places at approximately 87m intervals): 41,376m^2 • Onshore cable route and substation access haul road (9m width): 18,675m^2 • Temporary access road: 23,495m^2 Onshore cable trench approximate quantity of spoil material: 13,321m^3	Onshore cable route: 287,360m^2 (8,980m x 32m) Jointing bay construction excavation footprint: 570m^2 (30.6m x 18.6m). Total for 36 jointing bays: 20,520m^2 (570m^2 x 36) HDD (retained as an option to cross SPA / SSSI): • Entrance pit CCS (x1): 7,000m^2 (100m x 70m) • Exit pit CCS (x1): 3,000m^2 (100m x 30m) Onshore cable route CCS: 18,400m^2 (160m x 115m). Total for 5 CCS: 92,000m^2 (18,400m^2 x 5) Temporary roads: • Onshore cable route haul road between landfall and Snape Road (4.5m wide with additional 4m for passing places at approximately 87m intervals): 41,376m^2 • Onshore cable route and substation access haul road (9m width): 18,675m^2 • Temporary access road: 23,495m^2 Onshore cable trench approximate quantity of spoil material: 13,321m^3	Onshore cable corridor construction footprint may be located anywhere within the proposed onshore development area. The location strategy for access routes, CCS and jointing bays will be to site them near to field boundaries or roads as far as practical. Two link boxes sit underground beside each jointing bay at a depth of approximately 1.2m. The construction footprint of these is included in the jointing bay construction excavation footprint.
Impacts related to the onshore substation	Onshore substation CCS: 17,100m^2 (190m x 90m) Permanent footprint (used as CCS during construction): 36,100m^2 (190m x 190m) Substation operational access road: 12,800m^2 (1,600m x 8m)	Onshore substation CCS: 17,100m^2 (190m x 90m) Permanent footprint (used as CCS during construction): 36,100m^2 (190m x 190m) Substation operational access road: 12,800m^2 (1,600m x 8m)	Construction access is included above as the onshore cable route and substation access haul road.

Impact	Proposed East Anglia TWO Project Parameters	Proposed East Anglia ONE North Project Parameters (on the assumption that the proposed East Anglia TWO project is post-construction)	Notes
Impacts related to the National Grid Infrastructure	National Grid substation CCS: 78,750m^2 (250m x 315m) Permanent footprint (used as CCS during construction): 45,500m^2 (325m x 140m)	National Grid substation CCS: 78,750m^2 (250m x 315m) Permanent footprint (used as CCS during construction): 45,500m^2 (325m x 140m)	Design for the required overhead line (OHL) realignment work (including cable sealing end CCSs and pylon realignment CCS) is currently on going. As more detail is made available, this will be fully assessed and included in the Environmental Statement (ES) and DCO application. However, indicative locations for cable sealing end CCSs and pylon realignment CCS are shown in ***Figure 6.6*** of ***Chapter 6 Project Description***. Construction access is included above as the onshore cable route and substation access haul road. Operational access is included above as the substation operational access road,
Operation			
Impacts related to the landfall	2 transition bays will be installed underground, each with an operational volume of 227m^3	2 transition bays will be installed underground, each with an operational volume of 227m^3	Transition bays will be buried approximately 1.2m underground – there will no above ground infrastructure.
Impacts related to the onshore cable corridor	36 jointing bays will be installed underground, each	36 jointing bays will be installed underground, each	Jointing bays will be buried approximately 1.2m underground –

Impact	Proposed East Anglia TWO Project Parameters	Proposed East Anglia ONE North Project Parameters (on the assumption that the proposed East Anglia TWO project is post-construction)	Notes
	with an operational volume of 77m^3 72 link boxes will be installed underground (2 per jointing bay), each with an operational volume of 3m^3	with an operational volume of 77m^3 72 link boxes will be installed underground (2 per jointing bay), each with an operational volume of 3m^3	there will no above ground infrastructure. Link boxes will be located underground immediately adjacent to jointing bays – there will be no above ground infrastructure.
Impacts related to the onshore substation	Operational footprint: 36,100m^2 (190m x 190m) Substation operational access road: 12,800m^2 (1,600m x 8m)	Operational footprint: 36,100m^2 (190m x 190m) Substation operational access road: 12,800m^2 (1,600m x 8m)	The operational footprint does not include the additional landscaping footprint (which will be agreed post-PEIR).
Impacts related to the National Grid Infrastructure	National Grid operational substation: 45,500m^2 (325m x 140m)	National Grid operational substation: 45,500m^2 (325m x 140m)	The operational footprint does not include the additional landscaping footprint (which will be agreed post-PEIR). Design for the required overhead line (OHL) realignment work (including cable sealing end CCSs and pylon realignment CCS) is currently on going. As more detail is made available, this will be fully assessed and included in the Environmental Statement (ES) and DCO application. However, indicative locations for cable sealing end CCSs and pylon realignment CCS are shown in ***Figure 6.6*** of ***Chapter 6 Project Description***.

Impact	Proposed East Anglia TWO Project Parameters	Proposed East Anglia ONE North Project Parameters (on the assumption that the proposed East Anglia TWO project is post-construction)	Notes
Decommissioning			
No decision has been made regarding the final decommissioning policy for the onshore infrastructure as it is recognised that industry best practice, rules and legislation change over time. However, the onshore substation will likely be removed and be reused or recycled. It is expected that the onshore cables will be removed and recycled, with the transition bays and cable ducts (where used) left *in situ*. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, for the purposes of a worst-case scenario, impacts no greater than those identified for the construction phase are expected for the decommissioning phase.			

18.3 Cumulative Impact Assessment during Construction

18.3.1 Cumulative Impact 1: Impact to Human Health Including Construction Workers and the Public During Any Construction

13. Under Scenario 1 or Scenario 2 the assessment of impacts does not change. The cumulative effects to human health and land quality are likely to be impacted in the same manner. Under each scenario the proposed works would have the same parameters for construction activity. The works would see an increase in time of the construction period under construction scenario 2 (an estimated three years to six years construction phase). However, given the embedded mitigation measures and considering that any alteration to land quality would be highly localised it is considered that no cumulative impact effects are likely to occur. The cumulative impact to human health is therefore considered to remain the same and is of **minor adverse** significance for scenario 1 and **minor adverse** significance for scenario 2.

18.3.2 Cumulative Impact 2: Impact to Groundwater Quality of Aquifers, Including Source Protection Zones During Construction Stage Activities

14. Under Scenario 2 as there would be separate construction periods (with separate mobilisation, demobilisation, installation of compounds and haul road) there would be a greater likelihood for accidental discharges therefore, scenario 2 is considered the worst case scenario. Given the embedded mitigation measures and considering that any alteration to land quality would be highly localised it is considered that no cumulative impact effects are likely to occur. The cumulative impact to aquifers are therefore considered to remain the same and is of **minor adverse** significance for scenario 1 and **minor adverse** significance for scenario 2.

18.3.3 Cumulative Impact 3: Impact to Groundwater Quality of the Principle Aquifer Including Source Protection Zones from HDD and Piling

15. Under scenario 1 and scenario 2 the impacts from piling and HDD will remain the same. Given the embedded mitigation measures and considering that the alteration in HDD requirements and piling will likely be limited under the two scenarios the two development scenarios are considered similar. Therefore, the impact to principle aquifers will remain the same and is considered to be **minor adverse** significance for scenario 1 and **minor adverse** significance for scenario 2.

18.3.4 Cumulative Impact 4: Impact on Surface Water Quality from Direct and Indirect Release of Contamination to Surface Water Bodies

16. Under scenario 1 and scenario 2 the impacts from accidental release of contaminants during construction via the disturbance of existing potential contaminant sources will remain the same under both scenarios. The avoidance of potential contaminant sources and the proposed embedded mitigation methods would minimise the overall impacts of either scenario.

17. Under scenario 1 and scenario 2 the impacts from piling and HDD will remain the same. Given the embedded mitigation measures, and considering that the alteration in HDD requirements and piling will likely be limited under the two scenarios, the two development scenarios are considered similar. Therefore, the impact to principle aquifers will remain the same and is considered to have **minor adverse** significance.

18.3.5 Cumulative Impact 5: Impact to Strategic Mineral Resources

18. Under scenario 2 there is an increased impact to strategic mineral resources. Additional area will be utilised and there would be an increase in the potential loss of strategic resource through mineral sterilisation of different areas. This would likely cause the impact to be major adverse. With the application of current embedded mitigation and additionally the requirement for a materials management plan (MMP) (under the proposed East Anglia ONE North project) and an assessment of local mineral resource the impact would be reduced. Additional mitigation would also be identified once detailed design is completed and the exact nature of the cumulative impacts is known, therefore reducing the impact to **minor adverse** significance (assuming no avoidance).

18.4 Cumulative Impact Assessment during Operation

19. Operational impacts were scoped out of the assessment, as agreed with stakeholders and stated in the Scoping Report (SPR 2017).

18.5 Summary

20. ***Table A18.3*** gives an overarching summary of which of the two construction scenarios, detailed above, will be the realistic worst case in terms of impacts relating to ground conditions and contamination.

Table A18.3 Summary of Scenario 1 and Scenario 2 Realistic Worst Case Assumptions

Impact	Worst Case	Notes
Impact 1: Impacts to human health, including construction workers and public during construction	N/A	Under Scenario 1 or Scenario 2 the assessment of impacts does not change. The cumulative effects to human health and land quality are likely to be impacted in the same manner, and is minor adverse
Impact 2: Impacts to groundwater quality of aquifers, including source protection zones during construction stage activities	N/A	Cumulative impact remains the same under both scenarios; minor adverse.
Impact 3: Impact to groundwater quality of the principle aquifer including source protection zones from HDD and piling	N/A	Cumulative impact remains the same under both scenarios; minor adverse.
Impact 4: Impact on surface water quality from direct and indirect release of contamination to surface water bodies	N/A	Cumulative impact remains the same under both scenarios; minor adverse
Impact 5: Impact to strategic mineral resources	Scenario 2	Under scenario 2 additional area will be utilised and there would be an increase in the potential loss of strategic resource through mineral sterilisation of different areas.

21. Overall, construction scenario 2 creates a realistic worst case in terms of impacts to ground conditions and contamination. Therefore, scenario 2 will be carried through into the wider CIA with other developments, see ***section 18.7*** in ***Chapter 18 Ground Conditions and Contamination.***