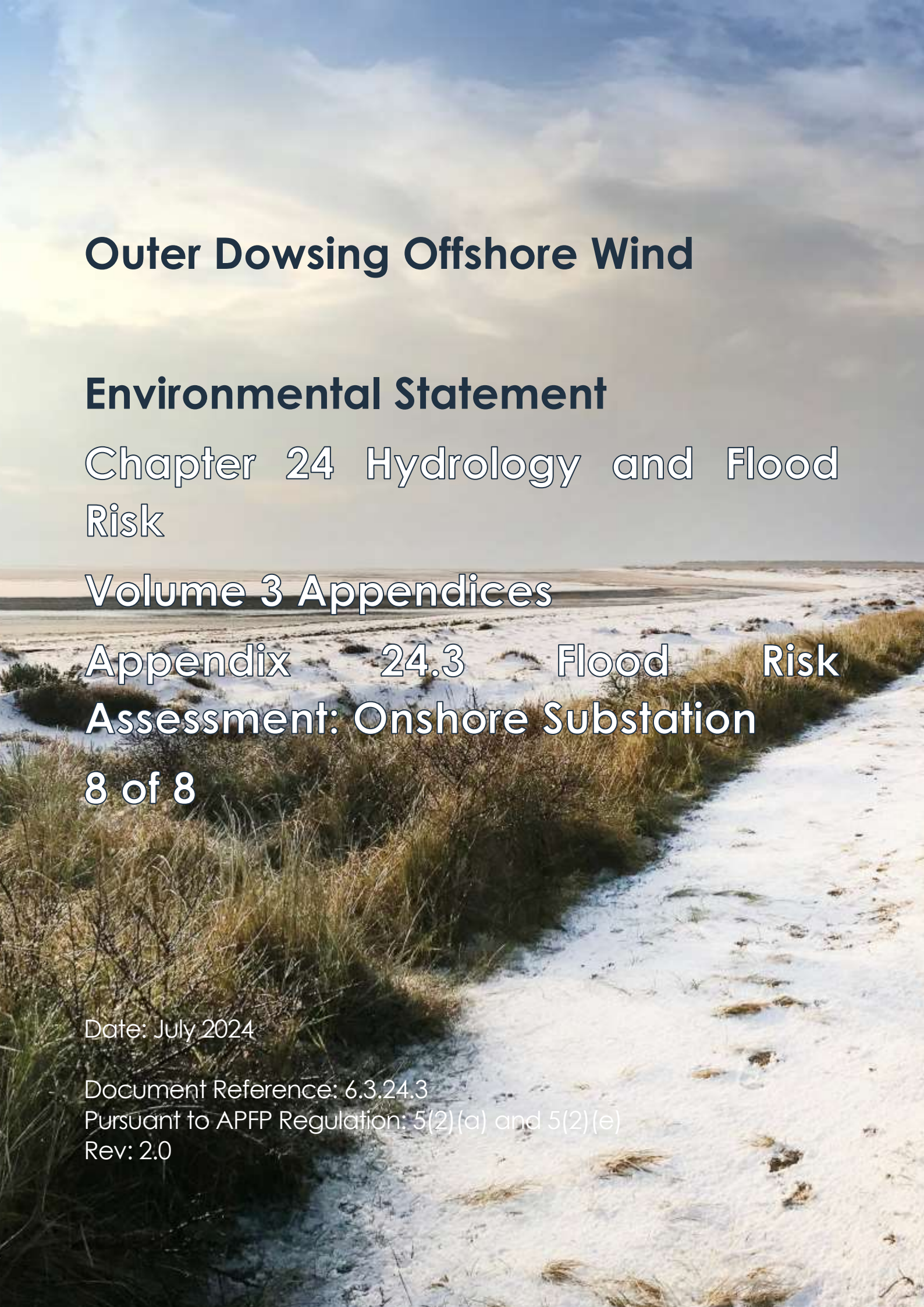

Outer Dowsing Offshore Wind

Environmental Statement

Chapter 24 Hydrology and Flood Risk

Volume 3 Appendices

Appendix 24.3 Flood Risk Assessment: Onshore Substation

8 of 8

Date: July 2024

Document Reference: 6.3.24.3
Pursuant to APFP Regulation: 5(2)(a) and 5(2)(e)
Rev: 2.0

Company:	**Outer Dowsing Offshore Wind**	Asset:	**Whole Asset**
Project:	**Whole Wind Farm**	Sub Project/Package:	Whole Asset
Document Title or Description:	Appendix 24.3 Flood Risk Assessment: Onshore Substation		
Internal Document Number:	PP1-ODOW-DEV-CS-REP-0196_02	3rd Party Doc No (If applicable):	N/A

Rev No.	Date	Status / Reason for Issue	Author	Checked by	Reviewed by	Approved by
1.0	March 2024	DCO Application	SLR	GoBe	Shepherd and Wedderburn	Outer Dowsing
2.0	July 2024	Response to Section 51 Advice	SLR	Outer Dowsing	Shepherd and Wedderburn	Outer Dowsing

Appendix C Technical Memorandum

Technical Memorandum

To:	Heather Tysoe	**From:**	Katrina Riches / George Frisby
Company:	Environment Agency		**SLR Consulting Limited**
cc:		**Date:**	21 August 2023
		Project No.	410.V05356.00013

RE: Outer Dowsing Offshore Windfarm Onshore Substation FRA
River Welland Breach Modelling

This technical note aims to outline the approach SLR propose to take with regard to breach and overtopping modelling for the Onshore Substation for Outer Dowsing Offshore Wind Farm.

A data request was submitted to the Environment Agency for model data relating to the proposed onshore cable route and substation search areas for Outer Dowsing Offshore Windfarm (ODOW). 2010 NTM Breach and Overtopping data was received with regard to scenarios for coastal areas and for the tidal reach of the River Welland.

Upon review it was evident that the data at the southern extent of the information provided, to the north and south of the River Welland, there were some issues and inconsistency in the data provided:

- north of the River Welland the flood model data is a lot coarser than the rest of the area provided, and interrogation of depth data only provides integer values such as '0', '1' or '2' ; and
- south of the River Welland the 1 in 200_CC2115_Depth and 1 in 1000_CC2115 Depth data seem to have the exact same extent and depths in certain areas.

The Environment Agency have reviewed these points and confirmed that they are aware of some issues in the modelling in certain locations, including the areas highlighted above. The Environment Agency are planning to update the existing modelling however no improvement on the data provided is currently available.

The Environment Agency have recommended that breach and overtopping analysis is carried out to ensure that the proposed design datums are sufficient to ensure that the proposed substation remains operational for the 0.1% annual exceedance probability scenario plus an allowance for climate change. Modelling completed by SLR will also ensure that breaches can be located at the critical locations.

The Environment Agency have provided guidelines for undertaking breach modelling which are appended to this note (Environment Agency, Anglian Region, Northern Area Requirements for Hazard Mapping, Version 8, Jan 2014).

1.0 Proposed Breach Modelling Criteria

1.1 Hydrology

- The shape of the astronomical tidal curves to be used in the modelling were taken from Environment Agency Flood Risk Mapping and Data Management: Anglian

Region Report (2016). These have been scaled to fit gauged water levels at Fosdyke Bridge.

- These tidal curves have been scaled to fit the extreme water levels at Fosdyke Bridge (CFB conditions for the UK 2018 for 'Location: ESTURY_RiverWELLAND Chainage: _3992_5).
- Climate change allowances for the sea level has been calculated from a base year of 2018 using the current guidance from EA for the Anglian Region for Upper End scenario (Flood risk assessments climate change allowances).
- Resultant Peak Tidal Levels at Fosdyke Bridge are summarised below:

AEP%	EA Report (m)	CFB (m)	CFB (97.5%confidence levels)
0.5%	5.99	5.98	6.38
0.1%	6.69	6.29	6.97
0.5%+CC	7.13	6.68	7.08
0.1%+CC	7.83	6.99	7.67

Climate change allowances

2018 – 2035 – 17yrs x 7mm = 119mm

2036 – 2065 = 339mm

2066 – 2080 – 15yrs x 15.8 = 237mm

Total sea level rise (2018-2080) = ***695mm***

Full head time (HT) boundary conditions can be found in the accompanying excel sheet.

1.2 Hydraulic Modelling

- Proposed southern and northern breach locations along the River Welland have been located at critical locations along the primary flood defences, which will allow for worst case flood events to the proposed sub station site option search areas. These locations have high levels of hydraulic connectivity to the sites due to proximity and existing watercourses, which also being downstream for the River Glen and Welland confluence and therefore close enough to the location of estuarine extreme water levels. (Fosdyke Bridge). The Breach locations are attached in the accompanying shapefiles and pdf.
- Modelling will be completed using 2D TUFLOW software with a grid size of 10m. Use of HPC and SGS to allow for underlying 1m LiDAR to be taken into account.
- LiDAR Composite DTM (1m 2022) will be used. (example tile: LIDAR-DTM-1m-2022-TF22nw)
- The heights of riverbank defenses in the River Welland study area are defined by a series of ZSH polylines in the TUFLOW 2D domain.
- A Head Time boundary on the River Welland will apply the coastal level in the watercourse channel.
- The flood plain model extent to extend significantly far from the site for no effects and all relevant flow paths to be modelled.

- The crest elevations used for the defences to be obtained from 'EA Spatial Flood Defences Including Standardised Attributes' layer and cross referenced against LiDAR.
- Breach of flood defences will be represented in TUFLOW using variable shape files.
- Breach criteria (as per EA guidance):
  - Ground level behind defence extracted to Lidar
  - Breach width = 50m
  - Breach duration 70hr
- The 0.1%+CC event peak water level is higher than the current crest level of the embankment. Therefore, for this event the embankment will be raised in the model to a suitable height so that the peak water level in the River Welland does not overtop the flood embankment.
- Hazard, Depth and Velocity Mapping, along with Flood Depth Progression and Sensitivity Testing will be completed in line with the EA guidance.
- Results will be reported in a suitable modelling report.
- All events to be modelled with a base date of 2006 for present day.

2.0 Proposed Overtopping Modelling Criteria

In email correspondence with Heather Tysoe on 4th August 2023, the Environment Agency have stated that *"With regards to overtopping, the Environment Agency will seek to raise flood defences in line with the climate change levels, however it is important to assess the potential depths which may occur from overtopping, should the defence heights remain unchanged".*

It is therefore proposed that overtopping modelling will also be undertaken to address the effect of inundation with regard to finished floor levels of the substations. Only the 0.1% AEP+CC event has estimated levels higher than the current defence crest levels. Overtopping modelling can be completed for this event for the River Welland for the reach from the Fosdyke bridge to such a point upstream where the Flood Defence crest levels are higher than the peak water level. The overtopping would be simulated fully in the 2D domain with both north and south defence embankments being overtopped simultaneously.

3.0 Climate Change Allowances

As detailed in Section 1.1, the climate change allowances have been calculated using the guidance for the Anglian Region for the Upper End scenario.

In email correspondence with Heather Tysoe on the 4th August 2023, the Environment Agency have stated that *"The following climate change guidance (section titled Assessing credible maximum scenarios for nationally significant infrastructure projects, new settlements or urban extensions) suggests that for an NSIP, the H++ climate change allowances should be applied."*

It is understood that the H++ climate change allowances should be applied as a sensitivity test to *"help assess how sensitive your proposal is to changes in the climate for different future scenarios. This will help to ensure your development can be adapted to large-scale climate change over its lifetime".* It is therefore proposed that the Upper End scenario is used to assess the design level for the onshore substation, however a sensitivity test using the H++ climate change allowance will be included as part of the assessment. It would be grateful if we could receive clarity that this approach is correct.

Outer Dowsing Offshore Windfarm
River Welland Breach Modelling

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