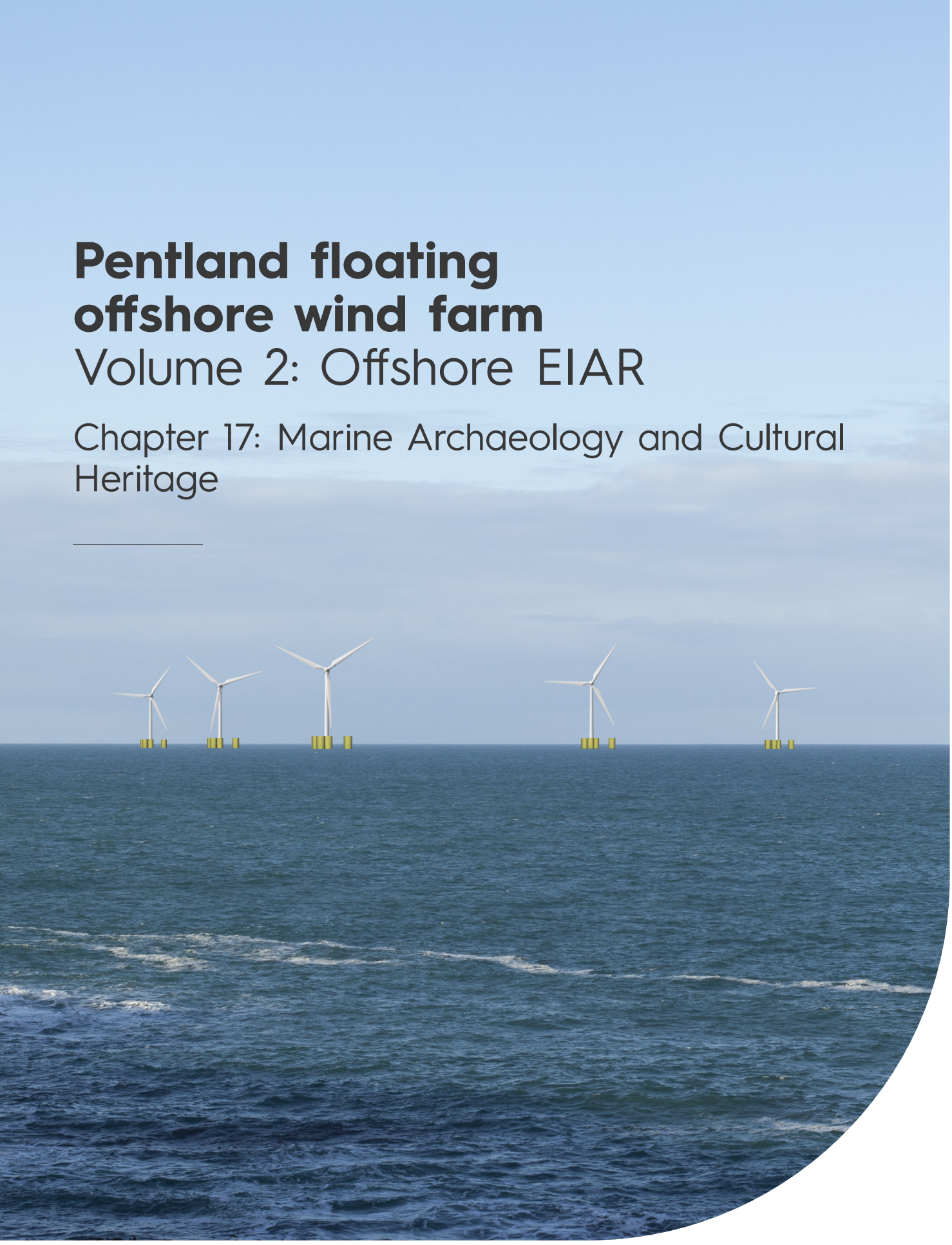
Pentland floating offshore wind farm

Volume 2: Offshore EIAR

Chapter 17: Marine Archaeology and Cultural Heritage



PENTLAND FLOATING OFFSHORE WIND FARM

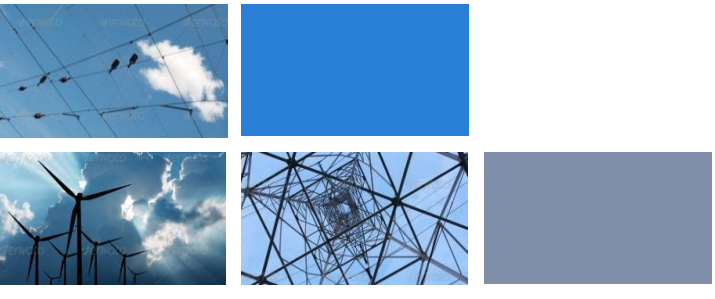
OFFSHORE EIAR (VOLUME 2): MAIN REPORT

CHAPTER 17: MARINE ARCHAEOLOGY AND CULTURAL HERITAGE

Document Title:	Pentland Floating Offshore Wind Farm Offshore EIAR
Document no.	GBPNTD-ENV-ORA-RP-00002
Project:	Pentland Floating Offshore Wind Farm
Originator Company	Orkney Research Centre for Archaeology (ORCA)
Revision	01
Originator	Paul Sharman
Date	29.07.2022

Revision History:

Revision	Date	Status	Originator	Reviewed	Approved
01	29.07.2022	Final	PS	TW/PM	PM



CONTENTS

LIST OF FIGURES

LIST OF TABLES

GLOSSARY OF PROJECT TERMS

Key Terms	Definition
Dounreay Trì Floating Wind Demonstration Project (the 'Dounreay Trì Project')	The 2017 consented project that was previously owned by Dounreay Trì Limited (in administration) and acquired by Highland Wind Limited (HWL) in 2020. The Dounreay Trì Project consent was for two demonstrator floating Wind Turbine Generators (WTGs) with a marine licence that overlaps with the Offshore Development, as defined. The offshore components of the Dounreay Trì Project consent are no longer being implemented.
Highland Wind Limited	The Developer of the Project (defined below) and the Applicant for the associated consents and licences.
Landfall	The point where the Offshore Export Cable(s) from the PFOWF Array Area, as defined, will be brought ashore.
Offshore Export Cable(s)	The cable(s) that transmits electricity produced by the WTGs to landfall.
Offshore Export Cable Corridor (OECC)	The area within which the Offshore Export Cable(s) will be located.
Offshore Site	The area encompassing the PFOWF Array Area and OECC, as defined.
Onshore Site	The area encompassing the PFOWF Onshore Transmission Infrastructure, as defined.
Pentland Floating Offshore Wind Farm (PFOWF) Array and Offshore Export Cable(s) (the 'Offshore Development')	All offshore components of the Project (WTGs, inter-array and Offshore Export Cable(s), floating substructures, and all other associated offshore infrastructure) required during operation of the Project, for which HWL are seeking consent. The Offshore Development is the focus of this Environmental Impact Assessment Report.
PFOWF Array	All WTGs, inter-array cables, mooring lines, floating sub-structures and supporting subsea infrastructure within the PFOWF Array Area, as defined, excluding the Offshore Export Cable(s).
PFOWF Array Area	The area where the WTGs will be located within the Offshore Site, as defined.
PFOWF Onshore Transmission Infrastructure (the 'Onshore Development')	All onshore components of the Project, including horizontal directional drilling, onshore cables (i.e. those above mean low water springs), transition joint bay, cable joint bays, substation, construction compound, and access (and all other associated infrastructure) across all project phases from development to decommissioning, for which HWL are seeking consent from The Highland Council.
PFOWF Project (the 'Project')	The combined Offshore Development and Onshore Development, as defined.

ACRONYMS AND ABBREVIATIONS

AMAAA	The Ancient Monuments and Archaeological Areas Act 1979
CIfA	The Chartered Institute for Archaeologists
DBA	Desk Based Assessment
EEA	European Economic Area
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
GDL	Garden and Designed Landscape
HEPS	Historic Environment Policy Statement for Scotland 2019
HES	Historic Environment Scotland
HMPA	Historic Marine Protected Area
LB	Listed Building
MAG	Magnetometry
MBES	Multi-Beam Echo-Sounding bathymetry
MS-LOT	Marine Scotland Licensing Operations Team
NRTE	Naval Reactor Test Establishment
OPEN	Optimised Environments Ltd
ORCA	Orkney Research Centre for Archaeology
PAD	Protocol for Archaeological Discoveries
PFOWF	Pentland Floating Offshore Wind Farm
PoMRA	Protection of Military Remains Act 1986
SBP	Sub-Bottom Profile
SM	Scheduled Monument
SSS	Sidescan Sonar Survey
THC	The Highland Council
THC HET	The Highland Council Historic Environment Team
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UNCLOS	United Nations Convention of the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WTG	Wind Turbine Generators
WSI	Written Scheme of Investigation
ZTV	Zone of Theoretical Visibility

17 MARINE ARCHAEOLOGY AND CULTURAL HERITAGE

17.1 Introduction

The potential effects of the Pentland Floating Offshore Wind Farm (PFOWF) Array and Offshore Export Cable(s), hereafter referred to as the 'Offshore Development' during construction, operation and maintenance, and decommissioning on Marine Archaeology and Cultural Heritage (marine historic environment) receptors are assessed in this chapter. The chapter also includes a review of the potential cumulative impacts with other relevant projects, and an assessment of the potential impacts on the setting of onshore historic environment assets by the Offshore Development.

The following specialists have contributed to the assessment:

- Orkney Research Centre for Archaeology (ORCA): Appendices, baseline description, impact assessment and Environmental Impact Assessment Report (EIAR) section write up;
- SULA Diving: Review of marine geophysical survey data and reporting, desk-based research and reporting; and
- Optimised Environments (OPEN): Provision of Zones of Theoretical Visibility (ZTV) and production of visualisations and wirelines.

Further details of the Project Team's competency including lead authors for each chapter are provided in Offshore EIAR (Volume 3): Appendix 1.1: Details of the Project Team of this Offshore EIAR .

Table 17.1 below provides a list of all the supporting studies which relate to the Marine Archaeology and Cultural Heritage impact assessment.

Table 17.1 Supporting studies

Details of study	Locations of supporting studies
Marine Archaeology and Cultural Heritage: Methodology	Offshore EIAR (Volume 3): Appendix 17.1
Marine Archaeology and Cultural Heritage: Gazetteer of sites	Offshore EIAR (Volume 3): Appendix 17.2
Marine Archaeology and Cultural Heritage: List of MMT geophysical surveys informing the assessment	Offshore EIAR (Volume 3): Appendix 17.3
OPEN: Cultural Heritage Visualisations and Wirelines	Offshore EIAR (Volume 4): Appendix 17.4

17.2 Legislation, Policy, and Guidance

The Offshore Development is located within Scottish and United Kingdom (UK) Territorial Waters. There are a number of international legally binding conventions, EU Directives, UK and Scottish legislation, policy frameworks and guidance to consider in relation to the marine historic environment. Various EU Environmental Impact Assessment (EIA) Directives have been incorporated in UK and Scottish legislation, all of which include the requirement to address potential impacts on the historic environment. Relevant legislation, guidance and policy relating to the marine historic environment that was used in the preparation of this chapter are summarised below:

17.2.1 Legislation

- The United Nations Convention of the Law of the Sea (UNCLOS) states that countries have a duty to protect objects of an archaeological and historical nature found at sea and shall co-operate for this purpose;
- Annex to the United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention on the Protection of the Underwater Cultural Heritage 2001 includes that the protection of underwater cultural heritage through *in situ* preservation shall be considered as the first option;

- The European Convention on the Protection of the Archaeological Heritage (revised), known as the Valletta Convention, contains provisions for the protection of archaeological heritage both underwater and on land, preferably *in situ*, but with provisions for appropriate recording and recovery if disturbance is unavoidable;
- The Protection of Military Remains Act 1986 (PoMRA) has the principal concern to protect the sanctity of vessels and aircraft that are military maritime graves. Any aircraft lost whilst in military service is automatically protected under this Act;
- The Marine and Coastal Access Act 2009 devolves marine planning, licensing and conservation powers including 'the need to protect the environment' (section 69a), which in section 115(2) states is inclusive of 'any site (including any site comprising, or comprising the remains of, any vessel, aircraft or marine structure) which is of historic or archaeological interest', in Scottish offshore waters (12 to 200 nm) to the Scottish Ministers;
- The Marine (Scotland) Act 2010 requires licensing activities in the marine environment to consider potential impacts on the marine environment including features of archaeological or historic interest, and defines marine historic assets in Section 73. Historic Environment Scotland (HES) is a statutory consultee on any development proposals that may affect the site or setting of an Historic Marine Protected Area (HMPA); and
- The Ancient Monuments and Archaeological Areas Act 1979 (AMAAA), and as amended, concerns sites that warrant statutory protection due to being of national importance and are Scheduled under the provisions of the Act. It is an offence to carry out, without the prior written consent of the Scottish Ministers (Scheduled Monument Consent), any works which would have the effect of demolishing, destroying, damaging, removing, repairing, altering, adding to, flooding or covering up the monument.

17.2.2 Policy

- The UK Marine Policy Statement (2011) states heritage assets should be conserved through marine planning in a manner appropriate and proportionate to their significance. Many heritage assets with archaeological interest are not currently designated as scheduled monuments or protected wreck sites but are demonstrably of equivalent significance;
- Scotland's National Marine Plan: A Single Framework for Managing Our Seas (March 2015) covers both Scottish inshore waters (out to 12 nm) and offshore waters (12 to 200 nm). Its policies and advice concerning the marine historic environment, include:
    - Policy GEN6 Historic environment: Development and use of the marine environment should protect and, where appropriate, enhance heritage assets in a manner proportionate to their significance;
    - As well as the designated marine heritage assets there are likely to be a number of undesignated sites of demonstrably equivalent significance, which are yet to be fully recorded or await discovery;
    - It is recommended that Historic Marine Planning Partnerships and licensing authorities should seek to identify significant historic environment resources at the earliest stages of planning or development process and preserve them *in situ* wherever feasible. Adverse impacts should be avoided, or, if not possible, reduced and mitigated. Where this is not possible licensing authorities should require developers to record and advance understanding of the significance of the heritage asset before it is lost, in a manner proportionate to that significance. (Chapter 4.20-25);
    - The use of the marine environment … recognises the protection and management needs of marine cultural heritage according to its significance. (High-Level Marine Objective 18); and
- Scottish Planning Policy (revised 2020) includes policies to protect and preserve archaeological sites and monuments and historic assets, designated and undesignated, *in situ* wherever possible and/or feasible. The SPP includes;

"*Where there is potential for a proposed development to have an adverse effect on a scheduled monument or on the integrity of its setting, permission should only be granted where there are exceptional circumstances*." (SPP 2020, para 145).

- The Historic Environment Policy Statement for Scotland (HEPS) 2019 includes policies that decisions affecting any part of the historic environment require understanding of its significance, its wider context and setting, and consideration of avoiding or reducing detrimental impacts.

17.2.3 Guidance

- Historic Environment Scotland Designation Policy and Selection Guidance 2019 stands alongside HEPS 2019 and outlines the principles and criteria that underpin the designation of HMPAs; and
- Historic Environment Scotland Managing Change in the Historic Environment Guidance Series: Setting (revised in 2020), states that "Setting can be important to the way in which historic structures or places are understood, appreciated and experienced. It can often be integral to a historic asset's cultural significance." The setting of historic assets or places should be taken into account when considering environmental assessments / statements, and when making decisions on applications.

17.3 Scoping and Consultation

Scoping and consultation has been ongoing throughout the EIA process and has played an important part in ensuring the scopes of the baseline characterisation and impact assessment are appropriate with respect to the Project and the requirements of the regulators and their advisors.

Relevant comments from the EIA Scoping Opinion and the Scoping Opinion Addendum specific to Marine Archaeology and Cultural Heritage provided by Marine Scotland Licensing Operations Team (MS-LOT) on behalf of Scottish Ministers, HES, and The Highland Council (THC) are summarised in Table 17.2 below, which provides a high-level response on how these comments have been addressed within the EIAR.

Table 17.2 Summary of consultation responses specific to marine archaeology, cultural heritage and setting

Consultee	Comment / Issue Raised	Offshore Development Approach and Section ID
Scoping Opinion		
HES	*Table 9-14 of the Scoping report includes an assessment of potential impacts on "historic landscapes and monuments". It is unclear if this includes scheduled monuments.*	'Monuments' includes Scheduled Monuments
HES	*We would also welcome some clarity on how the impacts of the turbine array itself versus the impacts of the onshore infrastructure have been assessed.*	An EIA methodology to clarify the issue was sent to consultees for comment and is provided as Appendix 17.1. See Sections 17.4.4.8 and 17.6.2 of this Chapter for the identification and assessment of any potential indirect impacts on onshore historic assets (including designated assets) and the setting of those assets from the turbine array. The Onshore Development does not form part of this consent application and therefore is not considered in this EIA.
HES	*In conclusion, we would recommend a detailed scoping assessment is undertaken in order to understand if any scheduled monuments in the vicinity of the development*	An EIA methodology to clarify the issue was sent to consultees for

Consultee	Comment / Issue Raised	Offshore Development Approach and Section ID
	may be impacted. If the applicant concludes that there will be no impacts on scheduled monuments in the vicinity, it would be helpful to understand the assessment behind this conclusion.	comment and is provided as Appendix 17.1.
THC	*The EIAR needs to identify all designated sites which may be affected by the development either directly or indirectly. This will require you to identify: -the architectural heritage (Conservation Areas, Listed Buildings) and the archaeological heritage (Scheduled Monuments), the landscape (including designations such as National Parks, National Scenic Areas, Areas of Great Landscape Value, Gardens and Designed Landscapes, shipwrecks and general setting of the development, the inter-relationship between the above factors.*	Section 17.4.4.4 of this Chapter identifies appropriate historic environment assets, designated and non-designated, which may be affected by the development either directly or indirectly. This includes Conservation Areas, Listed Buildings, Scheduled Monuments, Gardens and Designed Landscapes, shipwrecks, settings and the inter-relationship of the above. Any designations such as National Parks, National Scenic Areas, Areas of Great Landscape Value are addressed in Chapter 16: Seascape, Landscape and Visual Impact of this EIAR.
THC	*We would expect any assessment to contain a full appreciation of the setting of these historic environment assets and the likely impact on their settings. It would be helpful if, where the assessment finds that significant impacts are likely, appropriate visualisations such as photomontage and wireframe views of the development in relation to the sites and their settings could be provided. Visualisations illustrating views both from the asset towards the proposed development and views towards the asset with the development in the background would be helpful.*	This Chapter (Section 17.6.2) includes an assessment of potential impacts on the setting of historic environment assets relating to the Offshore Development Appropriate wirelines and visualisations relating to the Offshore Development are provided in Offshore EIAR (Volume 4): Visual Materials.
THC	*There are a large number of heritage assets in the vicinity of the development, these need to be assessed. HES have provided detailed advice on potential setting impacts.*	Relevant heritage assets within the vicinity of the Offshore Development are included in this Chapter (sections 17.4 and 17.5.6).
THC	*We recommend that you liaise with colleagues in the Council's Historic Environment Team on the scope of the archaeological assessments*	The Highland Council Historic Environment Team (THC HET) were provided with and responded to the Methodology (Appendix 17.1) as below.
MS-LOT on behalf of Scottish Ministers	*The Scottish Ministers advise that the Developer addresses both The Highland Council and HES representations in the EIA Report, and agree with the Scoping Opinions they provided.*	Highland Wind Ltd acknowledge the feedback and have addressed the representations as outlined above.
MS-LOT on behalf of Scottish Ministers	*Finally, the Scottish Ministers recommend that the Developer liaises with the Highland Council's Historic Environment Team on the scope of the archaeological assessments*	An EIA methodology to clarify the issue was sent to consultees for comment and is provided as Offshore EIAR (Volume 3): Appendix 17.1.

Consultee	Comment / Issue Raised	Offshore Development Approach and Section ID
Scoping Opinion Addendum		
HES	*We note that there is no cultural heritage chapter within the submitted 'Scoping Addendum Report'. However, in 2021 we received a draft 'Historic Environment Method Statement', setting out methodology for conducting the onshore and offshore aspects of the EIA, for which we provided detailed comments directly to the applicant. Therefore, our current understanding is that cultural heritage will be considered in the EIA.*	This chapter confirms HES understanding that cultural heritage is considered in the EIAR. Responses to 'Historic Environment Method Statement' detailed below.
Responses to ORCA Methodology relevant to Marine and Setting		
HES response to ORCA Methodology (HES email 29th October 2021, HES Case ID 300046189)	*We can confirm that the proposed development does not raise significant concerns for our interests*	Noted.
HES response to ORCA Methodology (HES email 29th October 2021, HES Case ID 300046189)	*We are content that the proposed approach appears to follow standard procedures outlined in guidance*	Noted.
HES response to ORCA Methodology (HES email 29th October 2021, HES Case ID 300046189)	*There are some specific issues, mostly small and technical [in consistency and standardisation of terminology used]*	Revised Methodology that accommodates these issues is attached as Appendix 17.1.
HES response to ORCA Methodology (HES email 29th October 2021, HES Case ID 300046189)	*We have some concerns with the principle outlined in the methodology that some marine survey work could be undertaken only after consent has been granted for the project. This is not good practice as it could create serious difficulties in assessing the EIA Report if this information was proposed but not included. However, we recognise that the earlier scheme for a single demonstrator turbine and its associated infrastructure appears to have been consented on this basis. it is difficult to see how we or the consenting bodies we advise could be satisfied that we have adequate information to make a decision on the final application.*	Noted. Marine geophysical survey data has been collected and reviewed for archaeological purposes. See Sections 17.4.3, 17.4.4 and Appendix 17.3
THC response to ORCA Methodology (email 5th November 2021 from Simon Hindson, Planning and Environment, THC)	*THC's Historic Environment Team reviewed the methodology and found that the scope of the proposed works is comprehensive. They had no recommendations for any amendments or additions to the document as submitted.*	Noted. This Chapter is written in line with the Methodology presented to THC, with minor revisions accommodating HES response above (see Appendix 17.1).

Consultee	Comment / Issue Raised	Offshore Development Approach and Section ID
Cumulative Projects List		
THC	Having reviewed the submitted document, I would suggest the following projects *are also included in the cumulative assessment:* > *Spacehub Sutherland (in all chapters of the EIAR not just the SLVIA section)* > *Slickly Wind Farm (at appeal stage therefore is technically "in planning")* > *Hollandmey Wind Farm (application)* > *Cairnmorehill Wind Farm (previously refused but a revised proposal will be submitted prior to submission of the PFOWF)* > *Coglemoss Wind Farm (consented)* > *Wathegar Wind Farm 1* > *Wathegar Wind Farm 2* > *Camster Wind Farm* > *Camster Wind Farm 2* > *Burn of Whilk Wind Farm* > *Golticlay Wind Farm* > *Boulfruich Wind Farm* > *Ackron Wind Farm (recently withdrawn)* > *Armadale Wind Farm (recently submitted)* *I would also like to ensure that Strathy South Wind Farm listed in the table is the version submitted to Scottish Ministers in 2020 and granted consent in 2021.*	Noted. As approved by HES and THC in their responses to ORCA Methodology, only the projects that are within a 30 km radius will be included in this Marine Archaeology and Cultural Heritage Chapter. Additionally, the withdrawal of Ackron Wind Farm and the submission of Armadale Wind Farm, were made after the 6 month cut-off date prior to submission for the inclusion of new cumulative developments. Table 17.15 lists out those cumulative developments which are of particular relevance to the cumulative assessment, to ensure that it is focused on key cumulative interactions and the identification of significant cumulative effects.

17.4 Baseline Characterisation

This section comprises a characterisation of known marine historic environment assets in the Offshore Site (defined below) including shipwrecks, aviation losses and submerged prehistoric and paleoenvironmental deposits, along with the potential for unidentified assets to be present. This characterisation is based on desk-based studies and a review of the marine geophysical survey data collected for the Offshore Development.

This section also includes a baseline summary of the onshore historic environment assets and their setting that may be affected by the Offshore Development. This is based on desk-based studies and site visits.

17.4.1 Study Area

The following areas are referred to in this impact assessment:

- The Offshore Site: The area encompassing the PFOWF Array Area (the area where the Wind Turbine Generators [WTGs] will be located) and the Offshore Export Cable Corridor (OECC) (where the Offshore Export Cable(s) will be located) to Mean High Water Springs (MHWS);
- The Offshore Study Area: The area for identifying the marine historic environment baseline and potential impacts upon it comprises the Offshore Site and the marine geophysical survey area (plus a 10km buffer) for desk-based sources (depending on the nature of the database, which may only be accurate to 10 km) for capturing assets that have not been located but might be within the Offshore Site (see Figure 17.1); and
- The Setting Study Area: The area assessed for potential impacts from the Offshore Development on the setting of historic assets (and thus potentially affecting their heritage significance), comprises an area of 30 km radius from the boundary of the PFOWF Array Area (i.e. the area where the Wind Turbine Generators (WTGs are to be located). This radius was proposed (and subsequently approved) in the Methodology sent to HES and THC for comment (see Table 17.2, Figure 17.2, Figure 17.3; and Offshore EIAR [Volume 3]: Appendix 17.1).

17.4.2 Sources of Information

A review was undertaken of the key literature and data relevant to this assessment relating to the marine historic environment and onshore historic assets for setting assessment purposes. These sources were used to give an overview of the existing historic environment. The key data sources used in the preparation of this chapter are listed below in Table 17.3.

Table 17.3 Summary of key sources of information pertaining to historic environment assets

Title	Source	Year	Author
The National Record of the Historic Environment (NRHE) of Scotland	Canmore (https://canmore.org.uk) and Pastmap database (http://pastmap.org.uk)	2022	HES
United Kingdom Hydrographic Office (UKHO) wreck register & nautical charts	https://www.admiralty.co.uk/digital-services/data-solutions/admiralty-marine-data-portal United Kingdom Hydrographic Office.	2022	UKHO
Statutory lists, registers and designated areas, including Lists of Scheduled Monuments, Listed Buildings, Gardens & Designed Landscapes, Designated Wrecks and Historic Marine Protected Areas	The Historic Environment Scotland Data Portal https://portal.historicenvironment.scot/	2022	HES
The Highland Historic Environment Record	Home - Highland Historic Environment Record	2022	THC
Off Scotland: a comprehensive record of maritime and aviation losses in Scottish waters	Edinburgh: C-Anne Publishing.	1998	Whittaker I.G.

Title	Source	Year	Author
The Ship Wreck Index of Great Britain & Ireland Vol.4 Scotland	London: Lloyd's Register of Shipping.	1998	Larn, R & Larn, B.
The British Newspaper Archives	Home | Search the archive | British Newspaper Archive	2022	n/a
Lloyds Shipping Register	http://www.lrfoundation.org.uk/public_education/reference-library/register-of-ships-online/	2022	Lloyds of London
The scope of Strategic Environmental Assessment of Continental Shelf Area SEA 4 in regard to prehistoric archaeological remains	https://assets.publishing.service.gov.uk/government	2003	Flemming, N.C.
Submerged Landscapes of the European Continental Shelf	Chichester: John Wiley & Sons Ltd.	2017	Flemming, N.C. *et al*. (editors)
Hexicon Trì: Marine Historic Environment Technical Baseline Report	Microsoft Word - Dounreay Trì Demo - ES - Appendix Contents and Cover Sheets (marine.gov.scot)	2015	ORCA

17.4.3 Site-Specific Surveys

The site-specific surveys conducted to inform the baseline characterisation comprised:

- Desk-based survey of appropriate sources of information, as summarised in Table 17.3 above. As stated in the Methodology (Appendix 17.1), the importance of identified historic environment assets was determined based on statutory designation and/or professional judgement against the characteristics and criteria expressed in:
    - The Historic Environment Policy Statement for Scotland (HEPS) 2019, including the Annexes;
    - Historic Environment Scotland Designation Policy and Selection Guidance 2019;
    - Historic Environment Scotland's Managing Change in the Historic Environment guidance series;
    - English Heritage (2012) Ships and Boats: Prehistory to Present. Designation Selection Guide. Swindon: English Heritage;
    - Wessex Archaeology (2011) Assessing Boats and Ships 1860-1913, 1914-1938, 1914-1938. Archaeological Desk-Based Assessment in 3 volumes. Salisbury: Wessex Archaeology; and
    - The Chartered Institute for Archaeologists (CIfA) Codes, Standards and Guidelines (http://www.archaeologists.net/codes/ifa).

- Marine geophysical surveys (see Figure 17.1 for the area surveyed) were conducted for the Offshore Development by MMT in 2021 and reviewed for archaeological purposes. The methods used met or exceeded appropriate professional standards for reconnaissance level archaeological surveys (as outlined in Plets *et al*. 2013). The survey methods are detailed in the MMT reports (MMT 2021a, 2021b and 2021c). The surveys were:
    - Sidescan sonar survey (SSS);
    - Multi-Beam Echo-Sounding bathymetry (MBES);
    - Magnetometry (MAG); and
    - Sub-Bottom Profile (SBP).

17.4.4 Baseline Description

17.4.4.1 Shipwrecks

There are no charted wrecks within the Offshore Site. There are no Historic Marine Protected Areas or Protected Places and Controlled Sites designated under the Protection of Military Remains Act 1986.

The nearest charted wreck of high importance is the pre-dreadnought Battleship HMS King Edward VII, which is just over 3.5 km to the north of the northern edge of the Offshore Site (see Figure 17.1). The trawler *Amisdale*, if any of it survives, was wrecked at the Dounreay shore in 1984, and is of negligible importance since no lives were lost. It lies 0.7 km east of the eastern edge of the OECC. The two non-sub contacts were sonar contacts detected during wartime submarine searches that are not submarines, but the nature of which was unclear. These were subsequently investigated and are now listed as dead by the UKHO. Both are outwith the Offshore Site, 4.5 km to the east (Non-Sub Contact 1) and 6.5 km to the north-east (Non-Sub Contact 2).

Eleven shipwreck sites are listed on the Canmore database and Whittaker (1998) that may be in or close to the Offshore Study Area, because the precise locations of their sinking are unknown, and descriptions included within details of their circumstance of loss indicate the possibility. These are listed in Offshore EIAR (Volume 3): Appendix 17.2. Except for one, all would be of Low or Negligible importance (as per definitions in Table 17.5). The exception is HMT *Orsino*, which was sunk by U-55 in 1916 somewhere off the north coast of Scotland, possibly in the Offshore Study Area. However, none of these eleven shipwrecks were identified in the marine geophysical survey data (see below).

The seabed across most of the Offshore Site comprises mainly flat seabed, which is not conducive to good preservation, though some cultural material may survive trapped in the few gullies that are present further to the south in the Offshore Site. The survival of wrecks, wreckage and associated artefacts, particularly in shallower waters, is also affected by the strong tides and severe winter storms that frequently occur in the area. Thus, there is low potential for the presence of significant unknown wrecks or their associated artefacts.

None of the possible anthropogenic anomalies identified in the 2015 survey data review (ORCA 2015) proved to be anthropogenic in nature when seen in the MMT survey data collected for the Offshore Development (Offshore EIAR [Volume 3]: Appendix 17.3).

17.4.4.2 Aviation Losses

There are no known aircraft losses in the Offshore Study Area, but a number of aircraft have gone ‘‘missing’’ off the north coast of Scotland so the possibility remains of finding one here. Any aircraft found is automatically designated as a Protected Place and Controlled Site under the Protection of Military Remains Act 1986 if lost on active service. These would be considered of High importance. None has been identified from the marine geophysical survey data (Sections 17.4.4.4 to 17.4.4.7 below).

17.4.4.3 Potential for submerged landscapes and cultural remains

The geophysical survey data indicate that the Offshore Site comprises flat seabed with bedrock covered by sediments, largely comprising silty fine sand with patches of mixed gravel, pebbles, cobbles, shells and occasional boulders. Review of the SBP survey data (see 17.4.4.7 below) indicates there is negligible to low potential for the survival of submerged landscapes, submerged peat and postglacial tsunami deposits in the Offshore Site. Landfall is to be made on a rocky foreshore, and so the potential for such deposits here are also Negligible.

17.4.4.4 SSS Survey

A review of the SSS data (see Offshore EIAR [Volume 3]: Appendix 17.3; MMT 2021a, 2021b and 2021c) shows good coverage with even small rocks and boulders being discernible.

No shipwrecks or manmade objects were seen on the SSS images.

A review of contacts marked as 'debris' in MMT's features table were examined and considered to be rocks or boulders.

17.4.4.5 MBES Survey

A review of the MBES data (see Offshore EIAR [Volume 3]: Appendix 17.3; MMT 2021a, 2021b and 2021c) shows good coverage with larger rocks and boulders being discernible on a sandy seabed with scours around boulders. The single MBES image has very good definition.

No shipwrecks were seen on the MBES image. Some linear features were noted that may be discarded fishing gear.

17.4.4.6 MAG Survey

The MAG data (see Offshore EIAR [Volume 3]: Appendix 17.3; MMT 2021a, 2021b and 2021c) shows anomalies that are probably geological features; nothing looks to be related to shipwreck or debris. Some MAG readings appear to indicate buried anomalies, which are most likely to be geological features.

17.4.4.7 SBP Survey

Nineteen images were supplied (see Offshore EIAR [Volume 3]: Appendix 17.3; MMT 2021a, 2021b and 2021c) but nothing of interest was seen. The images show sand layers over bedrock.

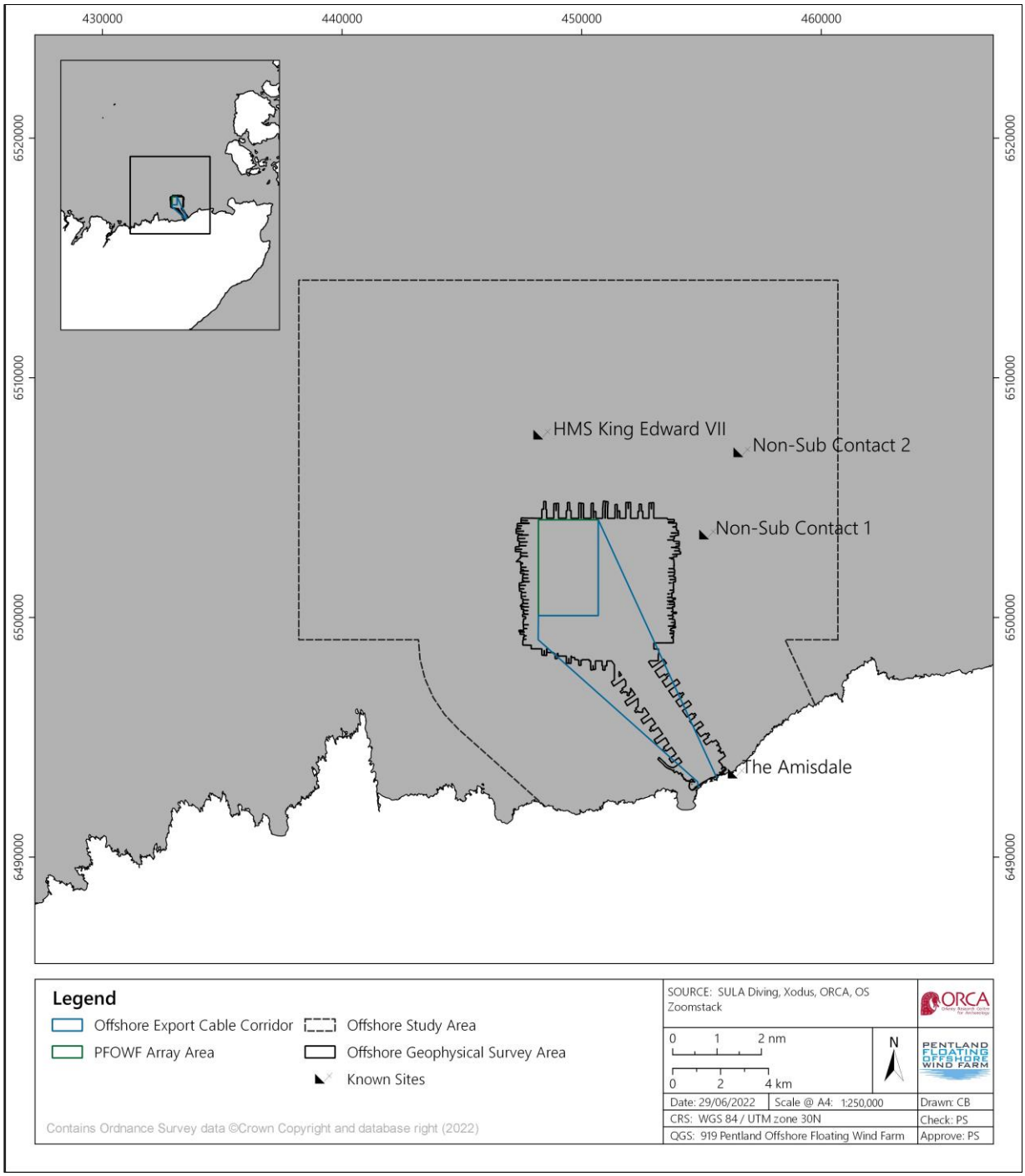


Figure 17.1 Marine Archaeology and Cultural Heritage Study Area

17.4.4.8 Historic Environment Assets and their Setting

The landscape of Caithness tends to be low, open, rolling farmland in the more cultivated northeast of the county, turning into moorland and the extensive low bog of the Flow Country, to the south and west. The landscape affords open distant views with isolated hills, which form focal landmarks. There are extensive dark conifer plantations across parts of the area. The land rises to south and west to the wilder higher ground of north Sutherland, with its long south-north oriented straths and settlements nowadays mostly concentrated along the coast. The coast comprises high cliffs, sandy bays with dune systems and low rocky shelf shorelines. (Stanton 1998).

There are 17 Scheduled Monuments (SMs), three A category Listed Buildings (LBs), nine B category LBs and three C category LBs within or close to the 0 to 10 km ZTV (see Figure 17.2). Some LB designations have multiple components, as at Sandside Harbour or Sandside House and gardens, for example. There are no Conservation Areas or Inventoried Gardens and Designed Landscapes (GDLs) within 10 km of the PFOWF Array Area.

There are 30 SMs, five B category LBs and one C category LB within or close to the 10 to 20 km ZTV (see Figure 17.2). The Thurso Conservation Area is also in this zone but is not affected due to topography and surrounding urbanisation. No A category LBs or Inventoried GDLs were identified. There are 26 SMs, one A category LB, 10 B category LBs and two C category LBs within or close to the 20-30 km ZTV (see Figure 17.2). No Conservation Areas or Inventoried GDLs were identified.

The nearest Inventoried GDL is 30 to 40 km to the east of the PFOWF Array Area at the Castle of Mey. There are many more non-designated sites identified in the online Canmore, Pastmap and Highland Council HER databases within the 30 km zone. One site (SM 1836; CH VP 11 (see Figure 17.3) that is 3 km outwith the 30 km Setting Study Area boundary has been included in the assessment as the most prominent site in this direction south of the PFOWF Array Area to represent undesignated sites just within the boundary.

In order to undertake a reasonable and proportionate assessment, as proposed in the methodology sent to and agreed by stakeholders (Section 17.3 above; Offshore EIAR [Volume 3]: Appendix 17.1), a selection of statutorily designated sites and areas have been considered below that act as proxy for the range of effects on all other designated and undesignated sites. The sites chosen and described below are likely to have the most visibility of and impact from the PFOWF Array Area (tested by reviewing the ZTV and running draft wirelines) and were selected as Cultural Heritage Viewpoints (CH VP), shown on Figure 17.3. The rest of the designated sites are summarised in table form in Offshore EIAR (Volume 3): Appendix 17.2.

17.4.4.8.1 Sandside Harbour, 1 and 2 Sandside Harbour and Fishing Store, LB 14988 Grade A

The Category A Listed Building of Sandside Harbour was constructed in c. 1830 (see Figure 17.3; CH VP 1). The harbour was built by Major Innes of Sandside House for trade and fishing. The harbour is sheltered at the west by high ground and looks east over the Pentland Firth and the Dounreay Site. Numbers 1 & 2 Sandside Harbour as well as the Fishing store are contemporary with the harbour. Numbers 1 and 2 are two storey dwellings that were built against the bank with access from the east and west at first floor level. The fishing store was built in a similar style to 1 and 2. The harbour and the exterior of the surrounding buildings remain little changed throughout their history. These buildings survive within a setting (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.4) that has seen some industrial development, with the construction in the 1950s of the former nuclear facilities at the Dounreay Site and the Vulcan Naval Reactor Test Establishment (NRTE) across Sandside Bay to the east (a Medium contribution of setting). As the harbour Numbers 1 and 2, and the Fishing store have a High Heritage Value and a Medium contribution of setting, the Category A Listed Buildings therefore have a High sensitivity to change.

Key views from the harbour would have been out north-east towards the Pentland Firth and the Dounreay Site. Key views from 1 and 2 Sandside as well as the fishing store would have been to the east, towards the eastern Pentland Firth and Sandside Bay, and to the surrounding countryside to the west, as indicated by the entrances and windows being on these elevations. Otherwise sensitivity to change is Medium.

17.4.4.8.2 Cnoc Urray, SM 564

There are more remains of brochs in Caithness than in any other area of Scotland. Brochs would have been impressive stone-built towers that allowed for viewing the landscape over some distance. Brochs are commonly found in coastal settings that may have been deliberate for defensive reasons, such as monitoring coastal traffic, or possibly for prestige. The concentration of brochs indicates that this was an area of prehistoric settlement and activity. Intervisibility between broch sites may have also played an important political and/or social role.

The Scheduled broch of Cnoc Urray survives as a turf covered mound measuring 26.54 m in diameter and 3.05 m high with a flat top 16.47 m in diameter situated in ploughed fields (see Figure 17.3 CH VP 2). It is unknown if the site extends below ground further than the scheduled area. The setting of the broch site (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.5) was changed dramatically with the construction of the Dounreay Site c. 390 m to the north and the Vulcan NRTE. The broch lies in modern squared fields, and still has open views to and from the south. However, due to the dominant presence of the Dounreay Site, the setting of the broch makes little positive contribution to the understanding and/or appreciation of the monument (a Low contribution of setting). As Cnoc Urray has a High Heritage Value and a Low contribution of setting the Scheduled broch therefore has a Medium sensitivity to change.

17.4.4.8.3 Cnoc Freiceadain, SM 90078

The Scheduled horned long cairns of Cnoc Freiceadain consists of two long cairns in a hilltop location surrounded by rough grazing (see Figure 17.3; CH VP 3). Both of these cairns are well preserved and may still contain surviving burial deposits. They are also an HES Property In Care, and promoted as a site to visit. The long axis of the northernmost cairn is south-west to north-east along the crest of the ridge, and that of the other, 60 m to the south, is virtually at right angles, east-south-east to west-north-west.

The setting of the burial cairns (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.6) on an elevated topographical position would have allowed for 360-degree views of the surrounding landscape. The topographic location also makes them a prominent feature on the skyline. Key views to and from the burial cairns would have been to and from other funerary sites or settlement sites in the surrounding area, such as the Hill of Shebster chambered cairn, 0.75 km to the south on the highest part of the Cnoc Freiceadain ridge and components of the Neolithic and Bronze Age landscape comprising stone rows, standing stones, burial cairns and hut circles of Creag Bhreac Mhor / Upper Dounreay, some 0.75 km downslope to the north and north-west.

The cairns are located within an area of prehistoric activity that is also within a more recent farming landscape with the extensive windfarm (21 WTGs) of Baillie Hill / Stemster Hill located 0.7 to 2.4 km to the east (a Low-Medium contribution of setting). As the Cnoc Freiceadain long cairns have a High Heritage Value and a Low-Medium contribution of setting, the Scheduled funerary monuments therefore have a Medium sensitivity to change.

17.4.4.8.4 Reay Church, LB 14992 Grade A

The Category A Listed Building of Reay Parish Church was constructed in 1739 on a T-plan with a bell tower at the eastern end (see Figure 17.3; CH VP 5). Later additions were added in 1909 and a Gothic window in 1933. The entrance to the church is on the south facing side with four windows on the south facing side, one window on the north elevation, a large Gothic window on the western elevation and an entrance on the eastern Bell tower.

As the entrance and windows of the Parish Church are located on the southern elevation of the building, it is an indication that the exterior of the building was meant to be viewed from the south looking north. From inside the building, the views would have been outwards to the landscape further south.

Reay Parish Church stands largely in isolation, with no immediate neighbouring buildings in any direction. It is located in a setting that makes a positive contribution to the understanding, appreciation of the siting of the church as well as its historical and architectural context (a Medium contribution of setting). As the Church has a High Heritage Value and a Medium contribution of setting, the Category A Listed Parish Church therefore has a High sensitivity to change. It also stands as proxy for the other Listed Buildings in Reay village (see Offshore EIAR [Volume 4]: Visual Materials, Figure 17.7) and the Scheduled Medieval burial ground and cross slab of Reay old parish church (SM 615).

17.4.4.8.5 Sandside House (LB 14984 Grade B) and Estate gardens (LB 14985 Grade B) and farm buildings (LB14986 Grade A)

The Sandside House Estate consists of the Category B Listed Sandside House (LB 14984) (see Figure 17.3 CH VP 4) and Garden walls, two walled gardens, a dovecote and privy (LB 14985). There are two Scheduled carved Pictish stones (SM 616) in the gardens, which were found elsewhere in Caithness and moved here to act as garden ornaments. The Home Farm complex lies north of the house. This includes a Category A Listed kiln barn of probable mid 18th-century date, byre, cottage and dairy in a long single storey range of buildings aligned north/south from the south gable of the kiln barn of probable late 18th to early 19th-century date. The implement shed is of mid 19th-century date. All are part of the same A-Listed complex (LB14986) (see Figure 17.3; CH VP 6). There is a working farmyard, a large 20th-century agricultural shed / byre to the north of these buildings, along with unlisted farm cottages.

Key views from within the Sandside Estate would have been to other adjacent farm buildings as well as to the main house itself. The key design axes of the estate grounds are east-west (as are the main house elevations and windows) with open views from the house down to the east to Sandside Bay and the Dounreay Site and the Vulcan NRTE in the background, and north-south to the farm buildings to the north with open ground rising slightly behind and the estate woodland to the south. Key views from these farm buildings would have been to the adjacent ranges and farm buildings, the house, and surrounding farmland. Sandside House has a prominent situation when viewed from the east, but not in any other direction.

All of the Listed buildings within the Sandside Estate survive in a setting (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.8) that has seen some more recent farming landscape and buildings as well as the construction of the Dounreay Site and the Vulcan NRTE within the wider setting (a Medium contribution of setting). As the kiln barn and range of former byres, cottages, dairy and implement shed has a High Heritage Value and a Medium contribution of setting, the Category A range of buildings therefore have a High sensitivity to change. The Category B Listed Sandside House and walled garden, dovecot and privy have a Medium Heritage Value and a Medium contribution of setting, therefore the resulting sensitivity to change is Medium.

17.4.4.8.6 Creag Bhreac Mhor stone rows, SM 2386

The monument is a group of short standing stones, aligned in rows, appearing to radiate from the direction of two cairns which are situated on a lower ridge to the north-west (see Figure 17.3; CH VP 7). Within Scotland, stone rows are a site type only found in Caithness and Sutherland and are thought to date from the Bronze Age (2500 to 800 BC). The monument is located on gently sloping moorland and lies around 70 m above sea level in rough grazing. The site has extensive views to the northwest with various other prehistoric monuments within 1 km, whilst being overlooked from all other directions by rising ground, including the northern spur of the Hill of Shebster with the long cairns of Cnoc Freiceadain c. 500 m to the south.

The key view for the stones seems to be to the cairns and beyond to the north-west in the direction of the Dounreay Site and the PFOWF Array Area (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.9) and being looked down on from Cnoc Freicadain. The stones are set in a wider landscape of squared fields, timber plantations, modern farming and WTGs, although the topography shelters the stones from the nearby Baillie / Stemster wind farm. Whilst the immediate area makes a High contribution to setting, changes to the wider setting results in a Medium contribution to setting, resulting in a High or Medium sensitivity to change.

17.4.4.8.7 Crosskirk, St Mary's Chapel and Broch, Forss, SM 90086

The remains of the chapel of St Mary (possibly dating from the 12th century, later used as two burial enclosures) lies east to west within a square burial ground, together with the adjacent remains of a broch and outer defensive works (see CH VP 8 Figure 17.3). The broch lay to the north of the burial ground and succeeded a promontory fort on the site. The broch was partly excavated between 1966 and 1972. The site is also an HES Property In Care (PIC 318), and promoted as a site to visit.

The chapel is located close to the shore on the south-west side of Crosskirk Bay adjacent to modern farmland. It is dominated to the south-west by Forss Business and Energy Park 250 m away, with the six-turbine Forss windfarm (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.10). Its location, on a lower coastal slope means it would have been quite inconspicuous in the wider landscape. The key views from the site would have been out to sea but the broch, an imposing tower, would have had a good level of intervisibility in the wide flat landscape including to the broch sites at Green Tullochs (SM554) 1.3 km to the south-west, where a chambered cairn is also part of that scheduling and Tulloch of Lybster (undesignated) 650 m to the south.

The coastal location of these sites indicates that views to and from the Pentland Firth are key, as is intervisibility with other similar sites in the area and prominent ones inland. However, the Scheduled chapel and broch are located within an area that has seen development, with more recent housing and farm buildings as well as the six-turbine Forss Wind Farm and the Forss Technology and Business Park dominating 250m to the south-west (Low contribution of setting). The High Heritage Value and Low contribution of setting, results in a Low to Medium sensitivity to change.

17.4.4.8.8 Dunnet Head Lighthouse and Keepers' Houses, LB 1890 Grade B

Dunnet Head Lighthouse was built by Robert Stevenson, Engineer, in 1831. It is a short circular tower of white-painted tooled ashlar with corbelled parapet with lattice cast-iron balustrade and circular domed lattice-pane light. There are white-painted flat-roofed single storey keepers' houses attached. The complex is enclosed by a coped rubble wall and a pair of square tooled ashlar gate piers with simple square caps.

The site occupies a highly prominent location on the cliffs of Dunnet Head (see Figure 17.3 CH VP 9), the most northerly point of the UK mainland. The key sightlines are to and from the Pentland Firth, whilst the views inland across Caithness with its farming landscape and windfarms are not essential to the understanding of the site, but do add to the experience (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.11). The immediate setting of windswept cliffs, peat bog and heather also adds to the atmosphere, resulting in a High contribution of setting. The Medium Heritage Value and High contribution of setting, results by definition in a High sensitivity to change. However, lighthouses can be considered as assets that are tolerant of change over a distance because their function is to act as a warning to shipping and other sea-users over a wide area, for as long as they are in use, thus tolerating most changes as long as these do not interfere with their function, or the immediate curtilage. Therefore the buildings can be considered as having a High sensitivity to change in their immediate location, but a Low sensitivity to change at a landscape / seascape level.

17.4.4.8.9 Bighouse Lodge, Garden Walls and Gate Piers, LB 7159 Grade B

Bighouse Lodge is a mid to late 18th-century country house, with early to mid 19th-century alterations and additions, and further additional west wing of circa 1900 (see Figure 17.3 CH VP 10). It is a plain mansion of two storeys over a raised basement. The main frontage faces south, with key sightlines up Strath Halladale. Associated walled gardens, pavilions, ice house, stables and various estate cottages are all part of the listing. It belonged to a cadet branch of the Mackays until absorbed into the Duke of Sutherland's estate in the early to mid 19th century.

The house and gardens are set on a low promontory near the mouth of the River Halladale at Melvich Bay in a crofting landscape, squared fields of rough grazing, and heather-clad moorland. The house sits in the shelter of the western slopes of the hill of Rubha an Tuir, which rises to the north-east, limiting views from the house to the open sea. There are open views to the house from the west side of the River Halladale and Melvich Beach, resulting in a High contribution of setting. VP 10 reflects this view, being located beside the A836 at the Halladale Inn on the west side of the river, looking across to Bighouse (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.12). The Medium Heritage Value and High contribution of setting, results in a High sensitivity to change.

17.4.4.8.10 Ben Griam Beg Hillfort, SM 1836

Whilst this site lies 3 km beyond the 30 km study area, it has been included because of its prominence and as an indicator of likely potential impact for other undesignated sites in this southerly direction from the PFOWF Array Area.

This Scheduled site comprises a hillfort and contemporary complex of walls and enclosures below it (see Figure 17.3 CH VP 11). The fort occupies the flattish summit of the hill and at 580 m OD is the highest in Scotland. It is assumed to be Iron Age but may span a longer period than that. The fort measures 152 m by 61 m, bounded by a ruinous drystone wall, 1.8 m thick and 1 m in average height. It is flanked at a lower level by enclosures on the west and north-east. Some way below the fort on the south the remains of a wall of similar build cross the steep hillside. On either side of this wall there are traces of irregularly shaped enclosures, which seem to be made up of small plots or pounds, clearance heaps and cleared platforms set into the slope. The remote and exposed situation of the complex may indicate a temporary refuge with the steep rock-strewn hill slopes affording a good natural defence, rather than a permanent settlement.

The site has extensive 360-degree views over the low-lying open landscape below and to Ben Griam Mor to the south-west (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.13). The site occupies a topographically prominent position on the summit of a distinctive, steep-sided hill in a predominantly open lower landscape of bog and moorland (High contribution of setting). The High Heritage Value and High contribution of setting, results in a High sensitivity to obvious change that does not blend into the distant vistas.

17.4.4.8.11 Bridge of Broubster standing stones, SM 426

The site consists of the remains of an elongated horseshoe-shaped setting of standing stones 0.2 to 2.2 m in height, with its open end to the south-west SW (see Figure 17.3 CH VP 12). These rare stone settings are thought to be connected with the Neolithic tradition of stone circle building.

The stones are set in a gap in forestry plantation, with 180-degree views across open moorland to the west (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.14). The area is one of many prehistoric sites including chambered cairns, standing stones, mounds, brochs and hut circles, as well as later sites such as the deserted township of Broubster. Intervisibility with many of the prehistoric sites in the Broubster to Shebster area to the south-west of the site still remains, whilst the plantation divorces the stones from similar sites to the east around Loch Shurrery. The extensive Broubster Forest starts to the west, whilst 4.5 km to the north is the Baillie Wind Farm. Such extensive modern changes result in a Low contribution of Setting except to the south-west. The High Heritage Value of the site and Low contribution of setting, results in a Minor sensitivity to change except in the immediate location and to the south-west, which would be Medium.

17.4.4.8.12 Cnoc na Ciste Chambered Cairn, Sordale Hill, SM 442

This Neolithic burial site sits 109 m OD on top of a prominent hill with at least five more burial cairns on its lower slopes, including the scheduled Sordale Hill Long and Gallow Hill cairns some 550 m to the west and south-west respectively (see Figure 17.3 CH VP 13). The hilltop is almost flat, meaning the 18 m diameter 2.5 m high cairn is quite conspicuous with open views all round. The passage was entered from the south-east. Kerbstones and a lintel are still visible.

The wider landscape comprises modern farm buildings and rough grazing, with Halkirk 3.5 km to the south-west and Thurso 7 km to the north-west (High contribution of setting), with Baillie Wind Farm in the far distance (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.15). The High Heritage Value of the site and High contribution of setting, results in a High sensitivity to change.

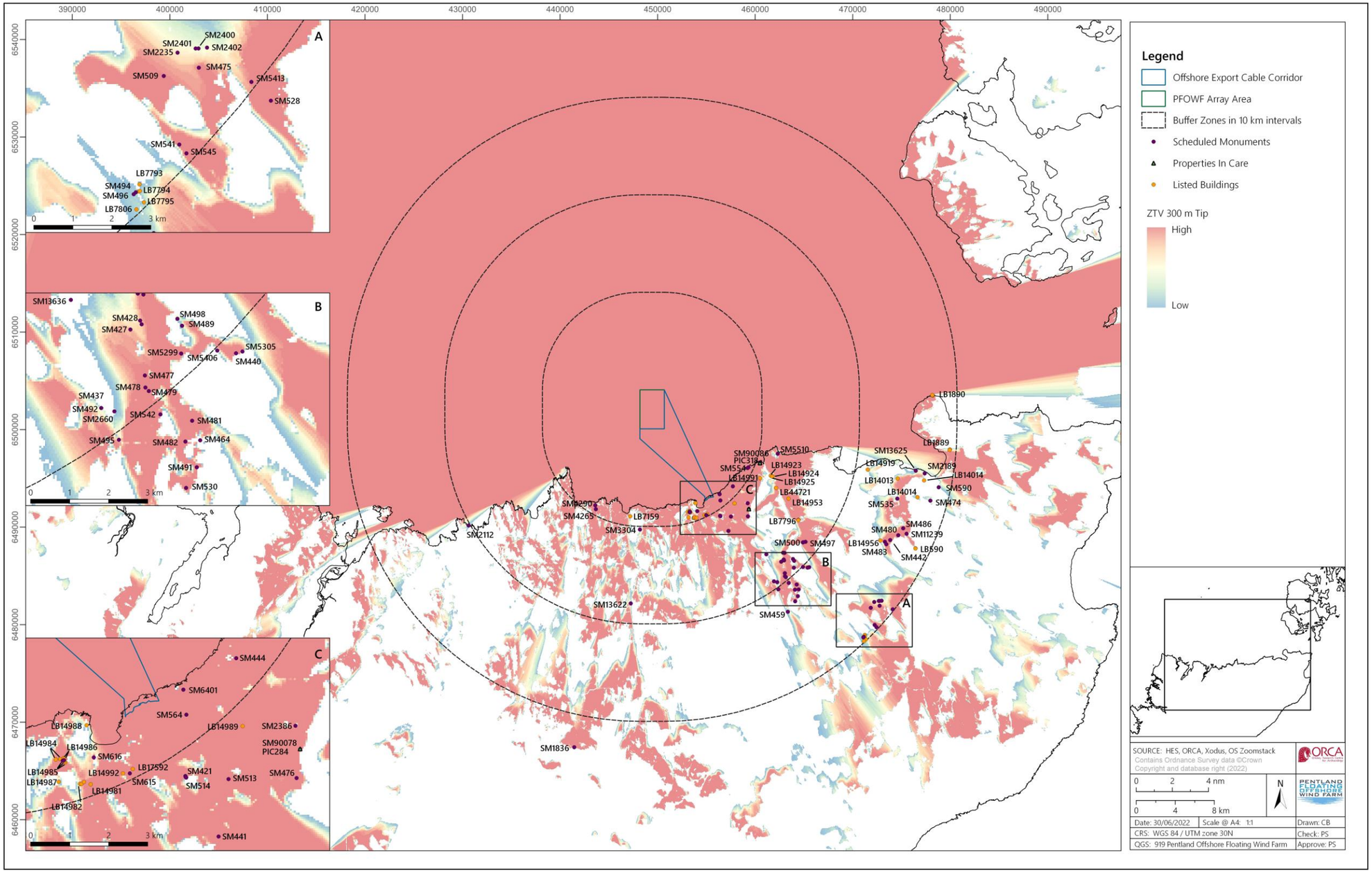


Figure 17.2 Designated historic environment assets in relation to the PFOWF Array Area ZTV

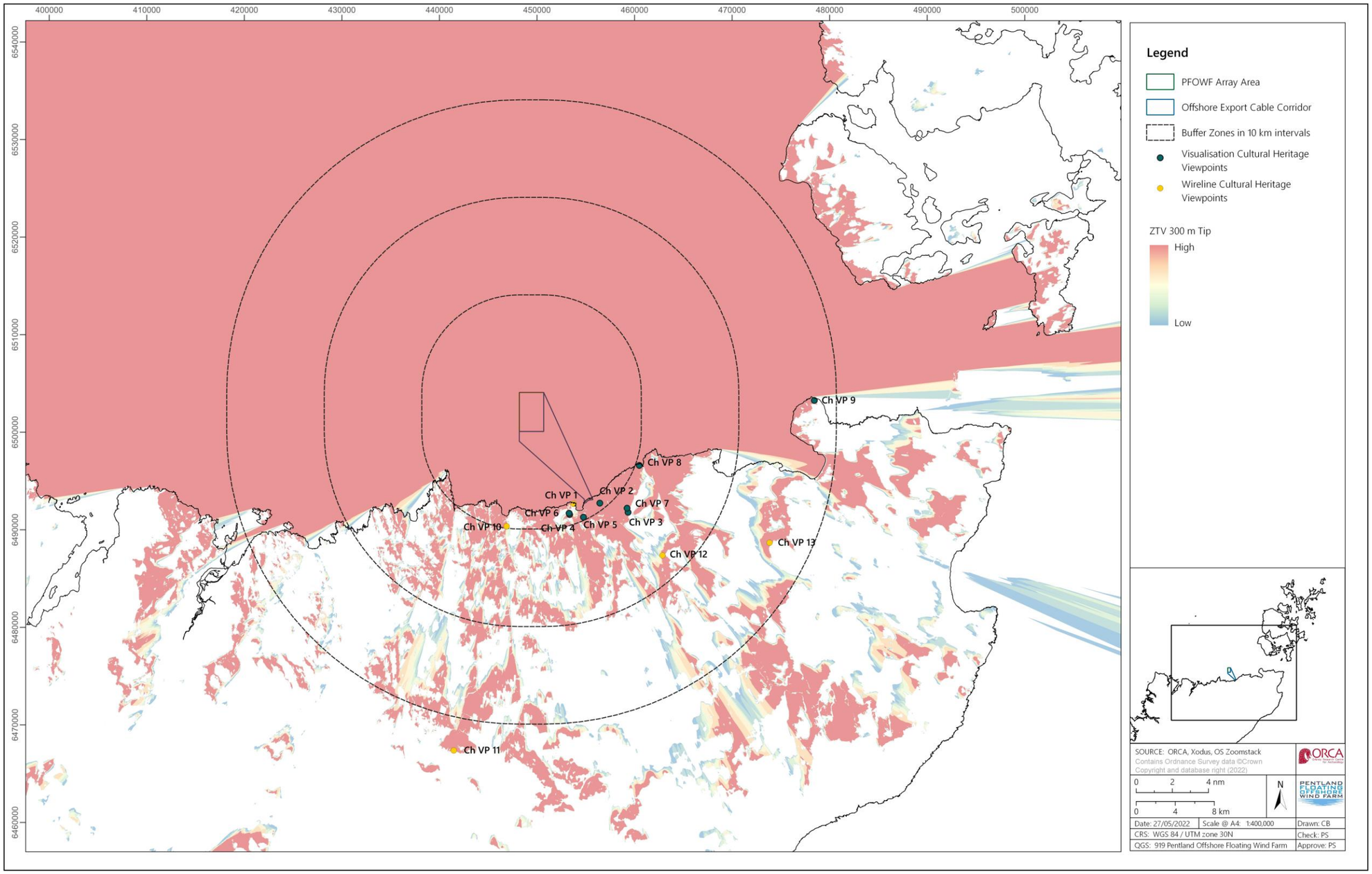


Figure 17.3 Historic environment asset viewpoints used for setting assessment in relation to the PFOWF Array Area ZTV

17.4.5 Summary of Baseline Environment

No sensitive historic environment receptors within the Offshore Study Area were identified from the baseline characterisation studies described above. The potential for unknown assets is considered Low to Negligible.

However, there are sensitive historic environment receptors within the Setting Study Area, which is focussed on the potential impacts of the Offshore Development on onshore assets (see 17.4.4.8).

Potential receptors and impacts scoped into and out of the assessment are provided in Section 17.5 along with justification.

17.4.6 Data Gaps and Uncertainties

Extensive desk-based review work was undertaken to identify the marine historic environment baseline in the Offshore Study Area. Combined with an archaeological review of the marine geophysical datasets collected for the Offshore Development, a robust baseline has been provided for the impact assessment. Despite the small area along the south-west side of the OECC that was not subject to geophysical survey (see Figure 17.1), it is considered that the area surveyed was sufficient to typify the OECC. No significant data gaps in the Offshore Site Area are considered to be present.

The Setting Study Area of 30 km radius was agreed upon with statutory consultees (see Section 17.3) to be sufficient for identifying potential significant effects. In order to keep the assessment reasonable and proportionate, it was agreed upon with the statutory consultees, as detailed in Table 17.2, that a selection of designated sites and areas (such as Scheduled Monuments, Listed Buildings, Conservation Areas, GDLs and any recommended by HES and THC) would be assessed rather than every such site and area, and act as proxy for the range of effects on all other designated (totalling more than 160) and many more undesignated sites. This means that although the baseline setting of every site has not been evaluated individually, it is considered that this approach has provided a robust baseline for an impact assessment of the Offshore Development.

17.5 Impact Assessment Methodology

17.5.1 Impacts Requiring Assessment

This assessment covers all potential impacts identified through the scoping process, as well as any further potential impacts that have been highlighted as the EIA has progressed. It should be noted that impacts are not necessarily relevant to all stages of the Offshore Development.

Table 17.4 below indicates all of the potential direct and indirect impacts assessed with regards to Marine Archaeology and Cultural Heritage and indicates the Offshore Development stages to which they relate. Cumulative impacts are discussed in Section 17.7.

Table 17.4 Impacts requiring assessment

Impact	Description
Construction	
Loss of or damage to known marine and intertidal historic environment assets;	During construction and installation, any activities that affect the seabed and intertidal zone have the potential to result in the damage to/loss of known cultural material lying on the seabed. Seabed preparation, the installation of Offshore Export Cable(s) and inter-array cables, trenching, anchors, mooring lines, clump weights and scour protection on the seabed have the potential to cause direct damage to sites of marine cultural heritage. The potential for this impact is considered in Section 17.5.2.
Loss of or damage to unknown marine and intertidal historic environment assets;	During construction, any activities that affect the seabed and intertidal zone have the potential to result in the damage to / loss of unknown cultural material lying on the seabed. Seabed preparation, the installation of Offshore Export Cable(s) and inter-array cables, trenching, anchors, mooring lines, clump weights and scour protection

Impact	Description
	on the seabed have the potential to cause direct damage to sites of marine cultural heritage. An assessment of this impact is provided in Section 17.6.1.
Loss of or damage to submerged prehistoric landscapes;	During construction, any activities that affect the seabed and intertidal zone have the potential to result in the damage to / loss of any submerged prehistoric and paleoenvironmental deposits lying on or below the seabed. Seabed preparation, the installation of Offshore Export Cable(s) and inter-array cables, trenching, anchors, mooring lines, clump weights and scour protection on the seabed have the potential to cause direct damage to sites of marine cultural heritage. An assessment of this impact is provided in Section 17.6.1.
Operation and Maintenance	
Loss of or damage to known marine historic environment assets;	During operation and maintenance any activities that affect the seabed and intertidal zone have the potential to result in the damage to / loss of known cultural material lying on the seabed. Potential scouring from Offshore Export Cable(s) and inter-array cables, anchors, mooring lines, clump weights and scour protection itself, as well as any cable re-burial works, or remedial cable protection works have the potential to result in the damage / loss of cultural material lying on the seabed. The potential for this impact is considered in Section 17.5.2
Loss of or damage to unknown marine historic environment assets;	During operation and maintenance any activities that affect the seabed and intertidal zone have the potential to result in the damage to/loss of unknown cultural material lying on the seabed. Potential scouring from Offshore Export Cable(s) and inter-array cables, anchors, mooring lines, clump weights and scour protection itself, as well as any cable re-burial works, or remedial cable protection works have the potential to result in the damage / loss of cultural material lying on the seabed. An assessment of this impact is provided in Section 17.6.2.
Loss of or damage to submerged prehistoric landscapes;	During operation and maintenance any activities that affect the seabed and intertidal zone have the potential to result in the damage to / loss of any submerged prehistoric and paleoenvironmental deposits lying on or below the seabed. Potential scouring from Offshore Export Cable(s) and inter-array cables, anchors, mooring lines, clump weights and scour protection itself, as well as any cable re-burial works, or remedial cable protection works have the potential to result in the damage / loss of cultural material lying on the seabed. An assessment of this impact is provided in Section 17.6.2.
Long-term changes to the setting of onshore historic environment assets that reduces their value;	There is a possibility that the offshore WTGs could have long-term effects on the setting of an onshore historic environment asset, affecting the way in which the asset is understood, appreciated and experienced, and thus the significance/ importance of the historic asset. There may also be cumulative effects on setting with other projects. An assessment of this impact is provided in Section 17.6.2.
Decommissioning	
Loss of or damage to known marine and intertidal historic environment assets;	During decommissioning, the removal of infrastructure from the seabed has the potential to result in the damage to / loss of known cultural material lying on the seabed. The potential for this impact is considered in Section 17.5.2
Loss of or damage to unknown marine and intertidal historic environment assets; and	During decommissioning, the removal of infrastructure from the seabed has the potential to result in the damage to / loss of unknown cultural material lying on the seabed. An assessment of this impact is provided in Section 17.6.3.
Loss of or damage to submerged prehistoric landscapes.	During decommissioning, the removal of infrastructure from the seabed has the potential to result in the damage to / loss of unknown cultural material lying on the seabed. An assessment of this impact is provided in Section 17.6.3.

The assessment of impacts on the marine historic environment and on onshore historic assets potentially indirectly affected by the Offshore Development by affecting their setting was a desk-based exercise making use of project specific desk-based research (see Section 17.4 above), marine geophysical survey data (Offshore EIAR [Volume 3]: Appendix 17.3), site visits, visualisations and wirelines created by OPEN (Offshore EIAR [Volume 4]: Visual Materials). All followed methodology and standard guidance as outlined in the Methodology (Offshore EIAR [Volume 3]: Appendix 17.1).

17.5.2 Impacts Scoped Out of the Assessment

The following impacts were scoped out of any further assessment:

- **Loss of or damage to known marine and intertidal historic environment assets during construction and installation**. There are no known assets within the Offshore Site, with nothing identified either from desk-based research or in the marine geophysical survey data. Therefore, there is no potential for direct impacts upon known marine historic environment receptors due to the construction and installation of the Offshore Development.
- **Loss of or damage to known marine and intertidal historic environment assets during operation and maintenance.** There are no known assets within the Offshore Site, with nothing identified either from desk-based research or in the marine geophysical survey data. Therefore, there is no potential for direct impacts upon known marine historic environment receptors due to the operation and maintenance of the Offshore Development.
- **Loss of or damage to known marine and intertidal historic environment assets during decommissioning.** There are no known assets within the Offshore Site, with nothing identified either from desk-based research or in the marine geophysical survey data. Therefore, there is no potential for direct impacts upon known marine historic environment receptors due to the decommissioning of the Offshore Development.
- **Cumulative impacts on known marine and intertidal historic environment assets during construction, operation and maintenance, and decommissioning.** There are no known assets within the Offshore Site, with nothing identified either from desk-based research or in the marine geophysical survey data. Therefore, there is no potential for direct cumulative impacts upon known marine historic environment receptors.

17.5.3 Assessment Methodology

The full assessment methodology for Marine Archaeology and Cultural Heritage is described in Appendix 17.1 (Offshore EIAR [Volume 3]).

Topic specific criteria have been developed for the value of the importance, sensitivity and vulnerability of historic environment receptors (both on the seabed and onshore relating to setting), as outlined in Table 17.5 and Table 17.6 Marine geophysical survey anomalies were reviewed to identify if there were any anthropogenic features, which would then be incorporated into the same value and impact criteria.

The sensitivity or value of the receptor is combined with the magnitude of impact, supported by expert judgement to arrive at a consequence for each impact under consideration. Example criteria for identifying the magnitude of impact on marine historic environment receptors are presented in Table 17.7 and example criteria for assessing magnitude of impact on the setting of onshore historic environment receptors are presented in Table 7.8. The determination of the consequence of any adverse effects is outlined in Table 17.9 with the significance of effect derived directly from the consequence ranking, as shown in Table 17.10, with residual effects identified subsequent to any additional mitigation, if possible or required. The example criteria presented in the tables below are used to inform the assessment, but the tables and matrices are tools and not mechanical systems. Professional judgement is also required to input into the assessment, which may result in heritage values and significance of effect being moved higher or lower than the matrix result. This may also result in a significant material effect that does not reduce the integrity or heritage value of the receptor being identified as potentially acceptable by the statutory authorities. This reasoning is stated in the individual assessment wherever this is the case.

"*Setting can often be integral to a historic asset's cultural significance.....'Setting' is the way the surroundings of a historic asset or place contribute to how it is understood, appreciated and experienced. Monuments, buildings, gardens and settlements were almost always placed and orientated deliberately, normally with reference to the surrounding topography, resources, landscape and other structures. Over time, these relationships change, although aspects of earlier settings can be retained*." (*Managing Change in the Historic Environment: Setting*. HES 2020). To assess setting impacts, a ZTV was established for the Offshore Development. A 30 km radius around the boundary of the PFOWF Array Area was established to identify any designated cultural heritage assets from which the development will be partially or fully visible (see Figure 17.3). There were many designated cultural heritage assets within the 30 km radius that were not within the ZTV and, after initial consideration in case they could be affected, were not considered further within the assessment. Those outwith the ZTV but with the potential to be affected, such as Bighouse (see Figure 17.3 VP 10), were retained within the assessment.

Due to the total number of sites, as agreed in the methodology sent to stakeholders (see Offshore EIAR [Volume 3]: Appendix 17.1), this EIAR assesses a selection of appropriate designated sites likely to have the most visibility of, and impact from, the PFOWF Array Area to act as proxy for all the others, which are summarised in table form in Offshore EIAR (Volume 3): Appendix 17.2. Wirelines and visualisations were provided by OPEN that showed the worst case scenario (see Section 17.5.4 below) for selected designated sites (see Offshore EIAR (Volume 4)Test wirelines were run for some sites for which the ZTV indicated visibility but were in fact not affected or had low visibility of the PFOWF Array Area and so were not included (see Offshore EIAR [Volume 3]: Appendix 17.2 for these).

Table 17.5 Example criteria for value of historic environment receptors

Value of receptor	Definition
Very high	World Heritage Sites; and Designated and undesignated wrecks, aircraft, archaeological sites, areas and buildings of international importance due to association, rarity, intrinsic value, loss of life and/or retaining archaeological, structural, architectural, decorative or other physical remains to the extent that it makes a highly significant contribution to our understanding or appreciation of the past.
High	Scheduled Monuments and sites proposed for scheduling; Category A Listed Buildings; Inventoried Gardens and Designed Landscapes; Interconnected groups of B-Listed buildings; Outstanding Conservation Areas; Historic Battlefields; Historic Marine Protected Areas and Designated Wrecks; Aircraft lost on military service; and Undesignated wrecks, archaeological sites, areas and buildings of national importance (identified in the HER) due to association, rarity, intrinsic value, loss of life and/or retaining archaeological, structural, architectural, decorative or other physical remains to the extent that it makes a significant contribution to our understanding or appreciation of the past.
Medium	Category B and Category C(S) Listed Buildings; Historic burial grounds; Protected heritage landscapes; Conservation Areas; and Undesignated archaeological sites, areas, buildings, wrecks and cargos of equivalent regional importance (identified in the HER), or of high local significance, due to association, rarity, intrinsic value, loss of life, and/or retaining archaeological, structural, architectural, decorative

Value of receptor	Definition
	or other physical remains to the extent that it makes a significant contribution to our understanding or appreciation of the past.
Low	Cultural heritage assets the physical remains of which contribute little to our understanding or appreciation of the past; Cultural heritage assets of local value or interest for education or cultural appreciation; Undesignated archaeological sites, areas, buildings, wrecks and cargos of equivalent local importance (identified in the HER) due to limited intrinsic, contextual or associative characteristics, or that are still common; and Unlisted historic buildings and settlements with local characteristics.
Negligible	Sites of former archaeological features, lifted or salvaged wrecks; Unlisted buildings of little historic or architectural interest; Sites or features the physical remains of which make a negligible contribution to our understanding or appreciation of the past; Single findspots; and Sites of little or no known heritage importance.

Table 17.6 Example criteria for importance of setting and sensitivity to change

Sensitivity to change	Importance of Setting
Very high	A setting that makes a crucial contribution to the understanding and/or appreciation of the siting and/or historical / archaeological / architectural context of a receptor. (Examples of this include: dominant topographic locations; surroundings that include highly related monuments in extremely close association; surroundings that are believed not to have changed from those when the receptor was created)
High	A setting that makes a critical contribution to the understanding and/or appreciation of the siting and/or historical / archaeological / architectural context of a receptor. (Examples of this include: prominent topographic locations; surroundings that include related monuments in close association; surroundings that are believed to be little changed from those when the receptor was created)
Medium	A setting that makes a positive contribution to the understanding and/or appreciation of the siting and/or historical / archaeological / architectural context of a receptor. (Examples of this include: surroundings that complement the siting and appearance of a receptor, such as the presence of a feature of the rural past within a more recent farming landscape containing little or no urban or industrial development)
Low	A setting that makes little positive contribution to the understanding and/or appreciation of the siting and/or historical / archaeological / architectural context of a receptor. (Examples of this include: surroundings that only partially complement the siting and appearance of a receptor, such as the presence of a feature of the rural past within a partly urbanized or industrialized landscape)
Negligible	A setting that does not contribute positively to the understanding and/or appreciation of the siting and/or historical / archaeological / architectural context of a receptor. (Examples of this include: immediate surroundings, such as commercial coniferous woodland or an industrial development, that are not relevant to the understanding of the context of the receptor)

Table 17.7 Example criteria for assessing magnitude of impact on marine historic environment receptors

Magnitude of Impact	Direct impacts: Marine	Indirect Impacts: Marine
High	Works would result in the complete loss of an asset, or the loss of an area, features or evidence fundamental to the historic character and integrity of the site, which would result in the complete loss of physical integrity.	The removal of, or a fundamental and irreversible change to, the relationship between a marine heritage asset or environment and a historically relevant seabed context. Major change that removes or prevents appreciation of characteristics key to a heritage asset, or permanent change to or removal of surroundings of a less sensitive asset or seabed context. A noticeable change to a key relationship between a marine heritage asset or environment and a highly sensitive, valued or historically relevant seabed context over a wide area or an intensive change to a less sensitive or valued asset or seabed context over a limited area.
Medium	Works would result in the loss of an important part of the site or some important features and evidence, but not areas or features fundamental to its historic character and integrity. The integrity of the site would be affected, but key physical relationships would not be lost.	Noticeable change to a non-key relationship between a marine heritage asset or environment and a historically relevant seabed context. A heritage asset and setting that is tolerant of moderate levels of change. Small changes to the relationship between a heritage asset and a historically relevant seabed context over a wide area or noticeable change over a limited area.
Low	Works would not affect the main features of the site. The historic integrity of the site would not be significantly affected.	Minor changes to the relationship between a heritage asset or environment and a historically relevant seabed context over a wide area or minor changes over a limited area. A heritage asset and setting that is considered tolerant of change.
Negligible	Works would be confined to a relatively small, peripheral and/or unimportant part of the site. The integrity of the site, or the quality of the surviving evidence would not be affected.	Changes to a historically relevant seabed context that cannot be discerned or perceived in relation to the heritage asset or environment.
Unknown	Groundbreaking works over features that have not been fully interpreted would reduce the chance of interpretation in the future. In the event of significant features this would constitute impact of high magnitude; for sites of lesser significance it is less problematical. Nevertheless, it remains an issue where features have not been or could not be interpreted.	Changes to a seabed context, where it is uncertain how these contribute to our understanding of the site because the feature or asset itself could not or has not been understood or interpreted.
Positive	An enhancement to the baseline condition of the asset.	An enhancement to the seabed context of a heritage asset or environment. An enhancement to preservation conditions of a heritage asset or environment.

Table 17.8 Example criteria for assessing magnitude of impact on the setting of onshore historic environment receptors

Magnitude of Impact	Setting Impact
High	The removal of, or a fundamental and irreversible change to, the relationship between a heritage asset and its relevant setting and the integrity of the setting. Major change that removes or prevents appreciation, understanding or experience of a heritage asset and its key characteristics, or permanent change to or removal of surroundings of a less sensitive asset. A noticeable change to a key relationship between a heritage asset and a highly sensitive, valued or historically relevant setting over a wide area or an intensive change to a less sensitive or valued asset or setting over a limited area.
Medium	Noticeable change to a non-key relationship between a heritage asset and its relevant setting, but the integrity of setting is adequately retained. A heritage asset and setting that is tolerant of moderate levels of change. Small changes to the relationship between a heritage asset and its setting over a wide area or noticeable change over a limited area.
Low	Minor changes to the relationship between a heritage asset and its setting over a wide area or minor changes over a limited area, with no adverse effect on the integrity of the setting. A heritage asset and setting that is considered tolerant of change.
Negligible	Changes to that cannot be discerned or perceived in relation to the heritage asset or environment.
Unknown	Changes to a setting, where it is uncertain how these contribute to our understanding, appreciation or experience of the site because the feature or asset itself could not or has not been understood or interpreted.
Positive	Changes to a setting that improves the relationship with the heritage asset.

Table 17.9 Consequence of adverse effects matrix

Importance / Sensitivity of Receptor	Magnitude of Impact				
	High	Medium	Low	Negligible	Positive
High	Major	Major	Moderate	Minor	Positive
Medium	Major	Moderate	Minor	Minor	Positive
Low	Moderate	Minor	Minor	Negligible	Positive
Negligible	Minor	Negligible	Negligible	Negligible	Positive
Uncertain	Uncertain / Major	Uncertain / Moderate	Uncertain / Minor	Uncertain / Negligible	Positive

Table 17.10 Assessment of significance of effect

Effect	Description	Significance of Effect
Positive	Positive – to be encouraged	Positive
Major	Highly significant and requires immediate action. May be intolerable risk or significance	Significant
Moderate	Significant – may require additional control measures and/or management where possible.	Significant
Minor	Not significant – however may require some management to ensure remains within acceptable levels	Not Significant
Negligible	Not Significant	Not Significant

17.5.4 Design Envelope Parameters

A detailed in Chapter 5: Project Description, this assessment considers the Offshore Development parameters, which are predicted to result in the greatest environmental impact, known as the 'realistic worst case scenario'. The realistic worst case scenario represents, for any given receptor and potential impact on that receptor, various options in the Design Envelope that would result in the greatest potential for change to the receptor in question. Confidence can be held that development of any alternative options within the design parameters will give rise to no effects greater or worse than those assessed in this impact assessment.

In terms of Marine Archaeology and Cultural Heritage, the realistic worst case scenario is based on the design option or combination of options that represent the greatest potential for impacts on any marine heritage receptors on or below the seabed by ensuring that the maximum parameters of components for the Offshore Development with potential to interact with such receptors are considered to ensure, for example, that the maximum area of seabed disturbance from the placement of subsea infrastructure, is assessed.

In terms of indirect impacts on historic environment assets onshore due to long-term changes to the setting of these assets that may reduce their heritage value, the maximum number and height of WTGs is assessed.

Where there are a number of options for the various Offshore Development components, the worst case in terms of seabed disturbance and potential effects on marine archaeology receptors has been assessed. For example, a number of anchoring options are being explored including drag embedment anchors. However, gravity anchors have the largest footprint and therefore represent the worst case anchor solution in terms of seabed disturbance and potential effects on marine archaeology receptors. Similarly, catenary mooring lines, although not the only mooring option, have also been identified as the worst case in terms of seabed disturbance and therefore the associated maximum parameters of that mooring option have been assessed. Hammer pile anchors have been assessed for impacts resulting from scour as they have the largest scour protection volume in comparison to other anchoring options being considered.

The Offshore Development components which have been identified as resulting in the worst case scenarios for each potential impact on Marine Archaeology and Cultural Heritage receptors are detailed below in Table 17.11.

Table 17.11 Design parameters specific to historic environment receptor impact assessment

Potential Impact	Design Envelope Scenario Assessed
Construction Phase	
Direct disturbance / displacement of marine historic environment assets (known and unknown) by installation of Offshore Development	**Offshore Export Cable(s)** > A maximum of two offshore export cables which will run from the PFOWF Array Area to landfall; > Maximum total combined length of cable is approximately 25 km; > Maximum trench width 3 m; > Maximum width of cable corridor 15 m (seabed disturbance, not trench width). Seabed prep including boulder removal, seabed levelling etc. will take place within this corridor; > Maximum % of seabed requiring preparation = 100% > Maximum seabed preparation footprint = 375,000 m^2 > Total duration of offshore ops = 4 months over spring / summer in Stage 1 or Stage 2 of the construction phase; and > Up to 50% of each of the Offshore Export Cable(s) may need protection, therefore maximum cable protection will be 6.25 km each cable, so 12.5 km in total. Cable protection height and width of 1 m and 7 m respectively. Total area of 87,500 m^2 / 0.0875 km^2 **HDD methods** > Two successful drilled holes (this may require up to five bore attempts); > The HDD exit point is expected to be approximately 600 m offshore. The water depth range in this region is between 15 m to 40 m; > Maximum offshore HDD length 700 m; > Maximum bore diameter 750 mm; and > Total duration of offshore ops = approximately 3 months over spring during Stage 1 or Stage 2 of the construction phase **Inter-array cables** > Maximum of 7 inter-array cables; > Maximum combined length of the cable is 25 km (all cables combined); > Maximum length of cable on the seabed is 20 km (all cables combined); > Maximum % of cable requiring seabed preparation (levelling, boulder removal) = 100%; > Maximum seabed preparation footprint (all cables) = 300,000 m^2; > Maximum of 14 gravity anchors on the seabed (2 per cable 20 m^2 per anchor); > 50% cable protection for IAC on seabed so 10,000 m in total. Cable protection height and width of 1 m and 7 m respectively. Total area of 70,000 m^2 / 0.07 km^2; and > Total duration of offshore ops = approximately 3 months in summer / autumn of Stage 2 of the construction phase.

Potential Impact	Design Envelope Scenario Assessed
	Moorings: catenary > Maximum number of moorings is 9 per substructure / WTG; > Maximum length of mooring that may come into contact with the seabed = 1,485 m per line (90% of total length); > Maximum lateral movement of 0.035 km^2 (assuming for full length of mooring line on seabed i.e. 1,485 m per mooring line); and > Total duration of offshore operations = approximately 6 months during spring / summer of Stage 1 and Stage 2 of the construction phase **Anchors: Gravity** > Up to 9 anchors per WTG; > Maximum permanent seabed footprint of 625 m^2 per anchor; > Maximum area of seabed preparation (levelling) of 900 m^2 per anchor; > Maximum seabed footprint of scour protection per anchor of 260 m^2; > Maximum permanent total anchor and scour protection footprint = 55,755 m^2.and > Total duration of offshore ops = approximately 6 months during spring / summer of Stage 1 and Stage 2 of the construction phase.
Operational Phase	
Direct disturbance/ displacement of marine historic environment assets (known and unknown) due to maintenance activities on the seabed and scouring around subsea infrastructure (including mooring lines as result of movement with wave and tides);	**Maintenance** Periodic ROV inspection surveys will be performed to ensure the cables remain buried and undamaged. If cables do become exposed, re-burial works, or remedial cable protection works would be undertaken. Maintenance activities expected to take place on the cables during the operational phase include but are not limited to: > Cable route inspection, both seabed and water column; > Cable repair by recovering the cable from its trench / water column and making the necessary repairs i.e. splicing in a new section etc.; > Reburial of sections of cable which have become exposed; and > Remedial protection over sections of the cable identified as in need of protection. **Offshore Export Cable(s) scouring** > Up to 50% of the Offshore Export Cable(s) may need protection, therefore maximum cable protection will be 6.25 km each cable, so 12.5 km in total. Cable protection height and width of 1 m and 7 m respectively. Total area of 87,500 m^2 / 0.0875 km^2 **Inter-array Cables scouring** > 50% cable protection for IAC on seabed so 10,000 m in total. Cable protection height and width of 1 m and 7 m respectively. Total area of 70,000 m^2 / 0.07 km^2.

Potential Impact	Design Envelope Scenario Assessed
	Moorings: Catenary scouring > Maximum number of moorings is 9 per substructure / WTG; > Maximum length of mooring that may come into contact with the seabed = 1,485 m per line (90% of total length); > Maximum lateral movement of 0.035 km^2 (assuming for full length of mooring line on seabed i.e. 1,485 m per mooring line). **Anchors – Gravity scouring** > Up to 9 anchors per WTG; > Maximum seabed footprint of 625 m^2 per anchor > Maximum seabed footprint of scour protection per anchor of 260 m^2; and > Maximum permanent total anchor and scour protection footprint = 55,755 m^2.
Indirect impacts on historic environment assets onshore due to long-term changes to the setting of assets that reduces their value	**WTGs and floating substructures** > Up to 7 WTGs with floating substructures > 300 m Maximum Blade Tip Height > 260 m Maximum Rotor Diameter
Decommissioning	
Direct disturbance / displacement of marine historic environment assets (known and unknown) by removal of infrastructure from the seabed.	In the absence of detailed information regarding decommissioning works, the implications for marine archaeology and cultural heritage are considered analogous with or likely less than those of the construction phase. Therefore, the worst case parameters defined for the construction phase also apply to decommissioning; The decommissioning approach is set out in Chapter 5: Project Description; Section 5.11. It is expected that most offshore components will be completely removed to shore for re-use, recycling and disposal during decommissioning, unless there is compelling evidence to leave the buried sections *in situ*. Piles may be cut 1 m below the surface. Buried cable and scour protection may not be practical to recover; and Relevant stakeholders and regulators will be consulted to establish the approach. The seabed will be restored, as far as reasonably practicable, to the condition it was prior to the construction of the Offshore Development.

17.5.5 Embedded Mitigation and Management Plans

As part of the Offshore Development design process, a number of designed-in measures and management plans have been proposed to reduce the potential for impacts on Marine Historic Environment receptors (see Table 17.12). As there is a commitment to implementing these measures, which will likely be secured through Section 36 Consent and Marine Licence conditions, they are considered inherently part of the design of the Offshore Development and have therefore been considered in the assessment presented below (i.e. the determination of magnitude of impact and therefore significance of effects assumes implementation of these measures). These measures are considered standard industry practice for this type of development.

There is limited opportunity to mitigate effects on the setting of onshore historic environment assets outwith standard mitigation measures undertaken in the iterative design process, summarised below in Table 17.12. This process has included the reduction of the PFOWF Array Area by 50%, reducing the horizontal extent of the offshore WTGs, reducing the maximum number of WTGs to seven, and locating them a minimum of 7.5 km from the Caithness coast, whilst previously they were located approximately 6 km (as described in Chapter 3: Site Selection and Alternatives).

Residual effects are those effects which remain after mitigation. The residual effects that the Offshore Development will have on marine historic environment assets and the setting of onshore historic environment receptors are summarised in Section 17.12.

Table 17.12 Embedded Mitigation Measures specific to the marine historic environment for the Offshore Development

Embedded Mitigation Measures and Management Plans	Justification
Management Plans	
Development of WSI and PAD	A marine heritage Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) to avoid or mitigate accidental impacts and manage any accidental discoveries of archaeological interest will be created as documents, submitted for approval to the licensing authorities and implemented during the construction phase of the Offshore Development. This will include the provision that if future sampling works (e.g. vibrocores, cone penetrometer tests, grab samples, auger samples, geotechnical pits) are undertaken to inform the Project design, the sample logs will be assessed to identify the potential for paleoenvironmental deposits to survive. Provision should be made for collecting and keeping spare cores, and for their analysis, so that material is available if it is shown that significant subsurface palaeolandscapes are to be damaged or destroyed.
Decommissioning activities	Decommissioning activities will create disturbance as infrastructure is removed but is not expected to be worse than or expand the footprint of disturbance that that during construction. The preparation of a Decommissioning Plan is required under Section 105 of the Energy Act 2004 (as amended).
Embedded Mitigations	
Micrositing and Avoidance	Seabed preparation, device locations, cable routing and installation activities will avoid any identified seabed heritage assets and anthropogenic geophysical anomalies by a minimum of 30 m as a result of conducting historic environment Desk Based Assessment (DBA) using data sources identified above and archaeological review of site-specific commissioned marine geophysical surveys. Final device locations and cable routes will be outlined in the DSLP and the Cable Plan respectively, which will be a condition of the Section 36 and Marine Licence consents.
Cable protection systems	Cable protection systems that reduce seabed scouring will be used if deemed a requirement following a risk-based analysis to prevent the potential exposure or disturbance of marine historic environment assets that may lie unidentified below the surface of the seabed. Requirements will be outlined within the Cable Plan, which will be required under the Section 36 and Marine Licence consent conditions.
Reduction in array area and number of WTGs	The likely effects of different layout scenarios on the setting of onshore historic assets have been investigated as part of the review of the worst case scenario layout for the Offshore Development. This process has led to the reduction of the PFOWF Array Area from 20 km^2 to 10 km^2, reducing the horizontal extent of the offshore WTGs. The maximum number of WTGs has been reduced from 10 to seven, and they are now

Embedded Mitigation Measures and Management Plans	Justification
	located a minimum of 7.5 km from the Caithness coast, whilst previously they were located approximately 6 km.

17.5.6 Data Gaps and Uncertainties

No significant uncertainties have been identified that may affect the impact assessment.

It is never possible to eliminate the risk entirely, because smaller artefacts / wreckage of stone, non-ferrous metals such as aluminium and wood might not be picked up by such surveys. However, the risk of unknown marine and intertidal historic environment assets being present in the Offshore Site has been much reduced because of the marine geophysical surveys conducted and reviewed and, along with the embedded mitigations and management plans, means that the impact assessment of this risk is robust.

The Setting Study Area of 30 km radius was agreed upon with statutory consultees (see Section 17.3) to be appropriate for identifying potential significant effects, rather than the 50 km radius applied in Chapter 16: Seascape, Landscape, and Visual Amenity. In order to ensure a reasonable and proportionate assessment, it was agreed, as detailed in Table 17.2, that that a selection of designated sites and areas (such as Scheduled Monuments, Listed Buildings, Conservation Areas, GDLs and any recommended by HES and THC) would be assessed and would act as proxies for the range of effects on all other designated (totalling more than 100) and (many more) undesignated sites. This means that although the effect on the setting of every site has not been assessed individually, it has been agreed that this approach has provided a robust impact assessment of the Offshore Development.

17.6 Assessment of Potential Effects

17.6.1 Effects During Construction

17.6.1.1 Loss of or damage to unknown marine and intertidal historic environment assets

The risk of unknown marine and intertidal historic environment assets being present in the Offshore Site has been much reduced because of the marine geophysical surveys conducted and reviewed. It is never possible to eliminate the risk entirely, because smaller artefacts / wreckage of stone, non-ferrous metals such as aluminium and wood might not be picked up by such surveys.

The historic importance of such items could vary anywhere from negligible to high. However, due to the surveys conducted to reduce the risk and the localised construction / installation activities, the likelihood of impact is considered low. The embedded mitigation of the implementation of a PAD to avoid or mitigate accidental impacts and manage any accidental discoveries of archaeological interest means that the magnitude of direct impact is **negligible**.

Therefore, the consequence of effect is **minor** and the resulting significance of effect **minor** and therefore **not significant**.

17.6.1.2 Loss of or damage to submerged prehistoric landscapes

Submerged prehistoric and paleoenvironmental deposits are generally considered to have moderate or high heritage value or sensitivity. However, no submerged paleoenvironmental deposits have been identified within the Offshore Site from review of the SBP marine geophysical survey data, and none is known from other studies. However, because SBP data comprise slice snapshots rather than 100% coverage, it is not possible to eliminate the risk. However, the surveys conducted and the localised construction / installation activities compared to the potential extent of such deposits, means that the likelihood of impact is considered low. The embedded mitigation of the implementation of a PAD to avoid or mitigate accidental impacts and manage any accidental discoveries of archaeological interest means that the **magnitude of direct impact is negligible.**

Therefore, the consequence of effect is **minor** and the resulting significance of effect is **minor** and therefore **not significant**.

.

Table 17.13 Summary of significance of effects from construction impacts

Summary of Effect	Receptor	Sensitivity	Magnitude of Impact	Rationale	Consequence	Significance of Effect	Additional Mitigation Requirements	Residual Significance of Effect
Loss of or damage to unknown marine and intertidal historic environment assets	Unlocated wreckage and other unknown assets	Negligible-High	Negligible	None have been identified in the Offshore Study Area during review of the marine geophysical data	Minor Effects	Not significant	No additional mitigation measures have been identified for this impact above and beyond the embedded project mitigation listed in Section 17.5.5 (instatement of WSI & PAD).	Not significant
Loss of or damage to submerged prehistoric landscapes	Submerged prehistoric sites & paleoenvironmental deposits	Moderate - High	Negligible	None have been identified in the Offshore Study Area during review of the marine geophysical data, though the possibility of patchy remains may still exist	Minor Effects	Not significant	No additional mitigation measures have been identified for this impact above and beyond the embedded project mitigation listed in Section 17.5.5 (instatement of WSI & PAD).	Not significant

17.6.2 Effects During Operation and Maintenance

17.6.2.1 Loss of or damage to unknown marine and intertidal historic environment assets

The risk of unknown marine and intertidal historic environment assets being present in the Offshore Site has been much reduced because of the marine geophysical surveys conducted and reviewed. It is never possible to eliminate the risk entirely because smaller artefacts / wreckage of stone, non-ferrous metals such as aluminium and wood might not be picked up by such surveys. The historic importance of such items could vary from negligible to high.

During operation and maintenance any activities that affect the seabed and intertidal zone have the potential to result in the damage / loss of unknown cultural material lying on the seabed. Potential scouring from Offshore Export Cable(s) and inter-array cables, anchors, mooring lines, clump weights and scour protection itself, as well as any cable re-burial works, or remedial cable protection works have the potential to result in the damage / loss of cultural material lying on the seabed.

However, due to the desk based survey and marine geophysical surveys conducted to reduce the risk (which did not identify any marine assets within the study area), the likelihood of impact during operation and maintenance is considered negligible. The embedded mitigation of the implementation of a PAD to avoid or mitigate accidental impacts and manage any accidental discoveries of archaeological interest means that the magnitude of direct impact is **negligible**.

Therefore, the consequence of effect is **minor** and the resulting significance of effect **minor** and therefore **not significant**.

17.6.2.2 Loss of or damage to submerged prehistoric landscapes

Submerged prehistoric and paleoenvironmental deposits are generally considered to have moderate or high heritage value or sensitivity. However, no submerged paleoenvironmental deposits have been identified within the Offshore Site from review of the SBP marine geophysical survey data, and none is known from other studies. Because SBP data comprises slice snapshots rather than 100% coverage, it is not possible to eliminate the risk.

During operation and maintenance any activities that affect the seabed and intertidal zone have the potential to result in the damage / loss of submerged deposits on or below seabed. Potential scouring from Offshore Export Cable(s) and inter-array cables, anchors, mooring lines, clump weights and scour protection itself, as well as any cable re-burial works, or remedial cable protection works have the potential to result in the damage / loss of cultural material lying on the seabed.

However, due to the desk-based survey and marine geophysical surveys conducted (which did not identify any marine assets within the study area) and in consideration of the potential extent of such deposits, the likelihood of impact during operation and maintenance is considered to be negligible. The embedded mitigation of the implementation of a PAD to avoid or mitigate accidental impacts and manage any accidental discoveries of archaeological interest means that the magnitude of direct impact is **negligible**.

Therefore, the consequence of effect is **minor** and the resulting significance of effect is **minor** and therefore **not significant**.

17.6.2.3 Adverse changes to the setting of onshore historic environment assets

The potential for the Offshore Development to adversely impact on the setting of onshore historic environment assets, reducing their heritage value by affecting the way the asset is understood, appreciated and/or experienced is assessed below.

A selection of statutorily designated sites and areas have been considered to act as proxies for the range of effects on all other designated and undesignated sites, as detailed in Section 17.5.3. The sites chosen are likely to have the most visibility of and impact from the PFOWF Array Area (tested by running draft wirelines). The remaining designated sites are summarised in table form in Offshore EIAR (Volume 3): Appendix 17.2.

17.6.2.3.1 Sandside Harbour, 1 and 2 Sandside and Fishing Store, LB 14988 Grade A

Sandside Harbour (see Figure 17.3 CH VP 1), Numbers 1 and 2 Sandside, and the Fishing Store have a High Heritage Value and a Medium contribution of setting, with a **high** sensitivity to change in terms of the key views from the harbour north-east towards the Pentland Firth and the Dounreay Site and from 1 and 2 Sandside and the fishing store towards the eastern Pentland Firth and Sandside Bay and to the west from the front elevations. Otherwise sensitivity to change is **medium**.

No WTGs would be visible from the harbour or the approach to it. There is no effect on the key sightlines out through the mouth of the harbour or from the east or west elevations of the buildings (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.4). Therefore, there is a **negligible** magnitude of impact, and resulting in an impact of **minor** consequence as calculated by matrix table.

However, professional judgement indicates that the resulting significance of effect is **negligible** since the effect does not impact the integrity of the setting, the heritage value of the receptors, or the understanding, appreciation or experience of the assets, and is therefore **not significant**.

17.6.2.3.2 Cnoc Urray, SM 564

The setting of the broch (see Figure 17.3 CH VP 2) makes little positive contribution to the understanding and/or appreciation of the siting of the monument (a Low contribution of setting) due to the close proximity of the Dounreay Site and the Vulcan NRTE c. 390 m to the north, meaning that it has a **medium** sensitivity to change.

The photomontage provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.5d) shows that four WTGs would be visible behind the Dounreay Site. These WTGs would not materially alter the baseline setting of the broch site (a **low** magnitude of impact on setting) as they would be seen with overhead power lines and associated pylons in the foreground, behind the Dounreay Site and the Vulcan NRTE and be no higher in the view than some of those buildings.

The consequence of effect would be **minor,** and the resulting significance of effect on setting would be m**inor** since the effect does not reduce the integrity of the setting, the heritage value of the receptor, or the understanding, appreciation or experience of the asset, and therefore **not significant**.

17.6.2.3.3 Cnoc Freiceadain, SM 90078

The setting of the two long cairns on an elevated topographical position (see Figure 17.3 CH VP 3) would have allowed for 360-degree views of the surrounding landscape and makes them a prominent feature on the skyline. Key views from the burial mounds would have been to other funerary sites or settlement sites in the surrounding area, such as the Hill of Shebster chambered cairn, c. 750 m to the south and Creag Breac Mhor to the north. The cairns are located within an area of prehistoric activity that is also within a more recent farming landscape with the extensive windfarm (21 WTGs) of Baillie Hill / Stemster Hill located 0.7 to 2.4 km to the east, pylons running nearby and the Dounreay Site at the coast (a Low contribution of setting eastwards due to Baillie Hill and a medium contribution of setting in terms of prominence). As the Cnoc Freiceadain long cairns have a high Heritage Value and a medium contribution of setting, the Scheduled funerary monument has a **medium** sensitivity to change.

The photomontage provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.6e) shows that the entirety of the Offshore Site would be visible breaking the horizon at sea in the middle distance beyond the Dounreay Site. Key views from the long cairns to the prehistoric monuments of Creag Bhreac Mhor 0.75 km to the north and north-west will have this change in the background, but the change does not disrupt the relationship between them. A similar effect is likely from the Hill of Shebster cairn to Cnoc Freiceadain. The change would not affect the key relationships of the site with monuments in any other direction. With the WTGs being out at sea, the land-based context of the site and its sense of place is not affected.

This noticeable change to the view northwards does not disrupt key relationships between the heritage asset and its relevant setting, forming a **medium** magnitude of impact on setting. The resulting consequence of effect on setting would be **moderate**.

However, because the effect is only in this quadrant, it might be considered that the change is material but partial. However, professional judgement indicates that the resulting significance of effect is **minor** since the effect does not significantly impact upon the heritage value of the receptors, or the understanding, appreciation or experience of the assets, and adequately retains the integrity of the setting, and is therefore **not significant**.

17.6.2.3.4 Reay Church, LB 14992 Grade A

Reay Parish Church (see Figure 17.3 CH VP 5) has a High Heritage Value and a Medium contribution of setting, the Category A Listed church therefore has a **high** sensitivity to change. It also stands as proxy for the other Listed Buildings in Reay village and the Scheduled Medieval burial ground and cross slab of Reay old parish church (SM 615).

The photomontage provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.7d) indicates that all of the PFOWF Array Area would be visible. The PFOWF Array Area would result in noticeable visual change in the relationship of Reay with the beach and the sea, and the approach to the church along the main road. The south elevation of the church and its key relationships with the other LBs and SMs in Reay, the village and the community it serves are not affected. The visual impact on the other various LBs and SMs in the village are much reduced because they are set amongst the other buildings of the village and many mature trees all screen the PFOWF Array Area to a great extent.

As the WTGs would be visible from the approaches to and from the main elevation of the Parish Church, the PFOWF Array Area would partly alter the setting of the Church (a **medium** magnitude of impact on setting). The resulting effect on the setting would be of **major** consequence by matrix definition.

This effect would not change the key relationships of the site with other heritage assets in the village, which is a **minor** consequence of effect. However, the change to the view northwards is a noticeable one, but confined solely to this direction and therefore only partial, resulting in a **moderate** significance of effect by matrix definition. However, professional judgement indicates that the resulting significance of effect is **minor** since the effect does not significantly impact upon the heritage value of the receptors, or the understanding, appreciation or experience of the assets, and adequately retains the integrity of the setting, and is therefore **not significant**.

17.6.2.3.5 Sandside House (LB 14984 Grade B) and Estate gardens (LB 14985 Grade B) and farm buildings (LB 14986 Grade A)

All of the Listed buildings within the Sandside Estate survive in a setting that has seen some more recent farming landscape and buildings as well as the construction of the Dounreay Site and the Vulcan NRTE within the wider setting (a medium contribution of setting). As the kiln barn and range of former byres, cottages, dairy and implement shed has a high Heritage Value and a medium contribution of setting (see Figure 17.3 CH VP 6), the Category A range of buildings therefore have a **high** sensitivity to change. The Category B Listed Sandside House and walled garden, dovecot and privy have a medium Heritage Value and a medium contribution of setting, therefore the resulting sensitivity to change is **medium**. Key views from within the Sandside Estate would have been to other adjacent farm buildings as well as to the main B-Listed house itself (see Figure 17.3 CH VP 4). The key design axes of the estate grounds are east-west (as are the main house elevations and windows) and to the south.

The PFOWF Array Area will be visible when looking northwards from the north side of the farm complex (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.8). The A-Listed farm buildings on the north side of the estate will be screened by the other parts of the range, estate cottages and modern farm sheds. The PFOWF Array Area will be screened from the other parts of the estate, especially the key axes (see Figure 17.3 CH VP 4) by the house itself and the woodland around the grounds.

Therefore, it is considered that this change to the setting of the various listed components of the Sandside Estate is a minor, limited impact of **low** magnitude. The resulting consequence of effect on the setting would by matrix definition be **moderate** for the Category A LBs and **minor** for the Category B LBs.

However, this effect is not to the key views or axes of the estate, or relationships between any of the key aspects of the estate, and so professional judgement indicates that the significance of effect on the A-Listed buildings is also m**inor**, and therefore **not significant**.

The garden walls of Sandside House will screen the view from the Scheduled carved stones (SM 616) to the PFOWF Array Area meaning that the change cannot be perceived in relation to these stones, resulting in a **negligible** magnitude of impact. The consequence of this effect is negligible, with the resulting significance of effect on the setting of the carved stones being **negligible** and **not significant.**

17.6.2.3.6 Creag Bhreac Mhor stone rows, SM 2386

The key view for the stones (see Figure 17.3 CH VP 7) seems to be to two cairns set on a lower ridge with a wider view beyond to the north-west in the direction of the Dounreay Site and the PFOWF Array Area. The stones are overlooked by the long cairns on Cnoc Freicadain. Whilst the immediate setting makes a high contribution, changes to the wider setting results in a medium contribution to setting, resulting in a **medium se**nsitivity to change, depending on how close to the asset that change is located.

The photomontage provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.9e) shows that the entirety of PFOWF Array Area would be visible breaking the horizon at sea in the middle distance beyond the Dounreay Site to the north-west in the key direction of the cairns to which the rows appear to be oriented. However, this view is already affected by the presence of the Dounreay Site in the middle distance, which has not affected the heritage value of the site, and the change does not sever the relationship between them. A similar effect is likely from Cnoc Freiceadain down to the stones. The change would not affect the key relationships of the site with monuments in any other direction. With the WTGs being out at sea, the land-based context of the site and its sense of place is not affected.

This noticeable change made by the PFOWF Array Area to the view northwards does not sever the key relationships between the heritage asset and its relevant setting, and so does not prevent the appreciation, understanding or experience of the stone rows. Therefore, this is a **medium** magnitude of impact on the setting of the stone rows. The resulting consequence of effect on setting would be **moderate** by matrix definition.

However, because the effect is only in this quadrant, it might be considered that the change is material but partial. Professional judgement indicates that the resulting significance of effect is **minor** since the effect does not significantly impact the heritage value of the receptors, or the understanding, appreciation or experience of the assets, and adequately retains the integrity of the setting, and is therefore **not significant**.

17.6.2.3.7 Crosskirk, St Mary's Chapel and Broch, Forss, SM 90086

The coastal location of these sites (see Figure 17.3 CH VP 8) indicates that views to and from the Pentland Firth are key, as is intervisibility with other similar sites in the such as the broch site at Green Tullochs (SM554) 1.3 km along the coast to the south-west, where a chambered cairn is also part of that scheduling and Tulloch of Lybster broch (undesignated) 650 m to the south.

The six-turbine Forss Wind Farm and the Forss Technology and Business Park 250 m to the south-west dominates Crosskirk. This has not affected the high heritage value of the chapel, which is a Property In Care (HES) and promoted as a site to visit, with car parking provided. The high heritage value and low contribution of setting results in a **low to medium** sensitivity to change.

The photomontage provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.10e) shows that the entirety of the PFOWF Array Area would be visible out to sea. The addition of the PFOWF Array Area would be a noticeable change to views from the site to the north-west, but not alter appreciation of Crosskirk's coastal location, intervisibility with other sites or any other key relationships between Crosskirk and its setting. This is a **medium** magnitude of impact with a **moderate** consequence of effect on setting by matrix definition.

However, taking into account the current setting of these sites, dominated by the Forss Wind Farm, the significance of effect is in reality **minor**. The change does not affect the integrity of the setting, or prevent the appreciation, understanding or experience of the site and is thus **not significant**.

17.6.2.3.8 Dunnet Head Lighthouse and Keepers' Houses, LB 1890 Grade B

The site occupies a highly prominent location on the cliffs of Dunnet Head, the most northerly point of the UK mainland (see Figure 17.3 CH VP 9). The key sightlines are to and from the Pentland Firth, whilst the views inland across Caithness with its farming landscape and windfarms are not essential to the understanding of the site, but do add to the experience. The medium Heritage Value and high contribution of setting, results in

a high sensitivity to change, according to definition. However, lighthouses can be considered as assets that are tolerant of change over a distance because of their function. Therefore, the buildings can be considered as having a **high** sensitivity to change in their immediate location, but a **low** sensitivity to change at a landscape / seascape level.

The photomontage provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.11e) shows that the entirety of PFOWF Array Area would be visible out to sea more than 25 km distant. The addition of the PFOWF Array Area would be a minor change to Dunnet Head's wider setting, not altering the experience and appreciation of the lighthouse, its location or understanding of its function, and does not affect the integrity of the setting.

This is a **low** magnitude of impact with a **minor** consequence of effect on setting that is of **minor** significance and thus **not significant**.

17.6.2.3.9 Bighouse Lodge, Garden Walls and Gate Piers, LB 7159 Grade B

The house sits outwith the ZTV in the shelter of the western slopes of the hill of Rubha an Tuir, which rises to the north-east, limiting views from the house to the open sea, precluding any direct views of the PFOWFArray Area from the house and grounds. There are open views to the house from the west side of the River Halladale and Melvich Beach, resulting in a high contribution of setting from this angle. Figure 17.3 VP 10 reflects this view, being located beside the A836 at the Halladale Inn on the west side of the river, looking across to Bighouse. The medium Heritage Value and high contribution of setting, results in a **high** sensitivity to change.

The wireline provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.12b) shows that two of the WTGs would be visible from Halladale Inn, possibly more when viewed from Melvich Beach. The main approach to the Lodge is from the south along the east side of the river, and thus not affected by this change. Similarly views from the house and gardens would not be affected. The PFOWF Array Area results in a noticeable change to the view across to the house from the west side of the river. This is a noticeable change to a non-key relationship between the asset and its setting, defined as a **medium** magnitude of impact**.**

Taking into account that this aspect of the setting undergoes a material change, the consequence of effect is **moderate** (rather than major by matrix calculation), resulting in a **moderate** significance of effect by matrix definition. However, professional judgement indicates that the resulting significance of effect is **minor** since the effect does not significantly impact the heritage value of the receptors, or the understanding, appreciation or experience of the assets, and adequately retains the integrity of the setting, and is therefore **not significant**.

17.6.2.3.10 Ben Griam Beg Hillfort, SM 1836

The site (see Figure 17.3 CH VP 11) has extensive 360-degree views over the low-lying open landscape below and to Ben Griam Mor to the south-west. The site occupies a topographically prominent position on the summit of a distinctive, steep-sided hill in a predominantly open lower landscape of bog and moorland (High contribution of setting). The high Heritage Value and high contribution of setting, results in a **high** sensitivity to obvious changes that do not blend into the distant vistas.

The wireline provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.13c) indicates that the PFOWF Array Area would be visible at a distance of 33 km but is a minor change in this wider landscape and therefore has an impact of **low** magnitude.

At this distance the effect is of **minor** consequence. Despite the sensitivity of the hillfort's setting, this change would not affect the integrity of the setting, the site's understanding, appreciation or integrity, sense of place or heritage value, resulting in a **minor** significance of effect that is n**ot significant.**

17.6.2.3.11 Bridge of Broubster standing stones, SM 426

The stones are set in a gap in forestry plantation, with 180-degree views across open moorland to the west (see Figure 17.3 CH VP 12). Intervisibility with many of the prehistoric sites in the Broubster to Shebster area to the south-west of the site still remains, whilst the plantation divorces the stones from similar sites to the east around Loch Shurrery. Extensive modern changes in the setting result in a low contribution of Setting, except to the south-west. The high Heritage Value of the site and low contribution of setting results in a **low** sensitivity to change except in the immediate location and to the south-west, which would be **medium**.

The wireline provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.14c) indicates that the PFOWF Array Area would be mostly screened from the site by topography, with some WTG blades only being visible to the west of the Baillie Hill Wind Farm. The key axes and sightlines to and from the site to the south-west are not affected. This is a minor change in the wider landscape and therefore has an impact of **low** magnitude of **minor** consequence.

This change would not affect the integrity of the setting, the site's understanding, appreciation or integrity, sense of place or heritage value, resulting in a **minor** significance of effect that is **not significant**.

17.6.2.3.12 Cnoc na Ciste Chambered Cairn, Sordale Hill, SM 442

This conspicuous neolithic burial site with a passage entered from the south-east sits on top of a prominent hill (see Figure 17.3 CH VP 13) with at least five more burial cairns on its lower slopes, including the scheduled Sordale Hill Long and Gallow Hill cairns some 550 m to the west and south-west respectively. The high Heritage Value of the site and high contribution of setting, results in a **high** sensitivity to change.

The wireline provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.15b) indicates that the PFOWF Array Area would be mostly screened from the site by topography, with just the WTG blades being visible. The key sightlines and intervisibility with other sites are not affected. This is a minor change in the wider landscape and therefore has an impact of **low** magnitude**.**

This impact is of **minor consequence**. This change does not affect the integrity of the setting, the site's understanding, appreciation or integrity, sense of place or heritage value, resulting in a **minor** significance of effect that is **not significant**.

17.6.2.3.13 Impact on the setting of remaining designated sites within the Setting Study Area

Many sites are screened from the PFOWF Array Area by extensive plantations across Caithness as well as the topography, including the Thurso Conservation Area. However, there are over 100 SMs and LBs within 30 km of the PFOWF Array Area that could be affected by it (see Offshore EIAR [Volume 3]: Appendix 17.2). It can be seen from the above detailed assessment of chosen proxy sites that there are no impacts of high magnitude on setting that result in a total removal of or fundamental and irreversible changes to the relationship between a heritage asset and its relevant setting. There are some impacts that are moderate in magnitude, creating a noticeable change to non-key relationships between a heritage asset and its relevant setting, where the resulting consequence of effect on setting would be **moderate**, with a **moderate** significance of effect by matrix definition.

However, professional judgement indicates that the resulting effects do not significantly impact the heritage value of the receptors, or the understanding, appreciation or experience of the assets, and adequately retains the integrity of the settings, and are therefore **not significant**.

Table 17.14 Summary of significance of effects from operation and maintenance impacts

Summary of Effect	Receptor	Sensitivity	Magnitude of impact	Rationale	Consequence	Significance of Effect	Additional Mitigation Requirements	Residual Effects
Loss of or damage to unknown marine and intertidal historic environment assets	Unlocated shipwrecks, aircraft and other unknown assets	Negligible-High	Negligible	None has been identified in the Offshore Study Area during review of the marine geophysical data	Minor Effects	Not Significant	No additional mitigation measures have been identified for this impact above and beyond the embedded project mitigation listed in Section 17.5.5 (instatement of WSI & PAD)	Not Significant
Loss of or damage to submerged prehistoric landscapes	Submerged prehistoric sites & paleoenvironmental deposits	Moderate - High	Negligible	None has been identified in the Offshore Study Area during review of the marine geophysical data.	Minor Effects	Not Significant	No additional mitigation measures have been identified for this impact above and beyond the embedded project mitigation listed in Section 17.5.5 (instatement of WSI & PAD).	Not Significant
Adverse changes to the setting of onshore historic environment assets	Sandside Harbour, 1 and 2 Sandside and Fishing Store	High – Medium (depending on direction)	Negligible	The WTGs are not visible from the asset	Negligible	Not Significant	No mitigation measures are currently proposed for potentially significant effects on setting, above and beyond the embedded project mitigation listed in Section 17.5.5 because there are no High magnitude effects on setting that result in a total or major alteration to the baseline setting. Professional judgement indicates that the resulting significance of effect is **minor** since the effect does not significantly impact the heritage value of the receptors, or the understanding, appreciation or experience of the assets, and adequately retains the integrity of the setting, and is therefore **not significant**.	Not Significant
Adverse changes to the setting of onshore historic environment assets	Cnoc Urray	Medium	Low	The baseline setting of the broch site not materially changed	Minor Effects	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Cnoc Freiceadain	Medium	Medium	Noticeable material change to view to north	Minor Effects	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Reay Church	High	Medium	Noticeable material change to view to north, does not significantly reduce the heritage value of the receptor or its relationships to nearby historic assets within the village.	Minor Effects	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Sandside House, gardens with carved stones and farm buildings	Medium to High, depending on direction and axis	Low	Effect is not to the key views or axes of the estate, or its relationship with any of the key aspects of the estate	Minor	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Creag Bhreac Mhor stone rows	Medium (at landscape scale)	Medium	The noticeable change to key view northwards would not prevent appreciation, understanding or experience of the stone rows, because it does not sever the connection between the rows and the cairns.	Minor Effects	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Crosskirk, St Mary's Chapel and Broch	Medium	Medium	Noticeable change does not alter appreciation of coastal location, intervisibility with other sites or heritage value	Minor Effects (because of current setting)	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Dunnet Head Lighthouse and Keepers' Houses	Low at landscape level	Low	The baseline setting does not materially change	Minor Effects	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Bighouse Lodge, Garden Walls and Gate Piers	High	Medium	Key axes and views from it would not be affected. Change to non-key views from west	Minor Effects	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Ben Griam Beg Hillfort	High	Low	Minor change in wider landscape	Minor Effects	Not Significant		Not Significant

Summary of Effect	Receptor	Sensitivity	Magnitude of impact	Rationale	Consequence	Significance of Effect	Additional Mitigation Requirements	Residual Effects
Adverse changes to the setting of onshore historic environment assets	Bridge of Broubster standing stones	Minor except Medium in immediate location and to south-west	Low	Mostly screened by topography, key sightlines not affected	Minor Effects	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Cnoc na Ciste Chambered Cairn, Sordale Hill	High	Low	Mostly screened by topography, key sightlines and intervisibility not affected	Minor Effects	Not Significant		Not Significant

17.6.3 Effects During Decommissioning

The decommissioning process will essentially be a reversal of the construction process (see Section 17.6.1) and whilst there will be disturbance as infrastructure is removed, this should not be worse than or expand the footprint of disturbance of that during construction. The preparation of a Decommissioning Plan is required under Section 105 of the Energy Act 2004 (as amended). Therefore, no adverse direct or indirect effects on the marine historic environment during decommissioning have been identified.

The removal of WTGs would reverse any setting impacts. Therefore, no adverse effects on the setting of onshore historic assets during decommissioning have been identified.

17.7 Assessment of Cumulative Effects

17.7.1 Introduction

The consideration of which projects could result in potential cumulative effects on Marine Archaeology and Cultural Heritage is based on the results of this impact assessment, with the expert judgement of the specialist consultant and projects identified by statutory consultants, including THC. Projects which overlap the Offshore Site have especially been considered for marine archaeology receptors. Projects within 30 km of the Offshore Site are considered to have the potential to result in cumulative impacts for cultural heritage receptors due to impacts on setting. The projects that have been considered for the cumulative impact assessment are listed in Table 17.15. These are also shown in Offshore EIAR (Volume 4): Appendix 17.4; Figure 17.4a.

The approach to the assessment of projects includes:

- Quantitative assessment of projects submitted to Scoping up to six months prior to PFOWF application submission;
- Qualitative assessment of projects submitted to Scoping up to five months prior to PFOWF application submission; and
- Acknowledgement of projects submitted to Scoping between five and two months prior to PFOWF application submission.

This approach was shared with MS-LOT and agreement was confirmed via email on 6 December 2021. The approach to the cumulative assessment is set out in Offshore EIAR (Volume 3): Appendix 6.1. The approach and list of cumulative projects screened into assessment was provided to MS-LOT and consultees and comments were received on 16 May 2022. These comments have been taken into account within this assessment. All relevant responses and actions in association with cumulative comments in relation to Marine Archaeology and Cultural Heritage receptors are discussed in Section 17.3.

There are limited project details for offshore wind farm sites awarded Option Agreements within the ScotWind leasing round. The cut-off date for a qualitative assessment of projects in the Scoping stage was February 2022, therefore, the ScotWind Projects are acknowledged but no assessment has been conducted. The sites with the greatest potential to act cumulatively with the Offshore Development include the West of Orkney Windfarm (within the N1 Plan Option [PO]) as well as other sites along the north, north-east and east coasts of Scotland (e.g. those sites within the N2, N3, NE2, NE3 and NE4 POs). These projects will undertake more detailed cumulative assessments with the PFOWF Offshore Development to support their applications for development consent.

Table 17.15 List of projects considered for the historic environment and settings Cumulative Impact Assessment

Project Name / Type	Status	Distance to the Offshore Development (km)	Project Description	Relevance to the cumulative assessment
SHE Transmission Orkney-Caithness Transmission Project	Consented	0 km - Overlaps OECC	Cables project	Due to overlapping footprint, there is the potential for additive effects as a result of seabed disturbance on marine archaeology features.
Forss III / Onshore Wind Farm	Application	8.3	2 WTG at 100m	Potential setting impact from projects within 30 km of the Offshore Development.
Forss / Onshore Wind Farm	Operational	9.9	6 WTG at 78m	Potential setting impact from projects within 30 km of the Offshore Development.
Drum Hollistan 2 / Onshore Wind Farm	Application	10.3	7 WTG at 125m	Potential setting impact from projects within 30 km of the Offshore Development.
Ackron Resubmission / Onshore Wind Farm	Application	10.6	12 WTG at 149.9m	Potential setting impact from projects within 30 km of the Offshore Development.
Limekiln Resubmission / Onshore Wind Farm	Application	12.3	21 WTG @ 149.9m	Potential setting impact from projects within 30 km of the Offshore Development.
Baillie Hill / Onshore Wind Farm	Operational	12.4	21 WTG at 115m	Potential setting impact from projects within 30 km of the Offshore Development.
Limekiln / Onshore Wind Farm	Consented	13.3	21 WTG at 139.4 / 125m	Potential setting impact from projects within 30 km of the Offshore Development.
Limekiln Extension / Onshore Wind Farm	Application	13.7	5 WTG at 149.9m	Potential setting impact from projects within 30 km of the Offshore Development.
Strathy North / Onshore Wind Farm	Operational	17.4	33 WTG at 110m	Potential setting impact from projects within 30 km of the Offshore Development.
Strathy Wood / Onshore Wind Farm	Consented	18.9	13 WTG at 180m	Potential setting impact from projects within 30 km of the Offshore Development.
Bettyhill / Onshore Wind Farm	Operational	21.1	2 WTG at 119m	Potential setting impact from projects within 30 km of the Offshore Development.
Strathy South Resubmission / Onshore Wind Farm	Consented	23.0	39 WTG at 200m	Potential setting impact from projects within 30 km of the Offshore Development.

The methodology for direct and indirect cumulative effects on marine historic environment assets is the same process as outlined in Section 17.5.3, identifying if there may be a greater magnitude of impact and consequence derived from the combination of the overall impact of a series of development projects. In terms of assessing cumulative impacts on the setting of onshore historic environment receptors, cumulative impacts are derived from the combination of the overall impact of a series of developments or from the combination of different environmental impacts. Various relevant guidance are listed in Appendix 17.1 (Offshore EIAR [Volume 3]).

Due to the total number of sites, as agreed in the methodology sent to stakeholders (see Offshore EIAR [Volume 2]: Appendix 17.1), this EIAR assesses the same selection of appropriate designated sites (see Section 17.6) to act as proxy for all the others, which are summarised in table form in Offshore EIAR (Volume 3): Appendix 17.2. Wirelines and visualisations were provided by OPEN that showed the worst case cumulative scenario for selected designated sites (see Offshore EIAR [Volume 4]). Test wirelines were run for some sites that proved not to be affected or had low visibility of the PFOWF Array Area and so were not included.

A cumulative impact on setting may result from different developments within a single view, or as seen when looking from different directions from a single viewpoint, or the sequential viewing of multiple developments when moving through the setting of one or more cultural heritage assets. The significance of cumulative effects has been assessed based on the sensitivity of the cultural heritage asset and its setting and the magnitude of impacts expected to occur within the setting. The magnitude of impacts is based on:

- The scale of change to the setting;
- Proximity of the PFOWF Array Area to other wind farm developments;
- Whether the developments integrate or contrast within the existing landscape; and
- Whether the PFOWF Array Area appears as an extension to another development or introduces a new aspect of the view.

The magnitude of cumulative impact on the setting of a historic environment asset is assessed using the criteria set out in Table 17.16.

Table 17.16 Definition of Magnitude of Cumulative Impact

Magnitude of Impact	Criteria
High	Offshore Development would be visually prominent and visible along with other prominent wind farm developments within the setting / landscape. Offshore Development severs last or key link between asset and original setting, and removes integrity of setting. Proposed WTGs and additional WTGs visible in multiple directions creating a feeling of being surrounded, removing Sense of Place.
Medium	Offshore Development would add to the successive or simultaneous visibility of other wind farm developments making wind farm developments seem larger and more spread out within the landscape setting. Offshore Development interrupts but does not sever links between asset and setting, retaining the integrity of setting. WTGs would be visible in two directions with the Offshore Development in one of these views.
Low	Offshore Development will not add to the successive visibility with other wind farm developments. Offshore Development does not interrupt links between asset and setting, with no effect on the integrity of setting. WTGs would be visible in only one direction with the Offshore Development in this view.
Negligible	Offshore Development is the only one in the setting, thus no Cumulative Effect (although there may still be significant direct or indirect effects).
Unknown	Changes to a setting, where it is uncertain how these contribute to our understanding, appreciation or experience of the site because the feature or asset itself could not or has not been understood or interpreted.
Positive	Changes to a setting that improves the relationship with the heritage asset.

The following impacts have been taken forward for the cumulative assessment:

- Construction:
  - Loss of or damage to unknown marine and intertidal historic environment assets;
  - Loss of or damage to submerged prehistoric landscapes;
- Operation and Maintenance:
  - Loss of or damage to unknown marine historic environment assets;
  - Loss of or damage to submerged prehistoric landscapes;
  - Long-term changes to the setting of onshore historic environment assets that reduces their value; and
- Decommissioning:
  - Loss of or damage to unknown marine and intertidal historic environment assets; and
  - Loss of or damage to submerged prehistoric landscapes.

17.7.2 Cumulative Construction Effects

17.7.2.1 Loss of or damage to unknown marine and intertidal historic environment assets

The risk of unknown marine and intertidal historic environment assets being present in the Offshore Site has been much reduced because of the marine geophysical surveys conducted and reviewed. It is never possible to eliminate the risk entirely because smaller artefacts / wreckage of stone, non-ferrous metals such as aluminium and wood might not be picked up by such surveys. Similar surveys were undertaken for the SHE Transmission Orkney-Caithness Transmission Project, resulting in a similar risk reduction (SSEN 2013).

The historic importance of such items could vary anywhere from **negligible to high**. However, due to the surveys conducted to reduce the risk and the localised construction / installation activities, the likelihood of cumulative impact is considered low. The embedded mitigation of the implementation of a WSI and PAD to avoid or mitigate accidental impacts and manage any accidental discoveries of archaeological interest means that the magnitude of direct cumulative impact is **negligible**. Therefore, the consequence of effect is **minor** and the resulting significance of effect is **minor** and therefore **not significant**.

17.7.2.2 Loss of or damage to submerged prehistoric landscapes

Submerged prehistoric and paleoenvironmental deposits are generally considered to have moderate or high heritage value or sensitivity. However, no submerged paleoenvironmental deposits have been identified within the Offshore Site from review of the SBP marine geophysical survey data, and none is known from other studies, or from the SHE Transmission Orkney-Caithness Transmission Project, which conducted similar studies.

Because SBP data comprises slice snapshots rather than 100% coverage, it is not possible to eliminate the risk. However, due to the surveys conducted to reduce the risk and the localised construction / installation activities compared to potential extent of such deposits, the likelihood of cumulative impact is considered low. The embedded mitigation of the implementation of a PAD to avoid or mitigate accidental impacts and manage any accidental discoveries of archaeological interest means that the magnitude of direct cumulative impact is **negligible**.

Therefore, the consequence of effect is **minor** and the resulting significance of effect **minor** and therefore **not significant**.

Table 17.17 Summary of significance of cumulative effects from construction impacts

Summary of Effect	Receptor	Sensitivity	Magnitude of Impact	Rationale	Consequence	Significance of Effect	Additional Mitigation Requirements	Residual Effects
Loss of or damage to unknown marine and intertidal historic environment assets	Unlocated wreckage and other unknown assets	Negligible-High	Negligible	None has been identified in the Offshore Study Area during review of the marine geophysical data	Minor Effects	Not Significant	No additional mitigation measures have been identified for this impact above and beyond the embedded project mitigation listed in Section 17.5.5 9 (instatement of WSI & PAD).	Not Significant
Loss of or damage to submerged prehistoric landscapes	Submerged prehistoric sites & paleoenvironmental deposits	Moderate - High	Negligible	None has been identified in the Offshore Study Area during review of the marine geophysical data, though the possibility of patchy remains may still exist	Minor Effects	Not Significant	No additional mitigation measures have been identified for this impact above and beyond the embedded project mitigation listed in Section 17.5.5 9 (instatement of WSI & PAD).	Not Significant

17.7.3 Cumulative Operation and Maintenance Effects

17.7.3.1 Loss of or damage to unknown marine and intertidal historic environment assets

The risk of unknown marine and intertidal historic environment assets being present in the Offshore Site has been much reduced because of the marine geophysical surveys conducted and reviewed. It is not possible to eliminate the risk, because smaller artefacts / wreckage of stone, non-ferrous metals such as aluminium and wood might not be picked up by such surveys. The historic importance of such items could vary anywhere from Negligible to High. Similar surveys were undertaken for the SHE Transmission Orkney-Caithness Transmission Project, resulting in a similar risk reduction.

During operation and maintenance any activities that impact the seabed and intertidal zone have the potential to result in the damage / loss of unknown cultural material lying on the seabed. Potential scouring from cables on the seabed, including the cables for the SHE Transmission Orkney-Caithness Transmission Project, scour protection, any cable re-burial works, or remedial cable protection works have the potential to result in the cumulative damage / loss of cultural material lying on the seabed.

However, due to the desk-based survey and marine geophysical survey conducted to reduce the risk (which did not identify any marine assets within the study area), the likelihood of cumulative impacts during operation and maintenance is considered Negligible. The embedded mitigation of the implementation of a WSI and PAD to avoid or mitigate accidental impacts and manage any accidental discoveries of archaeological interest means that the magnitude of direct cumulative impact is **negligible**.

Therefore, the consequence of cumulative effect is **minor** and the resulting significance of effect is **minor** and therefore **not significant**.

17.7.3.2 Loss of or damage to submerged prehistoric landscapes

Submerged prehistoric and paleoenvironmental deposits are generally considered to have moderate or high heritage value or sensitivity. However, no submerged paleoenvironmental deposits have been identified within the Offshore Site from review of the SBP marine geophysical survey data, and none is known from other studies, or from the SHE Transmission Orkney-Caithness Transmission Project, which conducted similar studies.

Because SBP data comprises slice snapshots rather than 100% coverage, it is not possible to eliminate the risk. However, due to the surveys conducted to reduce the risk and the localised operation and maintenance activities compared to potential extent of such deposits. The embedded mitigation of the implementation of a WSI and PAD to avoid or mitigate accidental impacts and manage any accidental discoveries of archaeological interest means that the magnitude of direct cumulative impact is **negligible**.

Therefore, the consequence of effect is **minor** and the resulting significance of effect is **minor** and therefore **not significant**.

17.7.3.3 Adverse changes to the setting of onshore historic environment assets

The potential for medium or long-term cumulative changes by the Offshore Development and other wind farms to adversely impact on the setting of onshore historic environment assets, reducing their heritage value by significantly affecting the way the asset is understood, appreciated and experienced is assessed below.

In order to keep the size of the assessment reasonable and proportionate, as proposed in the methodology sent to stakeholders and approved by them (Table 17.1, Table 17.2; and Offshore EIAR [Volume 3]: Appendix 17.1), a selection of statutorily designated sites and areas have been considered, which can act as proxy for the range of effects on all other designated and undesignated sites. The sites chosen are likely to undergo the most cumulative change (tested by running draft wirelines) The rest of the designated sites are summarised in table form in Offshore EIAR (Volume 3): Appendix 17.2.

17.7.3.3.1 Sandside Harbour, 1 and 2 Sandside and Fishing Store, LB 14988 Grade A

Sandside Harbour (see Figure 17.3 CH VP 1), Numbers 1 and 2 Sandside, and the Fishing store have a High Heritage Value and a Medium contribution of setting, with a **high** sensitivity to change in terms of the key views from the harbour north-east towards the Pentland Firth and the Dounreay Site and from 1 and 2 Sandside and the fishing store towards the eastern Pentland Firth and Sandside Bay and to the west from the front elevations. Otherwise sensitivity to change is **medium**.

The PFOWF Array Area is not visible from the harbour or the approach to it. There is no cumulative effect on the key sightlines out through the mouth of the harbour or from the east or west elevations of the buildings (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.4). Therefore, there is a **negligible** impact, of **minor** consequence.

The significance of effect is **negligible**, with the cumulative effect not impacting the integrity of the setting, the heritage value of the receptors, or the understanding, appreciation or experience of the assets, and is therefore **not significant**.

17.7.3.3.2 Cnoc Urray, SM 564

The setting of the broch (see Figure 17.3 CH VP 2) makes little positive contribution to the understanding and/or appreciation of the siting of the monument (a Low contribution of setting) due to the close proximity of the Dounreay Site and the Vulcan NRTE c. 390 m to the north, meaning that it has a **medium** sensitivity to change.

The cumulative effect on the broch from the Baillie Hill, Drum Hollistan, Forss and Limekiln Wind Farms, all of which are within 5 km of the site, and surround it (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.5a) is not added to by the four WTGs of the PFOWF Array Area, which do not materially alter the baseline setting of the broch site (a **low** magnitude of cumulative impact on setting) since they are seen with overhead power lines and associated pylons in the foreground, behind the Dounreay Site and the Vulcan NRTE and are no higher in the view than some of those buildings (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.5d).

Therefore, the consequence of cumulative effect would be **minor,** and the resulting significance of effect on setting would be **minor** since the effect does not reduce the integrity of the setting, the heritage value of the receptor, or the understanding, appreciation or experience of the asset, and is therefore **not significant**.

17.7.3.3.3 Cnoc Freiceadain, SM 90078

The setting of the two long cairns on an elevated topographical position (see Figure 17.3 CH VP 3) would have allowed for 360-degree views of the surrounding landscape and makes them a prominent feature on the skyline. Key views from the burial mounds would have been to other funerary sites or settlement sites in the surrounding area, such as the Hill of Shebster chambered cairn, c. 750 m to the south and Creag Breac Mhor to the north. The cairns are located within an area of prehistoric activity that is also within a more recent farming landscape with the extensive windfarm (21 WTGs) of Baillie Hill / Stemster Hill located 0.7 to 2.4 km to the east, pylons running nearby and the Dounreay Site at the coast (a Low contribution of setting eastwards due to Baillie Hill and a medium contribution of setting in terms of prominence). As the Cnoc Freiceadain long cairns have a high Heritage Value and a medium contribution of setting, the Scheduled funerary monument has a **medium** sensitivity to change.

The photomontage provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.6e) shows that the entirety of the PFOWF Array Area would be visible breaking the horizon at sea in the middle distance beyond the Dounreay Site. The wind farms of Limekiln, Drum Hollistan, Ackron and the tips of WTGs of Strathy North are all visible to the west and south-west (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.6b). Along with Forss to north and Baillie Hill immediately east, the PFOWF Array Area is in the last open view to the north. This does not remove the sense of place in terms of the prominence of the cairns on the ridge, or sever key views and relationships with other funerary sites and settlement sites in the surrounding area, such as the Hill of Shebster chambered cairn and Creag Breac Mhor to the north.

This noticeable cumulative change to the setting adds to the simultaneous visibility of other wind farm developments making wind farm developments seem larger and more spread out within the setting, resulting in a **medium** magnitude of impact on setting. The resulting consequence of effect on setting would be **moderate** by matrix definition.

However, professional judgement indicates that the resulting significance of effect is **minor** since the effect does not significantly impact upon the heritage value of the receptors, or the understanding, appreciation or experience of the assets, and adequately retains the integrity of the setting, and is therefore **not significant**.

17.7.3.3.4 Reay Church, LB 14992 Grade A

Reay Parish Church (see Figure 17.3 CH VP 5) has a High Heritage Value and a Medium contribution of setting, the Category A Listed church therefore has a high sensitivity to change. It also stands as proxy for the other Listed Buildings in Reay village and the Scheduled Medieval burial ground and cross slab of Reay old parish church (SM 615).

The photomontage provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.7d) indicates that all of the PFOWF Array Area would be visible from the burial ground and on the approach to the church along the main road. The closest onshore wind farms surround Reay, namely Limekilns, Drum Hollistan and Baillie Hill, all within less than 5 km (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.7a) with the other wind farms fading into the background or screened from view by topography, other buildings and vegetation.

This means that although there is some successive visibility of wind farms on approach to Reay, there is no more than anywhere else in Caithness. The south elevation of the church and its key relationships with the other LBs and SMs in Reay, the village and the community it serves are not affected. Therefore, the cumulative impact on the setting of the church remains **medium** magnitude and the resulting effect on the setting would be of **major** consequence by matrix definition (i.e. the same as the project alone assessment in Section 17.6).

The potential cumulative impact on the setting of the other various LBs and SMs in the village is much reduced because they are set amongst the other buildings of village and many mature trees all screen the PFOWF Array Area and the other wind farms in the vicinity to a great extent. This effect would not change the key relationships of the site with other heritage assets in the village, which is a **minor** consequence of effect. However, the change to the view northwards is a noticeable one, although confined solely to this direction and therefore only partial, resulting in a **moderate** significance of effect by matrix definition.

However, professional judgement indicates that the resulting significance of cumulative effect is **minor** since the effect does not significantly impact upon the heritage value of the receptors, or the understanding, appreciation or experience of the assets, and adequately retains the integrity of the setting, and is therefore **not significant**.

17.7.3.3.5 Sandside House (LB 14984 Grade B) and Estate gardens (LB 14985 Grade B) and farm buildings (LB 14986 Grade A)

All of the Listed buildings within the Sandside Estate survive in a setting that has seen some more recent farming landscape and buildings as well as the construction of the Dounreay Site and the Vulcan NRTE within the wider setting (a medium contribution of setting). As the kiln barn and range of former byres, cottages, dairy and implement shed has a high Heritage Value and a medium contribution of setting (see Figure 17.3 CH VP 6), the Category A range of buildings therefore have a **high** sensitivity to change. The Category B Listed Sandside House and walled garden, dovecot and privy have a Medium Heritage Value and a Medium contribution of setting, therefore the resulting sensitivity to change is **medium**. Key views from within the Sandside Estate would have been to other adjacent farm buildings as well as to the main B-Listed house itself (see Figure 17.3 CH VP 4). The key design axes of the estate grounds are east-west (as are the main house elevations and windows) and to the south.

The PFOWF Array Area will only be visible when looking northwards from the north side of the farm complex (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.8). It does not add to the successive visibility with other wind farm developments. The A-Listed farm buildings on the north side of the estate are screened by the other parts of the range, estate cottages and modern farm sheds, and the other parts of the estate, especially the key axes (see Figure 17.3 CH VP 4), are screened from the closest onshore wind farms (Drum Hollistan and Limekiln) by mature estate woodland.

Only wind farms such as Baillie Hill, Forss and Cairnmore Hill are in the east-facing axis of the house and those beyond merge into the background. These wind farms cannot be seen in the same view from Sandside as the PFOWF Array Area, and approaches to Sandside do not have other wind farms extending the cumulative effect to the setting.

Therefore, it is considered that this change to the setting of the various Listed components of the Sandside Estate is a limited cumulative impact of **low** magnitude. The resulting consequence of cumulative effect on the setting is **minor** and the significance of cumulative effect is m**inor**, and therefore **not significant** with no change to the integrity of setting of the asset.

The garden walls of Sandside House will screen the Scheduled carved stones (SM 616) from any cumulative effects, resulting in a **negligible** magnitude of impact. The consequence of this effect is negligible, with the resulting significance of effect on the setting of the carved stones being **negligible** and **not significant** with no change to the integrity of setting of the asset**.**

17.7.3.3.6 Creag Bhreac Mhor stone rows, SM 2386

The key view for the stones (see Figure 17.3 CH VP 7) seems to be to two cairns set on a lower ridge with a wider view beyond to the north-west in the direction of the Dounreay Site and the PFOWF Array Area. The stones are overlooked by the long cairns on Cnoc Freicadain. Whilst the immediate setting makes a high contribution, changes to the wider setting results in a medium contribution to setting, resulting in a **medium** sensitivity to change, depending on how close to the asset that change is located.

The photomontage provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.9e) shows that the entirety of PFOWF Array Area would be visible 11 km away breaking the horizon at sea in the middle distance beyond the Dounreay Site to the north-west in the key direction of the cairns to which the rows appear to be oriented. However, this view is already affected by the presence of the Dounreay Site in the middle distance in this direction, which has not affected the heritage value of the site, and the change does not sever the relationship between the stone rows and the cairns.

The large wind farms of Limekiln and Baillie Hill to the south-west and east respectively are screened from the site by topography. Drum Hollistan and Ackron are visible in a group to the west (Offshore EIAR [Volume 4] : Visual Materials; Figure 17.9b), with Forss to north. This cumulative effect does not remove the sense of place in terms of the immediate setting in open fields and rough grazing, or with other sites in the Creag Breac Mhor / Upper Dounreay prehistoric landscape, or with the Cnoc Freiceadain cairns upslope to the south.

WTGs would be visible in two directions (west and north) but Forss is already in the northerly view, so that the PFOWF Array Area is already in a view with WTGs in it, but it does extend the horizontal spread of WTGs in this view. This addition to the simultaneous visibility of another wind farm development (Forss), making WTGs more spread out within the northern aspect of the setting, results in a **medium** magnitude of cumulative impact on setting.

The resulting consequence of cumulative effect on setting would be **moderate** by matrix definition. However, professional judgement indicates that the resulting significance of effect is **minor** since the effect does not significantly impact upon the heritage value of the receptors, or the understanding, appreciation or experience of the assets, and adequately retains the integrity of the setting, and is therefore **not significant**.

17.7.3.3.7 Crosskirk, St Mary's Chapel and Broch, Forss, SM 90086

The coastal location of these sites (see Figure 17.3 CH VP 8) indicates that views to and from the Pentland Firth are key, as is intervisibility with other similar sites in the such as the broch site at Green Tullochs (SM554) 1.3 km along the coast to the south-west, where a chambered cairn is also part of that scheduling and Tulloch of Lybster broch (undesignated) 650 m to the south.

The six-turbine Forss Wind Farm and the Forss Technology and Business Park 250 m to the south-west dominates Crosskirk. This has not affected the high heritage value of the chapel, which is a Property In Care (HES) and promoted as a site to visit, with car parking provided. The high heritage value and low contribution of setting results in a **low to medium** sensitivity to change.

The photomontage provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.10e) shows that the entirety of the PFOWF Array Area would be visible out to sea. The six-turbine Forss Wind Farm and the Forss Technology and Business Park 250 m to the south-west dominates Crosskirk, with the tips of Baillie Hill just visible behind, 4 km to the south.

The addition of the PFOWF Array Area 10 km (6.2) away would be a noticeable change to views from the site to the north-west, extending the horizontal spread of WTGs round to the north-west. This does not alter appreciation of Crosskirk's coastal location, intervisibility with other sites or any other key relationships between Crosskirk and its setting.

This is a **medium** magnitude of cumulative impact with a **moderate** consequence of cumulative effect on setting by matrix definition, with a **moderate** significance of effect that is in a worst case assessment **significant**. However, taking into account the current setting of these sites, dominated by the Forss Wind Farm, the **significance of effect** is in reality **minor**. The cumulative change does not affect the integrity of the setting, or prevent the appreciation, understanding or experience of the site and is thus **not significant**

17.7.3.3.8 Dunnet Head Lighthouse and Keepers' Houses, LB 1890 Grade B

The site occupies a highly prominent location on the cliffs of Dunnet Head, the most northerly point of the UK mainland (see Figure 17.3 CH VP 9). The key sightlines are to and from the Pentland Firth, whilst the views inland across Caithness with its farming landscape and windfarms are not essential to the understanding of the site but do add to the experience. The medium Heritage Value and High contribution of setting, results in a high sensitivity to change, according to definition. However, lighthouses can be considered as assets that are tolerant of change over a distance because of their function. Therefore, the buildings can be considered as having a **high** sensitivity to change in their immediate location**,** but a **low** sensitivity to change **at a** landscape / seascape level.

The photomontage provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.11e) shows that the entirety of PFOWF Array Area would be visible out to sea more than 25 km distant. The addition of the PFOWF Array Area to the other wind farms in the background would extend the horizontal spread of WTGs (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.11c).

This presents a **medium** magnitude of cumulative impact with a **minor** consequence of effect on setting that is of **minor** significance and thus **not significant**. Such a cumulative change is to Dunnet Head's wider setting, not altering the integrity of the setting, the experience and appreciation of the lighthouse, its location or understanding of its function.

17.7.3.3.9 Bighouse Lodge, Garden Walls and Gate Piers, LB 7159 Grade B

The house sits outwith the ZTV in the shelter of the western slopes of the hill of Rubha an Tuir, which rises to the north-east, limiting views from the house to the open sea, precluding any direct views of the PFOWFArray Area from the house and grounds. There are open views to the house from the west side of the River Halladale and Melvich Beach, resulting in a high contribution of setting from this angle. Figure 17.3 VP 10 reflects this view, being located beside the A836 at the Halladale Inn on the west side of the river, looking across to Bighouse. The Medium Heritage Value and High contribution of setting, results in a **high** sensitivity to change from this direction.

The wireline provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials, Figure 17.12b) shows that two of the WTGs would be visible from Halladale Inn, possibly more when viewed from Melvich Beach. When seen from the A836 driving from west to east, and possibly from Melvich Beach, the PFOWF Array Area would be visible along with Drum Hollistan wind farm 2 km to the east. The Strathy wind farms would not be in an associated view, and Limekiln would be screened by topography, thus preventing a cumulative effect from these. The main approach to the Lodge is from the south along the east side of the river, and thus not affected by this cumulative change. Similarly views from the house and gardens would not be affected, and there are no cumulative interruptions of links between the Lodge and its setting.

The PFOWF Array Area would not add to successive visibility with other wind farm developments and would essentially be in the same view as Drum Hollistan, although extending the spread of WTGs in that view. Because this low magnitude of cumulative impact does not add to the **moderate** significance of effect of the project alone (see 17.6.2.3.9 above), the effect on the Lodge remains **moderate** by matrix definition**.** However, professional judgement indicates that the resulting significance of effect is **minor** since the effect does not significantly impact upon the heritage value of the receptors, or the understanding, appreciation or experience of the assets, and adequately retains the integrity of the setting, and is therefore **not significant**.

17.7.3.3.10 Ben Griam Beg Hillfort, SM 1836

The site (see Figure 17.3 CH VP 11) has extensive 360-degree views over the low-lying open landscape below and to Ben Griam Mor to the south-west. The site occupies a topographically prominent position on the summit of a distinctive, steep-sided hill in a predominantly open lower landscape of bog and moorland (high contribution of setting). The high Heritage Value and high contribution of setting, results in a **high** sensitivity to obvious changes that do not blend into the distant vistas.

The cumulative wireline provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.13c) indicates that the PFOWF Array Area would be visible at a distance of 33 km, adding to the wind farms in the 180-degree view to the north (the three Strathy wind farms, Ackron, Drum Hollistan, Forss, Limekiln, Baillie Hill and Stroupster.

This is a minor cumulative change in this wider landscape and therefore has a cumulative impact of low magnitude. At this distance the effect is of **minor** consequence. Despite the sensitivity of the hillfort's setting, this cumulative change would not affect the integrity of the setting, the site's understanding, appreciation or experience, sense of place or heritage value, resulting in a **minor** significance of effect that is **not significant**.

17.7.3.3.11 Bridge of Broubster standing stones, SM 426

The stones are set in a gap in forestry plantation, with 180-degree views across open moorland to the west (see Figure 17.3 CH VP 12). Intervisibility with many of the prehistoric sites in the Broubster to Shebster area to the south-west of the site still remains, whilst the plantation divorces the stones from similar sites to the east around Loch Shurrery. Extensive modern changes in the setting result in a low contribution of Setting, except to the south-west. The high Heritage Value of the site and low contribution of setting results in a **low** sensitivity to change except in the immediate location and to the south-west, which would be **medium**.

The cumulative wireline provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.14c) indicates that the PFOWF Array Area would be mostly screened from the site by topography, with some WTG blades only being visible to the west of and in the same view as the Baillie Hill Wind Farm. The key axes and sightlines to and from the site to the south-west are not affected.

This is a minor change in the wider landscape and therefore has a cumulative impact of **low** magnitude of **minor** consequence. This is a **minor** significance of effect, and thus **not significant**. This change would not affect the integrity of the setting, the site's understanding, appreciation or experience, sense of place or heritage value.

17.7.3.3.12 Cnoc na Ciste Chambered Cairn, Sordale Hill, SM 442

This conspicuous neolithic burial site with a passage entered from the south-east sits on top of a prominent hill (see Figure 17.3 CH VP 13) with at least five more burial cairns on its lower slopes, including the scheduled Sordale Hill Long and Gallow Hill cairns some 550 m to the west and south-west respectively. The high Heritage Value of the site and high contribution of setting, results in a h**igh** sensitivity to change.

The wireline provided by OPEN (Offshore EIAR [Volume 4]: Visual Materials; Figure 17.15b) indicates that the PFOWF Array Area would be mostly screened from the site by topography, with just the WTG blades being visible to the east of Baillie Hill. The Limekiln, Drum Hollistan and Ackron wind farms would be visible as a group to the west. The Causeymire and Halsary wind farms 10 km to the south would also be visible. However, because only the tips of the PFOWF would be visible 26 km to the north, there is no successive effect making wind farms seem more extensive across the landscape. The key sightlines and intervisibility with other historic assets are not affected.

This is a minor change in the wider landscape and therefore has a cumulative impact o**f low** magnitude. This impact is of **minor consequence**. This cumulative change would not significantly affect the integrity of the setting, the site's understanding, appreciation or experience, sense of place or heritage value, resulting in a **minor** significance of effect that is **not significant**.

17.7.3.3.13 Impact on the setting of remaining designated sites within the Setting Study Area

Many sites are screened from the PFOWF Array Area by extensive plantations across Caithness as well as the topography, including the Thurso Conservation Area. However, there are over 100 SMs and LBs within 30 km of the PFOWF Array Area that will see cumulative changes to their settings (see Offshore EIAR [Volume 3]: Appendix 17.2) with the other wind farms in Caithness and Sutherland.

It can be seen from the above detailed assessment of chosen proxy sites, that there are no cumulative impacts of high magnitude on setting that result in a total removal of or fundamental and irreversible change to, the relationship between a heritage asset and its relevant setting. There are some cumulative impacts that are **moderate** in magnitude, creating a noticeable change to non-key relationships between a heritage asset and its relevant setting, where the resulting consequence of effect on setting would be **moderate**, with a **moderate** significance of effect by matrix definition.

Professional judgement indicates that the resulting effects do not significantly impact upon the heritage value of the receptors, or the understanding, appreciation, or experience of the assets, and adequately retains the integrity of the settings, and are therefore **not significant**.

Table 17.18 Summary of significance of cumulative effects from operation and maintenance impacts

Summary of Effect	Receptor	Sensitivity	Magnitude of impact	Rationale	Consequence	Significance of Effect	Additional Mitigation Requirements	Residual Effects
Loss of or damage to unknown marine and intertidal historic environment assets	Unlocated shipwrecks, aircraft and other unknown assets	Negligible-High	Negligible	None has been identified in the Offshore Study Area during review of the marine geophysical data	Minor	Not Significant	No additional mitigation measures have been identified for this impact above and beyond the embedded project mitigation listed in Section 17.5.5 (instatement of WSI & PAD)	Not Significant
Loss of or damage to submerged prehistoric landscapes	Submerged prehistoric sites & paleoenvironmental deposits	Moderate – High	Negligible	None has been identified in the Offshore Study Area during review of the marine geophysical data.	Minor	Not Significant	No additional mitigation measures have been identified for this impact above and beyond the embedded project mitigation listed in Section 17.5.5 (instatement of WSI & PAD).	Not Significant
Adverse changes to the setting of onshore historic environment assets	Sandside Harbour, 1 and 2 Sandside and Fishing Store	High – Medium (depending on direction)	Negligible	PFOWF Array Area not visible. No cumulative effect on the key sightlines out through the mouth of the harbour or from the east or west elevations of the buildings.	Negligible	Not Significant	No mitigation measures are currently proposed for potentially significant cumulative effects on setting, above and beyond the embedded project mitigation listed in Section 17.5.5 because there are no High magnitude cumulative effects on setting that result in a total or major alteration to the baseline setting. Professional judgement indicates that the resulting significance of effect is **minor** since the effect does not significantly impact upon the heritage value of the receptors, or the understanding, appreciation or experience of the assets, and adequately retains the integrity of the setting, and is therefore **not significant**.	Not Significant
Adverse changes to the setting of onshore historic environment assets	Cnoc Urray	Medium	Low	Cumulative effect does not materially alter the baseline setting of the broch site	Minor	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Cnoc Freiceadain	Medium	Medium	Noticeable cumulative change to the setting adds to simultaneous visibility of other wind farms making wind farm developments seem larger and more spread out within the setting	Minor	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Reay Church	High	Low	Some successive visibility of wind farms, but mostly screened from view	Minor	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Sandside House, gardens with carved stones and farm buildings	Medium	Low	Other cannot be seen in the same view from Sandside as the PFOWF Array Area, and approaches to Sandside do not have other wind farms extending the cumulative effect to the setting	Minor	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Creag Bhreac Mhor stone rows	Medium (at landscape scale)	Medium	WTGs would be visible in two directions (west and north), making wind farms appear more spread out.	Minor	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Crosskirk, St Mary's Chapel and Broch	Medium	Medium	The addition of the PFOWF Array Area would extend the horizontal spread of WTGs round to the north-west.	Minor	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Dunnet Head Lighthouse and Keepers' Houses	Low at landscape level	Medium	The addition of the PFOWF Array Area to the other wind farms in the background would extend the horizontal spread of WTGs	Minor	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Bighouse Lodge, Garden Walls and Gate Piers	High	Low	PFOFW Array Area would not add to successive visibility with other wind farm developments.	Minor	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Ben Griam Beg Hillfort	High	Low	PFOFW Array Area would be a minor addition to spread of other wind farm developments	Minor	Not Significant		Not Significant

Summary of Effect	Receptor	Sensitivity	Magnitude of impact	Rationale	Consequence	Significance of Effect	Additional Mitigation Requirements	Residual Effects
Adverse changes to the setting of onshore historic environment assets	Bridge of Broubster standing stones	Minor except Medium in immediate location and to south-west	Low	PFOWF Array Area would be mostly screened from the site by topography	Minor	Not Significant		Not Significant
Adverse changes to the setting of onshore historic environment assets	Cnoc na Ciste Chambered Cairn, Sordale Hill	High	Low	PFOWF Array Area would be mostly screened from the site by topography	Minor	Not Significant		Not Significant

17.7.4 Cumulative Decommissioning Effects

The decommissioning process will essentially be a reversal of the construction process (see Section 17.6.1) and whilst there will be disturbance as infrastructure is removed, this should not be worse than or expand the footprint of disturbance of that during construction. The preparation of a Decommissioning Programme is required under Section 105 of the Energy Act 2004 (as amended). Therefore, no adverse direct or indirect cumulative effects on the marine historic environment during decommissioning have been identified.

The removal of WTGs would reverse any setting impacts. Therefore, no adverse cumulative effects on the setting of onshore historic assets during decommissioning have been identified.

17.8 Assessment of Transboundary Effects

In terms of impacts upon Marine Archaeology and Cultural Heritage receptors, any impacts will be localised to the extent of the Offshore Development within UK and Scottish Waters. Given the intervening distance to neighbouring European Economic Area (EEA) states, there is no potential for transboundary impacts and resultant effects to occur.

In terms of impacts on the setting of onshore archaeology and cultural heritage receptors, impacts will be localised to the extent of the Setting Study Area, covering the northern part of the UK and within UK waters. Given the intervening distance to neighbouring EEA states, there is no potential for transboundary impacts and resultant effects to occur.

17.9 Assessment of Impacts Cumulatively with the Onshore Development

The Onshore Development components are summarised in Chapter 5: Project Description. These Project aspects have been considered in relation to the impacts assessed within this Chapter.

In terms of direct impacts on marine historic environment assets, none are predicted offshore from the Onshore Development activities, since these will be wholly terrestrial with no pathway of impact to effect marine assets, resulting in no additional significant effects.

In terms of indirect impacts, there will be cumulative changes to the setting of certain historic environment assets by the Onshore Development in combination with the WTGs offshore. It is concluded that these changes will not be significant, because the Onshore Development will essentially blend with the existing Dounreay Site, SSE Substation and the Vulcan NRTE.

No additional significant adverse direct or indirect effects have been identified during the decommissioning phase, for similar reasons.

17.10 Mitigation and Monitoring Requirements

The Offshore Development embedded mitigation measures and management plans proposed in Section 17.5.5 address most identified impacts, including the requirement to provide a marine WSI and PAD.

No mitigation measures are currently proposed for potentially significant effects on setting, because there are no high magnitude effects on setting that result in a total or major alteration to the baseline setting or the integrity of the setting, and no effect fundamentally removes the understanding, appreciation or experience of the heritage asset to which the affected setting relates. The level of impact is considered **not significant** with the integrity of all settings adequately retained.

17.10.1 Monitoring Requirements

Any monitoring requirements during Construction will be detailed in the marine WSI and PAD that is part of the embedded mitigation (see Section 17.5.5).

17.11 Inter-relationships

Interrelated effects describe the potential interaction of multiple project impacts upon one receptor which may interact to create a more significant impact on a receptor than when considered in isolation. Interrelated effects may have a temporal or spatial element and may be short term, temporary or longer term over the life-cycle of the Offshore Development.

In line with the Scoping Opinion and Scoping Opinion Addendum received, this chapter has assessed all impacts that are relevant to Marine Archaeology and Cultural Heritage receptors during construction, operation and maintenance, and decommissioning phases of the Offshore Development. Therefore, it is considered that the assessment and conclusions presented in Section 17.12 provides a complete and robust assessment of all potential impacts relevant to Marine Archaeology and Cultural Heritage receptors. The assessment has also considered the potential for inter-related effects in relation to Marine Archaeology and Cultural Heritage receptors, and no additional inter-related effects beyond those presented in Section 17.6 have been identified.

Where the assessment contained in this chapter is considered within other assessment chapters, a summary of these interrelationships are presented below in Table 17.19 .

Table 17.19 Inter-relationships identified with Marine Archaeology and Cultural Heritage and other receptors in this EIAR

Receptor	Impacts	Description
Marine Physical Processes	Indirect impacts on marine archaeological assets on the seabed from changes to hydrodynamics	Changes in hydrodynamics could lead to increased scour and abrasion which may indirectly result in loss or disturbance of marine archaeological assets on the seabed. These impacts are discussed in Sections 17.6.2 and 17.7.3 of this Chapter.
Seascape, Landscape and Visual Amenity	Indirect impacts to Seascape, Landscape and Visual Amenity that are relevant to the setting of historic environment assets.	Indirect impacts from the Offshore Development on the setting of historic environment assets that affects their heritage value can also affect Seascape, Landscape and Visual Amenity. Setting impacts are assessed within Chapter 17: Marine Archaeology and Cultural Heritage, Sections 17.6.2.3.
Socio-economic, Recreation, and Tourism	Indirect impacts to the setting of historic environment assets that are Properties in Care and promoted as heritage sites to visit.	Indirect impacts from the Offshore Development on the setting of historic environment assets that affects their heritage value could affect the recreation and tourism experience.

17.12 Summary of Residual Effects

Table 17.20 summarises the effects for all impacts assessed. In summary, no significant residual effects other than those on the setting of some onshore historic environment assets have been identified.

Table 17.20 Summary of residual effects for Marine Archaeology and Cultural Heritage Receptors

Predicted Impact	Receptor	Assessment Consequence	Significance	Mitigation identified	Significance of Residual Effect
Construction					
Loss of or damage to unknown marine and intertidal historic environment assets	Unlocated wreckage and other unknown assets	Minor Effect	Not Significant	No additional mitigation measures beyond the embedded mitigation listed in Section 17.5.5, Table 17.12	Not Significant
Loss of or damage to submerged prehistoric landscapes	Submerged prehistoric sites & paleoenvironmental deposits	Minor Effect	Not Significant	No additional mitigation measures beyond the embedded mitigation listed in Section 17.5.5, Table 17.12	Not Significant
Operation and Maintenance					
Loss of or damage to unknown marine and intertidal historic environment assets	Unlocated shipwrecks, aircraft and other unknown assets	Minor Effect	Not Significant	No additional mitigation measures beyond the embedded mitigation listed in Section 17.5.5, Table 17.12	Not Significant
Loss of or damage to submerged prehistoric landscapes	Submerged prehistoric sites & paleoenvironmental deposits	Minor Effect	Not Significant	No additional mitigation measures have been identified for this effect above beyond the embedded mitigation listed in Section 17.5.5, Table 17.12	Not Significant

Predicted Impact	Receptor	Assessment Consequence	Significance	Mitigation identified	Significance of Residual Effect
Adverse changes to the setting of onshore historic environment assets	Sandside Harbour, 1 and 2 Sandside and Fishing Store	Negligible Effects	Not Significant	No mitigation measures are currently proposed for potentially significant effects on setting, above and beyond the embedded project mitigation listed in Section 17.5.5 because there are no High magnitude effects on setting that result in a total or major alteration to the baseline setting.	Not Significant
	Cnoc Urray	Minor Effects	Not Significant		Not Significant
	Cnoc Freiceadain	Minor Effects	Not Significant		Not Significant
	Reay Church	Minor Effects	Not Significant		Not Significant
	Sandside House, gardens with carved stones and farm buildings	Minor Effects	Not Significant		Not Significant
	Creag Bhreac Mhor stone rows	Minor Effects	Not Significant		Not Significant
	Crosskirk, St Mary's Chapel and Broch	Minor Effects	Not Significant		Not Significant
	Dunnet Head Lighthouse and Keepers' Houses	Minor Effects	Not Significant		Not Significant
	Bighouse Lodge, Garden Walls and Gate Piers	Minor Effects	Not Significant		Not Significant
	Ben Griam Beg Hillfort	Minor Effects	Not Significant		Not Significant
	Bridge of Broubster standing stones	Minor Effects	Not Significant		Not Significant

Predicted Impact	Receptor	Assessment Consequence	Significance	Mitigation identified	Significance of Residual Effect
	Cnoc na Ciste Chambered Cairn, Sordale Hill	Minor Effects	Not Significant		Not Significant
Decommissioning					
No adverse direct or indirect effects on the marine historic environment during decommissioning have been identified.					
Cumulative- Cumulative					
Loss of or damage to unknown marine and intertidal historic environment assets	Unlocated wreckage and other unknown assets	Minor Effect	Not Significant	No additional mitigation measures have been identified for this impact above and beyond the embedded project mitigation listed in Section 17.5.5 9 (instatement of WSI & PAD).	Not Significant
Loss of or damage to submerged prehistoric landscapes	Submerged prehistoric sites & paleoenvironmental deposits	Minor Effect	Not Significant	No additional mitigation measures have been identified for this impact above and beyond the embedded project mitigation listed in Section 17.5.5 9 (instatement of WSI & PAD).	Not Significant
Cumulative- Operation and Maintenance					
Loss of or damage to unknown marine and intertidal historic environment assets	Unlocated shipwrecks, aircraft and other unknown assets	Minor Effect	Not Significant	No additional mitigation measures beyond the embedded mitigation listed in Section 17.5.5, Table 17.12	Not Significant

Predicted Impact	Receptor	Assessment Consequence	Significance	Mitigation identified	Significance of Residual Effect
Loss of or damage to submerged prehistoric landscapes	Submerged prehistoric sites & paleoenvironmental deposits	Minor Effect	Not Significant	No additional mitigation measures have been identified for this effect above beyond the embedded mitigation listed in Section 17.5.5, Table 17.12.	Not Significant
Adverse changes to the setting of onshore historic environment assets	Sandside Harbour, 1 and 2 Sandside and Fishing Store	Negligible Effects	Not Significant	No mitigation measures are currently proposed for potentially significant effects on setting, above and beyond the embedded project mitigation listed in Section 17.5.5 because there are no High magnitude effects on setting that result in a total or major alteration to the baseline setting.	Not Significant
	Cnoc Urray	Minor Effects	Not Significant		Not Significant
	Cnoc Freiceadain	Minor Effects	Not Significant		Not Significant
	Reay Church	Minor Effects	Not Significant		Not Significant
	Sandside House, gardens with carved stones and farm buildings	Minor Effects	Not Significant		Not Significant
	Creag Bhreac Mhor stone rows	Minor Effects	Not Significant		Not Significant
	Crosskirk, St Mary's Chapel and Broch	Minor Effects	Not Significant		Not Significant
	Dunnet Head Lighthouse and Keepers' Houses	Minor Effects	Not Significant		Not Significant

Predicted Impact	Receptor	Assessment Consequence	Significance	Mitigation identified	Significance of Residual Effect
	Bighouse Lodge, Garden Walls and Gate Piers	Minor Effects	Not Significant		Not Significant
	Ben Griam Beg Hillfort	Minor Effects	Not Significant		Not Significant
	Bridge of Broubster standing stones	Minor Effects	Not Significant		Not Significant
	Cnoc na Ciste Chambered Cairn, Sordale Hill	Minor Effects	Not Significant		Not Significant
Cumulative - Decommissioning					
The removal of WTGs would reverse any setting impacts. Therefore, no adverse effects on the setting of onshore historic assets during decommissioning have been identified.					

17.13 References

Baird, R.N. (2003). Shipwrecks of the North of Scotland. Birlinn Ltd.: Edinburgh.

CIfA. (2022). *The Chartered Institute for Archaeologists Codes, Standards and Guidelines* (CIfA regulations, standards and guidance | Chartered Institute for Archaeologists).

Energy Act 2004. Available at: https://www.legislation.gov.uk/ukpga/2004/20/contents

English Heritage. (2012). *Ships and Boats: Prehistory to Present. Designation Selection Guide*. English Heritage: Swindon.

Flemming, N.C. (2003). *The scope of Strategic Environmental Assessment of Continental Shelf Area SEA 4 in regard to prehistoric archaeological remains*. https://assets.publishing.service.gov.uk/government.

Flemming, N.C., Harff, J., Moura, D., Burgess, A. & Bailey, G.N. (editors). (2017). *Submerged Landscapes of the European Continental Shelf*. John Wiley & Sons Ltd.: Chichester.

Hepper, D. (2007). *British Warship Losses in the Ironclad Era 1860-1919*. Greenhill Books: Barnsley.

HES. (2019). *The Historic Environment Policy Statement for Scotland 2019*. Historic Environment Scotland: Edinburgh.

HES. (2019). *Historic Environment Designation Policy and Selection Guidance 2019*. Historic Environment Scotland: Edinburgh.

HES. (2020). *Managing Change in the Historic Environment: Setting* (revised 2020). Historic Environment Scotland: Edinburgh.

HM Government (2011). UK Marine Policy Statement.

Larn, R & Larn, B. (1998). *The Ship Wreck Index of Great Britain & Ireland: Vol.4 Scotland*. Lloyd's Register of Shipping: London.

MMT. (2021a). *Geophysical Factual Survey Report: Export cable route (including nearshore)*. 103760-HWL-MMT-SUR-REP-SURREECR-02. August 2021.

MMT. (2021b). *Geophysical Factual Survey Report: Export cable route (Nearshore Area)*. 103760-HWL-MMT-SUR-REP-SURRENEAR-02. August 2021.

MMT. (2021c). *Geophysical Factual Survey Report: Offshore Windfarm Site*. 103760-HWL-MMT-SUR-REP-SURREOWFS-02. August 2021.

ORCA. (2015). *Hexicon Tri: Marine Historic Environment Technical Baseline Report*. Microsoft Word - Dounreay Tri Demo - ES - Appendix Contents and Cover Sheets (marine.gov.scot).

Plets, R., Dix, J., & Bates, R. (2013). *Marine Geophysics Data Acquisition, Processing and Interpretation: Guidance Notes*. English Heritage Publishing: Swindon.

Scottish Government (2015). Scotland's National Marine Plan: A Single Framework for Managing Our Seas.

Scottish Government (2020). Scottish Planning Policy.

SSEN. (2013). *Orkney - Caithness 220 kV Link Marine Environmental Appraisal Volume 1: Main Report*. 1 Volume 1_Main Report.pdf (marine.gov.scot).

Stanton, C. (1998). *Caithness and Sutherland, Landscape Character and Assessment*; Scottish Natural Heritage [now NatureScot] Review No 103. SNH Publications Section: Perth.

Wessex Archaeology. (2011). *Assessing Boats and Ships 1860-1913, 1914-1938, 1914-1938*. Archaeological Desk-Based Assessment in 3 volumes. Wessex Archaeology: Salisbury.

Whittaker I.G. (1998). *Off Scotland: a comprehensive record of maritime and aviation losses in Scottish waters*. C-Anne Publishing: Edinburgh.