Royal HaskoningDHV
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Norfolk Boreas Offshore Wind Farm

Consultation Report

Appendix 9.10 Norfolk Vanguard Air Quality outgoing documents

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Norfolk Vanguard Offshore Wind Farm

Environmental Impact Assessment

Air Quality Method Statement

Document Reference: PB4476-003-031

Author: Royal HaskoningDHV
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Client: Vattenfall Wind Power Ltd

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This method statement has been prepared by Royal HaskoningDHV on behalf of Vattenfall Wind Power Limited (VWPL) in order to build upon the information provided within the Norfolk Vanguard Environmental Impact Assessment (EIA) Scoping Report. It has been produced following a full review of the Scoping Opinion provided by the Planning Inspectorate. All content and material within this document is draft for stakeholder consultation purposes, within the Evidence Plan Process.

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1 INTRODUCTION

1. The purpose of this method statement is to build upon the information provided within the Norfolk Vanguard Environmental Impact Assessment (EIA) Scoping Report, in outlining the proposed approach to be taken and considerations to be made in the assessment of air quality effects of the proposed development.

2. This Environmental Impact Assessment air quality method statement has been informed by the Scoping Opinion provided by the Planning Inspectorate.

1.1 Background

3. A Scoping Report for the Norfolk Vanguard Environmental Impact Assessment (EIA) was submitted to the Planning Inspectorate on the 3rd October 2016. Further background information on the project can be found in the Scoping Report which is available at:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-000022-Scoping%20Report.pdf

4. The Scoping Opinion was received on the 11th November 2016 and can be found at:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-000018-Scoping%20Opinion.pdf.

1.2 Norfolk Vanguard Programme

5. This section provides an overview of key milestone dates for Norfolk Vanguard.

1.2.1 DCO Programme

- Scoping Request submission - 03/10/16 (complete)
- Preliminary Environmental Information submission - Q4 2017
- Environmental Statement and DCO submission - Q2 2018

1.2.2 Evidence Plan Process Programme

6. The Evidence Plan Terms of Reference (Royal HaskoningDHV, 2017) provides an overview of the Evidence Plan Process and expected logistics, below is a summary of anticipated meetings:

- Steering Group meeting -21/03/16 (complete)
- Steering Group meeting - 20/09/16 (complete)

- Post-scoping Expert Topic Group meetings - Q1 2017
  - Discuss method statements and Project Design Statement
- Expert Topic Group and Steering Group meetings as required - 2017
  - To be determined by the relevant groups based on issues raised
- PEIR Expert Topic Group and Steering Group meetings - Q4 2017/ - Q1 2018
  - To discuss the findings of the PEI (before or after submission)
- Pre-submission Expert Topic Group and Steering Group meetings - Q1/Q2 2018
  - To discuss updates to the ES following PEI consultation

2 PROJECT DESCRIPTION

2.1 Site Selection Update

7. Further to the site selection information provided within the Norfolk Vanguard Scoping Report (Royal HaskoningDHV, 2016), additional site selection work has been undertaken to refine the locations of the onshore infrastructure. The Norfolk Vanguard EIA Scoping Report identified search areas for the onshore infrastructure which were identified following constraints mapping to avoid or minimise potential impacts (e.g. noise, visual, landscape, traffic, human health and socio-economic impacts). Further data review has been undertaken to understand the engineering and environmental constraints within the search areas identified. The public drop-in-exhibitions in October 2016 and Scoping Opinion have also contributed to our broader understanding of local constraints and opportunities, feeding into the ongoing site selection and development of the EIA strategy. The project areas shown in Figure 1 are a draft for stakeholder consultation only and are provided in confidence. Equivalent information will be presented during open drop-in-exhibitions in March 2017, providing an opportunity for local people and the wider public to understand the way in which their feedback, as well as the Scoping Opinion and has influenced our design. Given the broad range and complexity of the factors influencing site selection and the scale of the area under discussion, it is our intention that local people and interested parties view the map for the first time, with Vattenfall and suitably qualified experts on hand. This enables a meaningful discussion of the proposed options and enables participants to refer directly to points of reference they may wish to discuss. During the March drop-in exhibitions, participants will also be invited to provide feedback on the latest design.

8. There are currently three landfall options with associated cable relay station search zones as well as an onshore substation search zone in proximity to the existing Necton 400kV National Grid substation (the grid connection point). A 200m wide cable corridor has been identified, within which the cable route will be located (see cable route parameters in Section 2.2.1). Ongoing public and stakeholder consultation as well as initial EIA data collection will be used to inform selection of final locations for the EIA and DCO application, with the aim to further avoid sensitive areas. Impacts that cannot be avoided through site selection will aim to be reduced through sensitive siting, alternative engineering solutions (mitigation by design) and additional mitigation measures where possible. Mitigation options will be developed in consultation with stakeholders.

2.1.1 Landfall Zones

9. The landfall search area was presented in the Scoping Report as Figure 1.3. This has been refined to three landfalls options (Zone 8), Bacton Green, Walcott Gap and Happisburgh South, following studies on the engineering feasibility of horizontal directional drilling (HDD). The two northern landfalls have the advantage that related onshore infrastructure (the cable relay station) could be placed close to the existing Bacton gas terminal in what is already an industrialised area thereby reducing landscape impacts, a preference stated by many at the public drop-in exhibitions. Discussions with the owners and operators of the gas terminal will inform the final landfall location.

10. Both northern options would require offshore cabling through the Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ) and concerns have been expressed by members of the public and a number of statutory authorities about impacts on the MCZ. Information from the offshore cable corridor geophysical and benthic survey from within the Cromer Shoal Chalk Beds MCZ will be reviewed to understand the extent of designated features and therefore the feasibility of installing offshore cables. Data on coastal erosion, including estimates of coastline movement over the life time of the wind farm, and the likelihood of archaeological finds, will be reviewed to understand the feasibility of a landfall south of Happisburgh. This site is outside the MCZ but siting the required onshore infrastructure within a rural location would require careful consideration.

2.1.2 Cable Relay Station Options

11. The cable relay station search area was presented in the Scoping Report as Figure 1.6. Refined search zones (Zone 7) have been defined based on the initial constraints mapping work, the updated landfall site selection and initial consultation. A number of receptors and impacts have been considered during the selection of the scoping search area and the refined search zones, particularly noise and visual impacts, ecology traffic, human health and socio-economic impacts. As with the landfall location, discussions with the owners of the gas terminal will inform the final landfall location.

2.1.3 Onshore Cable Route

12. The onshore cable corridor search area was presented in the Scoping Report (Royal HaskoningDHV, 2016) as Figure 1.5. The route shown on Figure 1 (Zone 4) is considered to be the shortest possible route (thereby minimising disturbance impacts) whilst also aiming to avoiding main residential areas and impacts to landscape and nature conservation designations where possible.

13. Routes in the north of the scoping search area were discounted owing to the presence of existing gas pipelines and the cables from the Dudgeon Offshore Wind Farm which significantly affected the number of complex crossings that would be required. The proposed route skirts around the main towns of North Walsham, Aylsham, Reepham and Dereham. The route corridor is currently 200m wide thereby allowing for further micro-siting following feedback from the public drop-in-exhibitions planned for March 2017 and information from planned survey work.

2.1.4 Substation Zone

14. The onshore substation search area, comprising five sectors, was presented in the Scoping Report (Royal HaskoningDHV, 2016) as Figure 1.4. Public consultation during the drop-in exhibitions indicated Sector 5 (to the south of the existing Necton 400kV National Grid substation) and Sector 1 (to the east) would be the best options in this location.

15. Sectors 2, 3 and 4 were discounted due to the proximity of the residential areas of Necton, Little Dunham, Great Fransham and Little Fransham.

16. Sector 1 was maintained as an option due to the existing woodland and topography of this area which could provide screening (in addition to project screening mitigation) which may limit visual impacts. Additional access would however be required for this sector.

17. Sector 5 was maintained as an option on the basis of keeping all existing and proposed development together, the lack of housing in this sector and good access from the A47. However concerns were raised regarding the ongoing industrialisation of the area.

18. The refined substation search zone (Zone 3) includes the parts of Sectors 1 and 5, south of the A47 and south of the existing overhead line.

19. A search area for underground cables has also been delineated (the western end of Zone 4) which is required to connect the substation located within Zone 3 to the existing Necton 400kV National Grid substation.

2.1.5 Extension to the Existing Necton 400kV National Grid Extension

20. Since completion of the Norfolk Vanguard EIA Scoping Report (Royal HaskoningDHV, 2016) a decision has been made by the VWPL to include the required extension works to the existing Necton 400kV National Grid substation within the EIA and DCO application for Norfolk Vanguard. The aim of this approach is to enable a more transparent impact assessment and allow the development of more effective mitigation.

21. Appropriate search zones for the extension works have been developed in consultation with National Grid, including:

- Zone 1 - Land adjacent to the existing substation which could accommodate extension to the existing busbars (see Section 2.2.1.5).
- Zone 2 - Land where overhead line realignment works maybe required adjacent to the existing National Grid substation (see Section 2.2.1.5).

22. VWPL will work closely with National Grid to ensure the design of the extension works is appropriate.

2.1.6 Norfolk Boreas

23. Since completion of the Norfolk Vanguard EIA Scoping Report (Royal HaskoningDHV, 2016) a grid connection agreement has been granted by National Grid for Norfolk Boreas at the existing Necton 400kV National Grid substation. Therefore the Norfolk Vanguard EIA will include the option for Norfolk Boreas cable ducts to be installed at the same time as Norfolk Vanguard.

2.2 Indicative Worst Case Scenarios

24. The following sections set out the indicative worst case scenarios for air quality. The PEIR/ES will provide a detailed Project Description describing the final Rochdale envelope for the Norfolk Vanguard DCO application. Each chapter of the PEIR/ES will define the worst case scenario arising from the construction, operation and decommissioning phases of the Norfolk Vanguard project for the relevant receptors and impacts. Additionally, each chapter will consider separately the anticipated cumulative impacts of Norfolk Vanguard with other relevant projects which could have a cumulative impact on the receptors under consideration.

2.2.1 Infrastructure Parameters

25. Two export schemes are being considered for Norfolk Vanguard, a High Voltage Alternating Current (HVAC) and a High Voltage Direct Current (HVDC) scheme. The decision as to which option will be used for the project will be agreed post consent and will depend on availability, technical considerations and cost. Both electrical solutions will have implications on the required onshore infrastructure. Typically the HVAC scenario involves a greater area of land take and additional infrastructure, and as such the HVAC scenario is assumed as the worst case in the remainder of this section. Where the worst case assumes the HVDC scenario, this is stated in the text.

26. The following key onshore project parameters are considered:

- Landfall (Horizontal Directional Drilling (HDD) and associated compounds);

- Cable relay station if required (HVAC only) within the cable relay station search zones;
- Cable corridor (with associated construction compounds and mobilisation areas);
- Onshore substation (within the substation search zone); and
- Extension to the existing Necton 400kV National Grid Substation, including overhead line modification.

27. There is an option for the cable ducts for Norfolk Boreas, (the sister project to Norfolk Vanguard) to be constructed and installed simultaneously with Norfolk Vanguard within a single cable corridor (see parameters in Section 2.2.1.3). Therefore this scenario will be considered within the Norfolk Vanguard EIA as associated development as part of the DCO application. There is also the scenario that the ducts for Norfolk Boreas cannot be installed at the same time as Norfolk Vanguard and therefore the scenario where Norfolk Boreas ducts are installed as part of a separate project will be considered within the Cumulative Impact Assessment (CIA), together with the parameters of Norfolk Vanguard described above.

28. All other components of Norfolk Boreas will be considered as part of the Norfolk Vanguard CIA.

2.2.1.1 Landfall

29. There are three potential landfall locations for Norfolk Vanguard:

- Bacton Green;
- Walcott Gap; and
- Happisburgh South.

30. Initial survey and data collection for the EIA will enable the selection of the landfall location for Norfolk Vanguard. Therefore the approach to baseline characterisation will initially consider all options and will then be refined once a final landfall location is selected. The PEIR and ES will present a single landfall option.

31. The Norfolk Vanguard offshore cables will be jointed to the onshore cables on the landward side of the landfall site. Cable ducts would be installed at the landfall so that the ends of the offshore cables can be pulled through to this joint location. These will be installed using Horizontal Directional Drilling (HDD) which is a trenchless installation technique. The HDD will exit at one of the following two locations:

- On the beach, above the level of mean low water spring (classified as “short HDD”).

- At an offshore location, away from the beach (up to 1000m in drill length) (classified as “long HDD”).

32. A total of 6 ducts for the HVAC option or 2 ducts for the HVDC option would be required at the landfall for Norfolk Vanguard.

33. Temporary footprint of works will be up to 3000m^2, of which up to 900m^2 (6 transition pits, based on the HVAC option) will involve excavation for Norfolk Vanguard.

34. If Norfolk Boreas cable ducts are installed concurrently with the Norfolk Vanguard ducts, the Norfolk Boreas ducts will be installed up to the joint pits on the landward site of the landfall works. No landfall works (e.g. transition pits, HDD works) will be undertaken for Norfolk Boreas and therefore the landfall works for Norfolk Boreas do not form part of the Norfolk Vanguard DCO and will be considered in the CIA (see Section 2.2.5).

2.2.1.2 Cable Relay Station

35. A Norfolk Vanguard cable relay station is required for a HVAC electrical solution only and would not be included in a HVDC connection solution. Therefore the HVAC option is the worst case scenario for this onshore infrastructure.

36. The cable relay station accommodates the reactive compensation equipment required to compensate the capacitive losses generated by long HVAC power cables, and will be located near to the landfall.

37. There are currently seven cable relay station search zones being considered and a final location will be defined following landfall site selection for the EIA and DCO application. The PEIR and ES will present a single cable relay station location.

38. Key parameters:

- There will be a maximum temporary loss of habitat of 15000m^2 during construction of the cable relay station.
- The operational area of the cable relay station will be approximately 10,500m^2.

2.2.1.3 Cable Route

39. There are several potential scenarios for the cable easement:

- Norfolk Vanguard HVDC: This would require a 35m temporary strip during construction, and a 13m permanent strip (including 8m access) during operation.

- Norfolk Vanguard HVAC: This would require a 50m temporary strip during construction, and a 25m permanent strip (including 8m access) during operation.
- Norfolk Vanguard and Norfolk Boreas HVDC: This would require a 45m temporary strip during construction, and a 20m permanent strip with (including 8m access) during operation.
- Norfolk Vanguard and Norfolk Boreas HVAC: This would require a 100m temporary strip during construction, and a 54m permanent strip (including two separate 8m access tracks and 6m separation between circuits) during operation.

40. The Norfolk Vanguard EIA worst case scenario for the cable route will be where ducts for Norfolk Vanguard and Boreas are installed concurrently using the HVAC scenario, due to the larger land-take required for this option, and associated earthworks and traffic movements.

41. The length of the onshore cable route will be approximately 60km.

2.2.1.4 Onshore Substation

42. The HVDC substation will be taller than the HVAC substation (both options have a construction area of 400m x 400m and a footprint of 250m x 300m), therefore it is anticipated that the volume of buildings to be constructed will be larger. The HVDC option therefore represents the worst case scenario, as there will be greater construction works required.

2.2.1.5 National Grid substation extension

43. An extension to the existing Necton 400kV National Grid substation will be required regardless of whether the HVAC or HVDC option is selected and will form part of the PEIR and EIA assessment.

44. The existing National Grid substation busbar would be extended in an east west direction with seven additional Air Insulation Switchgear (AIS) bays for Norfolk Vanguard.

45. The extension to the existing Necton 400kV National Grid substation for Norfolk Vanguard and Norfolk Boreas combined would require a further busbar extension and five further AIS bays for Norfolk Boreas. This extension to the Necton 400kV National Grid substation will be included in the Norfolk Vanguard DCO and EIA.

46. Re-configuration of overhead lines to change the arrangements of the 400kV circuits in close proximity to the substation would also be required.

2.2.2 Construction Programme

47. The HVAC option is based on a three phase development programme which would take a total of seven years (2020-2026), while the HVDC option is based on a two phase development programme which would take a total of six years (2020-2025). Both programmes include two years of enabling works during 2020 and 2021, consisting of road modifications, hedge and tree removal, preconstruction drainage, mobilisation area establishment and major crossing construction.

48. Duct installation for the landfall and onshore cable and primary works for the substation and cable relay station are due to take place during 2022 and 2023. The installation of the onshore cables will occur in phases in parallel with the commissioning of the phases of the offshore wind farm. In the HVAC programme, the cable and electrical plant installation and commissioning will take place over three years from 2024 to 2026. In the HVDC programme, installation and commissioning will take place over 2 years, from 2024 to 2025.

49. Construction and decommissioning works will not take place continuously in all locations during the proposed construction time. Construction activity along the onshore cable route will move along the route, between different sections and activity will be phased, with the trenching and laying of ducts taking place first, followed by the cable installation.

50. The construction period for the cable relay station and substation is expected to be approximately 18 months.

51. The worst case scenario for the construction programme would occur if the HVAC connection arrangement is utilised, as a longer construction phase is required.

2.2.3 Operation and Maintenance (O&M) Strategy

52. O&M activities were scoped out of the assessment, as agreed by the Planning Inspectorate in the Scoping Opinion.

2.2.4 Decommissioning

53. No decision has been made regarding the final decommissioning policy for the substation and cable relay station, as it is recognised that industry best practice, rules and legislation change over time. However, the substation and cable relay station equipment will likely be removed and reused or recycled. It is expected that the onshore cables will be removed from ducts and recycled, with the joint pits and ducts 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.

2.2.5 Cumulative Impact Scenarios

2.2.5.1 Norfolk Boreas

54. If Norfolk Boreas uses the same landfall as Norfolk Vanguard, a total of 12 ducts would be required at the landfall (under the worst case HVAC electrical solution). The Happisburgh South landfall site is the only landfall option which can accommodate 12 ducts.

55. The following landfall scenarios for Norfolk Vanguard and Norfolk Boreas are currently being considered:

- HVDC - Landfalls for Norfolk Vanguard and Norfolk Boreas at Bacton Green (4 ducts in total)
- HVDC - Landfalls for Norfolk Vanguard and Norfolk Boreas at Walcott Gap (4 ducts in total)
- HVDC - Landfalls for Norfolk Vanguard and Norfolk Boreas at Happisburgh South (4 ducts in total)
- HVAC North - Landfall for Norfolk Vanguard at Bacton Green (6 ducts) with Norfolk Boreas at Walcott Gap (additional 6 ducts); or
- HVAC South - Landfall for Norfolk Vanguard and Norfolk Boreas at Happisburgh South (12 ducts)

56. As discussed in Section 2.2.1, initial data collection for the Norfolk Vanguard EIA will enable selection of the landfall location for Norfolk Vanguard which will also inform the site selection for Norfolk Boreas. Final landfall locations for Norfolk Vanguard and Norfolk Boreas will be confirmed in the Norfolk Vanguard PEIR and EIA. The options of HVAC and HVDC will be retained in the Norfolk Vanguard EIA and DCO application. Due to the greater number of ducts, an HVAC option will represent the worst case scenario.

57. The Norfolk Boreas cable relay station (only required under the HVAC scenario) will be located within one of the cable relay station search zones shown for Norfolk Vanguard. The Norfolk Vanguard and Norfolk Boreas cable relay stations may be co-located or at separate locations, subject to the landfall site selection. Final cable relay station site locations will be known for the Norfolk Vanguard PEIR and EIA. The cable relay stations for Norfolk Vanguard and Norfolk Boreas will be constructed separately, although construction periods could overlap. The footprint of the Norfolk Boreas cable relay station will be the same as described for Norfolk Vanguard in Section 2.2.1.

58. The CIA for Norfolk Boreas cable installation includes the following scenarios:

- Ducts for Norfolk Boreas are pre-installed during Norfolk Vanguard construction with cable pull through required during Norfolk Boreas construction;
  - Norfolk Boreas duct installation will be assessed in the project impact assessments for Norfolk Vanguard;
  - The cable pull through for Norfolk Boreas will be considered as part of the Norfolk Vanguard CIA); or
- Norfolk Boreas ducts and cables are installed at a separate time to Norfolk Vanguard.
  - This scenario will be considered in the Norfolk Vanguard CIA, together with the parameters of Norfolk Vanguard alone.

59. The Norfolk Boreas substation will be located in the substation search zone shown for Norfolk Vanguard but will be constructed separately, although Norfolk Vanguard and Norfolk Boreas construction periods could overlap. The footprint of the Norfolk Boreas substation will be the same as those described for Norfolk Vanguard (Section 2.2.1).

60. As discussed in Section 2.2.1, the extension to the existing Necton 400kV National Grid substation for Norfolk Boreas would be done concurrently with Norfolk Vanguard under the Norfolk Vanguard DCO and therefore this is considered as part of the Norfolk Vanguard EIA.

2.2.5.2 Other Projects

61. Construction and commissioning of the substation for the Dudgeon Offshore Wind Farm is complete and operation is due to commence electrification in 2017. It is not anticipated that there will be any operational phase air quality impacts as a result of the Dudgeon Offshore Wind Farm; as the wind farm will be completed prior to commencement of construction of Norfolk Vanguard, there are not anticipated to be any cumulative air quality impacts and this is scoped out of the CIA.

62. The cable corridor for the Hornsea Project 3 Offshore Wind Farm makes landfall at Weybourne with grid connection at Norwich Main. Where the Hornsea Project 3 cable corridor crosses the Norfolk Vanguard cable corridor, there will be potential cumulative impacts on Air Quality and this will be assessed in the CIA.

63. Other developments (such as housing and roads) will be considered in the CIA. CIA screening will be undertaken in consultation with stakeholders.

3 BASELINE ENVIRONMENT

3.1 Desk Based Review

64. A desk-based review was undertaken to determine the air quality baseline along the cable route. Monitoring data were obtained from the following Local Authority websites for use in the method statement:

- North Norfolk District Council (NNDC);
- Broadland District Council (BDC);
- Breckland Council (BC); and,
- Norwich City Council(NCC).

65. The maximum extent of the road traffic study area covers an additional four Local Authorities:

- Great Yarmouth District Council (GYDC);
- South Norfolk District Council (SNDC);
- Waveney District Council (WDC); and,
- Kings Lynn and West Norfolk District Council (KLWNDC).

66. Baseline monitoring data will be obtained if detailed assessment is required within these Local Authority areas.

67. The monitoring locations identified with the study area are detailed in **Figure 1**.

3.1.1 Available Data

68. The most recent air quality monitoring data available from the NNDC website were provided in the 2013 Air Quality Progress Report (NNDC, 2013). The 2013 Progress Report stated that monitoring undertaken by NNDC is concentrated within Hoveton, which is located on the boundary of the maximum extent of the study area. NNDC has identified an air quality hotspot around the junction of the A1151 Norwich Road and Station Road with regard to the annual mean NO_2 Objective. However, a statutory Air Quality Management Area (AQMA) has not been designated. Results of recent NO_2 monitoring from Hoveton are provided in **Table 1.** Exceedance of the annual mean Objective is shown in bold text.

Table 1: Annual Mean NO_2 Monitoring Undertaken by NNDC

Site	Monitored Annual Mean NO_2 Concentration ($\mu g.m^{-3}$)				
	2008	2009	2010	2011	2012
Hoveton 10a	38.14	33.85	**45.47**	32.07	**47.04**
Hoveton 10b	35.41	34.83	**44.60**	31.83	-
Hoveton 10c	33.87	31.60	**44.72**	30.50	37.38
Hoveton 1	-	-	-	33.87	37.96
Hoveton 2	-	-	-	34.46	37.58

Site	Monitored Annual Mean NO_2 Concentration ($\mu g.m^{-3}$)				
	2008	2009	2010	2011	2012
Hoveton 3	-	-	**56.70**	23.21	28.94
Hoveton 4	-	-	39.03	20.11	24.95
Hoveton 5	-	-	**53.99**	27.56	35.32
Hoveton 6	-	-	32.18	31.52	**41.03**
Hoveton 11	14.31	12.49	20.45	18.07	14.70
Hoveton Continuous Analyser	-	-	-	27.05	25.74

- Data were not available

69. As detailed in **Table 1**, annual mean NO_2 concentrations in Hoveton were in exceedence of the Objective in some locations, particularly in 2010; however, there was a large fluctuation in monitored concentrations at diffusion tubes between 2009 and 2012. Data recorded at the continuous analyser showed consistent results in 2011 and 2012.

70. BDC does not undertake automatic air pollution monitoring, however diffusion tube monitoring is undertaken at 16 locations in the district, mainly focussed in the south in Hellesdon, Burlingham and Wroxham. Recent monitoring data within the study area, up to 2014, undertaken by BDC was obtained from the 2015 Updating and Screening Assessment from BDC's website (BDC, 2015), and is presented in **Table 2**.

Table 2: Annual Mean NO2 Monitoring Undertaken by BDC

Site ID	Location	Monitored Annual Mean NO_2 Concentration ($\mu g.m^{-3}$)				
		2010	2011	2012	2013	2014
BN1	**A47 N Burlingham**	30.0	32.5	35.6	33.7	30.8
BN2	**Norwich Rd, Acle**	21.0	22.5	24.3	23.5	21.6
BN3	**Cox Hill, Beighton**	14.0	15.4	14.7	17.9	16.5
BN7	**Heath Crescent, Hellesdon**	16.0	16.6	16.1	15.8	15.5
BN11	**21 Reepham Rd, Hellesdon**	20.0	35.3	38.6	34.5	34.3
BN12	**10A Boundary Rd, Hellesdon**	32.0	31.2	36.4	33.8	33.5
BN13	**214 Mile Cross Ln, Hellesdon**	n/a	27.4	30.4	27.0	25.8
BN14	**Berrington Road, Hellesdon**	n/a	30.9	25.2	24.7	17.6
BN15	**Library Wroxham**	n/a	20.9	23.8	22.3	21.7
BN16	**The Avenues, Wroxham**	n/a	20.0	21.9	20.5	19.2

71. As detailed in **Table 2**, annual mean NO_2 concentrations were below the Objective at all monitoring locations in the study area in 2010 – 2014.

72. BDC undertakes automatic and diffusion tube monitoring within its area of jurisdiction. The only monitoring undertaken within the maximum extents of the study area is at two diffusion tubes in Dereham. Recent monitoring data were obtained from the 2016 Annual Status Report (BC, 2016).

Table 3: Annual Mean NO_2 Monitoring Undertaken by BC

Site ID	Location	Monitored Annual Mean NO_2 Concentration ($\mu g.m^{-3}$)				
		2011	2012	2013	2014	2015
D1	Dereham	26.03	31.25	36.82	35.44	33.86
D2	Dereham	13.97	18.20	20.24	28.55	27.78

73. As detailed in **Table 3,** annual mean NO_2 concentrations were below the Objective at both monitoring locations in the study area in 2011 – 2015.

74. Following a review of its latest Local Air Quality Management report (NCC, 2015), Norwich City Council does not undertake any air pollution monitoring within the study area; monitoring is focussed within the city centre statutory designated AQMA which is bordered by the inner ring road. This area is not anticipated to experience increases in project development-generated traffic.

3.1.2 Designated sites

75. There are a number of designated ecological sites within the study area, which may contain features that are sensitive to nutrient nitrogen and NOx deposition. Where possible, Norfolk Vanguard site selection has avoided these designated sites. Consideration will be given to potential impacts on designated sites within the study area. These will be identified in the Onshore Ecology PEIR/ES Chapter and the potential inter-relationships will be assessed.

3.2 Planned Data Collection

76. Sufficient Local Authority air quality monitoring data is are available for use in the air quality assessment and therefore a site-specific monitoring survey will not be undertaken. This was agreed by the Planning Inspectorate. The latest available monitoring data will be obtained during consultation.

3.3 Sensitive Receptors

77. As the width and precise locations of the landfall, cable route, construction laydown areas, substation and cable relay station are not yet defined, identification of specific sensitive receptors could not be undertaken at this stage. However, the following receptors will be considered in the assessment:

- Human receptor locations sensitive to dust within 350m of proposed construction phase activities;
- Receptors sensitive to air pollution situated within 200m of the road network to be utilised by construction traffic;

- Ecological receptor locations sensitive to dust within 50m of the proposed construction phase activities; and,
- Ecological receptor locations within 200m of roads affected by the proposed development.

78. The maximum extents of the study area, for the construction phase dust assessment and road traffic emissions assessment, showing the spatial distribution of receptors, are detailed in **Figure 2** and **Figure 3.**

79. It should be noted that not all road links within the study area shown in **Figure 3** will be affected by traffic associated with Norfolk Vanguard project. Those links which are expected to receive additional traffic during the construction of the project will be screened as part of the air quality assessment and a detailed assessment will be undertaken for those links that exceed the screening criteria.

4 IMPACT ASSESSMENT METHODOLOGY

4.1 Defining Impact Significance

80. Air quality guidance identifies specific methodologies for assessing the significance of impacts associated with construction dust and fine particulate matter, and road traffic exhaust emissions. These approaches differ from the standard EIA significance methodology, and are detailed below.

4.1.1 Construction Dust and Fine Particulate Matter

81. The potential effects of the construction phase on nearby receptors are associated with dust soiling onto buildings and cars and people's exposure to airborne dust and fine particulate matter. The Institute of Air Quality Management (IAQM) guidance (IAQM, 2014) on assessing the significance of construction dust effects advises a risk-based approach, considering the scale of the activities and the sensitivity of the potential receptors. The guidance is applicable for standard construction activities, including construction and earthworks, and is therefore considered to be appropriate for the assessment of the potential for construction phase dust impacts associated with a development of this nature.

82. The dust emission magnitude is determined based on the scale of each construction activity to be undertaken. The sensitivity of the study area is determined based on the sensitivity of receptors and their proximity to the construction works. The dust emission magnitude and sensitivity of the area are then combined to determine the risk of effects prior to mitigation.

83. The IAQM recommends mitigation measures that are commensurate with the level of risk of the site. Once these are identified, the significance of construction phase effects can be determined. The aim is to prevent significant effects at receptors due to the implementation of effective mitigation, which is usually achievable.

4.1.2 Construction Phase Road Traffic Exhaust Emissions

84. In accordance with IAQM and EPUK guidance (IAQM and EPUK, 2015), the requirement for a detailed air quality assessment will be screened using the two-stage criteria approach detailed in the guidance.

85. The Stage 1 criteria are as follows:

- The development comprises 10 or more residential units or a site area of more than 0.5ha; or,
- The development has more than 1,000m^2 of floor space for all other uses or a site area greater than 1ha; coupled with either of the following:

- The development has more than 10 parking spaces; or,
- The development will have a centralised energy facility or combustion process.

86. If the above criteria are exceeded, then the screening should proceed to stage 2 and the following criteria should be applied:

- A change in Light Duty Vehicle (LDV) flows of more than 100 Annual Average Daily Traffic (AADT) within or adjacent to an AQMA, or more than 500 AADT elsewhere; or
- A change in Heavy Duty Vehicle (HDV) flows of more than 25 AADT within or adjacent to an AQMA or 100 AADT elsewhere.

87. If the stage 2 criteria are exceeded, a detailed air quality assessment should be undertaken for each road link exceeding the criteria.

88. Guidance is also provided by the IAQM and EPUK (IAQM and EPUK, 2015) to determine the significance of a development's impact on local air quality. **Table 4** details the impact descriptors at identified individual receptors that take account of the magnitude of changes in pollutant concentrations, and the concentration in relation to the air quality Objectives.

Table 4: IAQM and EPUK Impact Descriptors for Individual Receptors

Long Term Average Concentration at Receptor in Assessment Year	% Change in Concentration Relative to the Air Quality Assessment Level (AQAL)			
	1	2 - 5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109 of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Note: Figures are to be rounded up to the nearest round number. Any value less than 1% after rounding (effectively less than 0.5%) will also be described as "Negligible".

89. Further to the determination of the impact at individual receptors, IAQM and EPUK guidance (IAQM and EPUK, 2015) recommends that assessment is made of the overall significance of the impact of a development on local air quality. The overall significance will need to take into account the following factors:

- The existing and future air quality in the absence of the development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

90. The guidance also states that a judgement of the significance should be made by a competent professional who is suitably qualified. The air quality assessment and determination of the significance of the development on local air quality will be undertaken by experienced members of the IAQM.

4.2 Potential Impacts

4.2.1 Potential Impacts during Construction

4.2.1.1 Impact: Construction Dust and Fine Particulate Matter

91. Dust emitted by construction activities has the potential to affect nearby receptors, such as residential properties, through:

- Nuisance caused by soiling of surfaces; and,
- Effects on human health as a result of exposure to fine particulate matter.

4.2.1.2 Approach to assessment

92. Assessment of potential impacts associated with the construction phase will be undertaken in accordance with the IAQM guidance '*Guidance on the Assessment of Dust from Demolition and Construction'* (IAQM, 2014). Mitigation approaches to minimise generation of dust and fine particulate matter will be recommended where appropriate.

4.2.1.3 Impact: Construction Phase Road Vehicle Exhaust Emissions

93. There is the potential for exhaust emissions from road traffic generated during the construction phase to lead to impacts at receptors in the vicinity of the affected road network.

4.2.1.4 Approach to assessment

94. The development will be screened using the stage 1 and stage 2 criteria provided by the IAQM and EPUK (IAQM and EPUK, 2015) to determine whether a detailed air quality assessment is required.

95. Where the stage 2 criteria are exceeded, a detailed air quality assessment will be undertaken to consider potential impacts at receptors. The detailed assessment will incorporate each road link exceeding the stage 2 criteria.

96. If required, the detailed air quality assessment will be undertaken using the dispersion model ADMS-Roads. The assessment will consider the impact of construction phase-generated vehicle movements on NO_2 and particulate matter (PM_{10} and $PM_{2.5}$) concentrations at identified existing receptor locations adjacent to road links that exceed the stage 2 criteria. Changes in pollutant concentrations as a

result of the proposed development will be compared to significance criteria provided in IAQM and EPUK guidance (IAQM and EPUK, 2015).

97. The technical approach to the air quality assessment will be in accordance with Defra technical guidance (Defra, 2016).

98. Any detailed air quality assessment would utilise the latest available emission factors, mapped background pollutant concentrations and oxides of nitrogen (NOx) to NO_2 conversion factors provided by Defra.

99. Verification of the dispersion model will be undertaken where suitable monitoring data are available within the study area.

4.2.2 Potential Impacts during O&M

100. Operational phase air quality impacts were scoped out of the assessment, which was agreed by the Planning Inspectorate. Impacts associated with O&M were therefore not considered.

4.2.3 Potential Impacts during Decommissioning

101. There is the potential for nearby receptors to experience dust soiling and human health impacts as a result of decommissioning activities.

4.2.3.1 Approach to assessment

102. The programme for decommissioning is expected to be similar in duration to the construction phase. The detailed activities and methodology for decommissioning will be determined later within the project lifetime. A qualitative assessment will therefore be undertaken on the basis that it is anticipated that impacts during decommissioning would be similar to, or less than, those experienced during the construction phase. An EIA will be carried out ahead of any decommissioning works being undertaken.

4.2.4 Potential Cumulative Impacts

103. Onshore cumulative impacts will be considered as part of the EIA process. Any other project with the potential to result in impacts that may act cumulatively with Norfolk Vanguard will be identified during consultation as part of the EPP and following a review of available information (see Section 2.2.5). These projects will then be included in the CIA and therefore are scoped into the assessment.

104. The assessment would consider the potential for significant cumulative impacts to arise as a result of the construction, operation and decommissioning of Norfolk

Vanguard in the context of other developments that are existing, consented or at application stage, including Norfolk Boreas and Hornsea Project 3..

4.2.4.1 Impact: Construction Dust and Fine Particulate Matter

105. There is the potential for cumulative impacts associated with nearby developments, including the Norfolk Boreas project at landfall, the cable relay station, substation and the cable corridor (if Norfolk Boreas ducts are not installed concurrently with Norfolk Vanguard), and Hornsea Project 3 at receptors. These may occur where developments are located within 700m of each other, or in the case of Hornsea Project 3 where the cable routes cross, and the study areas will overlap.

4.2.4.2 Approach to assessment

106. A qualitative assessment will be undertaken to consider the potential for cumulative impacts, taking into account the distance to committed developments and the proposed mitigation measures and management plans.

4.2.4.3 Impact: Construction Phase Road Traffic Emissions Assessment

107. There is the potential for cumulative impacts to occur at receptors as a result of interactions with committed developments in the vicinity of the proposed development. It is not anticipated that there would be any cumulative traffic impact associated with Norfolk Boreas, as landfall works for Norfolk Boreas would be undertaken at a later date. There may be cumulative road traffic impacts associated with Hornsea Project 3, where there is overlap in road links affected by the projects.

4.2.4.4 Approach to assessment

108. Where a detailed air quality assessment is required, traffic flow data utilised in the assessment will include traffic associated with committed developments within the study area, which will be agreed with the relevant stakeholders. These traffic flows will be included in the 'without development' and 'with development' scenarios, and therefore any cumulative impact of road traffic emissions will be considered in the assessment. The assessment will be undertaken using the methodology described in **Section 4.2.1.2.1**.

5 REFERENCES

Broadland District Council (BDC) (2015) Updating and Screening Assessment

Breckland Council (BC) (2016) Air Quality Annual Status Report

Department for the Environment Food and Rural Affairs (2016) 'Local Air Quality Management Technical Guidance Document (TG16)'

Institute of Air Quality Management (IAQM) (2014) Guidance on the Assessment of Dust from Demolition and Construction

IAQM & Environmental Protection UK (EPUK) (2015) Land-use Planning & Development Control: Planning for Air Quality

North Norfolk District Council (NNDC) (2013) Air Quality Progress Report

Norwich City Council (2015) Updating and Screening Assessment

Royal HaskoningDHV (2016). Norfolk Vanguard Offshore Wind Farm Environmental Impact Assessment Scoping Report

Royal HaskoningDHV (2017) Norfolk Vanguard Offshore Wind Farm: Evidence Plan Terms of Reference. Document Reference PB4476.001.004. Unpublished – Live Document