From:	Gemma Keenan
To:	Tracey Williams
Cc:	Norfolk Vanguard; Sian Evans; rebecca.sherwood@vattenfall.com; "ruari.lean@vattenfall.com"; Josh Taylor (josh.taylor@wbd-uk.com)
Subject:	Norfolk Vanguard - Email 18 of 18 Deadline 1 Submissions
Date:	16 January 2019 15:22:16
Attachments:	ExA_AS:10.D1.8B Norfolk Vanguard Additional Submission - Landfall Info Sheet.pdf ExA_AS:10.D1.8C Norfolk Vanguard Additional Submission - Substation Info Sheet.pdf ExA_AS:10.D1.8A Norfolk Vanguard Additional Submission - Happisburgh HDD Feasibility.pdf

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Dear Tracey

This is email 18 of 18 of the Applicant's submission for Norfolk Vanguard Examination Deadline 1.

We enclose the following documents:

- Norfolk Vanguard Additional Submission - Happisburgh HDD Feasibility
- Norfolk Vanguard Additional Submission - Landfall Info Sheet
- Norfolk Vanguard Additional Submission - Substation Info Sheet

Please could you kindly confirm receipt.

Best Regards

Gemma Keenan BSc, MIEMA, CEnv
Senior Environmental Consultant

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Norfolk Vanguard Offshore Wind Farm

Additional Submission

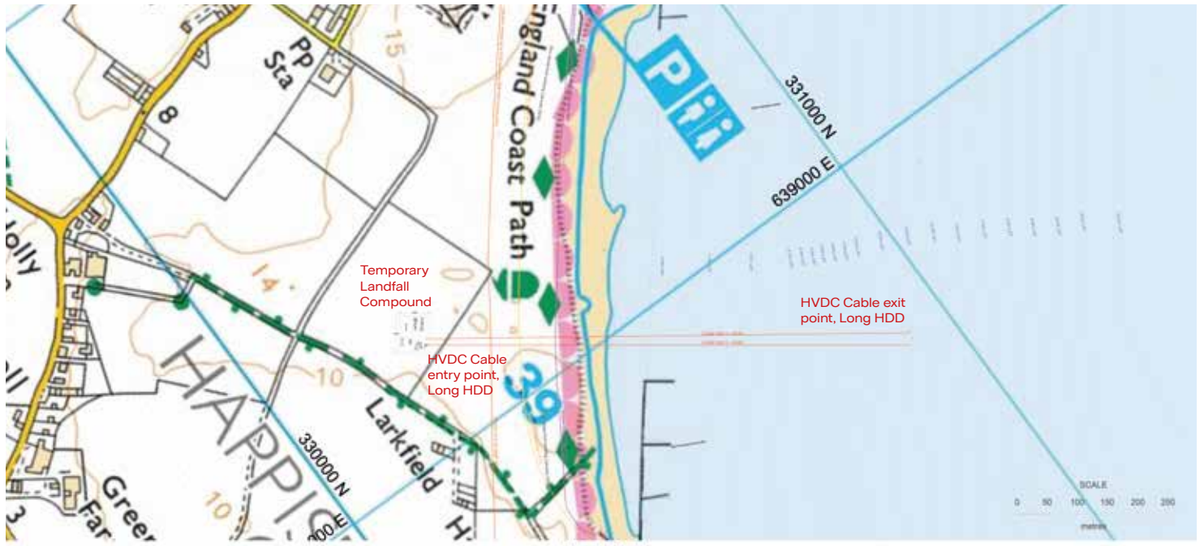
Landfall Information Sheet (Autumn 2018)

Applicant: Norfolk Vanguard Limited
Document Reference: ExA;AS;10.D1.7B
Deadline 1

Date: January 2019

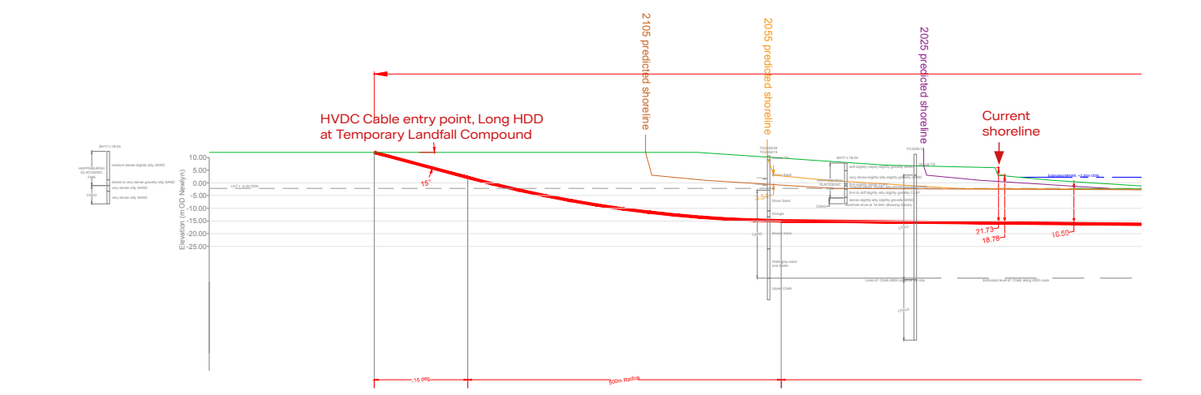
Photo: Kentish Flats Offshore Wind Farm

Indicative Landfall cross sections



PLAN VIEW

PLAN VIEW



Geological Cross section based on site investigation drilling at Happisburgh in Summer 2017. The Cromer Forest Bed was not encountered in these bore holes.

VATTENFALL

Landfall

Autumn 2018

What is landfall?

Landfall is the location along the project cable route where the offshore transmission cables carrying power from the wind turbines are brought ashore and link to the onshore cables. Following an extensive site selection process[1], the landfall for Norfolk Vanguard and Norfolk Boreas will be south of Happisburgh.

Summary Information:

Location – South of Happisburgh

Timescale – 20 weeks duct installation (2022/23), up to 16 weeks per cable installation phase (up to 2 phases – 2024/25)

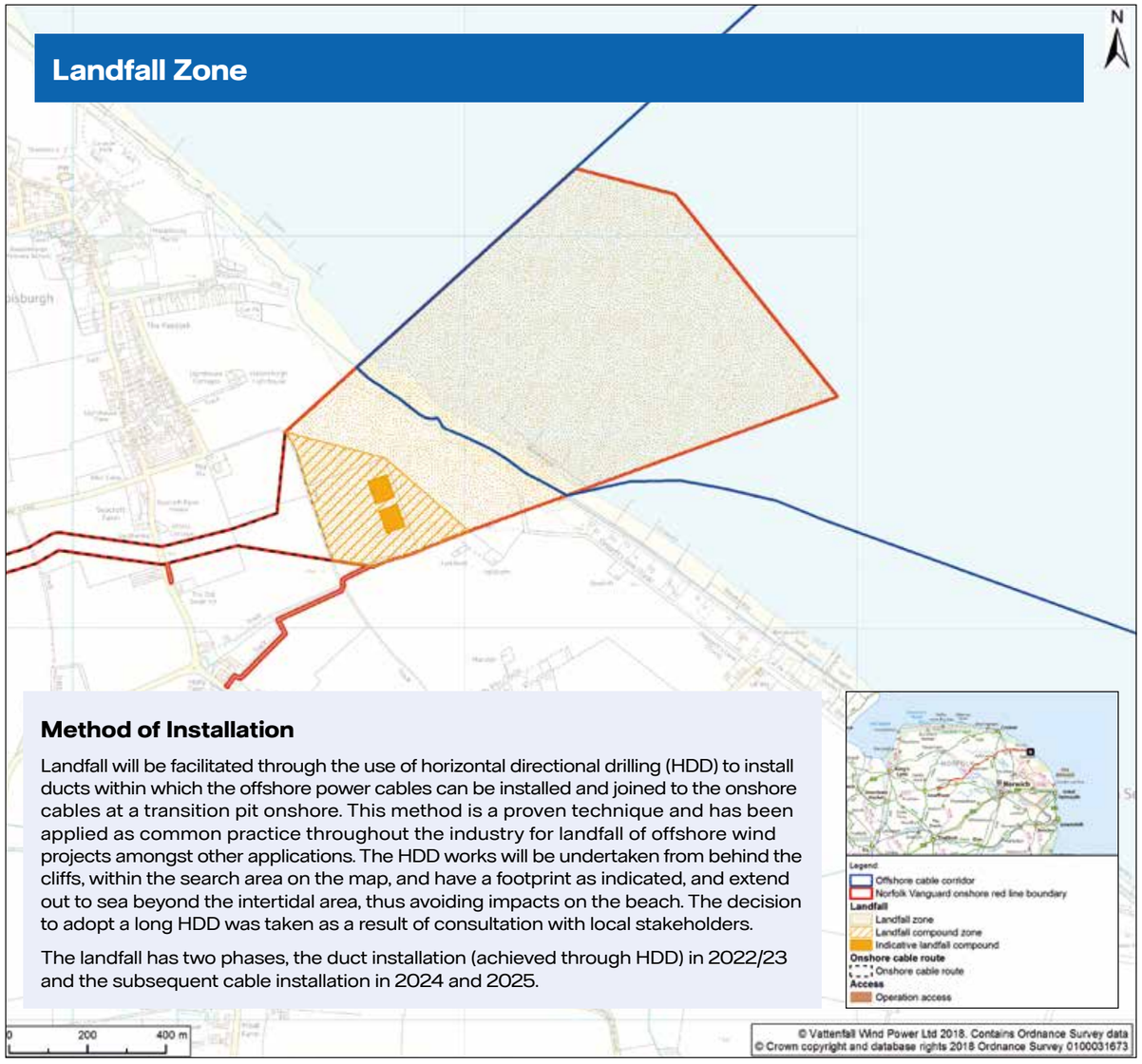
Access to landfall compound – using temporary running track from the junction of the onshore cable route with Whimpwell Street

Traffic – Approximately 3 HGVs per hour in the first and last week to allow for site setup and demobilisation, reducing to 0.3 HGV's per hour for the remaining 18 weeks. Approximately 10-20 personnel.

Example Horizontal Directional Drilling (HDD) Rig

Activity	Year					
	2020	2021	2022	2023	2024	2025
Landfall						
Duct Installation						
Cable Pull, Joint and Commission						
Phase 1						
Phase 2						

[1] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-001492-Chapter%2004%20Site%20Selection%20and%20Assessment%20of%20Alternatives%20Norfolk%20Vanguard%20ES.pdf



Duct Installation 2022/2023

1. A new temporary access will be created within the onshore cable route, from the public highway at the crossing of the onshore cable route and Whimpwell Street, to the landfall compound zone where a temporary landfall construction compound will be instated of dimensions 50m x 60m.
2. The HDD method involves:
    a. A pilot hole of small diameter to be drilled from the landfall compound to the exit point.
    b. The pilot hole being enlarged through multiple passes with reamers until the necessary diameter for duct installation is achieved.
    c. The duct being pulled into the reamed drill hole (maximum duct size of 750mm per circuit).
3. The site will then be reinstated to its pre-construction state and all materials removed.

The entire duct installation process for Norfolk Vanguard, described above (1 - 3) is expected to be completed within 20 weeks.

Cable pull and jointing 2024/25

1. Temporary access will again be taken from the public highway at the crossing of the onshore cable route and Whimpwell Street, to the landfall site.
2. The pre-installed ducts will be exposed through excavation of a transition pit (15m x 10m x 5m per circuit) and a concrete floor laid to allow a stable surface for winching and jointing of the cables.
3. The offshore cables will be positioned into the pre-installed ducts offshore and pulled through the duct to the onshore transition pit, where they will be jointed with the onshore cables.
4. The site will then be reinstated to its pre-construction state and all materials removed.

The cable installation process is expected to require up to 16 weeks to complete per circuit and will be repeated as necessary for the second Norfolk Vanguard circuit which will be programmed for the following year.

Coastal Erosion

The landfall is located along a section of Norfolk coastline which is fronted by unprotected cliffs which are subject to dynamic natural processes. This area of the coastline is considered within the Kelling to Lowestoft Shoreline Management Plan (SMP) published and adopted by North Norfolk District Council (NNDC) in 2012. The shoreline policy is 'Managed Realignment' at the landfall and as such, forecast erosion rates presented by the SMP, and further analysis as part of a coastal erosion study[2] have been, and will continue to be, considered in the design of the landfall.

The landfall design will mitigate against impacts to or from coastal erosion processes over the lifetime of the project. Our methodology is underpinned by the following principles and decisions, which ensure the landfall will have no significant impact on either the cliffs or the beach.:

- Landfall compound zone (and location of HDD entry and subsequent transition pit) is setback from the current cliff edge by at least 125m to allow for forecast coastal processes. Furthermore, the landfall compound zone currently extends a further 200m inland to allow flexibility in the siting of the landfall post consent, during detailed design, using the most up to date information and forecasts.
- Use of long HDD method prevents the requirement for surface excavations on the beach or at the existing cliff face which could act as weak points during storm events.
- Ground investigations (boreholes) within the landfall compound zone, conducted in 2017, to a depth of 20m below ground level, have shown that the land is primarily dense sands and clay soils, which are suitable for the HDD installation method.[3] Research into the stability of HDD installations has found the integrity of the annular space is maintained with little evidence of voids and the strength properties increased over time through consolidation, or equalization, with the native soil.
- Drill profile is proposed to be sufficiently far back from the cliff face and deep enough below the beach to ensure the ducts will not become exposed during the operational lifetime of the wind farm as a result of coastal processes and will not impact on the stability of the cliff or beach as a result of vibration or fracturing.

Figure 32. HDD installed 200mm diameter duct excavated 1 year after installation. Ariaratnam & Beljan (2005).

[2] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-001525-Appendix%2004.03%20Coastal%20Erosion%20Study%20Norfolk%20Vanguard.pdf

[3] No signs of the Cromer Forest Bed geological layer were seen in the borehole surveys. This layer is typically associated with the recent discoveries of early man in Norfolk and therefore no impact on this geoarchaeological feature is anticipated.

Commitment to minimising impacts and responding to local concerns

Commitment to HVDC technology -
This commitment has resulted in:

- The number of cable circuits (and ducts to be installed at the landfall) for Norfolk Vanguard being reduced from six to two.*
- Reduced duct installation construction time at the landfall from up to nine months to five months.
- Removed the previous requirement for a cable relay station (CRS) in the coastal area.
- Reduced the onshore cable route working width from 100m to 45m.
- Reduces the maximum number of cable installation phases from three to two.

Commitment to Long HDD

- Removes any requirement for construction works on the beach.

Commitment to not using Happisburgh public car parks for construction

- All construction traffic will use the temporary compound and temporary access during construction of the landfall.

Commitment to avoid Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ)

- The landfall location allows the offshore cables to avoid this environmentally designated site.

*There will also be two cable circuits and ducts for Norfolk Boreas.


Cable pulling preparation

Further Information

Further detailed information about Landfall, including installation methods and coastal erosion can be found in the Norfolk Vanguard Environmental Statement. This can be downloaded from **https://infrastructure.planninginspectorate.gov.uk/projects/eastern/norfolk-vanguard/?ipcsection=docs&stage=app&filter1=Environmental+Statement**