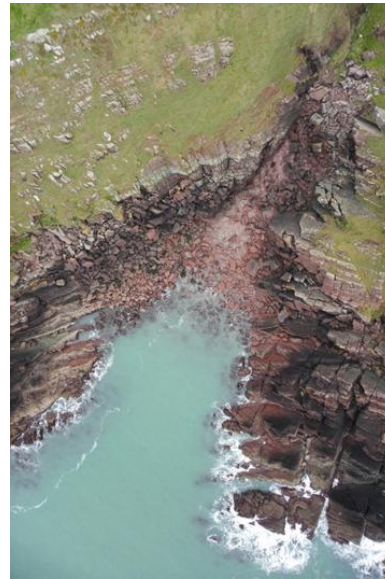




mWave Marine Energy Device and Onshore Infrastructure

ENVIRONMENTAL STATEMENT



June 2019

CHAPTER 13: Marine Archaeology

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Glossary

Term	Definition
Cadw	The historic environment service of the Welsh Government
Designation	The recognition of particular heritage value(s) of an historic asset by giving it formal status under law or policy intended to sustain those values.
Heritage	All inherited resources which people value for reasons beyond mere utility.
Heritage, cultural	Inherited assets which people identify and value as a reflection and expression of their evolving knowledge, beliefs and traditions, and of their understanding of the beliefs and traditions of others.
Heritage, natural	Inherited habitats, species, ecosystems, geology and landforms, including those in and under water, to which people attach value.
Heritage asset	An identifiable component of the historic environment. It may consist or be a combination of an archaeological site, an historic building, or a parcel of historic landscape. Nationally important historic assets will normally be designated.
Historic environment	All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and deliberately planted or managed.
Historic Environment Record	A public, map-based data set, primarily intended to inform the management of the historic environment. In Wales these are maintained by the four Welsh Archaeological Trusts.
Intertidal	Area that is above water during low tide and underwater during high tide.
Marine Energy Test Area Project	The META project, located in Pembrokeshire, consists of eight test sites where a range of marine energy testing activities will be permitted over a 15 year period. The licensing and consenting of the mWave project was originally intended to be undertaken within the consenting and licensing of the META project, with mWave being deployed within META Site 8
Natural change	Change which takes place in the historic environment without human intervention, which may require specific management responses (particularly maintenance or periodic renewal) in order to sustain the significance of a place.
Reversible	Capable of being reversed so that the previous state is restored.
Scouring	Erosive action of suspended sediment.
Sediment transport	Movement of solid particles (sediment) due to gravitational forces and/or the movement of the fluid in which the sediment is entrained.
Setting	The surroundings in which an historic asset is experienced, its local context, embracing present and past relationships to the adjacent landscape.
Importance	The sum of the cultural heritage values
Spring tides	Tide following a new or full moon during which the tidal range is maximum.
Tidal excursion	The horizontal distance along the estuary that a particle moves during one tidal cycle of ebb and flood.
Tidal flow (or current)	Currents resulting from the impact on sea level caused by the interaction of the Earth, sun and moon.
Tidal range	Height difference between high tide and low tide.
Value	An aspect of worth or importance, here given by people to historic assets.
Value, aesthetic	Value deriving from the ways in which people draw sensory and intellectual stimulation from a place.
Value, communal	Value deriving from the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory.
Value, evidential	Value deriving from the potential of a place to yield evidence about past human activity.
Value, historical	Value deriving from the ways in which past people, events and aspects of life can be connected through a place to the present.
Value, heritage	The sum of the four component values (evidential, historical, aesthetic and communal).

Acronyms

Acronym	Description
AD	Anno Domini
BC	Before Christ
EIA	Environmental Impact Assessment
ES	Environmental Statement
DAT	Dyfed Archaeological Trust
dWNMP	Draft Welsh National Marine Plan
HER	Historic Environment Records
ICOMOS	International Council on Monuments and Sites
NPS	National Policy Statement
PDE	Project Design Envelope
LCG	Landing Craft Gun
LDP	Local Development Plan
MCA	Marine Character Area
META	Marine Energy Test Area
MHWS	Mean High Water Spring
MLWS	Mean Low Water Spring
NPS	National Policy Statement
NMRW	National Monuments Record in Wales
NRW	Natural Resources Wales
PCNPA	Pembrokeshire Coast National Park Authority
RCAHMW	Royal Commission for Ancient and Historic Monuments in Wales
SCA	Seascape Character Area
SSC	Suspended sediment concentration
UK	United Kingdom
ZoI	Zone of Impact

Units

Unit	Description
m	metres
m ²	metres squared
km	kilometre
NM	nautical miles
in	inches
ft	feet
hp	horse power
gt	Gross tonnage

13. MARINE ARCHAEOLOGY

13.1 Introduction

- 13.1.1.1 This chapter of the Environmental Statement (ES) presents the results of the Environmental Impact Assessment (EIA) for the potential impacts of the mWave project on marine archaeology. An archaeological desk based assessment has been prepared in support of the onshore planning application (see Chapter 2: Project Description, Section 2.6.5).
- 13.1.1.2 The assessment presented is also informed by the following technical chapters:
- Chapter 5: Coastal Processes;
 - Chapter 14: Seascape and Landscape; and
 - Chapter 15: Other Users.
- 13.1.1.3 The EIA will consider the potential effects of the installation, operational and decommissioning phases of the mWave project on historic assets within the marine archaeology study area. The impact assessment will consider both direct and indirect potential impacts and will be assessed based on the nature of the proposed activities. This Environmental Statement Chapter will review the legislative, policy and guidance framework relevant to marine archaeology and will also set out an appropriate methodology for the assessment of impacts and effects on the historic environment.
- 13.1.1.4 The significance of potential impacts will be assessed by taking into account the potential magnitude of impacts (e.g. a high magnitude impact could involve the total loss of a heritage asset) and the sensitivity of heritage assets. The assessment of the likely effects on the marine historic environment will include the following activities:
- Identification of all marine heritage assets that could be affected by the proposed development, along with provision of a description of the value / sensitivity of those assets;
 - Identification of the likely effects of the proposed development on marine heritage assets within the site and an appropriate study area centred on it; and
 - Assessment of significance of effects, taking into account measures proposed to avoid, reduce or offset adverse effects.
- 13.1.1.5 This chapter is supported by information contained within a technical report included in Appendix 13.1: Marine Archaeology.

13.2 Purpose of this chapter

- 13.2.1.1 The primary purpose of the Environmental Statement is to support the marine licence application for the mWave project, including the full scale WEC, marine communications cable up to MHWS, Acoustic Doppler Current Profiler (ADCP), Subsea Umbilical Termination Unit (SUTU) and navigational markers (if needed). The Environmental Statement will also support the planning application for the onshore section of the communication cable (from MLW), the termination box, cable anchor point and onshore control station.
- 13.2.1.2 This Environmental Statement chapter:
- Presents the existing marine archaeology baseline established from desk studies, and consultation;
 - Presents the potential environmental effects on marine archaeology arising from the mWave project, based on the information gathered and the analysis and assessments undertaken;
 - Identifies any assumptions and limitations encountered in compiling the baseline information; and
 - Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process.

13.3 Study area

- 13.3.1.1 As discussed in Chapter 1: Introduction, the licensing and consenting of the mWave project was originally intended to be undertaken within the consenting and licensing of the Marine Energy Wales META project with mWave being deployed at the eastern end of META Site 8 (East Pickard Bay). Whilst the mWave device is short term and of limited extent compared to the META project, the baseline information for the META Site 8 has been used in the following assessment to ensure consistency of information across the two projects which are likely to be in the consenting process at the same time.
- 13.3.1.2 The marine archaeology wider study area (see Figure 13.1) for the proposals is defined as the Milford Haven Waterway (henceforth referred to as “the Waterway”) – the area inclusive of the Waterway and extends 12 Nautical Miles from St Govan’s Head to Skomer Island. The local study area is defined as the area within the META site 8 consented site (within which the mWave project will be deployed), with a 500m archaeological search area which encompasses the cable route from mWave to MHWS (Figure 13.2). The study area was set out in the RPS¹ EIA Scoping Report, and agreed with the Royal Commission for Ancient and Historic Monuments in Wales (RCHAMS) as well as the Dyfed Archaeological Trust (DAT), from whom baseline data records were obtained.

¹ RPS (2018) Marine Energy Test Area (META), Environmental Impact Assessment. Scoping Report.

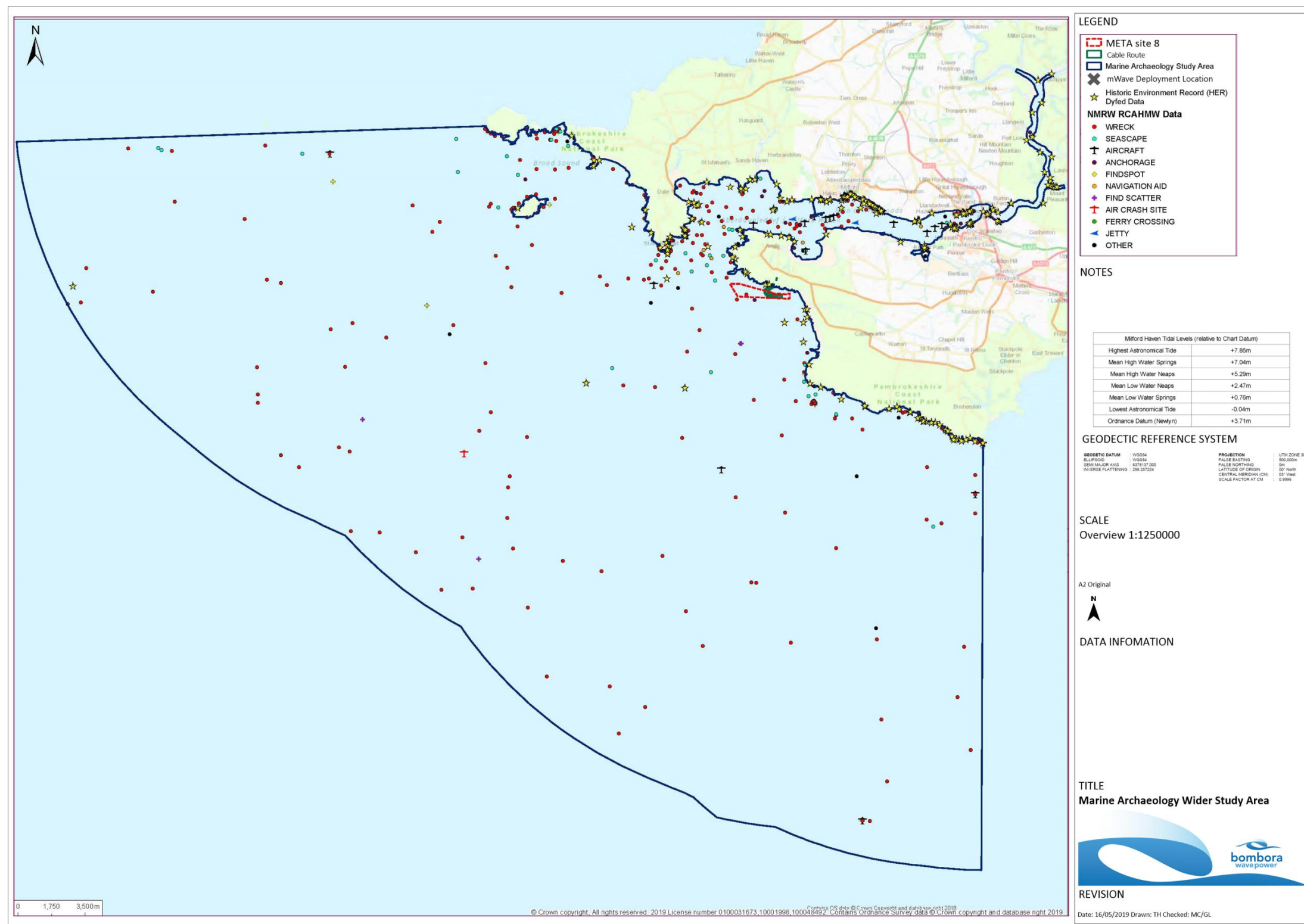


Figure 13.1: Marine Archaeology Wider Study Area

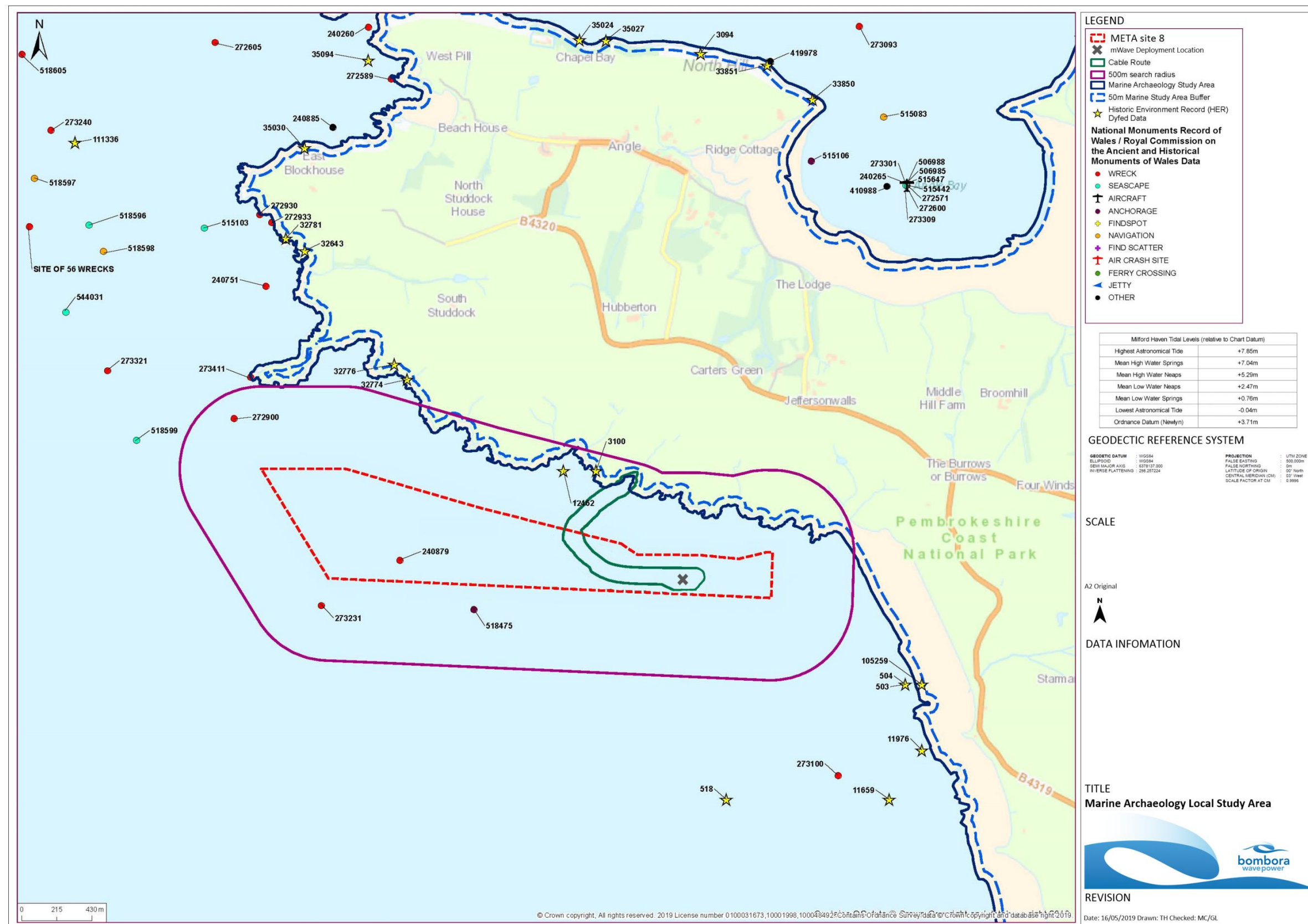


Figure 13.2: Marine Archaeology Local Study Area

13.4 Policy context

13.4.1.1 Planning policy guidance provides advice concerning how the historic environment should be addressed within the planning process. This is set out in detail within technical appendix 13.1 and summarised in Table 13.1 below.

13.4.2 National Planning Policy

13.4.2.1 While it is recognised that the mWave project does not constitute a Nationally Significant Infrastructure project (NSIP), the National Policy Statements (NPS) available to support NSIPs are considered to provide useful context to the production of an Environmental Statement. Chapter 3: Needs and Alternatives outlines the policy context for the mWave project, and how the mWave project has adhered to the UK marine Policy Statement and the draft Welsh National Marine Plan (dWNMP).

13.4.2.2 The principal national planning policy relevant to this assessment is Planning Policy Wales (Edition 10, Welsh Government, December 2018), (PPW10). Chapter 6 of PPW10 (Distinctive and Natural Places) includes a section (6.1) on The Historic Environment. This establishes Welsh Government objectives with regard to the protection of the historic environment, including in marine and intertidal zones, as well as onshore, and explains that responsibility for caring for the historic environment lies with all those that have an interest in the planning system.

13.4.3 Local Planning Policy

13.4.3.1 The Pembrokeshire Coast National Park Authority (PCNPA) Local Development Plan (LDP) was adopted by the National Park Authority on the 29 September 2010, and also includes policies relevant for this assessment.

13.4.3.2 The PCNPA issues Supplementary Planning Guidance to the LDP for the Pembrokeshire Coast National Park, including the 'Historic Environment (Archaeology)', adopted 22 June 2011. PCNPA also issued Supplementary Planning Guidance to the Local Development Plan, Adopted 11 December 2013 titled 'Seascape Character Assessment'.

Table 13.1: Summary of policy framework provisions relevant to marine archaeology.

Summary of relevant policy framework	How and where considered in the Environmental Statement
Planning Policy Wales (Edition 10, Welsh Government, December 2018), Chapter 6 - Distinctive and Natural Places - section 6.1 "The Historic Environment". - Objectives regarding the historic environment are defined in paragraph 6.1.6, as follows: - protect the Outstanding Universal Value of the World Heritage Sites; - conserve archaeological remains, both for their own sake and for their role in education, leisure and the economy;	The assessment of the likely potential impacts of the proposals has been undertaken in accordance with the PPW 10. Relevant designated and non-designated heritage assets surrounding the onshore and offshore elements of the mWave project, have been identified and the likely potential impacts of the proposals assessed proportionately within the Environmental Statement and baseline Appendices.

Summary of relevant policy framework	How and where considered in the Environmental Statement
- safeguard the character of historic buildings and manage change so that their special architectural and historic interest is preserved; - preserve or enhance the character or appearance of conservation areas, while at the same time helping them remain vibrant and prosperous; - preserve the special interest of sites on the register of historic parks and gardens; and - protect areas on the register of historic landscapes in Wales. - Regarding archaeological remains, Section 6.1 of PPW10 states: 'The conservation of archaeological remains and their settings is a material consideration in determining planning applications, whether those remains are a scheduled monument or not' (Paragraph 6.1.23). 'Where nationally important archaeological remains are likely to be affected by proposed development, there should be a presumption in favour of their physical protection in situ. It will only be in exceptional circumstances that planning permission will be granted if development would result in a direct adverse impact on a scheduled monument (or an archaeological site shown to be of national importance)' (Paragraph 6.1.24). - In cases involving less significant archaeological remains, local planning authorities will need to weigh the relative importance of the archaeological remains and their settings against other factors, including the need for the proposed development' (paragraph 6.1.25). - Section 6.1 goes on to say: 'Where archaeological remains are known to exist or there is a potential for them to survive, an application should be accompanied by sufficient information, through desk-based assessment and/or field evaluation, to understand a full understanding of the impact of the proposal on the significance of the remains' (paragraph 6.1.26). 'If the planning authority is minded to approve an application and where archaeological remains are affected by proposals that alter or destroy them, the planning authority must be satisfied that the developer has secured appropriate and satisfactory provision for their recording and investigation, followed by the analysis and publication of the results and the deposition of the resulting archive in an approved repository' (paragraph 6.1.27).	Where appropriate, mitigation is put forward to enable preservation. Planning permission will be sought from PCNPA. The onshore works associated with the project use minimal intrusive works (Chapter 2 Project Description) and as such no impact on archaeology is anticipated. Notwithstanding this a desk based assessment has been undertaken and the report will be provided in support of the onshore planning application.. The principles of assessment set out in PPW 10 have been applied to the marine element of the project as they are relevant to inform marine consent.
Pembrokeshire Coast National Park Local Development Plan, adopted 29 September 2010 - Policy 17 Shore Based Facilities "Development of shore-based facilities including those linked to proposals below mean low water, will be permitted within the developed areas of the coast where compatible with adjacent uses"	The significance of known and potential assets up to MHWS associated with the mWave project have been considered in the baseline assessment for the marine element of the project and these judgements and, where relevant, mitigation measures will be agreed through consultation with relevant statutory bodies. The onshore works associated with the project use minimal intrusive works (Chapter 2: Project Description) and as such no impact on archaeology is anticipated. Notwithstanding this a desk based assessment has been undertaken and the report will be provided in support of the onshore planning application.

Summary of relevant policy framework	How and where considered in the Environmental Statement
Pembrokeshire Coast National Park Authority - Supplementary Planning Guidance 'Historic Environment (Archaeology)', adopted 22 June 2011	The Milford Haven Waterway Registered Landscape has been scoped out from the maritime archaeology chapter, given the proposed development would have no more than a local impact on this landscape, however, the landscape assessment and descriptions are used to inform this assessment, and therefore considered in the baseline study.
The Register of Landscapes of Outstanding Historic Interest (Register of Landscapes of Outstanding Historic Interest in Wales. Cadw/ICOMOS UK. 1998) recognises that historic landscapes are one of Wales' most valuable cultural assets being a special, often fragile and irreplaceable part of our heritage. Four of these Registered Landscapes lie within Pembrokeshire Coast National Park, including Milford Haven Waterway, described as a 'highly articulate and distinctive land and seascape'.	
Pembrokeshire Coast National Park Authority - Supplementary Planning Guidance 'Seascape Character Assessment', adopted 11 December 2013	
- The seascape character assessment of Pembrokeshire Coast National Park includes territorial waters up to 12 nautical miles offshore and extends from Cardigan Island in the north to the Taf estuary in Carmarthen Bay in the south. The study area reaches inland to include the areas of Milford Haven outside the Park, and up to the tidal limits of the Daugleddau. The following Seascape Character Areas (SCAs) are relevant for this assessment: - SCA 31 – Outer Milford Haven (Dale Road – Site 7) - SCA 32 – Inner Milford Haven (Warrior Way – Site 6) - SCA 34 – Freshwater West (East Pickard Bay – Site 8)	The marine aspects of the relevant Seascape Character Assessments are considered in the baseline study.

13.5 Consultation

13.5.1.1 A summary of the key issues raised during the META consultation, which is relevant to the mWave device, specific to marine archaeology is outlined below in Table 13.2, together with how these issues have been considered in the production of this Environmental Statement chapter.

Table 13.2: Summary of key consultation issues raised during consultation relevant to marine archaeology.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
December 2018	Dyfed Archaeological Trust – baseline data	Marine archaeology study area does not include heritage assets in intertidal zone, which need to be considered.	Marine archaeology study area revised to include search area covering intertidal areas.
	Welsh Government	The scoping report has identified the relevant data sources for the marine archaeology in the vicinity of Sites 6, 7 and 8 and in our opinion the approach to consider both the direct and indirect impact on the identified historic assets is appropriate.	No action required

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
	Welsh Government	The elements of the proposed developments that will be visible in the registered Milford Haven landscape of outstanding historic interest will have no more than a local impact on the registered historic landscape. Consequently, we consider that the impact of the proposed development on the registered historic landscape can be scoped out of the EIA.	This receptor has not been included as receptor, but included as part of baseline research

13.6 Methodology to inform the baseline

13.6.1 Desktop study

- 13.6.1.1 The overall aim of the baseline assessment is the identification of all heritage assets that would be affected by the proposed development, along with provision of a description of the value / sensitivity of those assets, in compliance with the 'Standard and guidance for historic environment desk-based assessments' (Chartered Institute for Archaeologists, December 2014, revised in 2017).
- 13.6.1.2 Information on marine archaeology within the marine archaeology study area was collected through a detailed desktop review of existing studies and datasets. These are summarised at Table 13.3 below.

Table 13.3: Summary of key desktop reports.

Title	Source	Year	Author
Historic Environment Records (NPRN numbers referenced in text and figures below)	Royal Commission for Ancient and Historic Monuments in Wales / National Monuments Record for Wales	2018	Royal Commission for Ancient and Historic Monuments in Wales / National Monuments Record for Wales
Historic Environment Records (PRN numbers referenced in text and figures below)	Dyfed Archaeological Trust / Cadw	2018	Dyfed Archaeological Trust / Cadw
Records wrecks and obstructions	United Kingdom Hydrological Office	2018	United Kingdom Hydrological Office
National Seascape Assessment for Wales	Natural Resources Wales	2015	Natural Resources Wales
Supplementary Planning Guidance to the Local Development Plan - 'Seascape Character Assessment'	Pembrokeshire Coast National Park Authority	2013	Pembrokeshire Coast National Park Authority
Landscapes of Outstanding Historic Interest	Cadw	1998	Cadw, CCW, and ICOMOS UK

13.6.2 Identification of designated and non-designated heritage assets

- 13.6.2.1 Designated assets are considered here to be statutory designated assets such as scheduled monuments and designated wrecks. All non-statutory designations, such as local designations, are considered in this chapter as non-designated assets.
- 13.6.2.2 All designated and non-designated heritage assets within the marine archaeology study area of archaeological value / sensitivity that could be affected by the installation, operation and maintenance, and decommissioning of the mWave project were identified using the three-step process described below:
- Step 1: All designated and non designated sites of international, national and local importance within the marine archaeology study area were identified using a number of sources. These included the Royal Commission for Ancient and Historic Monuments in Wales (RCAHMW), National Monuments Record for Wales (NMRW), Dyfed Archaeological Trust (DAT), Cadw, Natural Resources Wales (NRW) and PCNPA;
 - Step 2: Information was compiled on the relevant heritage assets for each of these sites from the baseline records provided and additional documentary research; and
 - Step 3: Using the above information and expert judgement, sites were included for further consideration if:
 - A designated or non designated site directly overlaps with the mWave project; and
 - Sites and associated features (including setting) were located within the potential Zone of Impact (Zol) for impacts associated with the mWave project.

13.6.3 Bathymetric Survey

- 13.6.3.1 A hydrographic and geophysical survey has been undertaken of the mWave deployment site, its immediate vicinity and the cable route corridor (Titan, 2018). The survey area extends for about 2 kilometres seaward (west) from the foreshore and is about 600m North-South. Approximately, the southern third of the survey area lies within the active Castlemartin Firing Range danger zone. Complete swathe bathymetry and sonar coverage was achieved, whilst sub-bottom profiler and magnetometer data was collected on primary profiles at a nominal 40m interval with cross lines at about 120m intervals. Good data was recovered down to a maximum depth about 15m below the seabed.

13.7 Marine archaeology baseline environment

13.7.1 Designated and non-designated heritage assets

- 13.7.1.1 Maritime archaeological sites and materials can be defined as the physical remains of boats and ships that have been wrecked, sunk or have foundered; aircraft losses; historical human structures (such as settlements) and artefacts which rest upon the seabed as the result of being jettisoned or lost overboard (for example, anchors, cannon or fishing gear).
- 13.7.1.2 Records of known wreck sites and losses in UK waters are biased towards the recent, predominantly post-Medieval and modern periods, through the survival of associated historic

sources. Although the existence and survival of Palaeolithic watercraft are highly speculative in the UK, Bronze and Iron Age sea-going vessels are considered likely to have been lost in the marine archaeology search area. The precise location of most wrecks is not known. The majority of known and recorded wreck sites lie relatively close to the coast, by virtue of their accessibility and visibility.

- 13.7.1.3 Data for known shipwrecks and recorded shipping losses within the local marine archaeology search area, are depicted in Figure 13.3. These datasets provide a general picture of maritime casualties in the marine archaeology search area, but should not be viewed as representing the totality of the potential maritime archaeological remains in the marine archaeology search area. Wrecks and obstructions are generally charted, although a small number lack accurate positional information. It is also worth noting that locations can change or disperse overtime due to the effect of currents and storms.
- 13.7.1.4 Further information on relevant assets is provided in the gazetteer presented in technical Appendix 13.1. These are not all of the heritage assets identified on the search, rather they are the ones identified within a 500m radius of the sites in Royal Commission for Ancient and Historic Monuments / National Monument Record (RCAHMW/NMR) and Dyfed Archaeological Trust (DAT) searches, and considered to be relevant to this assessment.
- 13.7.1.5 The following sections set out the baseline marine archaeology within the local study area off East Pickard Bay (as identified in Section 13.3).

Study area overview

- 13.7.1.6 The mWave deployment site and cable route lies within Marine Character Area 22 – South Pembrokeshire Coastal and Inshore Waters, as defined by the National Seascape Assessment for Wales (Natural Resources Wales, November 2015). This Marine Character Area (MCA) comprises the coastal and inshore waters hugging the south Pembrokeshire coast. It stretches from Old Castle Head in the east to the southern entrance to Milford Haven in the west (see technical appendix 13.1).
- 13.7.1.7 The mWave project also lies within Seascape Character Area 34 – Freshwater West, as defined by the PCNPA Supplementary Planning Guidance to the Local Development Plan, adopted 11 December 2013, and titled 'Seascape Character Assessment' (see technical appendix 13.1). An assessment of effects of the mWave project both onshore and offshore elements, on the seascape and landscape character areas is presented in Chapter 14: Seascape. Landscape Assessment. Finally, mWave and the cable route fall within the South Pembrokeshire Heritage Coast. This area has recently been used in the making of the film Robin Hood (2010) and in Harry Potter and the Deathly Hallows – Part 2 (2011).

Designated heritage assets

- 13.7.1.8 A review of marine archaeological data has returned no designated sites (designated wrecks) within the local study area including the marine communications cable route. There is one land-based scheduled ancient monument, West Pickard Camp, adjacent to the cable route and as such is within the 500m search area.
- 13.7.1.9 West Pickard Camp (NPRN 92,623 / PRN 3099) is a scheduled monument located on West Pickard Bay headland to the immediate west of the marine communications cable route landfall, which is in East Pickard Bay (**Figure 13.3**). This Iron Age promontory fort is univallate and occupies a blunt promontory at c. 40m above sea level. It is protected by sea cliffs to the west and south and by a curving bank and ditch to the north and east. A simple northeast-facing entrance lies midway along the defences. The internal area measures c. 55m east-west and 60m north-south. The western side is thought to have been lost to erosion, and is within and immediately adjacent to the west of the marine communications cable route (**Figure 13.3**). Flint flakes and cores have been found in this area, but there are few details regarding the circumstances of recovery, or the amount of flint recovered (PRN 3100, immediately adjacent to the west of the cable search area, to the north of the site).

Non-designated heritage within local study area

- 13.7.1.10 An unnamed modern wreck (NPRN 240,879) can be found within the local study area, sited approximately 1.7km to the west of mWave deployment area (**Figure 13.3**). The wreck lies orientated north-south with the bows to the north and has a length of 70m and width of 10m. It stands 3m above the general level of the seabed and was first located in July 2006. A Notice to Mariners was subsequently issued (NM 447/07). In addition to this marked as off Freshwater West beach, some 1.5km to the southeast of mWave deployment site, is a post medieval wreck (see NPRN 273,100 Highland Home see below), the precise location of the wreck is unconfirmed. The full character and extent of archaeological remains is presently unknown.

Prehistoric (within 500m search area)

- 13.7.1.11 A flint tranche axe, flint flakes and a flint implement have been recovered from a site eroding from below a peat exposure, identified as a Prehistoric submerged forest (NPRN 524,740). The peat has been sampled and dated to a calibrated C14 date of 5250-4550 BC. Charcoal was also recovered. This site is mapped approximately 1.2km to the south-west of the site at Freshwater West beach, however, these deposits may extend beyond the recorded area and into the area of the site and cable route.
- 13.7.1.12 As mentioned above, the western side of West Pickard Camp is thought to have been lost to erosion, potentially within the marine communications cable route. Flint flakes and cores have also been found in this area. Along with coastal processes which will have resulted in previous land areas now being submerged, the proximity of these finds may be indicative of medium potential for Prehistoric remains within the site and marine communications cable route.

Roman and Medieval (within 500 m search area)

- 13.7.1.13 There are no known heritage assets dating to the Roman or Medieval periods within the 500m search area of the local study area.
- 13.7.1.14 The site is assessed as having negligible potential for heritage assets from the Roman to the Medieval periods.

Post-Medieval (within 500 m search area)

- 13.7.1.15 The Speedwell (NPRN 272,900) was a 99 ton wooden schooner belonging to Conwy. At time of loss on 2 November 1854, the schooner was on passage from Neath to Liverpool. The vessel ran onto Sheep Island, floated off and then sank in deep water, mapped approximately 350 m to the north-west of the site. The crew managed to escape the vessel and landed at Milford.
- 13.7.1.16 The Highland Home (NPRN 273,100) was an iron-hulled barque built by Ramage and Ferguson, Leith, in 1886. Technical and configuration specifications are given as 1371 gt, 1298 nt; 234 ft length x 37 ft breadth x 21 ft 2 in depth; one deck, one bulkhead, passenger deck 31 ft, forecastle 28 ft. At time of loss, the vessel was owned by J R Cuthbertson, Glasgow, and was on passage from Fleetwood to London. The barque was under tow to the steam tug Warrior between St Anne's Head and West Freshwater Bay. The tow parted, and the two vessels became separated. Wreckage from the Highland Home was later found in Freshwater Bay and around Linney Head. Finds from the Highland Home recovered and reported to the Receiver of Wreck, include a brass letter 'O'; the ship's bell; portholes; a silver coffee pot and a pair of binoculars. The precise location of the wreck is unconfirmed, although it is possible that this is the Unnamed Wreck (NPRN 240,879) (see above).
- 13.7.1.17 Assuming that the Unnamed Wreck (NPRN 240,879) is the provenance of the finds reported to the Receiver of Wreck and recorded as the Highland Home (NPRN 273,100), it is possible that other elements of the Unnamed Wreck have dispersed throughout the site, therefore, the site is assessed as having a high archaeological potential for finds associated with this wreck.

Modern (within 500m search area)

- 13.7.1.18 West Pickard Camp was used by the military during WW2, in association with the nearby Angle Airfield (the control station will be located on its south eastern boundary). A gun emplacement (PRN 32765) was constructed in the south-eastern corner of West Pickard Camp, necessitating the removal of part of the defensive bank. To the east of West Pickard Camp scheduled monument boundary, is a weapons pit (PRN 33438 / NPRN 270745), and to the north-east of (outside) the cable route is a gun emplacement (PRN 33438 / NPRN 270754).

- 13.7.1.19 Castlemartin's military training areas and ranges strongly influence the character and sounds associated with the MCA's coast and waters. Castlemartin is the only UK Army range where armoured units practice direct-fire live gunnery exercises, with both on-land impact areas and a large offshore safety area adjacent to the east and south-east of the site – coastal and marine access is restricted during live firing (MCA 22 / SCA 34).
- 13.7.1.20 Castlemartin played a vital role in the preparation and run up to D-Day, with several shore to sea and sea to shore practice operations taking place. The area also saw the use of several remotely controlled Tiger Moths or Queen Bees as gunnery target practice during WWII. Casualties of aircraft bombing lie on the sea floor, where several boats were downed by aircraft with others torpedoed by German submarines. These waters contain the convergence of the shipping lanes heading for Milford Haven and those continuing westward. On the reef habitats there are several large upstanding and unidentified steel wrecks, likely to be war-time losses (MCA 22 / SCA 34).
- 13.7.1.21 There are no reported wrecks in the subtidal region of the proposed marine communications cable route.
- 13.7.1.22 A modern wreck, Landing Craft Gun (LCG No. 15 (NPRN 273,231)) can be found to the south-west, 180m to the south of the local study area boundary, approximately 1.5km from mWave deployment site. This wreck is reported to lie upside down and is a Protected Place under the Protection of Military Remains Act (1986). This Act makes it an offence to interfere with the wreckage of any designated vessel without a licence. The wreck site is used for recreational diving purposes. The LCG No. 15 was a large flat-bottomed landing craft of 627 tons, modified to act as a gun platform for 4.7-inch guns, and intended to be used in the invasion of Sicily. The craft sank whilst in transit due to heavy sea conditions with the loss of all on board on 25 April 1943. This led to modifications for subsequent craft used in the latter stages of the Second World War.
- 13.7.1.23 General patterns in reported shipping losses define a traditional sailing route inside the St Govan's Shoal, hugging the coast to pass inside the Crow's rock, or passing to the south of St Govan's Shoal and the former location of a lightship. Freshwater Bay (NPRN 518,475) traditionally provided sheltered anchorage for vessels passing through these waters and an anchorage is suggested by an anchor symbol on an historic chart. Sailing Directions dating to 1884 note '*... offers fair shelter with offshore winds, in depths not less than 9 fathoms. If caught with an onshore wind, it is better to work on the southern or Linney head side of the bay...*'
- 13.7.1.24 Sheep Rock is also identified as a seascape asset (NPRN 518,599) used as a navigational aid. This isolated pinnacle is shown (with water depths over of 6.4 m) some 750 m to the west of Sheep Island on an historic chart. Described as '*... several patches off the southwest side of Sheep island, the shoals, named Sheep rock of 3 1/3 fathoms.*' In Sailing Directions dating to 1884.

- 13.7.1.25 There are a number of wrecks, arbitrarily mapped at SM8814700050, whose exact location and condition is not known. These may be in, or in the vicinity of the local study area boundary and marine communications cable route.

- 13.7.1.26 The site is assessed as being of low archaeological potential for the Modern period.

Archaeological Potential

- 13.7.1.27 The mWave site and the local study area are not covered by the Dyfed Archaeological Trust's "Milford Haven Waterway Ports & Harbours Project" survey.
- 13.7.1.28 A Prehistoric submerged forest is mapped approximately 1.6km to the south-east of the mWave site at Freshwater West beach (NPRN 524,740), but possibly present elsewhere. The remains associated with the West Pickard Camp (western side) may survive in the inter-tidal area between West Pickard and East Pickard Bay, potential attested by the recorded flint flakes and cores which have been found in this area (PRN 3100).
- 13.7.1.29 There are a number of wrecks, arbitrarily mapped at SM8814700050, whose exact location and condition are not known, and may be within, or in the vicinity of the site and marine communications cable route.
- 13.7.1.30 The local study area has high potential for deposits dated to the post-Medieval period, specifically associated with the wreck mapped on site (Figure 13.3), believed to be the Highland Home.
- 13.7.1.31 Overall, the local study area and marine communications cable route have medium potential for archaeological deposits dating to the Prehistoric periods, and low potential for the Modern period.
- 13.7.1.32 The local study area and cable route have negligible potential for archaeological deposits dating to the Roman and Medieval periods.

13.7.2 Summary of marine archaeology baseline

- 13.7.2.1 Designated assets are considered here to be statutory designated assets such as scheduled monuments and designated wrecks. All non-statutory designations, such as local designations, are considered in this chapter as non-designated assets.
- 13.7.2.2 There are no marine designated heritage assets (designated wrecks) within the mWave deployment site, the marine communications cable route, within the local study area boundary or the 500m search area. There is one scheduled monument, West Pickard Camp located on West Pickard Bay headland approximately 100m to the west of the cable landfall.
- 13.7.2.3 Designated and non-designated heritage assets identified are described in this baseline, and are summarised in

13.7.2.4 **Table 13.4.** These heritage assets, including those identified as relevant for the assessment of marine archaeology in relation to mWave project, are located within the local study area are depicted in Figure 13.3.

Table 13.4: Designated and non-designated heritage assets and relevant qualifying interest features within local study area showing proximity to mWave and cable route.

Designated and non-designated heritage assets	Approx closest distance to mWave Project (km)	Relevant qualifying feature
West Pickard Camp (Scheduled Monument) PRN 3099 / NPRN 92623	0.1	Designated heritage asset – prehistoric fortification
Pickard (prehistoric artefacts) PRN 3100	0	Non-designated – prehistoric artefacts
LCG No 15 (wreck) NPRN 273,231	1.5	Protected Place under the Protection of Military Remains Act (1986)
Gun Emplacement, Angle PRN 32765	0.14	Non-designated – military
Weapons Pit, Angle PRN 33438 / NPRN 270745	0.08	Non-designated – military
Gun Emplacement , Angle PRN 33438 / NPRN 270754	0.16	Non-designated – military
Speedwell NPRN 272,900	2.9	Non-designated – wreck
Anchorage, Freshwater Bay NPRN 518,475	1.3	Non-designated – anchorage
Submerged Forest, Freshwater West PRN 11976 / NPRN 524,740	1.6	Non-designated – prehistoric deposits
Sheep Rock NPRN 518,599	3.4	Non-designated – obstruction
Highland Home NPRN 273,100	1.5	Non-designated – wreck
Unnamed Wreck NPRN 240,879	1.7	Non-designated - wreck

13.7.2.5 As set out above (paragraph 13.6.2.1), ‘Step 3’ sets out that sites were included for further consideration if a designated and non designated site directly overlaps with the mWave project’ and/or designated/non designated heritage sites and associated features (including setting) were located within the potential Zone of Impact (ZoI) for impacts associated with the mWave project.

13.7.2.6 Potential ZoI would be areas where known and potential heritage assets could be affected in terms of partial or total loss of significance as a result of direct changes to the asset, change within the setting of the asset, or indirect changes from the proposals (such as sediment disturbance).

13.7.2.7 The assessment of impact of proposed devices on suspended sediment concentrations (chapter 5: Coastal Processes) considered that the very finest material disturbed from installation, operational and decommissioning activities would travel in the order of 50m from mWave deployment site off East Pickard Bay, during an average tide (see chapter 5: Coastal Processes and chapter 15: Other Users).

13.7.2.8 Only heritage assets within sites and/or within the potential ZoI, as depicted in Figure 13.3, will be considered in terms of the impact assessment presented below (Section 13.11). For ease of reference these are listed below in Table 13.5 and have been shaded. Note those not shaded have been included for consideration due to the potential for finds from the wrecks being dispersed over the wider area due to prevailing sea conditions.

Table 13.5: Designated and non-designated heritage assets subject to impact assessment for the mWave project in relation to marine archaeology.

Designated and non-designated heritage assets	Closest distance to mWave Project (km)	Relevant Qualifying Interest Feature
LCG No 15 (wreck) NPRN 273,231	1.5	Protected Place under the Protection of Military Remains Act (1986)
West Pickard Camp (Scheduled Monument) PRN 3099 / NPRN 92623	0.1	Designated heritage asset – prehistoric fortification
Pickard (prehistoric artefacts) PRN 3100	0	Non-designated – prehistoric artefacts
Highland Home NPRN 273,100	1.5	Non-designated – wreck

13.7.2.9 The designated and non-designated heritage assets presented in Table 13.5 contribute to the selection of marine archaeological receptors to be taken forward to the marine archaeology impact assessment as set-out in the following sections.

13.7.3 Local study area, mWave deployment site including cable route

13.7.3.1 As discussed above the mWave deployment site and the cable route fall within the South Pembrokeshire Heritage Coast, and also lies within Marine Character Area 22 – South Pembrokeshire Coastal and Inshore Waters and Seascape Character Area 34 – Freshwater West.

13.7.3.2 A review of marine archaeological data has returned no designated wrecks within the mWave deployment site or the local study area. There is one scheduled monument, the hill fort of West Pickard Bay Camp, located on the coast to the immediate west of the cable route corridor. The hill fort is approximately 100m from the actual cable route which landfalls at East Pickard Bay.

- 13.7.3.3 A Prehistoric submerged forest is mapped at Freshwater West beach (NPRN 524,740), but possibly is present elsewhere, and remains associated with the West Pickard Camp (western side) may survive in the inter-tidal area of West Pickard Bay, possibly also attested by the recorded flint flakes and cores which have been found in this area (PRN 3100). The mWave deployment site and cable route are assessed as having medium potential for archaeological deposits from the Prehistoric period. Should similar archaeological deposits survive within the deployment site and / or cable route, they would be of local to regional importance, on account of their evidential value.
- 13.7.3.4 The Anchorage at Freshwater Bay (NPRN 518475), mapped approximately 1.3km from mWave deployment site, is suggested by an anchor symbol on an historic chart in Sailing Directions dating to 1884, which also identifies Sheep Rock (NPRN 518599), an isolated pinnacle some 750m to the west of Sheep Island in Sailing Directions dating to 1884. Non-designated wrecks of local importance from this period include:
- an unnamed wreck (NPRN 240,879) approximately 1.7km from mWave deployment site, where some of the wreckage was found, and likely to be the Highland Home (NPRN 273100), built in 1886, whose precise location is unconfirmed; and
 - the Speedwell (NPRN 272900), a 99 ton wooden schooner was lost in 1854 when it ran onto Sheep Island, floated off and then sank in deep water, and is mapped approximately 2.6km from mWave deployment site.
- 13.7.3.5 These known wrecks are of local importance, which stems from these wrecks' evidential and historic value, as would comparable wrecks for which there is currently no location or condition data, but which have a low potential to be located with the site or immediate vicinity.
- 13.7.3.6 There are no reported wrecks in the subtidal region along the proposed cable route, however there are a number of wrecks, arbitrarily mapped at SM8814700050, and one within the local study area, but whose exact location and condition are not known. As such it may be in, or in the vicinity of the local study and cable route.
- 13.7.3.7 LCG No. 15 (NPRN 273,231) can be found approximately 1.5km from mWave deployment site. This large flat-bottomed landing craft sunk in 1943, and is reported to lie upside down. This is a Protected Place under the Protection of Military Remains Act 1986.
- 13.7.3.8 The heritage value of archaeological asset to be assessed at within the local study area including the mWave deployment site and the cable route is summarised in Table 13.6 below.
- 13.7.3.9

Table 13.6: The assessed value of non-designated heritage assets subject to impact assessment in the marine archaeology chapter.

Non-designated heritage assets	Archaeological Potential	Heritage Value
mWave local study area and marine communications cable route		
Unnamed Wreck / 'Highland Home'	The site itself has high potential for deposits dated to the post-Medieval period, specifically associated with the wreck mapped on site, believed to be the Highland Home.	Locally important (low evidential and historic value)
Prehistoric deposits	The marine communications cable route and the immediate vicinity, has a medium potential for archaeological deposits dating to the Prehistoric period, associated with the proximal record of a Prehistoric submerged forest, and finds on the intertidal zone in the proximity of West Pickard Camp.	Locally to Regionally important (low to medium evidential value)
Marine archaeological resource - wrecks	The local study area, including mWave site and marine communications cable route have low potential for unknown wrecks dating to the post-Medieval Modern period to be located within the site.	Locally important (low evidential and historic value)

13.7.4 Bathymetric survey

- 13.7.4.1 As identified previously the bathymetric survey provided good data set for a 2km by 600m area to a depth of 15m (Titan 2018). The sonar data shows the seabed in Freshwater West, including the microsite to consist almost entirely of smooth, virtually featureless sands. The only bedforms identified were insignificant sand ripples lying scattered across the site. Very few anthropogenic features were *identified* on the seabed with most associated with small magnetic anomalies in the rock zone and are presumed to be related to fishing activities (crab pots etc). There were a two objects (non magnetic) within the microsite area. A 1.7m long object lying 28 metres to the northeast of the proposed mWave location and a 459m long shallow trench connecting a series of shallow pits (or possibly a series of non-reflective small contacts) running northwest -southeast crossing the microsite and ending in the firing range danger zone. This feature approaches within 153 metres of the proposed mWave location.
- 13.7.4.2 Although the survey was not *intended* to be a UXO survey, 212 magnetic anomalies were encountered in and in the immediate vicinity of the 2km by 600m survey area. Only 12 magnetic anomalies lie within the microsite. The survey concluded that no sonar contacts or magnetic anomalies appear to have any archaeological significance and no substantial wrecks or debris have been identified. The survey also showed an area around the deployment location of mWave, approximately 250m by 90m devoid of any features.

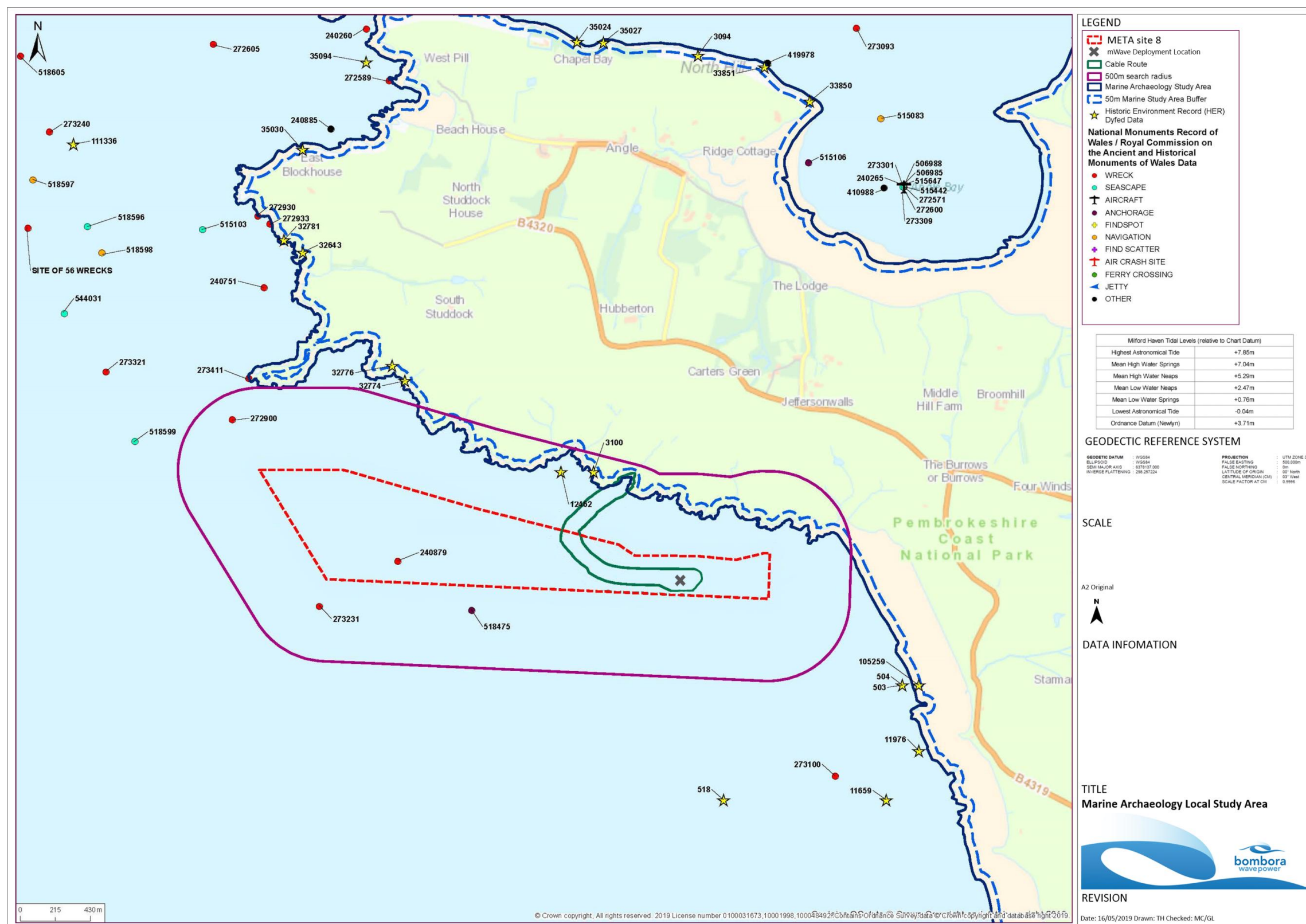


Figure 13.3: Heritage assets identified in the local study area including mWave deployment site and marine communications cable route (to MHWS), plus 500m archaeological search area

13.7.5 Future baseline scenario

- 13.7.5.1 The (Marine Works (EIA) Regulations 2007 (as amended)) requires that “a description of the relevant aspects of the current state of the environment (baseline scenario), and an outline of the likely evolution thereof without implementation of the project, as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge” is included within the Environmental Statement.
- 13.7.5.2 In the event that the mWave project does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.
- 13.7.5.3 All heritage assets mentioned above will continue to deteriorate slowly through natural erosion and coastal processes, without the implementation of the mWave project, or measures to protect them. The rate of deterioration cannot be ascertained from available data, but this is widely considered to be a long-term process.

13.7.6 Data limitations

- 13.7.6.1 There were no known significant limitations for the baseline assessment presented in this chapter, which is deemed to comply with the relevant policy and guidance set out above.
- 13.7.6.2 A hydrographic and geophysical survey has been undertaken of the mWave deployment site and its immediate vicinity (Titan, 2018). The report concluded that there were no sonar contacts or magnetic anomalies which appear to have any archaeological significance and no substantial wrecks or debris were identified at the deployment site. As such, it is considered that the location of likely and known heritage assets has been established within acceptable levels. These data limitations may affect the certainty of the EIA.

13.8 Key parameters for assessment

- 13.8.1.1 A summary of the key parameters of mWave are identified in Table 13.7 below. They have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These parameters have been selected from the details provided in the project description (Chapter 2: Project Description).
- 13.8.1.2 This chapter is informed by assessments presented in the following chapters:
- Chapter 5 “Coastal Processes”;
 - Chapter 14 “Seascape”; and
 - Chapter 15 “Other Users”.

13.8.2 Impacts scoped out of the assessment

- 13.8.2.1 No marine archaeological impacts have been scoped out of assessment.

Table 13.7: Design parameters considered for the assessment of potential impacts on marine archaeology

Potential impact	Design parameter	Justification
Installation and Decommissioning phases		
Disturbance of sediments – buried prehistoric deposits	- No site preparation works are required. - Deployment of mWave gravity based foundation WEC device for 6 - 12 month testing, The device will touch the seabed, gravity foundation maximum penetration 1m;	There is potential for disturbance of sediments due to installation or decommissioning of mWave and the communications cable resulting in a potential effect on near-surface (1m or less) prehistoric deposits and shipwrecks.
Disturbance of archaeological resource – shipwrecks	- Use of 4 rock bags to stabilise the offshore section of cable route has been allowed as a worst case assessment. - Temporary disturbance from pre-installed moorings required for installation, 200m x 200m = 40,000m²	
Sediment deposition on the seabed	The impact of devices on suspended sediment concentrations (SSC) is assessed in Chapter 5: Coastal Processes. That assessment considers that the very finest material disturbed from installation and decommissioning activities would travel in the order of 50m during an average tide.	There is potential for sediment deposition due to installation or decommissioning of the communications cable and marine renewable devices resulting in a potential effect on a variety of heritage assets.
Operational phase		
Disturbance of sediments - buried prehistoric deposits	- Total seabed loss <1900m², comprising: - mWave gravity base with penetration into the sand of 1m and ADCP and SUTU footprint - Scour protection - whilst not anticipated an allowance of 2m area around the edge of mWave and the use of rock bags to stabilise the offshore section of cable route has been allowed as a worst case assessment. - Up to 210 m² of habitat loss from cabling associated with the surface laying of 1,400 m of cable of 0.15 m diameter seaward of mean low water springs (MLWS). - Total intertidal habitat disturbance of up to 6.75 m² associated with the surface laying of 45 m of cable of 0.15 m diameter between MLWS and MHWS. - Temporary moorings from some O&M vessels.	Presence of devices on the seabed and operation and maintenance activities including the deployment of vessel moorings, may affect a variety of heritage assets through the removal or disturbance of archaeological resource.
Disturbance of archaeological resource – shipwrecks		

13.9 Impact assessment methodology

13.9.1 Overview

13.9.1.1 The marine archaeology EIA has followed the methodology set out in Chapter 4: Environmental Impact Assessment Methodology. Specific to the marine archaeology EIA, the following guidance documents have also been considered:

- Technical Advice Note 24: The Historic Environment (TAN24: Welsh Government 2017);
- Conservation Principles for the Sustainable Management of the Historic Environment in Wales (Welsh Assembly Government, published by Cadw in 2011);
- The National Seascape Assessment for Wales (Natural Resources Wales, November 2015), comprises two complementary and linked elements: a marine character assessment; and a visual resource mapping element – only the marine character aspects are considered in this assessment; and
- 'Standard and guidance for historic environment desk-based assessments' (Chartered Institute for Archaeologists, December 2014, revised in December 2017).

13.9.1.2 In addition, the marine archaeology EIA has considered the legislative frameworks which provide protection to the historic environment. Statutory protection for archaeology is principally enshrined in the Ancient Monuments and Archaeological Areas Act (1979) amended by the National Heritage Act (1983) and the National Heritage Act (2002). Nationally important archaeological sites are listed in a Schedule of Monuments and are afforded statutory protection.

13.9.1.3 For other components of the historic environment, the Planning (Listed Buildings and Conservation Areas) Act (1990) and the Town and County Planning Act (1990) provide statutory protection to listed buildings and their settings, and present measures to designate and preserve the character and appearance of Conservation Areas.

13.9.1.4 The Historic Environment (Wales) Act (2016) gives more effective protection to listed buildings and scheduled monuments, improves the sustainable management of the historic environment, and introduces greater transparency and accountability regarding decisions affecting the historic environment.

13.9.1.5 The Marine and Coastal Access Act (2009) provides the legal mechanism to help ensure clean, healthy, safe, productive and biologically diverse oceans and seas by putting in place a new system for improved management and protection of the marine and coastal environment.

13.9.1.6 There are numerous maritime wrecks in the seas around Wales. Although all of them have historic value, six currently have legal protection. These six are known as 'designated wrecks' or 'protected wrecks' and are statutorily protected by the Protection of Wrecks Act (1973). None of these wrecks occur within proximity of the mWave project.

13.9.2 Impact assessment criteria

13.9.2.1 The criteria for determining the significance of effects is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts. This section describes the criteria applied in this chapter to assign values to the sensitivity of receptors and the magnitude of potential impacts. The terms used to define sensitivity and magnitude are based on those which are described in further detail in Chapter 4: Environmental Assessment Methodology.

Magnitude

13.9.2.2 The criteria for defining magnitude in this chapter are outlined in Table 13.8 below.

Table 13.8: Definition of terms relating to the magnitude of an impact.

Magnitude of impact	Definition
Major	Change to most or all key archaeological materials, such that the resource is totally altered. Comprehensive changes to setting (adverse) Large scale or major improvement or resource quality; extensive restoration or enhancement; major improvement of attribute quality (beneficial)
Moderate	Changes to many key archaeological materials, such that the resource is clearly modified. Considerable changes to setting that affect the character of the asset. (adverse) Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (beneficial)
Minor	Changes to key archaeological materials, such that the asset is slightly altered. Slight changes to setting. (adverse) Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (beneficial)
Negligible	Very minor changes to archaeological materials or setting (adverse) Very minor benefit to, or positive addition of one or more characteristics, features or elements (beneficial)
No change	No loss or alteration or characteristics, features or elements; no observable impact in either direction

Sensitivity

13.9.2.3 The criteria for defining sensitivity in this chapter are outlined in Table 13.9 below.

Table 13.9: Definition of terms relating to the sensitivity of the receptor.

Sensitivity	Definition
Very High	• World Heritage Sites (including nominated sites). • Assets of acknowledged international importance. • Assets that can contribute significantly to acknowledged international research objectives.
High	• Scheduled Monuments (including proposed sites). • Undesignated assets of schedulable quality and importance. • Assets that can contribute significantly to acknowledged national research objectives.

Sensitivity	Definition
Medium	• Designated or undesignated assets that contribute to regional research objectives.
Low (or lower)	• Designated and undesignated assets of local importance. • Assets compromised by poor preservation and/or poor survival of contextual associations. • Assets of limited value, but with potential to contribute to local research objectives.
Negligible	• Assets with very little or no surviving archaeological interest.
Unknown	• The importance of the resource has not been ascertained.

Significance

- 13.9.2.4 The significance of the effect upon marine archaeology is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 13.10. Where a range of significance of effect is presented in Table 13.10, the final assessment for each effect is based upon expert judgement.
- 13.9.2.5 For the purposes of this assessment, any effects with a significance level of minor or less have been concluded to be not significant in terms of the EIA Regulations.

Table 13.10: Matrix used for the assessment of the significance of the effect.

		Magnitude of impact				
Sensitivity of receptor		No change	Negligible	Minor	Moderate	Major
	Negligible	Negligible	Negligible	Negligible or minor	Negligible or minor	Minor
	Low	Negligible	Negligible or minor	Negligible or minor	Minor	Minor or moderate
	Medium	Negligible	Negligible or minor	Minor	Moderate	Moderate or major
	High	Negligible	Minor	Minor or moderate	Moderate or major	Major or substantial
	Very high	Negligible	Minor	Moderate or major	Major or substantial	Substantial

13.10 Measures adopted as part of the mWave Project

- 13.10.1.1 As part of the project design process, designed-in measures have been proposed to reduce the potential for impacts on marine archaeology (see Table 13.11). As there is a commitment to implementing these measures, they are considered inherently part of the design of the mWave project and have therefore been considered in the assessment presented in section 13.11 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These measures are considered standard industry practice for this type of development.

Table 13.11: Designed-in measures adopted as part of the mWave project.

Measures adopted as part of the mWave project	Justification
Placed on seabed with minimal gravity foundation Flat sandy seabed. No requirement for seabed preparation in advance of deployment (section 2.5.2).	Localised footprint with minimal disturbance to seabed Minimises disturbance prior to installation.
Gravity foundation. (section 2.5.2).	Simple installation, requires no moorings therefore limited extent of effect.
Cable laid on surface and not trenched (section 2.5.3).	Minimises disturbance during installation and potential for suspended sediments.
The Environmental Management Plan (EMP) will cover both the offshore and onshore elements of the project (Chapter 2: Project Description, Appendix 2.2).	The marine section of EMP will include planning for accidental spills, including measures to reduce the risk of an incident. In addition to this it will include an INNS assessment using NRW-PS Biosecurity Risk Assessment.
The Environmental Monitoring and Mitigation Plan (EMMP) will cover both the offshore and onshore elements of the project (Chapter 2: Project Description, Appendix 2.2).	Linked closely to the EMP, this document will provide details of any requirements identified within this chapter to minimise potential effects on ecology prior to installation, as well as any recommended monitoring.

- 13.10.1.2 In some cases, particularly where potentially significant effects are identified, there may be additional mitigation measures required that are not "built in" to the project design ahead of the assessment. These are discussed in "Further mitigation and residual effect" below.

13.11 Assessment of significance

- 13.11.1.1 The baseline summarised above indicates human activity within a 500m search radius from each site during the Prehistoric, Medieval, post-Medieval and Modern periods.
- 13.11.1.2 The overall significance of heritage assets derives from a combination of the key heritage values identified in the Cadw guidance document *Conservation Principles for the Sustainable Management of the Historic Environment in Wales* (Welsh Assembly Government, published by Cadw in 2011), evidential, historical, aesthetic and communal values.

13.11.2 Installation phase

13.11.2.1 The impacts of the installation of the mWave device have been assessed on marine archaeology. The potential impacts arising from the installation of the mWave project are listed in Table 13.7 **Error! Reference source not found.** A description of the potential effect on marine archaeology receptors resulting from each identified impact is given below.

Removal or disturbance of sediments – buried prehistoric deposits

Magnitude of impact

13.11.2.2 The design of mWave and the nature of the deployment site means that mWave can be placed on the seabed without the need for site preparation (levelling), and its gravity foundation will settle into the sand to a depth of 1m. The deployment of temporary moorings for use over the installation period will minimise disturbance to the seabed. As such there is some potential for disturbance of sediments caused by the installation (and decommissioning) of the mWave device and the marine communications cable at East Pickard Bay, resulting in a potential effect on near surface (up to 1m) deposits.

13.11.2.3 The impact is predicted to be of local spatial extent (see Zol above), short-term duration over the consented period of the project (6-12months), and not reversible. It is predicted that the impact would affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

13.11.2.4 The marine archaeological potential and heritage value is assessed in section 13.7, and is summarised in relation to Prehistoric deposits in Table 13.12 below:

Table 13.12: Buried prehistoric deposits – potential and heritage value

Non-designated heritage assets	Archaeological Potential	Heritage Value
Prehistoric deposits	The mWave site and cable route have medium potential for archaeological deposits dating to the Prehistoric period, associated with the proximal record of a Prehistoric submerged forest, and finds on the intertidal zone in the proximity of West Pickard Camp.	Locally to Regionally important (low to medium evidential value)

13.11.2.5 The bathymetric survey confirmed no evidence of anthropogenic features within the mWave footprint, or immediately surrounding area. The potential Prehistoric deposits are deemed to be of medium vulnerability, and medium value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of the effect

13.11.2.6 The significance of effect takes into consideration the findings of the bathymetric survey, which confirmed no evidence of anthropogenic features within the mWave footprint, or immediately surrounding area and the method of installation of the cable, which will be laid on the seabed minimising its effect. Overall, the sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible to minor adverse significance** which is not significant in EIA terms.

Further mitigation and residual effect

13.11.2.7 No further mitigation is proposed for this impact.

Removal or disturbance of archaeological resource – shipwrecks

Magnitude of impact

13.11.2.8 There will be no site preparation or removal of sediments from site. mWaves gravity foundation will be placed on the seabed and settle into the sand to a depth of 1m. As such there is a small potential for disturbance of archaeological deposits during the installation (and decommissioning) of mWave and the marine communications cable at East Pickard Bay resulting in a potential effect on shipwrecks, should they be present.

13.11.2.9 The bathymetric survey confirmed no evidence of shipwreck features within the mWave footprint, or immediately surrounding area. The cable will be laid on the seabed minimising its effect. The impact is predicted to be of local spatial extent, short duration, intermittent and not reversible. It is predicted that the impact would affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

13.11.2.10 The marine archaeological potential and heritage value is assessed in 13.7, and is summarised in relation to the archaeological resource, including wrecks, in Table 13.13 below:

Table 13.13: Archaeological resource including wrecks – potential and heritage value

Non-designated heritage assets	Archaeological Potential	Heritage Value
Unnamed Wreck / 'Highland Home'	The site itself has high potential for deposits dated to the post-Medieval period, specifically associated with the wreck mapped on site, believed to be the Highland Home.	Locally important (low evidential and historic value)
Marine archaeological resource - wrecks	The site and cable route have low potential for unknown wrecks dating to the post-Medieval Modern period to be located within the site.	Locally important (low evidential and historic value)

13.11.2.11 Both wrecks are distant from the mWave deployment site and cable route, as such the potential marine archaeological resource, including wrecks is deemed to be of low vulnerability, low recoverability and low value. The sensitivity of the receptor is therefore, considered to be low.

Significance of the effect

13.11.2.12 The significance of effect takes into consideration the findings of the bathymetric survey, which confirmed no evidence of shipwrecks within the mWave footprint, or immediately surrounding area and the method of installation of the cable, which will be laid on the seabed minimising its effect. Overall, the sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **negligible significance**.

Further mitigation and residual effect

13.11.2.13 No further mitigation is proposed for this impact.

Sediment deposition on the seabed

Magnitude of impact

13.11.2.14 There is potential for sediment deposition during the installation (and decommissioning) of the mWave device and the marine communications cable at East Pickard Bay resulting in a potential effect on a variety of heritage assets.

13.11.2.15 The impact of the mWave device and marine communications cable installation on suspended sediment concentrations (SSC) is assessed in Chapter 5: Coastal Processes. That assessment considers that there would be negligible impact due to the method of installation proposed (no site levelling and placement of device and cable on seabed).

13.11.2.16 The impact is therefore predicted to be of local spatial extent, intermittent (short-term installation and decommissioning activities) and reversible. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

13.11.2.17 The potential for Prehistoric deposits at East Pickard Bay is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of this receptor is therefore, considered to be medium (see above).

13.11.2.18 The potential marine archaeological resource, including wrecks, is deemed to be of low vulnerability, low recoverability and low value. The sensitivity of the receptor is therefore, considered to be low (see above).

13.11.2.19 Other heritage assets within the Zol of each site are listed in Table 13.14 and considered here.

Table 13.14: Marine archaeological deposits – potential and heritage value

Non-designated heritage assets	Archaeological Potential	Heritage Value
Unnamed Wreck / 'Highland Home'	The site itself has high potential for deposits dated to the post-Medieval period, specifically associated with the wreck mapped on site, believed to be the Highland Home.	Locally important (low evidential and historic value)
Prehistoric deposits	The site and cable route have medium potential for archaeological deposits dating to the Prehistoric period, associated with the proximal record of a Prehistoric submerged forest, and finds on the intertidal zone in the proximity of West Pickard Camp.	Locally to Regionally important (low to medium evidential value)
Marine archaeological resource - wrecks	The site and cable route have low potential for unknown wrecks dating to the post-Medieval Modern period to be located within the site.	Locally important (low evidential and historic value)

13.11.2.20 The potential marine archaeological resource is deemed to be of low vulnerability, low recoverability and low to medium value. The sensitivity of the receptor is therefore, considered to be low to medium.

Significance of the effect

13.11.2.21 Overall, the sensitivity of the above receptor is considered to be low to medium and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible to minor adverse significance**.

Further mitigation and residual effect

13.11.2.22 No further mitigation is proposed for this impact.

Future monitoring

13.11.2.23 Note, no marine archaeology monitoring to test the predictions made within the installation phase impact assessment is considered necessary, however, the LCG No. 15 (NPRN 273,231) is a Protected Place under the Protection of Military Remains Act (1986). This Act makes it an offence to interfere with the wreckage of any designated vessel without a licence. Whilst the mWave installation works are 1.5km from the wreck and therefore sufficiently distant, should works be required closer to the wreck appropriate consultation should be made with regards to work in the vicinity to establish the radius of the protected area. It is also worthy of note that this Protected Place is located within Castlemartin's MoD firing range, which also restricts types of activity within this area.

13.11.3 Operational and maintenance phase

Removal or disturbance of sediments - buried prehistoric deposits

Magnitude of impact

- 13.11.3.1 Operation and maintenance activities, including the deployment of vessel moorings (see Table 13.7) may affect a variety of heritage assets through the removal or disturbance of sediments.
- 13.11.3.2 The bathymetric survey confirmed no evidence of anthropogenic features within the mWave footprint, or immediately surrounding area. The impact is predicted to be of local spatial extent, short duration, intermittent and not reversible. It is predicted that the impact would affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

- 13.11.3.3 The marine archaeological potential and heritage value is assessed in section 13.7, and is summarised in relation to Prehistoric deposits in Table 13.15 below

Table 13.15: Buried prehistoric deposits – potential and heritage value

Non-designated heritage assets	Archaeological Potential	Heritage Value
Prehistoric deposits	The site and cable route have medium potential for archaeological deposits dating to the Prehistoric period, associated with the proximal record of a Prehistoric submerged forest, and finds on the intertidal zone in the proximity of West Pickard Camp.	Locally to Regionally important (low to medium evidential value)

- 13.11.3.4 The potential Prehistoric deposits are deemed to be of medium vulnerability, and medium value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of the effect

- 13.11.3.5 The significance of effect takes into consideration the findings of the bathymetric survey, which confirmed no evidence of anthropogenic features within the mWave footprint, or immediately surrounding area and the method of installation of the cable, which will be laid on the seabed minimising its effect. Overall, the sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **negligible to minor adverse significance**, which is not significant in EIA terms.

Further mitigation and residual effect

- 13.11.3.6 No further mitigation is proposed for this impact.

Removal or disturbance of archaeological resource – shipwrecks

Magnitude of impact

- 13.11.3.7 Maintenance activities including the deployment of vessel moorings, may affect a variety of heritage assets resulting in a potential effect on shipwrecks, should they be present within the area.
- 13.11.3.8 The bathymetric survey confirmed no evidence of anthropogenic features within the mWave footprint, or immediately surrounding area. The impact is predicted to be of local spatial extent, short duration, intermittent and no reversibility. It is predicted that the impact would affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

- 13.11.3.9 The marine archaeological potential and heritage value is assessed in 13.7, and is summarised in relation to the archaeological resource, including wrecks, in Table 13.16 below.

Table 13.16: Archaeological resource including wrecks – potential and heritage value

Non-designated heritage assets	Archaeological Potential	Heritage Value
Unnamed Wreck / 'Highland Home'	The site itself has high potential for deposits dated to the post-Medieval period, specifically associated with the wreck mapped on site, believed to be the Highland Home.	Locally important (low evidential and historic value)
Marine archaeological resource - wrecks	The site and cable route have low potential for unknown wrecks dating to the post-Medieval Modern period to be located within the site.	Locally important (low evidential and historic value)

- 13.11.3.10 The potential wrecks are deemed to be of low vulnerability, low recoverability and low value. The sensitivity of the receptor is therefore, considered to be low.

Significance of the effect

- 13.11.3.11 The significance of effect takes into consideration the findings of the bathymetric survey, which confirmed no evidence of shipwrecks within the mWave footprint, or immediately surrounding area and the method of installation of the cable, which will be laid on the seabed minimising its effect. The overall sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**.

Further mitigation and residual effect

- 13.11.3.12 No further mitigation is proposed for this impact.

Future monitoring

- 13.11.3.13 No marine archaeology monitoring to test the predictions made within the operational and maintenance phase impact assessment is considered necessary, however, the LCG No. 15 (NPRN 273,231), 1.5km to the south of the site, is a Protected Place under the Protection of Military Remains Act (1986). This Act makes it an offence to interfere with the wreckage of any designated vessel without a licence. Whilst the mWave installation works are 1.5km from the wreck and therefore sufficiently distant, should works be required closer to the wreck appropriate consultation should be made to establish the radius of the protected area.

13.11.4 Decommissioning phase

- 13.11.4.1 The impacts of the decommissioning of the mWave project have been assessed on marine archaeology. The environmental effects arising from the decommissioning of the mWave project are listed in Table 13.7. A conclusion of significance of effect for the deployment of mWave at East Pickard Bay is provided below.
- 13.11.4.2 A description of the potential effect on marine archaeology receptors resulting from each identified impact is given below.

Removal or disturbance of sediments – buried prehistoric deposits

- 13.11.4.3 The effects of decommissioning activities are expected to be the same or similar to the effects from the installation. The significance of effect is therefore **negligible to minor significance** (see paragraph 13.11.2.6).

Removal or disturbance of archaeological resource – shipwrecks

- 13.11.4.4 The effects of decommissioning activities are expected to be the same or similar to the effects from the installation. The effect will, therefore, be of **negligible significance** (see paragraph 13.11.2.12).

Sediment deposition on the seabed

- 13.11.4.5 The effects of decommissioning activities are expected to be the same or similar to the effects from the installation. The effect will, therefore, be of **negligible to minor adverse significance** (see paragraph 13.11.2.21).

13.12 Cumulative Impact Assessment

13.12.1 Methodology

- 13.12.1.1 The Cumulative Impact Assessment (CIA) takes into account the impact associated with the mWave project together with other projects and plans. The projects and plans selected as relevant to the CIA presented within this chapter are based upon the results of a screening exercise and are presented in Table 13.17. Each project has been considered on a case by case basis for scoping in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.
- 13.12.1.2 In undertaking the CIA for the mWave project, it is important to bear in mind that other projects and plans under consideration will have differing potential for proceeding to an operational stage and hence a differing potential to ultimately contribute to a cumulative impact alongside the mWave project. For example, relevant projects and plans that are already under construction are likely to contribute to cumulative impact with the mWave project (providing effect or spatial pathways exist), whereas projects and plans not yet approved or not yet submitted are less certain to contribute to such an impact, due to the short duration of the mWave project (18 months).
- 13.12.1.3 Table 13.17 lists the projects considered within the marine archaeology CIA.

Table 13.17: Projects considered within the marine archaeology CIA

Project phase	Developer Reference	Approx. distance to mWave (km)	Spatial/ temporal overlap with the mWave project	Details	Date Construction	Further Consideration required?	Justification
Dredging sites							
Installation/ Operation and Maintenance	Neyland Yacht Haven Ltd. - DML1743	11.5	No spatial overlap. Potential for temporal overlap.	Dredge and disposal from Neyland Marina - annual volume 5500 m³.	13/12/2017-12/12/2020	No	Dredging impact forms part of baseline and mWave project has no dredging or disposal associated with it. Distant from mWave and therefore highly unlikely to have any impact overlap. No further consideration.
Installation/ Operation and Maintenance	Milford Haven Port Authority - DML1646	4.5	No spatial overlap. Potential for temporal overlap.	Maintenance dredging throughout the Milford Haven. Annual volume 362500 m³.	09/03/2017-08/03/2022	No	Dredging impact forms part of baseline and mWave project has no dredging or disposal associated with it. Distant from mWave project and therefore highly unlikely to have any impact overlap. No further consideration.
Dredge disposal sites							
Installation/ Operation and Maintenance	Neyland dredge disposal site - LU190	11.5	No spatial overlap. Potential for temporal overlap	Location: South of Neyland within the central channel of the Milford Haven, 0.22 nm diameter x 5 m depth Status: Open	Not applicable	No	Disposal impact forms part of baseline and mWave project has no dredging or disposal associated with it. Distant from mWave project and therefore highly unlikely to have any impact overlap. No further consideration.
Installation/ Operation and Maintenance	Milford Haven dredge disposal site - LU170	5	No spatial overlap. No temporal overlap as site is closed.	Location: South of St Ann's Head at the mouth of the Milford Haven estuary, unknown diameter x 30 m depth. Status: Closed	Not applicable	No	Dredge disposal site is not in use therefore no further consideration required.
Installation/ Operation and Maintenance	St Ann's Head dredge disposal site - LU180	5	No spatial overlap. No temporal overlap as site is closed	Location: Within the Milford Haven dredge disposal site, unknown diameter x 30 m depth. Status: Closed	Not applicable	No	Dredge disposal site is not in use therefore no further consideration required.
Installation/ Operation and Maintenance	Milford Haven Two dredge disposal site - LU169	16	No spatial overlap No temporal overlap.	Location: To the south of Milford Haven dredge disposal grounds, unknown diameter x 50 m depth. Status: Open		No	Dredge disposal site is located approximately 16 km from the mWave project. Disposal impact forms part of baseline and mWave project has no dredging or disposal associated with it. It is therefore highly unlikely to have any impact overlap. No further consideration.
Installation/ Operation and Maintenance	Milford Haven Three dredge disposal site - LU169	37	No spatial overlap No temporal overlap.	Location: To the west of Milford Haven dredge disposal grounds, 1 nm diameter x unknown depth. Status: Open		No	Dredge disposal site is located at its closest 37 km from the mWave project, Disposal impact forms part of baseline and mWave project has no dredging or disposal associated with it. Project is highly unlikely to have any impact overlap. No further consideration.
Research							
Installation	Greenlink Interconnector Ltd. - RML1827	0	Potential spatial overlap Temporal overlap	Ground investigations		Yes	Research operations are likely to have vessels present, with equipment for undertaking ground truthing surveys therefore this project cannot be excluded from further consideration in the CIA.
Installation	University College of Swansea - DEML1861	7	Location is assumed to be by the Pembroke Power station. No spatial overlap. Temporal overlap.	Pembroke Power bubble barrier experiment Investigation into the effectiveness of bubble curtains in sediment management	07-2018 - no end date given Band 2 licence issued 12/12/2018 - three-year study	No	Distant from mWave project and therefore highly unlikely to have any impact overlap. No further consideration.
Installation	University College of Swansea - DEML1845	1.5	Potential spatial overlap Temporal overlap	Deposition and subsequent removal of marker buoys with environmental monitoring and mid-water settlement plates.	30/08/2018-29/08/2019	No	Vessels and equipment will be required for the placement of marker buoys. Whilst the ML is currently valid, it is unlikely to have temporal with mWave activities, as ML finishes in August 2019. No further consideration.
Installation/ Operation and Maintenance	Neyland Yacht Haven Ltd - CML1658	11.5	No spatial overlap.	Pile replacement in Neyland Marina.	21/11/2016-20/11/2019	No	Pile replacement is currently ongoing until 2019, which does not overlap with the installation and operational

Project phase	Developer Reference	Approx. distance to mWave (km)	Spatial/ temporal overlap with the mWave project	Details	Date of Construction	Further Consideration required?	Justification
			No temporal overlap.				phases of mWave. Given the distance from mWave project it is therefore highly unlikely to have any impact overlap. No further consideration
Installation/ Operation and Maintenance	Mixed use developments - Local Planning Authority Reference: 14/0158/PA	10	No spatial overlap. Temporal overlap remains unknown.	Undetermined planning application. Demolition of several existing buildings and the mixed-use redevelopment of Milford Waterfront comprising up to 26,266 m ² of commercial, hotel, leisure, retail and fishery related floorspace. Up to 190 residential properties, up to 70 additional marina berths, replacement boat yards, landscaping, public realm enhancements, access and ancillary works. A decision on this application is yet to be made by the local planning authority.	EIA screening decision was returned on the 30/04/2018 - no further information has been provided	No	Given the distance from mWave project it is therefore highly unlikely to have any impact overlap. No further consideration.
Installation/ Operation and Maintenance/ Decommissioning	Greenlink Interconnector Ltd. - Government reference: qA1296053	0	Spatial overlap at edge of deployment area. Temporal overlap	The Project is a 500MW subsea electricity interconnector linking the power markets in Ireland and Great Britain and is planned for commissioning in 2023. As an EU Project of Common Interest, it is one of Europe's most important energy infrastructure projects. The interconnector is planned to make Landfall at Fresh Water West beach	07/2018 - ongoing	Yes	Given potential for temporal and spatial overlap with mWave this project cannot be excluded from further consideration in the CIA.
Installation/ Operation and Maintenance/ Decommissioning	Valereo - Welsh Government reference: qA1312073		No overlap with the mWave project. Onshore is remote from mWave control station site.	Development of a cogeneration facility to supplement electrical power and steam demands of the refinery all within the refinery boundaries on land.	07/12/2017 - Nationally significant project (ongoing)	No	Project is assumed to have no marine elements to the project. Onshore is remote from mWave control station site (inner face of Haven), therefore there will be no impact overlap. No further consideration.
Installation/ Operation and Maintenance	EGNEDOL Wales Ltd	N/A	Potential temporal overlap	EGNEDOL propose to create an environmentally sustainable centre of excellence in Milford Haven, at the Waterston and Blackbridge sites. The proposal includes providing business units and refurbishing a jetty to serve as a primary supply link to the EGNEDOL electricity generation plan, and for export of products. The land-based green energy scheme may generate up to 350 MW.	Not available	No	Planning permission for the EGNEDOL project was refused on 19/10/2018, therefore it is considered highly unlikely that this project will overlap temporally with the mWave project. No further consideration.
Ministry of Defence sites							
	Ministry of Defence	0.1	Temporal overlap	The Castlemartin Range is located immediately south of the entrance to the Waterway and extends for up to 12 NM from the coast between Little Furznip (at the southern extent of Freshwater West) and St Govan's Head (Milford Haven Port Authority 2019). The southern boundary of the East Pickard Bay (Site 8) site is located adjacent to the northern boundary of the Castlemartin Military Practice Area D113A. The range at Castlemartin supports the training of military personnel (Army) in the firing of a range of munitions at land based targets. The seaward danger area provides a safety zone for overfire and shrapnel which may result from the striking of targets (RPS, 2010). The Castlemartin Range is used every day of the week and on some weekends (RPS, 2010).	Not applicable	Yes	There is a high level of uncertainty as to timing of MOD activities at the MOD site, however on-going activity is likely therefore there is the potential for cumulative impacts with the mWave project.
Aquaculture projects							
Installation/ Operation and Maintenance	Tethys Oysters	3	Temporal overlap	The oyster farm is located on the eastern side of Angle Bay, whereby oysters are grown in baskets on metal supports. The farm will be serviced from the shore by foot	Oct 2017 – Oct 2020 (possible renewal of licence)	No	Whilst there is potential for temporal overlap with the mWave project, it is distant and therefore highly unlikely to have any impact overlap. No further consideration.

Project phase	Developer Reference	Approx. distance to mWave (km)	Spatial/ temporal overlap with the mWave project	Details	Date of Construction	Further Consideration required?	Justification
Installation/ Operation and Maintenance	Pembrokeshire Scallops	6.5	Temporal overlap	The scallop farm is located within Castlebeach Bay, whereby a system of weighted ropes will be deployed for growing scallops and mix species of native algae. The farm will be serviced by vessels and divers	Jan 2019 – Q4 2020 (possible renewal of licence)	no	Whilst there is potential for temporal overlap with the mWave project, it is distant and therefore highly unlikely to have any impact overlap. No further consideration.
Pembroke Dock Marine Projects							
Installation/ Operation and Maintenance	Milford Haven Port Authority - SC1810: Pembroke Dock Infrastructure	10	No spatial overlap. Potential for temporal overlap	Pembroke Dock redevelopment. Scoping Report submitted. The intention of the Project is to create a flexible and efficient port-related office, industrial, warehousing and distribution, and ancillary operations infrastructure. This will involve the redevelopment of its existing space to incorporate increased deep-water access, internal and external heavy fabrication areas, construction of MEECE and Education/Skills Facility and the construction of a heavy lift facility.	Q3 2019 – Q3 2023	No	Port activity as a result of Pembroke Dock Port operations is distant and therefore highly unlikely to have any impact overlap. No further consideration.
Installation/ Operation and Maintenance	META Project, Site 8	0	Spatial overlap Temporal overlap will occur throughout the duration of the mWave project	The META project will allow the deployment and testing of marine renewable devices in the waters off East Pickard Bay. The maximum scenario is for up to two devices at Site 8. An assessment of the maximum META project design has been undertaken in the ES supporting the consents. An assessment of the maximum META project design has been undertaken in the ES supporting the consents.	In consenting	Yes	Given potential for temporal and spatial overlap with mWave this project cannot be excluded from further consideration in the CIA
Installation/ Operation and Maintenance/Decommissioning	Marine Energy Wales - DEML1875	9.4	No spatial overlap Potential for temporal overlap	Marine Energy Test Area - Phase 1 Band 2 application submitted. The Project aims to create pre-consented test areas within the Pembroke Dock area. The test areas will have licensable activities to suit testing of initial stage marine renewable devices. These include testing of non-operating components and subassemblies. No full-scale testing is to be support within the test areas.	21/04/2019-21/04/2029	No	Project is distant and therefore highly unlikely to have any impact overlap. No further consideration.
Installation/ Operation and Maintenance/Decommissioning	Wave Hub Ltd. - SC1082	20	No spatial overlap No temporal overlap	Demonstration zone Scoping Report submitted The Project entails the development of 90 km2 of seabed with water depths of approximately 50 metres and a wave resource of approximately 19 kW/m; to support the demonstration of wave arrays with a generating capacity of up to 30MW for each project. Consent for this Project could be achieved in 2022, infrastructure could be built by 2024 and the first technology could be installed in 2025.	2024	No	No temporal overlap with the mWave project. No further consideration.

13.12.2 Cumulative Impact Assessment

- 13.12.2.1 A description of the significance of cumulative effects upon marine archaeology receptors arising from each identified impact is given below.
- 13.12.2.2 The only consented schemes with the potential to have a cumulative impact on the heritage assets identified in the above assessment is the Greenlink Interconnector Ltd, MOD firing range and META Site 8, as demonstrated in Table 13.17: Projects considered within the marine archaeology CIA
- 13.12.2.3 , and as set out below.

Removal or disturbance of sediments – buried prehistoric deposits

- 13.12.2.4 There is potential for cumulative removal or disturbance of sediments as a result of the mWave project, the META Site 8 project, MOD firing activity and the Greenlink Interconnector site surveys and marine communications cable installation, resulting in a potential effect on near-surface and deeply buried prehistoric deposits.

Magnitude of impact

- 13.12.2.5 Sediment disturbance associated with the above projects are likely to be of local spatial extent, long-term duration over the consented period of the project, but intermittent (short-term installation activities) and not reversible. It is predicted that the impact would affect the potential receptors directly. The cumulative magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

- 13.12.2.6 The potential Prehistoric deposits off East Pickard Bay are deemed to be of medium vulnerability, and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

- 13.12.2.7 The bathymetric survey confirmed no evidence of anthropogenic features within the mWave footprint, or immediately surrounding area. Overall, the sensitivity of the receptor is considered to be medium and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance** which is not significant in EIA terms.

Further mitigation and residual effect

- 13.12.2.8 Whilst bathymetric survey has confirmed no anthropogenic features within the mWave site, should the archaeological review of data for the other projects confirm the presence of Prehistoric archaeological deposits in the areas affected by those projects, but they are avoided, the CIA would be reduced to **negligible** significance. In addition, it is possible that these deposits are not present, or if present, not significant, and should this be confirmed the stated residual effect would also be re-assessed as **negligible**.

Removal or disturbance of archaeological resource – shipwrecks

- 13.12.2.9 There is potential for sediment deposition during the installation (and decommissioning) of the various projects at East Pickard Bay resulting in a potential effect on known and potential shipwrecks.

Magnitude of impact

- 13.12.2.10 Removal or disturbance of archaeological resource - shipwrecks is predicted to be of local spatial extent, long-term duration, but intermittent (short-term installation and decommissioning activities) and reversible for both the mWave device, the META Site 8 project, and the Greenlink Interconnector. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

- 13.12.2.11 The potential marine archaeological resource, including wrecks is deemed to be of low vulnerability, low recoverability and low value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

- 13.12.2.12 The bathymetric survey confirmed no evidence of shipwrecks within the mWave footprint, or immediately surrounding area. Overall, the sensitivity of the receptor is considered to be low and the magnitude of the impact is deemed to be minor. The effect will, therefore, be of **minor adverse significance**.

Further mitigation and residual effect

- 13.12.2.13 Archaeological recording of wrecks is a mostly non-destructive process and in principle, allows preservation *in situ* of remains. Should the review of data for the other projects confirm the presence of wrecks, the effect from the proposed development could be reduced to **negligible** if these assets are avoided through design.

13.12.2.14 It is also possible, that these deposits are not present, or if present, not significant, and should this be confirmed through review of data, the stated residual effect would also be reduced to **negligible**. If wrecks are present in the other project sites, but they cannot be avoided through design, the residual effect will remain **minor adverse significance**, which is not significant in EIA terms.

Sediment deposition on the seabed

13.12.2.15 There is limited potential for sediment deposition during the installation (and decommissioning) of mWave and the marine communications cable through its installation method, namely placement on the seabed. Notwithstanding this there is a potential for sediment disturbance from ground investigation and marine communications cable installation works associated with GreenLink Interconnector, MOD activity and marine renewable devices at the META project at Site 8 resulting in a potential cumulative impact on potential heritage assets.

13.12.2.16 The impact of installation works on suspended sediment concentrations (SSC) is assessed in Chapter 5: Coastal Processes. That assessment provided an illustration of an intrusive method of works to give an indication of sediment transport in the area. The assessment showed that the material disturbed would travel in the order of 50-600m from the site during an average tide.

Magnitude of impact

13.12.2.17 Cumulative sediment deposition on the seabed associated with the mWave project, the META project and the Greenlink Interconnector are predicted to be of local spatial extent, long-term duration, but intermittent (short-term installation and decommissioning activities) and reversible. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

13.12.2.18 The potential for Prehistoric deposits on East Pickard Bay is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of this receptor is therefore, considered to be **medium**.

13.12.2.19 The potential marine archaeological resource, including wrecks, on East Pickard Bay is deemed to be of low vulnerability, low recoverability and low value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

13.12.2.20 Overall, the sensitivity of the above receptors is considered to be low to medium and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible to minor adverse significance**.

Further mitigation and residual effect

13.12.2.21 No further mitigation is proposed for this non-significant effect.

Future monitoring

13.12.2.22 No marine archaeology monitoring to test the predictions made within the CIA is considered necessary, however the LCG No. 15 (NPRN 273,231), 180 m to the south of Site 8 META project and 1.5km from mWave, is a Protected Place under the Protection of Military Remains Act (1986). This Act makes it an offence to interfere with the wreckage of any designated vessel without a licence, and appropriate consultation should be made with regards to work in the vicinity to establish the radius of the protected area.

13.13 Transboundary effects

13.13.1.1 A screening of transboundary impacts has been carried out and has identified that there was no potential for significant transboundary effects with regard to marine archaeology from the mWave project upon the interests of other EEA States.

13.14 Inter-related effects

13.14.1.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of the proposal on the same receptor. These are considered to be:

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the project (construction/installation, operational and maintenance, and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three key project stages (e.g. subsea noise effects, operational turbines, vessels and decommissioning); and
- Receptor led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on [chapter topic], such as [direct habitat loss or disturbance, sediment plumes, scour, jack-up vessel use etc.], may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects might be short term, temporary or transient effects, or incorporate longer term effects.

13.14.1.2 No inter-related effects arising from the mWave project on marine archaeology have been identified.

13.15 Conclusion and summary

- 13.15.1.1 The potential impact of the installation, operation and maintenance and decommissioning of the mWave project including communication cable has been assessed for the deployment site off East Pickard Bay and the cable landfall at East Pickard Bay.
- 13.15.1.2 Due to the installation methods proposed, there is limited potential for removal or disturbance of sediments caused by the installation (and decommissioning) of the mWave device and the marine communications cable. This would result in a negligible potential direct effect on near-surface Prehistoric deposits and shipwrecks. The bathymetric survey confirmed no evidence of anthropogenic features within the mWave footprint, or immediately surrounding area.
- 13.15.1.3 There is also some limited potential for sediment deposition during the installation (and decommissioning) of the mWave device and the marine communications cable resulting in a potential temporary effect on a variety of heritage assets.
- 13.15.1.4 The design characteristics for mWave are set out in Table 13.7 above. The impact of devices on suspended sediment concentrations (SSC) is assessed in Chapter 5: Coastal Processes as negligible due to the fact that there is no site preparation works, and the device and cable will be laid on the seabed. Deployment of mWave is temporary for a maximum of 18 months and any effects would be transitory and wave climate and sediment transport would return to previous levels.
- 13.15.1.5 In conclusion due to the short deployment time for mWave and the communication cable, the impacts of the mWave project is assessed as negligible to minor adverse significance, which is not significant in EIA terms.
- 13.15.1.6 Table 13.18 provides a summary of the potential impacts, mitigation measures and residual effects during the installation, operation and maintenance, and decommissioning phases of the mWave project.

Table 13.18: Summary of potential environment effects, mitigation and monitoring for the mWave project.

Description of impact	Measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Residual effect	Proposed monitoring
Installation Phase							
Removal or disturbance of sediments –buried prehistoric deposits	Installation works will be undertaken in accordance with the EMP	Negligible	Medium	Negligible to Minor adverse (not significant in EIA terms)	None		None
Removal or disturbance of archaeological resource – shipwrecks	Installation works will be undertaken in accordance with the EMP	Negligible	Low	Negligible (not significant in EIA terms)	None		None
Sediment deposition on the seabed	Installation works will be undertaken in accordance with the EMP	Negligible	Low-Medium	Negligible to Minor adverse (not significant in EIA terms)	None		None
Operational Phase							
Removal or disturbance of sediments - buried prehistoric deposits		Negligible	Medium	Negligible to Minor adverse (not significant in EIA terms)	None		None
Removal or disturbance of archaeological resource – shipwrecks		Negligible	Low	Negligible (not significant in EIA terms)	None		None
Decommissioning Phase							
Removal or disturbance of sediments –buried prehistoric deposits	Decommissioning works will be undertaken in accordance with the EMP)	Minor	Medium	Minor adverse (not significant in EIA terms)	None		None
Removal or disturbance of archaeological resource – shipwrecks	Decommissioning works will be undertaken in accordance with the EMP)	Minor	Low	Minor adverse (not significant in EIA terms)	None		None
Sediment deposition on the seabed	Decommissioning works will be undertaken in accordance with the EMP)	Negligible	Low-Medium	Negligible to Minor adverse (not significant in EIA terms)	None		None

13.16 References

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