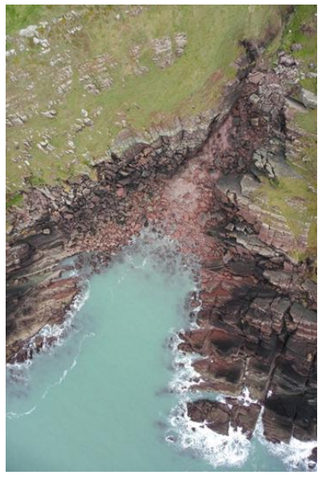
mWave Marine Energy Device and Onshore Infrastructure

WATER FRAMEWORK DIRECTIVE COMPLIANCE ASSESSMENT



June 2019

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Glossary

Term	Definition
Above Ordnance Datum	Height of land above Mean Sea Level Newlyn.
Below Chart Datum	Depth of land below Mean Sea Level Newlyn.
Decommissioning phase	The period over which retrieval and removal of mWave infrastructure will occur.
Draught	The vertical distance between the waterline and the bottom of the hull of a marine vessel.
Effect	Change that is caused by an action; for example, land clearing (action) during construction which results in habitat loss (effect).
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Directive and EIA Regulations, including the publication of an Environmental Statement.
Environmental Management Plan	Document that sets out the environmental framework within which the project will be delivered including covering consents and legislative requirements. The plan will include sub-plans where these are required e.g. Marine Pollution Contingency Plan.
Environmental Mitigation and Monitoring Plan	A document detailing the mitigation and monitoring proposed to be undertaken.
META Project	The META project, located in Pembrokeshire, consists of eight test sites where marine energy testing activities will be permitted. 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.
MHWS	The height of mean high water springs is the average throughout the year (when the average maximum declination of the moon is 23.5°) of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest.
MLWS	The height of the mean low water springs is the average height obtained by the two successive low waters during the same period as mean high water springs.
Operation and maintenance phase	The period over which operational and maintenance activities to support mWave marine energy testing.
Receptor	A component of the natural or man-made environment that is affected by an impact, including people.
Chain ballast	Weight required in the form of chain which will be placed in the ballast trays of the device. as part of waves seabed attachment method.
Seabed clearance	Clearance of areas of seabed for some devices to allow safe attachment to/placement on the seabed.
Subsea Umbilical Termination Unit	Underwater connection box approx 1.5m^2. mWave umbilical from device, communication cable coming from East Pickard Bay landfall and ADCP will connect into unit.

Acronyms

Acronym	Description
AOD	Above Ordnance Datum
bcd	below chart datum
EMMP	Environmental Mitigation and Monitoring Plan
EMP	Environmental Management Plan
ES	Environmental Statement
HRA	Habitats Regulation Assessment
INNS	Invasive Non-Native Species
META	Marine Energy Test Areas
MEW	Marine Energy Wales
MHPA	Milford Haven Port Authority
MHWS	Mean High Water Springs
ML	Marine Licence
MLWS	Mean Low Water Springs
NRW	Natural Resources Wales
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SUTU	Subsea Umbilical Termination Unit
WEC	Wave Energy Converter
WFD	Water Framework Directive

Units

Unit	Description
Ha	Hectare
km	Kilometre
m	Metre
mm	Millimetre
month	Calendar month
m^2	Metres squared
MW	Megawatt (electrical power)
m/s	Metres per second
NM	Nautical Mile

EXECUTIVE SUMMARY

The EU Directive 2000/60/EC, referred to as the Water Framework Directive (WFD), established a framework for community action in the field of water policy. The WFD is transposed into United Kingdom (UK) law by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. Natural Resources Wales (NRW) is the responsible authority in Wales for delivering the aim of the WFD, which is for all waterbodies to achieve "good status".

Bombora WavePower Ltd (Bombora / the Applicant) have prepared an Environmental Statement in support of their environmental permitting requirements for testing the mWave marine energy device (the project). This report presents the assessment carried out in accordance with the WFD.

Bombora aim to test their full scale wave energy converter, mWave, for a period of 6 - 12 months offshore of the Angle Peninsular, with the long term aim of producing environmentally friendly, consistent, cost competitive energy, for commercial scale needs in national electricity grids.

WFD is primarily concerned with non-temporary deterioration. If the water body:

- is only impacted for a short period of time;
- recovers within a short period of time;
- recovers without the need for any restoration measures,

this will not constitute deterioration of status under WFD.

The mWave project will be installed for a maximum of 18 months. The outcome of the Environmental Impact Assessment (EIA) reported within the Environmental Statement identified that any potential effects on hydromorphology, water quality and benthic habitats will recover without the need for any restorative measures within a short period of time following decommissioning. However as the device is the first full scale test of the Wave Energy Converter (WEC), located within a designated site and a coastal waterbody of 'good' status, a WFD Compliance Assessment has been undertaken.

The project has the potential to impact one WFD waterbody either directly or indirectly; namely; the coastal waterbody Pembrokeshire South which currently is of 'good' overall status.

A WFD Compliance Assessment was undertaken in accordance with OGN 72 document '*Guidance for assessing activities and projects for compliance with the Water Framework Directive'* (NRW 2018). The guidance document identifies that a WFD assessment can comprise of up to three stages, screening, scoping and impact assessment.

Screening identified that proposed project activities would require scoping against WFD. A scoping exercise was then undertaken by assessing project activities for the installation, operation and decommissioning phases against criteria associated with relevant WFD quality elements in accordance with OGN 072 guidance note namely, hydromorphology, water quality, benthic habitats, WFD protected areas and invasive non-native species.

Following scoping a detailed assessment was undertaken for potential effects on invasive non-native species for installation, operation and decommissioning and for potential effects on hydromorphology for operation.

The outcome of the scoping and detailed assessment concluded that the project will not cause deterioration in the status of the Pembrokeshire South coastal waterbody or any other waterbody within the Western Wales RBMP (NRW, 2015). Nor will the project compromise the future achievement or maintenance of "Good" chemical or ecological status/potential.

A cumulative effects assessment was undertaken and this concluded that the project, together with other plans and projects will not cause deterioration in the status of the Pembrokeshire South coastal waterbody or any other waterbody within the Western Wales RBMP (NRW, 2015). Nor will the project, together with other plans or projects compromise the future achievement or maintenance of "Good" chemical or ecological status/potential.

1 INTRODUCTION

1.1 Introduction

1.1.1.1 This Water Framework Directive (WFD) Compliance Assessment has been prepared as part of a suite of documents in support of a planning application and marine licence application for the mWave project. The Water Framework Directive (WFD) (Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy) was implemented in the UK by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, as amended in 2017.

1.1.1.2 The fundamental principle of the WFD is to protect water resources and to promote sustainable water use. The WFD was put in place to:

- Enhance the status, and prevent further deterioration of, aquatic ecosystems and associated wetlands which depend on the aquatic ecosystems;
- Promote the sustainable use of water;
- Reduce pollution of water, especially by 'priority' and 'priority hazardous' substances; and
- Ensure progressive reduction of groundwater pollution[1].

1.1.1.3 The WFD sets the objectives for all waterbodies in Europe classified under the WFD. Table 1.1 provides a summary of the WFD objectives.

Table 1.1 WFD Objectives Summary

Objectives	Reference
Member states shall implement the necessary measures to prevent deterioration of the status of all bodies of surface water.	4.1(a)(i)
Member states shall protect, enhance, and restore all bodies of surface water, subject to the application of subparagraph (iii) for artificial and heavily modified bodies of water, with the aim of achieving good surface water status by 2015.	4.1(a)(ii)
Member states shall protect and enhance all artificial and heavily modified waterbodies of water, with the aim of achieving good ecological potential and good surface water chemical status by 2015.	4.1(a)(iii)
Progressively reduce pollution from priority substances and cease or phasing out emissions, discharges and losses of priority hazardous substances.	4.1(a)(iv)

1.1.1.4 The WFD creates a mechanism through which each signatory has to aim to bring its water resources to an accepted biological and chemical standard (good ecological/chemical status for natural waterbodies; and good ecological potential/good chemical status for artificial/heavily modified waterbodies) by 2015; this is based on a series of parameters (quality elements) dependent on the type of waterbody considered (i.e. rivers; lakes; transitional waters and coastal waters) and its hydromorphological designation (i.e. natural; artificial or heavily modified). In cases where good status/potential cannot be achieved by 2015 a provision is given under Article 4.4 of the WFD extending the deadline to 2021 or 2027. The date has been extended to 2027 in respect of a large number of waterbodies. Within Wales the competent authority, as of 2013, for delivering the Directive is Natural Resources Wales (NRW). In 2015, approximately 39% of water bodies achieved good or high status (NRW, 2015).

1.1.1.5 The WFD requires member states to establish river basin districts and a management plan for each. In Wales, as in England, WFD-related actions are managed through the River Basin Management Plan (RBMP) process. For the mWave project, the relevant RBMP is the Western Wales RBMP. The first Western Wales RBMP was published by Environment Agency Wales in 2009 and was updated with a suite of documents in 2015.

1.1.1.6 The WFD has important implications for planning works that may affect relevant waterbodies. It has the effect of controlling such development such that it does not cause deterioration in waterbody status, ideally, such development should improve the status of the affected waterbodies.

1.1.1.7 The WFD (Articles 4.7 and 4.8) provides that, in the event of a project resulting in an adverse impact on a waterbody which could cause a deterioration in its WFD status, or could prevent actions which are required to raise the WFD status of the waterbody, then the project must be assessed and justified in the context of the actions proposed to mitigate the adverse impact on the status of the waterbody.

1.1.1.8 The WFD does allow derogations from its requirements to prevent deterioration in status or to restore waterbodies to Good Ecological (or Good Potential) status if the Development meets certain socio-economic and environmental criteria. For a derogation to be applicable, it must satisfy the criteria in Article 4.7:

Article 4.7 'Member States will not be in breach of this Directive when:

- *failure to achieve good groundwater status, good ecological status or, where relevant, good ecological potential or to prevent deterioration in the status of a body of surface water or groundwater is the result of new modifications to the physical characteristics of a surface waterbody or alterations to the level of bodies of groundwater, or*
- *failure to prevent deterioration from high status to good status of a body of surface water is the result of new sustainable human development activities and all the following conditions are met:*

(a) all practicable steps are taken to mitigate the adverse impact on the status of the body of water;

(b) the reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years;

(c) the reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set

[1] http://ec.europa.eu/environment/water/water-framework/

out in paragraph 1 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development, and

(d) the beneficial objectives served by those modifications or alterations of the waterbody cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.

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1.1.1.9 Where a derogation is proposed under Article 4.7, Article 4.8 of the WFD requires that other waterbodies are not adversely affected. This means that a similar consideration must be applied to these waterbodies. Article 4.8 states:

'When applying paragraphs 3, 4, 5, 6 and 7, a Member State shall ensure that the application does not permanently exclude or compromise the achievement of the objectives of this Directive in other bodies of water within the same river basin district and is consistent with the implementation of other Community environmental legislation.'

1.1.1.10 In Wales, the Environment (Wales) Act 2016 and the Well-being of Future Generations (Wales) Act 2015 also has to be considered. The overarching aims of the Environment Act (2016) is to enable Wales' resources to be managed in a more proactive, sustainable, combined manner. The Well-being of Future Generations Act asks 44 Public Bodies in Wales to work in a sustainable way and consider the impact public sector work can have for people living in Wales, now and in the future.

1.1.1.1 This WFD Compliance Assessment for the mWave project constitutes one of the Appendices to the Environmental Statement and should therefore be read in conjunction with the following chapters of the Environmental Statement:

- Chapter 2 – Project Description
- Chapter 5 – Coastal Processes
- Chapter 7 – Benthic Subtidal and Intertidal Ecology
- Chapter 8 – Fish and Shellfish

1.1.1.2 This report does not aim to repeat information provided elsewhere within the Environmental Statement. Therefore, where information is discussed in more robust detail elsewhere, a summary of the relevant information has been provided along with the reference to the appropriate chapters of the Environmental Statement.

1.1.1.3 Section 2 of this report initially sets out the methodology for the WFD Compliance Assessment. Section 3 presents the findings of the screening assessment, Section 4 the findings of the scoping assessment and Section 5 the outcome of the detailed assessment. Section 6 sets out the conclusions of the WFD Compliance Assessment for the mWave marine energy device.

2 METHODOLOGY FOR WFD COMPLIANCE ASSESSMENT

2.1 Introduction

2.1.1.1 WFD is primarily concerned with non-temporary deterioration. If the water body:

- is only impacted for a short period of time;
- recovers within a short period of time;
- recovers without the need for any restoration measures,

this will not constitute deterioration of status under WFD.

2.1.1.2 The mWave Project entails the testing of a full-scale wave energy prototype device which is to be deployed off East Pickard Bay on the south side of the Angle Peninsula. mWave will not be grid-connected, although a temporary communications cable and onshore control station will be required to enable testing. The mWave project will be installed for a maximum of 18 months. The outcome of the Environmental Impact Assessment (EIA) reported within the Environmental Statement identified that any potential effects on hydromorphology, water quality and benthic habitats will recover without the need for any restorative measures within a short period of time following decommissioning. However as the device is the first full scale test of the Wave Energy Converter, located within a designated site and a coastal waterbody of 'good' status, a WFD Compliance Assessment has been undertaken.

2.1.1.3 This WFD Compliance Assessment has been undertaken in line with the internal NRW guidance OGN 72 Guidance for assessing activities and projects for compliance with the Water Framework Directive (NRW, 2018). Consideration has also been taken of the Environment Agency's guidance 'Clearing the Waters for All' (Environment Agency, 2017).

2.1.1.4 The OGN 72 guidance details a three step process as follows:

- **Screening -** exclude any activities that do not need to go through the scoping or detailed assessment stages,
- **Scoping** – identify the quality elements that are potentially at risk from the proposed activity and need further detailed assessment,
- **Detailed assessment** – consider the potential impacts of an activity on bodies of surface and ground water, identify ways to avoid or minimise impacts, and identify if an activity may prevent the water body achieving good status or cause deterioration. As noted in Section 1, in the event that an activity may prevent the water body achieving good status or cause deterioration then it may be allowed to proceed if it meets the requirements of Article 4.7.

Screening

2.1.1.5 OGN 72 (Table 6) sets out activities that NRW considers will not cause a risk of deterioration or prevent a waterbody from achieving its objective when all criteria set out in Stage 1 screening are met. As the project is not an activity included within Table 6 of the OGN 72 and is located within a coastal waterbody, a screening process is required to identify any potential risks to WFD waterbodies.

2.1.1.6 The following steps have been undertaken as part of the screening process for the mWave project:

- Defining the study area, based on the location of key components of the project, the distance of waterbodies from the project, and the hydrological connectivity of waterbodies to the project (discounting those waterbodies not considered to be relevant using the theoretical likelihood of the project activities interacting with WFD status or potential);
- Defining the relationship of the project's activities with the included waterbodies (i.e. screening out components not considered to be relevant so that the possibility of effect and the consequences can be identified).

2.1.1.7 **Scoping**

2.1.1.8 To identify the quality elements that are potentially at risk from the proposed project activities and the need for further detailed assessment, baseline data on the screened-in waterbodies, their current WFD status and potential, their specific objectives and any mitigation measures or failures undertaken to date would be collated. A preliminary assessment of the remaining screened in activities of the project against the WFD elements (biological, chemical and hydromorphological elements that make up the overall WFD status) of the screened in waterbodies has then been carried out. This is to identify whether any activities could have an impact on the status or potential of the waterbodies and whether a detailed assessment is required.

Detailed assessment

2.1.1.9 If required, a detailed assessment based on the findings of the preliminary assessment in respect of any components of the Project, identified as likely to have an impact upon the WFD elements. This assessment would also consider any conflicts between the project and relevant RBMP mitigation measures, and any cumulative impacts of the development.

Cumulative assessment

2.1.1.10 Other developments that could potentially have a cumulative impact with the Project would be considered.

2.2 Information used in the WFD Compliance Assessment

2.2.1.1 The assessment carried out, pursuant to the WFD, and reported within this document draws information from other assessments reported elsewhere, particularly the Environmental Statement and No Significant Effect Report (NSER) relating to the project. WFD data has been collated from the NRW Water Watch Wales for waterbodies potentially affected by the project.

3 SCREENING

3.1.1 Introduction

3.1.1.1 This section identifies WFD waterbodies that could potentially be at risk as a result of project activities. Subsequently, the activities associated with the project that are relevant to WFD in terms of their potential for impacts to waterbodies are considered.

3.1.2 Identification of relevant WFD Waterbodies potentially affected by Project Activities

3.1.2.1 The mWave project will be situated within the Western Wales River Basin District (RBD) which extends across the entire western half of Wales from the Vale of Glamorgan in the south, to Denbighshire in the north and includes the island of Anglesey off the north-west coast of North Wales as shown in Figure 3.1.

Coastal and Transitional WFD waterbodies and marine project activities

3.1.2.2 Within the Western Wales River Basin District, all the components of the mWave project lie contained within the Pembrokeshire South waterbody as shown in Figure 3.1. This waterbody has been considered further in the Scoping section (Section 3) of this document.

3.1.2.3 The Milford Haven Outer transitional waterbody (GB641008220000) and the Carmarthen Bay (GB611008590002) coastal waterbody are hydrologically connected to the Pembrokeshire South coastal waterbody. However, due to the development being fully located within the Pembrokeshire South coastal waterbody, its minimal footprint, and the distance the development lies from these waterbodies, no further assessment has been considered necessary for these hydrologically connected waterbodies.

Groundwater and River WFD waterbodies and onshore project activities

3.1.2.4 The onshore cable route and the temporary control station lies within the Pembrokeshire Carboniferous Limestone groundwater waterbody (GB41002G206000). However, the cable will be surface laid as far as feasible along its length and the minimal groundworks associated with the installation and decommissioning of the temporary onshore components (temporary control station, chemical toilet and bunded fuel tank) in agricultural land (rough grassland) will not result in any effects on this groundwater. During all phases of the project an Environmental Management Plan (EMP) and Environmental Mitigation and Monitoring Plan (EMMP (see Section 4) will be implemented and the use of any potentially polluting materials controlled. No potential effects on this groundwater waterbody are therefore predicted, so onshore activities associated with the project are not considered further in this assessment.

3.1.2.5 The closest river waterbody is the Castlemartin Corse (GB110061025000). This waterbody will not be affected by the onshore project activities. The scale, location and nature of the mWave device will not result in effects on fish or any other quality element within this river waterbody. This river waterbody is not considered further in this assessment.

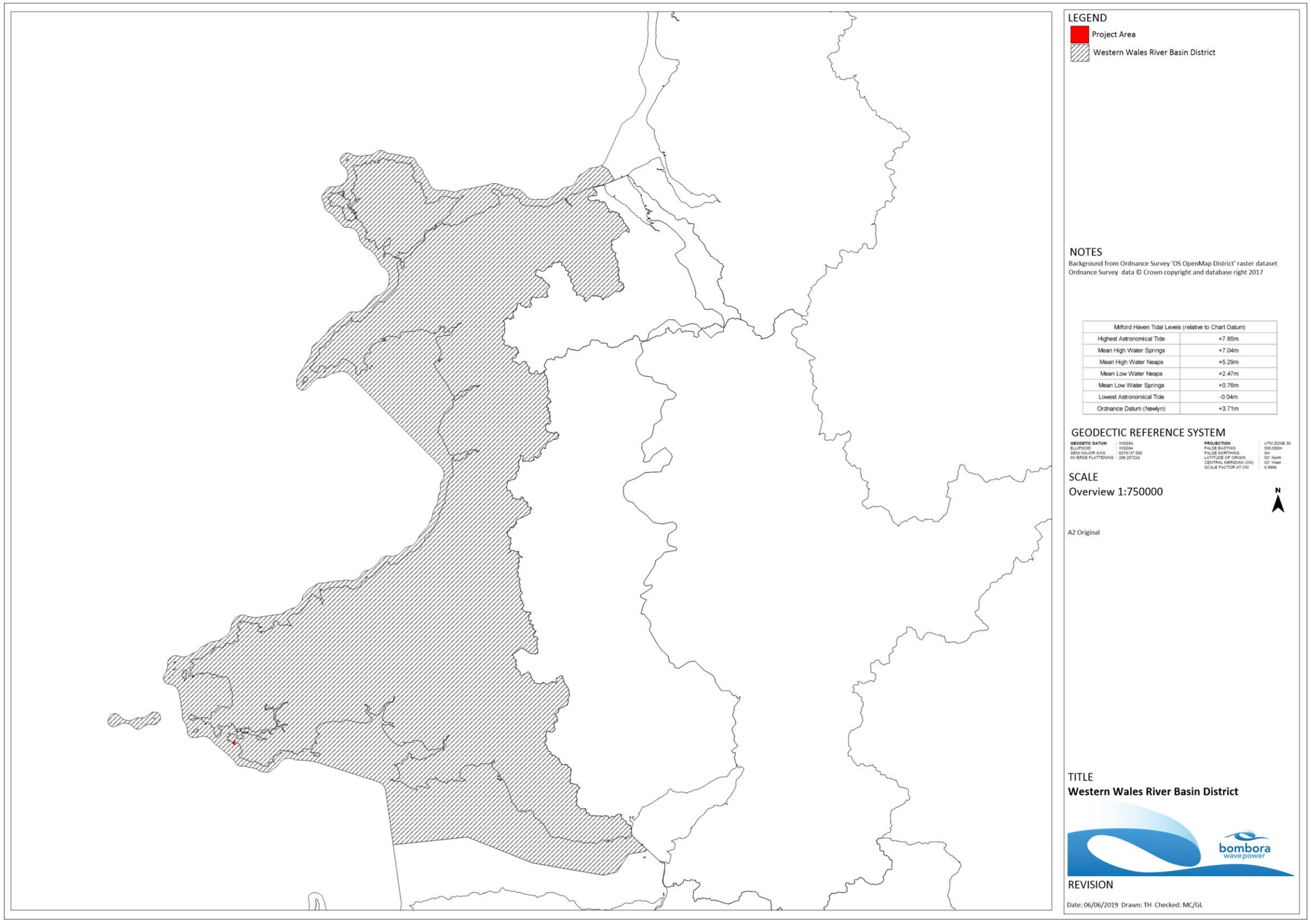
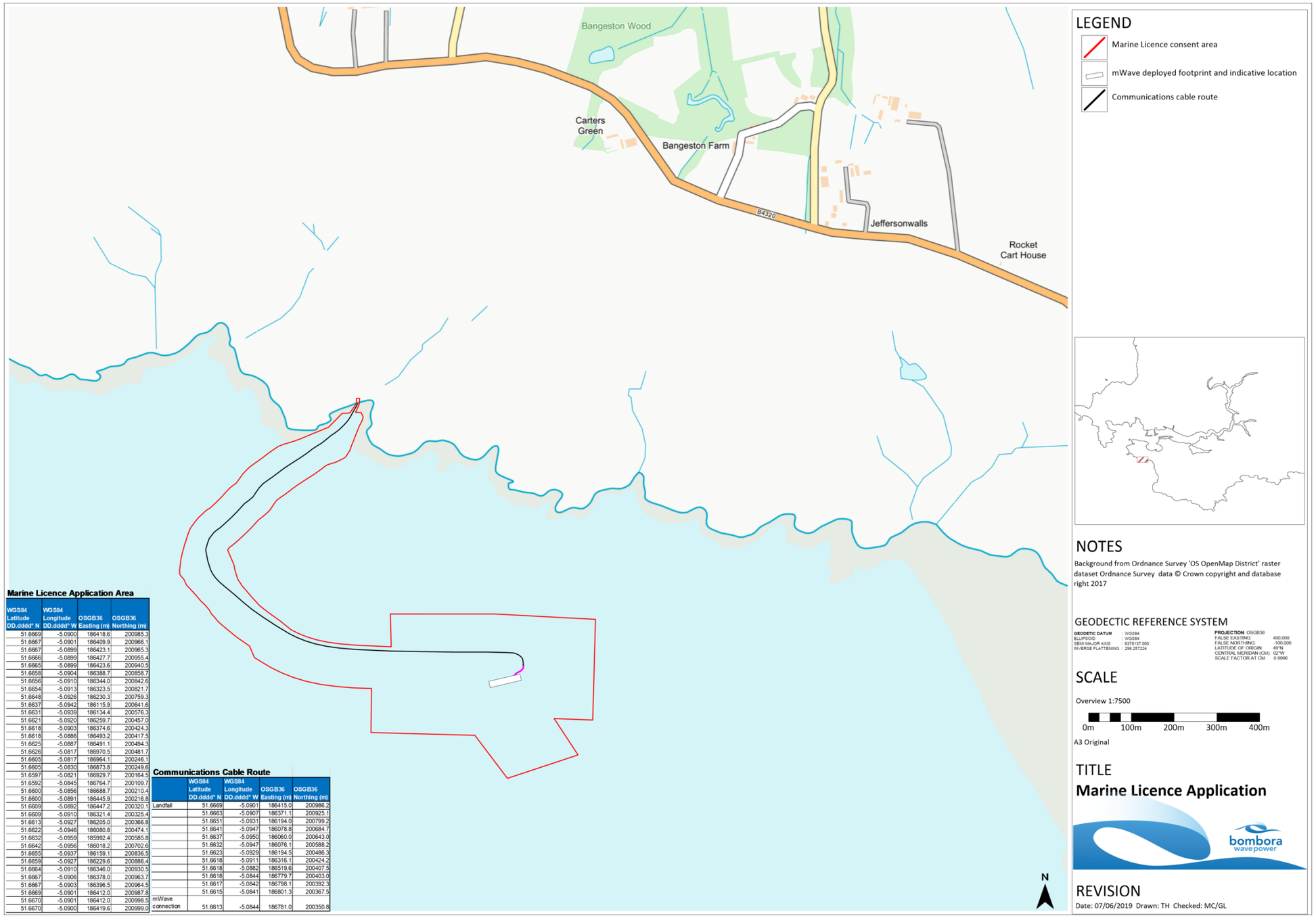


Figure 3.1 Western Wales River Basin District



Marine Licence Application Area

WGS84 Latitude DD.dddd° N	WGS84 Longitude DD.dddd° W	OSGB36 Easting (m)	OSGB36 Northing (m)
51.6669	-5.0900	186418.6	200985.3
51.6667	-5.0901	186409.9	200966.1
51.6667	-5.0899	186423.1	200965.3
51.6666	-5.0899	186427.7	200955.4
51.6665	-5.0899	186423.6	200940.5
51.6658	-5.0904	186388.7	200858.7
51.6656	-5.0910	186344.0	200842.6
51.6654	-5.0913	186323.5	200821.7
51.6648	-5.0926	186230.3	200759.3
51.6637	-5.0942	186115.9	200641.6
51.6631	-5.0939	186134.4	200576.3
51.6621	-5.0920	186259.7	200457.0
51.6618	-5.0903	186374.6	200424.3
51.6618	-5.0886	186493.2	200417.5
51.6625	-5.0887	186491.1	200494.3
51.6626	-5.0817	186970.5	200481.7
51.6605	-5.0817	186964.1	200246.1
51.6605	-5.0830	186873.8	200249.6
51.6597	-5.0821	186929.7	200164.5
51.6592	-5.0845	186764.7	200109.7
51.6600	-5.0856	186688.7	200210.4
51.6600	-5.0891	186445.9	200216.8
51.6609	-5.0892	186447.2	200320.1
51.6609	-5.0910	186321.4	200325.4
51.6613	-5.0927	186205.0	200366.8
51.6622	-5.0946	186080.8	200474.1
51.6632	-5.0959	185992.4	200585.8
51.6642	-5.0956	186018.2	200702.6
51.6655	-5.0937	186159.1	200836.5
51.6659	-5.0927	186229.6	200886.4
51.6664	-5.0910	186346.0	200930.5
51.6667	-5.0906	186378.0	200963.7
51.6667	-5.0903	186396.5	200964.5
51.6669	-5.0901	186412.0	200987.8
51.6670	-5.0901	186412.0	200998.5
51.6670	-5.0900	186419.6	200999.0

Communications Cable Route

	WGS84 Latitude DD.dddd° N	WGS84 Longitude DD.dddd° W	OSGB36 Easting (m)	OSGB36 Northing (m)
Landfall	51.6669	-5.0901	186415.0	200986.2
	51.6663	-5.0907	186371.1	200925.1
	51.6651	-5.0931	186194.0	200799.2
	51.6641	-5.0947	186078.8	200684.7
	51.6637	-5.0950	186060.0	200643.0
	51.6632	-5.0947	186076.1	200588.2
	51.6623	-5.0929	186194.5	200486.3
	51.6618	-5.0911	186316.1	200424.2
	51.6618	-5.0882	186519.6	200407.5
	51.6618	-5.0844	186779.7	200403.0
	51.6617	-5.0842	186798.1	200392.3
	51.6615	-5.0841	186801.3	200367.5
mWave connection	51.6613	-5.0844	186781.0	200350.8

Figure 3.2 mWave project site including marine communication cable

3.1.3 Identification of Marine Project Components and Activities relevant to WFD

3.1.3.1 The mWave marine energy device is a full scale Wave Energy Converter to be located in the marine environment. Figure 3.2 above shows the location of mWave and the marine communication cable which makes landfall at East Pickard Bay.

3.1.3.2 The mWave device is a submerged pressure-differential absorber with flexible membranes as the working interface. As such the mWave device will sit on the seabed, and it will comprise multiple seafloor-mounted, air-filled cells covered by flexible rubber membranes. As a wave passes overhead the device uses the change in water pressure to displace air in the membrane covered cells, the membranes inflate and deflate to move air within the device.

3.1.3.3 The physical size of the mWave structure is approximately 75m long (including the Power Take Off (PTO) module), 7m high and 15m wide at the base and approximately 17m wide at its largest width. The device will be manufactured onshore and towed to site. No ground clearance will be required prior to installation as the device will be located on sandy substrate. The device will have gravity based foundations. Although it is not predicted that scour protection will be required, monitoring by video camera will be undertaken. If monitoring indicates that scour protection is needed rock will be brought to site contained in bags which can be removed at the end of the deployment period, unless leaving in situ is deemed to be lower impact. Each rock bag would contain up to five tonnes of rock, with a diameter of up to 2m. This amount of scour protection required would equate to 100 rock bags which is equivalent to 500 tonnes. It is estimated to take up to 10 vessel trips over a five day period to deploy this volume of rock.

3.1.3.4 A marine communication cable which will be surface laid links the offshore device to the shore at East Pickard Bay. In sandy areas the cable will be weighted down at intervals of approximately 200m in sandy areas with three rock bags. A further fourth rock bag will be installed near the shore end of the cable approximately 100m from the rocky shore. The onshore cable will then, where feasible, be surface laid to the temporary control station located in agricultural land at the south eastern extent of the WWII RAF Angle Airfield, to the south of the B4320. The communication cable is approximately 1.8km in total, with approximately 1.4km subtidal, 50m intertidal and 350m onshore.

3.1.3.5 The mWave device, communication cable and onshore control station will be in situ for up to 18 months to allow for testing of mWave. All components of the project will then be removed. No electricity will be exported during the testing of mWave.

3.1.3.6 Figure 3.3 provides an illustration of the mWave device and Figure 3.4 illustrates the main components of mWave.

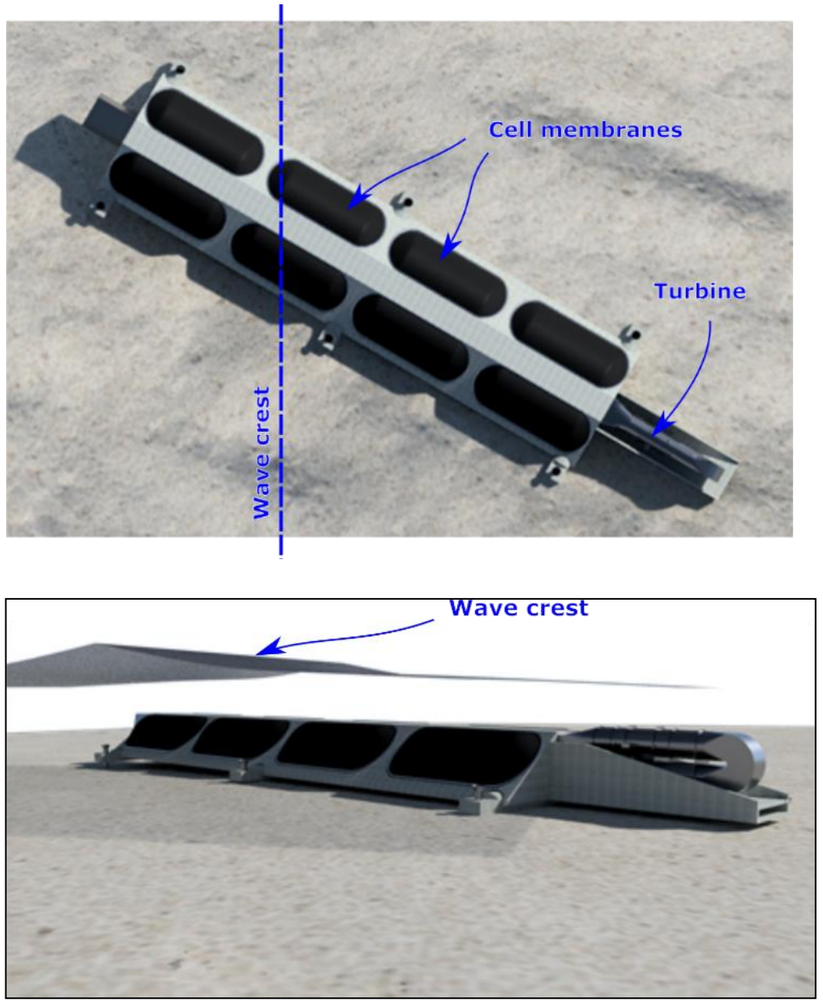


Figure 3.3: Artistic impression of the commercial full-scale mWave prototype, in (a) plan view and (b) elevation view, with waves approaching from the right.

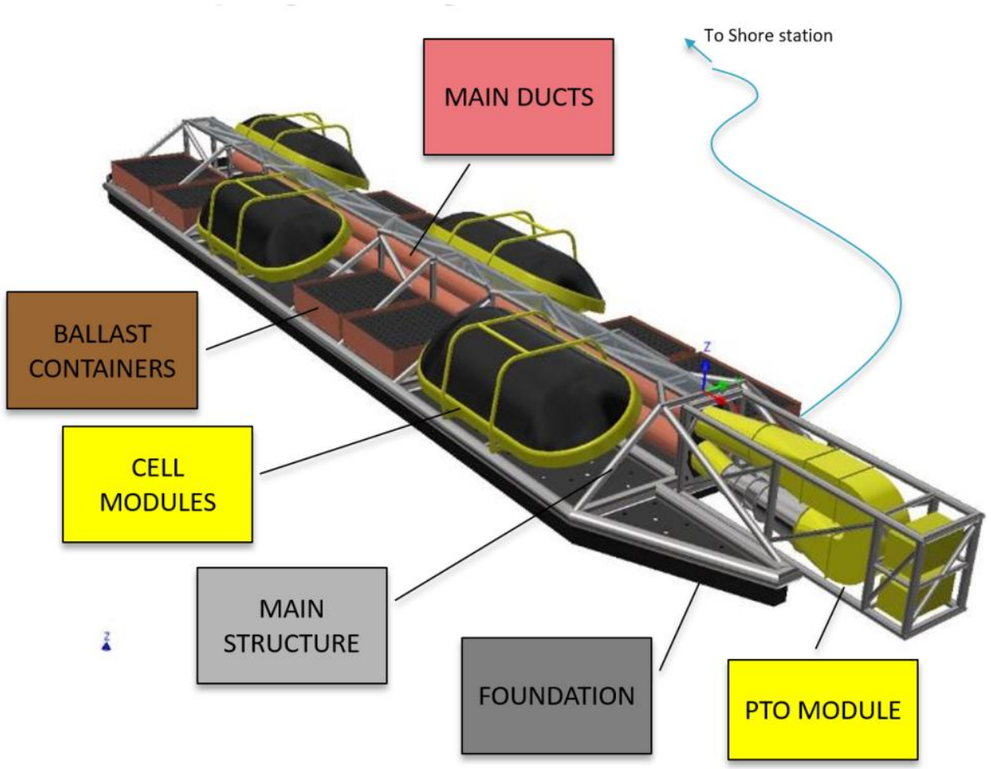


Figure 3.4: CAD image of the mWave device to be installed off East Pickard Bay.

3.1.3.7 Table 3.1 presents the key elements of the project relevant to WFD screening.

Table 3.1 Key elements of the mWave project relevant to WFD screening

Project detail	Design parameter
Advanced works	Deployment of six temporary moorings. No seabed clearance or levelling required.
Position in water column	mWave device sits on the seabed, using gravity foundations.
Largest Dimensions	75m (L) x 17m (W) x 7m (H)
Height of water above device	4.2m MLWS 7.35m mid tide 10.5m MHWS
Seabed footprint mWave (with possible 2m width scour protection around edge of device)	1032 m^2 (total including possible scour protection 1700m^2)
Area of other elements	Cable 210m^2 ADCP/SUTU and cable 24m^2
Maximum area offshore	<1900 m^2
Number of days and vessels for: installation /decommissioning - some operations will overlap. Ballast chain Cable laying	3 days -3 vessels on site (2 multicats, (50m by 6m draught), 1 RIB) 5 days - 14 vessel trips for ballast chain 3 days- 1 cable laying vessel (50m by 6m draught)
No. of vessels for O&M - mWave Total number of vessel movements installation, O&M and decommissioning Scour protection	3 (tow vessel plus MIT (50m by 6m draught) and RIB) Visits over 2 days once per month giving 76 vessel movements over 12 month period. 10 vessel visits (if needed)
Total Vessels during all phases	122 Vessels
Lubricants and antifoulants	Any antifoulants (only around sensors) or lubricants used will be EU/Internationally approved for use in marine environments.
Mooring/Attachment method for mWave	Gravity base foundation - no anchoring system required.
Mooring spread for installation/ decommissioning Some temporary mooring during O&M	200 m x 200 m (40,000 m^2)

3.1.3.8 For purposes of screening and scoping activities that potentially have an effect on WFD waterbodies, the mWave project has been divided into the following three key activities:

- Installation activities: Installation of the mWave device in the marine environment, laying of the communication cable offshore and in the intertidal environment. Temporary moorings for installation vessels. Total installation time for the mWave device, marine and intertidal communication cable is estimated to be a maximum of 10 days, with some activities overlapping.
- Operational activities: Operation and footprint of the mWave device in the marine environment. Device to be in situ for up to 12-18 months, with testing over a 6 - 12 month period. No operational maintenance is planned for the cable. Offshore O&M activities will be undertaken approximately once per month which will comprise routine inspection and scheduled maintenance for the mWave device.
- Decommissioning activities: Removal of the mWave device from the marine environment and the offshore and intertidal communication cable. Temporary moorings for installation vessels. Total decommissioning time for the mWave device, marine and intertidal communication cable is estimated to be a maximum of 10 days, with some activities overlapping.

4 SCOPING

4.1.1 Status of the Pembrokeshire South Coastal Waterbody and relevant quality elements

4.1.1.1 Information for the Pembrokeshire South coastal waterbody has been collated from the NRW Water Watch Wales website[2]. The current overall status of the Pembrokeshire South waterbody is 'Good', with ecological status as 'Good' and chemical status as 'Good'. The current status objective for this waterbody is to an maintain overall status of Good by 2027.

4.1.1.2 Table 4.1 presents the summary data for the Pembrokeshire South coastal waterbody.

Table 4.1 WFD Summary Data for the Pembrokeshire South Coastal Waterbody

WFD Waterbody Parameters	Description
Name	Pembrokeshire South
ID	GB611008590003
River Basin District	Western Wales
Type (estuarine, fluvial, coastal or groundwater)	Coastal
Total area (km2)	413.30
Overall waterbody status	Good
Ecological status	Good
Chemical status	Good
Target waterbody status and deadline	Good status by 2015
Hydromorphological status of waterbody	Not designated
Heavily modified waterbody and for what use	No
Phytoplankton status	High
History of harmful algae	No
Angiosperm status	Not monitored
Invertebrates status	Good
Macroalgae status	Not monitored
Fish status	Not monitored
WFD protected areas within 2km	Yes

4.1.2 Mitigation Measures Adopted as Part of the Project

4.1.2.1 In order to avoid or reduce the potential environmental effects, a number of measures have been designed into the project. Details of these can be found within Chapter 2: Project Description and each topic chapter of the Environmental Statement. The key ones relevant to the WFD Compliance Assessment are briefly outlined below:

- Placed on seabed, with good clearance for vessels which are likely to be in the area, with good water coverage, minimises the potential for interaction.
- The offshore mWave deployment location is on sandy substrate away from sensitive habitats, such as Annex I Reef (Chapter 7, section 7.7.3).
- Cable laid on surface and not trenched either offshore or onshore (Chapter 2, Section 2.5.3).
- The cable landfall selected to minimise impact. Drop Down Video (DDV) survey confirmed that the habitats and communities across the bedrock reef at East Pickard Bay were relatively low in diversity (Chapter 7, section 7.7.6).
- Flat sandy seabed and no requirement for seabed preparation in advance of deployment (Chapter 2, section 2.5.2).
- Gravity foundation, simple installation, requires no moorings (Chapter 2, Section 2.5.2).
- No external moving parts which may cause impact to marine life (only movement of air-filled membrane cells) (Chapter 2, Section 2.5.2).
- Due to design (using air filled membrane cells) noise levels are anticipated to be lower than conventional WEC (Chapter 6, Offshore Noise)

4.1.2.2 In addition to this, to accompany the Environmental Statement, the following two outline plans will be submitted:

- Environmental Management Plan (EMP), which will include a Marine Pollution Contingency Plan and an Invasive Non-Native Species Risk Assessment.
- Environmental Monitoring and Mitigation Plan (EMMP);

4.1.2.3 The EMP will cover both the offshore and onshore elements of the project. The onshore and offshore installation works will be undertaken in accordance with the EMP. It will set out the key management measures that Bombora and their contractors will adopt and implement during all stages of the mWave Project. The marine section of EMP will include planning for accidental spills, including measures to reduce the risk of an incident. In addition to this the EMP will include an INNS assessment using NRW-PS Biosecurity Risk Assessment Template which will reduce the risk of spreading marine invasive non-native species (INNS) (see Chapter 7, Benthic Subtidal and Intertidal Ecology).

[2] https://waterwatchwales.naturalresourceswales.gov.uk/en/: accessed June 2019

4.1.2.4 The EMMP is linked closely to the EMP and it will provide details of any requirements identified within the various assessment chapters to minimise potential effects on receptors. In addition to this it will provide details of any advanced checks which may be required in advance of installation works. The EMMP will outline the post-consent monitoring requirements for the mWave project, including the post-deployment monitoring that will be undertaken during the operation of the device. This document will also detail any mitigation measures that will be undertaken to minimise potential effects to environmental receptors, or which will be implemented as good construction practice to further reduce insignificant effects as identified in the ES. The EMMP will detail survey, monitoring and/or mitigation requirements for the mWave project and for each relevant receptor group, based on the predictions made in the ES.

4.1.3 Scoping Assessment for the Pembrokeshire South Coastal Waterbody

4.1.3.1 The three key activities screened in for consideration (installation, operation and decommissioning) have been compared to the scoping criteria for each quality element for a coastal waterbody as outlined in the OGN 72 (NRW, 2018) and Clearing the Waters for All guidance (Environment Agency, 2016) for the water body. The output of this assessment is provided in Appendix A and a summary is provided for installation and decommissioning in Table 4.2 and for operation in Table 4.3.

Table 4.2 Summary of Scoping Assessment for installation and decommissioning of the project

Installation and Decommissioning of mWave device and cable	
Quality element	Potential effect on quality element identified?
Hydrolomorphology	No
Water quality	No
Biology: habitats	No
Biology: fish	Not applicable for a coastal waterbody
Protected area	The device lies within designated sites (WFD protected areas). Designated sites are covered in the No Significant Effects Report (NSER) prepared for the planning and marine licence applications. No significant effects on the conservation features or integrity of the designated sites resulting from the installation or decommissioning of the project. Installation and decommissioning of the project will not result in potential effects on WFD protected areas.
Invasive species	Yes

Table 4.3 Summary of Scoping Assessment for operation of the project

Operation of mWave device and cable	
Quality element	Potential effect on quality element identified?
Hydrolomorphology	Yes - Potential changes to the physical form or alters the process of sediment transport (erosion, deposition or transfer)
Water quality	No
Biology: habitats	No
Biology: fish	Not applicable for a coastal waterbody
Protected area	The device lies within designated sites (WFD protected areas). Designated sites are covered in the NSER. No significant effects on the conservation features or integrity of the designated sites resulting from the installation or decommissioning of the project. Installation and decommissioning of the project will not result in potential effects on WFD protected areas.
Invasive species	Yes

4.1.3.2 Potential effects arising from installation, operation and decommissioning for the introduction and spread of invasive non-native species and potential effects arising from operation on the hydromorphology quality element (changes to the physical form or alters the process of sediment transport (erosion, deposition or transfer)) have been considered further for the Pembrokeshire South coastal waterbody in Section 5.

5 DETAILED ASSESSMENT

5.1.1 Detailed Assessment for Hydromorphology and Invasive Non-native Species

5.1.1.1 The outcome of the scoping assessment presented in Section 4 identified potential effects on the hydrolmorphological ((changes to the physical form or alters the process of sediment transport (erosion, deposition or transfer)) quality element arising from operation of the project and also in relation to the introduction and spread of invasive non-native species arising from the installation, operation and decommissioning of the project for the Pembrokeshire South coastal waterbody.

5.1.1.2 Further detailed assessment has been undertaken and presented in the Hydromorphology and Invasive Non-Native Species Compliance Tables in Appendix A (*see italicised text*).

5.1.1.3 Table 5.1 presents the outcome of the detailed assessments and identifies whether, with the implementation of relevant mitigation measures (see Section 4), the project will cause a risk of deterioration or failure to meet the future achievement or maintenance of "Good" chemical or ecological status/potential.

5.1.1.4 Table 5.1 also presents a summary of the outcome of the WFD Compliance Assessment for all quality elements for the project for completeness in the Pembrokeshire South coastal waterbody. As noted in Section 2, WFD is primarily concerned with non-temporary deterioration. If the water body:

- is only impacted for a short period of time;
- recovers within a short period of time;
- recovers without the need for any restoration measures,

5.1.1.5 this will not constitute deterioration of status under WFD. As noted in Section 2, the mWave project will be installed for a maximum of 18 months. The outcome of the Environmental Impact Assessment (EIA) reported within the Environmental Statement identified that any potential effects on hydromorphology, water quality and benthic habitats will recover without the need for any restorative measures within a short period of time following decommissioning.

Table 5.1 WFD Compliance Assessment Outcome Summary

Quality Element	Risk of deterioration or failure to meet the future achievement or maintenance of "Good" chemical or ecological status/potential.	Outcome of WFD Compliance Assessment
Hydromorphology	No	Detailed assessment identifies minimal changes to hydromorphological parameters on a very localised scale during operation. The effects would be transitory and the wave climate and sediment transport would return to previous levels once the device was decommissioned.
Biology: benthic habitats	No	mWave deployed on sandy substrate. Cable route across rocky habitat. Survey confirmed that there were no species or features of notable marine nature conservation importance were found at the proposed location of the device or along the cable route and none of the habitats and species seen are considered especially vulnerable or sensitive to the expected physical effects of the device and the cable deployment, presence or retrieval.
Biology: fish	No	The device is located in a coastal waterbody so no requirement to consider the fish quality element. However, an assessment has been undertaken in relation to effects on fish and shellfish as part of the EIA presented within the Environmental Statement and no significant adverse effects were identified on shellfish and resident or migratory fish.
Water Quality	No	Mitigation measures will be implemented through the EMP and EMMP to further reduce any risks of indirect effects associated with the project.
Protected Areas	No	The presence of the designated sites is covered in the NSER undertaken for the project. The NSER identified no significant effects resulting from the project on the integrity of the designated sites were identified.
Invasive non-native species	No	Measures within the INNS plan will be implemented to reduce any risks of introduction or spread of invasive non-native species.

6 CUMULATIVE EFFECTS

6.1.1 Cumulative Effects assessment for quality elements for the Project Activities and other Plans and Projects

6.1.1.1 A cumulative effects assessment has been undertaken for the project. Other developments (projects/plans) that could result in cumulative effects associated with the project activities were identified. These projects were screened as part of the EIA process within Chapter 4: Environmental Assessment Methodology, but a full list is provided below.

- Neyland Yacht Haven ltd - Dredge and dredge disposal activities - DML1743.
- Milford Haven Port Authority – Maintenance Dredging within Milford Haven - DML1646
- Neyland Yacht Haven ltd - Dredge disposal site - LU190.
- Milford Haven dredge disposal site - LU170
- St Ann's Head dredge disposal site - LU180
- Milford Haven Two dredge disposal site - LU169
- Milford Haven Three dredge disposal site - LU169
- Greenlink Interconnector Ltd. – Ground Investigations - RML1827.
- University College of Swansea – Removal of Marker Buoys and monitoring equipment - DEML1845.
- Neyland Yacht Haven Ltd - CML1658
- Mixed use developments - Redevelopment of 26,266 m2 of waterfront including commercial, hotel, leisure, retail and fishery related floorspace - Local Planning Authority Reference: 14/0158/PA.
- Greenlink Interconnector Ltd. - 500MW subsea electricity interconnector linking the power markets in Ireland and Great Britain - Government reference: qA1296053
- Valero - Welsh Government reference: qA1312073
- Ministry of Defence Castlemartin Range - training of military personnel (Army) in the firing of a range of munitions at land-based targets.
- Milford Haven Port Authority - Redevelopment of Pembroke Dock - SC1810.
- META Site 8 project - device installation and operation.
- Marine Energy Wales - Testing of initial stage marine renewable devices - DEML1875.
- Tethys Oysters - oysters farm where oysters are grown in baskets on metal supports
- Pembrokeshire Scallops - system of weighted ropes will be deployed for growing scallops and mix species of native algae.

6.1.1.2 In addition to this Draft National Welsh Marine Plan (dWNMP) (Welsh Government, 2017) - Marine planning associated with inshore region (0-12 nautical miles) and offshore region (beyond 12 nautical miles) of Wales, has also been considered.

6.1.1.3 Project locations are shown in Figure B1 in Appendix B.

6.1.1.4 The outcome of the cumulative assessment undertaken for hydromorphology, benthic habitats, invasive non-native species and water quality is presented in Appendix B and summarised below.

6.1.1.5 The dWNMP undertook a Habitats Regulation Assessment (HRA) of the proposed plans included within the dWNMP. It was concluded within the dWNMP HRA Appropriate Assessment (AA) that it would be necessary to rely on implementation of general cross-cutting protective policies within the WNMP to safeguard European sites during future assessment of specific schemes/projects. However, it was considered that there would be no adverse effect on site integrity due to the implementation of the policies due to measures that are in place. Therefore, no further cumulative assessment has been undertaken.

Hydromorphology

6.1.1.6 No cumulative effects associated with the project and other projects on hydromorphology have been identified in ES Chapter 5, Coastal Processes. As the project has very localised effects which are transitory there is no impact pathway for cumulative effects with identified projects.

Water Quality

6.1.1.7 No cumulative effects associated with the project and other projects on water quality have been identified in Environmental Statement Chapter 5: Coastal Processes and Chapter 2: Project Description, Residues and Emissions. As the project has very localised effects there is no impact pathway for cumulative effects with identified projects.

Benthic habitats

6.1.1.8 No cumulative effects associated with the project and other projects on benthic habitats have been identified in Environmental Statement Chapter 7 Benthic Subtidal and Intertidal Ecology: As the project has very localised effects there is no impact pathway for cumulative effects with identified projects. All projects within the Pembrokeshire South coastal waterbody that resulted in habitat loss and/or disturbance were either temporary, had a small footprint, and / or spatially restricted to the project footprint ensuring no spatial overlap with the mWave project. When habitat sensitivity (including recovery potential) was considered, no significant impacts were predicted, such that these projects would not result in the deterioration of the status of the Pembrokeshire South coastal waterbody.

Invasive Non-Native Species

6.1.1.9 There is a potential for cumulative effects associated with the project and other projects in close proximity associated with the introduction and spread of invasive non-native species. However, all projects will be required to produce and implement an Invasive Non-Native Species (INNS) Management Plan which has to be agreed with NRW, in consultation with the statutory consultees. The Management Plans will reduce the risks of introduction and spread of marine INNS as a result of vessel movements and installation activities associated with individual projects.

6.1.2 Cumulative Effects Assessment for WFD Protected Areas for the Project and other Projects and Plans

6.1.2.1 The NSER undertaken for the project considered cumulative effects with other plans and projects. The NSER identified that there would be no significant adverse cumulative effects on the conservation objectives or integrity of designated sites.

6.1.3 Outcome of the Cumulative Effects Assessment

6.1.3.1 It is concluded that the project, together with other plans and projects will not cause deterioration in the status of the Pembrokeshire South coastal waterbody or any other waterbody within the Western Wales RBMP (NRW, 2015). Nor will the project, together with other plans or projects compromise the future achievement or maintenance of "Good" chemical or ecological status/potential.

7 CONCLUSION

7.1.1.1 The EU Directive 2000/60/EC, referred to as the Water Framework Directive (WFD), established a framework for community action in the field of water policy. The WFD is transposed into United Kingdom (UK) law by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. NRW is the responsible authority in Wales for delivering the aim of the WFD, which is for all waterbodies to achieve "good status".

7.1.1.2 WFD is primarily concerned with non-temporary deterioration. If the water body:

- is only impacted for a short period of time;
- recovers within a short period of time;
- recovers without the need for any restoration measures,

this will not constitute deterioration of status under WFD.

7.1.1.3 The mWave project will be installed for a maximum of 18 months. The outcome of the EIA reported within the Environmental Statement identified that any potential effects on hydromorphology, water quality and benthic habitats will recover without the need for any restorative measures within a short period of time following decommissioning. However as the device is a prototype, located within a designated site and a coastal waterbody of 'good' status, a WFD Compliance Assessment has been undertaken.

7.1.1.4 The project has the potential to effect one WFD waterbody either directly or indirectly; namely; the coastal waterbody Pembrokeshire South which currently is of 'good' overall status.

7.1.1.5 The WFD Compliance Assessment was undertaken in accordance with the three stages (screening, scoping and detailed assessment) presented within the OGN 72 document 'Guidance for assessing activities and projects for compliance with the Water Framework Directive' (NRW 2018).

7.1.1.6 Screening identified that proposed project activities would require scoping against WFD. A scoping exercise was then undertaken by assessing the three key project activities (installation, operation and decommissioning) against criteria associated with relevant WFD quality elements in accordance with OGN 072 guidance note. These WFD quality elements comprised hydromorphology, water quality, benthic habitats, WFD protected areas and invasive non-native species.

7.1.1.7 Following scoping a detailed assessment was undertaken for potential effects on invasive non-native species for installation, operation and decommissioning and for potential effects on hydromorphology for operation.

7.1.1.8 The outcome of the scoping and detailed assessment concluded that the project will not cause deterioration in the status of the Pembrokeshire South coastal waterbody or any other waterbody within the Western Wales RBMP (NRW, 2015). Nor will the project compromise the future achievement or maintenance of "Good" chemical or ecological status/potential.

7.1.1.9 A cumulative effects assessment was undertaken and this concluded that the project, together with other plans and projects will not cause deterioration in the status of the Pembrokeshire South coastal waterbody or any other waterbody within the Western Wales RBMP (NRW, 2015). Nor will the project, together with other plans or projects compromise the future achievement or maintenance of "Good" chemical or ecological status/potential.

8 REFERENCES

Environment Agency (2016) Clearing the Waters for All. https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters

NRW (2015) River Basin Planning Process Report for Wales 2009 – 2015: Updated December 2015

NRW (2018) unpublished OGN 72 Guidance for assessing activities and projects for compliance with the Water Framework Directive

Welsh Government (2017) Draft National Welsh Marine Plan. https://gov.wales/draft-welsh-national-marine-plan.

APPENDIX A

The following tables summarise the information relevant to the consideration of the requirements of the Water Framework Directive for the marine components of the mWave marine energy device.

Note that although the answer to the question could be yes, there is enough information to enable the compliance parameter to be scoped out in the notes section where issues have been addressed in other supporting information. Where further assessment has been considered necessary to confirm the effects of the project on a compliance parameter, text is *italicised.*

Activity	Description, notes, or other information
Applicant name	Bombora WavePower Ltd
Application ref:	Not available
Brief description of project	The mWave marine energy device is a prototype electricity generating unit to be located in the marine environment. Installation: Installation of the mWave device and offshore and intertidal communication cable will involve: • Deployment of 6 temporary moorings for mWave installation vessels. The moorings will span an area of approximately 200m by 200m. Cable laying vessel will moor off landfall for cable pull onshore; • Onshore manufacture of the mWave device; • The mWave device will be towed to the location. The device will be allowed to sink to the seafloor with gravity foundations. The foundation of mWave comprises a keyed skirt that presses into the sand. The device is placed on the seabed and the penetration of the skirt into the sand up to 1m keeps the device in place throughout its deployment. The device contains ballast trays in the areas not occupied by cells and chain will be placed in the trays to add further weight to the device. • Offshore cable will be surface laid from a vessel starting in the intertidal area moving offshore. Four rock bags (approximately 2m diameter) will be placed at approximately 200m intervals to keep the cable in place across the offshore sandy section of the cable route. • Intertidal cable will be laid through a plastic conduit which is clamped to the rock face, where necessary, in the intertidal area. • ADCP will be installed at a mooring in close proximity to monitor waves and currents. Operation: No operational maintenance is planned for the cable. Offshore O&M activities will be undertaken approximately once per month which will comprise routine inspection and scheduled maintenance for the mWave device. Decommissioning: Decommissioning of the mWave device and offshore and intertidal communication cable will involve: • Deployment of 6 temporary moorings for installation vessels; • The chain ballast on the mWave device is removed and the device lifted off the seabed. The sand will fall out of the skirt back onto the seabed. • Cables and other components i.e. conduit and rock clamps will be removed from the offshore and intertidal environment.
Location of activity	The mWave deployment site is on the south coast of the Angle Peninsula in Pembrokeshire, West Wales. The site is some 2.5km south-east of Sheep Island, the southern extent of the Milford Haven Waterway, and some 1.3km west of Freshwater West beach. The marine communication cable will make landfall at East Pickard Bay. Figure 3.2 shows the location of the offshore works along with coordinates for

	the consented area.
Total footprint of activity	<1900 m^2
Timing of activity	Installation and decommissioning of the project is expected to last a maximum of 10 days, with some activities overlapping. Project expected to be in situ for up to 18 months, with offshore testing over a 6 - 12 month period.
Extent of activity (for example size, scale frequency, expected volumes of output or discharge)	See above
Use or release of chemicals (state which ones)	None. Only biodegradable lubricants will be used.

Surface Water Compliance: Hydrmorphology Compliance

Consider if your activity:	Yes	No	Hydromorphology risk issue(s) to Pembrokeshire South Waterbody
Could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status		x	No. Impact assessment not required. Project not located in waterbody of high status.
Changes the physical form or alters the process of sediment transport (erosion, deposition or transfer)	x		*Yes. Further assessment required for the operation of the project.* *The device will be located on a sandy site as this is required for the gravity foundations. Further assessment of scour is provided in Chapter 5, Coastal Processes and this demonstrated that scour protection is not anticipated to be required. For the mWave installation a worst case scour is expected to occur to a depth of up to 1.4m with a width of up to 4.8m during operation and is thus very localised around the structure. However, an allowance for the installation of rock has been included in the project. A video camera will be positioned on the device and it will monitor the scour during the deployment. Time and date stamped photos will be taken of a gauge painted onto the device to allow assessment of change in sediment depth during the deployment. If monitoring indicates that scour protection is needed rock will be brought to site contained in bags which can be removed at the end of the deployment period, unless leaving in situ is deemed to be lower impact. Each rock bag would contain up to five tonnes of rock, with a diameter of up to 2m. This amount of scour protection required would equate to 100 rock bags which is equivalent to 500 tonnes. It is estimated to take up to 10 vessel trips over a five day period to deploy this volume of rock.* *Any effects of the development would be localised immediately around the device during operation The effects would be transitory and the wave climate and sediment transport would return to previous levels once the device was decommissioned.* *It is considered that even if monitoring identifies that scour protection is required during operation of the device, the minimal footprint of the development, scour protection and potential extent of scour will not result in the deterioration of the hydromorphological quality element of the Pembrokeshire South coastal waterbody.* *Studies undertaken within Chapter 5 to support conclusion of limited and transitory effects of the installation, operation and decommissioning of the device. No significant effects identified.* *No further detailed assessment required.*
Have a significant impact on the hydromorphology conditions of a waterbody, for example changes to: 1. depth variation, the seabed and intertidal zone structure; 2. tidal patterns, for example dominant currents, freshwater flow and wave exposure.		x	No. Impact assessment not required. Very localised effects on the wave climate identified during worst case scenario in Chapter 5: Coastal Processes.
Has a physical footprint greater than 1% of the area of a surface waterbody or greater than 0.5km², then it should be scoped in for hydromorphology		x	No. Impact assessment not required. Footprint <1% and <0.5 km². Waterbody area = 413,318,151.16 m². Total marine footprint less than 1900 m²
Is in a waterbody that is heavily modified for the same use as your activity		x	No. Impact assessment not required

Surface Water Compliance: Water Quality Compliance

A scoping assessment has been undertaken on water quality and how physicochemical parameters could be affected by the project is provided in the table below:

Consider if your activity:	Yes	No	Hydromorphology risk issue(s) to Pembrokeshire South Waterbody
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)		x	No. Impact assessment not required. Potential for changes to water quality are not predicted by mWave proposed for East Pickard Bay located within this waterbody for a period of more than 14 days.
Is in a waterbody with a phytoplankton status of moderate, poor or bad		x	No phytoplankton status is classified as high. Impact assessment not required
Is in a waterbody with a history of harmful algae		x	No. Impact assessment not required

A scoping assessment has been undertaken on water quality and release of chemicals is provided in the table below:

Consider if your activity:	Yes	No	Hydromorphology risk issue(s) to Pembrokeshire South Waterbody
The chemicals are on the Environmental Quality Standards Directive (EQSD) list		x	No. Impact assessment not required. Sediment contaminants are highly unlikely to be present given the anthropogenically undisturbed nature of the area within which the site is found.
It disturbs sediment with contaminants above Cefas Action Level 1.		x	No. Impact assessment not required. Sediment contaminants are highly unlikely to contain concentrations above Cefas Action Level 1 given the anthropogenically undisturbed nature of the area within which the site is found.
If your activity has a mixing zone (like a discharge pipeline or outfall) consider if:		x	No
The chemicals released are on the Environmental Quality Standards Directive (EQSD) list		x	No. No chemicals on the Environmental Quality Standards Directive (EQSD) list will be released as part of the project activities.

Surface Water Compliance: Biology Compliance

Annex V of the Directive sets out Biological Quality Elements (BQEs) which are used to classify ecological status using five classes from high to bad including elements such as fish, invertebrates or algae.

Quality Element	Pressure Description
Phytoplankton	Nutrient enrichment
Macroalgae	Nutrient enrichment, hazardous chemicals
Angiosperms	Nutrient enrichment, morphological alterations
Benthic invertebrates	Organic pollution, hazardous chemicals and some morphological alterations
Fish (transitional only)	Organic enrichment (dissolved oxygen), habitat destruction

Following consideration of the proposed project activities and the pressure descriptions for each receptor, benthic invertebrates and macroalgae receptors have been taken forward for scoping. The project will not cause nutrient enrichment of the waterbody that could potentially impact on phytoplankton, and the nearest seagrass (angiosperms) beds are located at sufficient distances from the project site to not be affected to changes to seabed morphology from the installation of the proposed device. The project is not located in a transitional waterbody, so no scoping assessment for fish is required [note: the Environmental Statement considered the project in relation to fish. Chapter 8 of the Environmental Statement identifies that the scale, nature of the project will not have any significant effects on resident or migratory fish].

Consider if your activity:	Yes	No	Hydromorphology risk issue(s) to Pembrokeshire South Waterbody
$0.5km^2$ or larger		X	No. Impact assessment not required
1% or more of the water body's area		X	No. Impact assessment not required
Within 500m of any higher sensitivity habitat	X		mWave device is located on sandy substrate which is 200m south of rocky coast which overlaps with 'possible' mapped extent of Annex I reef. The cable route will cross the rocky subtidal and intertidal habitat Drop down video camera survey of the confirmed that the habitats and communities across the bedrock reef at East Pickard Bay were relatively low in diversity compared to many other areas around Pembrokeshire, due to the effects of scour and siltation. No species or features of notable marine nature conservation importance were found and none of the habitats and species seen are considered especially vulnerable or sensitive to the expected physical effects of the cable deployment, presence or retrieval. As such there will be no impact on sensitive habitats.
1% or more of any lower sensitivity habitat		X	No. Impact assessment not required. Total marine footprint less than 1900 m^2 Through the review of various datasets the majority of the seabed within East Pickard Bay, it is predicted to correspond with circalittoral coarse sediment (UK BAP Priority habitat). Data available on EMODnet indicate that the coarse sands in this area are characterised by the Nephtys cirrosa and Bathyporeia spp. in infralittoral sand' biotope (SS.SSa.IFiSa.NcirBat) and the '*Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand' biotope (SS.SSa.IMuSa.FfabMag) both of which are considered Welsh BAP priority habitats. EUSeaMap (2016) data predict Atlantic and Mediterranean high energy circalittoral rock in the nearshore area to the north of the deployment site which overlaps with the mapped distribution of possible Annex I 'reef' habitat feature of the Pembrokeshire Marine SAC in this area. This is also consistent with the multibeam backscatter data that has been collected of the area. No species or features of notable marine nature conservation importance were found at the proposed location of the device or along the cable route and none of the habitats and species seen are considered especially vulnerable or sensitive to the expected physical effects of the device and the cable deployment, presence or retrieval. Chapter 7 Benthic Subtidal and Intertidal Ecology of the ES considered the effects of the project on benthic features. Negligible to minor adverse effects were predicted on subtidal or intertidal benthic features.

WFD Protected Areas Compliance

An assessment of the following WFD protected areas have been considered at risk if they are located within located 2 km of the mWave device location and contain features where there is the potential for likely significant effect.:

- special areas of conservation (SAC)
- special protection areas (SPA)
- shellfish waters
- bathing waters
- nutrient sensitive areas

List of designated sites, distance to project and qualifying feature to be considered as part of the Scoping Assessment. Those which are a feature of the designated site, but are not present in the vicinity of mWave have been italicised.

Designated Sites	Distance to mWave	Qualifying Interest Feature to be considered
Pembrokeshire Marine/ Sir Benfro Forol SAC	0	Annex I habitats: *Estuaries;* *Large shallow inlets and bays;* **Reefs;** *Sandbanks which are slightly covered by sea water all the time;* *Mudflats and sandflats not covered by seawater at low tide;* *Coastal lagoons (*Priority feature);* Atlantic salt meadows (Glauco-Puccinellietalia maritimae); and *Submerged or partially submerged sea caves.*
Limestone Coast of South West Wales SAC/Arfordir Calchfaen de Orllewin Cymru	1.1	Annex I habitats: Submerged or partially submerged sea caves.
Skomer MCZ	8	*Infaunal sediment communities* *Epifaunal mixed sediment communities* *Zostera marina population* *Sponge assemblages* *Nudibranch species assemblages* *Pentapora foliacea (ross coral) population* *Lusitanian anthozoan populations (pink sea fan Eunicella verrucose, red sea fingers Alcyonium glomeratum, yellow cluster anem one Parazoanthus axinellae, cup corals Balanophyllia regia and Ca smithii)* *Rocky reef faunal communities* *Algal communities associated with major sublittoral habitat* *Littoral communities on bedrock shores* *Littoral communities on boulder shores* *Rock-pool communities* *Nationally rare and scarce hydroid populations* *Echinus esculentus population* *Algal species of recognised importance*

Consider if your activity:	Yes	No	Hydromorphology risk issue(s) to Pembrokeshire South Waterbody
Within 2km of any WFD protected area	x		Yes. Requires impact assessment. East Pickard Bay is located within or 2 km from Pembrokeshire Marine SAC, Limestone Coast of South Wales SAC, West Wales Marine SAC. Chapter 7 of the ES considered the effects of the project on benthic qualifying features of designated sites. Negligible to minor adverse effects were predicted on subtidal or intertidal benthic features. No significant adverse effects were identified on any qualified benthic features of the designated sites. A No Significant Effect Report was undertaken for the project. This concluded that there were no significant adverse effects on any of the conservation objectives of the designated sites as a result of the installation, operation or decommissioning of the mWave project. No significant effects were identified on the integrity of the designated sites. No further detailed assessment required.

Invasive Non-native Species Compliance

An assessment was undertaken to determine whether the project could introduce or spread INNS.

Risks of introducing or spreading INNS include:

- materials or equipment that have come from, had use in or travelled through other waterbodies
- activities that help spread existing INNS, either within the immediate waterbody or other waterbodies

Consider if your activity:	Yes	No	Hydromorphology risk issue(s) to Pembrokeshire South Waterbody
Introduce or spread INNS	x		*Yes. Requires impact assessment.* *There is a risk of the introduction and spread of marine INNS during installation activities as a result of increased vessel movements. Vessels can act as a vector for INNS by allowing the colonisation of species from other geographical areas either as marine fouling on the vessel hull or following entrainment into the vessel through seawater intakes (for ballast water), which can, in turn, upset the ecological balance of local communities.* *Vessel movements within East Pickard Bay have been considered in detail in Chapter 2 Project Description of the Environmental Statement. The potential for introduction and spread of invasive species has been considered in Chapter 7 of the Environmental Statement.* *For the installation, maintenance and decommissioning, there will be a total number of 122 vessel trips. The vessels employed in installation, maintenance and decommissioning activities are likely to be local to the Milford Haven Waterway or Wales, thereby limiting the potential for the introduction of new marine INNS to the area via this pathway. An EMP will be prepared for the project. The marine section of EMP will include an INNS assessment using NRW-PS Biosecurity Risk Assessment Template which will reduce the risk of spreading marine invasive non-native species (INNS) As set out in Chapter 7: Benthic Subtidal and Intertidal Ecology of the Environmental Statement, while a number of INNS are known to occur within the Milford Haven Waterway, including the slipper limpet Crepidula fornicata, which is present throughout Milford Haven, the measures set out in the INNS Risk Assessment contained within the EMP will ensure that the risks of spread and introduction of INNS into the Pembrokeshire South coastal waterbody are minimised wherever possible.* *No further detailed assessment required.*

APPENDIX B CUMULATIVE ASSESSMENT

The projects and plans selected as relevant to the cumulative assessment of the project presented are listed below and shown in Figure 6.1. Each project has been considered on a case by case basis for scoping in or out based upon data confidence, effect-receptor pathways, and the spatial/temporal scales involved.

Project phase	Developer - Reference	Approx. distance to mWave (km)	Spatial/ temporal overlap with the mWave project	Details	Date of Construction	Further Assessment required?	Notes taken from assessment
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 m^3.	13/12/2017-12/12/2020	No	Project has very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects due to distance of projects WFD protected areas are considered in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified.
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 m^3.	09/03/2017-08/03/2022	No	Project has very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects due to distance of projects WFD protected areas are considered in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified. Potential for cumulative effects from invasive non-native species will be minimised through the implementation of INNS Management Plans.
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	Project has very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects due to distance of projects WFD protected areas are considered in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified.
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	Site closed. No further assessment.
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	Site closed. No further assessment.
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	Project has very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects due to distance of projects WFD protected areas are considered in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified.
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	Project has very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects due to distance of projects WFD protected areas are considered in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified.

Project phase	Developer - Reference	Approx. distance to mWave (km)	Spatial/ temporal overlap with the mWave project	Details	Date of Construction	Further Assessment required?	Notes taken from assessment
Research							
Installation	Greenlink Interconnector Ltd. - RML1827	0	Potential spatial overlap Temporal overlap	Ground investigations		Yes	Both projects will have very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects. WFD protected areas are considered in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified. Potential for cumulative effects from invasive non-native species will be minimised through the implementation of INNS Management Plans.
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	No cumulative effects as there will be no temporal overlap of the projects.
Installation/ Operation and Maintenance	Neyland Yacht Haven Ltd - CML1658	11.5	No spatial overlap. No temporal overlap.	Pile replacement in Neyland Marina.	21/11/2016-20/11/2019	No	No cumulative effects as there will be no temporal overlap of the projects.
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	Insufficient information to assess but due to the distance no cumulative effects are anticipated
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	Both projects will have very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects. WFD protected areas are considered in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified. Potential for cumulative effects from invasive non-native species will be minimised through the implementation of INNS Management Plans.
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	Insufficient information to assess but due to the distance no cumulative effects are anticipated.
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	Not applicable	Yes	Project has very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects

Project phase	Developer - Reference	Approx. distance to mWave (km)	Spatial/ temporal overlap with the mWave project	Details	Date of Construction	Further Assessment required?	Notes taken from assessment
				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.			due to the differing nature of the projects WFD protected areas are considered in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified.
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	Project has very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects due to distance of projects WFD protected areas are considered in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified.
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	Project has very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects due to distance of projects WFD protected areas are considered in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified. Potential for cumulative effects from invasive non-native species will be minimised through the implementation of INNS Management Plans.
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	Project has very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects due to distance of projects WFD protected areas are considered in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified.
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. META Site 8 will be consented for up to two devices. 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 There is the potential for spatial overlap in the intertidal area at East Pickard Bay, and temporal overlap with all META project sites. The project has very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects. WFD protected areas are considered in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified. Potential for cumulative effects from invasive non-native species will be minimised through the implementation of INNS Management Plans.
Installation/ Operation and Maintenance/Decommissioning	Marine Energy Wales - DEML1875	9.4	No spatial overlap Potential for temporal	Marine Energy Test Area - Phase 1 Band 2 application submitted.	21/04/2019-21/04/2029	No	Project has very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects due to distance of projects WFD protected areas are considered

Project phase	Developer - Reference	Approx. distance to mWave (km)	Spatial/ temporal overlap with the mWave project	Details	Date of Construction	Further Assessment required?	Notes taken from assessment
			overlap	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			in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified.
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	Project has very localised effects for hydromorphology, benthic habitats and water quality so there will be no cumulative effects due to distance of projects WFD protected areas are considered in the NSER where no significant cumulative effects on conservation objectives or the integrity of designated sites were identified.

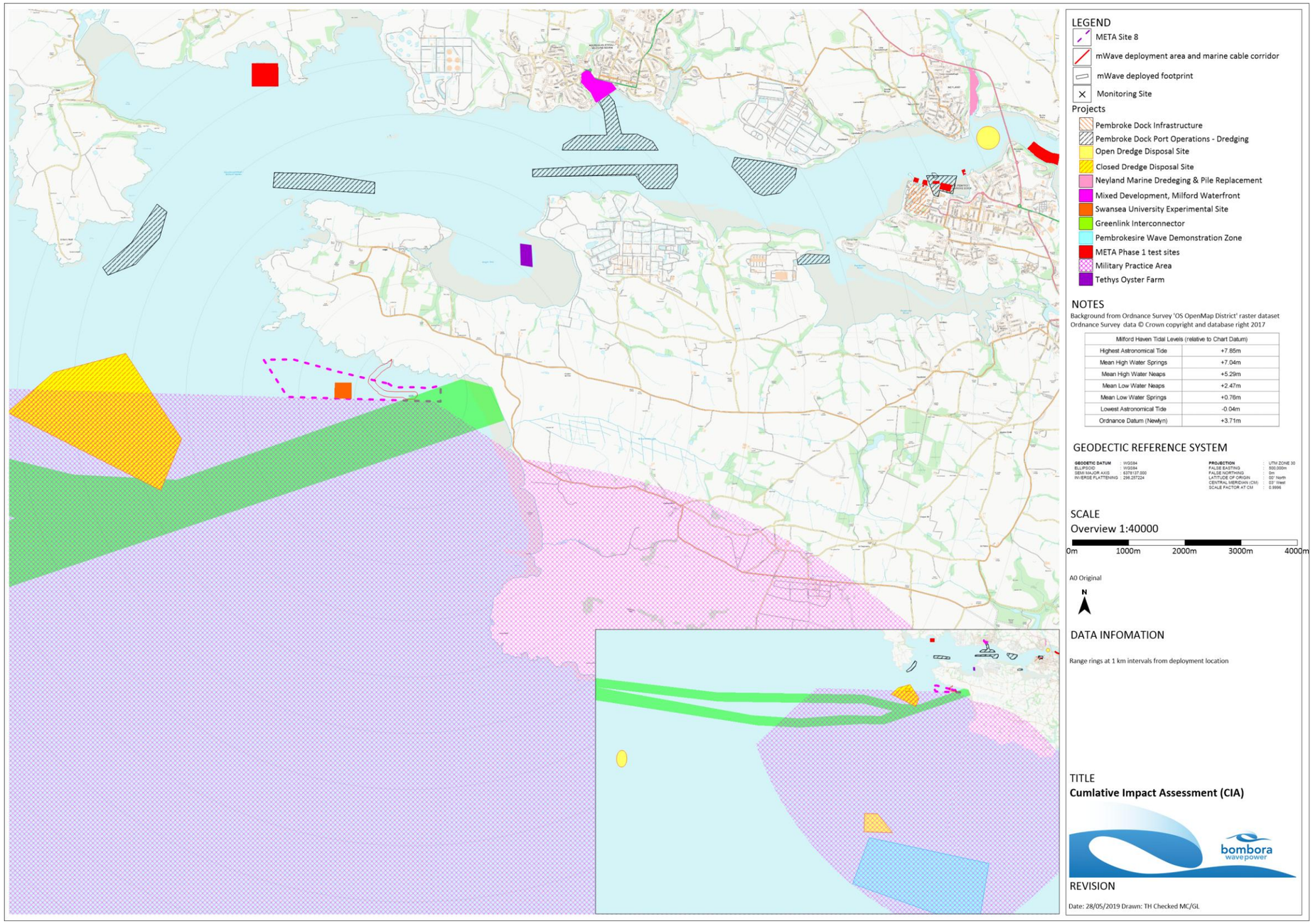


Figure B1 Location of projects considered as part of the cumulative effects assessment