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FURTHER SCOTTISH LEASING ROUND (SALTIRE PRIZE PROJECTS): REGIONAL LOCATIONAL GUIDANCE

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THE SALTIRE PRIZE PROGRAMME

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Preface

The Saltire prize of £10 million, announced on the 23 March 2010, will be awarded by Scottish Government to the team that can demonstrate a commercially viable wave or tidal stream energy technology that achieves the greatest volume of electrical output of at least 100 GWh over a continuous 2 year period before 2017. All wave and tidal stream energy developments, including those in The Crown Estate's (TCE) first leasing round in the Pentland Firth and Orkney waters, will be eligible to compete for the prize, under the condition that they are in a site in Scottish waters leased by TCE.

In the spirit of encouraging rapid development of wave and tidal energy, and to give opportunities for other projects to compete for the Saltire Prize, TCE and the Scottish Government are working in partnership to prepare plans for a further Scottish leasing round for wave and tidal projects. This leasing round is entirely separate and in addition to the leasing in the Pentland Firth and Orkney waters. A scoping paper on the proposed geographic areas to be leased for the Further Scottish Leasing Round was published and interested parties were invited to comment.

Subsequently and partly in response to comments received on the Scoping Study, Marine Scotland has undertaken further analysis of the proposed areas. The results of this work are described in this report and collectively known as Regional Locational Guidance (RLG). The RLG is provided primarily to assist developers interested in competing for the Saltire Prize to identify and develop projects rapidly, but may also be of interest to planners and regulators. The RLG collates and presents a range of information relevant to the development process and based on this, Marine Scotland's appreciation of the physical characteristics and the relative degree of constraints in these areas. Developers are strongly encouraged to take the information in the RLG into account when selecting and pursuing site developments, since it may be material to the consents process. However, it is recognised that developers will also undertake their own site suitability and environmental impact assessment work.

Technical Summary

The Regional Locational Guidance document has been produced to underpin the Further Scottish Leasing Round for wave and tidal stream energy in Scottish Seas. The initial Scoping Study (Harrald and Davies, 2010) identified six proposed areas in Scottish waters, two potentially suitable for tidal stream energy generation and four for wave energy generation, off the Scottish west coast and to the west of the Shetland Isles. Following comments received on the Scoping Study, we have included an additional seventh area, off the Shetland Isles. The sites are listed below and shown in Figure S1.

Tidal stream energy sites

- West of the Mull of Kintyre
- South-west of Islay

Wave energy sites

- West of Colonsay
- West of Tiree
- West of the Outer Hebrides, considered in three parts:
    - west of South Uist and Barra,
    - west of Harris and North Uist, and
    - west of Lewis
- West of Shetland
- South-west of Shetland

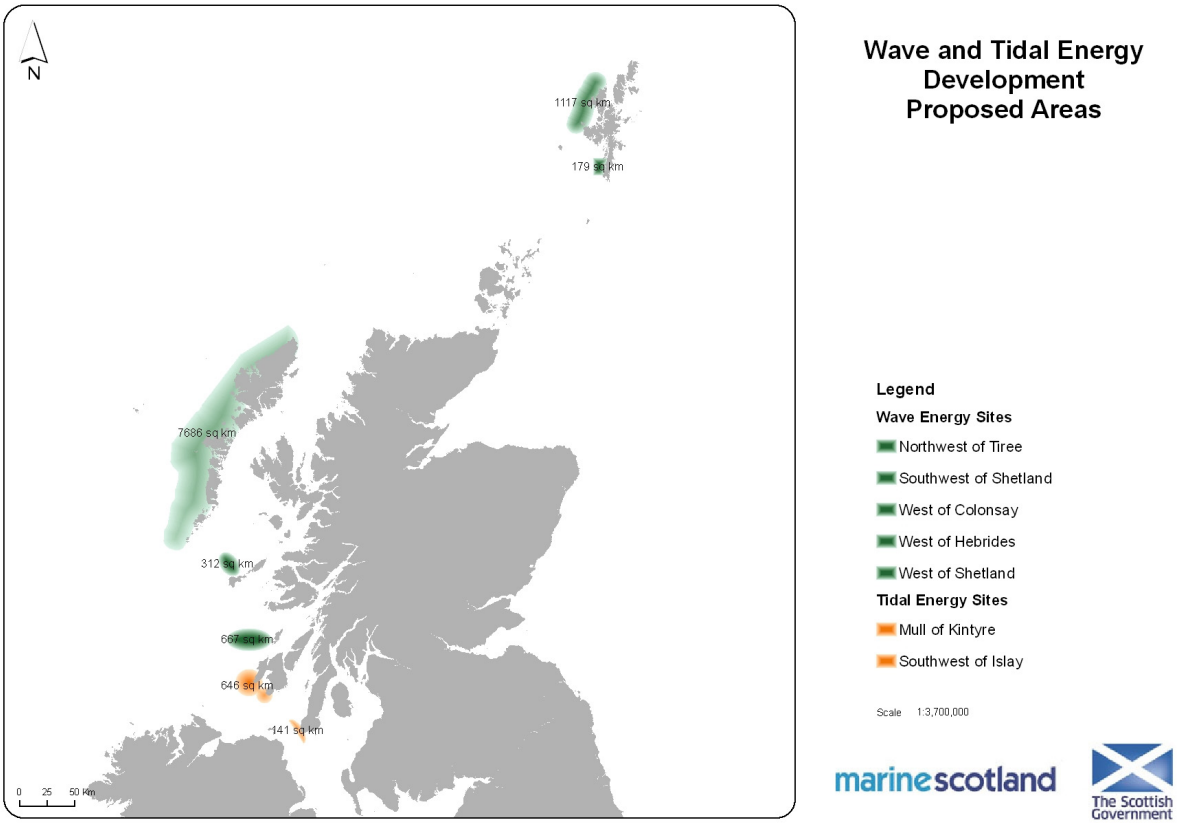

Figure S1: Areas identified in the Scoping Study for further consideration for leases for wave and tidal stream power developments in the context of the Further Scottish Leasing Round (Saltire Prize projects) (source: OS, MSS and TCE).

This document provides guidance to planners, regulators and potential developers on the resource and physical characteristics of the seven areas and potential for interactions with other users and the environment. The information is intended to assist in the identification of sites of opportunity within the areas previously identified in the scoping study, while highlighting possible sensitivities in the marine environment and surrounding coast. Data have been plotted using a Geographical Information System (GIS), which describe the following characteristics: the size of the wave and tidal resource, infrastructure, military, existing commercial uses of the site, designated areas, protected habitats and species, cultural sites and recreational uses. Although we have attempted to use the best available GIS data, the data quality and resolution is highly variable both between and within datasets and thus care is needed when interpreting the resulting maps.

The timetable for the Saltire Prize projects is very demanding, and, as noted in the Scoping Study, the first step is to locate suitable areas to deliver the leasing round within the short time-scale of the programme. These areas must not only possess sufficient wave or tidal stream energy, but also have the necessary infrastructure or potential to install it and avoid sensitive areas. Such an approach will not only reduce the potential for conflict or damage to the environment and other users of the sea, but also minimise the risk of additional delays arising in the licensing and consenting processes.

In brief, the seven sites identified all possess significant wave or tidal stream energy resource but have various constraints on development. The key technological factors and constraints are summarised in Table S1.

Table S1. Summary of main technological factors, infrastructure and constraints concerning the areas identified.

Sites	Technological factors	Infrastructure	Commercial and military constraints	Environmental constraints	Cultural and recreational constraints
			TIDAL STREAM ENERGY SITES		
South-west of Islay	Estimated annual mean power of ≤ 5.9kW/m 30 to 50 m deep ridge in west 100m deep in east Sands and gravels	Large port facilities are not close by Grid requires upgrading	Navigational concerns from MoD Close to busy shipping route	Extensively designated shoreline Near to SAC for seals Area of search for SPA Close to MEHRA In-combination effects (proposed offshore wind farm) Nursery ground for many commercial species	Numerous wrecks around headlands SAMs on the coast
West of the Mull of Kintyre	Estimated annual mean power of ≤ 3.1kW/m Steeply shelving seabed to 100m Sands and gravels	Close to suitable ports Grid reinforcements required	Navigational issues with MoD and shipping industry Adjacent to IMO route and busy shipping route Proposed offshore wind site to the north	Area of search for SPA Possible in-combination effects with proposed offshore wind site Nursery and spawning ground for some commercial fish	Wrecks off the southern tip of the peninsular SAMs on the coast Sailing routes cross the site
			WAVE ENERGY SITES		
West of Colonsay	Estimated annual mean power of ≤ 24.6kW/m in offshore area Gently sloping seabed to 50m Rock, sands and gravels	Far from large ports Grid requires upgrading to accommodate additional transmission	Naval shipping and submarine activity	Many designated sites onshore Close to MEHRA Nursery and spawning grounds for many species of commercial fish	Sailing routes transit the site

West of Tiree	Estimated annual mean power of ≤ 27.9kW/m in offshore area Rock, muds, sands and gravels Slopes gradually to 50m depth 10km from shore	Lack of large ports Requirement for grid re-enforcement	MoD exercise area Commercial fishing grounds Windfarm site proposed to the south-west of the site	A number of onshore sites designated for conservation Frequent sightings of basking sharks and cetaceans Search area for further SPAs Sensitive area for commercial fish	A number of SAMs located on shore Beaches used for windsurfing events Sailing route crosses length of site
West of South Uist and Barra	Estimated annual mean power of ≤ 43.0kW/m in offshore area Solid rock 20 to 50m depth up to 7km from shore	Limited access to grid but may benefit from improvements to grid on Lewis No large ports in close proximity to the area	Much of site within an MoD missile firing range Commercial fishing grounds for shellfish	Number of designated sites located both marine and coastal. Nursery grounds for commercial fish Important area for seabirds and potentially for cetaceans	Many SAMs onshore Sailing routes transit the site
West of Harris and North Uist	Estimated annual mean power of ≤ 37.8kW/m in offshore area Predominantly solid rock with gravels and sands in north Most of inshore area under 50m depth	Limited access to grid but may benefit from improvements to grid on Lewis Nearest large port is Stornoway	Partly within an MoD firing range Commercial fishing for shellfish	Number of designated sites both marine and coastal including large NSA Area of search for future SPA Noted area for basking sharks and cetaceans Nursery and spawning grounds for many commercial fish	Many SAMs on the coastline RYA sailing area and sailing routes
West of Lewis	Estimated annual mean power of ≤ 42.4kW/m in offshore area Rock, sands and gravels Less than 50m depth 5km from shore	Improvements to the grid are in progress but may require more capacity Nearest large port is Stornoway	Heavily fished area especially shellfish	Designated sites both marine and coastal Sensitive site for many commercial fish	Many SAMs on the coastline RYA sailing routes transit the site

West of Shetland	Estimated annual mean power of ≤32.8 kW/m Rock, sands and gravels Depth of 30 to 50m within 10km of shore	Connection to UK grid would require installation of proposed interconnector Potentially suitable ports nearby such as Sullom Voe, and Scalloway.	Important area for shellfish, demersal and pelagic fisheries	Many designated sites for conservation both coastal and marine Area of search for future SPA Important area for protected species (seabirds, cetaceans, seals) MEHRA Sensitive site for commercial fish species	RYA sailing area Some SAMs on the coast Many wrecks
South-west of Shetland	Estimated annual mean power of ≤ 31.9kW/m offshore Rock, sands and gravels Depth under 50m 2.5km from shore	Connection to UK grid would require installation of proposed interconnector. Site is closer to existing grid connections than in north-west Mainland Small port of Scalloway close by and Lerwick ≤ 40km away.	Commercial fishing activity Coastal shipping route Fish farms in north	National Scenic Area Close to SPA of Sumburgh Head Important area for seabirds and area of search for SPA Sensitive area for commercial fish	RYA sailing area

Abbreviations:

IMO	International Maritime Organisation
MEHRA	Marine Environmental High Risk Area
MoD	Ministry of Defence
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monument
SPA	Special Protection Area

Overall, the areas that appear to most closely meet the requirements for avoidance of environmentally sensitive areas and minimisation of impact on other users of the seas are the wave power areas west of particularly west of Lewis and west and south-west of Shetland (Fig. S2). Further discussions with MoD are necessary to ascertain whether there may be opportunities for tidal power development to the south-west of Islay and the Mull of Kintyre. Additional studies of the acoustic characteristics of devices may help to clarify whether these significant tidal resources could be utilised in the future.

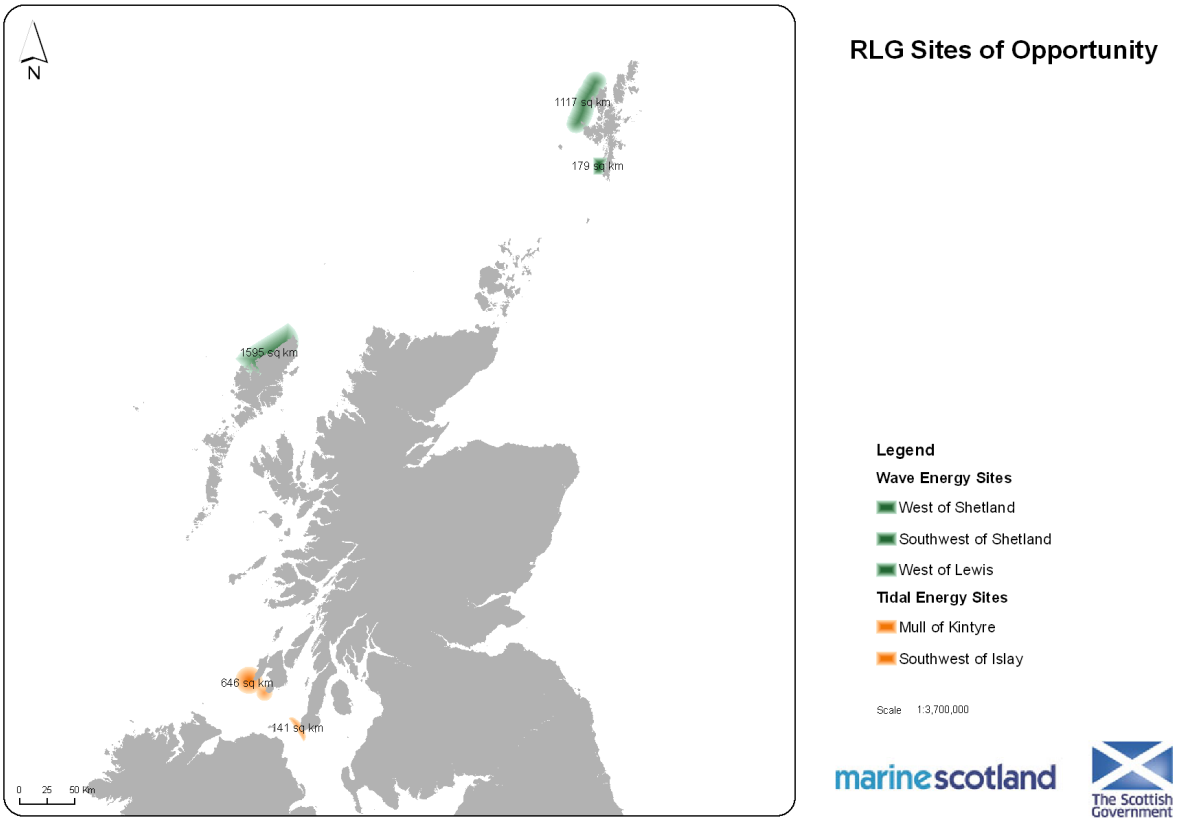

Figure S2: Sites of opportunity for wave and tidal stream power development in the Further Scottish Leasing Round (Saltire Prize projects) identified in the Regional Locational Guidance (source: OS, MSS and TCE).

The Saltire Prize Programme

Further Scottish Leasing Round (Saltire Prize projects) Regional Locational Guidance

Marion Harrald, Catarina Aires and Ian Davies

1 Introduction

The Saltire Prize Programme was launched by Scottish Government (SG) in order to stimulate innovation across the world that will lead to delivery of commercial scale wave or tidal stream energy technology. The prize of £10 million will be awarded to the team that can demonstrate a commercially viable wave or tidal stream energy technology that achieves the greatest volume of electrical output of at least 100 GWh over a continuous two year period ending no later than 30 June 2017 using only the power of the sea. To give opportunities for companies to compete for the Saltire Prize, the Scottish Government has been working in partnership with The Crown Estate (TCE), to develop a further leasing round for wave and tidal stream energy projects. The first step is to locate suitable areas to deliver the leasing round within the short time-scale of the programme. These areas must not only possess sufficient wave or tidal stream energy, but also have the necessary infrastructure or potential to install it, avoid environmentally sensitive areas and minimise impact on other users of the seas.

An initial scoping study for areas was conducted using TCE's Marine Resource System (MaRS), which uses Geographical Information Systems (GIS) to produce models of resource location and levels of constraint in a given region. Details of this exercise are described in the Further Scottish Leasing Round (Saltire Prize projects): Scoping Study (Harrald and Davies, 2010), which was made available for comment from 23 March to 28 May 2010. Following responses to the Scoping Study consultation, we have also included a further wave energy site off the south-west of the Shetland Isles. In this regional locational guidance document, we consider the two tidal stream energy sites, the four wave energy sites proposed initially and the additional wave site arising from the consultation. These are illustrated in Figure 1 and include the following locations:

Tidal stream energy sites

- West of the Mull of Kintyre
- South west of Islay

Wave energy sites

- West of Colonsay
- West of Tiree
- West of the Outer Hebrides, considered in three parts:
    - west of South Uist & Barra,

- west of Harris and North Uist, and
- west of Lewis

- West of Shetland
- South-west of Shetland

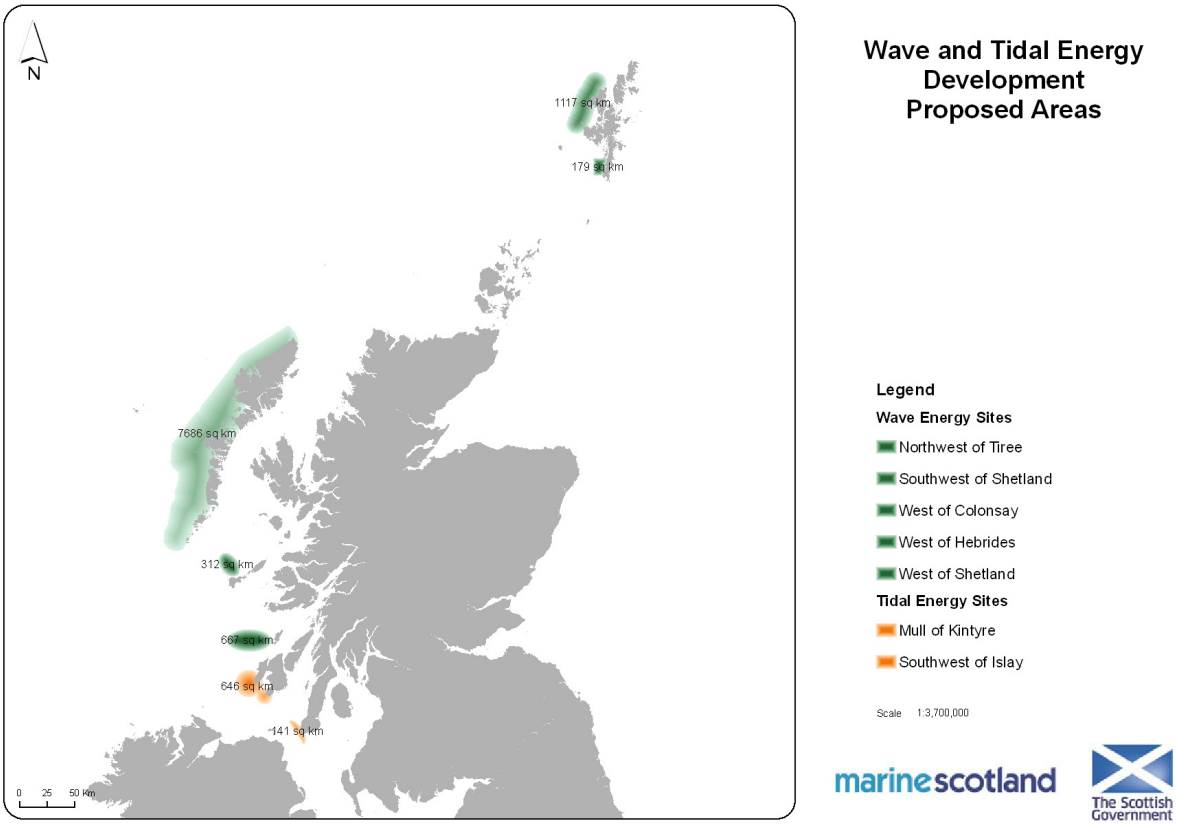

Figure 1.1. Location and area (km^2) of sites considered for wave and tidal stream energy development under the Further Scottish Leasing Round (source: OS, MSS and TCE).

We use GIS data, supplemented by information from stakeholders and consultees, to explore these sites at a finer scale than was possible in the initial scoping exercise. We investigate the level of the resource, infrastructure and constraints in the environment, commercial use, the MoD, recreation and cultural heritage. The information given is limited to the boundaries of the Saltire Prize sites, as shown in Figure 1, and adjacent areas if there is a possibility of interactions. Certain areas with natural heritage conservation designations, which were excluded from selection in the scoping study (SACs, SSSIs, NNR, LNR and Ramsar Sites), are illustrated as 'protected sites' in the figures.

This document does not discuss the potential impact on the ecology, geomorphology or anthropogenic factors; rather it highlights potential interactions that may require consideration at the planning and consenting stage. We do not attempt to cover all aspects that should be considered in an Environmental Statement or Appropriate Assessment and generally do not provide sufficient detail to meet the requirements of such documents. Environmental impacts of developments will be dependent on the design and size of the device(s), the site location, time of year and use of the surrounding waters. Guidance on the

preparation of Environmental Statements and Appropriate Assessments is being prepared for Scottish Government, and will include factors as discussed in documents such as the Scottish Marine Renewables SEA (2006), the EMEC EIA Guidelines (2008) and reviews such as Shields et al. (2009), Dolman & Simmonds (2010), etc.

1.1 Data Sources

The datasets used in this exercise are mostly from third parties with some produced in-house by MSS or TCE. The origin, copyrights and a description of all of the datasets are presented in Annex I. The data quality is highly variable in terms of accuracy and spatial resolution. Some data, such as the shipping density, are based on exact counts and positions from instrumentation on board ships, while others, such as the wave and tidal resources, are largely modelled and averaged for 50% of the water column. Most of the data obtained are Scotland-wide but some are regional. In the case of datasets illustrating species distribution, it is important to understand which datasets originate from systematic surveys in which the data have been effort-corrected and which are from opportunistic sightings. For example, the cetacean distribution data have been effort corrected and originate mostly from systematic surveys but do include opportunistic records. However, datasets such as the UK Biodiversity Action Plan (BAP) priority species, basking sharks and marine turtles, originate from opportunistic sightings and indicate presence of a species and not absence. The time period over which these datasets have been compiled is highly variable. The UK BAP species and habitats data layers have been limited to records over the past 30 years (from 1980), whereas the shipping data is averaged over the past year (2009-10). Full details are contained within the table in Annex I and the sources identified therein. The information presented in this document is not a substitute for survey work undertaken on behalf of the developer.

2 Tidal Stream Energy Sites

2.1 South-West of Islay

Summary

The scoping study identified two areas of tidal resource off headlands in the south-west of Islay. The areas are considered together in this document. The region proposed contains a high level of tidal resource with an estimated annual mean of up to 5.9 kW/m. However, there are a number of serious concerns with this site. Firstly, there is concern from the Ministry of Defence that tidal devices may interfere with military operations. Secondly, the supporting infrastructure in terms of power cables and substations may need to be improved before development can take place in this region. Thirdly, this is also a potentially difficult area to work in; being close to a busy shipping lane through the North Channel and having strong currents and prevailing winds blowing onto a coastline of exposed headlands. In addition to these, there are also a number of industrial and environmental constraints which should be taken account of. As already mentioned this area is subject to heavy shipping traffic although this may only be an issue when deploying/servicing the device as most tidal devices are anchored to the seabed and would thus not necessarily impede shipping movements. Parts of the site harbour valuable shellfish fisheries but these do not coincide with areas of high tidal interest. The site is also close to a Special Area of Conservation (SAC) for seals and it is under consideration as a future Special Protection Area (SPA). The habitats within the sites of interest are also protected under the UK BAP. In particular the area may contain species and habitats of interest which fall under the category of 'tidal rapids' under the UK BAP. There is also potential for environmental in-combination effects with the planned offshore windfarm to the north-west of the site.

2.1.1 Technological Constraints

2.1.1.1 Size of Tidal Resource

The scoping study identified two areas of tidal resource off headlands in the south-west of Islay. The areas are considered together in this document. There is wide variation in power produced between spring and neap tides (Fig. 2.1.1). Off the Oa peninsular (the south-east headland) for instance, the estimated power available during springs is 22.5 kW/vertical m^2 of water column compared to 3.6 kW/m^2 during neaps. The estimated annual mean resource in these areas is up to 5.9 kW/m^2 off the Rinns of Islay where the depth is 30 to 50 metres, and up to 5.7 kW/m^2 south-west of the Oa peninsular where the depth is 50 to 100 metres. The depths are shallower (between 30 and 50 m) immediately south of the Oa peninsular although the tidal resource drops to an annual mean of 1.9 kW/m. There are high tidal stream velocities offshore of the Rinns of Islay and the Oa peninsular (Fig.s 2.1.2-3). The tidal streams vary between 3.6 and 1.1 m/s during springs and 1.9 and 0.6 m/s during neaps. The spring tidal range varies between 2.6 m in the north-west of the site to approximately 1.5 m elsewhere.

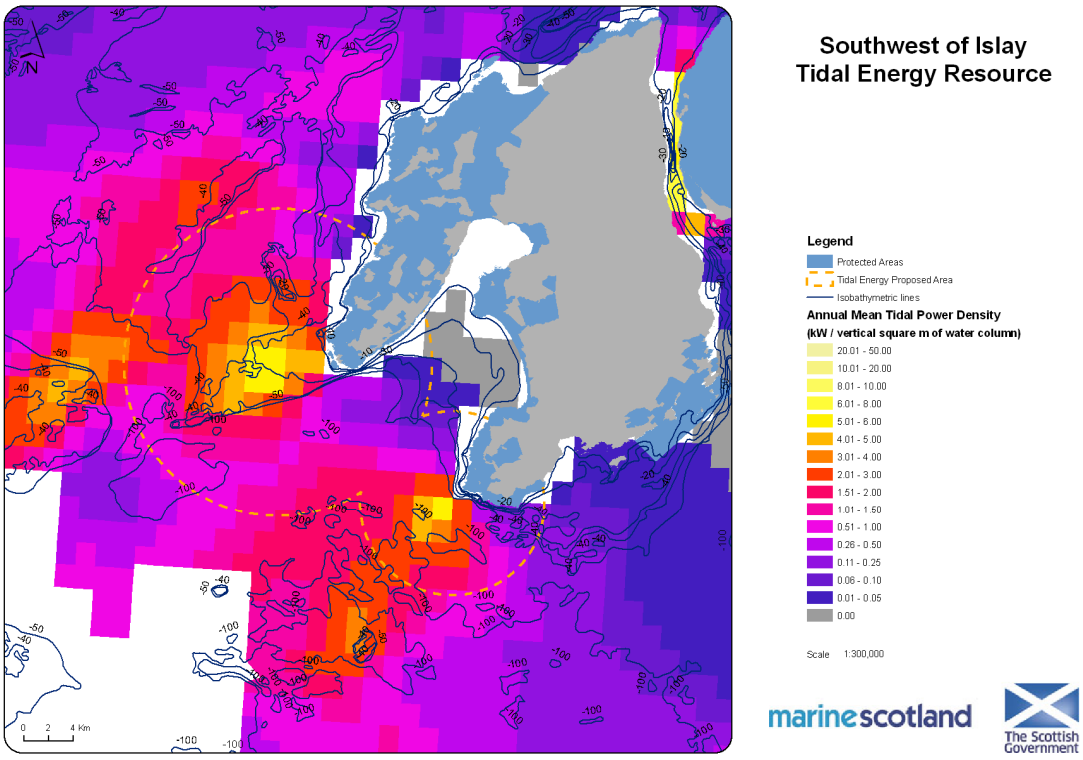

Figure 2.1.1: South-west Islay: Annual mean tidal power density (source: OS; DTI - © Crown Copyright. All rights reserved 2008; BGS - Reproduced with the permission of the British Geological Survey ©NERC. All rights Reserved)

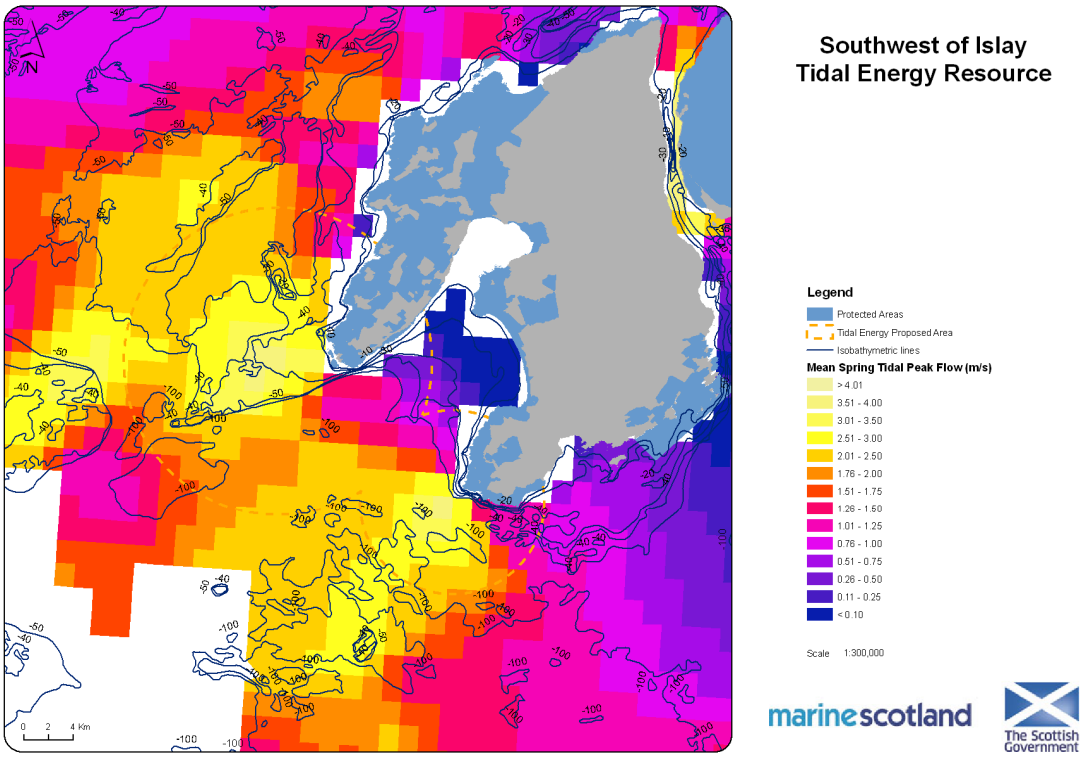

Figure 2.1.2: South-west Islay: Mean spring tidal peak flow (source: OS, DTI, BGS)

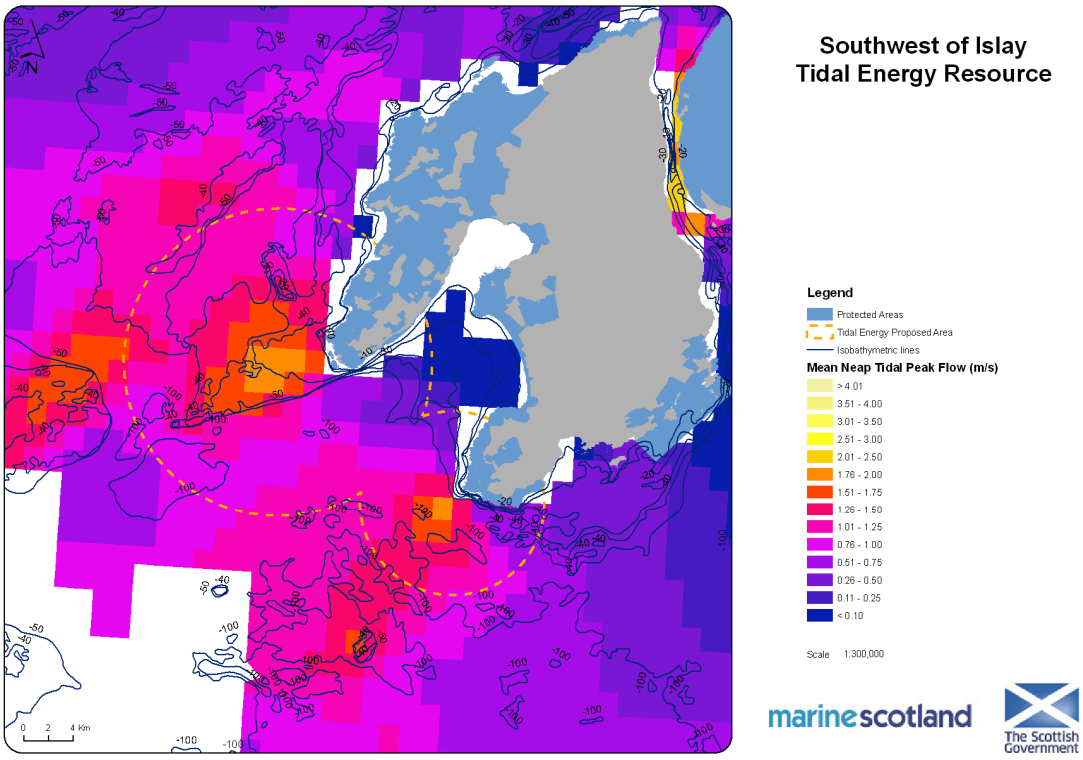

Figure 2.1.3: South-west Islay: Mean neap tidal peak flow (source: OS, DTI, BGS)

2.1.1.2 Wave Height and Period

The annual mean wave height in the areas of peak tidal resource is 2.0 m off the Rinns of Islay and the Oa Peninsular (Fig. 2.1.4). The wave height varies seasonally between 1.3 and 2.6 m off the Rinns of Islay (summer and winter means respectively) and between 1.3 and 2.5 m off the Oa Peninsular. The annual mean wave period varies from 6.8 s off the Rinns of Islay to 6.6 s off the Oa Peninsular.

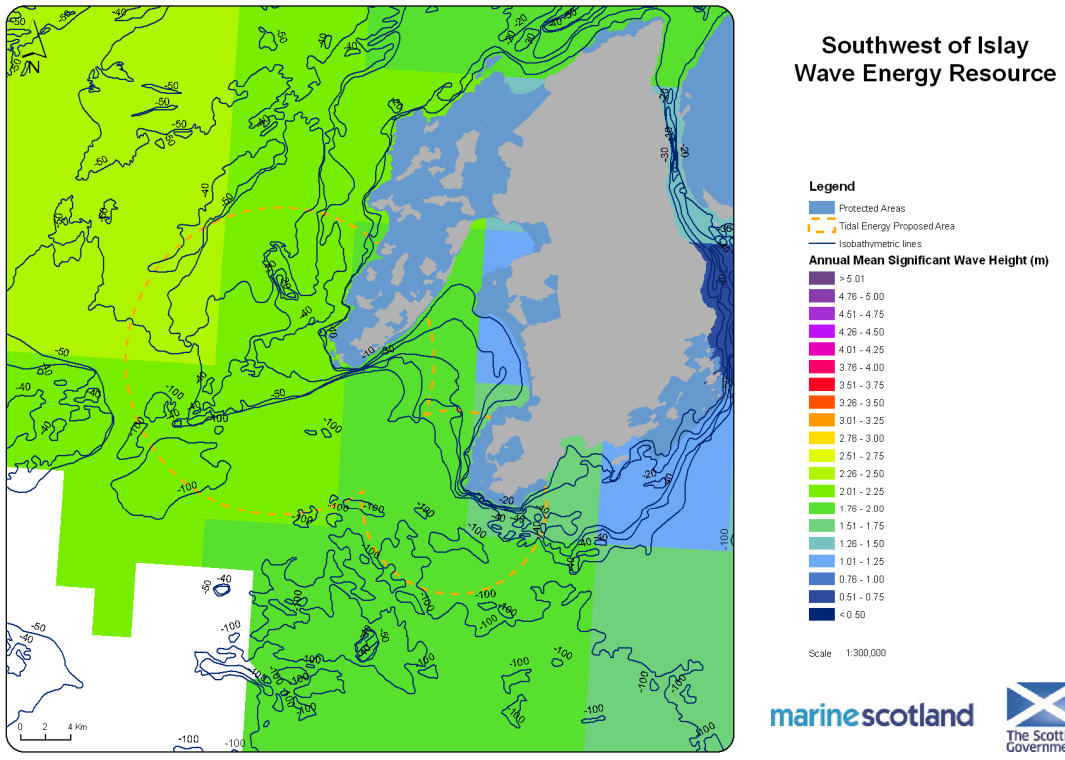

Figure 2.1.4: South-west Islay: Annual mean significant wave height (source: OS, DTI, BGS)

2.1.1.3 Bathymetry and Seabed

The seabed off the south-west headland (the Rinns of Islay) shelves steeply from 10 to 30 m (Fig. 2.1.5). There is a ridge at a depth of 30 metres that projects south-west from the headland and slopes to 50 m on the northern side and 100 m on the southern side. Off the south-east headland (the Oa), the seabed drops to a greater depth (50 m) immediately off the coast and to 100 metres 2 km from the coast. The ridge protruding from the Rinns of Islay is composed of gravel. The seabed off the Oa Peninsular is slightly sandier progressing to gravel 4.5 km offshore. In between (Loch Indaal) and offshore from the two headlands, the seabed is composed of sand and sandy gravel. To the west of the Rinns of Islay and to the south-east of the Oa peninsular are areas of sand, gravelly sand and sandy gravel.

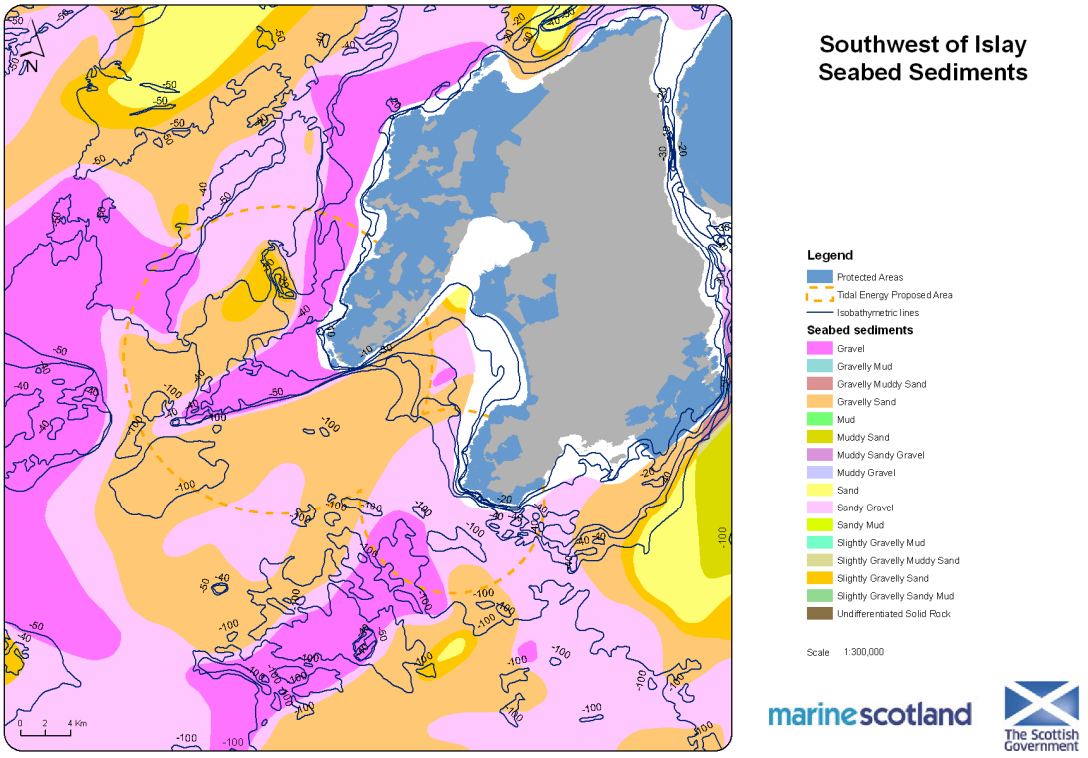

Figure 2.1.5: South-west Islay: Bathymetry and seabed sediments (source: OS and BGS - Reproduced with the permission of the British Geological Survey ©NERC. All rights Reserved)

2.1.1.4 Existing Infrastructure

Port and harbour access: There are two ports within 45 km of the site, Port Ellen and Port Askaig (Fig. 2.1.6). These are ferry terminals and suitable for vessels of up to 80 m in length. Port Askaig was recently re-developed and there are plans to expand Port Ellen (Islay Energy Trust, pers comm.). In addition, there are two smaller harbours at Portnahaven and Bowmore. The site of Campbeltown/Machrihanish, over 75 km away, has been identified as a potential location for manufacturing of wave and tidal devices. Larger port facilities are located on both sides of the North Channel; the Ports of Londonderry and Larne in Northern Ireland are ~80 km away and the ports in the Clyde (e.g. Port Glasgow, Greenock, Hunterston and Ardrossan) 100 to 180 km away.

Grid connection: Scottish and Southern Energy (SSE) states that there is no existing grid capacity to accommodate new power generation. They propose the establishment of two 132 kV subsea cable circuits between South Kintyre and Hunterston, establishment of a new 132 kV switching station at Crossaig Forest on Kintyre and rebuilding of the existing Crossaig to Carradale line with a double circuit 132 kV overhead line. Subject to consents, the estimated completion date for this is 2013 and would generate 250 MW of incremental export capacity, although 100 MW of this is already committed.

There are no cable landings within the vicinity of this site. The nearest cable landings are Girvan, Troon and Ardrossan (between 100 and 120 km away). The nearest substation is approximately 250 km away. It is unlikely that these facilities would be attractive to potential developers. However, there is an area to the west of Islay which is in the process of being leased for offshore wind and thus there may be potential for sharing of new assets and future grid improvements. Developers may also consider connection to Northern Ireland.

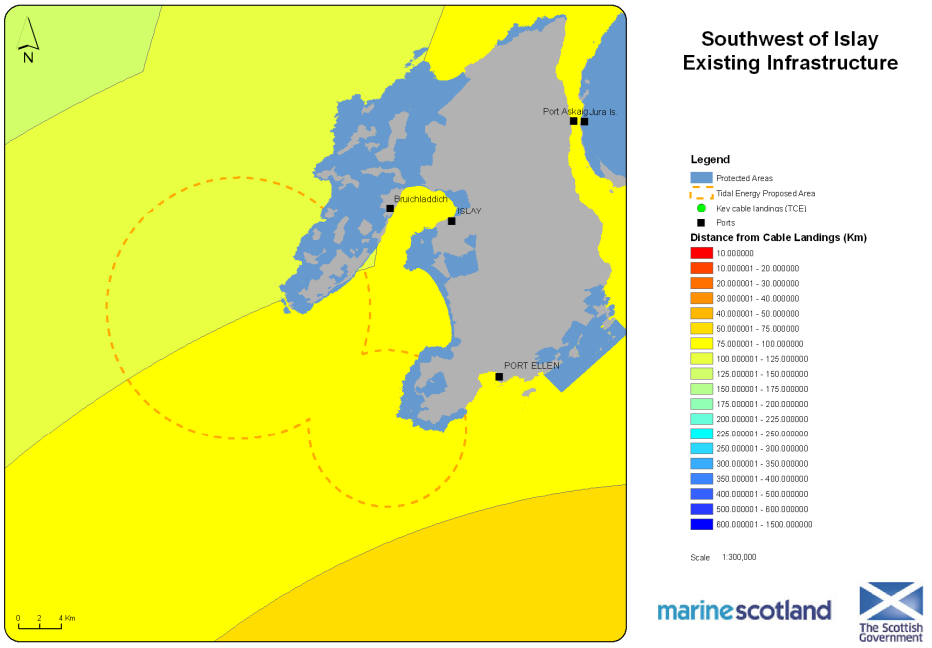

Figure 2.1.6: South-west Islay: Existing infrastructure (ports and cable landings) (source: OS; TCE - © Crown copyright 2006; DECC)

2.1.2 Other Constraints

2.1.2.1 Commercial Uses

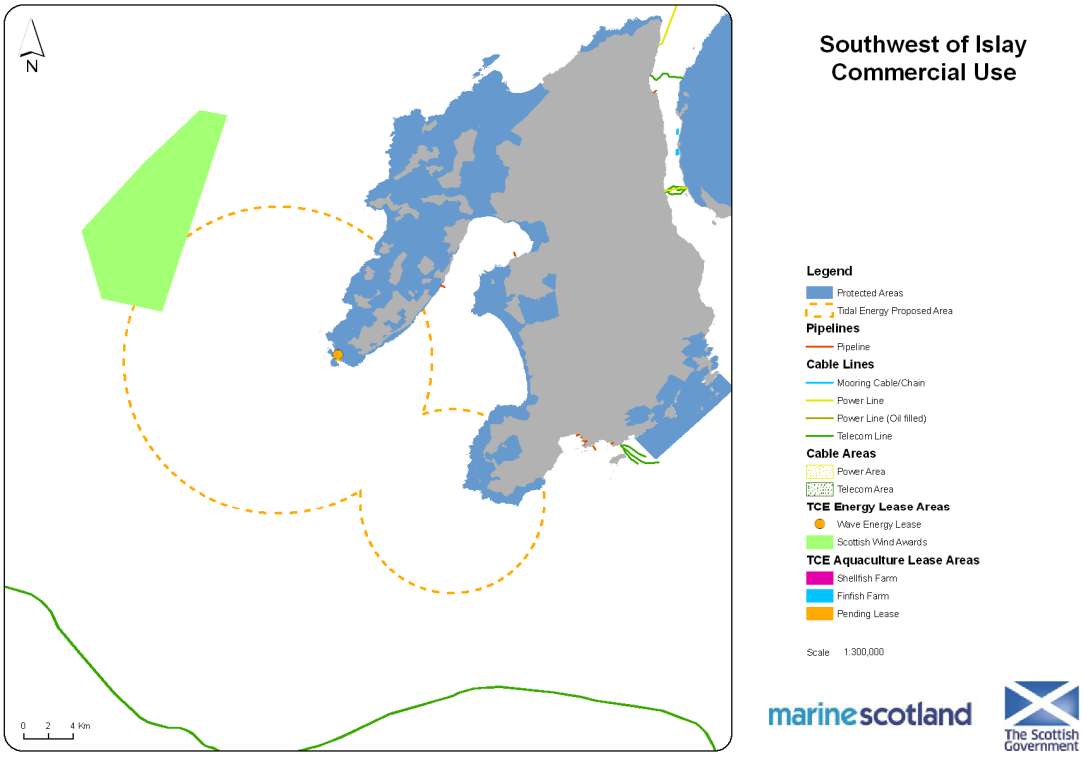

Figure 2.1.7: South-west Islay: Existing commercial uses (source: OS, SeaZone Hydrospatial, TCE, Kingfisher)

The Crown Estate energy leases: - SSE Renewables Holdings (UK) has an exclusivity agreement with TCE for the development of the proposed Islay Offshore Wind Farm (Fig. 2.1.7). The proposal is for an array of 138 x 5 MW turbines, which would provide an installed capacity of 690 MW.
- Wavegen has installed the Limpet (Land Installed Marine Powered Energy Transformer), a shoreline energy converter sited near Portnahaven, on the Rinns of Islay.

Fish / shellfish farm leases: there are none in this site.

Cables and pipelines: there are none in this site

2.1.2.2 Military

The MoD has expressed serious concern that tidal devices in this area may interfere with their submarine/shipping activities as are marked on the map (Fig. 2.1.8).

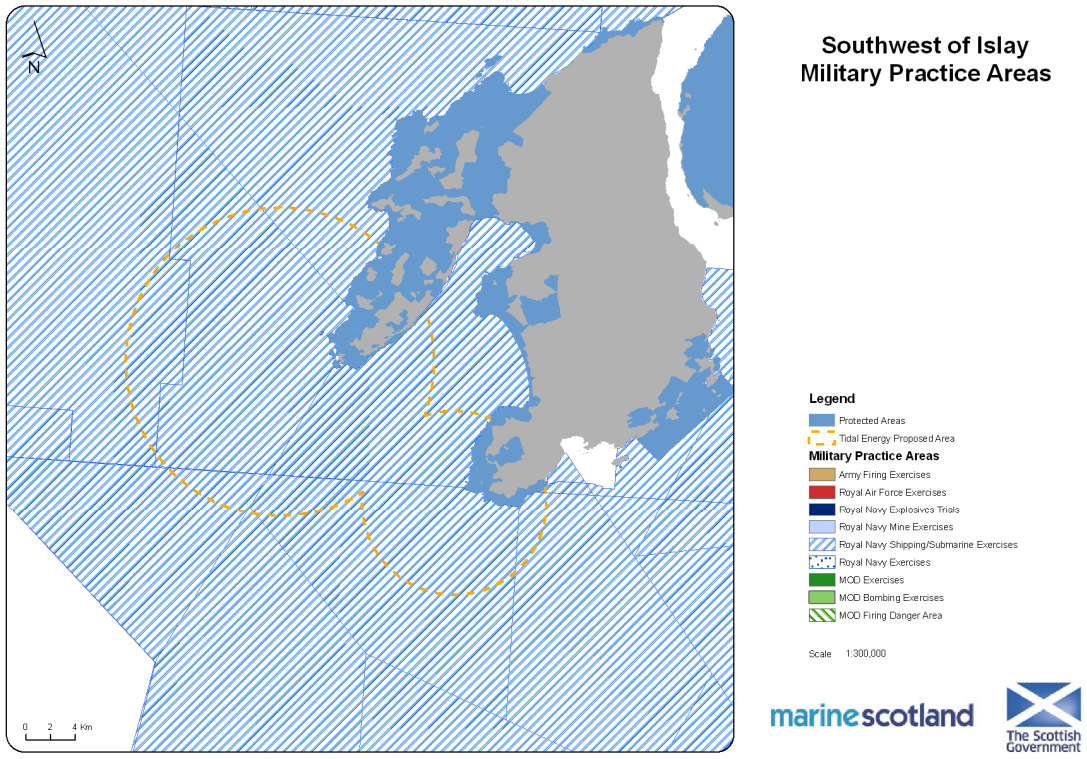

Figure 2.1.8: South-west Islay: Military practice areas (source: OS, SeaZone Hydrospatial)

2.1.2.3 Shipping

There are no ferry routes through the site (Fig. 2.1.9). However, service boats to the mainland may cross the ferry route between Kennacraig on the mainland and Port Ellen on Islay. The proposed area is on the edge of the North Channel, the main shipping route north from the Clyde and the Irish Sea. Over 300 ship movements (cargo vessels, tankers and ferries) per year pass through this site at a distance of 3 km south of Portnahaven and 6 km south of the Oa. However, less than 20 movements per year transit the site within 1-2 km from shore. Much of the west coast of Islay has also been identified as a Marine Environmental High Risk Area (MEHRA). MEHRAs have been classified to attempt to limit the risk presented by ships in environmentally sensitive areas, particularly to mitigate risk from pollution, e.g. oil spillage. Mariners are advised to take extra care in these areas.

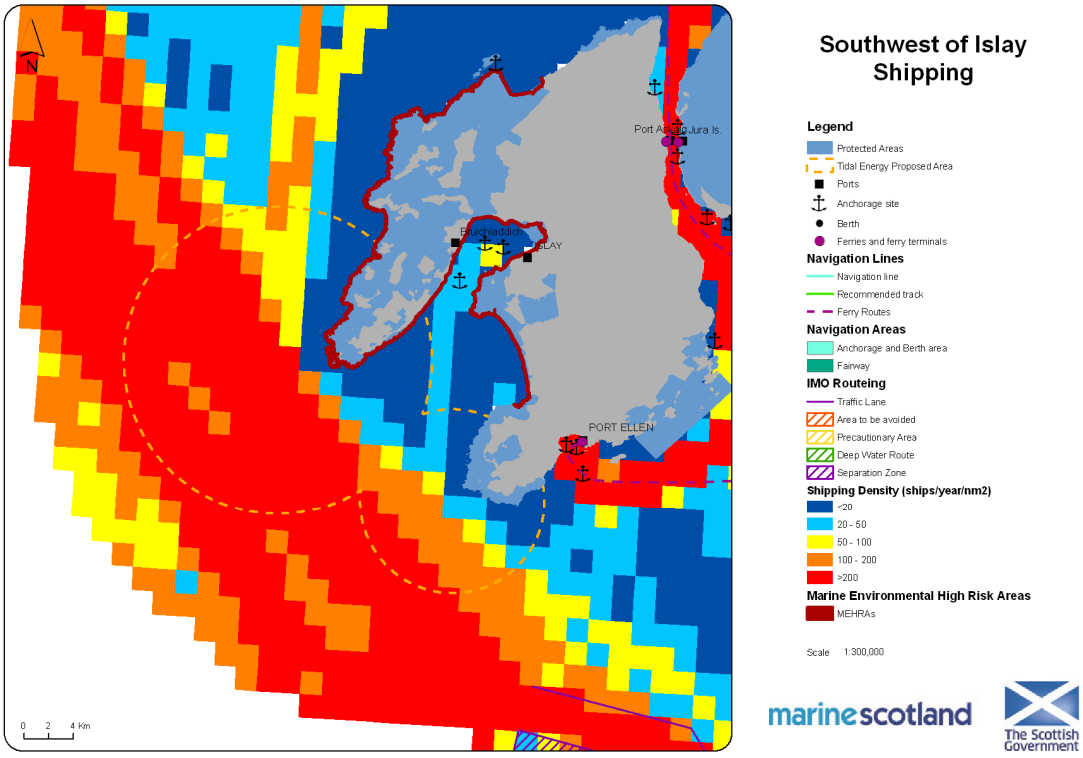

Figure 2.1.9: South-west Islay: Shipping (source: OS, SeaZone Hydrospatial, DECC, Anatec Ltd - data provided by Anatec Ltd in March 2010 under licence to Marine Scotland. Source data reproduced with the permission of Anatec Ltd)

2.1.2.4 Commercial Fishing

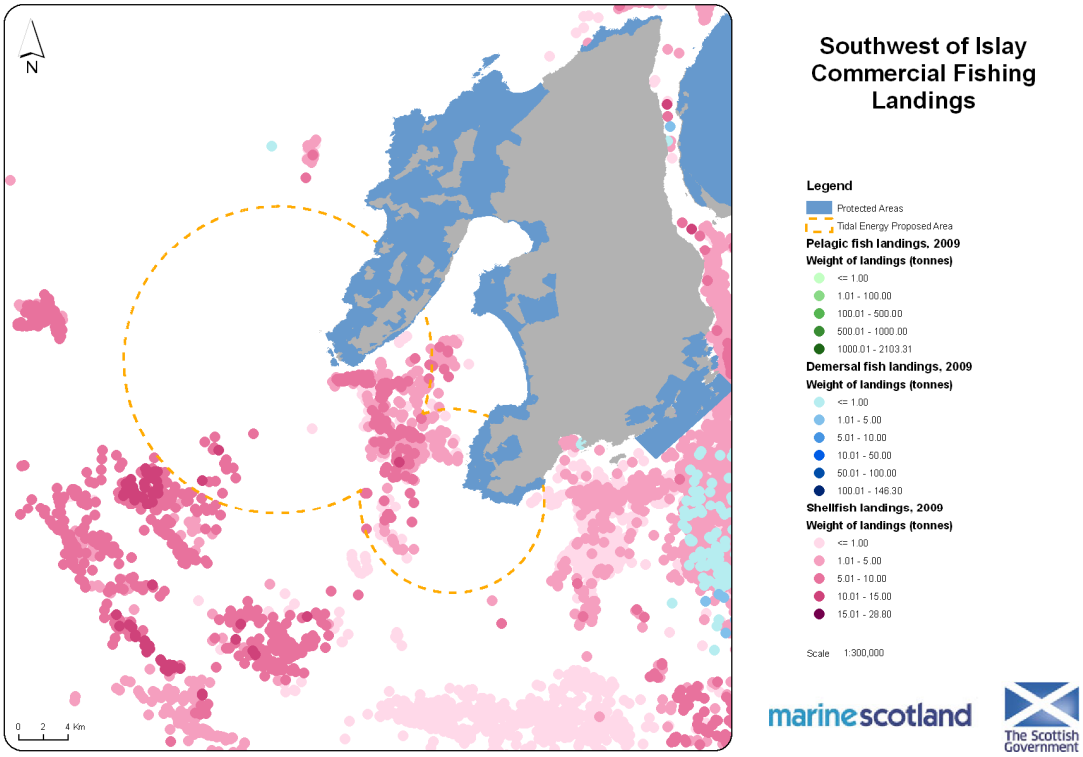

Figure 2.1.10: South-west Islay: Commercial landings of pelagic and demersal fish and shellfish (tonnes) (source: OS, MSS)

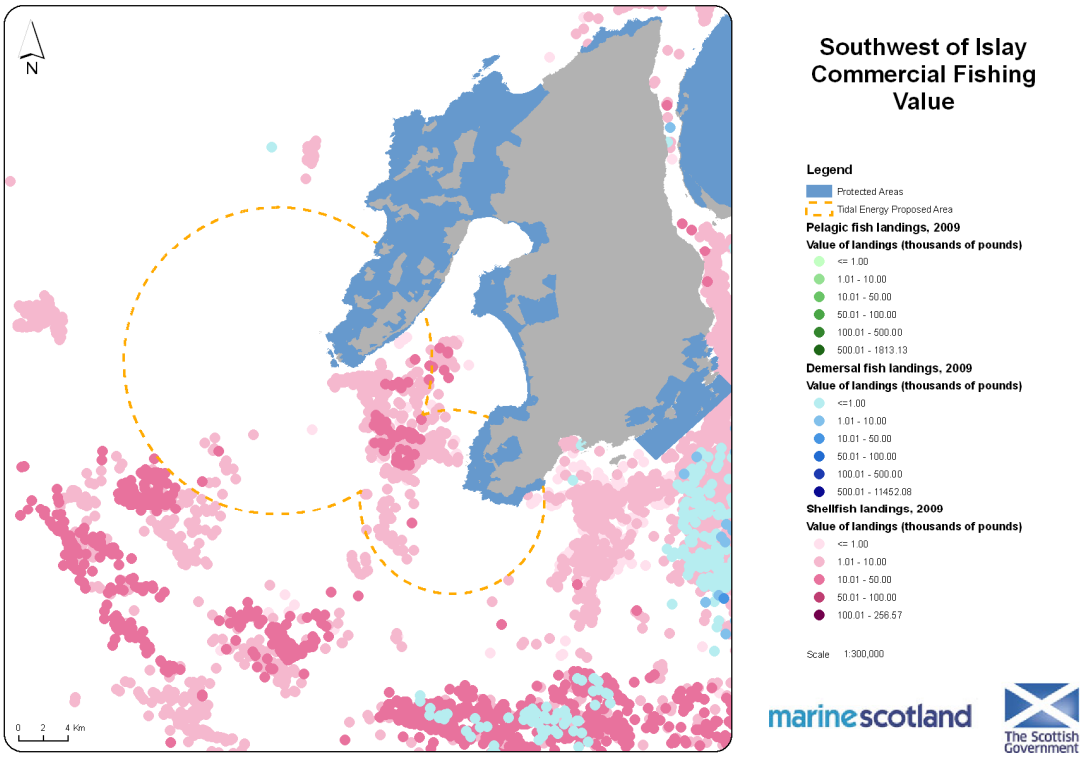

Figure 2.1.11: South-west Islay: Commercial landings of pelagic and demersal fish and shellfish (value) (source: OS, MSS)

The data from boats ≥ 15 m for 2009 suggest that there is an important fishery for scallops in this site, of up to 15 tonnes (i.e. around £100 000) per trip (Figs. 2.1.10-11). The most productive ground appears to be mostly between the two headlands and outside the main areas of tidal resource off the headlands. Parts of the site are also important for crab and scallop fishing by smaller vessels (MSS, personal communication).

2.1.2.5 Environment

Designated Areas

The proposed site does not overlap with areas designated for conservation in the marine environment (Fig. 2.1.12). However, the South-East Islay Skerries SAC, the qualifying feature of which is a colony of common seals (*Phoca vitulina*), is 9 km away and seal migration and foraging through the site may require consideration. There are also potential effects of locating infrastructure on the extensively designated western coastlines of Islay. The proposed site borders two SPAs which support aggregations of breeding and non-breeding birds (the Rinns of Islay and the Oa peninsular) and two SACs (the Rinns of Islay and Eilean na Muice Duibhe). The loch in between the two headlands, Loch Indaal, is also an area of search for future marine SPAs.

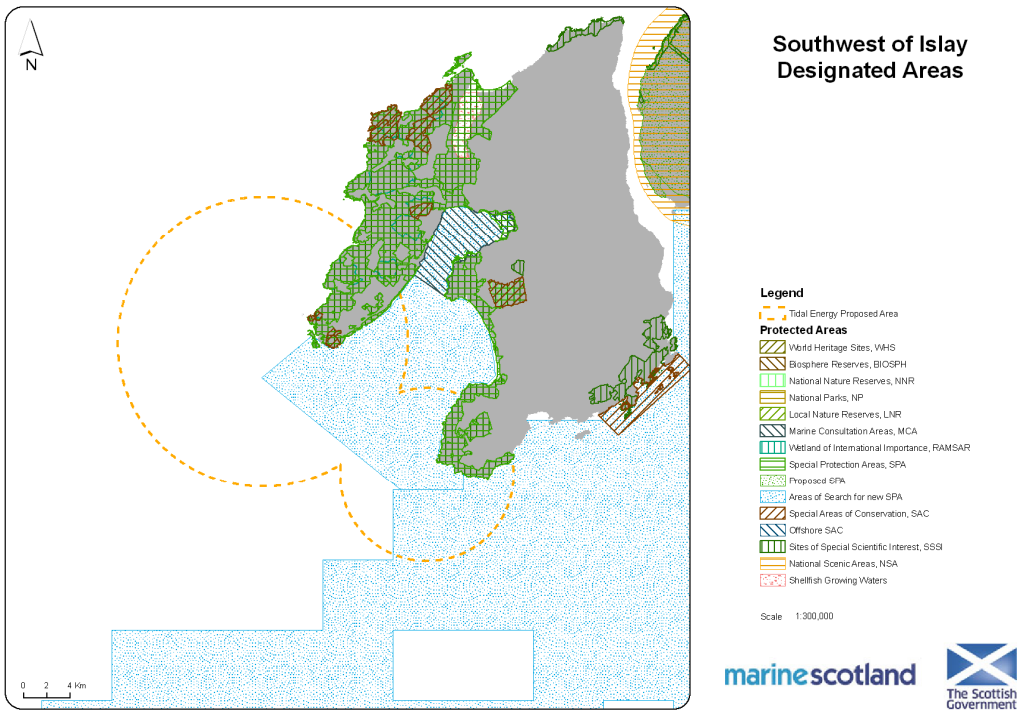

Figure 2.1.12: South-west Islay: Designated areas (source: OS; SeaZone Hydrospatial; SNH - © Crown copyright. All rights reserved. Scottish Natural Heritage, 100017908 [2010]; JNCC - © Crown copyright and database right [2010] All rights reserved. Ordnance Survey Licence number 100017955; SG)

Protected Species

Seabird distribution is variable with greater numbers in the south-west of the site (Fig. 2.1.13). The coastline contains numerous seabird colonies, particularly around the headlands and within Loch Indaal. Notable sites for birds are Loch Indaal for geese, seaducks and waders and the Oa Peninsular for golden eagle (*Aquila chrysaetos*), chough (*Pyrrhocorax pyrrhocorax*) and corncrake (*Crex crex*). Harbour porpoise (*Phocoena phocoena*) is recorded within this site but overall abundance of cetaceans is relatively low (<1 sighting per hour) (Weir et al., 2001; Cetacean Atlas, 2003) (Fig. 2.1.14). Basking sharks (*Cetorhinus maximus*) are sighted occasionally (<40 sightings) within the region, while otters (*Lutra lutra*) are regularly observed here.

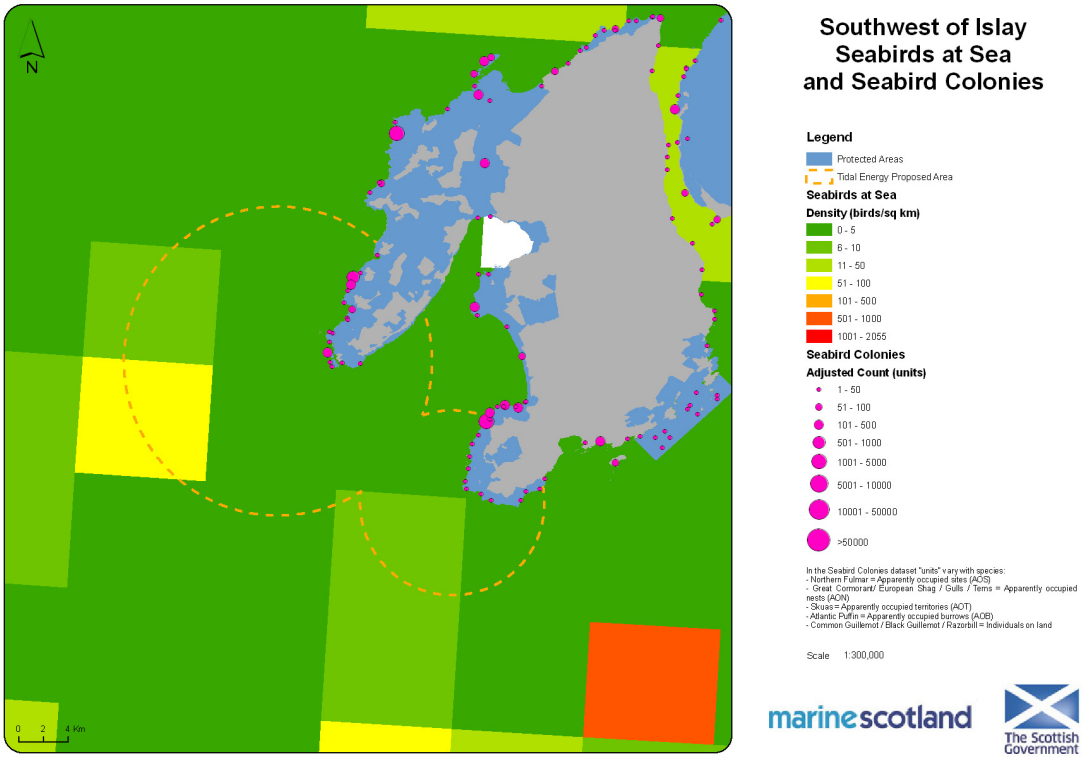

Figure 2.1.13: South-west Islay: Seabirds at sea and seabird colonies (source: OS, JNCC)

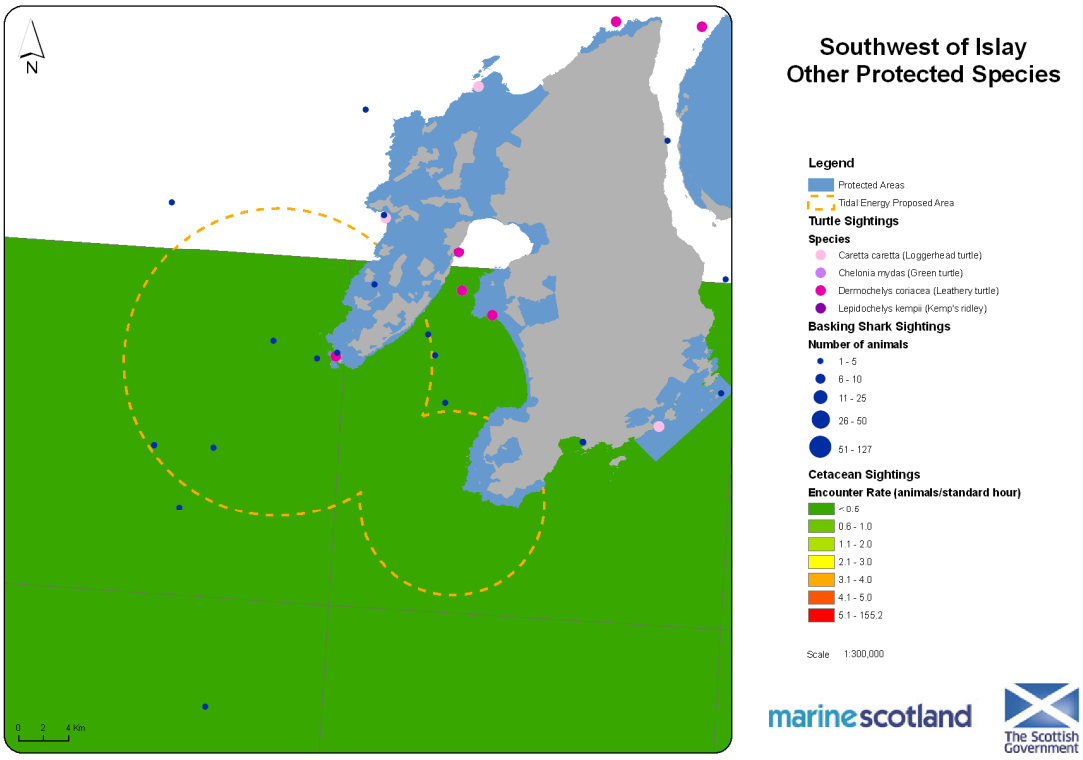

Figure 2.1.14: South-west Islay: Cetaceans and turtles protected as European Protected Species under the EC Habitats Directive (2000) and basking sharks protected under the Wildlife and Countryside Act (1981) (source: OS; NBN; MCS; JNCC - the JNCC Support Co., Sea Mammal Research Unit and Sea Watch Foundation bear no responsibility for any further analysis or interpretation of that material, data and/or information)

Protected Habitats

Some of the habitats in this region qualify for protection under the UK BAP. The area is characterised by its strong currents and thus habitats may qualify as a 'tidal rapid'. The seabed encircling most of the two headlands (in the south-west and the Oa Peninsular) is composed of infralittoral coarse sediment, which comes under the UK BAP habitat term of 'sublittoral sands and gravels'. Beyond this, the seabed is composed of coarse sediment, which also falls under the same UK BAP habitat heading. There are also seagrasses (*Zostera marina* and *Z. noltei*) in the more sheltered bays on the south coast of Islay and horse mussel beds (*Modiolus modiolus*) have been recorded in the north-west of the site.

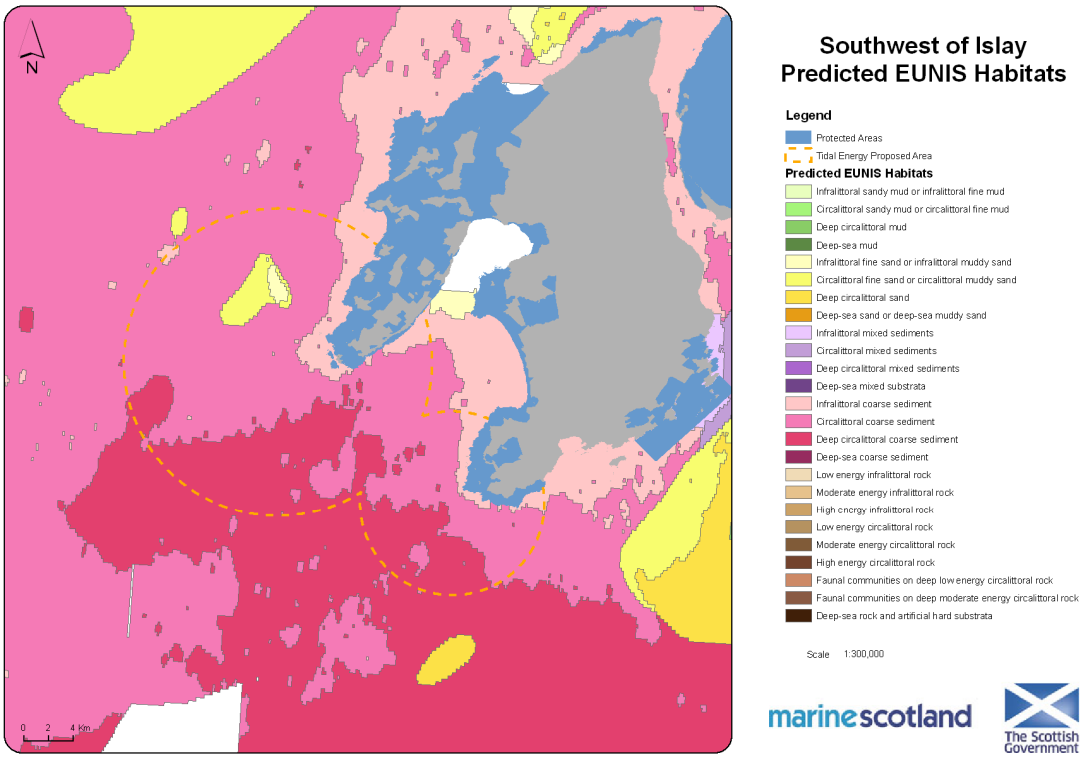

Figure 2.1.15: South-west Islay: Seabed habitats (predicted by EUNIS) (source: OS; JNCC - Information contained here has been derived from MESH Consortium webGIS data (www.searchmesh.net) which received funding from the INTERREG IIIB NEW programme)

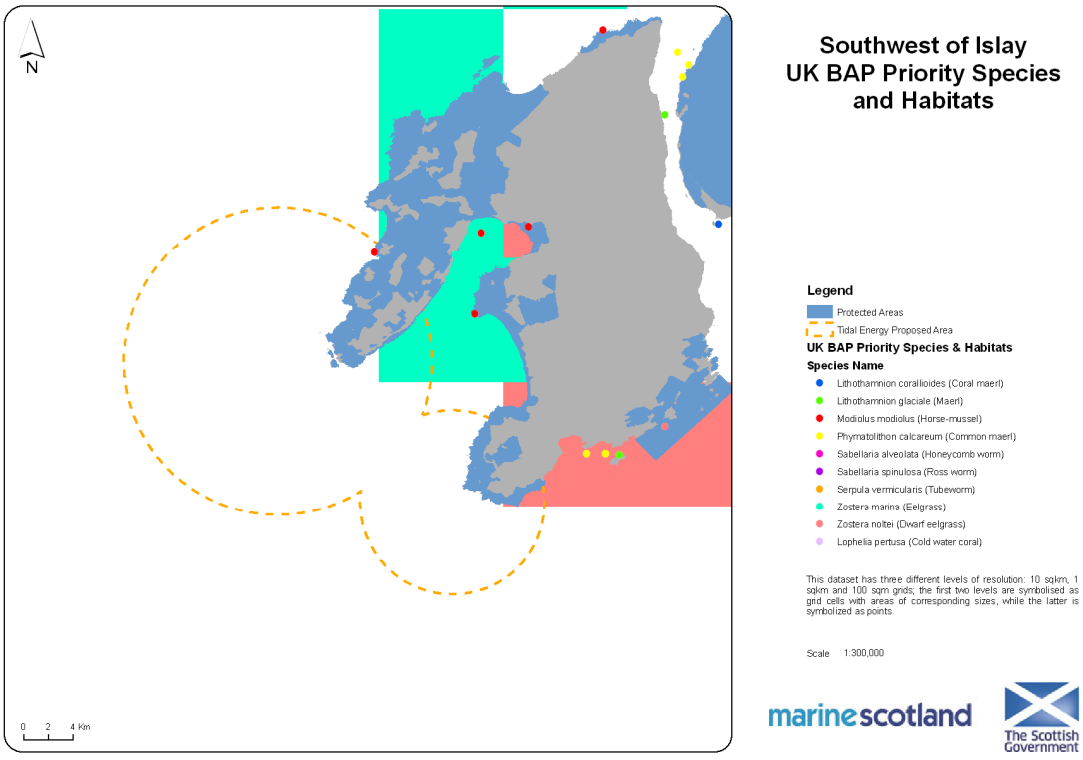

Figure 2.1.16: South-west Islay: UK BAP Priority species and habitats (source: OS, NBN)

Fish Sensitivities

The site has been identified as being a sensitive area for fish during the winter months. It has also been classified as a nursery ground for saithe, cod and *Nephrops* and as a spawning ground for *Nephrops*, plaice and sprat (Fig.s 2.1.17-18).

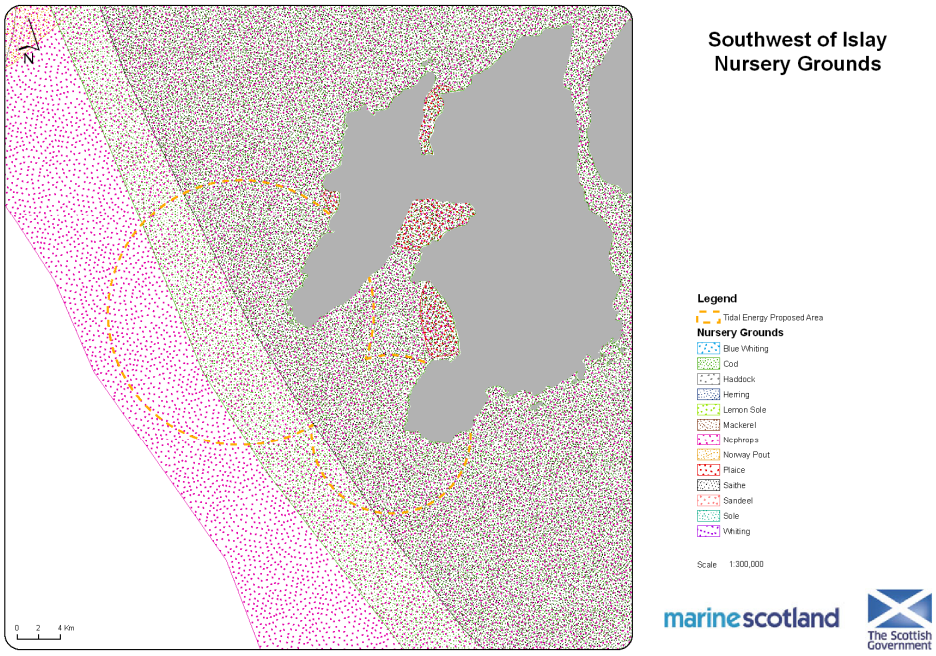

Figure 2.1.17: South-west Islay: Nursery grounds for commercial species (source: OS, MSS, CEFAS)

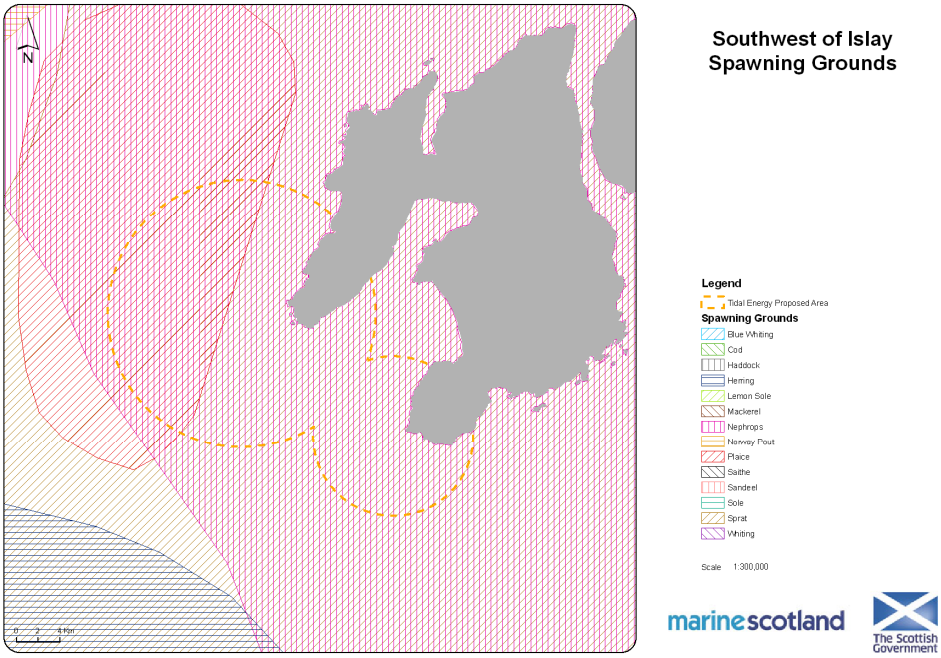

Figure 2.1.18: South-west Islay: Spawning grounds for commercial species (source: OS, MSS, CEFAS)

2.1.2.6 Cultural Heritage

Numerous wrecks surround the Islay coastline, especially adjacent to the headlands (Fig. 2.1.19). The wreck of the Otranto, off the west coast of the Rinns of Islay, is marked as military. There are a number of Scheduled Ancient Monuments (SAMs) on the coast which may require appraisal in terms of related onshore infrastructure. There are two on Oa Peninsular: Cill Eathain chapel and Cill Chomhan Chapel. There are five on the Rinns of Islay: Cladh Cill Iain chapel, Nereabolls Northern Churchyard, Orsay Island chapel, Cultoon stone circle and Cill Chiarain chapel.

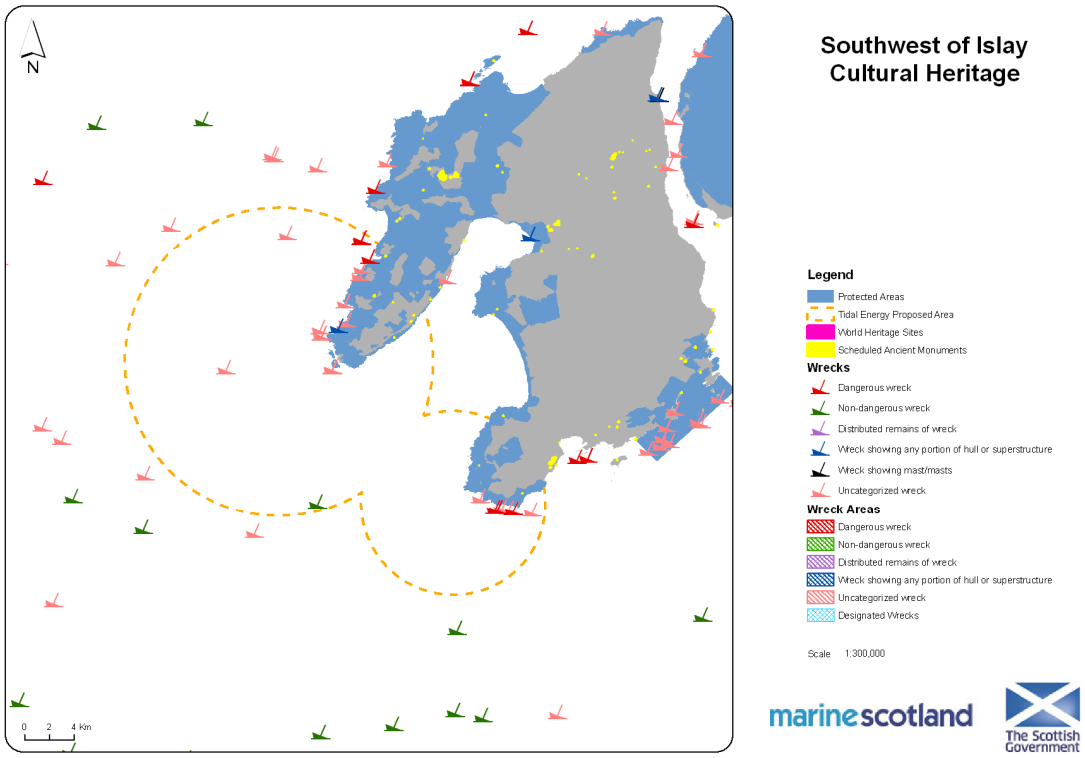

Figure 2.1.19: South-west Islay: Cultural heritage (source: OS; Historic Scotland - © Crown Copyright. All rights reserved [2009] 100017955; SeaZone Hydrospatial)

2.1.2.7 Recreation

There are a number of sailing routes through the proposed site (Fig. 2.1.20). A combination of clear waters, the challenging currents and numerous wrecks surrounding the two southerly headlands in the proposed area, result in this being a popular area for divers. There are no designated bathing waters within or adjacent to the site.

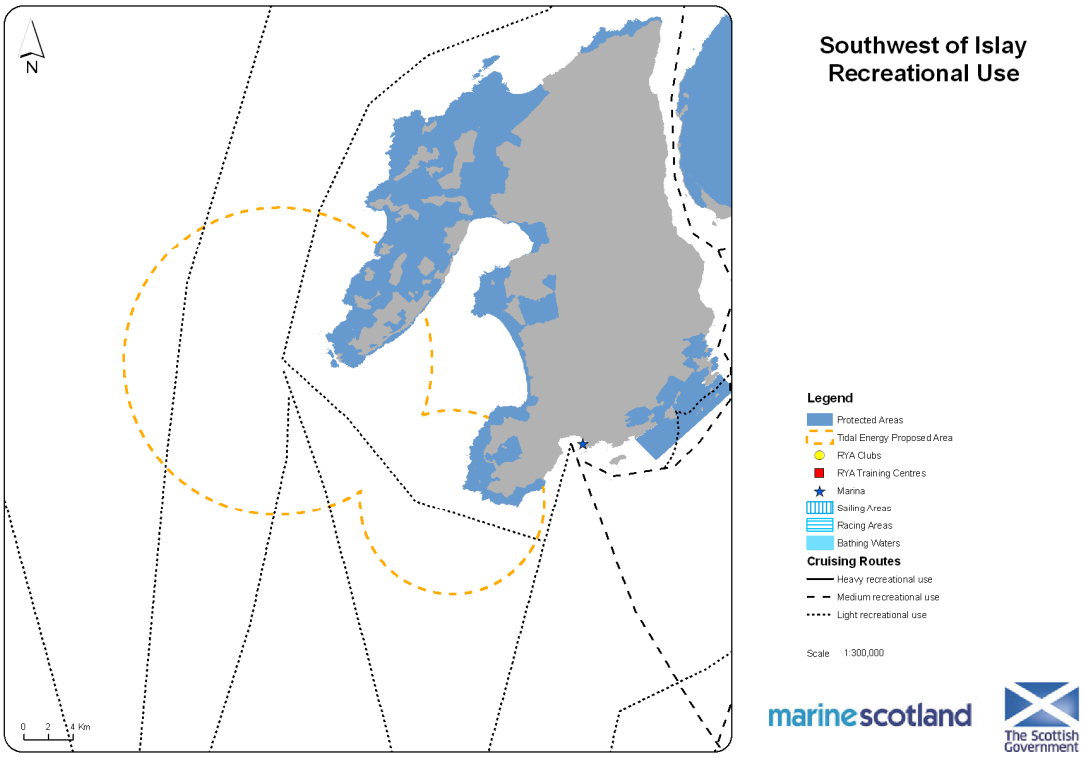

Figure 2.1.20: South-west Islay: Recreational use (source: OS, RYA, SG)

2.2 Mull of Kintyre

Summary

This area is characterised by high tidal flows, although not as strong as off the south-west coast of Islay. The annual mean power output is predicted to be up to 3.4 kW/vertical m^2 of water column. The seabed is composed of sand/gravel and shelves steeply, particularly off the south-west point of the Mull of Kintyre. The Campbeltown/Macrihanish facility, which has been proposed as a new site for development of marine renewables, is also close by. There are two critical issues that may restrict development in this region, however. The MoD is seriously concerned that tidal devices may impede navigation in this already narrow channel of water, although it may be possible to exploit the shallower areas of the North Channel close to shore. The shipping industry have expressed concerns on similar grounds; 11 km of the 21 km wide North Channel is occupied by the International Maritime Organisation (IMO) shipping route which leaves little open space for development around this. Currently, the grid does not have sufficient capacity to accommodate additional power sources, but reinforcements have been proposed with an estimated completion date of 2013. This site has relatively few environmental interests, although the north of the site is under consideration for a future SPA. There is also potential for in-combination environmental effects owing to the planned offshore wind farm to the north.

2.2.1 Technological Constraints

2.2.1.1 Size of Tidal Resource

The proposed site south of the Mull of Kintyre is predicted to have an annual mean tidal power density of up to 3.1 kW/m^2 and is predicted to generate a mean output of up to 12.7 kW/m^2 during springs and 1.5 kW/m^2 during neaps (Fig.s 2.2.1-2.2.3). The site experiences a maximum mean tidal flow of between 3.0 and 1.5 m/s during springs and neaps respectively. The mean spring tidal range is approximately 1.9-2.1 m across the site, while the neap tidal range is 0.9-1.1 m.

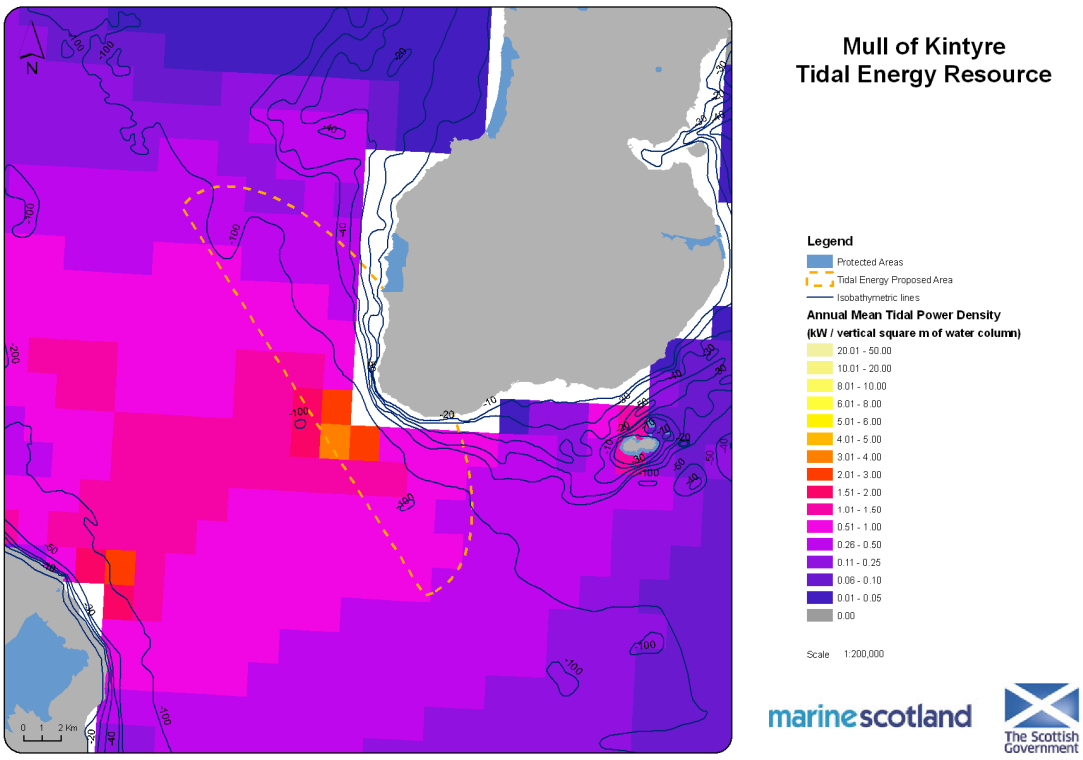

Figure 2.2.1: Mull of Kintyre: Annual mean tidal power density (source: OS, DTI, BGS)

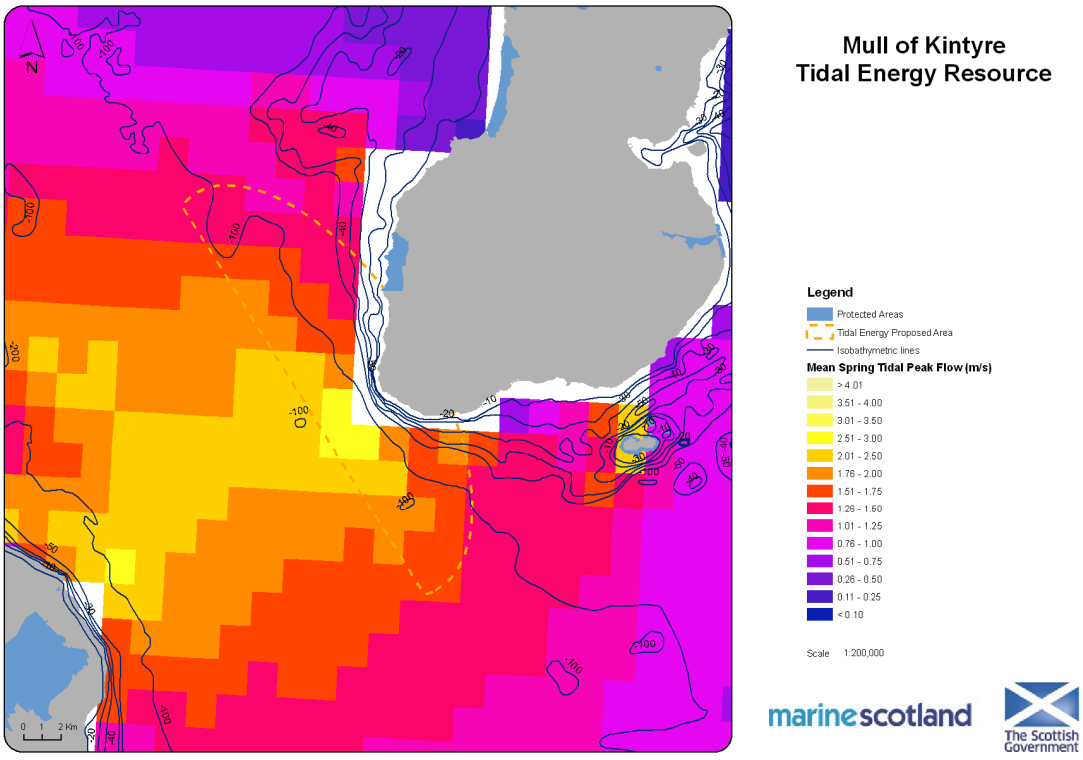

Figure 2.2.2: Mull of Kintyre: Mean spring tidal peak flow (source: OS, DTI, BGS)

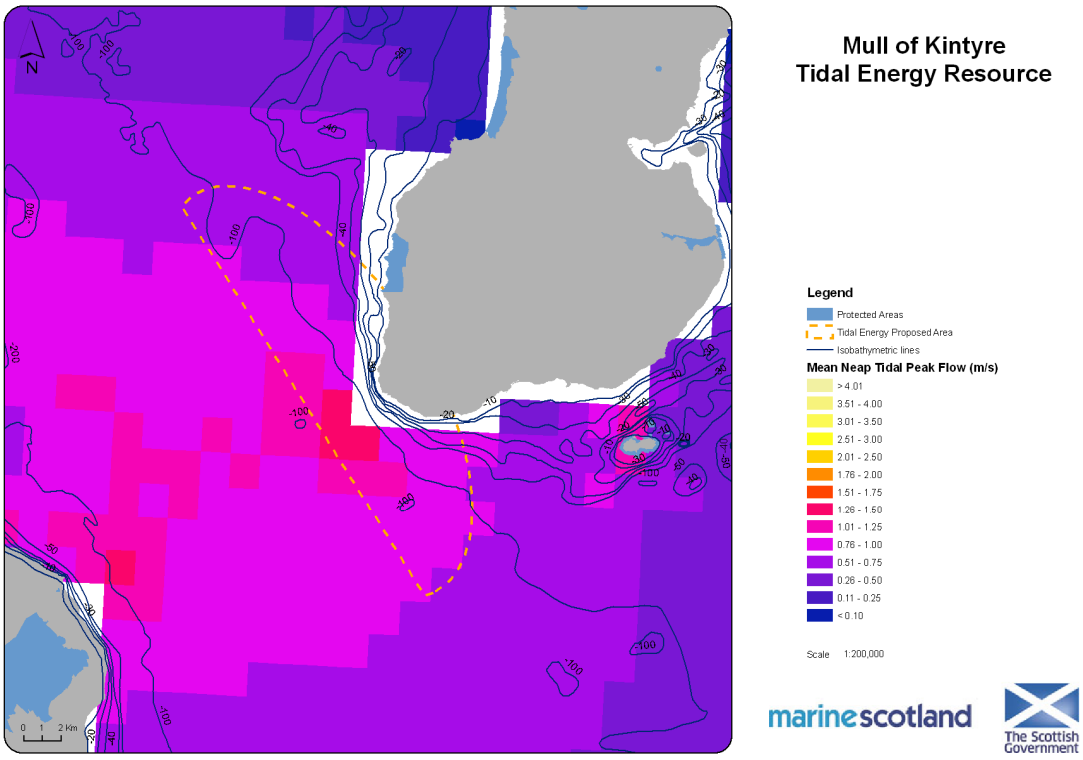

Figure 2.2.3: Mull of Kintyre: Mean neap tidal peak flow (source: OS, DTI, BGS)

2.2.1.2 Wave Height and Period

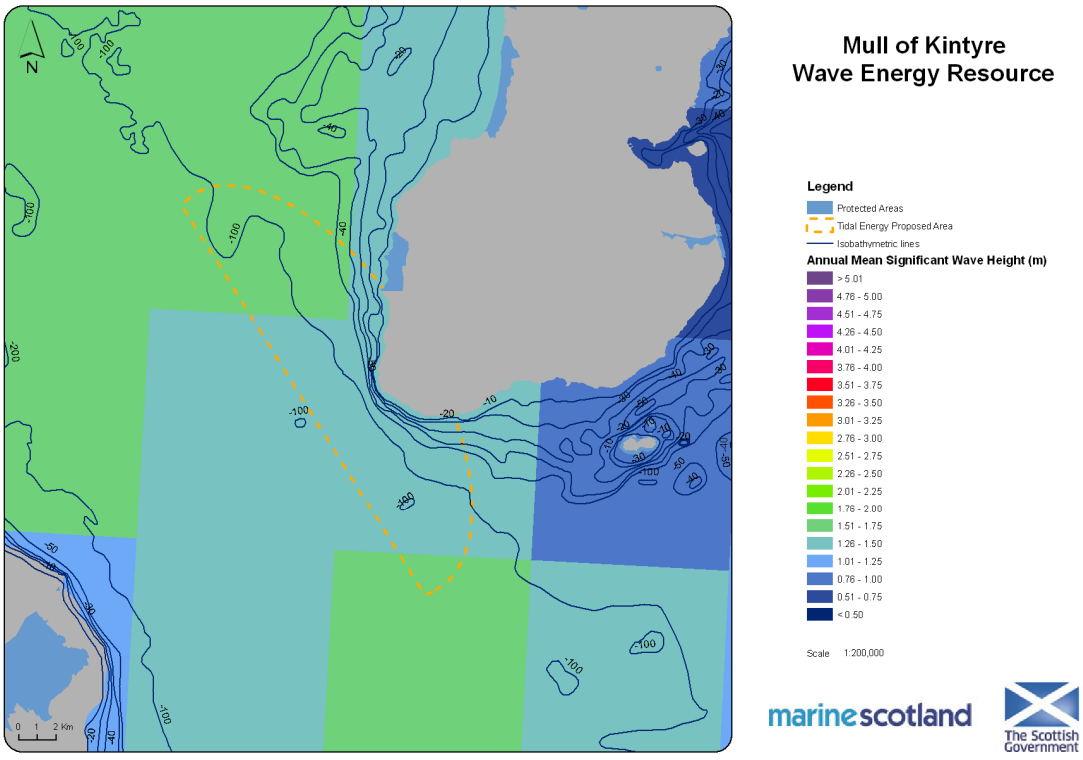

Figure 2.2.4: Mull of Kintyre: Annual mean significant wave height (source: OS, DTI, BGS)

The annual mean wave height varies between 1.4 and 1.6 m with a winter mean of up to 2.0 m (Fig. 2.2.4). The wave period varies between 6.2 and 6.4 s.

2.2.1.3 Bathymetry and Seabed

The seabed is composed of sandy gravel with strips of muddy sand and gravel falling in a NW-SE direction across the site (Fig. 2.2.5). Nearer the westerly shore of the Mull of Kintyre is a zone of gravelly sand extending out 3-4 km from the shore. The seabed shelves and reaches 50 m 2-3 km from the shore. The depth increases to 100 m between 3 and 8 km from the shore. At the southern end of the site, the seabed shelves more steeply and reaches a depth of 100 m at a distance of 1.5–4 km from the shore.

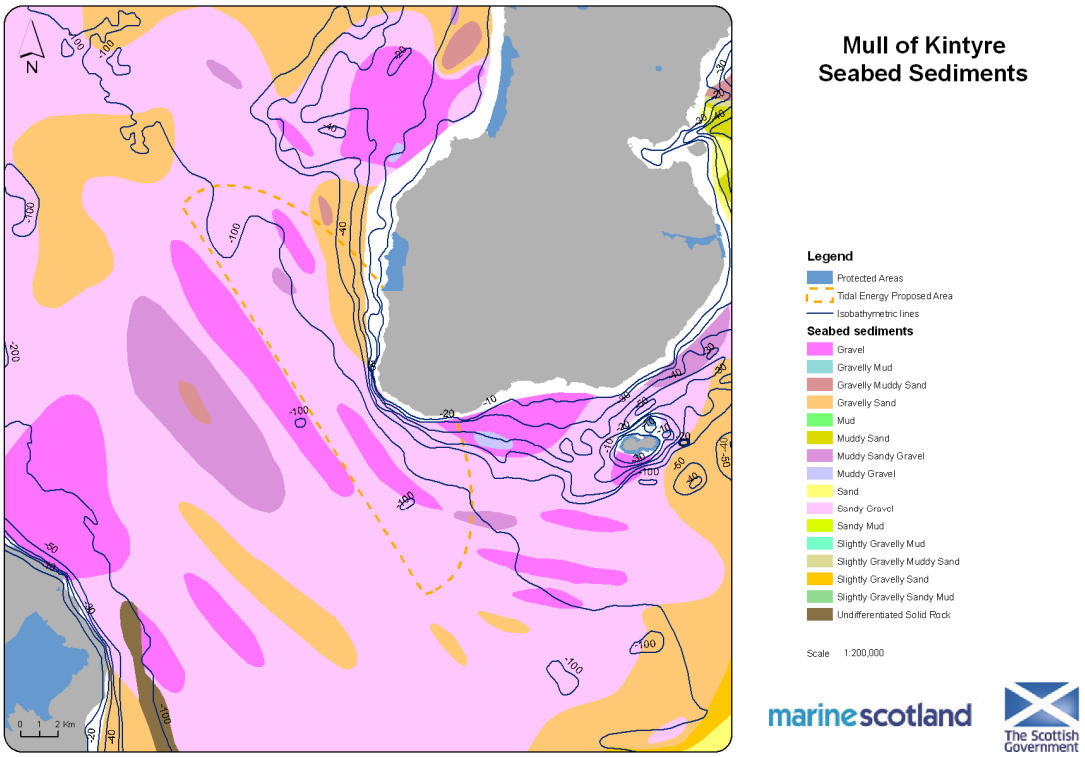

Figure 2.2.5: Mull of Kintyre: Bathymetry and seabed sediments (source: OS, BGS)

2.2.1.4 Existing Infrastructure

Grid connection: Currently there is no existing capacity to support even small scale (<10 MW) additional energy generation. Such developments would be reliant on Scottish Hydro Electric Transmission Limited's (SHETL) planned reinforcement, involving establishment of subsea cables between Kintyre and Hunterston, establishment of a switching station on Kintyre and rebuilding of a double circuit overhead line between Crossaig to Carradale. The planned completion date for this is October 2013. This would generate 250 MW of export capacity, although 100 MW of this has already been committed to other projects. There may also be opportunity to link up the grid in Northern Ireland.

Port and harbour access: The site is 30 km from Campbeltown/Machrihanish, which has been identified as a potential location for manufacture of wave and tidal devices. Larger Ports in the Clyde region are between 55 and >100 km away (Fig. 2.2.6) and in Northern Ireland (e.g. Ports of Larne and Belfast) are 40 – 80 km away.

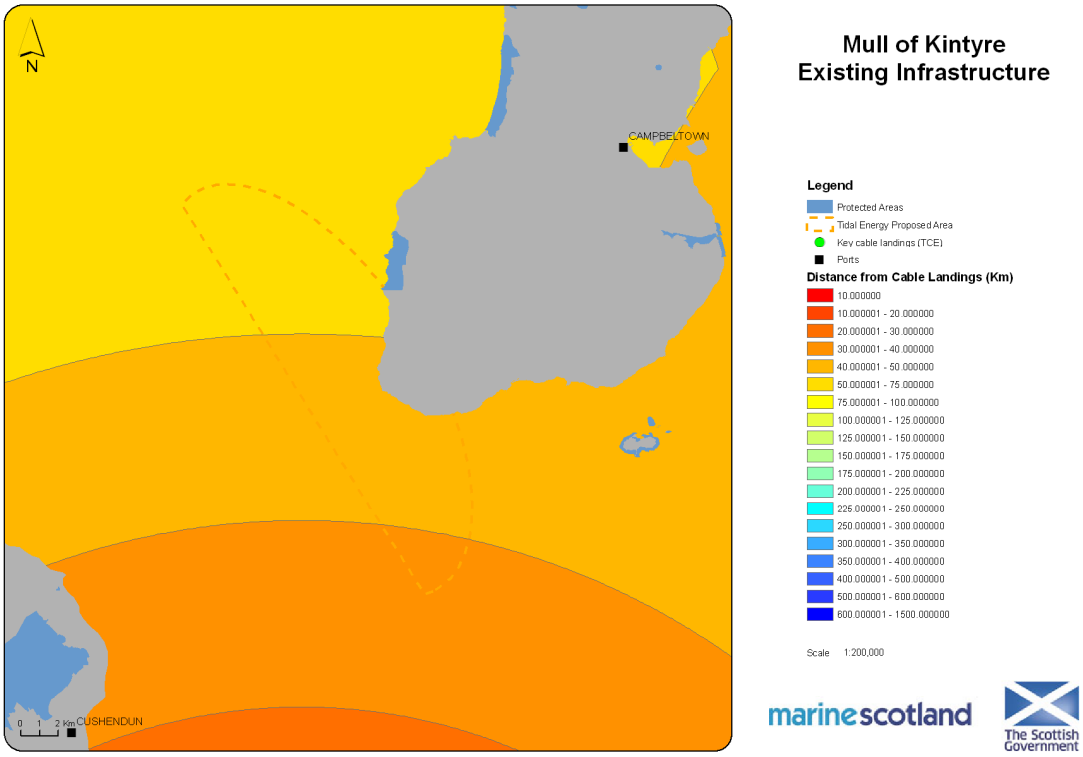

Figure 2.2.6: Mull of Kintyre: Existing infrastructure (ports and cable landings) (source: OS, TCE, DECC)

2.2.2 Other Constraints

2.2.2.1 Commercial Uses

TCE energy leases: An area immediately to the north of the proposed site has been leased for offshore wind under the Scottish Wind Award (within Territorial waters) round (Fig. 2.2.7).

Fish / shellfish farm leases: there are none in this site.

Cables and pipelines: There is a telecom cable passing through the south-west side of the site.

Potential development: There is interest in development of tidal energy off the coast of Northern Ireland, as indicated in AECOM and Metoc (2009).

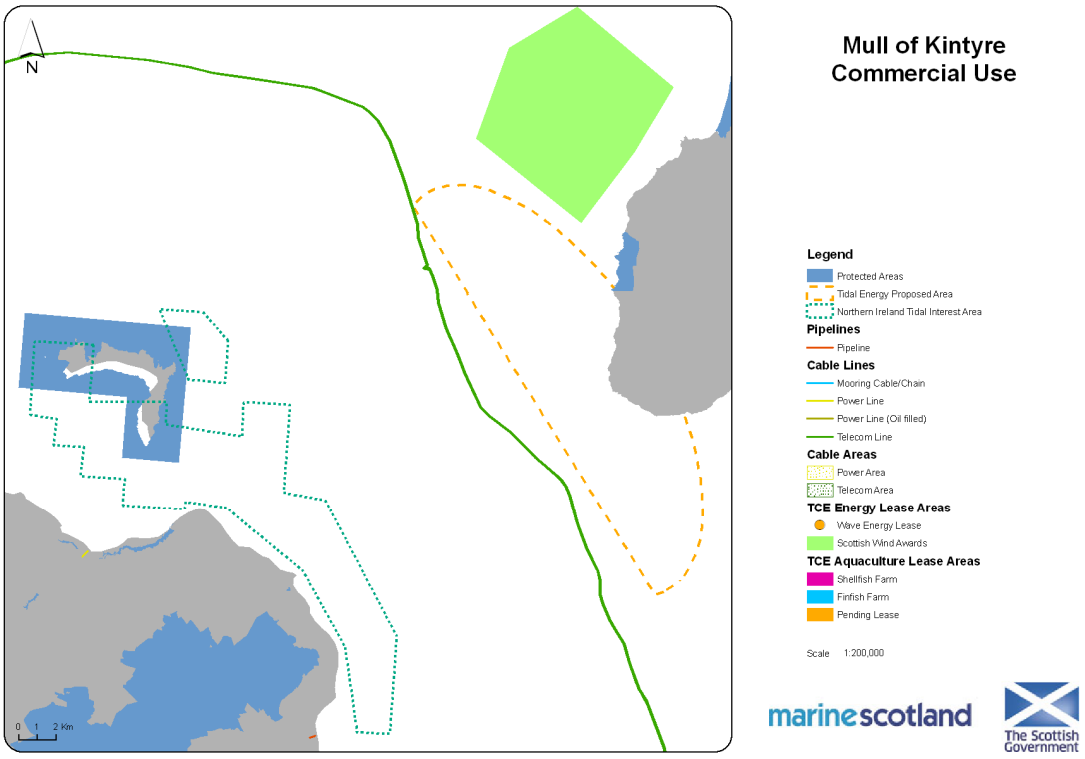

Figure 2.2.7: Mull of Kintyre: Existing commercial uses (source: OS, SeaZone Hydrospatial, TCE, Kingfisher, AECOM and Metoc, 2009)

2.2.2.2 Military

The MoD operates in this area (Fig. 2.2.8) and is very concerned that locating tidal devices in this site may interfere with the navigation of their vessels, bearing in mind the large area occupied by the IMO shipping route and the possibilities for tidal stream power development in adjacent waters off Northern Ireland (Fig. 2.2.7). However, the area of seabed at a suitable depth for development (<50 m) is constrained to within 1-3 km from shore and thus development may be less constrained within this section of the site.

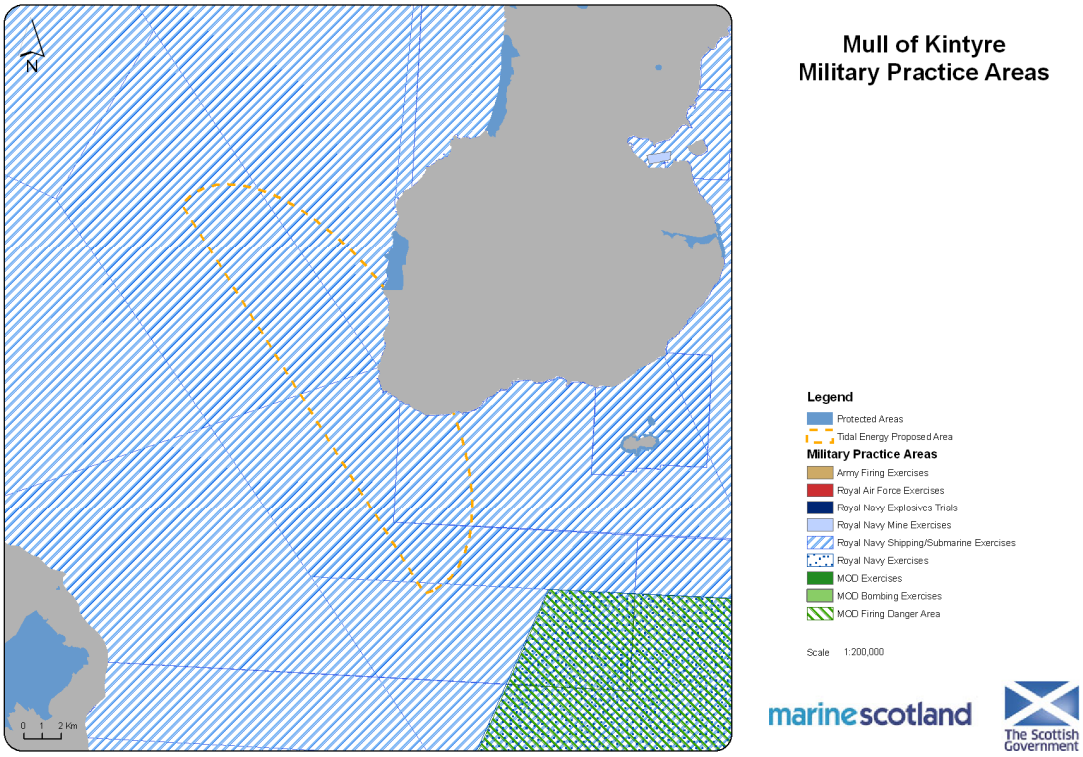

Figure 2.2.8: Mull of Kintyre: Military practice areas (source: OS, SeaZone Hydrospatial)

2.2.2.3 Shipping

The proposed site runs through one of the narrowest sections of the North Channel. The site is adjacent to a shipping lane within the IMO route immediately to the west (Fig. 2.2.9). A maximum of 1284 shipping movements have passed through this site in the past year (2009-10), which equates to an average of 3.5 movements per day. There is far less shipping traffic (< 1 movement per day) immediately off the west coast of the Mull of Kintyre, but the tidal resource is lower here.

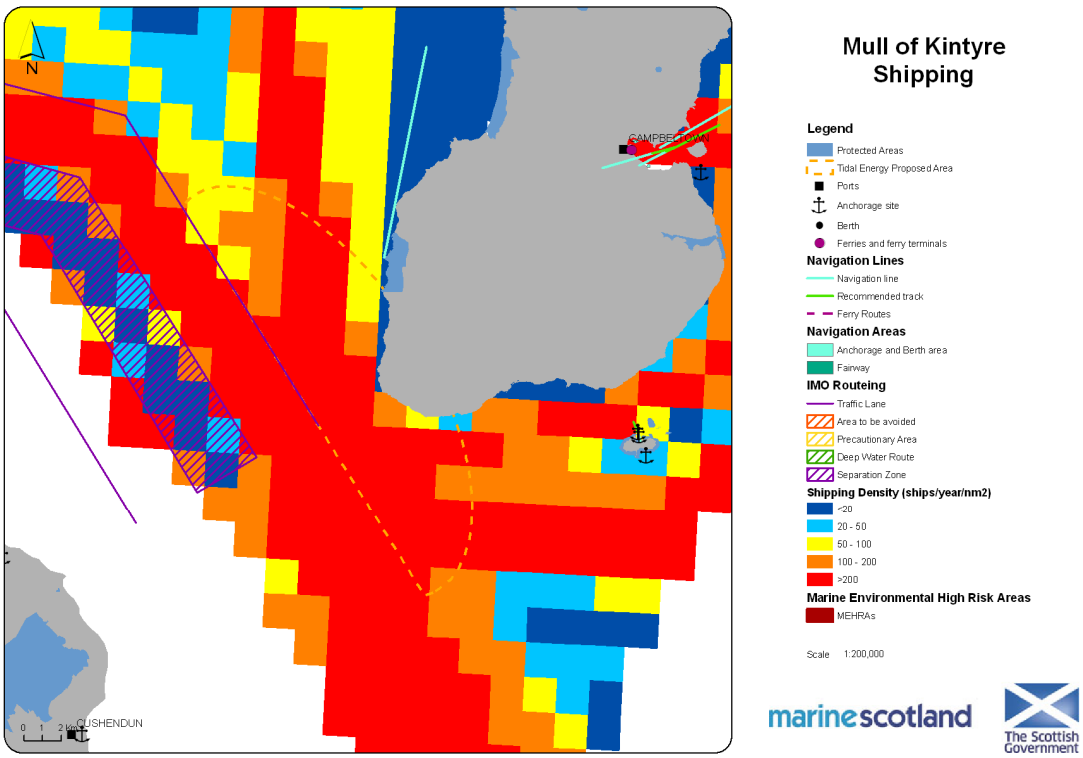

Figure 2.2.9: Mull of Kintyre: Shipping (source: OS SeaZone Hydrospatial, DECC, Anatec Ltd)

2.2.2.4 Commercial Fishing

The data presented in the maps below, from the vessels ≥15 m in 2009, suggests that this area is not heavily fished but is used by shellfish boats for scallops and occasional *Nephrops* (Fig.s 2.2.10-11). Up to 5 tonnes of shellfish (i.e. up to around £10 000) were caught per trip. The site may also be used by smaller boats for crab, scallop and *Nephrops* fishing (MSS, personal communication). There are a number of local fishing ports nearby, such as Campbeltown, Tarbert, Carradale and Cumbrae (Clyde SSMEI, 2010).

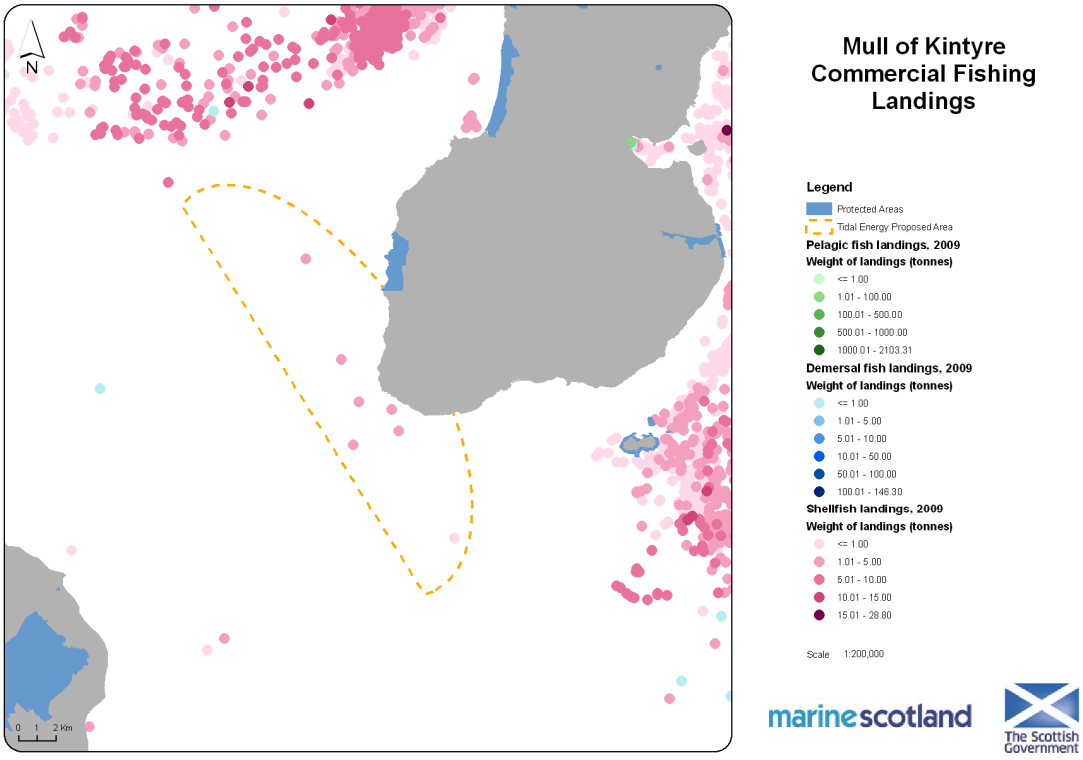

Figure 2.2.10: Mull of Kintyre: Commercial landings of pelagic and demersal fish and shellfish (tonnes) (source: OS, MSS)

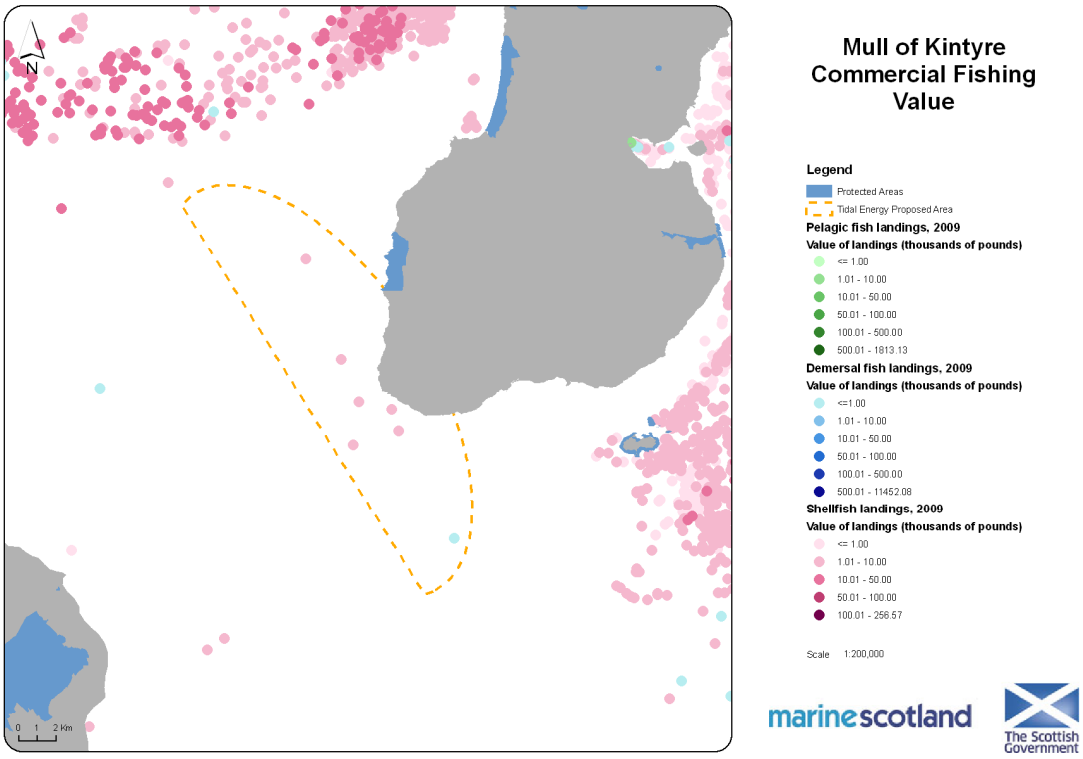

Figure 2.2.11: Mull of Kintyre: Commercial landings of pelagic and demersal fish and shellfish (value) (source: OS, MSS)

2.2.2.5 Environment

Designated areas

The site does not overlap with any sites currently designated for conservation interest (Figure 2.2.12). However, the area to the north has been identified as being subject to further search by the JNCC as a potential offshore SPA. There is also a SSSI present along the northern boundary of the site for biological features (breeding choughs, subalpine calcareous grassland and tall herb ledges).

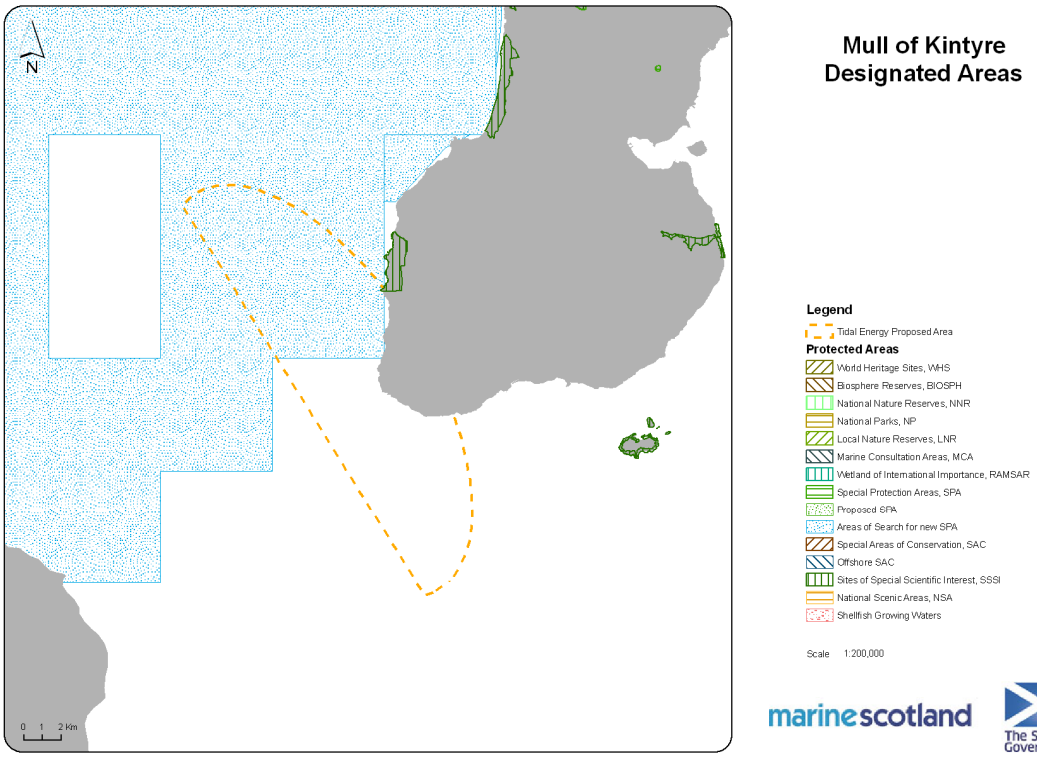

Figure 2.2.12: Mull of Kintyre: Designated areas (source: OS, SeaZone Hydrospatial, SNH, JNCC, SG)

Protected Species

Seabird abundance is higher in the west and north-west and there are a number of bird colonies both within and nearby the site (Figure 2.2.13). The abundance of cetaceans is relatively low and includes harbour porpoise and minke whale (*Balaenoptera acutorostrata*) (Weir et al., 2001; Cetacean Atlas, 2003) (Fig. 2.2.14). There is one recorded basking shark (*Cetorhinus maximus*) sighting in this site and occasional leatherback turtles (*Dermochelys coriacea*). In-combination effects may also require consideration owing to the proposed wind farm site immediately to the north.

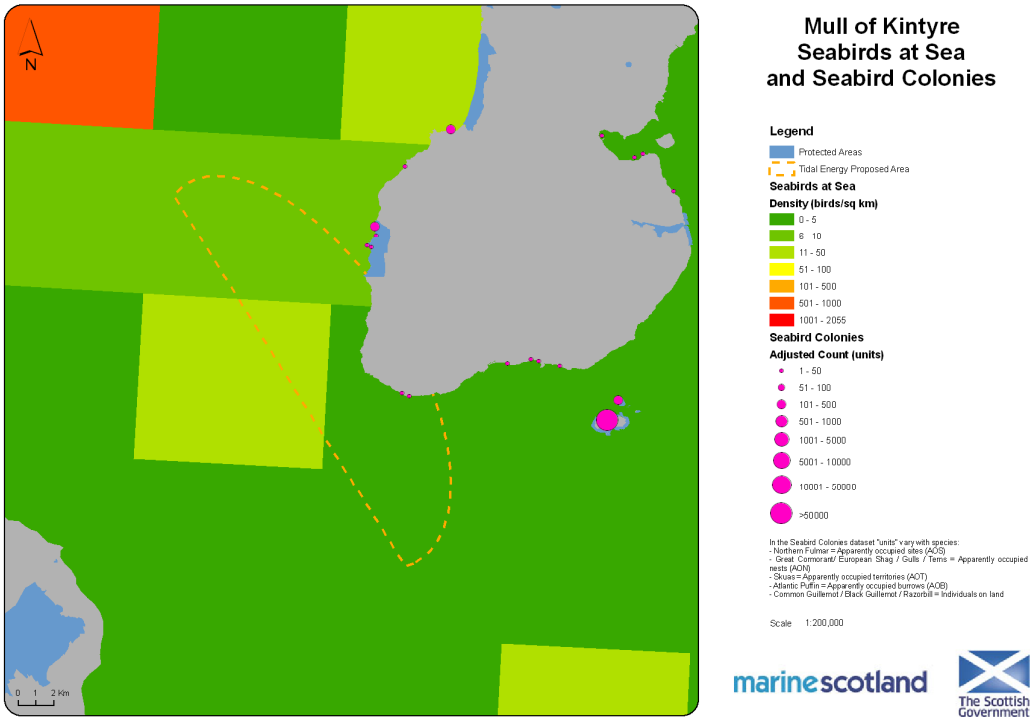

Figure 2.2.13: Mull of Kintyre: Seabirds at sea and seabird colonies (source: OS, JNCC)

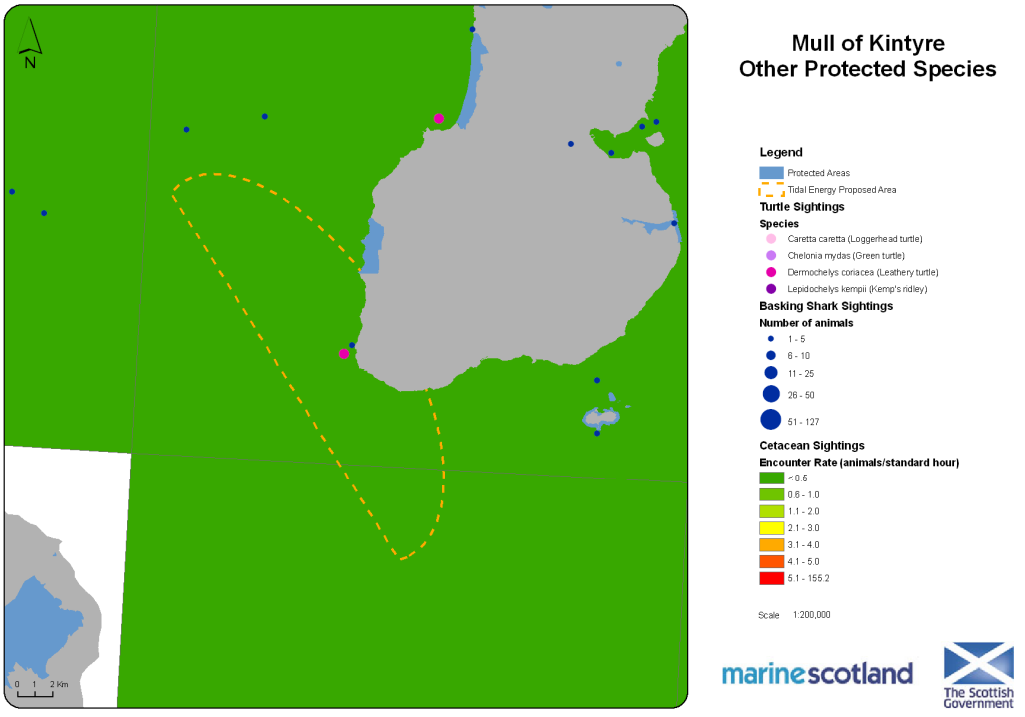

Figure 2.2.14: Mull of Kintyre: Cetaceans, turtles and basking sharks (1980) (source: OS, NBN, MCS, JNCC)

Protected Habitats

This area experiences strong currents and may therefore be classified as a UK BAP priority habitat for tidal rapids. The seabed also comes under the definition of the BAP habitat, sublittoral sediment (Fig. 2.2.15 & 2.2.16). The seabed immediately offshore of the west coast of the Mull of Kintyre is composed of infralittoral coarse sediment out to 1 km. Beyond this is coarse sediment.

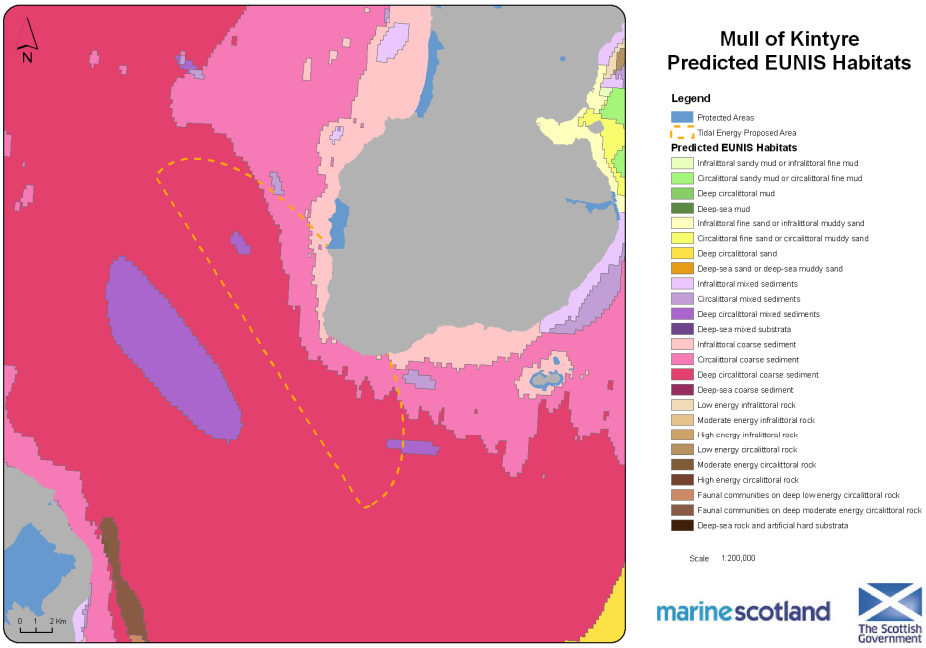

Figure 2.2.15: Mull of Kintyre: Seabed habitats (predicted by EUNIS) (source: OS, JNCC)

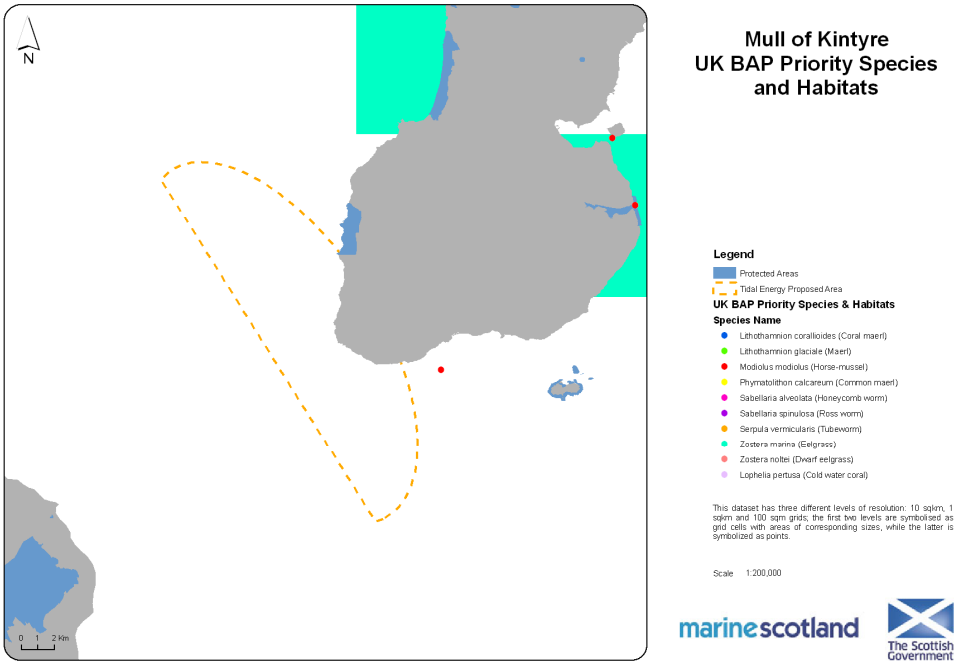

Figure 2.2.16: Mull of Kintyre: UK BAP Priority species and habitats (source: OS, NBN)

Sensitive Sites for Fish

This site has not been identified as being particularly sensitive for fish. However, it is thought to be a nursery site for cod, *Nephrops* and saithe and a spawning ground for *Nephrops* and sprat (Fig.s 2.2.17-18).

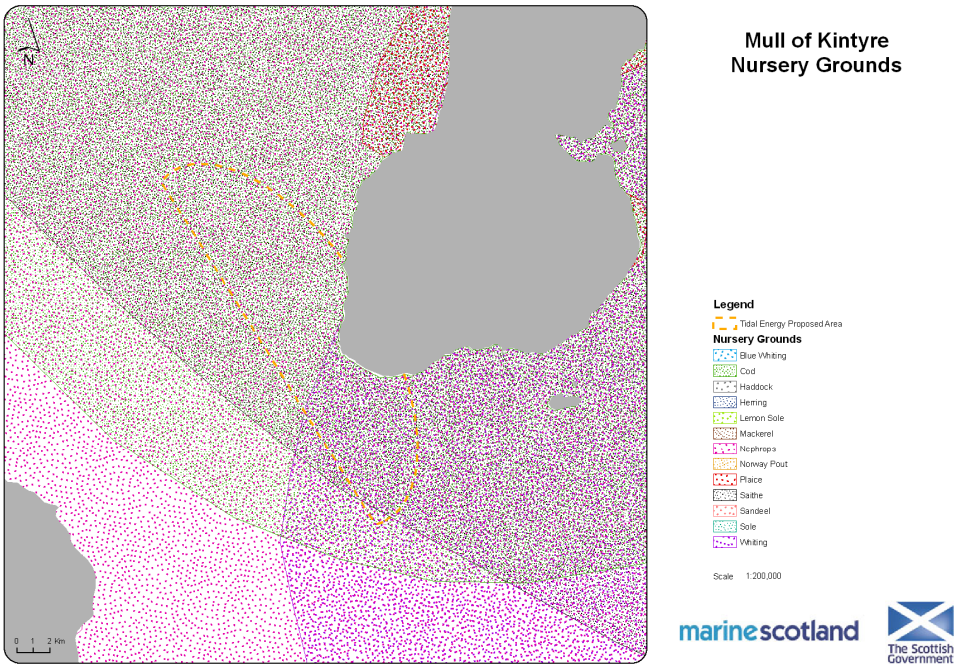

Figure 2.2.17: Mull of Kintyre: Nursery grounds for commercial species (source: OS, MSS, CEFAS)

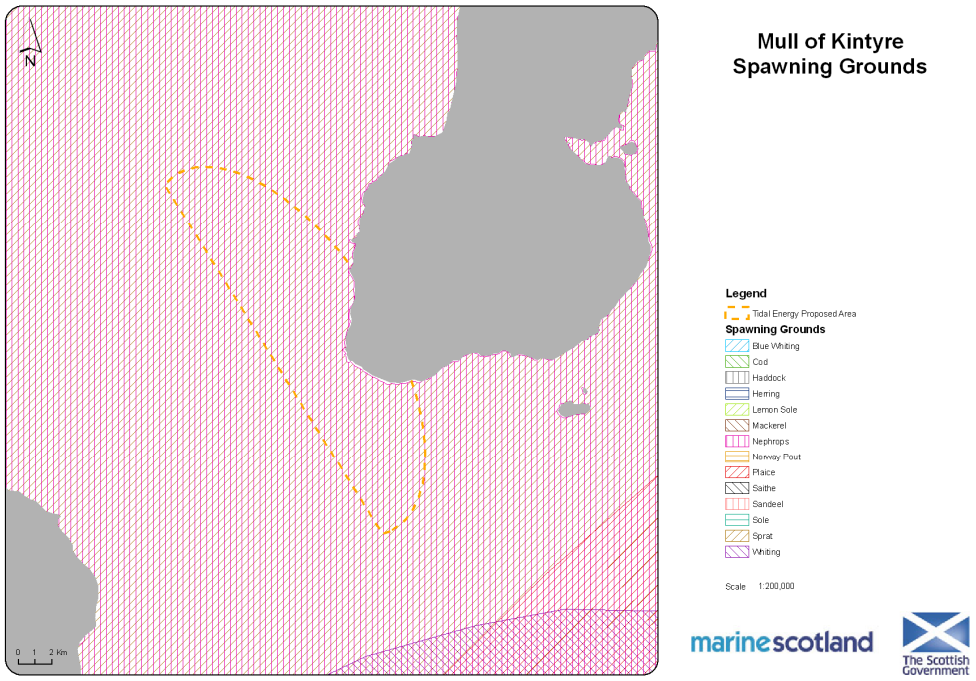

Figure 2.2.18: Mull of Kintyre: Spawning grounds for commercial species (source: OS, MSS, CEFAS)

2.2.2.6 Cultural Heritage

There are several wrecks in the proposed site, none of which are military or protected (Fig. 2.2.19). A number of sites are listed under the Schedule of Ancient Monuments in this area: Borgadel Water, Fort Burn, Balemacruma Fort, Balmavicar Burn township, Rubha a'Mharaiche and Dunan fort.

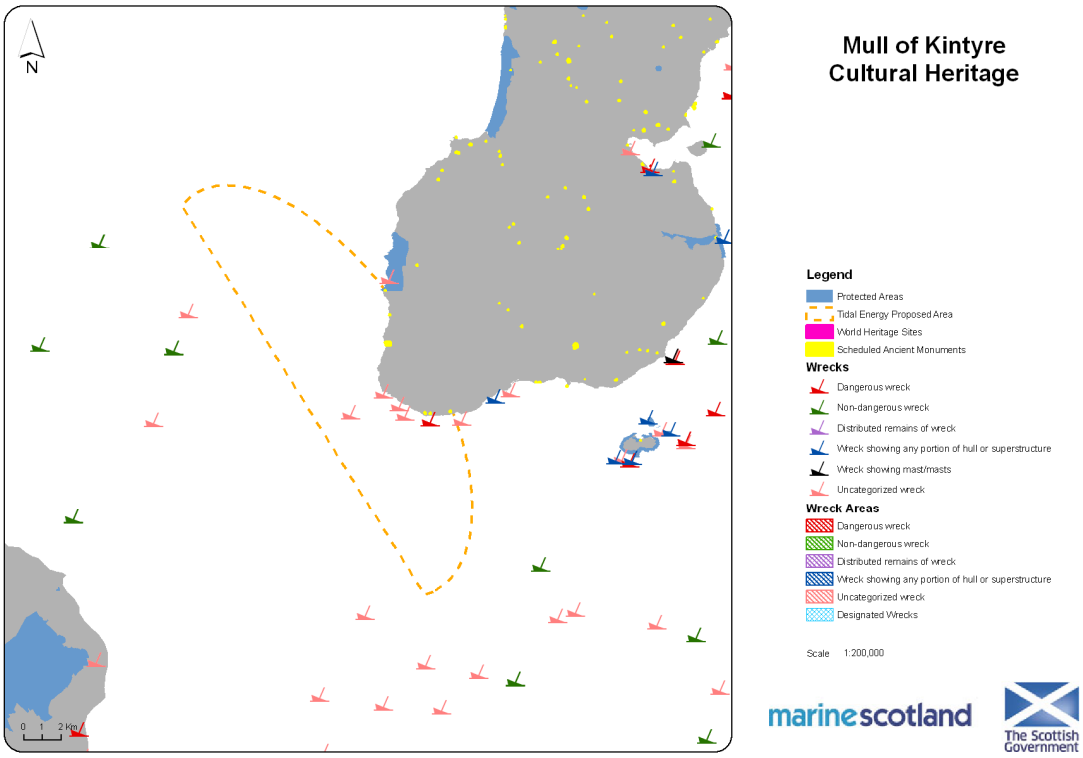

Figure 2.2.19: Mull of Kintyre: Cultural heritage (source: OS, Historic Scotland, SeaZone Hydrospatial)

2.2.2.7 Recreation

No designated bathing waters exist within or adjacent to the site (Fig. 2.2.20). There are a number of sailing routes that cross the site, however.

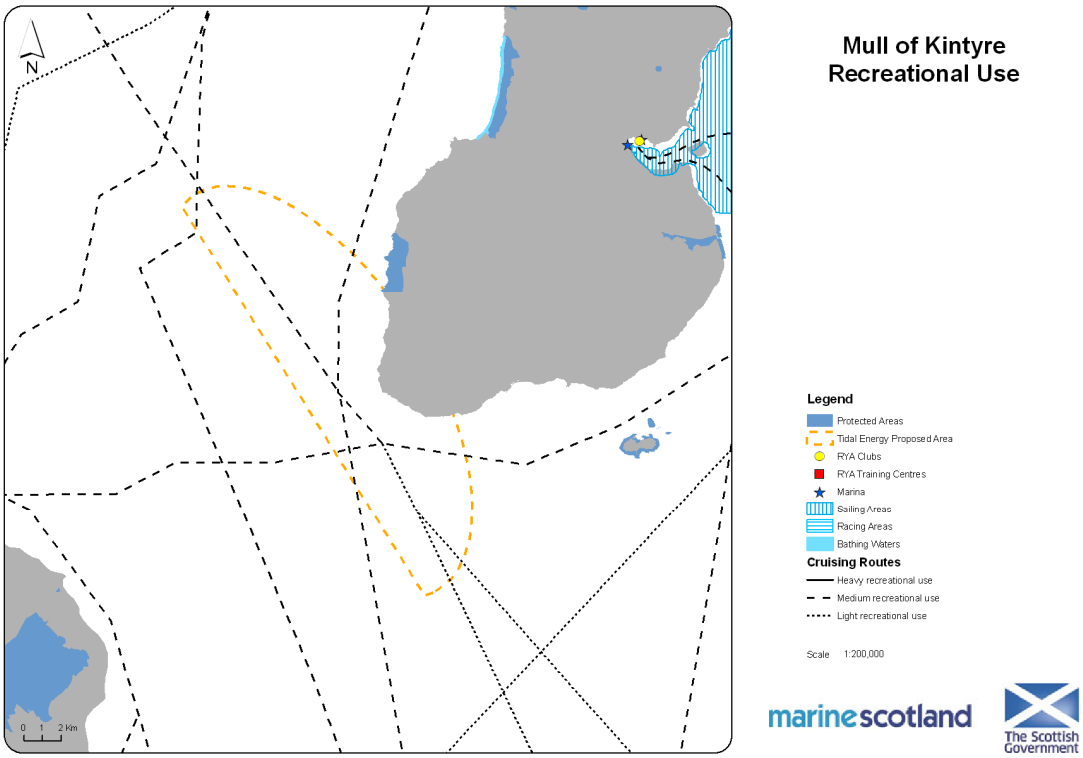

Figure 2.2.20: Mull of Kintyre: Recreational use (source: OS, RYA - © Copyright RYA [2008]; SG)

3 Wave Energy Sites

3.1 West of Colonsay

Summary

The wave resource at this site is relatively high although not as high as sites west of the Hebrides and west of Shetland. The seabed, composed of bedrock close to the shore and sand and gravel beyond ~10 km, slopes gradually and exhibits a depth for the most part of <50 m. A major constraint within this area is lack of essential infrastructure, i.e. proximity to large ports, access to the national grid and capacity to accommodate additional transmission. Other constraints in this site are its use by the Navy for submarine exercises and naval shipping and the extensively designated western shoreline.

3.1.1 Technological Constraints

3.1.1.1 Size of Wave Resource

The annual mean wave power in the site west of Colonsay varies between 14.0 kW/m of wave crest inshore and 24.6 kW/m offshore (Fig. 3.1.1). In summer it declines to 5.4-8.6 kW/m and in winter it rises to 22.9-43.4 kW/m. The annual mean wave height and wave period varies between 1.8 m and 6.6 s inshore and 3.1 m and 7.3 s offshore (Fig. 3.1.2). In summer the maximum wave height in the proposed area is 1.6 m and in winter it is 3.1 m.

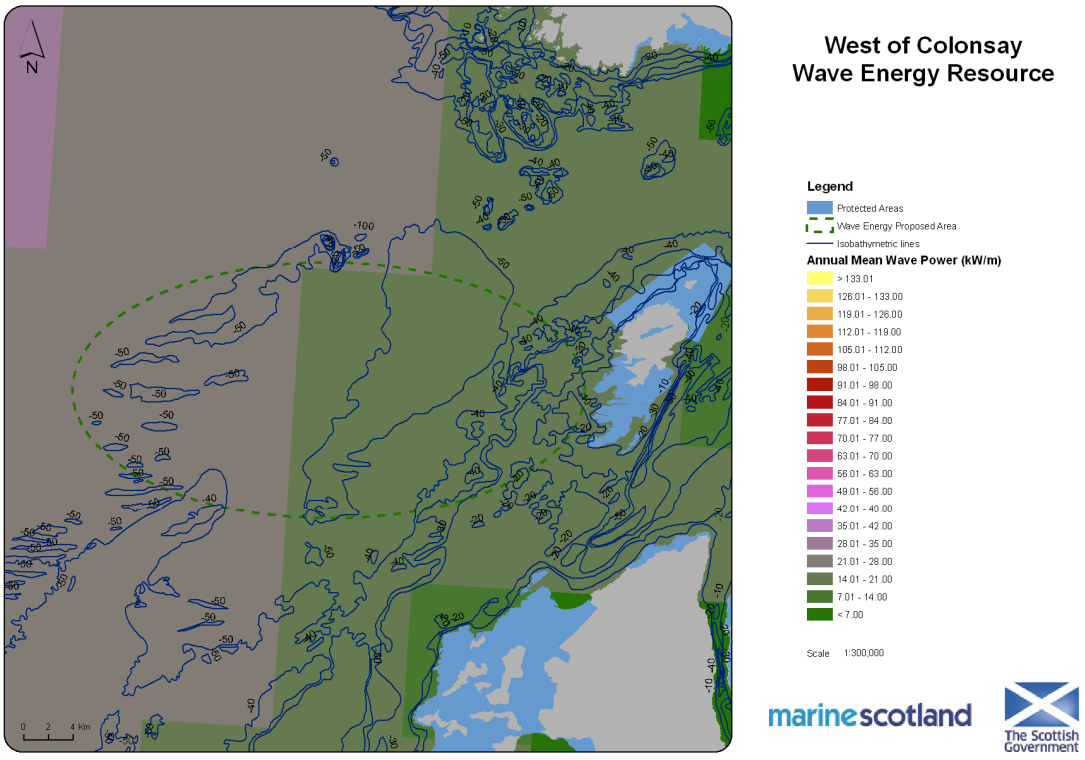

Figure 3.1.1: West of Colonsay: Annual mean wave power density (source: OS, BGS, DTI)

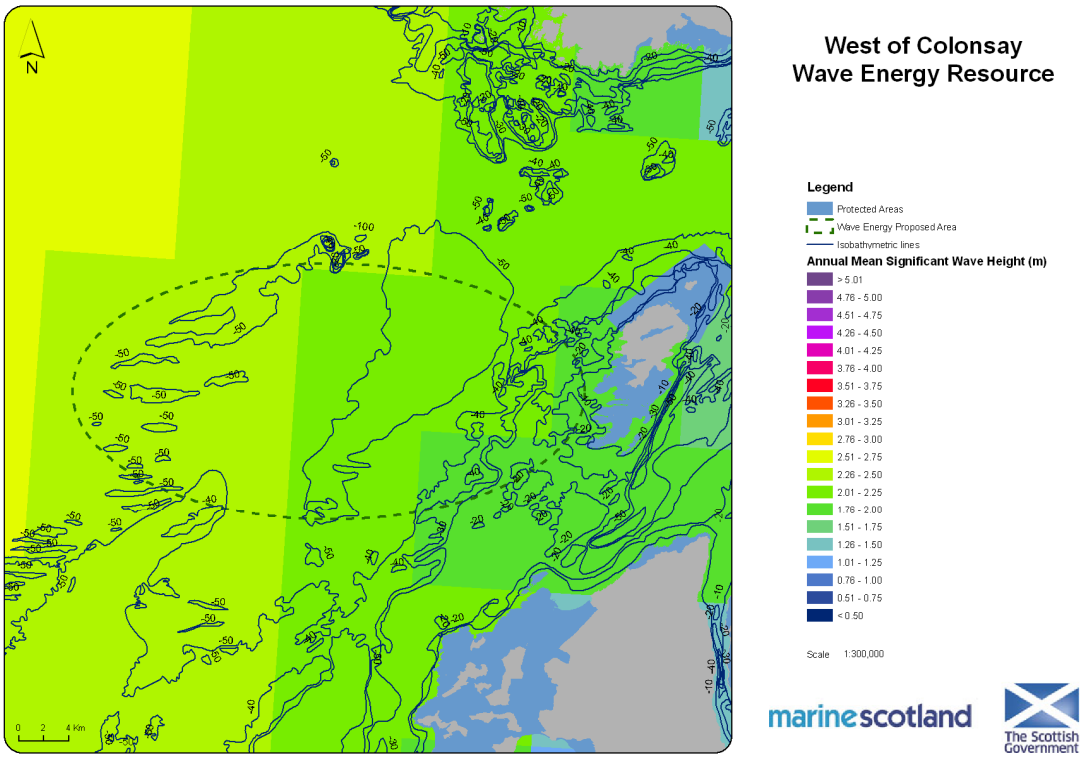

Figure 3.1.2: West of Colonsay: Annual mean significant wave height (source: OS, BGS, DTI)

3.1.1.2 Tidal Streams

The tidal streams are relatively weak and consistent across the area ranging between 0.3 and 0.8 m/s during neap and spring tides respectively (Fig. 3.1.3).

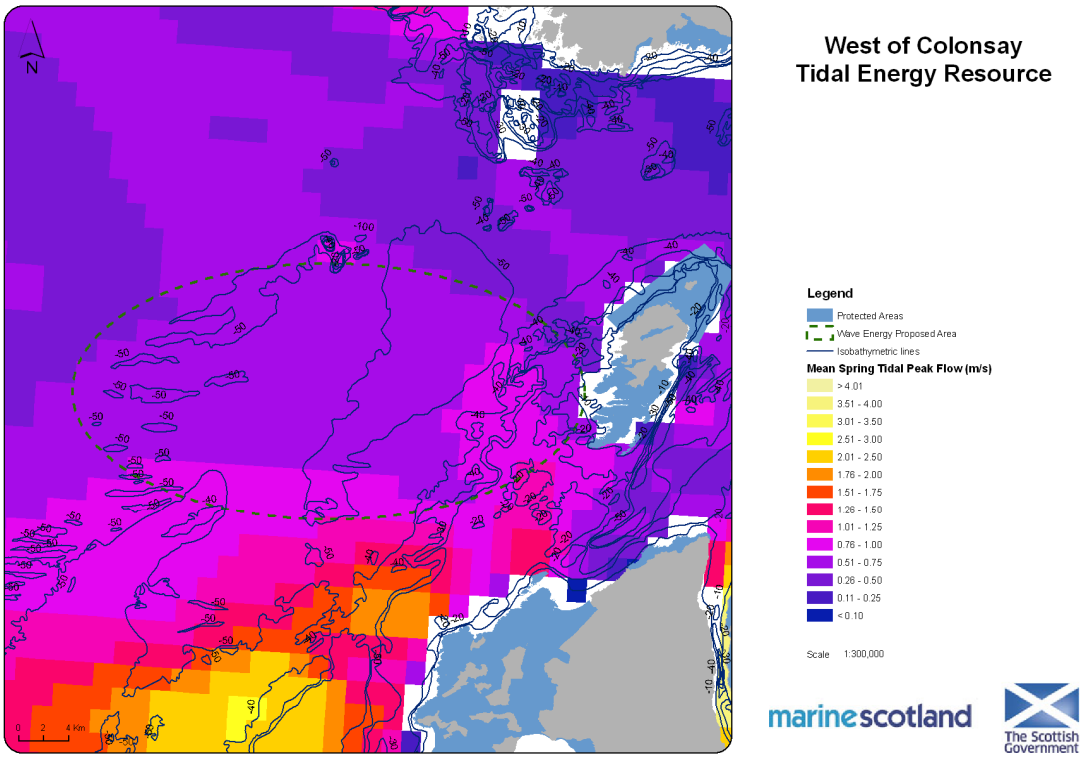

Figure 3.1.3: West of Colonsay: Mean spring tidal peak flow (source: OS, BGS, DTI)

3.1.1.3 Bathymetry and Seabed

The seabed immediately offshore of Colonsay slopes gradually from 10 to 30. The data from the BGS suggests this area is composed of sandy gravel (Fig. 3.1.4). However, the EUNIS habitats data indicates that there are areas of solid rock offshore from Colonsay out to 10 km. At this point the depth levels out to ~50 m between 7 and 14 km from the shore. There is a narrow strip of gravelly sand and slightly gravelly sand. In deeper water it grades to pure sand. The progression of areas of bedrock and boulders to pure sand, as in the EUNIS data, is supported by recent footage by Marine Scotland – Science (http://www.youtube.com/user/MarineLaboratory).

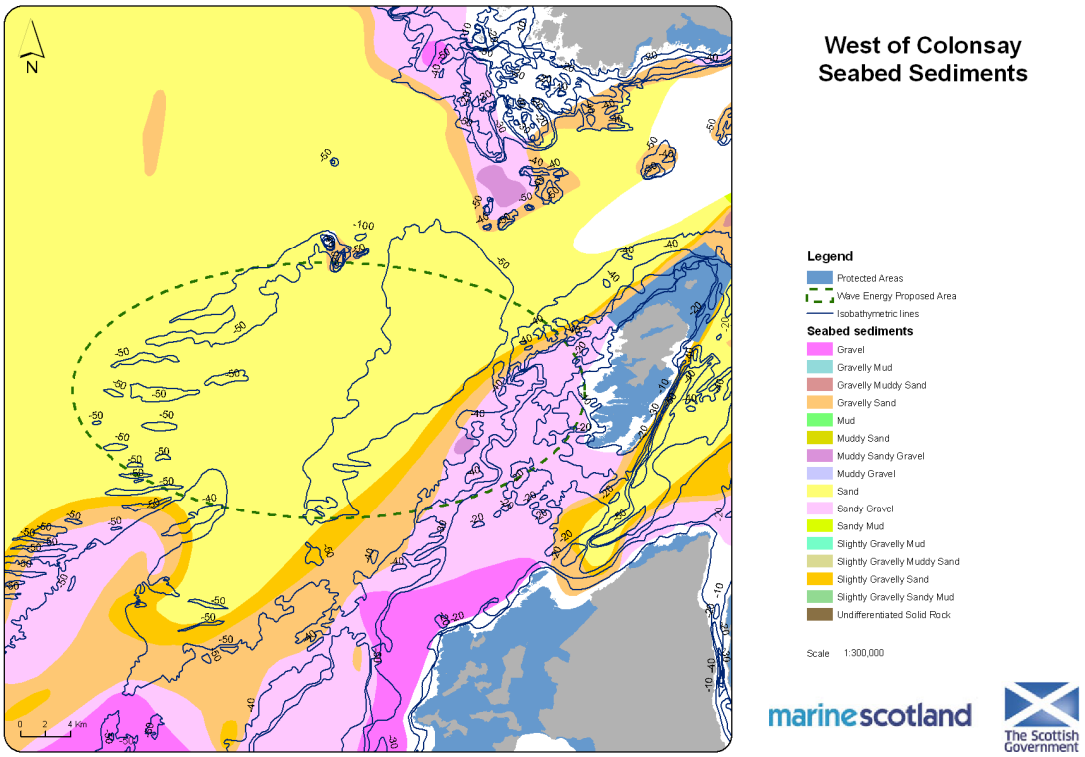

Figure 3.1.4: West of Colonsay: Bathymetry and seabed sediments (source: OS, BGS)

3.1.1.4 Existing Infrastructure

Ports and harbours: The nearest port is Colonsay, a distance of >14 km away (Fig. 3.1.5). Access to larger ports, such as Oban are > 65 km away, and the facility at Campbeltown/Machrihanish facility (identified as a potential development location for wave and tidal technology - SE & SIE, 2010), is approximately 130 km away.

Grid connection: There is no available existing capacity to accommodate new power generation. SSE have proposals for grid reinforcement and, subject to consents, the estimated completion date for this is 2013. This would generate 250 MW of incremental export capacity, although 100 MW of this is already committed.

The nearest cable landings are Girvan, Troon and Ardrossan (between 150 and 180 km away). The nearest substation is approximately 250 km away. There are no power cables in the vicinity of this site.

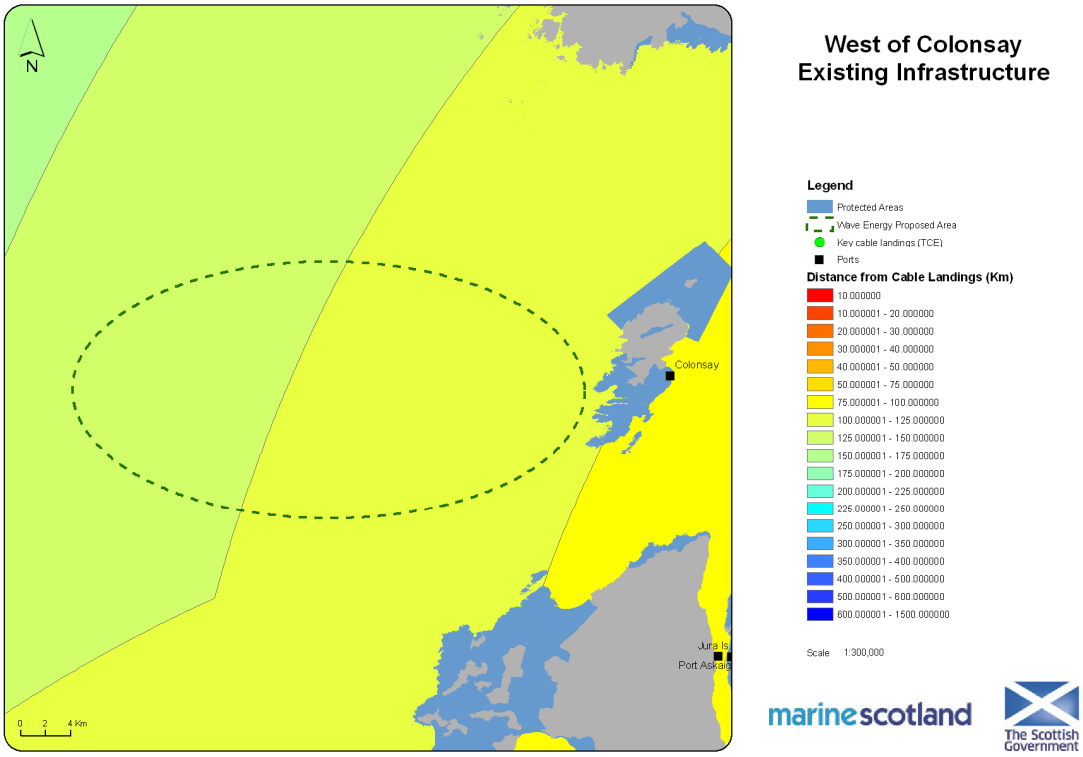

Figure 3.1.5: West of Colonsay: Existing infrastructure (ports and cable landings) (source: OS, TCE, DECC)

3.1.2 Other Constraints

3.1.2.1 Commercial Uses

There are no commercial uses of this site with regards to existing Crown Estate leases, fish farms or cables and pipelines (Fig. 3.1.6).

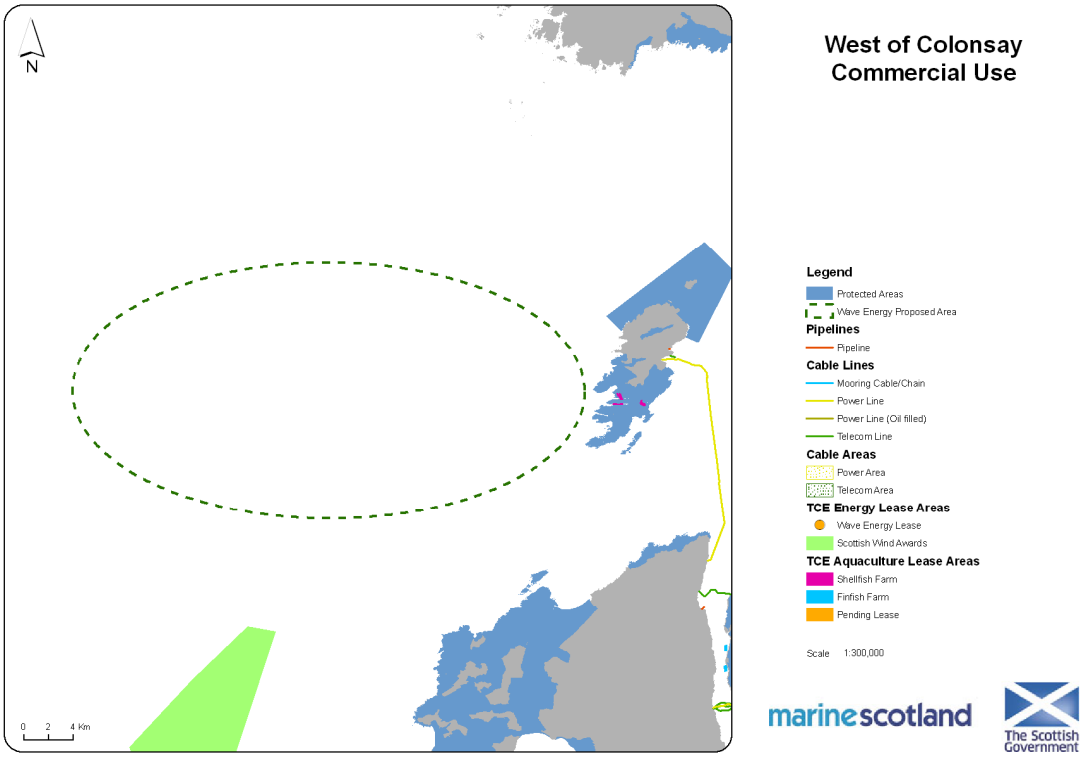

Figure 3.1.6: West of Colonsay: Existing commercial uses (source: OS, SeaZone Hydrospatial, Kingfisher and TCE)

3.1.2.2 Military Use

The site is part of a wide area identified for naval shipping and submarine exercises (Fig. 3.1.7).

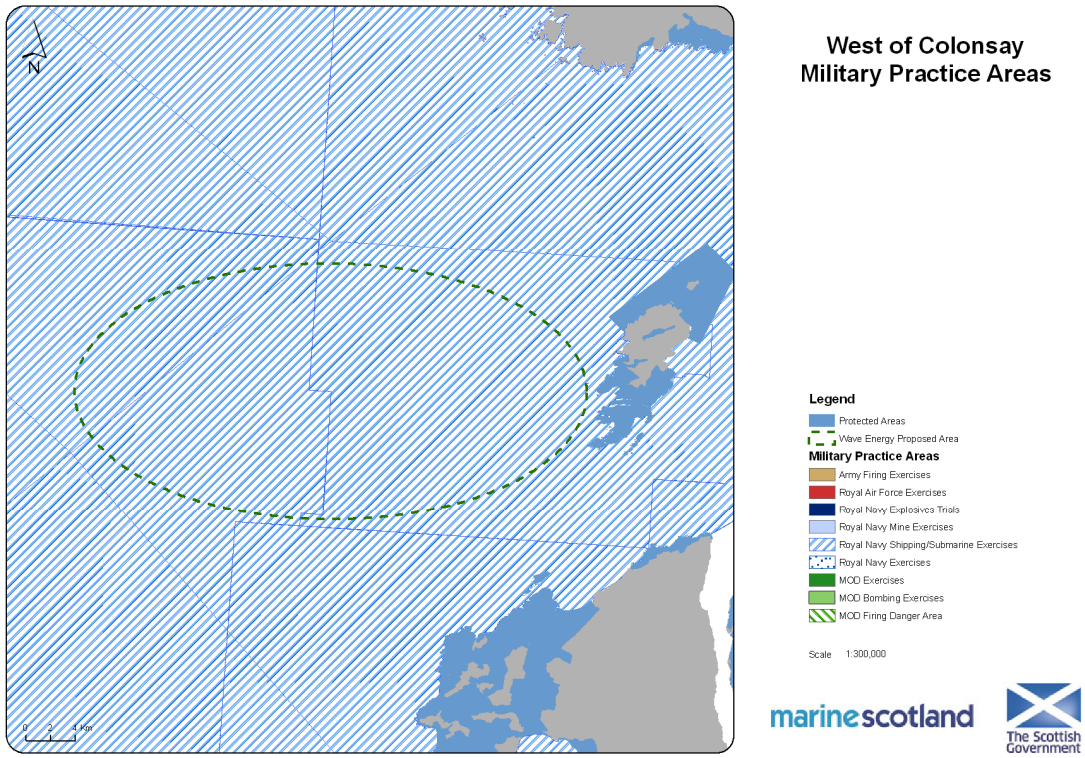

Figure 3.1.7: West of Colonsay: Military practice areas (source: OS, SeaZone Hydrospatial)

3.1.2.3 Shipping

The site is outside any ferry routes (Fig. 3.1.8). The majority of the area experiences a relatively low volume of shipping traffic (between 0 and 7 movements/year). There are 3 routes through the site running from north to south which experience up to 126 movements/year. There is also a route along the western boundary of the site, going towards the Outer Hebrides, which experiences up to 196 movements/year. The site is also in the vicinity of the West Islay, Argyll & Bute MEHRA on the western and northern coasts of Islay, which was classified due to the pollution risk posed to the abundance of seabirds and the value of commercial fishing activity in the area. As such, it is recommended that an area of 3 nm surrounding the coast of Islay should be avoided by vessels over a certain size.

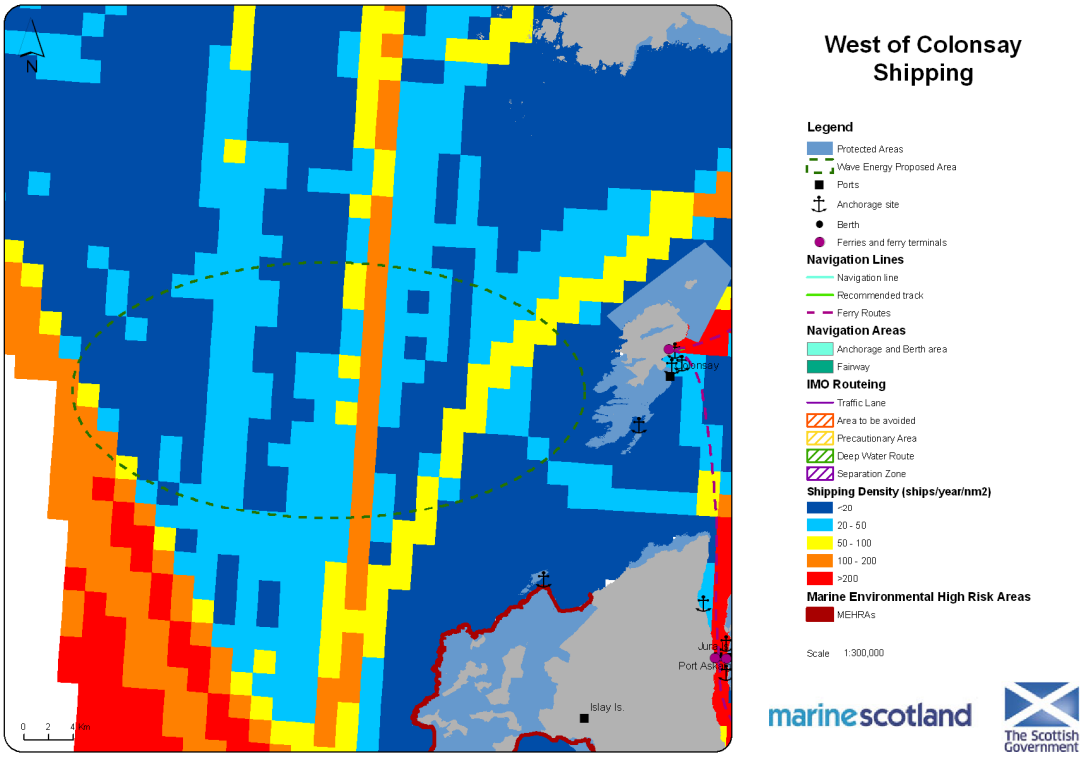

Figure 3.1.8: West of Colonsay: Shipping (source: OS, SeaZone Hydrospatial, DECC, Anatec Ltd)

3.1.2.4 Fishing

The data for larger vessels of ≥15m in 2009, indicates that there was only occasional fishing activity occurring in this site (Fig. 3.1.9-10). Up to 5 tonnes of shellfish, consisting of scallops and *Nephrops,* were landed per trip of a value of £10 000. The area to the north was fished much more heavily for shellfish and demersal fish, however, smaller boats may use this area for scallop and crab fishing (MSS, personal communication).

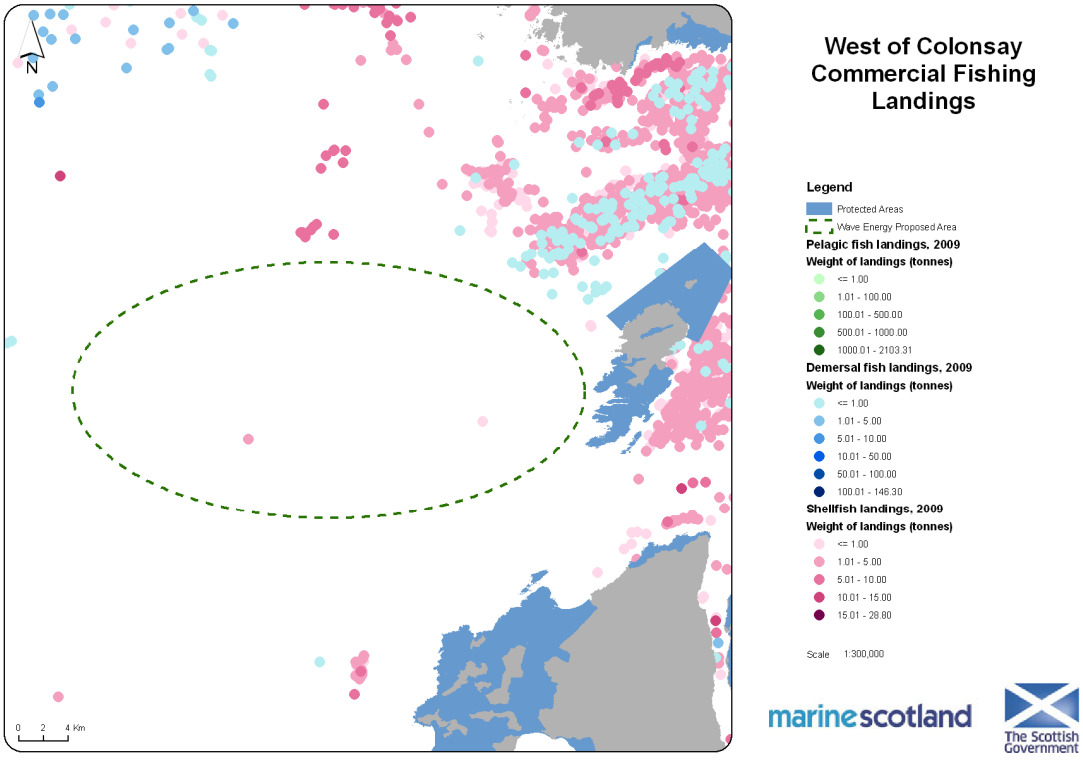

Figure 3.1.9: West of Colonsay: Commercial landings of pelagic and demersal fish and shellfish (tonnes) (source: OS, MSS)

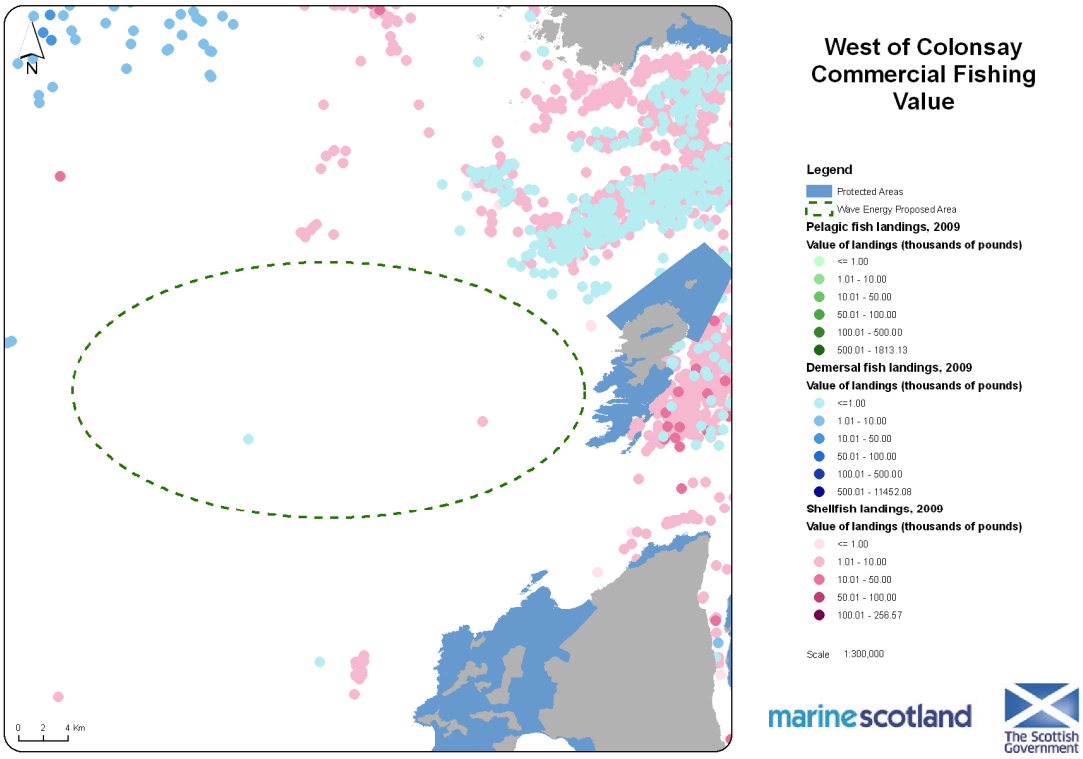

Figure 3.1.10: West of Colonsay: Commercial landings of pelagic and demersal fish and shellfish (value) (source: OS, MSS)

3.1.2.5 Environment

Designated Areas

There are no designated areas within this site, but it will be necessary to consider the potential effects of locating onshore infrastructure on the extensively designated western coastlines of Colonsay (Fig. 3.1.11). The Oransay and South Colonsay SPA lies to the south-west of Colonsay, the qualifying features of which are chough and corncrake. The machair grassland on the south-west coast is protected in the SAC of Oransay. Parts of this section of coast also form the Oransay and South Colonsay SSSI for its sand dunes, machair, grey seals (*Halichoerus grypus*), chough and corncrake. There is also an inlet in the south-west that is classified as a shellfish growing water. Further north is the North Colonsay and Western Cliffs and the West Colonsay Seabird Cliffs SSSI, both of which protect the chough.

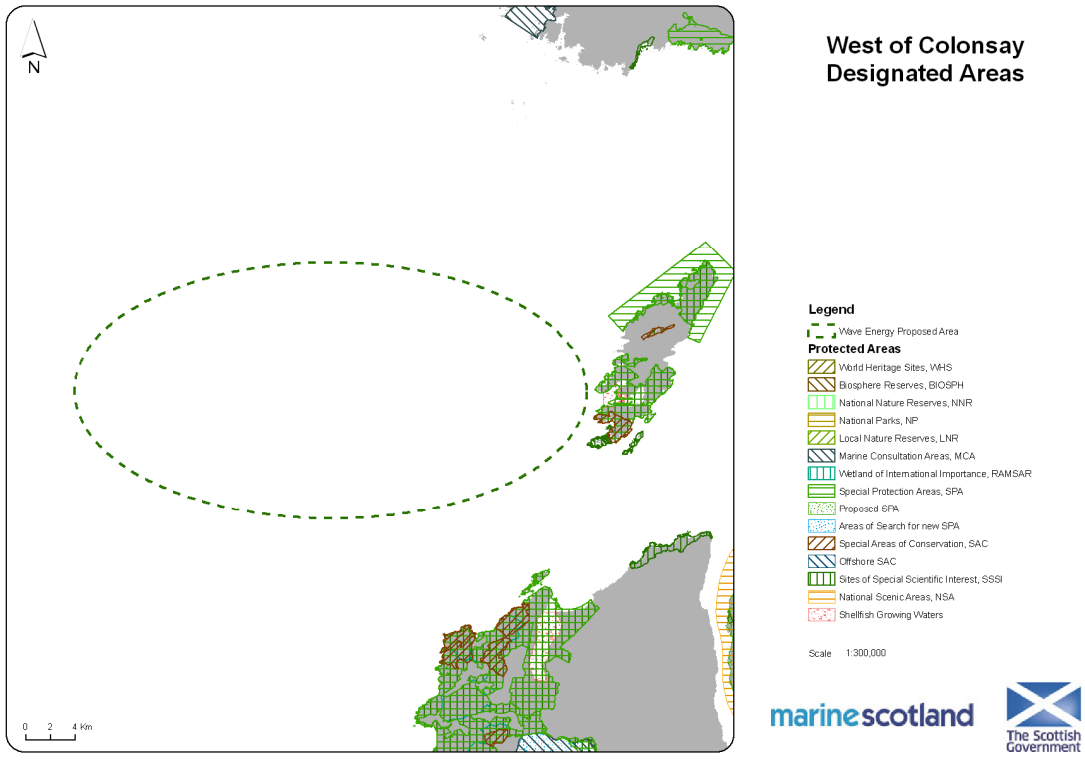

Figure 3.1.11: West of Colonsay: Designated areas (source: OS, SeaZone Hydrospatial, SNH, JNCC, SG)

Protected Species

There is only partial coverage of this area for cetaceans from the Cetacean Atlas (2003) (Figure 3.1.12). Low numbers (between 0.13 cetaceans / hour) have been recorded offshore of the coast. Species recorded here are harbour porpoise and minke whale (Weir et al., 2001; Cetacean Atlas, 2003). There is limited data on the density of seabirds at sea parts of this site. However, the data suggest that seabird numbers are generally relatively low, but higher inshore. The west coast of Colonsay contains numerous seabird colonies

and harbours important breeding sites for seabirds such as gulls and auks, chough and corncrake. Basking sharks have been sighted relatively frequently here in comparison to the other sites.

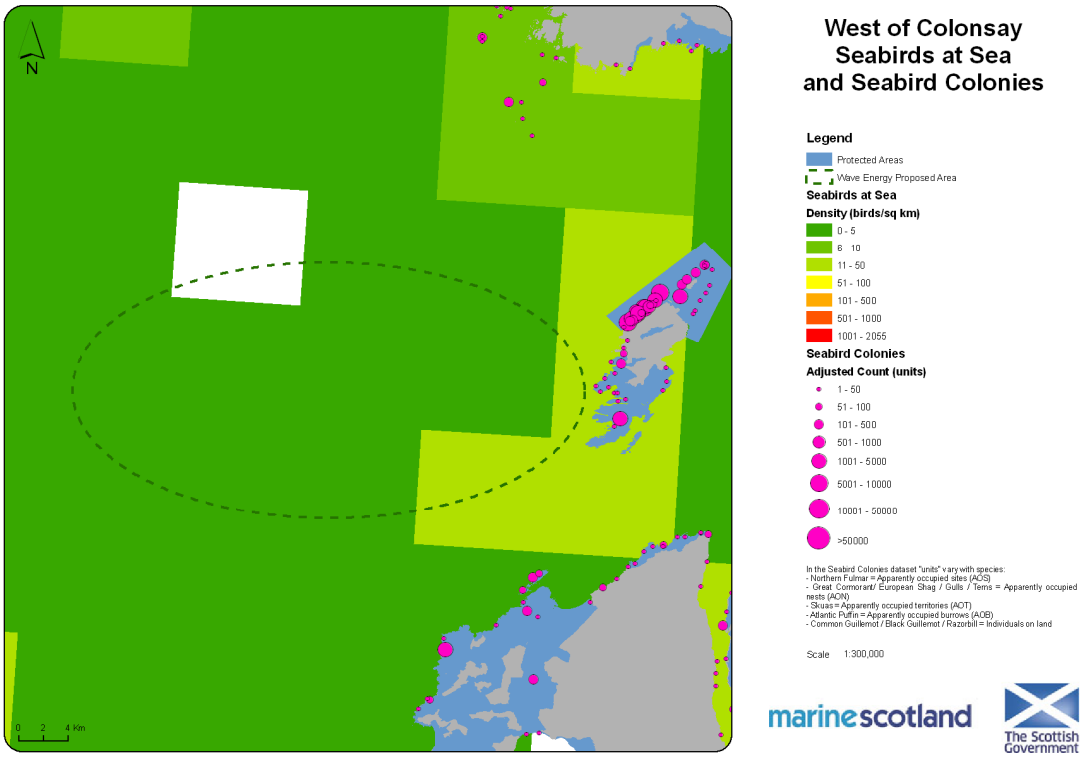

Figure 3.1.12: West of Colonsay: Seabirds at sea and seabird colonies (source: OS, JNCC)

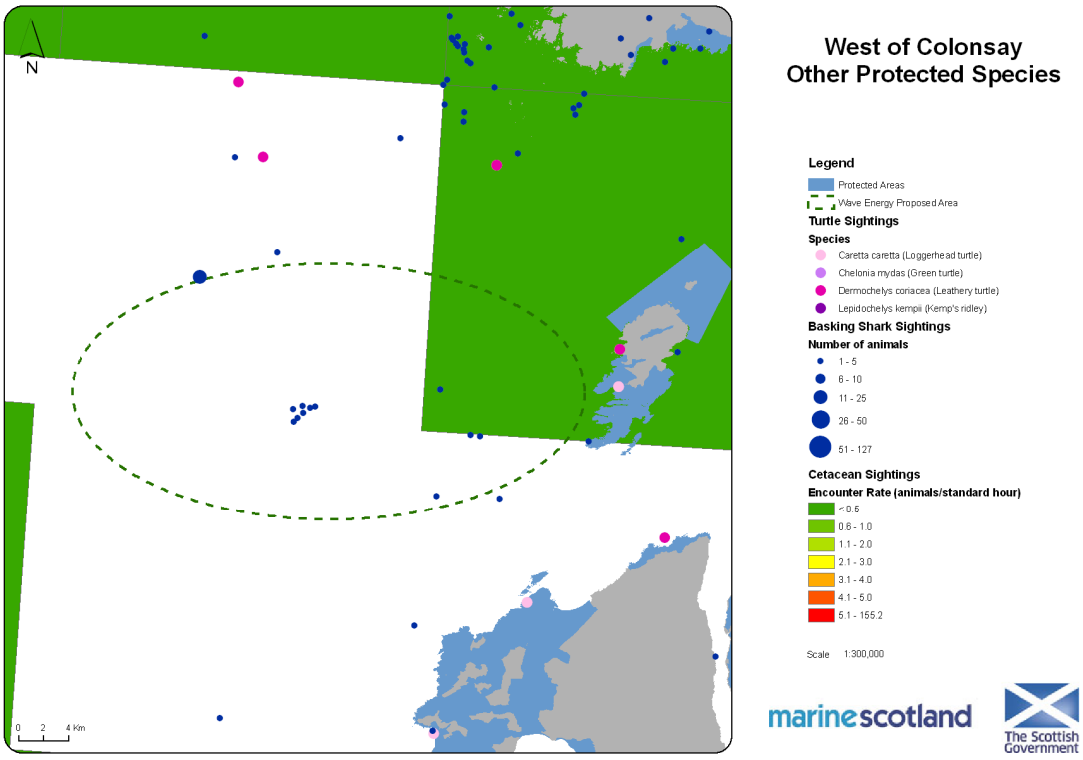

Figure 3.1.13: West of Colonsay: Cetaceans, turtles and basking sharks (source: OS, NBN, MCS, JNCC)

Protected Habitats

Surrounding the south-west coast of Colonsay is an area of coarse sediment to a distance of 2 km (Fig. 3.1.14). Beyond this out to 10 km from the coast is a zone of rock. Further out from this the seabed takes the form of fine sands or muddy sands. These areas of sediment could be classified as the UK BAP priority habitat, sublittoral sands and gravels. The seagrass species, *Zostera marina* and *Z. noltei*, have also been found in this area (Fig. 3.1.15).

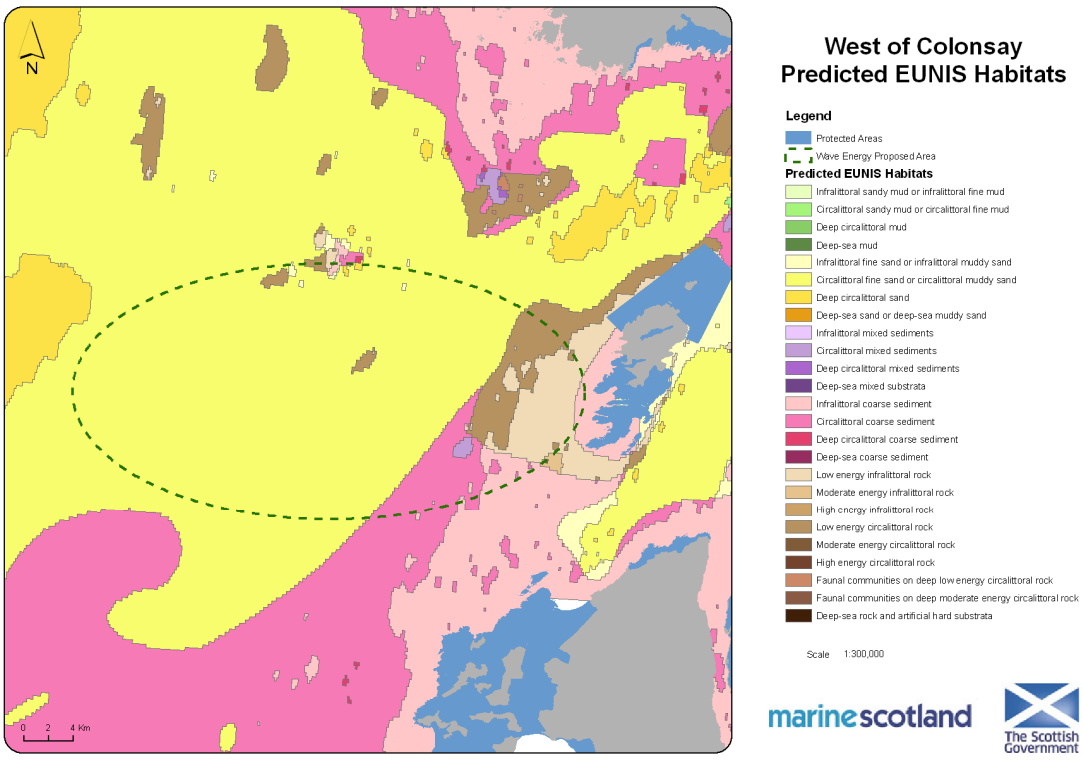

Figure 3.1.14: West of Colonsay: Seabed habitats (predicted by EUNIS) (source: OS, JNCC)

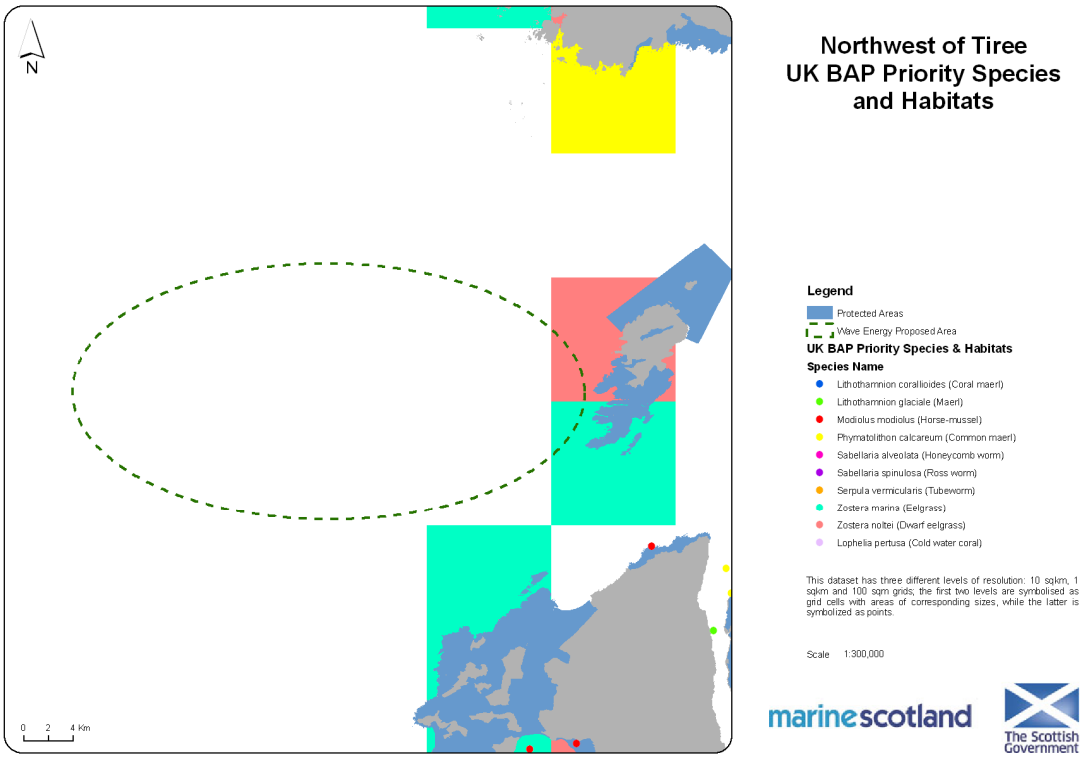

Figure 3.1.15: West of Colonsay: UK BAP Priority species and habitats (source: OS, NBN)

Fish Sensitivities

Data suggests that this area supports a nursery ground for cod, *Nephrops*, saithe and whiting and is a spawning area for *Nephrops*, Norway pout and sprat (Fig.s 3.1.16-17).

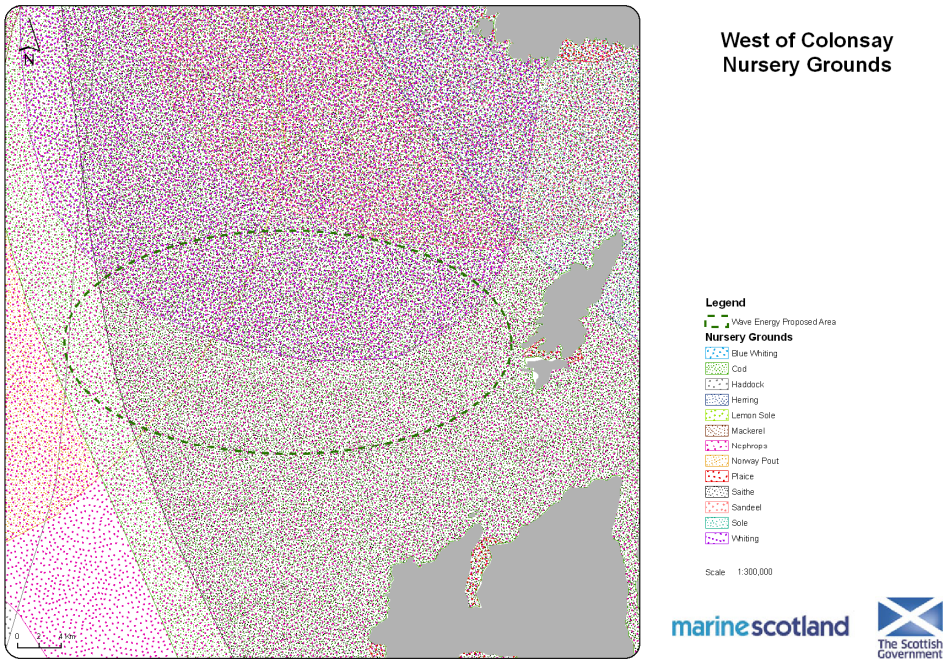

Figure 3.1.16: West of Colonsay: Nursery grounds for commercial species (source: OS, MSS, CEFAS)

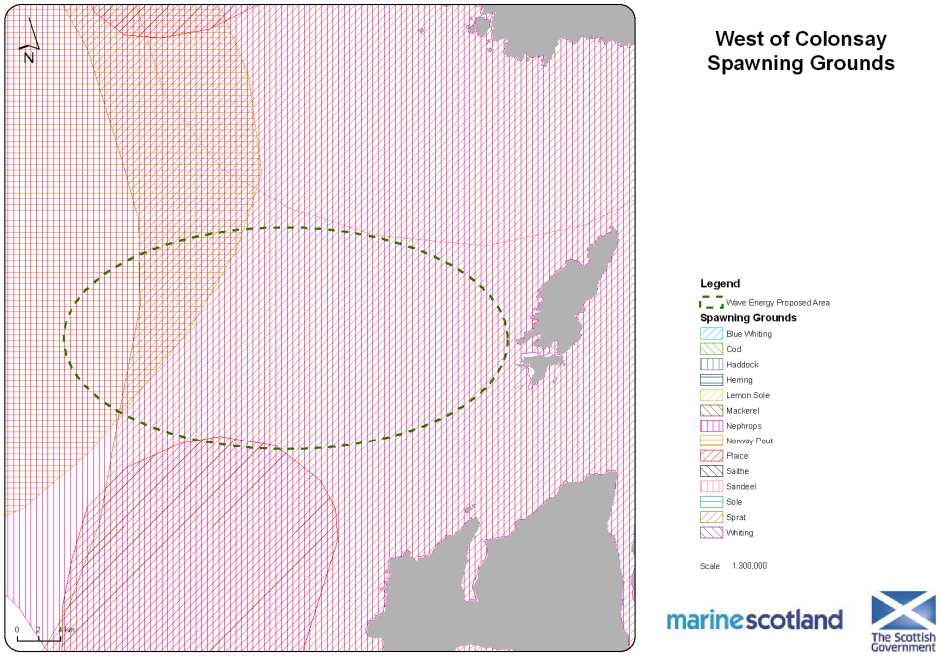

Figure 3.1.17: West of Colonsay: Spawning grounds for commercial species (source: OS, MSS, CEFAS)

3.1.2.6 Cultural Heritage

There are SAMs onshore adjacent to the site (Fig. 3.1.18). There are no designated wrecks or military wrecks, although there are two non-protected wrecks, one at a depth of 30 m and the other 50 m.

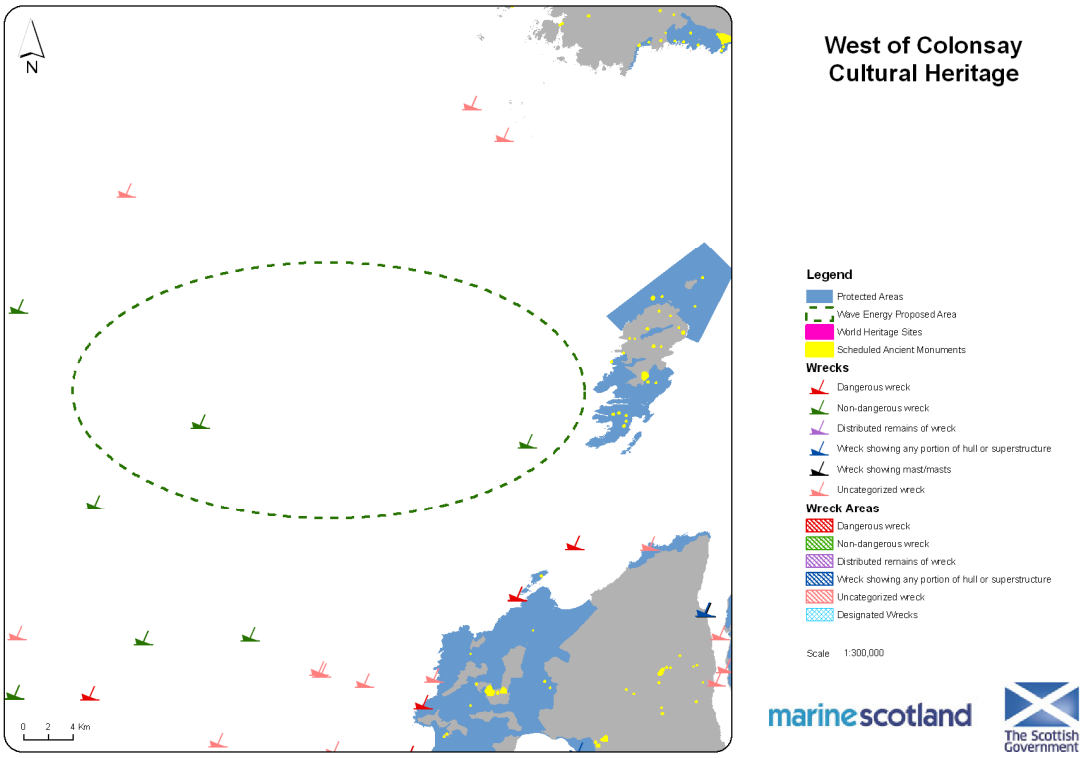

Figure 3.1.18: West of Colonsay: Cultural heritage (source: OS, Historic Scotland, SeaZone Hydrospatial)

3.1.2.7 Recreation

There are two lightly used sailing routes that cross this site (Fig. 3.1.19).

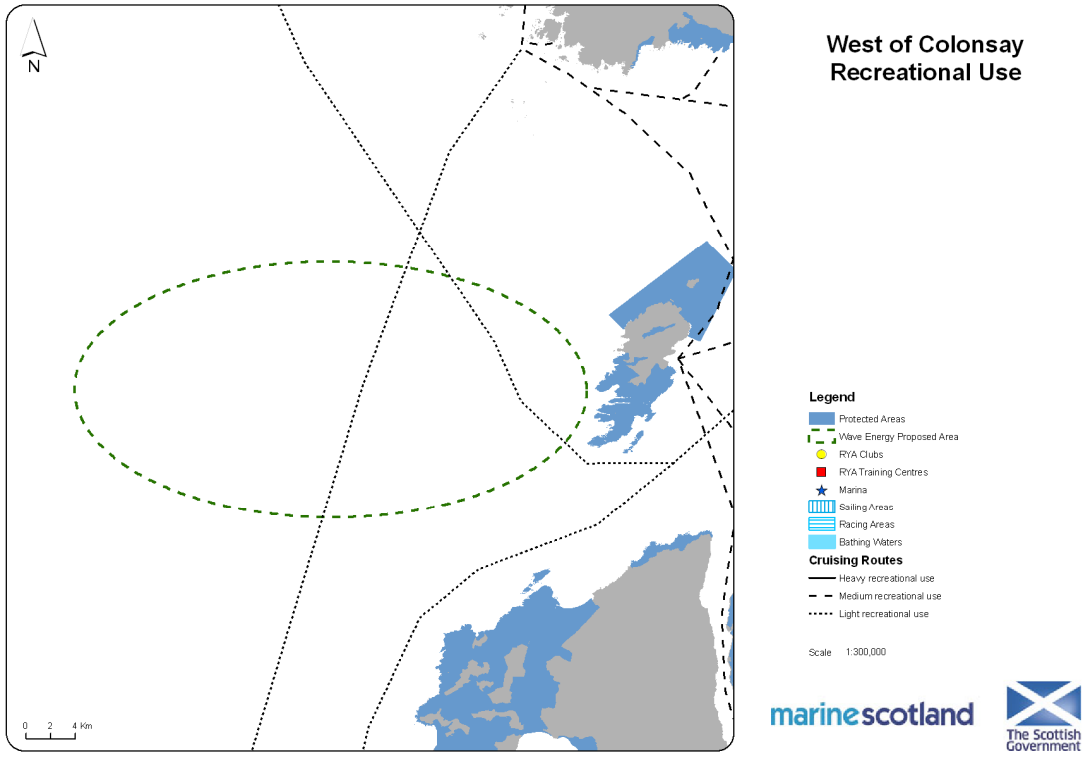

Figure 3.1.19: West of Colonsay: Recreational use (source: OS, RYA, SG)

3.2 West of Tiree

Summary

This remote site off Tiree in the Inner Hebrides harbours significant wave resource. The depth is <50 m up to 10 km from the shore and the seabed is characterised by expanses of solid rock, boulders, gravels and sands. One of the main concerns in this region is likely to be the minimising of disturbance to marine species and habitats. Exceptionally high numbers of basking sharks are recorded from the waters surrounding Tiree as well as many cetaceans and seabirds. There is also potential for in-combination effects to marine species from the wind farm proposal to the west of this site. Another concern is the lack of large ports in the vicinity and the need for reinforcement of the grid, which is currently not anticipated to occur before 2016. This area is also exploited by shellfish and demersal fisheries, particularly in the mid to northern sectors of the site. With regard to recreation, the site is highly regarded for surfing, which is of great benefit to the local economy.

3.2.1 Technological Constraints

3.2.1.1 Size of Wave Resource

The annual mean wave power in the site west of Tiree varies between 13.9 kW/m inshore and 27.9 kW/m of wave crest offshore (Fig. 3.2.1). In summer, it declines to between 5.2 and 10.4 kW/m and in winter it rises to between 24.1 and 48.6 kW/m. The annual mean wave height varies between 2.2 and 2.7 m and the wave period between 7.1 and 7.4 s (Fig. 3.2.2). In summer the maximum wave height in the proposed site is 1.6 m and in winter it is 3.1 m.

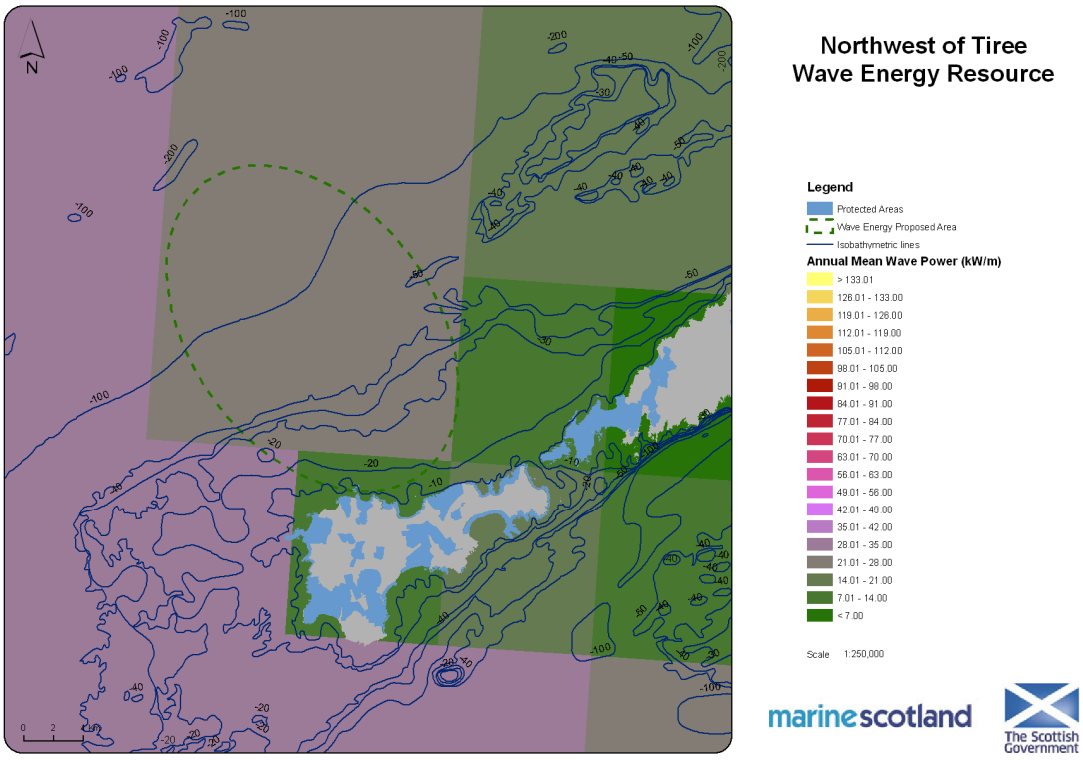

Figure 3.2.1: West of Tiree: Annual mean wave power density (source: OS, BGS, DTI)

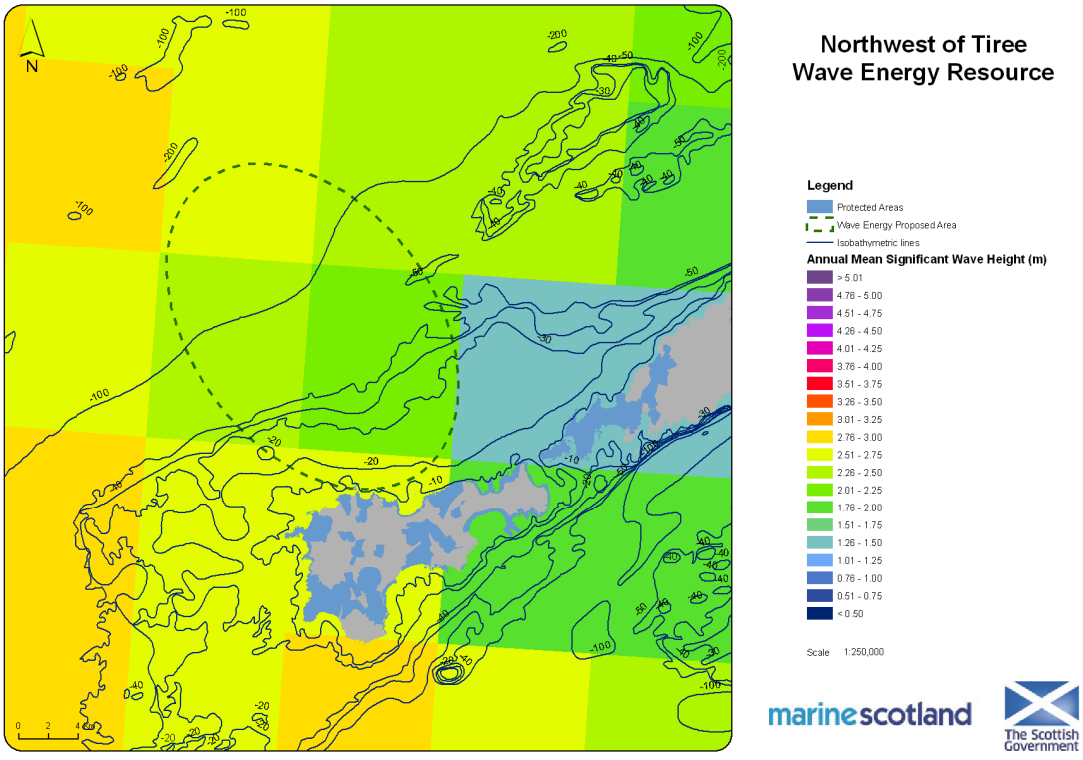

Figure 3.2.2: West of Tiree: Annual mean significant wave height (source: OS, BGS, DTI)

3.2.1.2 Tidal Streams

The tidal streams are relatively low and consistent across much of the site (< 0.3 m/s) (Fig. 3.2.3). However, in the south-east the tides reach up to 0.3 m/s during neap tides and 0.6 m/s during springs. The tidal range can reach up to 3.9 m during spring tides and 1.7 m during neaps.

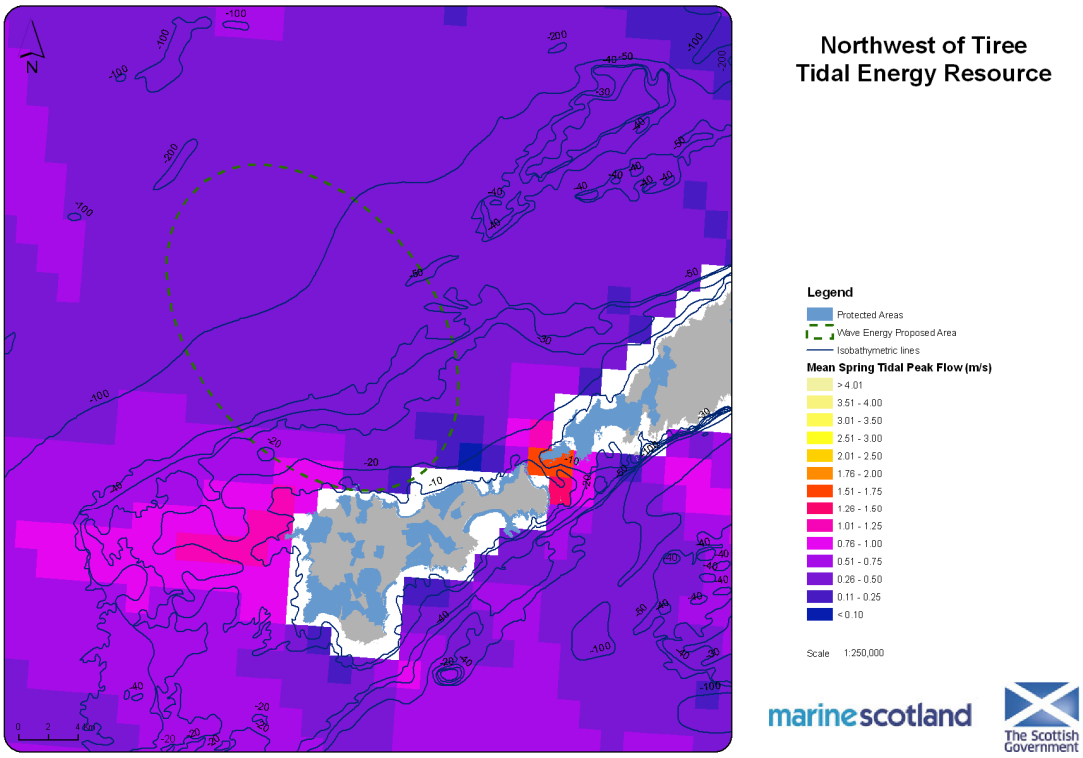

Figure 3.2.3: West of Tiree: Mean spring tidal peak flow (source: OS, BGS, DTI)

3.2.1.3 Bathymetry and Seabed

The seabed slopes gradually from 5 to 50 m at a distance of 10 km from the shore and reaches a depth of 100 m 18 km from the shore (Fig. 3.2.4). The seabed data from the BGS suggests that the seabed off the coast of Tiree is composed of variants of sands and gravels, progressing to pure sand and muddy sand. However, the EUNIS habitat maps (Fig. 3.2.14) indicates that there are further complexities, with large areas of solid rock in the south and south-west of the site out to ~20 km. Video transects taken by Marine Scotland – Science (http://www.youtube.com/user/MarineLaboratory), help to clarify that the seabed is composed, at least partly, of hard ground and boulders of various sizes.

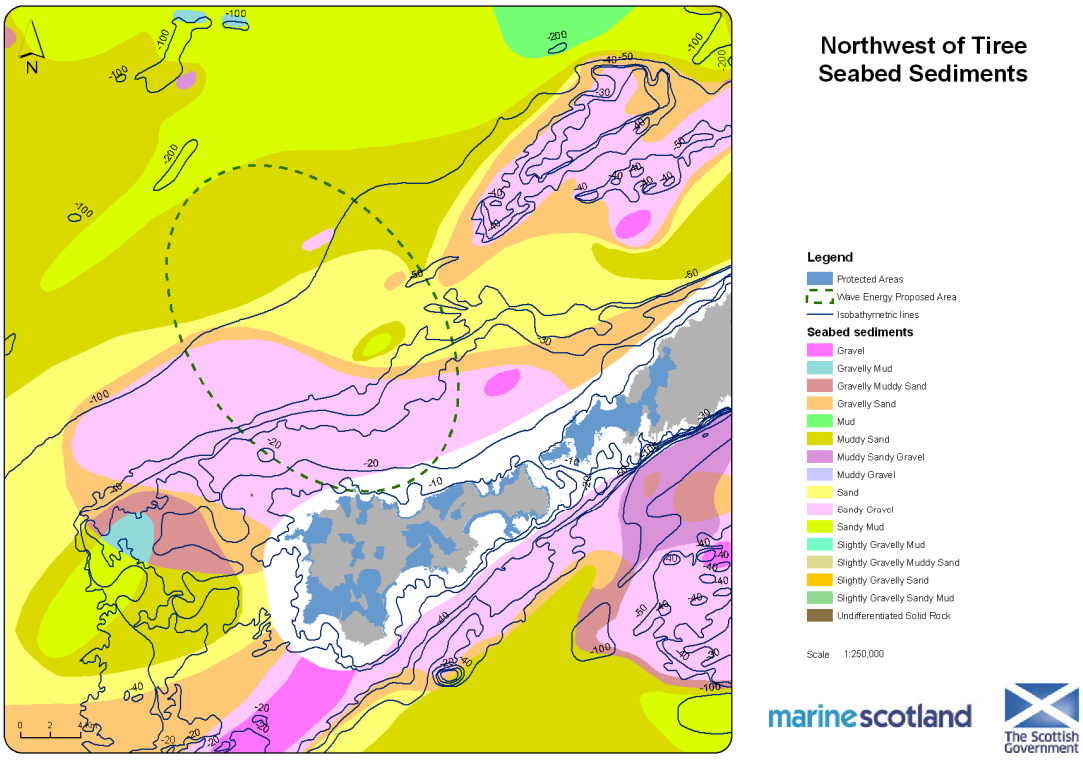

Figure 3.2.4: West of Tiree: Bathymetry and seabed sediments (source: OS and BGS)

3.2.1.4 Infrastructure

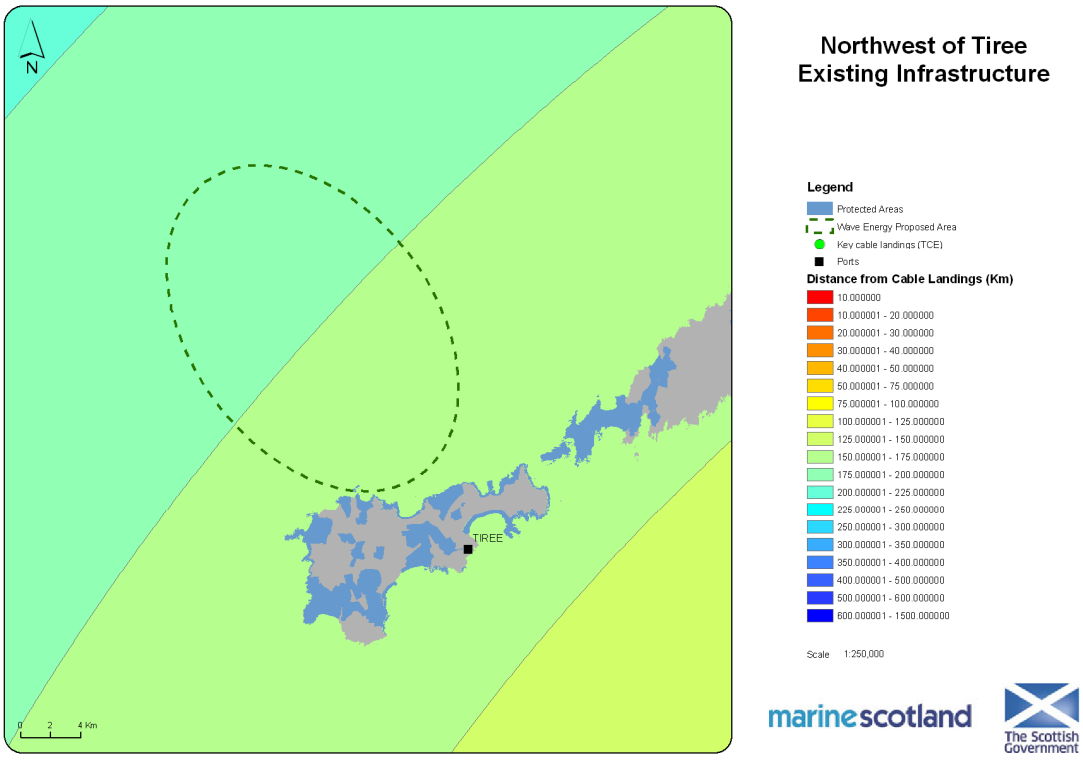

Figure 3.2.5: West of Tiree: Existing infrastructure (ports and cable landings) (source: OS, TCE, DECC)

Grid connection: As advised by SSE, connection of marine developments, even of <10 MW, would require reinforcement to the mainland grid system in addition to physical connection on shore. There is a plan for construction of a 132 kV wood pole overhead line circuit between Nant and Dalmally in north Argyll, which could accommodate 180 MW of export capacity. The timescale of this is >6 years, however, and would miss the Saltire Prize target of generating power for 2 years by 2017.

Ports and harbours: This is a remote site and access to large ports locally is limited (Fig. 3.2.5). The port of Tiree is ~30 km away. The larger port of Oban is >100 km away and ports in the Clyde are >250 km away.

3.2.2 Other Constraints

3.2.2.1 Commercial Uses

TCE energy leases: A windfarm site has been proposed off the south-west of Tiree to the south and south-west of the suggested site (Fig. 3.2.6). There may be potential to share resources in terms of transmission to the grid.

Fish / shellfish farm leases: There are none in this site.

Cables and pipelines: There are none in this site.

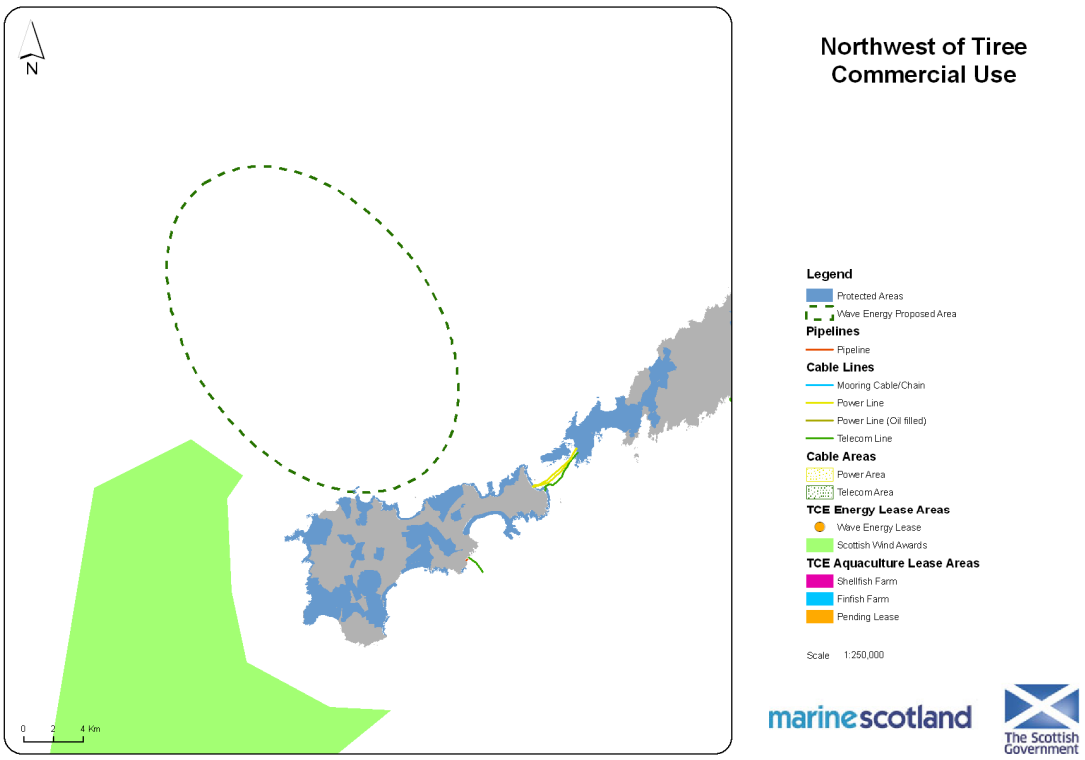

Figure 3.2.6: West of Tiree: Existing commercial uses (source: OS, SeaZone Hydrospatial, Kingfisher, TCE)

3.2.2.2 Military

This area is used by the Navy for submarine exercises and shipping (Fig. 3.2.7).

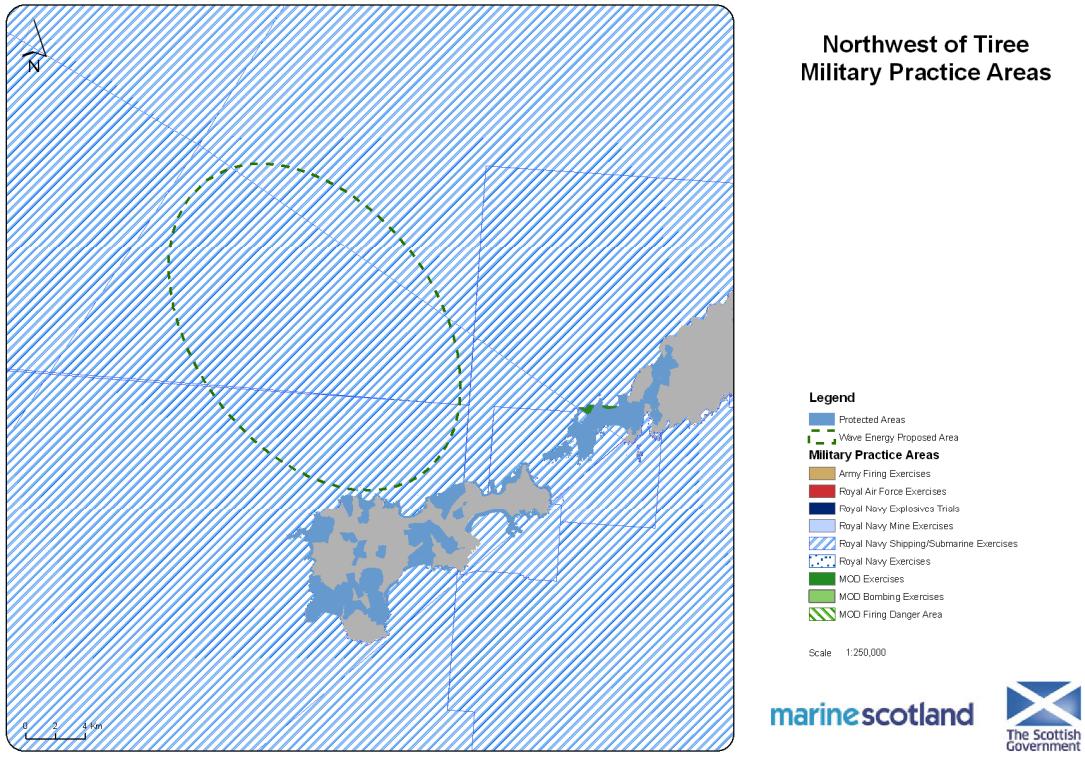

Figure 3.2.7: West of Tiree: Military practice areas (source: OS, SeaZone Hydrospatial)

3.2.2.3 Commercial

There is little shipping other than on the north-west boundary (≤192 shipping movements/year transiting the site) and on the eastern boundary of the site (≤64 movements/year) (Fig. 3.2.8). There are no ferry routes through this site.

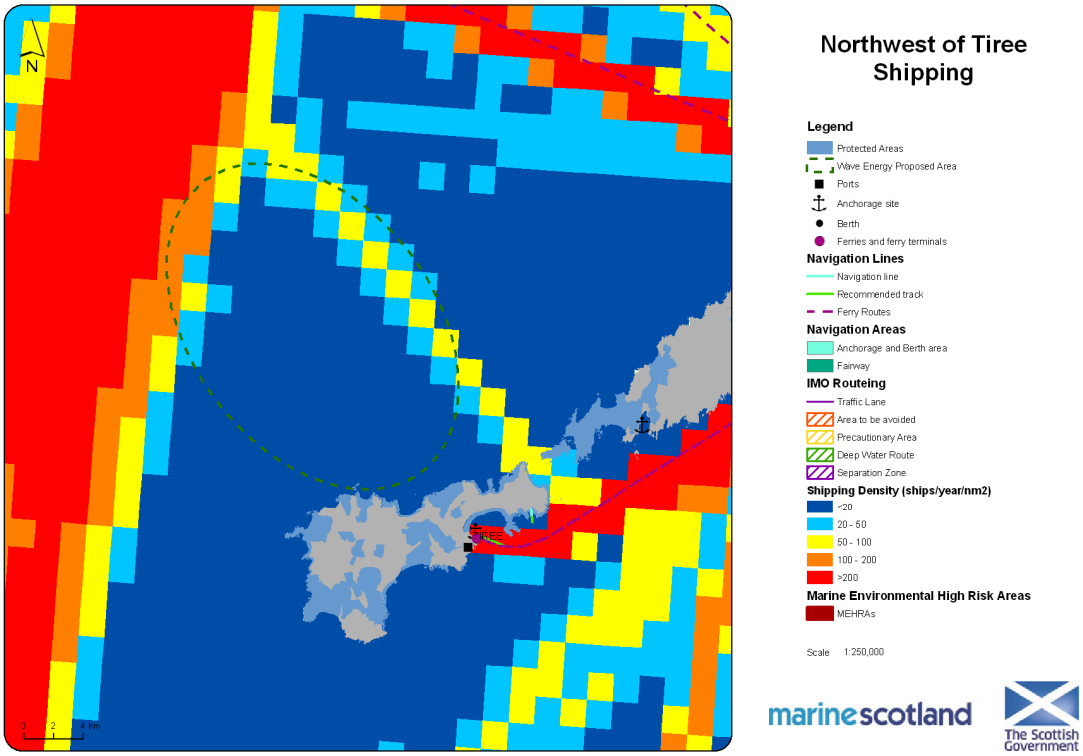

Figure 3.2.8: West of Tiree: Shipping (source: OS, SeaZone Hydrospatial, DECC, Anatec Ltd)

3.2.2.4 Fishing

Data for larger fishing vessels (≥15 m), suggests the mid to northern sector is an important fishing ground for demersal species (particularly haddock and whiting) and shellfish (brown crabs and *Nephrops*) (Fig.s 3.2.9-10). In 2009, ≤29 tonnes of shellfish with a value of ≤£100 000 were caught per trip. In the same year, ≤10 tonnes of demersal fish were landed per trip with a value of ≤£100 000.

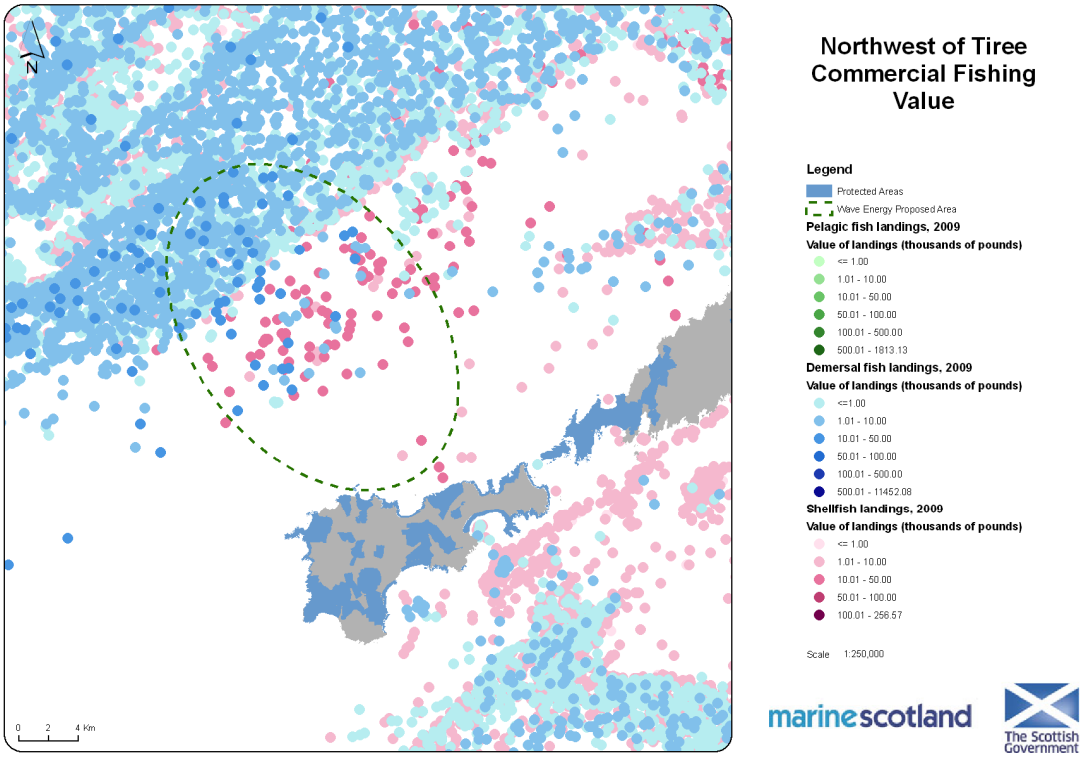

Figure 3.2.9: West of Tiree: Commercial landings of pelagic and demersal fish and shellfish (tonnes) (source: OS, MSS)

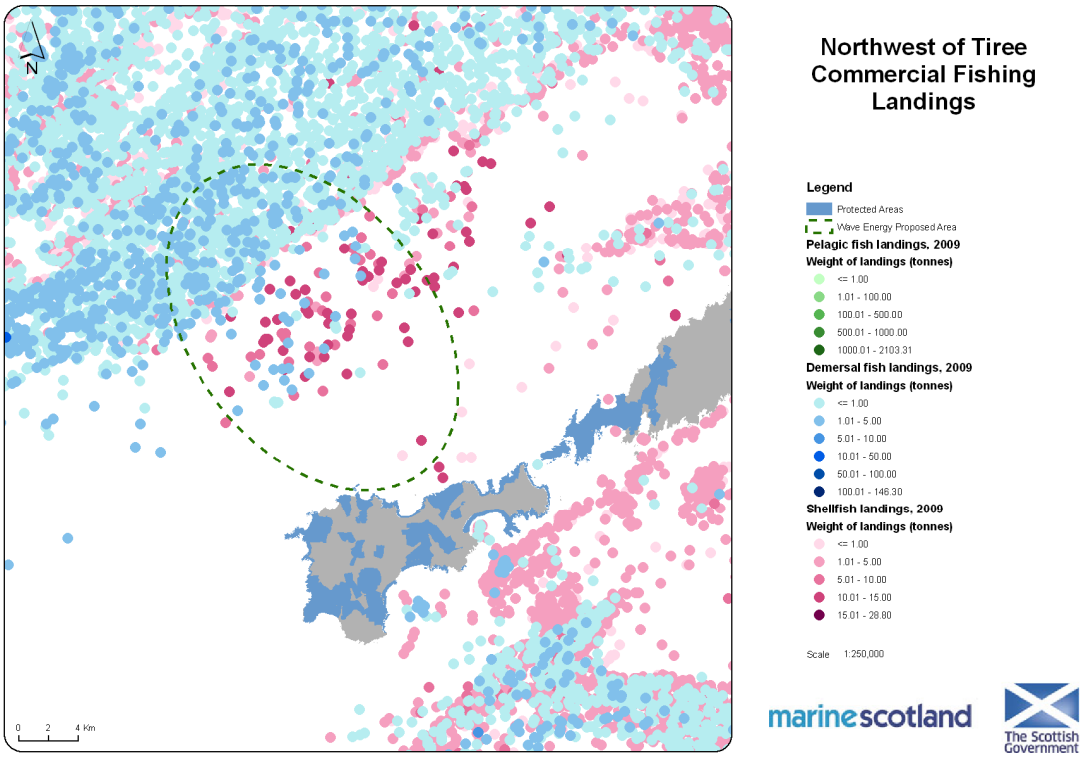

Figure 3.2.10: West of Tiree: Commercial landings of pelagic and demersal fish and shellfish (value) (source: OS, MSS)

3.2.2.5 Environment

Designated Areas

Developers will need to consider the potential impacts of onshore infrastructure on the many sites designated for conservation purposes along the western coastlines of Tiree and Coll (Fig. 3.2.11). The SPA of Sleibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast) may require appraisal for the breeding and non-breeding aggregations of birds it supports. Part of this SPA is also designated as a biological SSSI. The SAC of Tiree Machair supports fixed and shifting sand dunes and machair grassland. The JNCC is also considering the southern half of the site as a future offshore SPA.

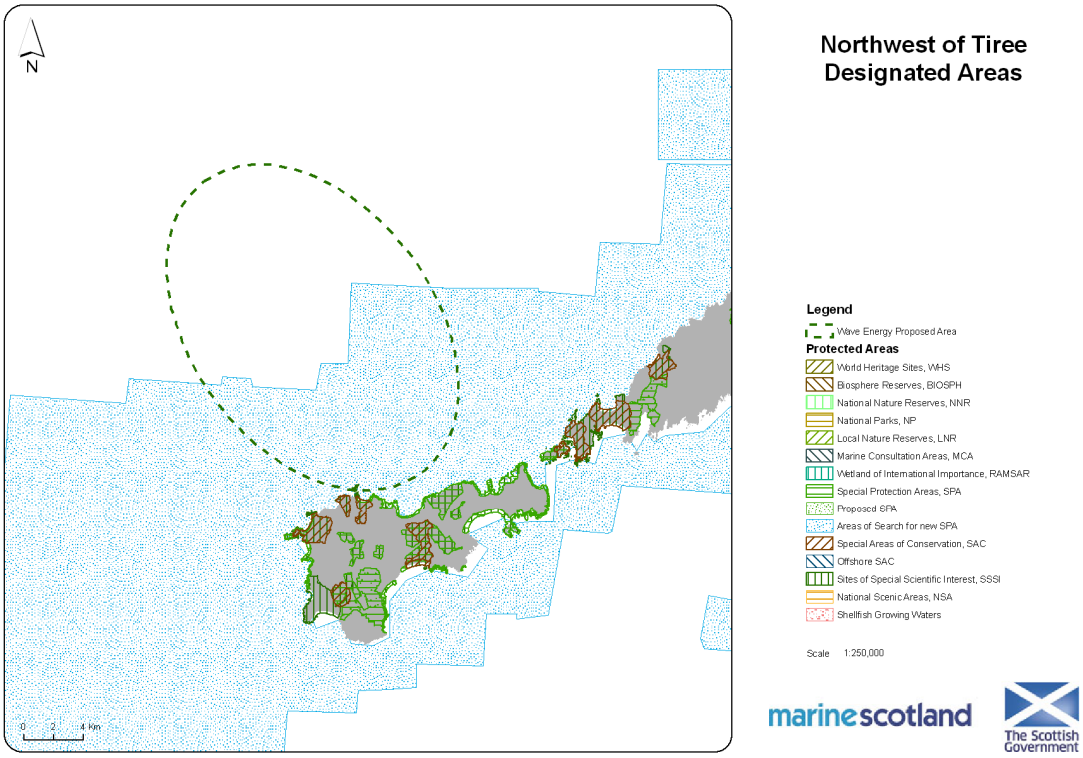

Figure 3.2.11: West of Tiree: Designated areas (source: OS, SeaZone Hydrospatial, SNH, JNCC, SG)

Protected Species

This area is relatively important for seabirds although abundance of seabirds at sea and colony size appears to be larger to the south of Tiree (Fig. 3.2.12). The coastal wetlands are particularly important for large numbers of wintering geese such as, Greenland barnacle goose (*Branta leucopsis*), Greenland white-fronted goose (*Anser albifrons flavirostris*) and breeding waders such as dunlin (*Calidris alpina schinzii*).

A high abundance and diversity of cetaceans have been recorded in the north of this site (3.36/hour) (Fig. 3.2.12). Species sighted include minke whale, short-beaked common dolphin (*Delphinus delphis*), white beaked dolphin (*Lagenorhynchus albirostris*), Risso's dolphin (*Grampus griseus*), killer whale (*Orcinus orca*) and harbour porpoise (Weir et al. 2001; Cetacean Atlas, 2003). Relatively high numbers of seabirds are found offshore and on the coast. This is also one of the most important areas for basking sharks in Scotland. Sightings are particularly numerous near the coast and in Gunna Sound (between Tiree and Coll). However, the lower numbers recorded offshore may be due to fewer recorders at sea than on the coast. The potential for disturbance to marine species may also be heightened due to in-combination effects from the proposed wind farm development to the west of this site.

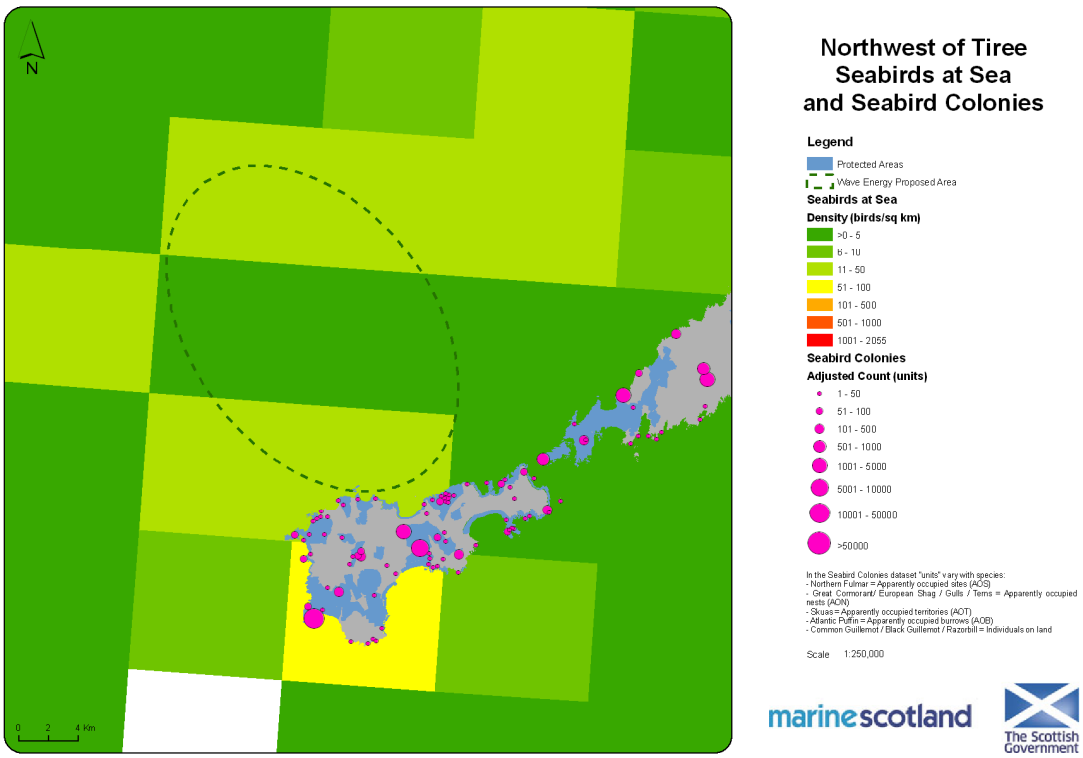

Figure 3.2.12: West of Tiree: Seabirds at sea and seabird colonies (source: OS, JNCC)

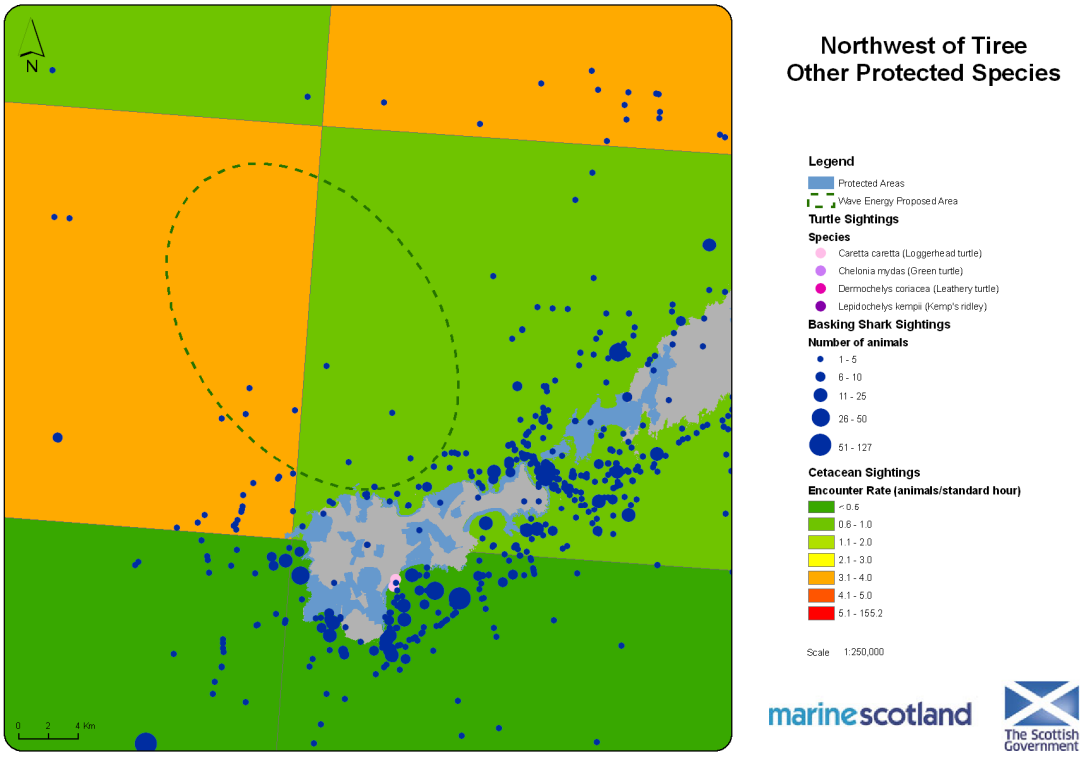

Figure 3.2.13: West of Tiree: Cetaceans, turtles and basking sharks (source: OS, NBN, MCS, JNCC)

Protected Habitats

This site contains a number of UK BAP priority habitats and species (Fig. 3.2.14 & 3.2.15). The area of coarse sediment and sand comes under the classification of 'sublittoral sands and gravels'. 'Mud habitats in deep water' are present at a distance of 20 km offshore. The seagrass species, *Z. marina*, is present in southern Tiree and common maerl (*P. calcareum*) in the north.

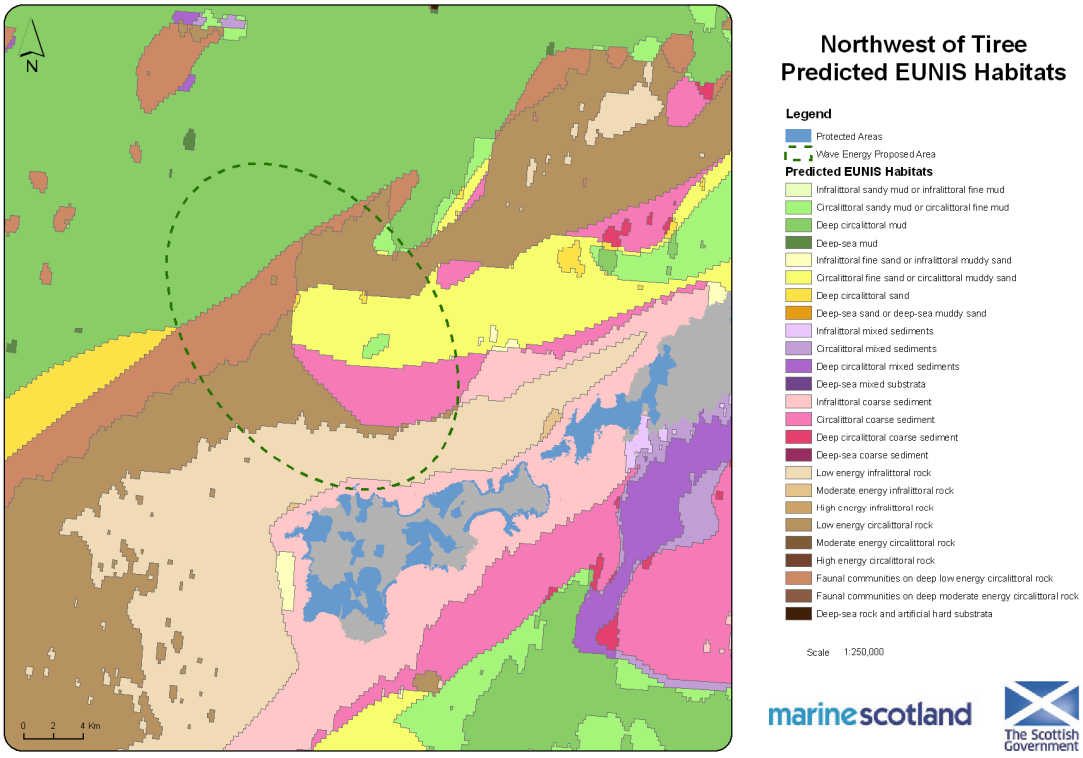

Figure 3.2.14: West of Tiree: Seabed habitats (predicted by EUNIS) (source: OS, JNCC)

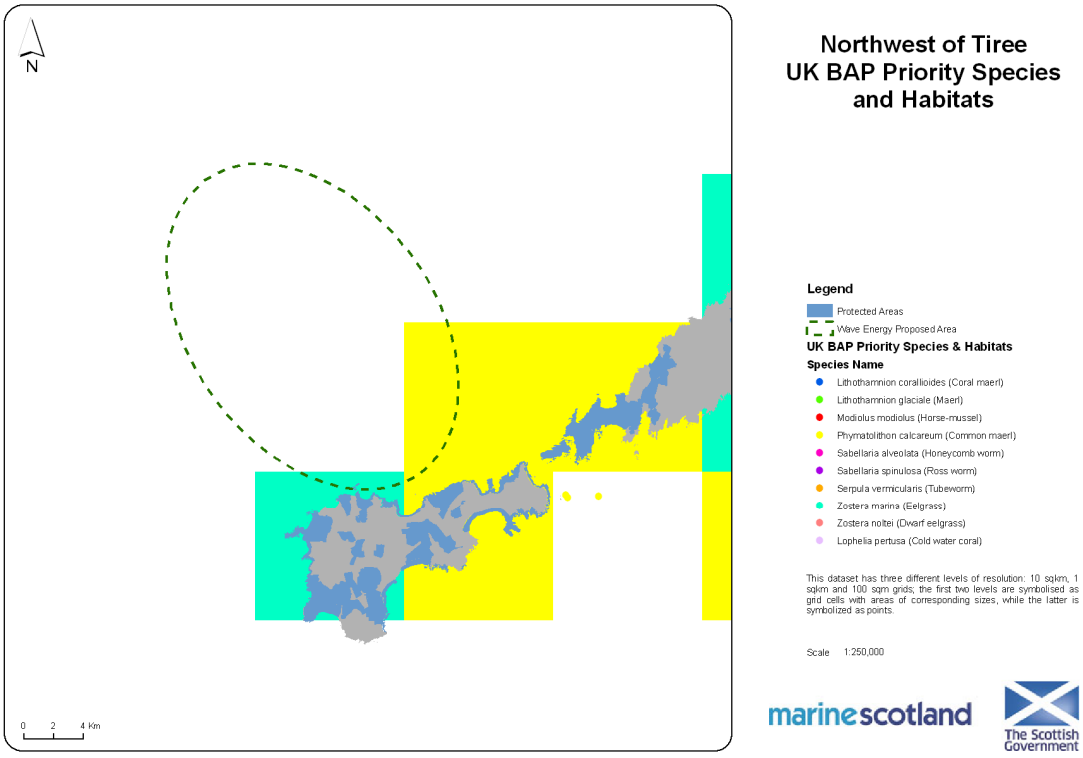

Figure 3.2.15: West of Tiree: UK BAP Priority species and habitats (source: OS, NBN)

Sensitive Areas for Fish

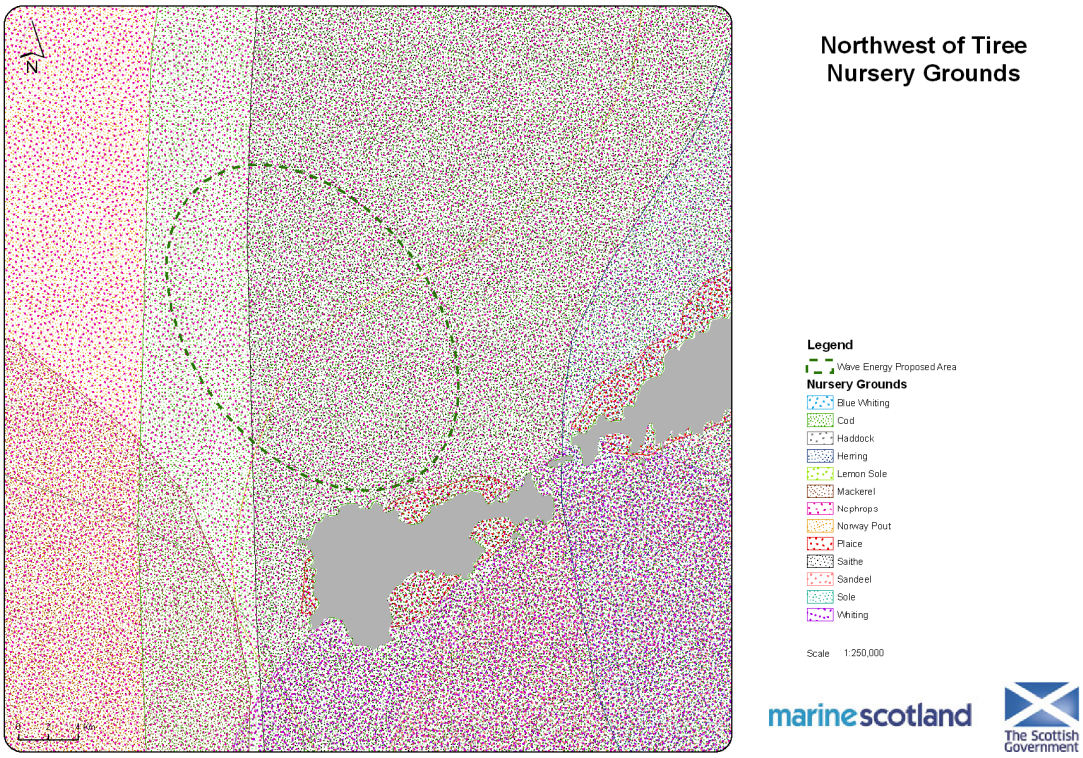

Figure 3.2.16: West of Tiree: Nursery grounds for commercial species (source: OS, MSS, CEFAS)

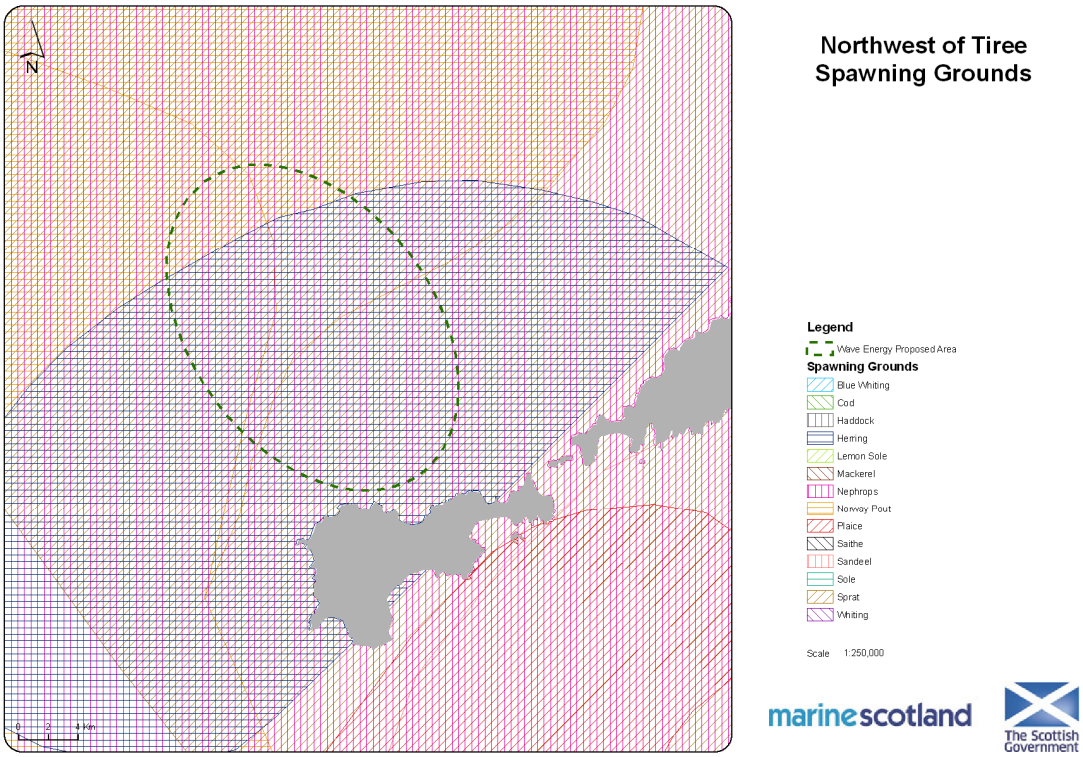

Figure 3.2.17: West of Tiree: Spawning grounds for commercial species (source: OS, MSS, CEFAS)

The data on spawning and nursery areas for fish suggest this is a relatively sensitive area for commercial fish and thus development may be restricted to certain times of year (Fig. 3.2.16 & 3.2.17). Cod, *Nephrops,* Norway pout and saithe are thought to use the area as a nursery ground and herring, *Nephrops,* Norway pout and sprat for spawning.

3.2.2.6 Cultural Heritage

There are no wrecks within the site but there are three that are marked on the Tiree coast. A number of SAMs are found along the west coast of Tiree, which may require consideration with regard to onshore infrastructure. These include:

Cill Choinnich, chapel, Kilkenneth
Cill Fhinnein, chapel, Kenovay
Balephetrish, marble and limestone quarry
Kirkapol, church, chapel and cross-incised rocks

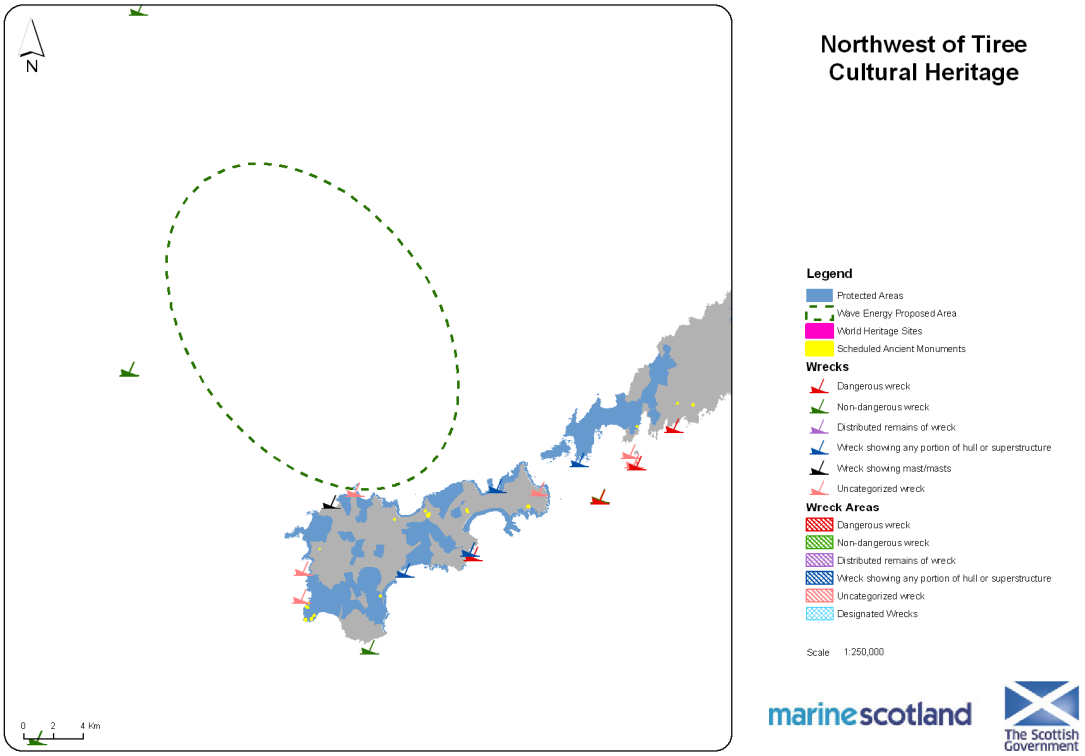

Figure 3.2.18: West of Tiree: Cultural heritage (source: OS, Historic Scotland, SeaZone Hydrospatial)

3.2.2.7 Recreation

One sailing route passes through the eastern sector of the site (Fig. 3.2.19), but perhaps more significantly for Tiree is surfing, which provides an important contribution to the island's economy. The world championship wind surfing (the Tiree Wave Classic) event takes place on Tiree on the beaches adjacent to this area.

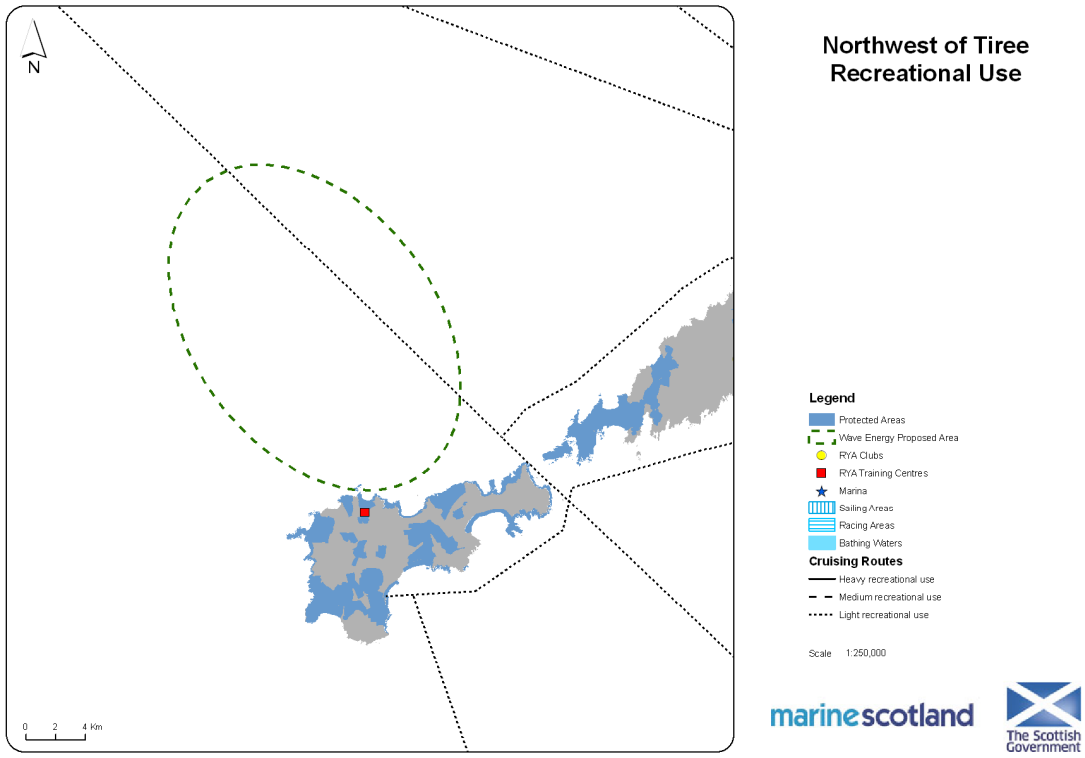

Figure 3.2.19: West of Tiree: Recreational use (source: OS, RYA, SG)

3.3 West of South Uist and Barra

Summary

This site contains ample wave resource offshore of the coast. However, a missile firing range is situated to the west of South Uist within the site. Development within the firing range would be restricted but there is still scope outside the range. The seabed outside the range is composed of solid rock and the depth ranges between 10 and 30 m. However, this stretch of coastline is highly regarded for the species and habitats it supports. Much of the remaining coastline out with the firing range is designated for conservation purposes and further areas are being considered, e.g. the proposed SAC in the Sound of Barra and the area of search for new SPAs to the west of South Uist. There is also a shellfish fishery within this site. A further challenge is the lack of infrastructure in terms of access to the grid and proximity to large ports.

3.3.1 Technological Constraints

3.3.1.1 Wave Resource

The annual mean wave resource in varies between a minimum of 10.8 kW/m of wave crest in the north closer to shore and a maximum of 43.0 kW/m further offshore and in the south (Fig. 3.3.1). The power generated in winter (78.1 kW/m) is over five times greater than that produced during the summer (14.9 kW/m). Annual mean wave height varies between 1.7 and 3.1 m within the site and reaches up to 3.9 m in winter (Fig. 3.3.2). The wave period varies between 6.3 and 7.9 s (annual mean).

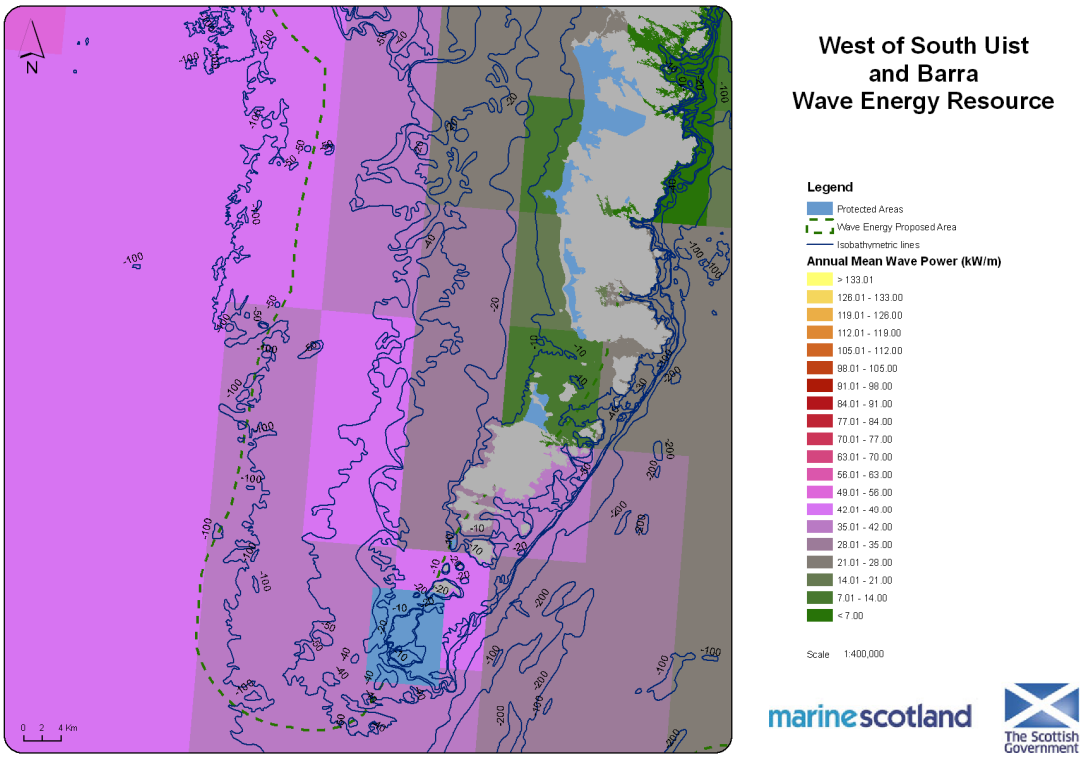

Figure 3.3.1: West of South Uist and Barra: Annual mean wave power density (source: OS, BGS, DTI)

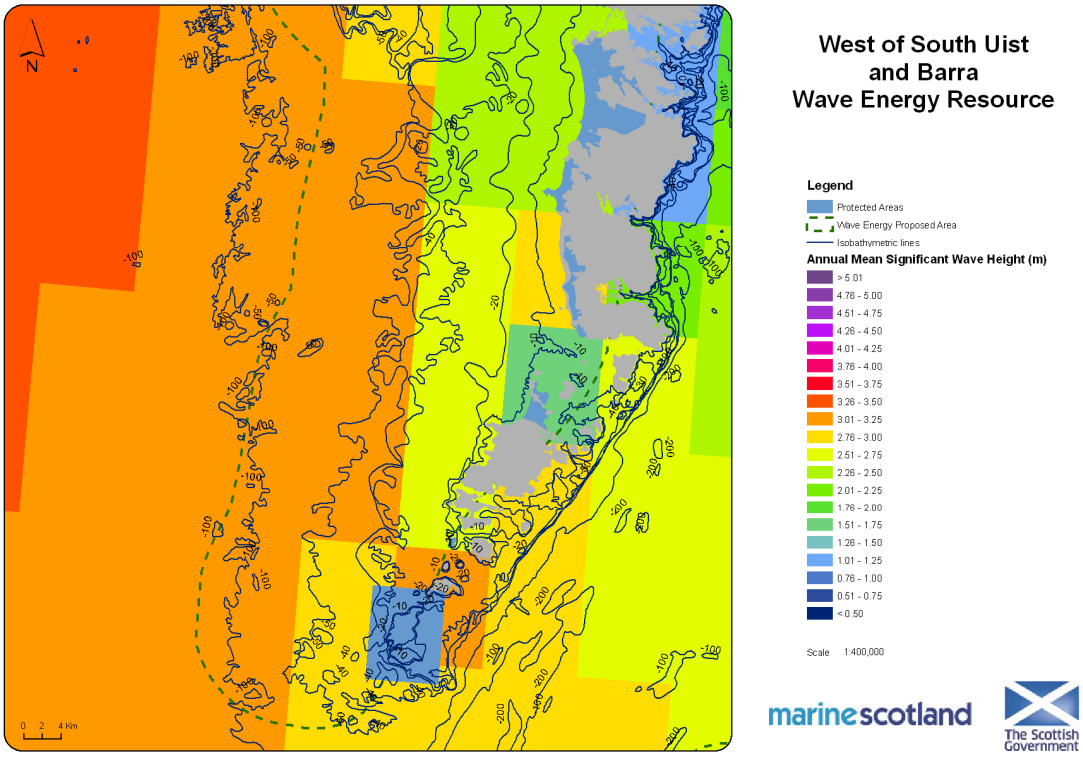

Figure 3.3.2: West of South Uist and Barra: Annual mean significant wave height (source: OS, BGS, DTI)

3.3.1.2 Tidal Streams

The tide is relatively strong in the south, reaching 0.32 m/s and 1.75 (mean annual neap and spring respectively) to the south of Berneray and in Loch Maddy (Fig. 3.3.3). It is weaker in the north offshore from North Uist (between 0.07 and 0.11 m/s). The tidal range is relatively consistent across the site, up to ~3.3 m during springs and 1.5 m during neaps.

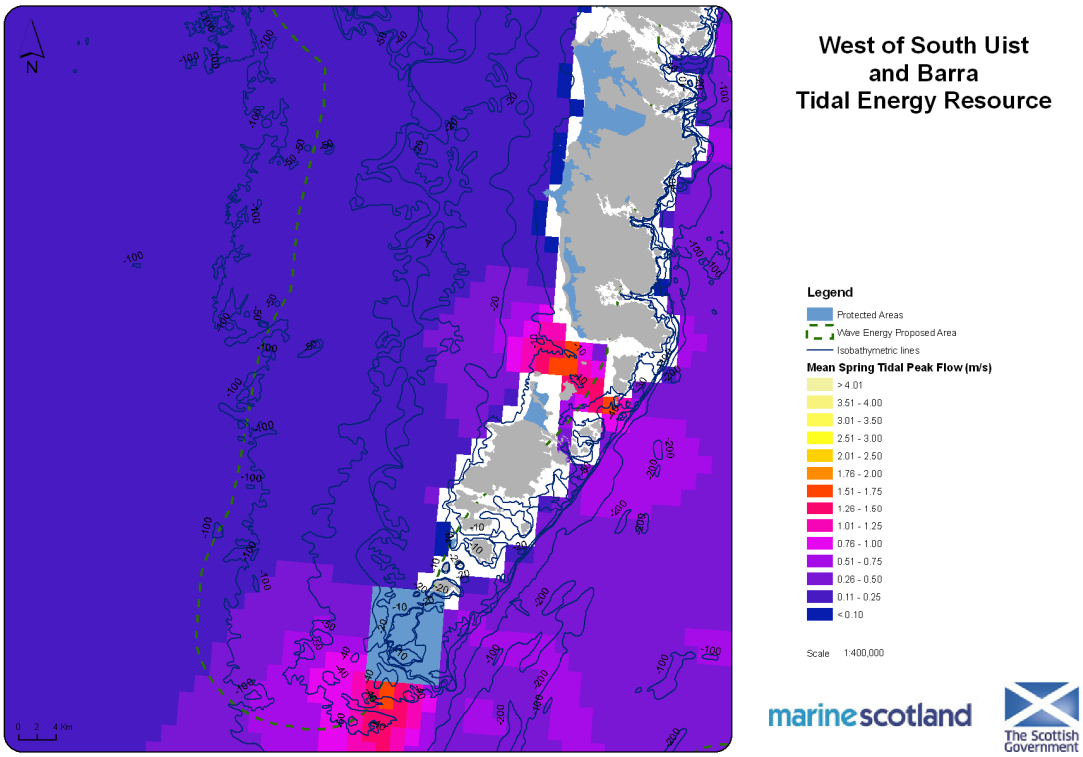

Figure 3.3.3: West of South Uist and Barra: Mean spring tidal peak flow (source: OS, BGS, DTI)

3.3.1.3 Bathymetry and Seabed

Virtually the whole of this area has been classified as undifferentiated solid rock (Fig. 3.3.4). The depth slopes more steeply in the south. At the southern end of the site, the depth reaches 20 to 30 m <2 km from shore and 50 m 5-6 km from shore. In the north of the site, the seabed reaches 30 m at a distance of ~7 km from shore and 50 m at a distance of ~13 km.

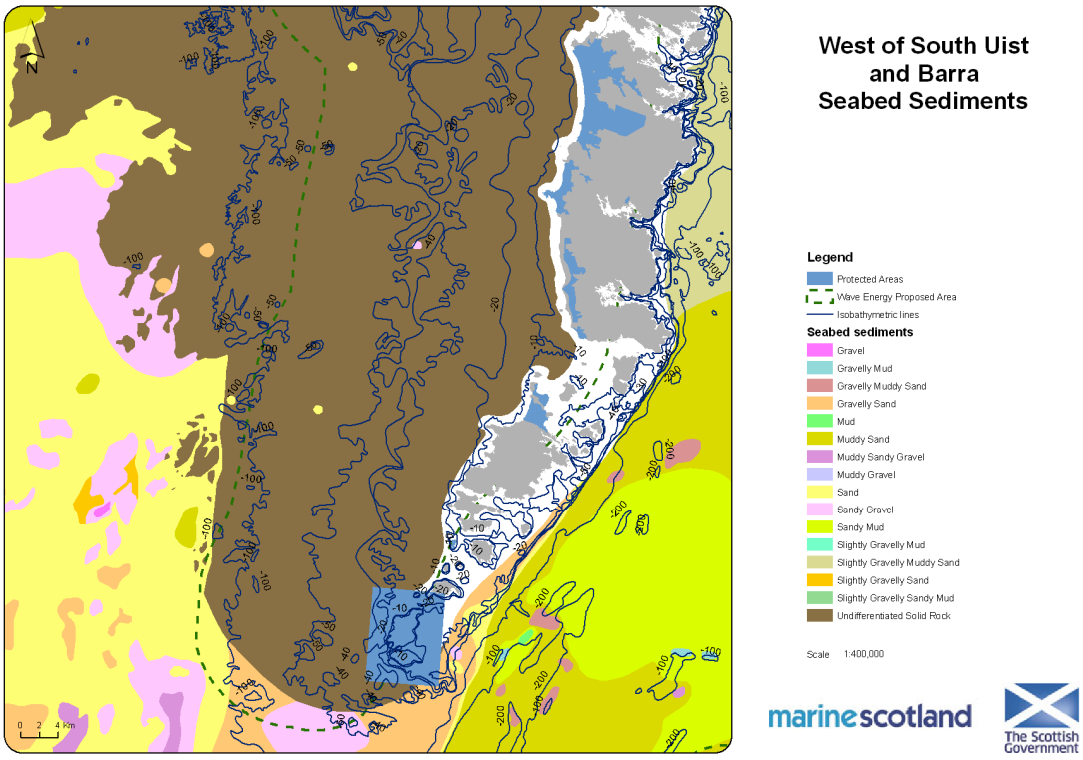

Figure 3.3.4: West of South Uist and Barra: Bathymetry and seabed sediments (source: OS and BGS)

3.3.1.4 Existing Infrastructure

Ports and harbours: There are a number of small ports within or adjacent to the site such as Benbecula, Loch Boisdale and Castle Bay (Fig. 3.3.5). The nearest large port is Stornoway, between 120 and 220 km away, which has been identified as a potential location for the production of wave and tidal devices (SE & SIE, 2010).

Grid connection: The single connection from Lewis via Skye to Fort Augustus on the Scottish mainland is already at full capacity. Subject to consents, SHETL plans reinforcement of a 450 MW HVDC circuit between Gravir on Lewis and Beauly west of Inverness by 2012-13. 152 MW of this capacity will be allocated to already consented renewable energy generation. There is potential for wave/tidal development to connect into the 298 MW of spare capacity. However, if all other existing proposals gain consent, then only 18 MW of capacity will remain. There is potential to install a second 450 MW connection, but this is subject to approval by Ofgem. As the planned reinforcements are connecting to the east coast of Lewis, local reinforcements would be required in order to link up to this point.

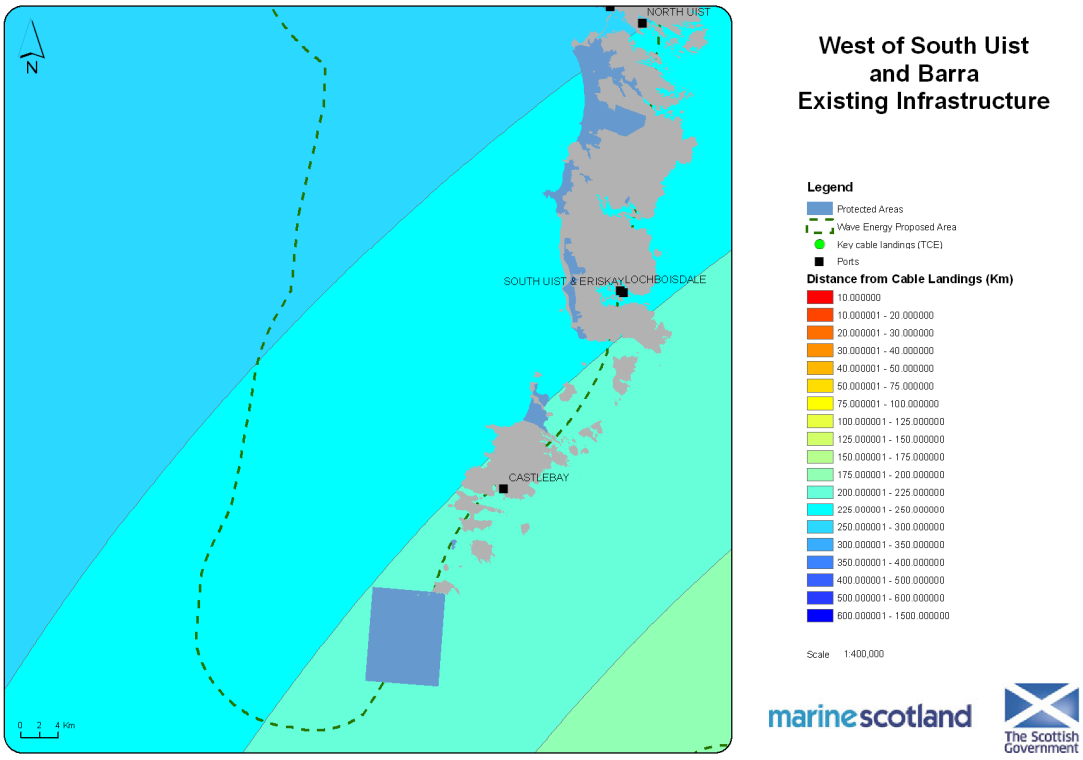

Figure 3.3.5: West of South Uist and Barra: Existing infrastructure (ports and cable landings) (source: OS, TCE, DECC)

3.3.2 Other Constraints

3.3.2.1 Commercial Uses

TCE energy leases: There are none within this site (Fig. 3.3.6).

Fish and shellfish farms: There are fish and shellfish farms to the east of the Western Isles but not in the area of high wave resource.

Cables or pipelines: There are power cables linking Barra to South Uist, but again not in the areas of high wave resource.

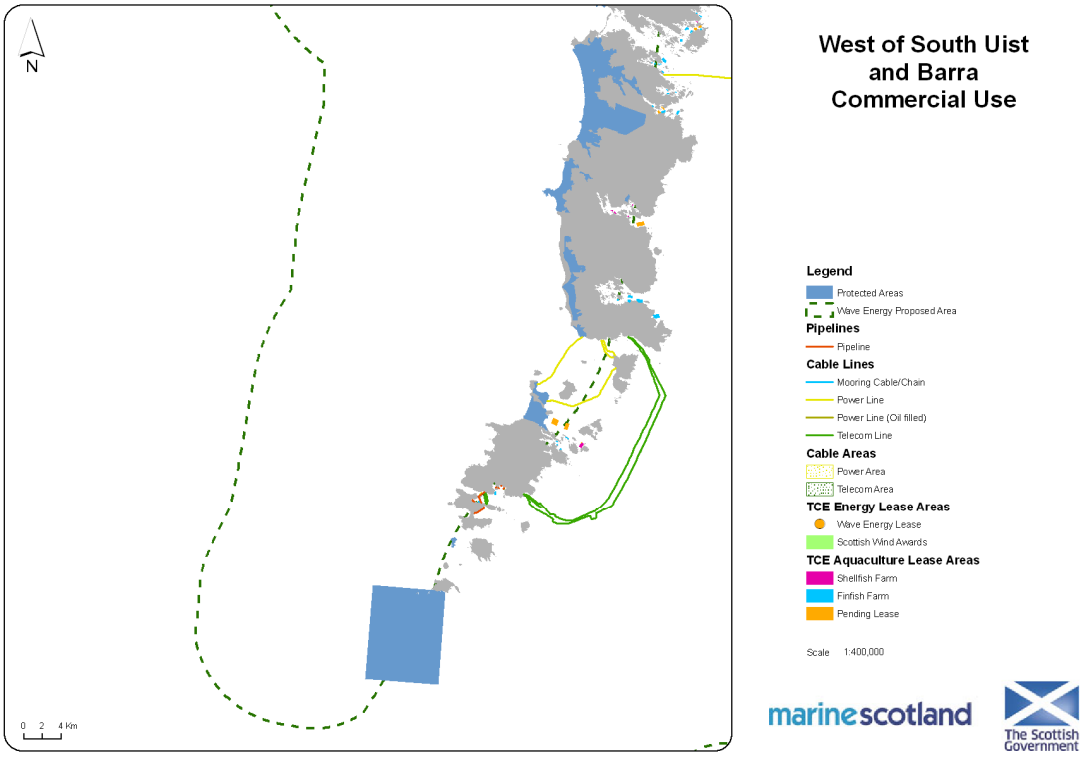

Figure 3.3.6: West of South Uist and Barra: Existing commercial uses (source: OS, SeaZone Hydrospatial, Kingfisher and TCE)

3.3.2.2 Military

Military activity is a large constraint on development within this site. The area offshore from Barra to North Uist is a missile firing range (Fig. 3.3.7). It is marked on chart Q.6403 as the Hebrides Firing Danger Area (D701, D701A). The MoD has warned that development is unlikely to be feasible within the Danger Area. There is also submarine and shipping activity to the south of the Danger Area and to the east of South Uist. Despite these restrictions, it may still be possible to consider development in the area between the shore and the Danger Area. The MoD has also indicated that shipping activity within the Danger Area is possible and thus servicing the development would not necessarily be impeded.

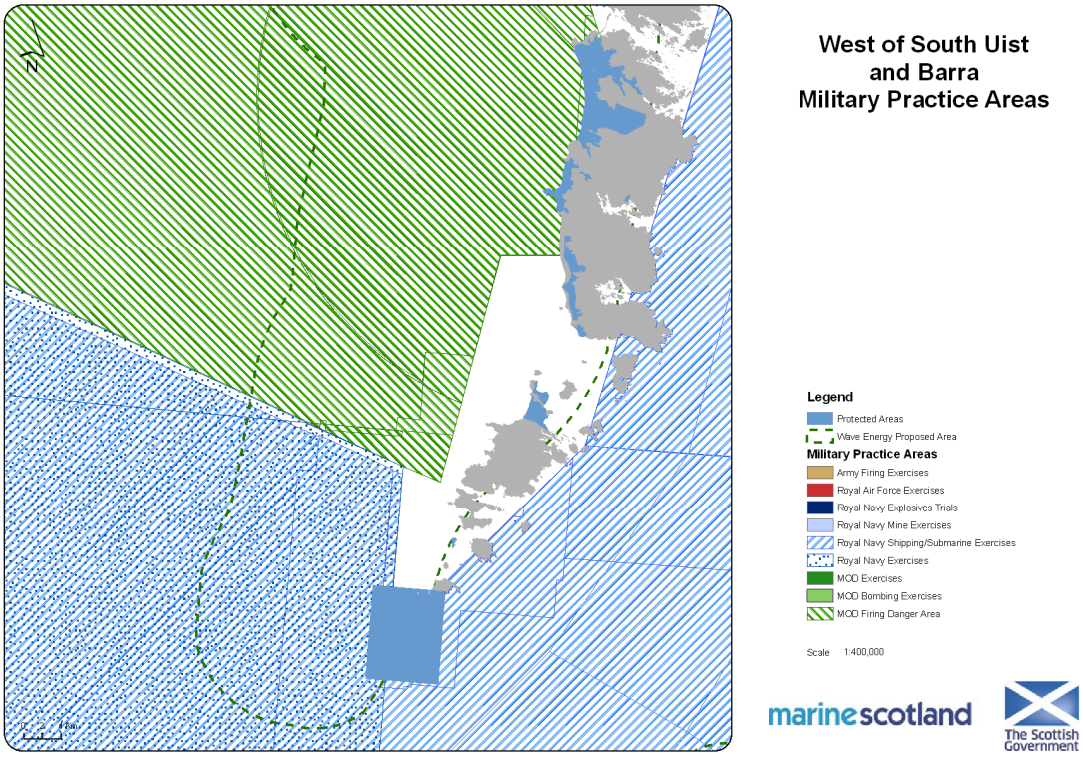

Figure 3.3.7: West of South Uist and Barra: Military practice areas (source: OS; SeaZone Hydrospatial)

3.3.2.3 Shipping

Other than on the southern boundary of this site, there is practically no shipping traffic, as most large ships use the IMO route adjacent to the western boundary of the site (Fig. 3.3.8). Up to 35 shipping movements/year have been recorded transiting the south of the site in the year 2009-10. There is also ferry traffic between Barra and South Uist and east towards Oban.

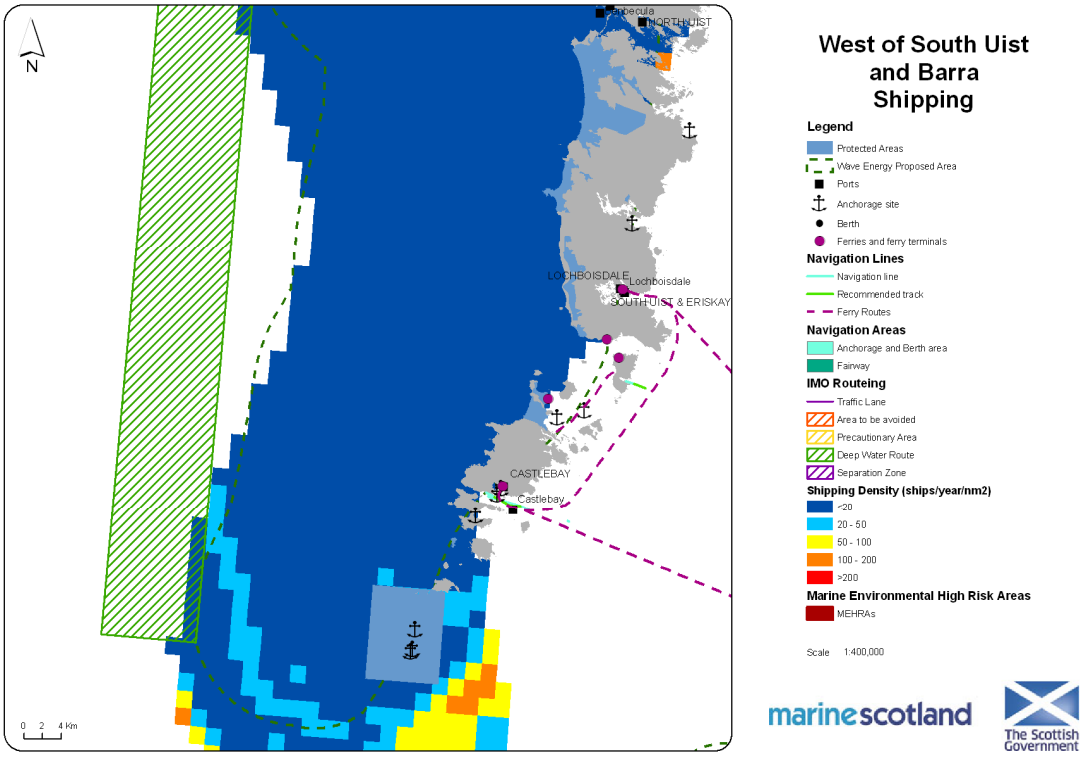

Figure 3.3.8: West of South Uist and Barra: Shipping (OS, SeaZone Hydrospatial, DECC, Anatec Ltd)

3.3.2.4 Fishing

The maps of larger fishing vessels of ≥15 m, indicate that this area of hard ground supports a relatively important shellfish fishery, particularly edible crabs (Fig.s 3.3.9-10). Up to 29 tonnes were landed in one trip west of the island of Barra with a value of between £50-100 000. However, the most productive site in the 2009 data set appears to be >15 km west of South Uist where up to 15 tonnes of shellfish is landed routinely. There is also occasional fishing for demersal species, such as cod in the south of the site. This site is also thought to be locally important for smaller creel boats (≤15 m), which are supported by a summer fishery for edible crab, velvet crab, lobster and crawfish (MSS, personal communication).

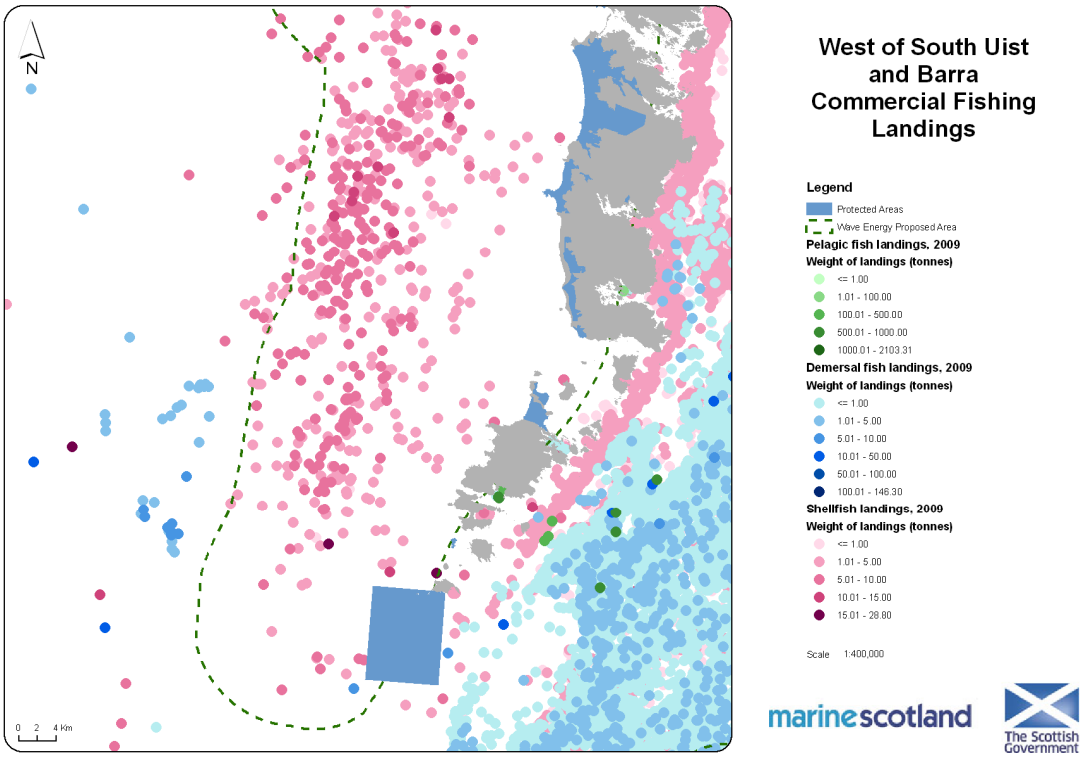

Figure 3.3.9: West of South Uist and Barra: Commercial landings of pelagic and demersal fish and shellfish (tonnes) (source: OS, MSS)

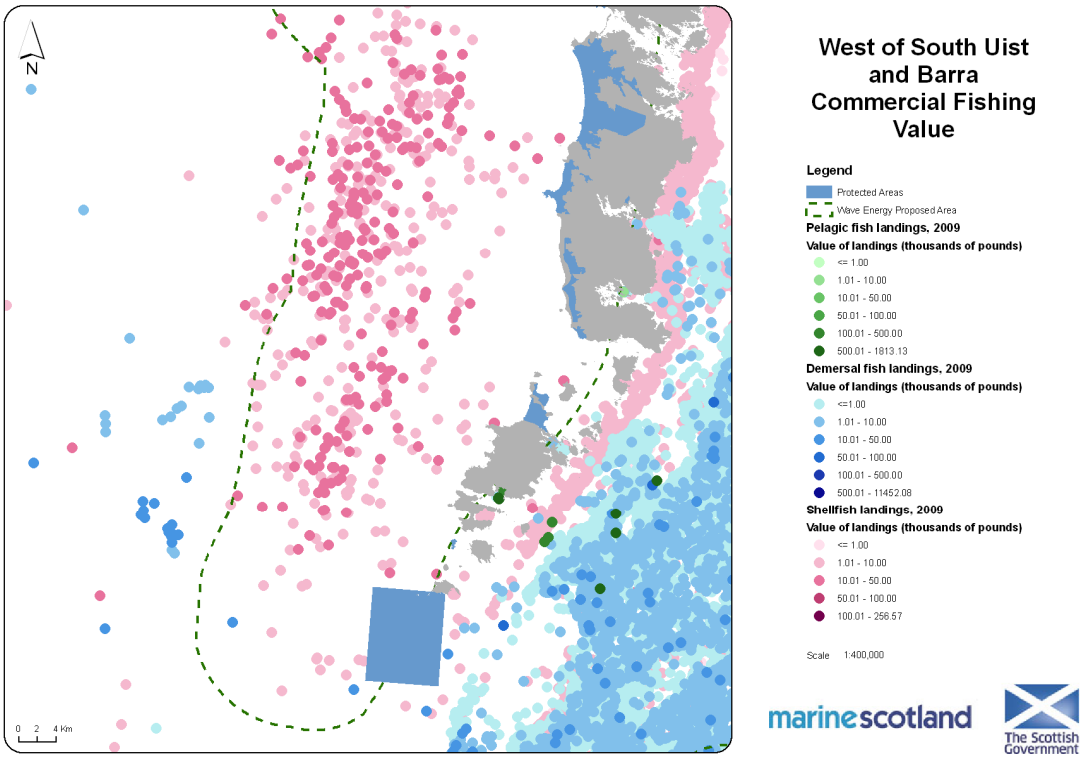

Figure 3.3.10: West of South Uist and Barra: Commercial landings of pelagic and demersal fish and shellfish (value) (source: OS, MSS)

3.3.2.5 Environment

Designated Areas

There are a number of sites of conservation interest within this site both marine and terrestrial (Fig. 3.3.11). At the southern extent of the site, the SPA of Mingulay & Berneray supports an assemblage of breeding seabirds (fulmar *Fulmarus glacialis*, guillemot *Uria aalge*, kittiwake *Rissa tridactyla*, puffin *Fratercula arctica*, razorbill *Alca torda*, shag *Phalacrocorax aristotelis*). Two further SACs are also being proposed; the Sound of Barra (between Barra and South Uist) in order to safeguard an important breeding and moulting area for common seals and the subtidal sandbanks containing maerl and seagrass beds; and the Mingulay reef complex (to the east of Mingulay outside this site), which supports deep water coral reefs (*Lophelia pertusa*). Much of this site is also being considered by the JNCC as a future SPA.

Of concern on the terrestrial side is the SPA of Eoligarry Barra (also a SSSI), which supports breeding corncrake. South Uist Machair and Lochs SPA is of importance for its population of breeding waterbirds, such as corncrake, terns and waders. The South Uist Machair and Lochs SAC supports machair and vegetation present in oligotrophic lochs and naturally eutrophic lochs. This area is also designated as a NSA.

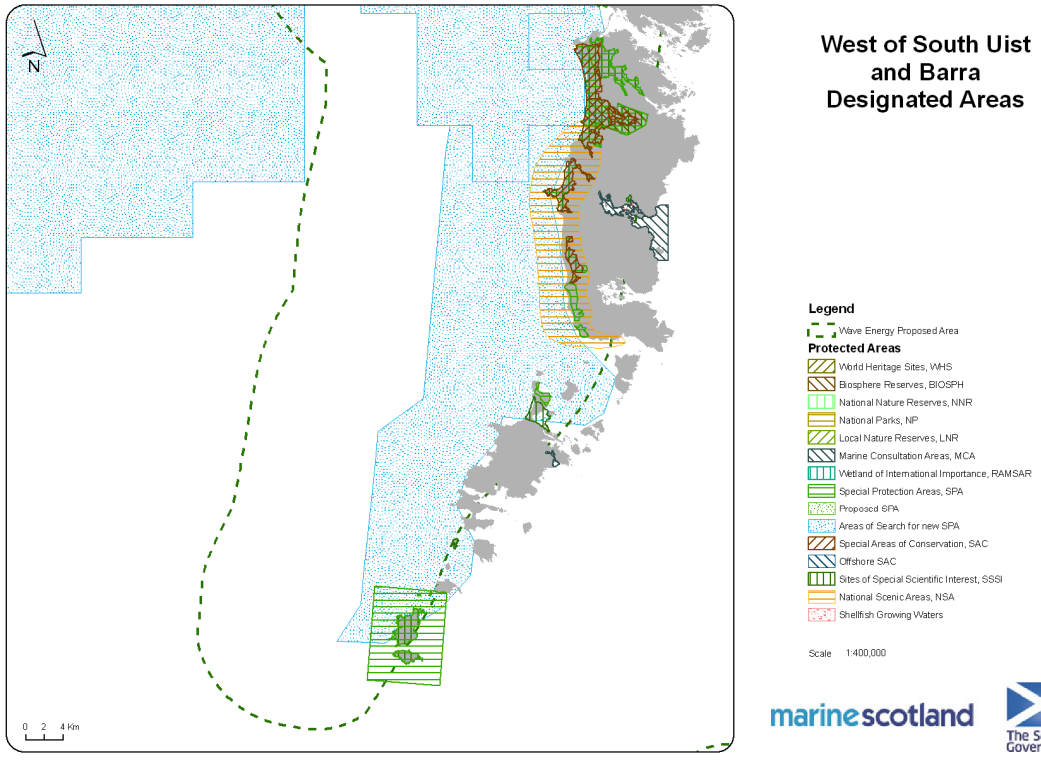

Figure 3.3.11: West of South Uist and Barra: Designated areas (source: OS, SeaZone Hydrospatial, SNH, JNCC, SG)

Protected Species

There are numerous seabird colonies along the coast and particularly large colonies on the islands of Mingulay & Berneray in the south (Fig. 3.3.12). Abundance of seabirds at sea is correspondingly high around these islands. There are numerous sightings of basking sharks to the east of this site but fewer within it (Fig. 3.3.13). Although the Cetacean Atlas (2003) data indicates that recordings of cetaceans are relatively low in this site (1.3 cetaceans / hour in the north of the site and 0.3 cetaceans / hour in the south), other sources suggest that the west coast of South Uist supports an abundant and diverse population of cetaceans and may receive occasional visits from rarer, more oceanic species (Bones and Maclennan, 1994a,b). Species recorded within the site include minke whale, white beaked dolphin, Risso's dolphin, killer whale and harbour porpoise (Weir et al., 2001; Cetacean Atlas, 2003).

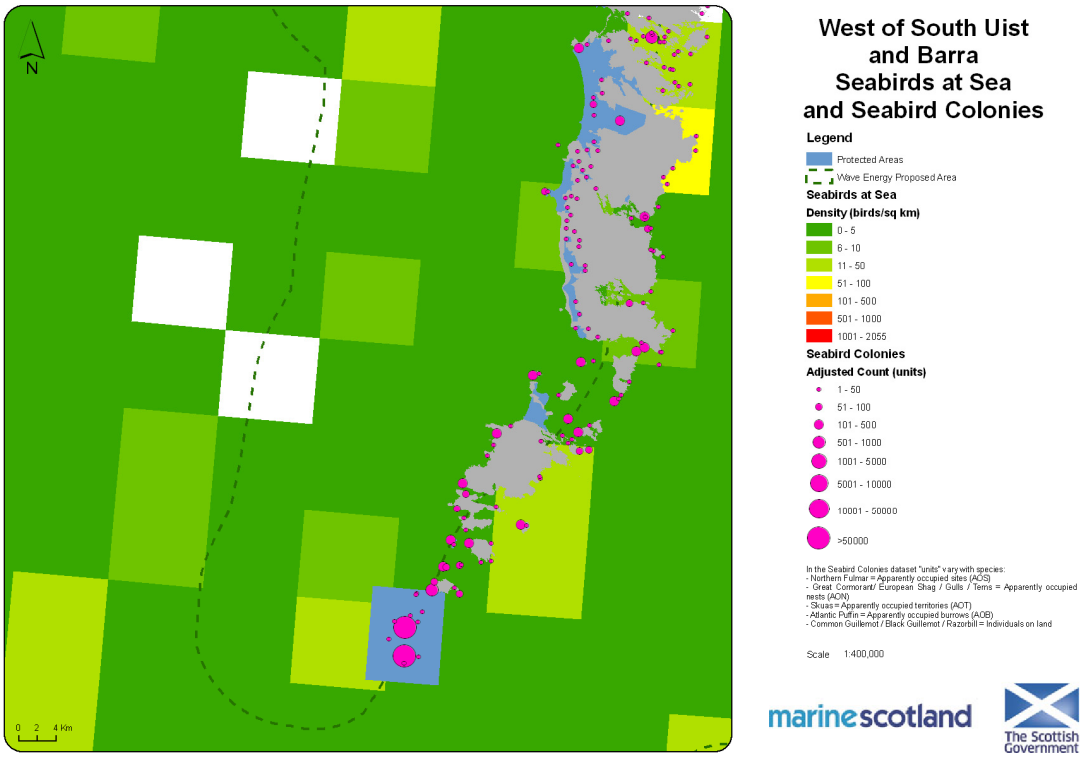

Figure 3.3.12: West of South Uist and Barra: Seabirds at sea and seabird colonies (source: OS, JNCC)

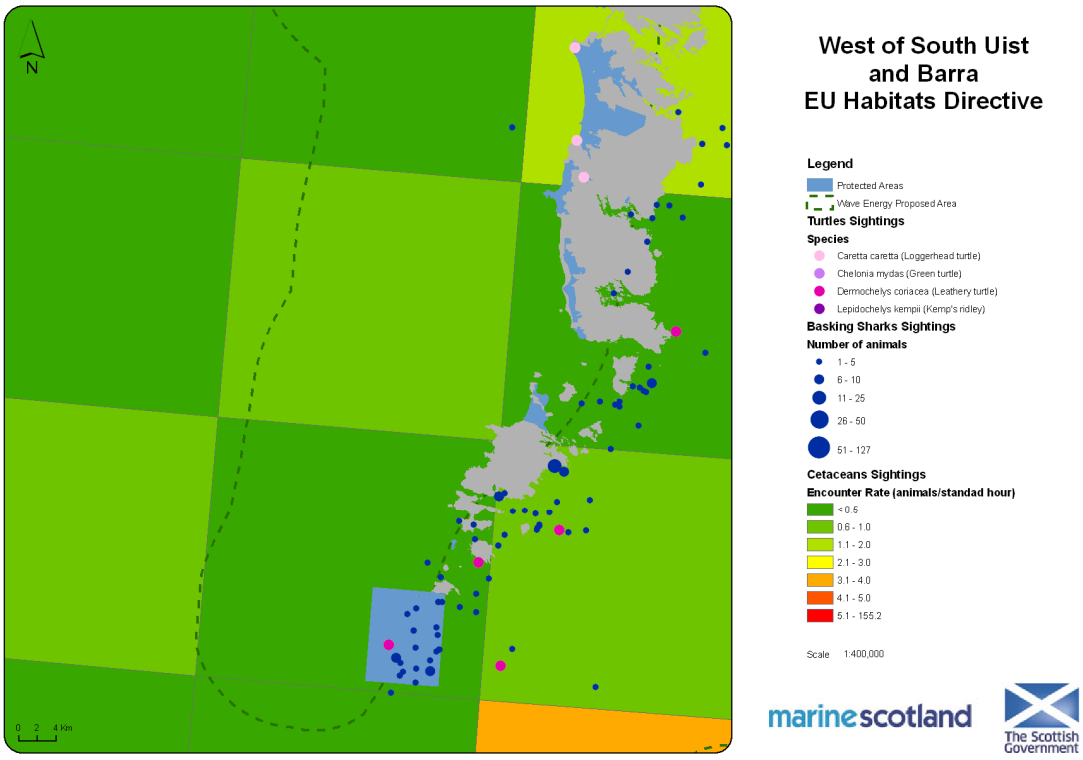

Figure 3.3.13: West of South Uist and Barra: Cetaceans, turtles and basking sharks (source: OS, NBN, MCS, JNCC)

Protected Habitats

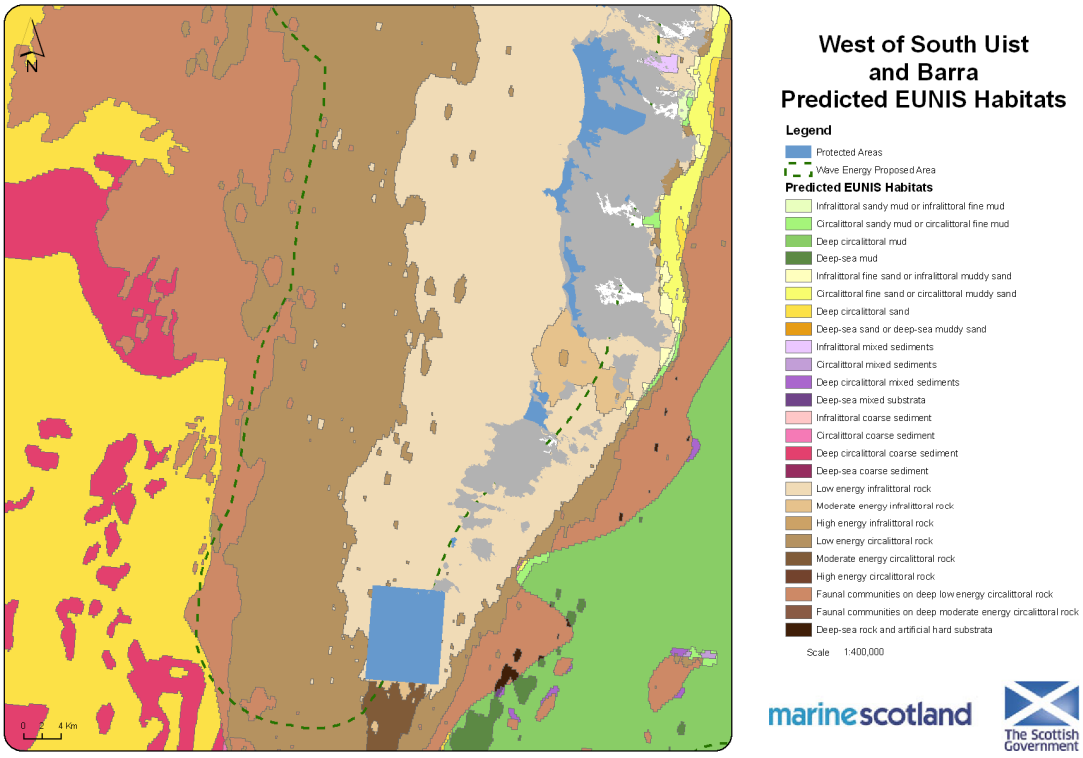

Figure 3.3.14: West of South Uist and Barra: Seabed habitats (predicted by EUNIS) (source: OS, JNCC)

A number UK BAP priority habitats and species are present in this site (Fig.s 3.3.14-15). These include maerl (*Phymatolithon calcareum, Lithothamnion corallioides, Lithothamnion glaciale*), horse mussel beds, rossworm (*Sabellaria spinulosa*), serpulid reefs (*Serpula vermicularis*) and seagrass (*Z. noltii*).

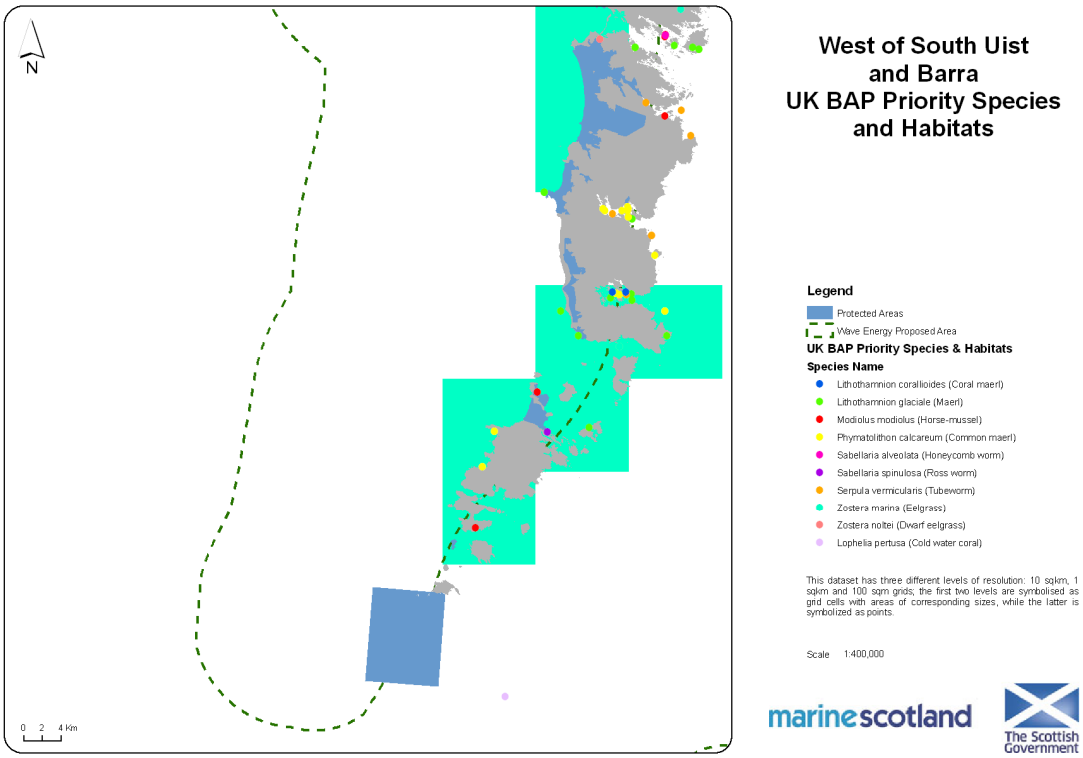

Figure 3.3.15: West of South Uist and Barra: UK BAP Priority species and habitats (source: OS, NBN)

Sensitive Areas for Commercial Fish

The months of March to May and August to September have been identified as being sensitive periods for commercial fish species in this site. At least parts of the area are used as a nursery ground by herring, lemon sole, mackerel, plaice, *Nephrops* and Norway pout (Fig. 3.3.16). Haddock, herring, *Nephrops,* Norway pout and sprat are thought to use the area for spawning (Fig. 3.3.17).

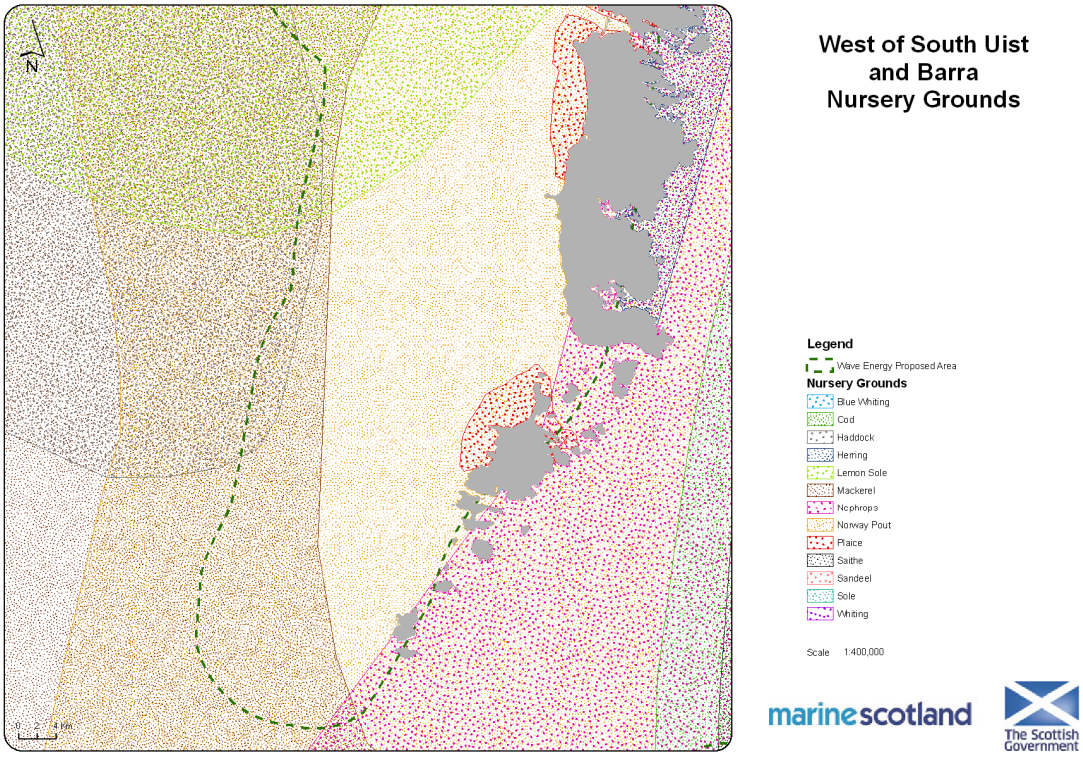

Figure 3.3.16: West of South Uist and Barra: Nursery grounds for commercial species (source: OS, MSS, CEFAS)

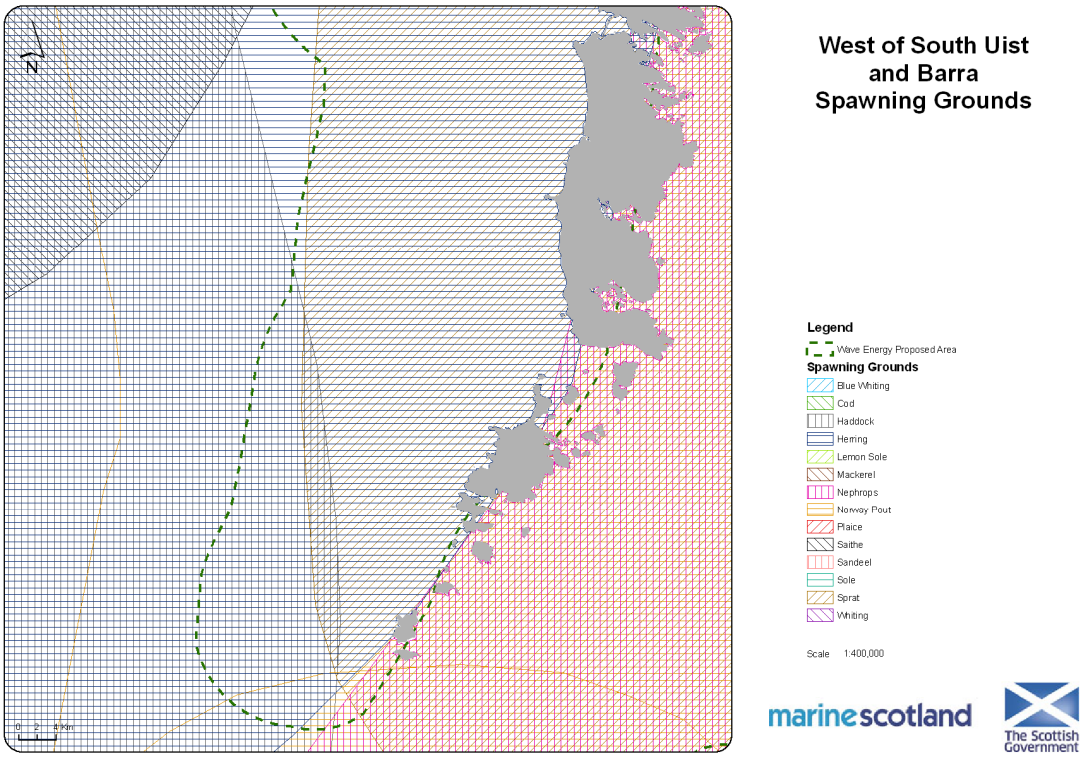

Figure 3.3.17: West of South Uist and Barra: Spawning grounds for commercial species (source: OS, MSS, CEFAS)

3.3.2.6 Cultural Heritage

There are a number of wrecks within or adjacent to the eastern boundary of this site (Fig. 3.3.18). This section of coast is also rich in historical monuments listed as SAMs. Those that are located adjacent to the coast are:

Sron an Duin, dun, Skate Point, Berneray
Mingulay Village and field system, Mingulay
Dun a'Chaolais, broch, Vatersay
Dun Bran Promontory, fort and broch; Dun Vulan, dun, Barra
St Michael's Chapel, Port na Cille, Barra
Dun Cuier, dun, Barra
Dun Chlif, dun 1200m NW of Ben Erival
Cille Bharra, church, two chapels, and seven grave markers, Barra
Dun Scurrival, dun, Eoligarry, Barra
Pollachar, standing stone, South Uist
Bruthach an Tionail Ard, wheelhouse settlement, Kilpheder, South Uist
Dun Vulan, dun, Loch Ardvule, South Uist
Crois Chnoca Breaca, standing stone, South Uist

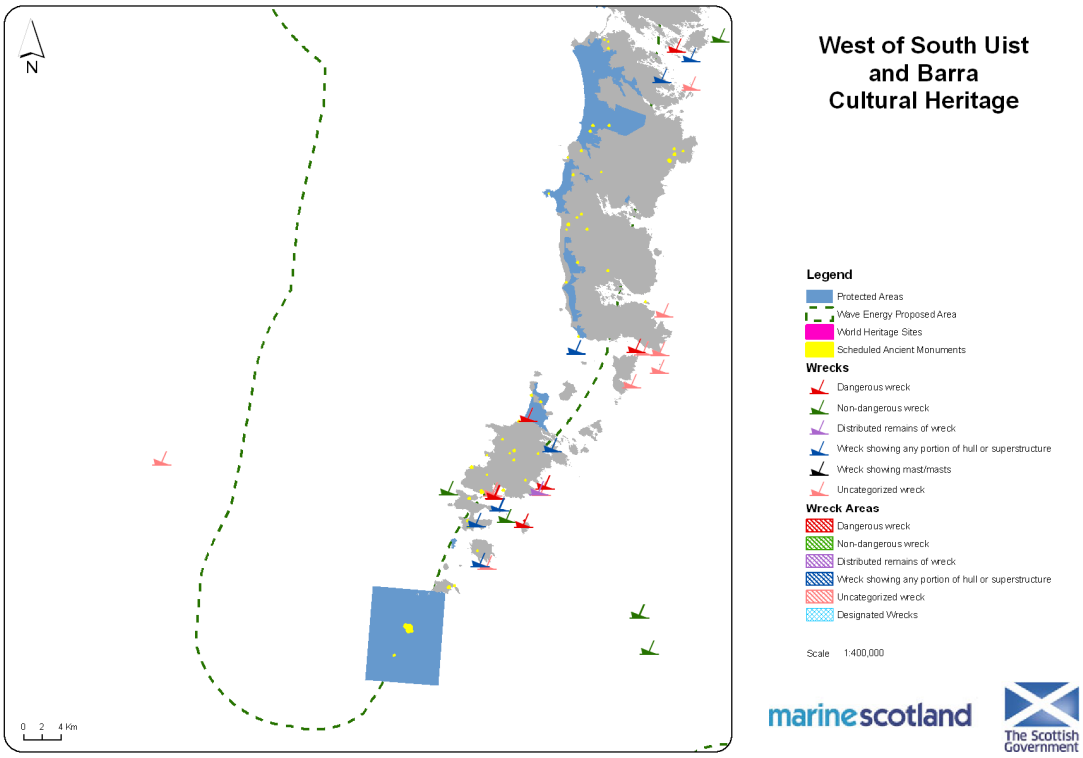

Figure 3.3.18: West of South Uist and Barra: Cultural heritage (source: OS, Historic Scotland, SeaZone Hydrospatial)

3.3.2.7 Recreation

A sailing route transits the length of the site and another from the Sound of Eriskay (Fig. 3.3.19).

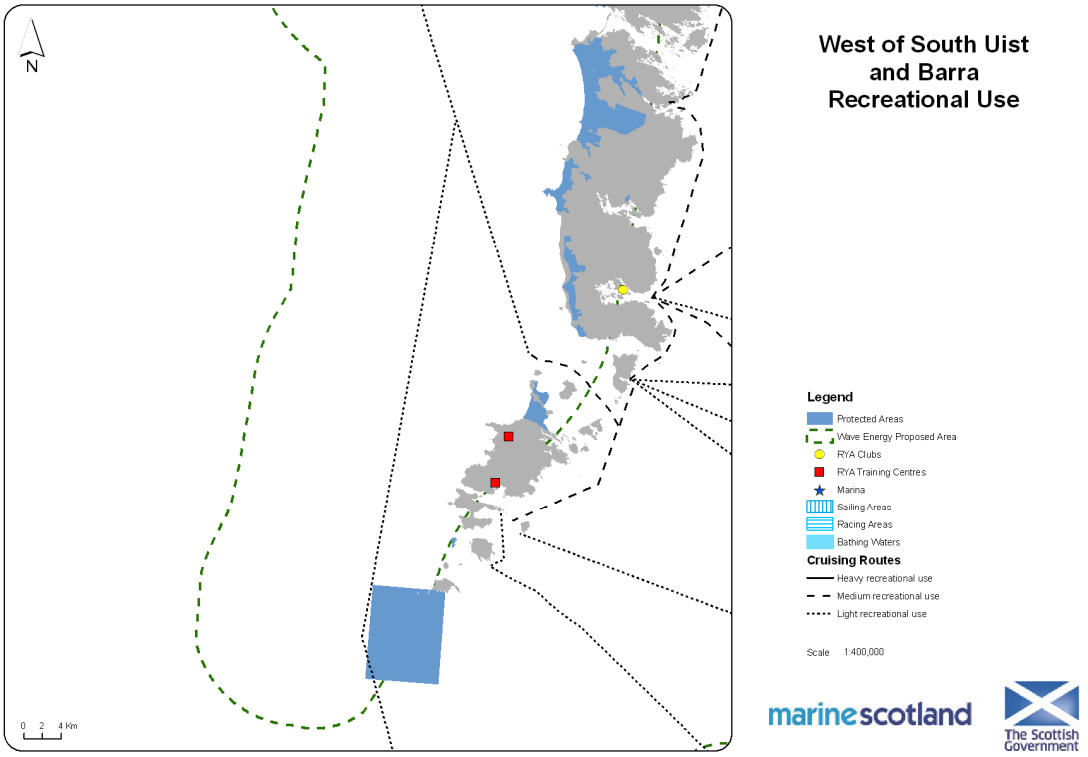

Figure 3.3.19: West of South Uist and Barra: Recreational use (source: OS, RYA, SG)

3.4 West of Harris and North Uist

Summary

This site has a relatively high wave power resource out with the sounds and sea lochs. The seabed, composed of solid rock, shelves gently and exhibits a depth of <50 m in much of the area. However, much of the southern extent of the site is a part of the MoD Hebrides Firing Range and development may be severely restricted within it. Access to the national grid would also require upgrading. This area is also very highly regarded for its natural heritage and consequently contains numerous protected sites and search areas for new SPAs. It is also exploited for its shellfish grounds. The Sound of Harris is used as a sailing area.

3.4.1 Technological Constraints

3.4.1.1 Size of Wave Resource

The maximum annual mean energy potential in the area west of Harris and south Lewis varies between 26.5 kW/m of wave crest in the south-east of the site and 37.8 kW/m in the north-west (Fig. 3.4.1). The potential resource drops considerably in the summer to a maximum of 15.3 kW/m (mean annual power). The variation reflects the trend in greater wave heights further offshore ($\leq$3.1 m) compared with inshore ($\leq$2.4 m) and the drop in wave height during the summer months (2.1 m) (Fig. 3.4.2). There is a similar trend in wave period, which varies between 7.8 s offshore and 6.7 s inshore. Maximum wave period is approximately 2 s greater in winter than in the summer.

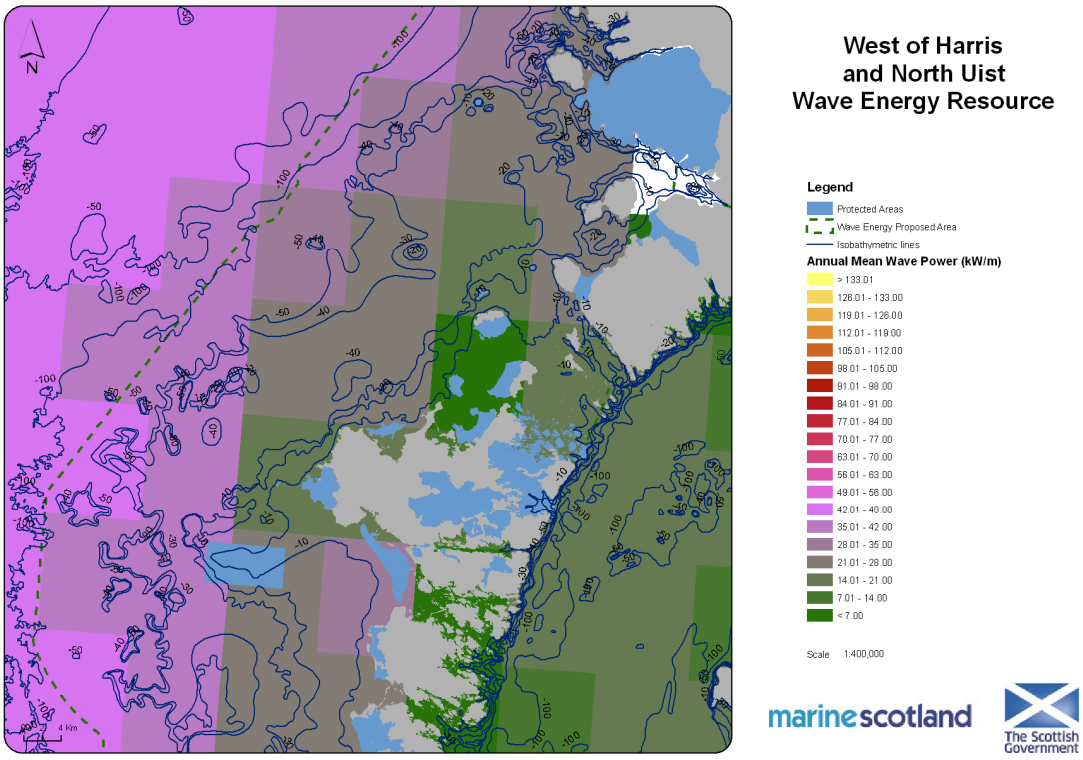

Figure 3.4.1: West of Harris and North Uist: Annual mean wave power density (source: OS, BGS, DTI)

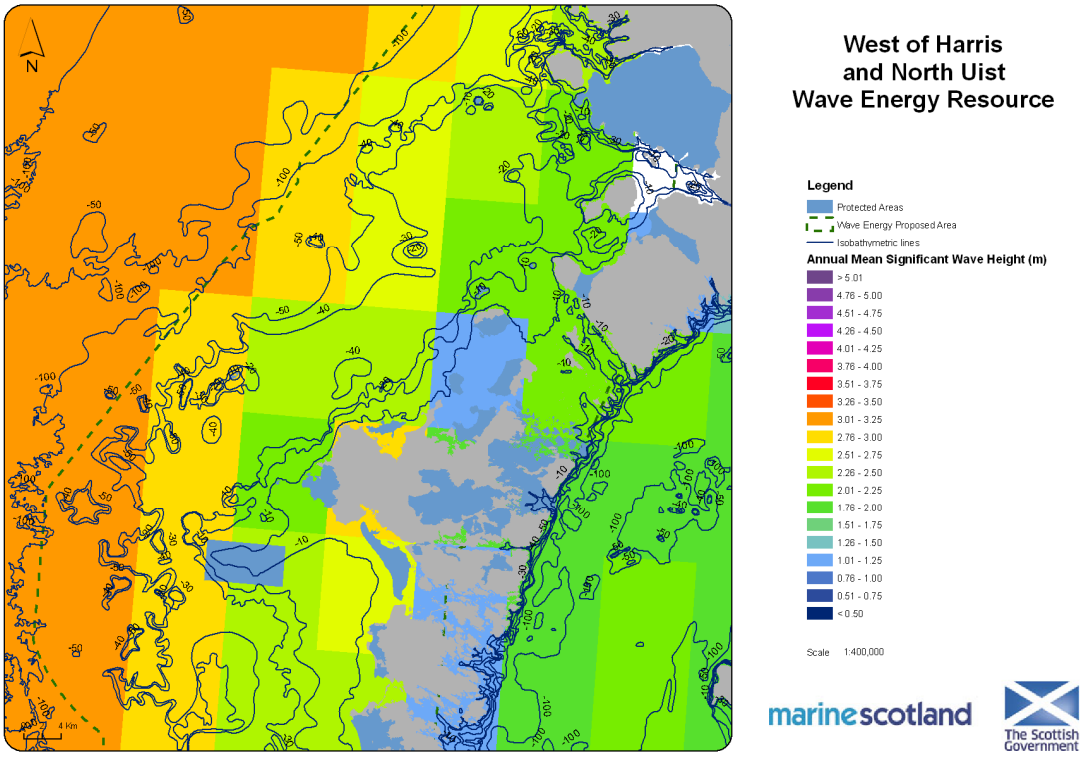

Figure 3.4.2: West of Harris and North Uist: Annual mean significant wave height (source: OS, BGS, DTI)

3.4.1.2 Tidal Streams

There are strong tides in the Sound of Harris of up to 2.2 m/s during springs (Fig. 3.4.3). The currents offshore are relatively weak in comparison, reaching a maximum of 0.34 m/s during neaps and 0.57 m/s during springs. The tidal range is consistent across the site and varies between 1.6 and 3.7 m.

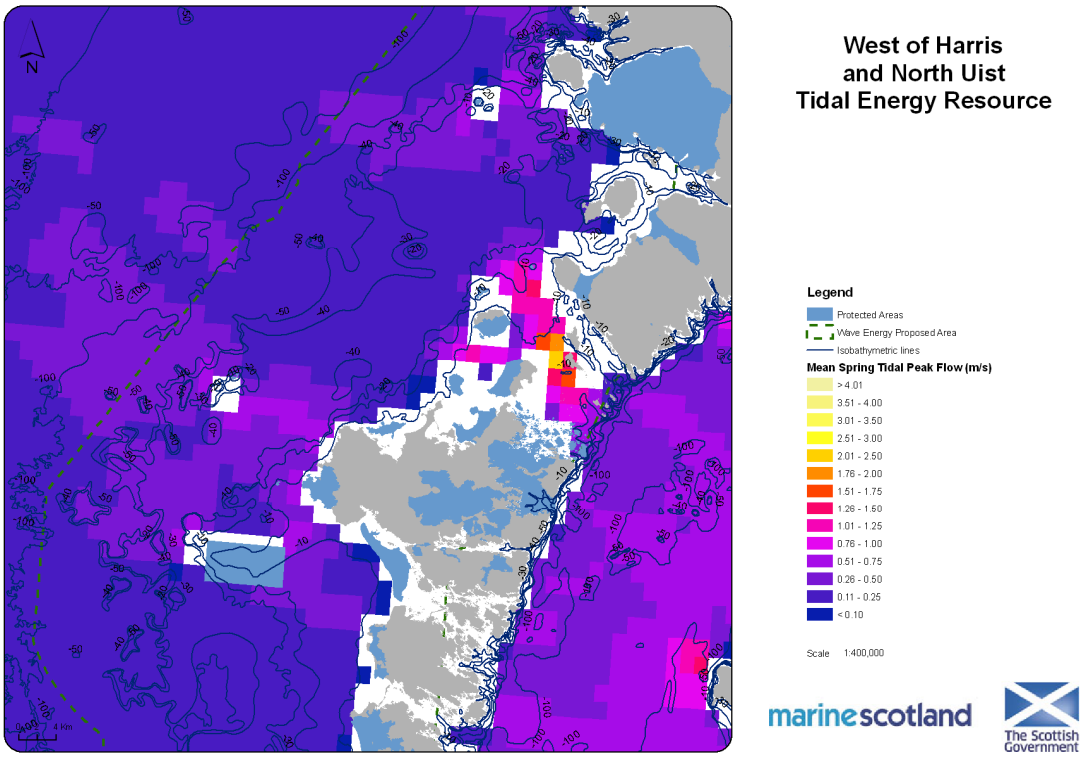

Figure 3.4.3: West of Harris and North Uist: Mean spring tidal peak flow (source: OS, BGS, DTI)

3.4.1.3 Bathymetry and Seabed

The seabed west of North Uist, the Sound of Harris and Harris is composed predominantly of solid rock (Lewisian gneiss) (Fig. 3.4.4). In the north there are swathes of gravelly sand, sandy gravel and sand. The depth immediately offshore is ~30 m between 2 and 15 km from the shore. At the northern end of the site, the seabed slopes more steeply and reaches 50 m at a distance of 3-5 km from the shore and 100 m at a distance of 9-10 km. In the mid to northern sector of the site the depth is 50 m ~15-20 km from shore and reaches 100 m at a distance of 18-25 km. In the south of the site the seabed drops to 50 m between 21 and 30 km from the shore and reaches 100 m beyond the western boundary of the site.

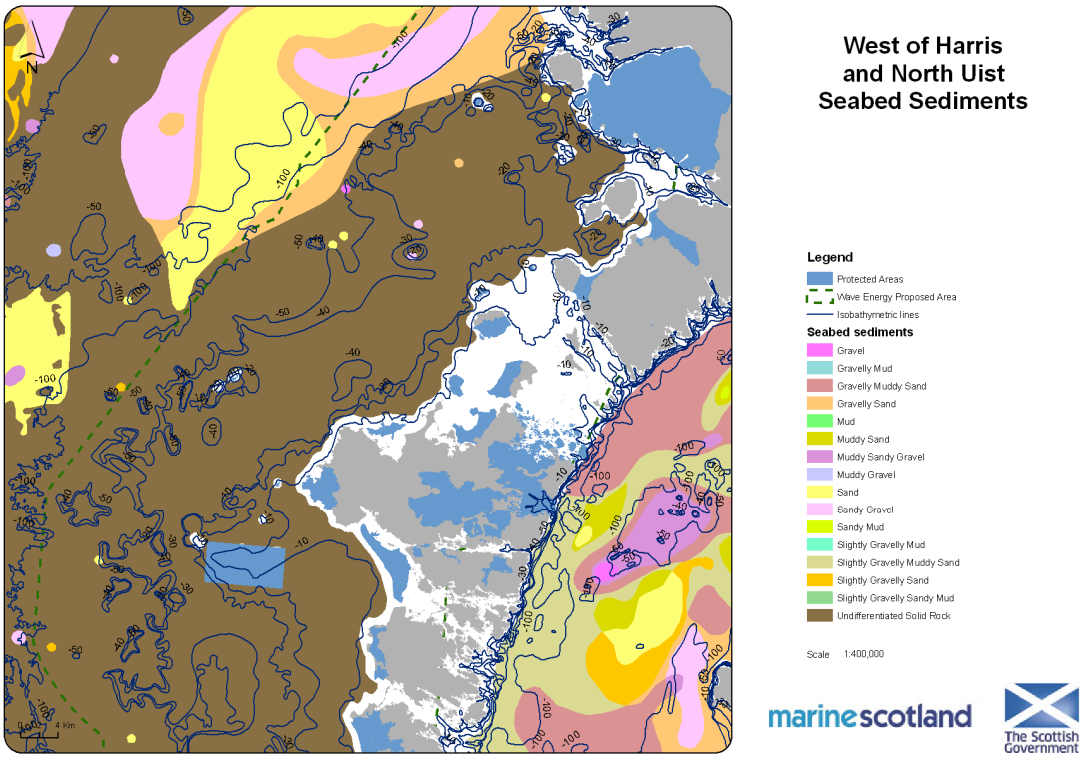

Figure 3.4.4: West of Harris and North Uist: Bathymetry and seabed sediments (source: OS, BGS)

3.4.1.4 Existing Infrastructure

Ports and harbours: The site is approximately 100 to 160 km away from the port of Stornoway, a potential site for development of wave/tidal devices (SE & SIE, 2010) (Fig. 3.4.5). There are also a number of smaller ports within the site, such as Benbecula, Grimsay and Loch Maddy.

Grid connection: The single connection from Lewis via Skye to Fort Augustus on the Scottish mainland is already at full capacity. Subject to consents, SHETL plans reinforcement of a 450 MW HVDC circuit between Gravir on Lewis and Beauly west of Inverness by 2012-13. 152 MW of this capacity will be allocated to already consented renewable energy generation. It may be possible for wave/tidal developments to connect into the 298 MW of spare capacity. However, if all other existing proposals gain consent, then only 18 MW of capacity will remain. There is potential to install a second 450 MW connection, but this is subject to approval by Ofgem. As the planned reinforcements are connecting to the east coast of Lewis, local reinforcements would be required in order to link up to this point.

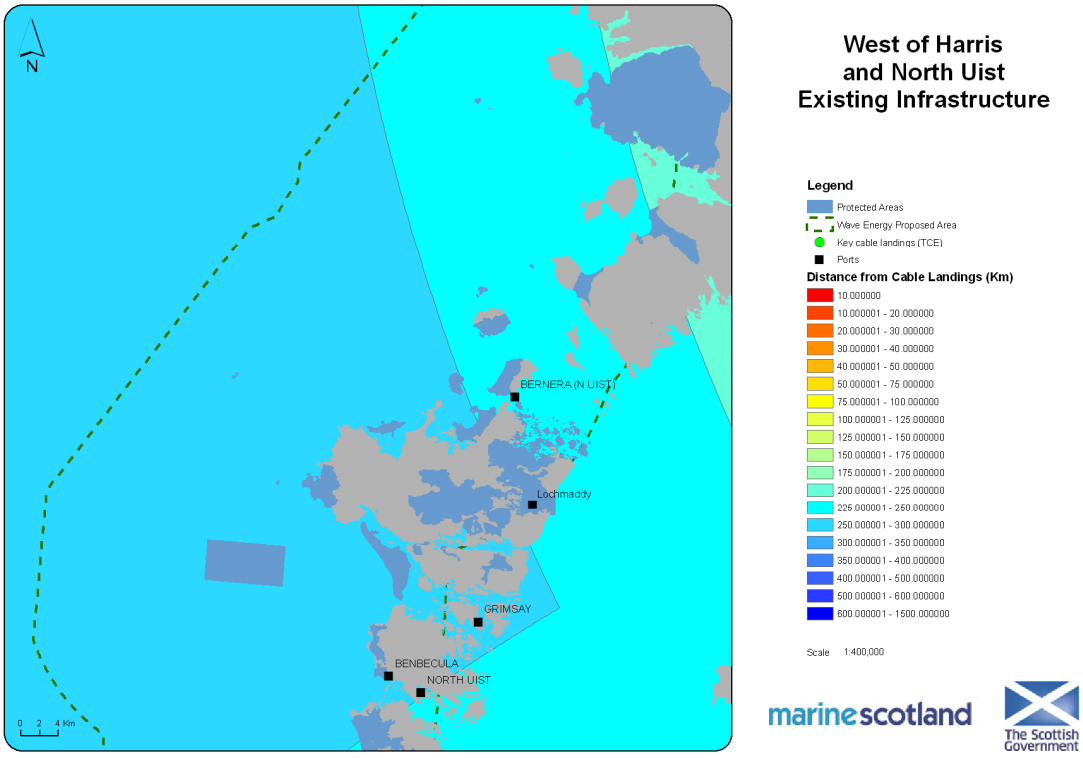

Figure 3.4.5: West of Harris and North Uist: Existing infrastructure (ports and cable landings) (source: OS, TCE, DECC)

3.4.2 Other Constraints

3.4.2.1 Commercial Uses

TCE energy leases: There are none within this site (Fig. 3.4.6).

Fish and shellfish farms: There are a number of fish farms in the sea lochs or sounds within the islands but these are generally in areas protected from wave action and thus unlikely to be of interest for wave energy generation.

Cables or pipelines: There are none within this site.

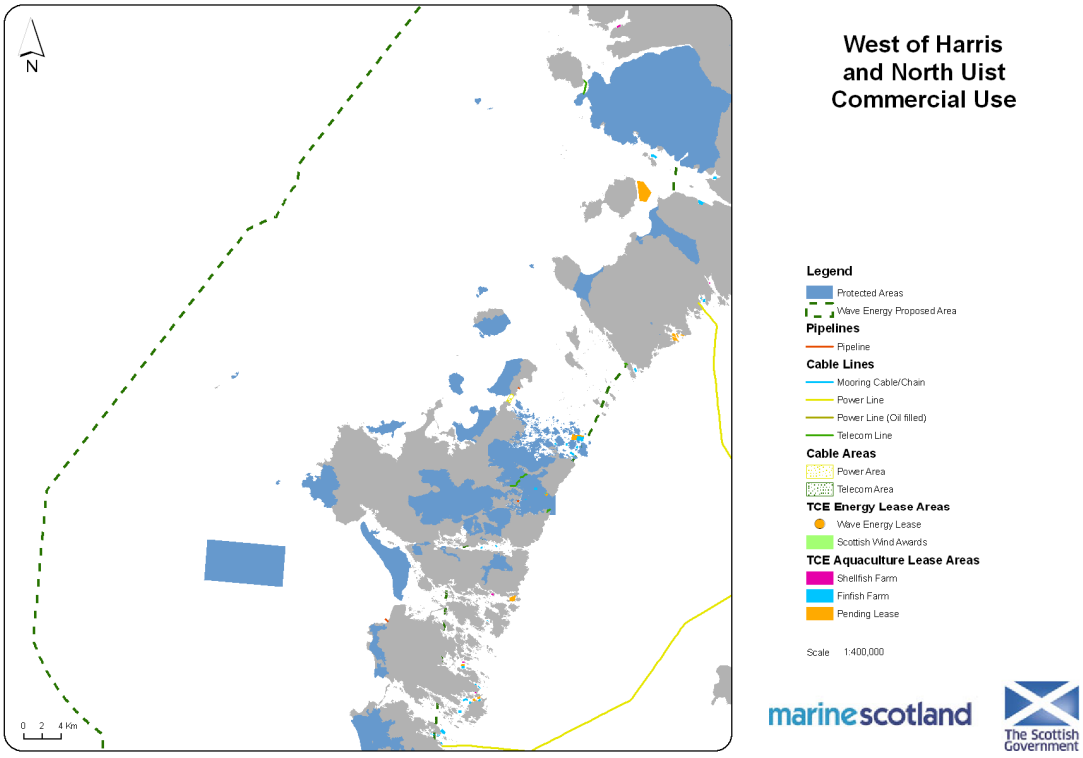

Figure 3.4.6: West of Harris and North Uist: Existing commercial uses (source: OS, SeaZone Hydrospatial, Kingfisher, TCE)

3.4.2.2 Military

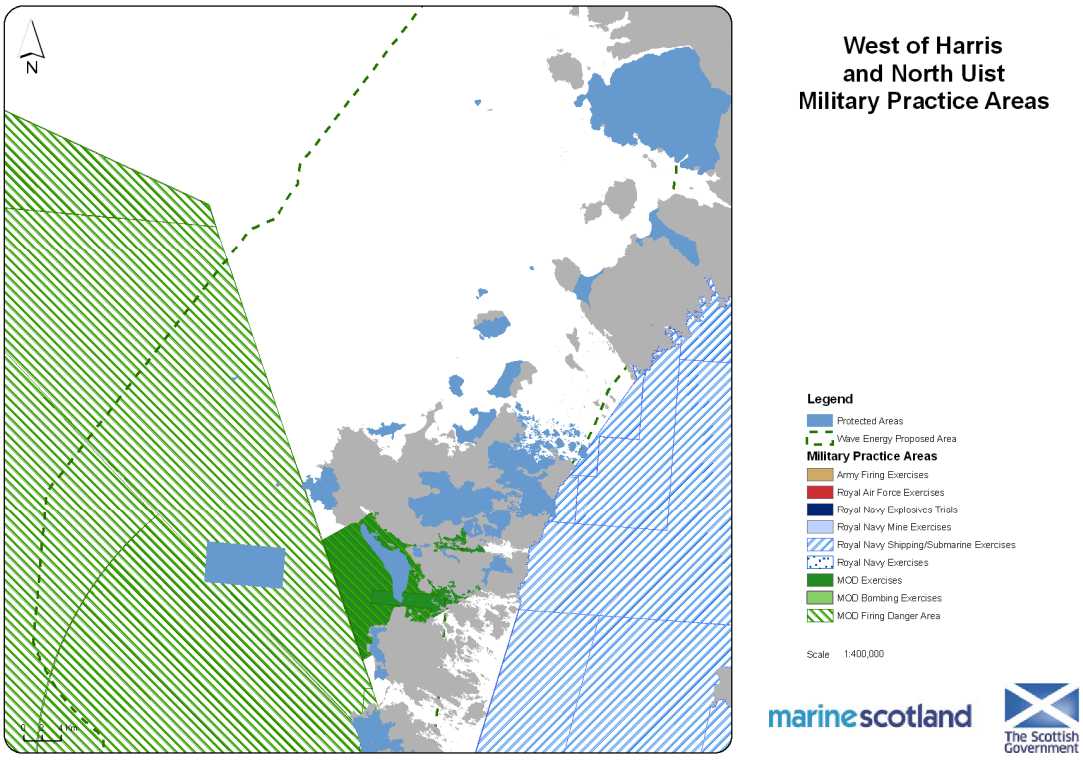

Figure 3.4.7: West of Harris and North Uist: Military practice areas (source: OS, SeaZone Hydrospatial)

The area to the south of North Uist is a part of the MoD Hebrides Firing Range, as defined on Chart Q.6403 (D701C, D710E) (Fig. 3.4.7). As such, development within the Firing Range may be heavily restricted. The sea to the east of the Hebrides is used for shipping and submarine exercises.

3.4.2.3 Shipping

Most shipping traffic travels within the IMO shipping route to the west of the Hebrides (Fig. 3.4.8). This is outside the site and generally in water in excess of 100 m. Therefore there is very little shipping within the site, with the exception of the ferry route between Bernera, North Uist and Harris and between Loch Maddy and North Harris.

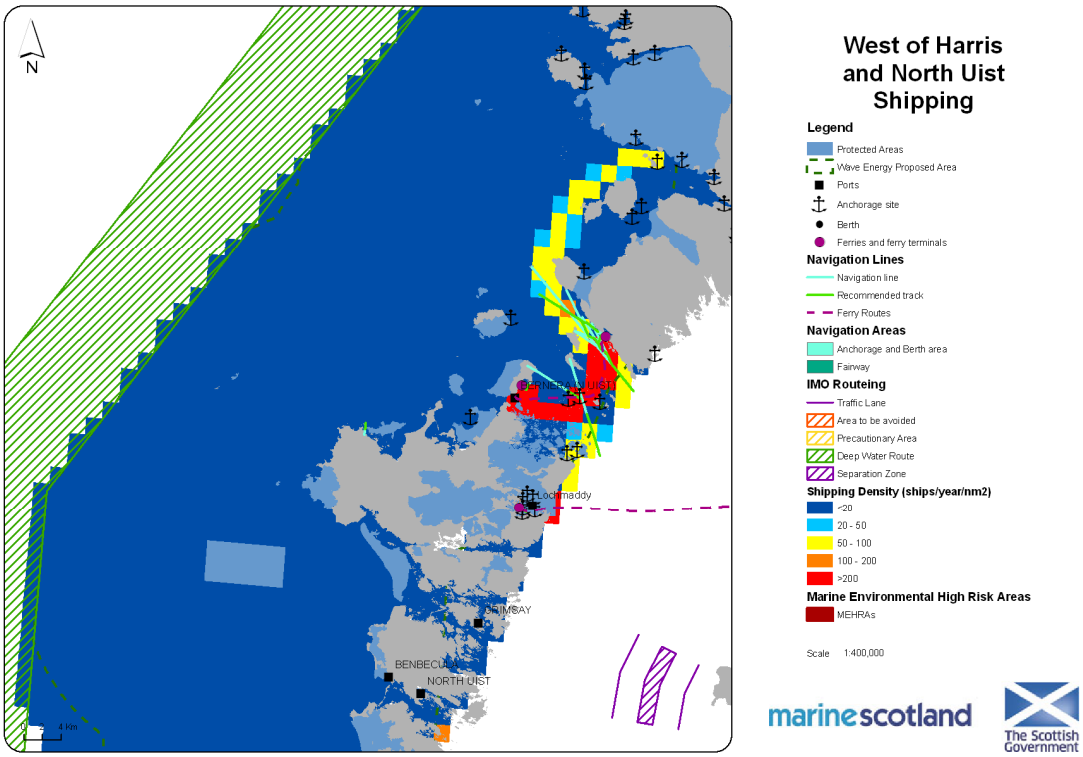

Figure 3.4.8: West of Harris and North Uist: Shipping (source: OS, SeaZone Hydrospatial, DECC, Anatec Ltd)

3.4.2.4 Commercial Fishing

The 2009 data for fishing vessels ≥15 m suggests that the area between ~12 and 15 km west of North Uist and Harris is a relatively important ground for shellfish, particularly edible crab (Fig.s 3.4.9-10). Up to 15 tonnes of shellfish were caught per trip in the mid to northern sector of the site, which equates to a value of up to £100 000. This area appears to be locally important for smaller vessels (≤15 m) and supports a seasonal creel fishery, mostly during the summer months, of velvet and edible crab, crawfish and lobster. Large catches of mackerel and herring are reported from this area periodically (MSS, personal communication).

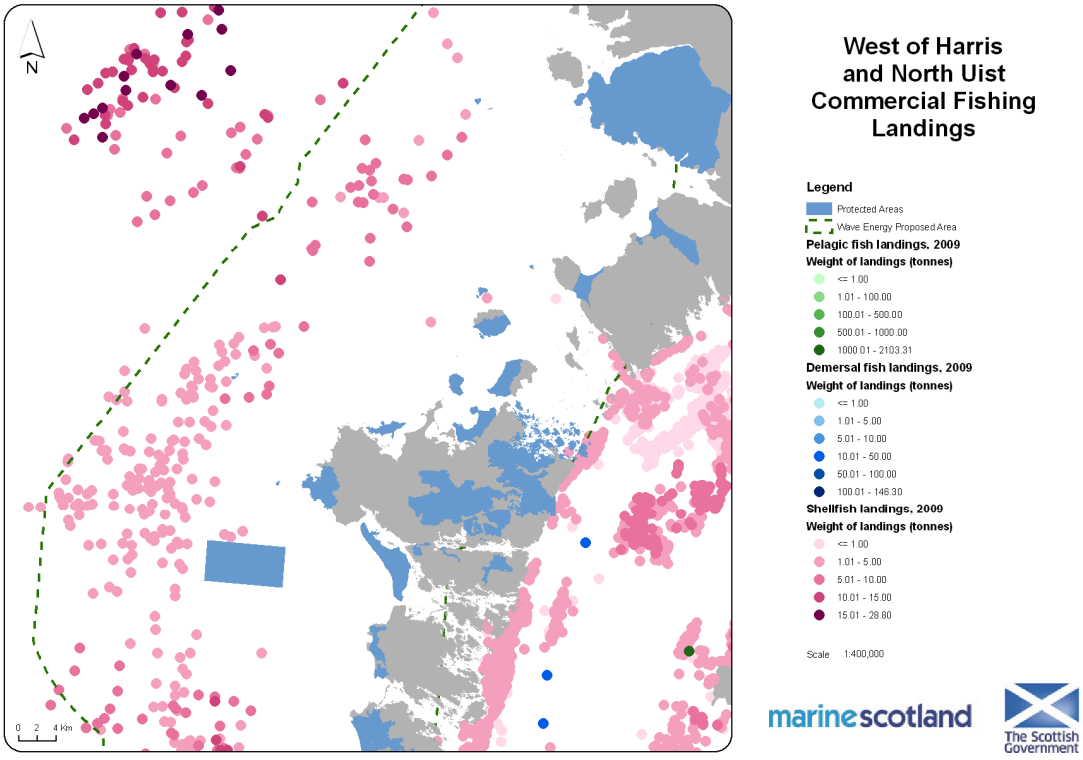

Figure 3.4.9: West of Harris and North Uist: Commercial landings of pelagic and demersal fish and shellfish (tonnes) (source: OS, MSS)

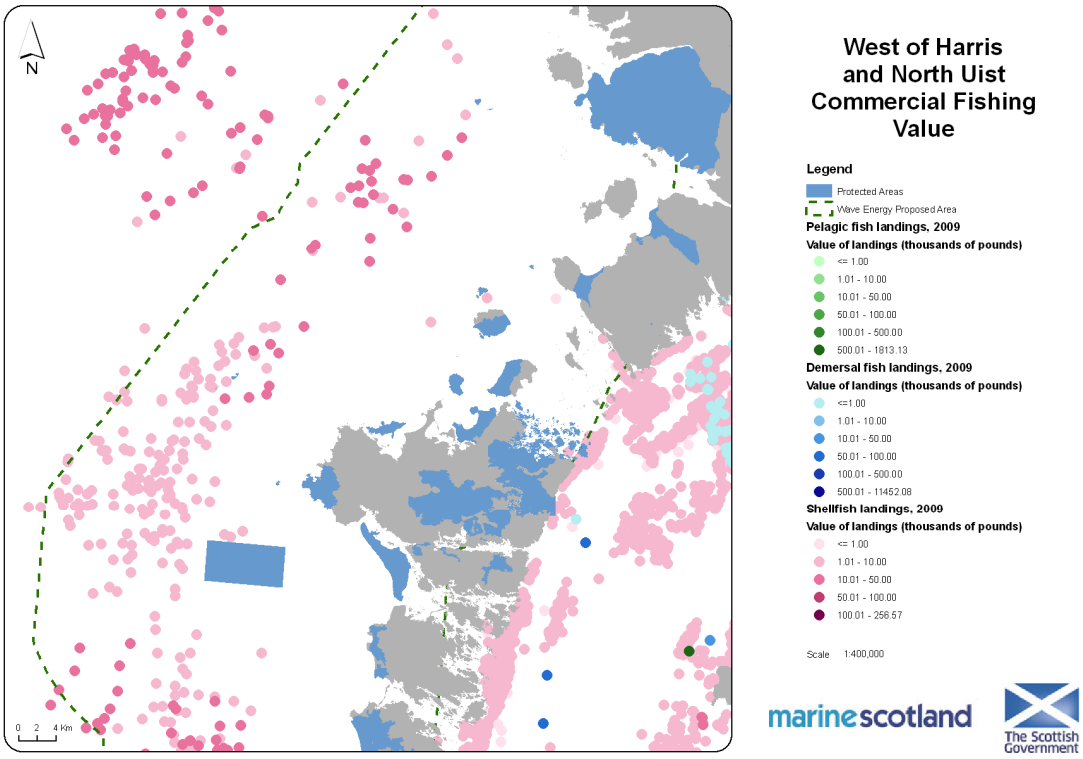

Figure 3.4.10: West of Harris and North Uist: Commercial landings of pelagic and demersal fish and shellfish (value) (source: OS, MSS)

3.4.2.5 Environment

Designated Areas

The proposed site overlaps with a number of designated sites (Fig. 3.4.11). The Monach Isles are situated 10 km off the west coast of North Uist and are designated as an SAC, SPA and SSSI. These low lying islands harbour extensive machair, maritime grassland, fens, marshes and shallow brackish lochs. The Monach Isles are an important breeding site for common tern (*Sterna hirundo*) and little tern (*Sterna albifrons*) in summer and the Greenland barnacle goose in winter. Grey seals also use the Monach Isles as a breeding area.

The coast of South Uist exhibits Scotland's most extensive cultivated machair system, which extends 2 km inland. The area also contains a number of oligotrophic and naturally eutrophic lochs and is of great importance to breeding populations of corncrake, little tern and waders. The area is designated as the South Uist Machair SAC and the South Uist Machair and lochs SPA.

Immediately to the north of this, the sites of North Uist Machair SAC, North Uist Machair and Islands SPA and Baleshare and Kirkibost SSSI, encompass a range of habitats of importance including cultivated machair, saltmarsh, dunes, calcareous coastland plains and acid grasslands. These habitats are home to corncrake and during the winter there are large numbers of waders, Greenland and barnacle goose.

The lagoon of Loch Maddy (Loch nam Madadh SAC) is an exceptionally complex fjardic loch system. Loch Maddy and Obain Loch Euphoirt (also an SAC) are some of the few examples in Europe of a rock-bound silled lagoon. Otters are frequent sightings in Loch Maddy. Off the coast of North Harris, lie the Small Seal Islands, a biological SSSI. On the west coast of South Harris, Northton Bay and Luskentyre Banks are both protected as a SSSI. A large area encompassing North Uist, Harris and south Lewis is designated as the Lewis, Harris and North Uist NSA Area. The North Harris SAC and North Harris Mountains SPA contain Atlantic salmon *Salmo salar* and the site is of particular importance for a population of golden eagle.

Approximately 36 km from the western boundary of this site is the World Heritage site (WHS), SAC, SPA and SSSI of St Kilda. Of most relevance to marine renewable development are the breeding seabirds it harbours, which may venture far wider than the SAC. The SPA covers an area of 29 000 ha surrounding the islands to protect the breeding and feeding grounds of an assemblage of seabirds including fulmar, gannet (*Morus bassanus*), great skua (*Stercorarius skua*), guillemot, kittiwake, Leach's petrel (*Oceanodroma leucorhoa*), Manx shearwater (*Puffinus puffinus*), puffin and razorbill.

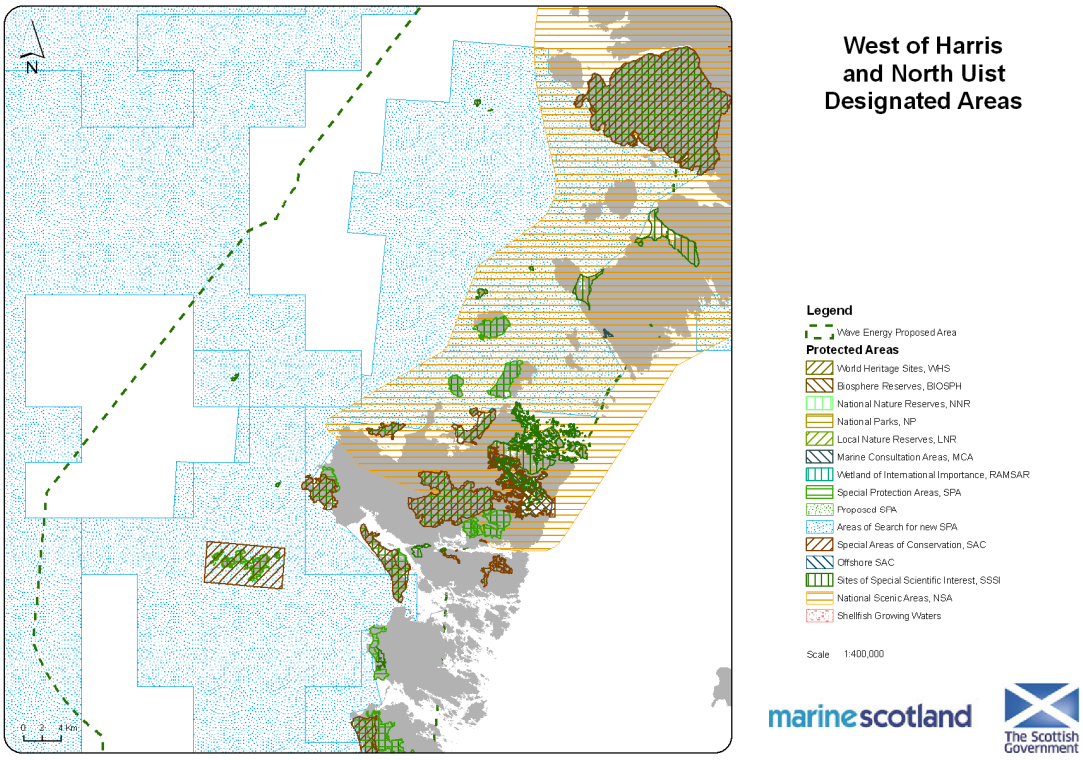

Figure 3.4.11: West of Harris and North Uist: Designated areas (source: OS, SeaZone Hydrospatial, SNH, JNCC, SG)

Protected Species

The Cetacean Atlas (2003) data suggests that the site is frequented by a relatively low number of cetaceans (≤0.31 cetaceans/hour) but diversity is high (Fig. 3.4.13). Species documented include minke whale, white beaked dolphin, Risso's dolphin and harbour porpoise (Weir et al., 2001; Cetacean Atlas, 2003). There are also regular sightings of basking sharks.

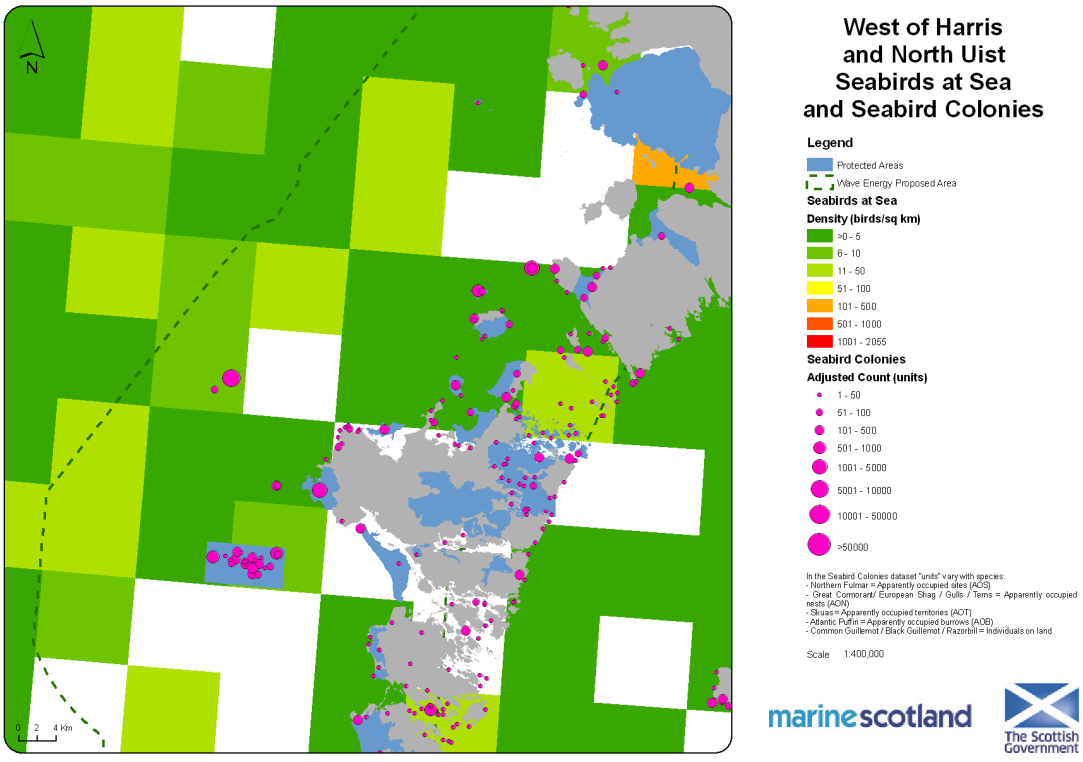

Figure 3.4.12: West of Harris and North Uist: Seabirds at sea and seabird colonies (source: OS, JNCC)

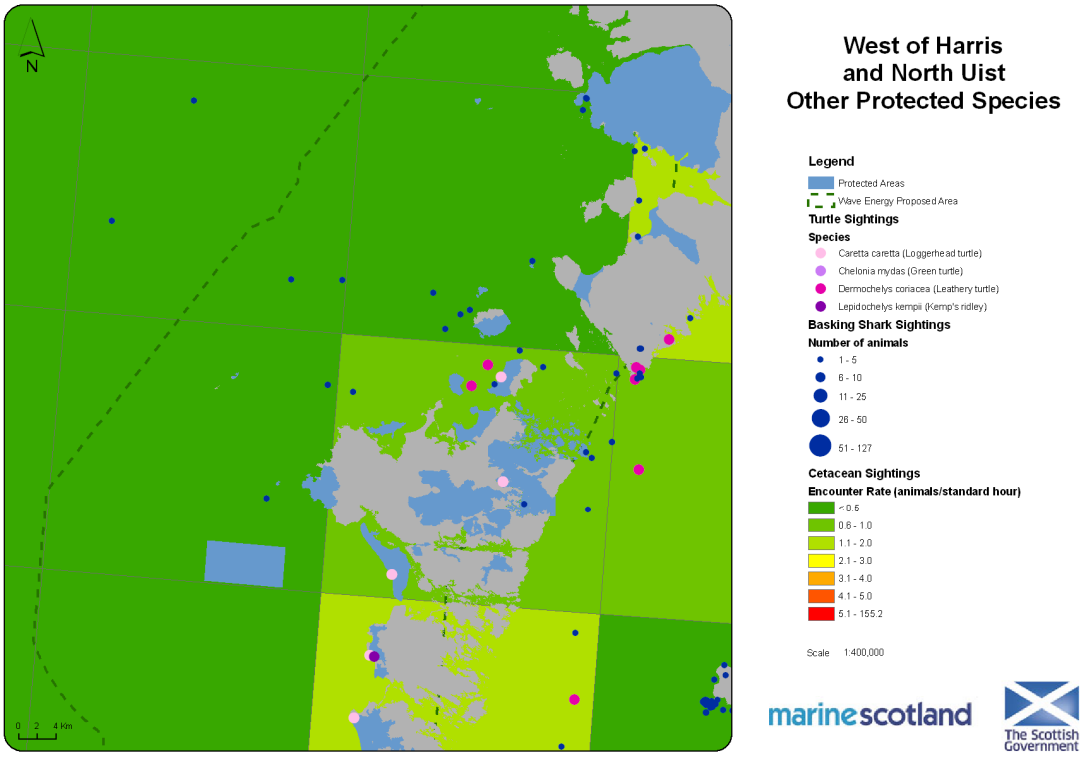

Figure 3.4.13: West of Harris and North Uist: Cetaceans, turtles and basking sharks (source: OS, NBN, MCS, JNCC)

Protected Habitats

The majority of the seabed in this site is solid rock. However, the coarse sediment in the north of the site falls under the definition of the UK BAP priority habitat, sublittoral sands and gravels. Other habitats present in this site, which qualify under BAP, are seagrasses (*Z. marina* and *Z. noltei*), maerl (*L. corraloides, L. glaciale* and *P. calcareum*), serpulids and horse mussel beds.

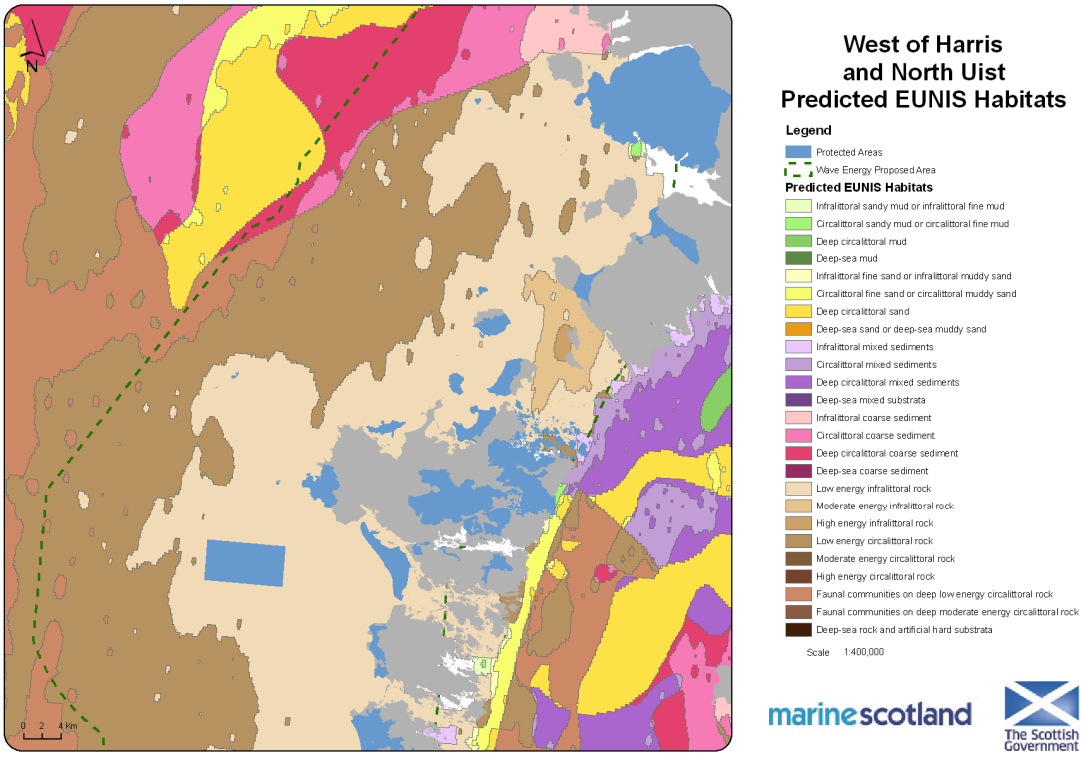

Figure 3.4.14: West of Harris and North Uist: Seabed habitats (predicted by EUNIS) (source: OS, JNCC)

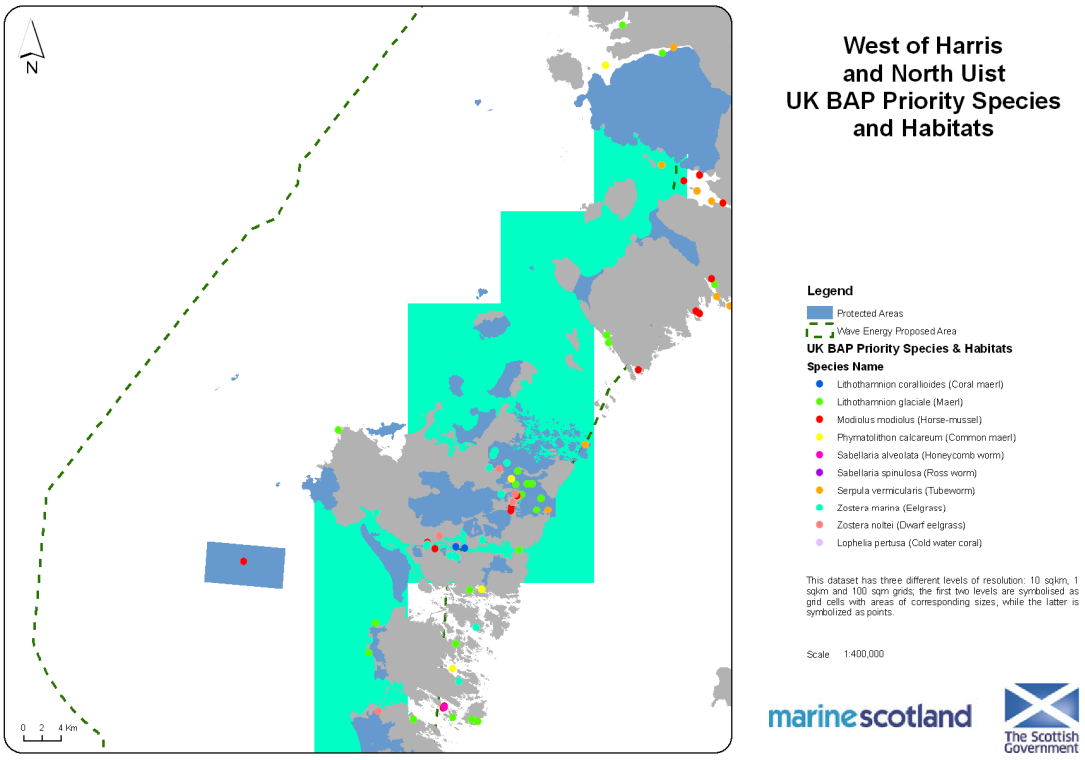

Figure 3.4.15: West of Harris and North Uist: UK BAP Priority species and habitats (source: OS, NBN)

Sensitive Areas for Fish

This area is sensitive for commercial fish during the winter (Jan – April) and late summer (Aug – Sept) (Fig. 3.4.16-17). It is used as a nursery ground by haddock, herring, lemon sole, mackerel, plaice, Norway pout, sandeel and whiting and a spawning ground by cod, herring, lemon sole, *Nephrops*, Norway pout, saithe, sandeel and sprat.

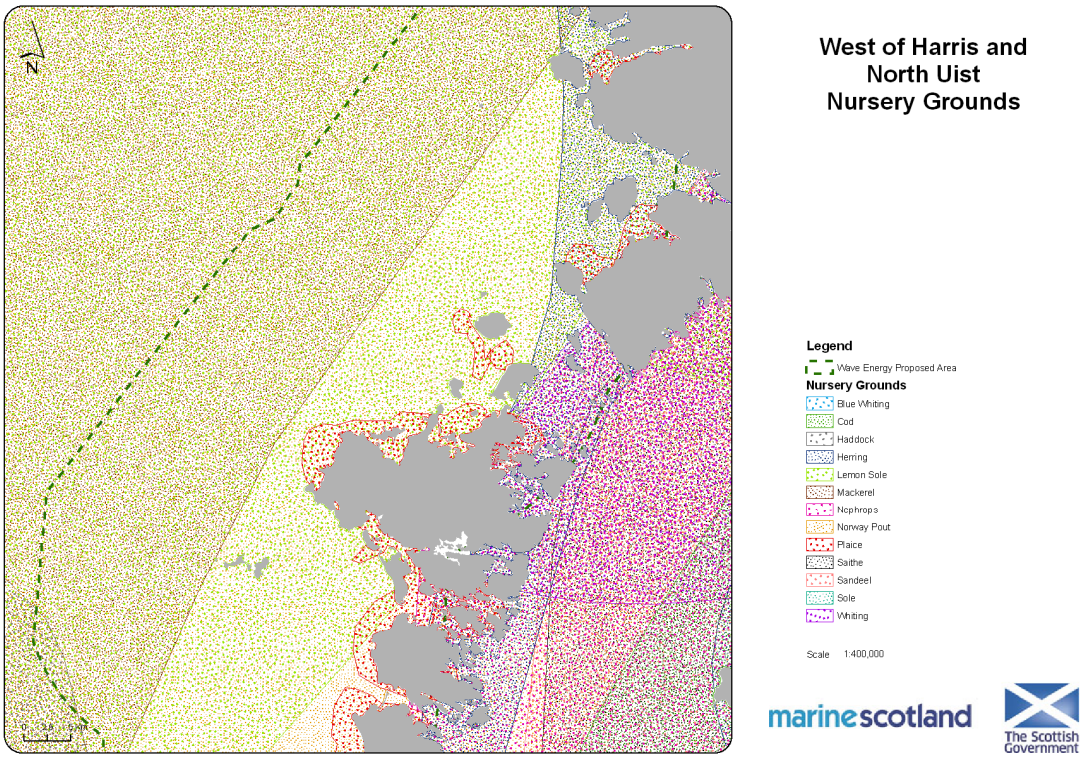

Figure 3.4.16: West of Harris and North Uist: Nursery grounds for commercial species (source: OS, MSS, CEFAS)

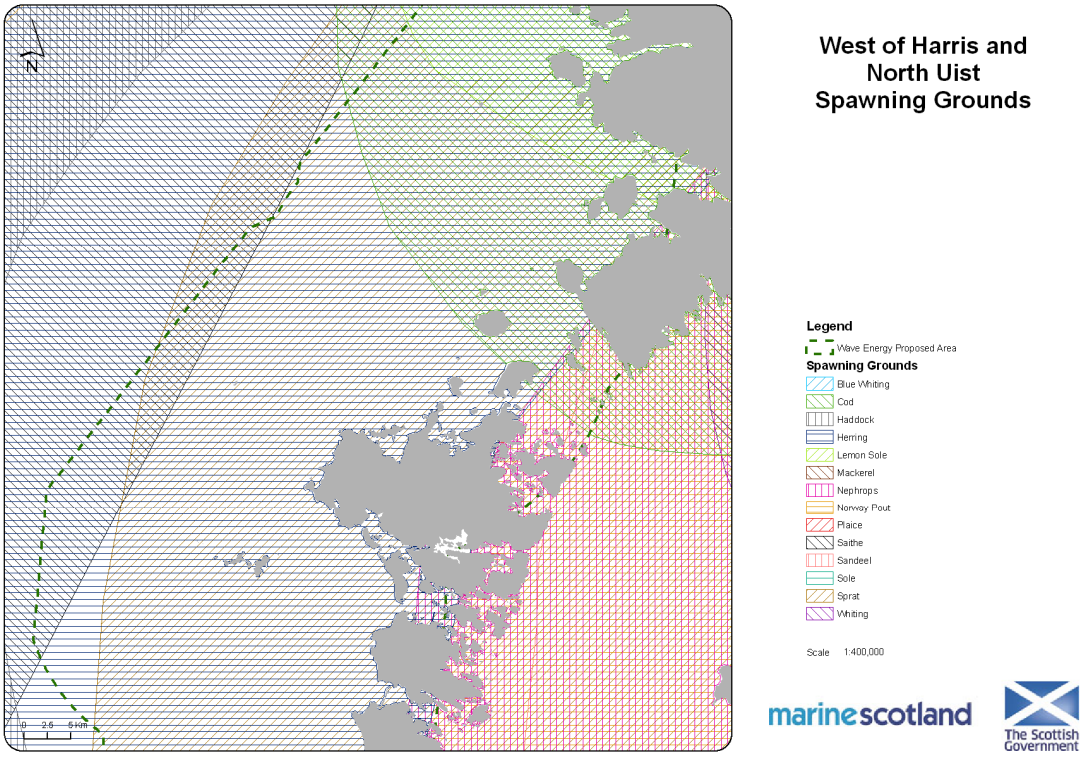

Figure 3.4.17: West of Harris and North Uist: Spawning grounds for commercial species (source: OS, MSS, CEFAS)

3.4.2.6 Cultural Heritage

Many SAMs can be found along this stretch of coastline (Fig. 3.4.18). These include:

Dun Buidhe, broch, Eochar, North Uist
Teampull Bhuirgh, chapel and settlement 450 m SW of Borve Castle, North Uist
Dun Torcusay, dun 290m ESE of Garry-a-siar, Benbecula, North Uist
Nunton, St Mary's Chapel (Cladh Mhuire), chapel, Benbecula, North Uist
Teampull and Tobar Chaluim Chille, church and well, Balivanich, North Uist
Teampull na Trionaid and Teampull Clann a'Phiocair, church, North Uist
Dun Grogarry, dun, North Uist
Cille-Pheadair, cross 800 m north of Balmartin, North Uist
Dun Scolpaig, dun (site of) and tower, North Uist
Caisteal Odair, promontory fort, North Uist
Foshigarry, settlement, North Uist
Dun a'Ghallain, dun,Griminish, North Uist
Dun an Sticer, dun, Loch an Sticir, North Uist
Cladh Maolrithe, standing stones, cashel, chapel and shielings, Bernera, North Uist
Rubh an Teampull, settlement, South Harris
Chapel (on site of broch), Rubh' an Teampuill, Toe Head, South Harris
Traigh an Taoibh Thuath, settlement, South Harris
Borvemore, standing stone and site of stone circle, Scarista, South Harris
Borve Lodge, chambered cairn, South Harris
Clach Mhic Leoid, standing stone, South Harris
Bunavoneadar, whaling station, North Harris
Meilein, burial cairn, North Harris
Gearraidh na h-Airde Moire, shielings, Loch Resort, North Harris
Aird Sleitenish,stone circle, North Harris

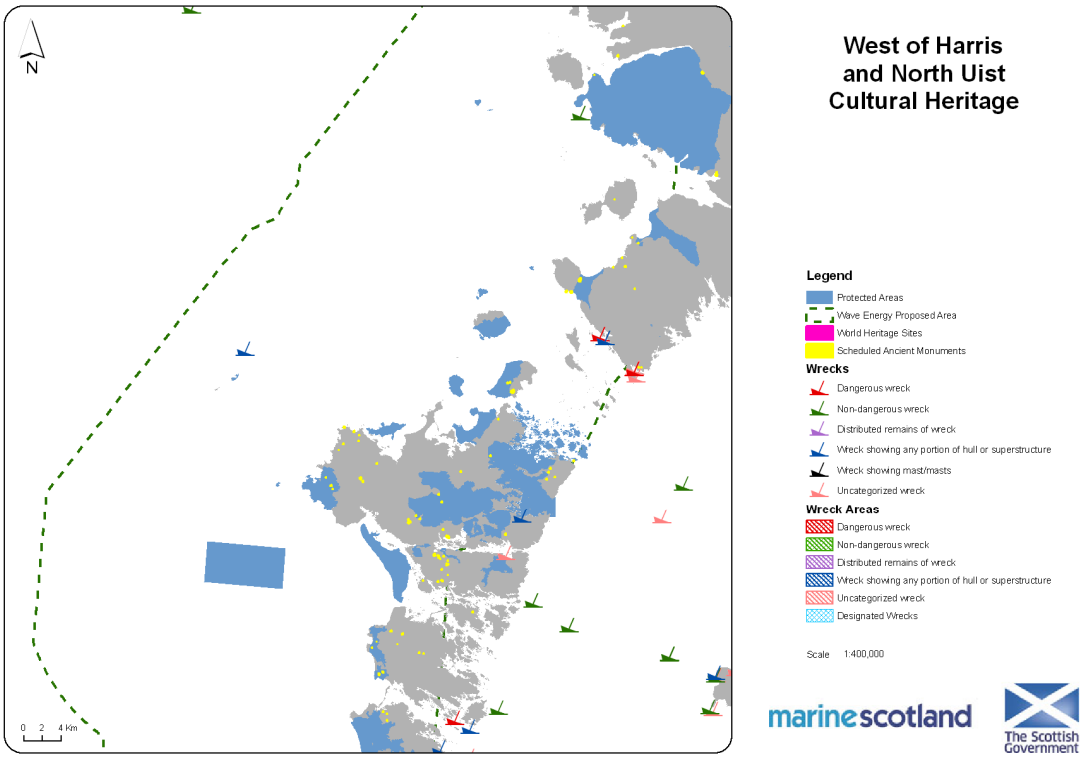

Figure 3.4.18: West of Harris and North Uist: Cultural heritage (source: OS, Historic Scotland, SeaZone Hydrospatial)

3.4.2.7 Recreation

The wreck of Bountiful II to the west of North Uist is protected (3.4.19). There are also two wrecks in the Sound of Harris and one off the coast of North Harris. Recreational use in this area includes an RYA sailing area in the Sound of Harris. There are also 5 sailing routes that cross the length of this site or pass between the islands.

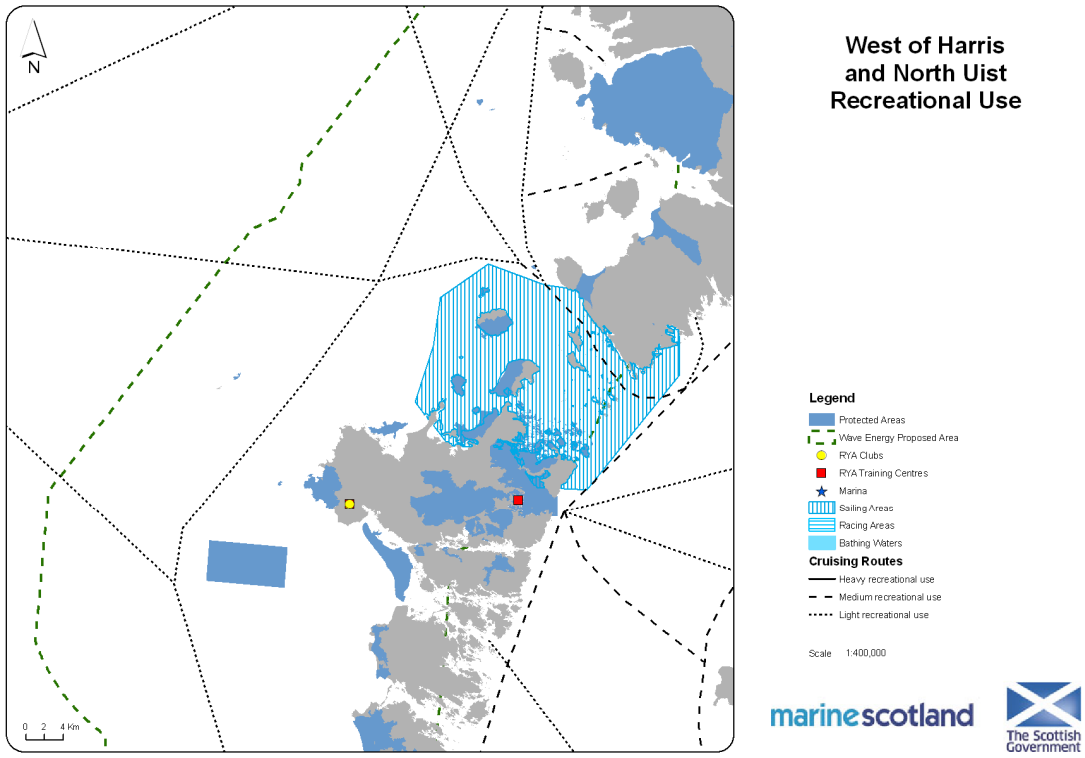

Figure 3.4.19: West of Harris and North Uist: Recreational use (source: OS, RYA, SG)

3.5 West of Lewis

Summary

This is an area of high wave resource. The seabed is predominantly a combination of gravel and sand and the depth is less than 50 m out to 4-5 km. The port of Stornoway is reasonably close by. The grid is not capable of carrying additional power sources at present and it is not clear whether planned improvements to the grid would be of sufficient capacity to accommodate this new source of energy. The region is relatively heavily fished particularly for shellfish but also demersal and pelagic species further offshore. The sea off the Butt of Lewis is also rich in cetaceans. There are few sites on the coast or in the sea designated for conservation purposes, with the exception of areas of calmer waters such as the Loch Roag lagoon system Marine Consultation Area (MCA) and NSA to the south.

3.5.1 Technological Constraints

3.5.1.1 Wave Resource

The annual mean wave power ranges between 4.5 kW/m of wave crest inshore and 42.4 kW/m offshore (Fig. 3.5.1). The maximum estimated summer mean is 14.6 kW/m compared to 76.4 kW/m in winter. Annual mean wave height varies between 1.5 m inshore and 3.1 m offshore (Fig. 3.5.2). In summer, the maximum estimated wave height in the region is 2.0 m, whereas in winter it is 3.9 m. The mean annual wave period is less variable (7.3 – 8.0 s) and varies between 6.6 s in summer to 8.7 in winter.

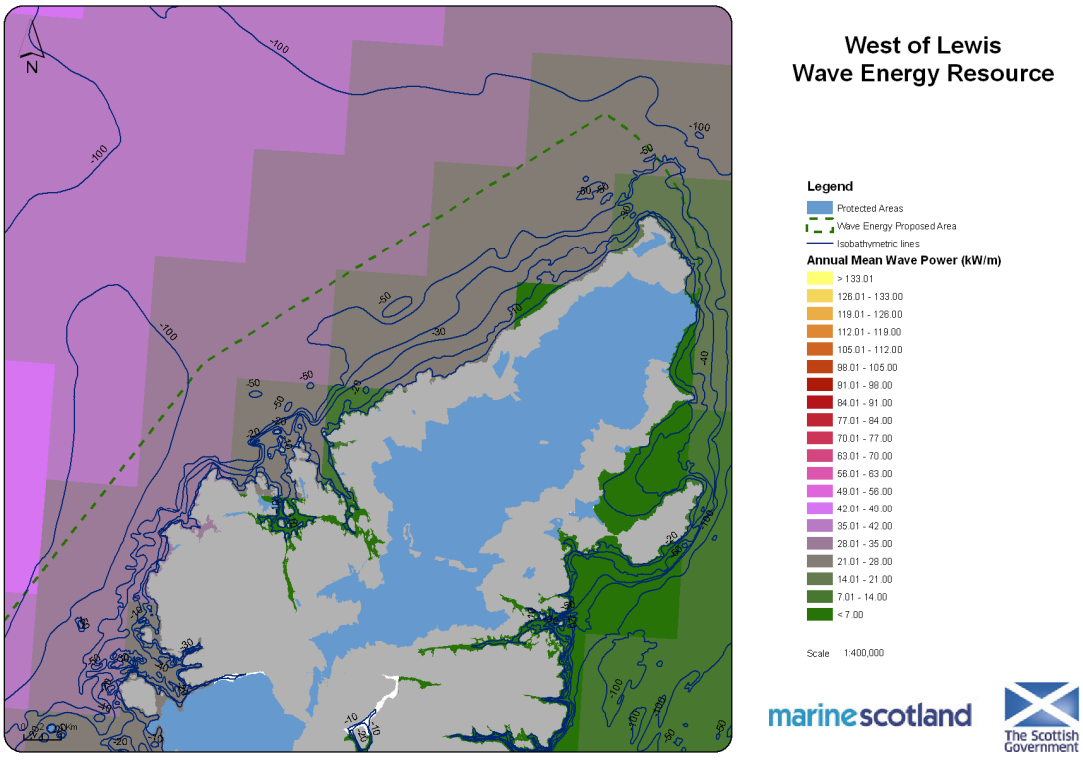

Figure 3.5.1: West of Lewis: Annual mean wave power density (source: OS, BGS, DTI)

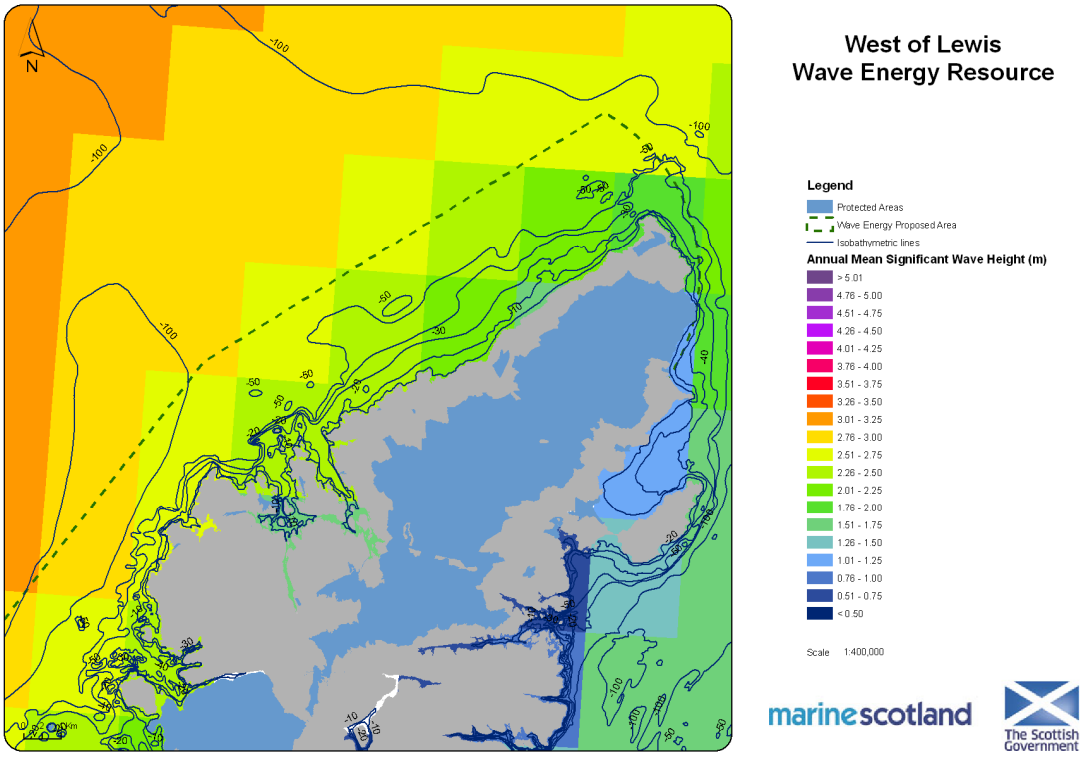

Figure 3.5.2: West of Lewis: Annual mean significant wave height (source: OS, BGS, DTI)

3.5.1.2 Tidal Streams

With the exception of the water surrounding the Butt of Lewis, the tidal currents are consistent and relatively low across the site (Fig. 3.5.3). They range from 0.13 m/s during neaps to 0.36 m/s during springs with little seasonal variability. Around the Butt of Lewis, the tides can reach 1.57 m/s during springs. The tidal range is consistent across the site, ranging from 3.26 m during springs to 1.43 m during neaps.

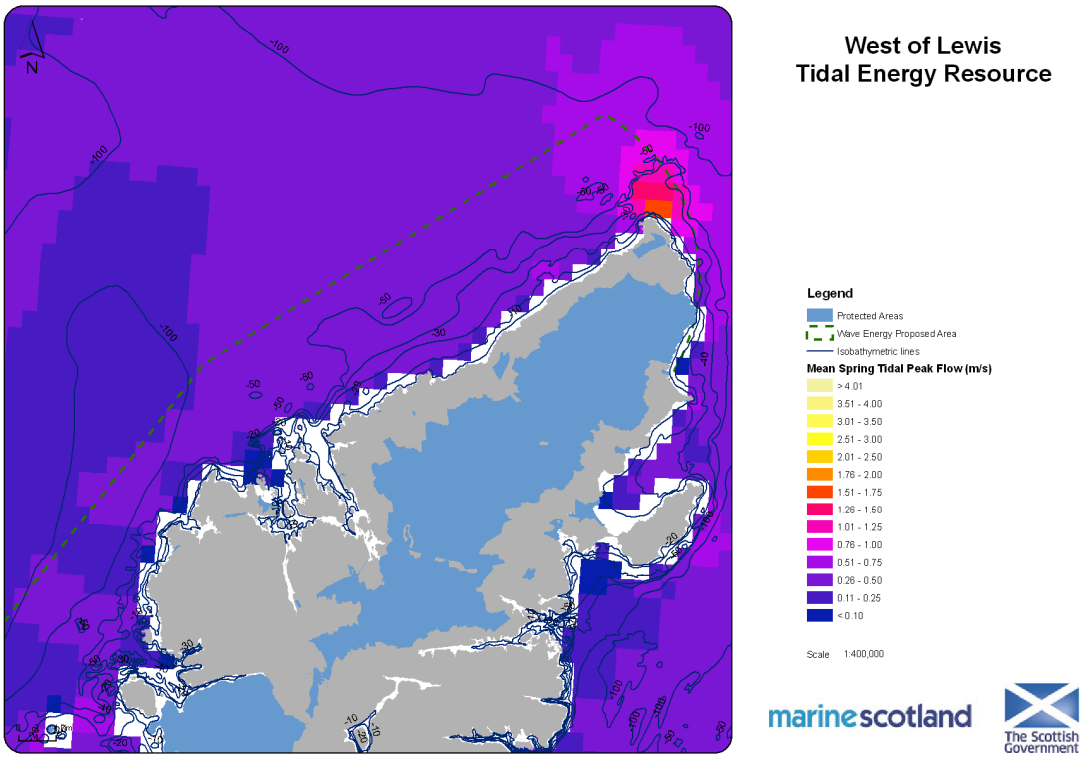

Figure 3.5.3: West of Lewis: Mean spring tidal peak flow (source: OS, BGS, DTI)

3.5.1.3 Bathymetry and Seabed

The expanse of Lewisian gneiss extends into the southern end of this site. Immediately to the north is gravelly sand and sandy gravel (Fig. 3.5.4). In the mid to northern sector, the seabed is composed of sand, gravelly sand or gravel. Elsewhere, and further offshore, is sandy gravel. The seabed slopes relatively gradually offshore and drops to 30 m 1.5 – 3.5 km from the shore. It reaches a depth of 50 m at a distance of 4 – 5 km from the shore before levelling out to between 50 – 100 m beyond.

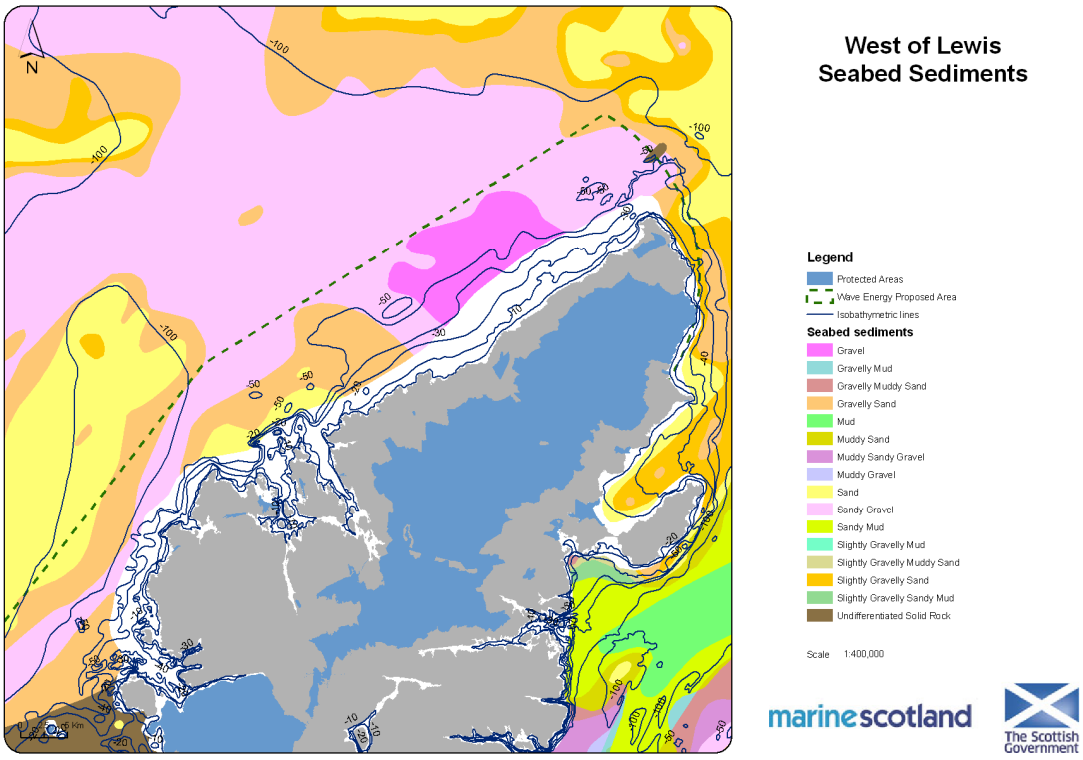

Figure 3.5.4: West of Lewis: Bathymetry and seabed sediments (source: OS and BGS)

3.5.1.4 Existing Infrastructure

Ports and harbours: The site is between 40 and 145 km from Stornoway, the nearest large port (Fig. 3.5.5). The Arnish Fabrication Yard is also located in Stornoway and has been identified as a site suitable for the production of wave/tidal devices with deep water berthing and good lifting facilities. Ports nearer to the site are limited with the exception of the small piers of Valtos, Miavaig and Bernera within the site.

Grid connection: The single connection from Lewis via Skye to Fort Augustus on the Scottish mainland is already at full capacity. Subject to consents, SHETL plans reinforcement of a 450 MW HVDC circuit between Gravir on Lewis and Beauly west of Inverness by 2012-13. 152 MW of this capacity will be allocated to already consented renewable energy generation. There is potential for wave/tidal development to connect into the 298 MW of spare capacity. However, if all other existing proposals gain consent, then only 18 MW of capacity will remain. There is potential to install a second 450 MW connection, but this is subject to approval by Ofgem. As the planned reinforcements are connecting to the east coast of Lewis, local reinforcements would be required in order to link up to this point.

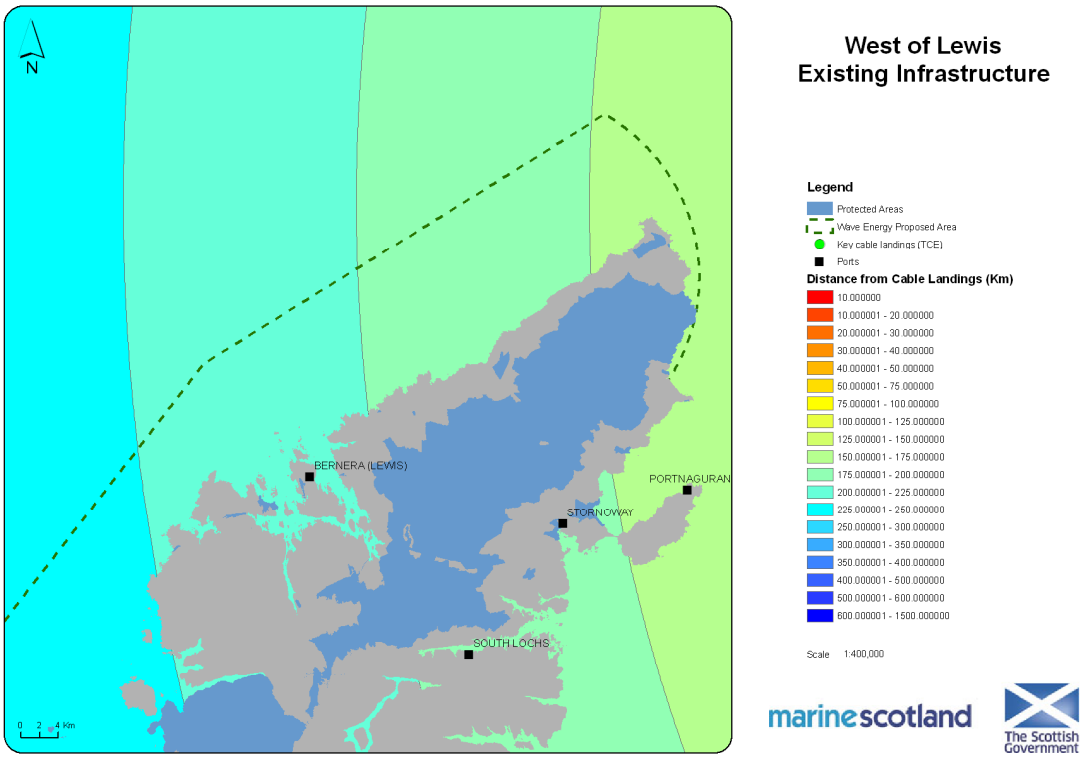

Figure 3.5.5: West of Lewis: Existing infrastructure (ports and cable landings) (source: OS, TCE, DECC)

3.5.2 Other Constraints

3.5.2.1 Commercial Uses

TCE energy leases: There are none within this site.

Fish or shellfish farms: There are many fish farms within Loch Roag and one marked in Loch Resort but none offshore in the areas of high wave resource.

Cables or pipelines: There are power cables linking Barra to South Uist, but again these are not in areas of high wave resource.

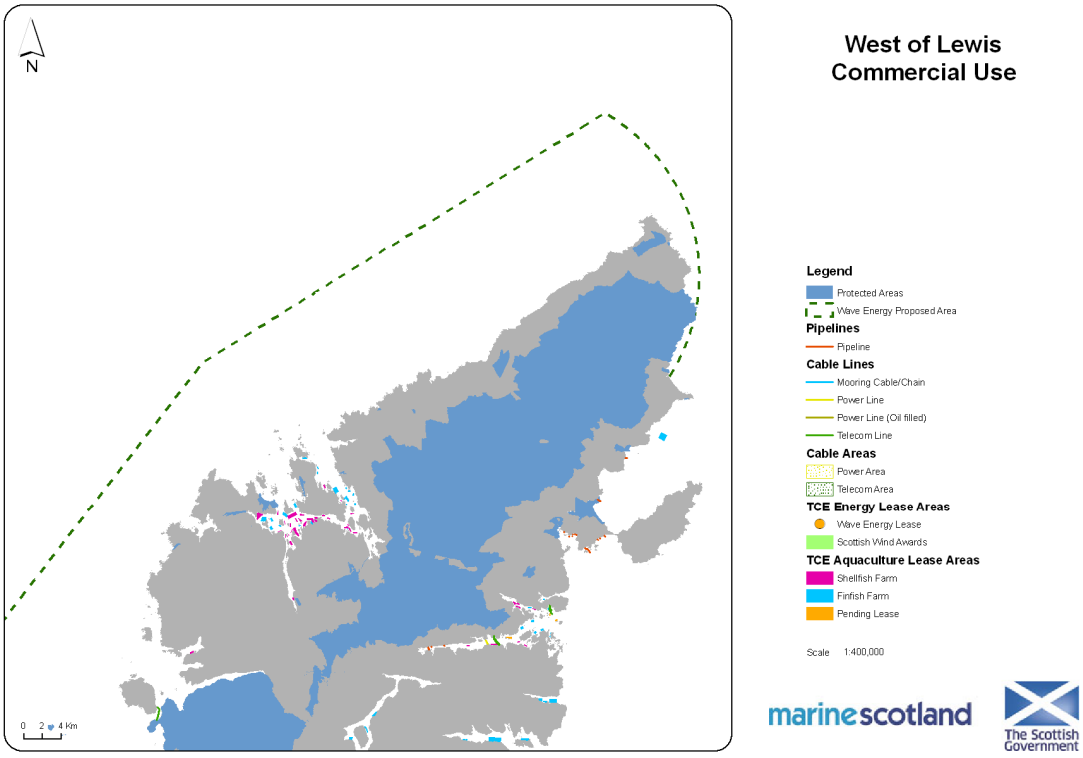

Figure 3.5.6: West of Lewis: Existing commercial uses (source: OS, SeaZone Hydrospatial, Kingfisher, TCE)

3.5.2.2 Military

The east of Lewis is used as a Navy submarine exercise area (Fig. 3.5.7). There is one point on the west coast identified for firing practice immediately offshore from the village of Barvas. Other than this, there is no marked military activity within this site.

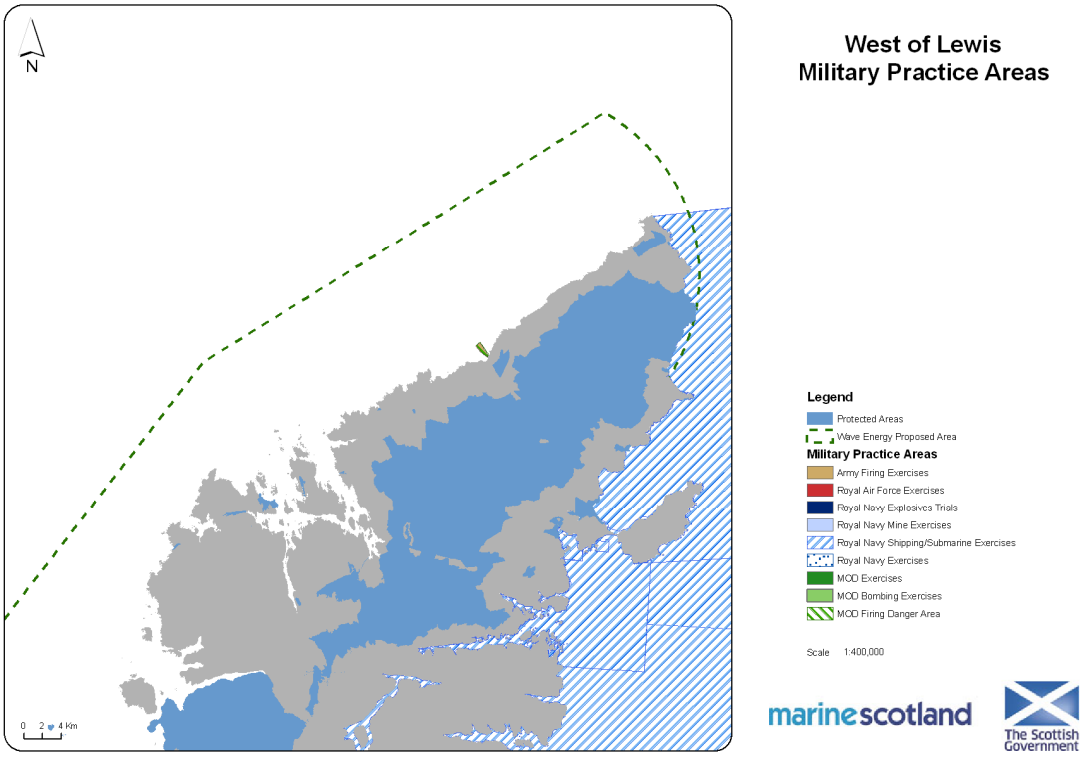

Figure 3.5.7: West of Lewis: Military practice areas (source: OS, SeaZone Hydrospatial)

3.5.2.3 Shipping

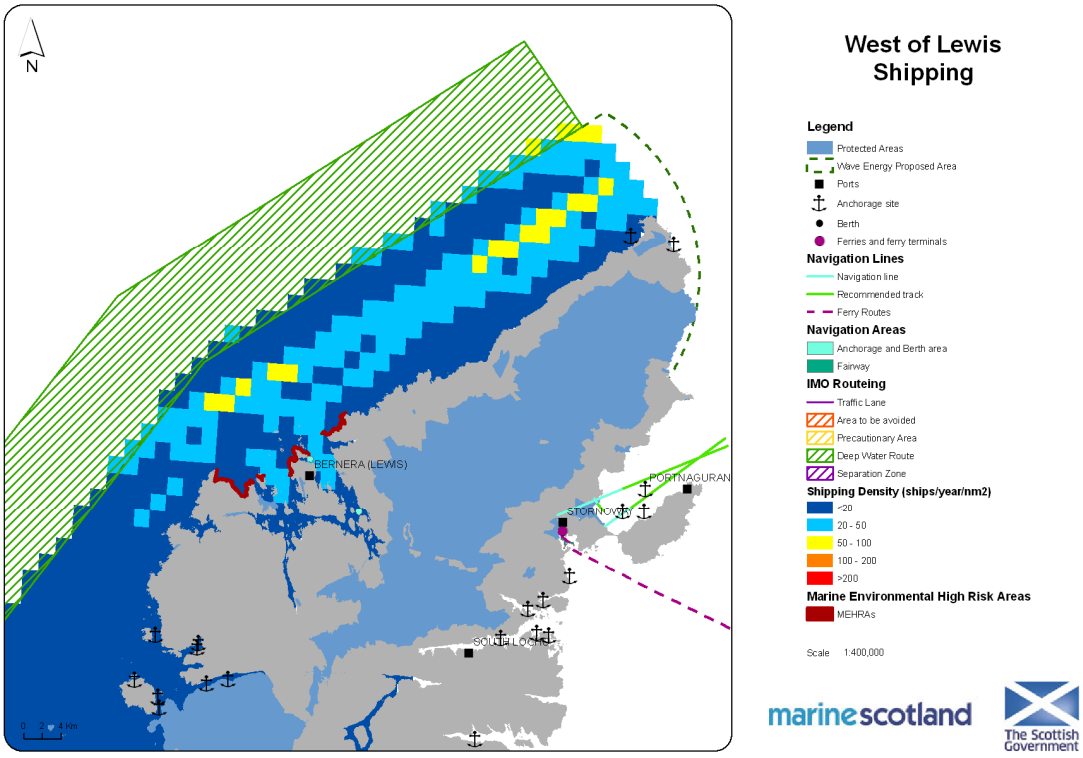

Figure 3.5.8: West of Lewis: Shipping (source: OS, SeaZone Hydrospatial, DECC, Anatec Ltd)

The majority of ships pass through the designated IMO route, which is adjacent to the western boundary of this site (Fig. 3.5.8). There is a relatively low level of shipping (up to 52 shipping movements / year) ~10 km from the coast and within Loch Roag. No ferry routes exist within this site. The coast of Gallan Head, surrounding East and West Loch Roag, has been identified as a MEHRA. This is an area containing vulnerable concentrations of seabirds and near-shore fishing activity. As such ships are expected to travel through the deep water IMO-route to the west or through the Minches in adverse weather conditions.

3.5.2.4 Commercial Fishing

The data from vessels of ≥15 m indicates that this site supports a rich fishery for many species (Fig.s 3.5.9-10). Shellfish (mostly edible crabs) are caught to the west of Lewis particularly west of the Butt of Lewis. Demersal species (saithe, megrim, whiting, haddock and cod) are mostly caught in the north of the site with a value of ≤£50 000 per trip. Pelagic species (herring, mackerel and monk fish), with a value of ≤£500 000, are mostly caught in the north and western boundary of the site. However, the pelagic boats tend to follow the movement of the stock and thus closure of a smaller area for wave development may not stop the same fish being detected/caught elsewhere (MSS, personal communication). Anecdotal evidence, suggests that this area is also important for smaller creel vessels, which fish here for edible crab, velvet crab and lobster.

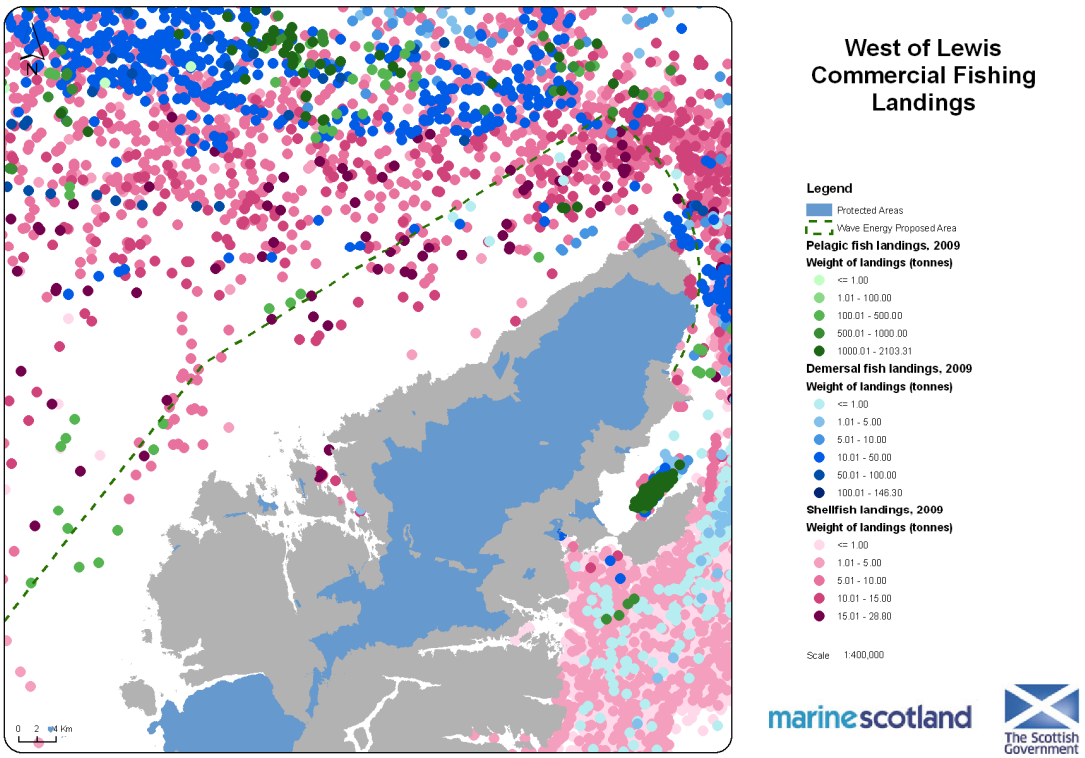

Figure 3.5.9: West of Lewis: Commercial landings of pelagic and demersal fish and shellfish (tonnes) (source: OS, MSS)

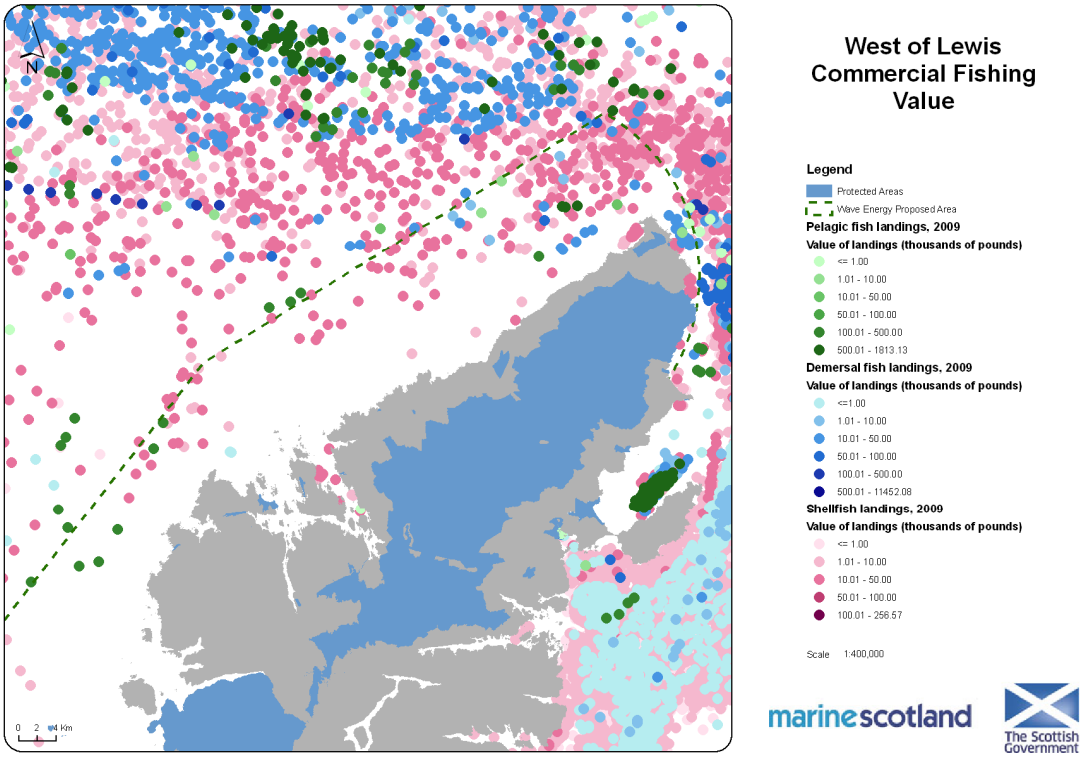

Figure 3.5.10: West of Lewis: Commercial landings of pelagic and demersal fish and shellfish (value) (source: OS, MSS)

3.5.2.5 Environment

Designated Areas

There are a number of designated sites on the coast of this site (Fig. 3.5.10). However, these sites are outwith the areas of high wave resource, with the exception of a JNCC search area for new SPAs covering the southern part of this site. The Loch Roag lagoons are considered to be one of the best examples of a lagoon system in the UK. Loch Roag is a complex of silled lagoons which progress from freshwater to marine. Its basin displays a diverse range of habitats including seagrass beds and rocky reef. The whole lagoon system is classified as an MCA. Within the lagoon system, part of West Loch Roag is designated as an SAC. Also, on the western shore of West Loch Roag, the site of Tràigh na Berie Roag is an SAC for its machair grassland. Loch Roag also contains two shellfish growing waters.

On the land, the South Lewis, Harris and North Uist NSA extends into the southern component of this site. Also, the Lewis Peatlands SAC and SPA stretches across much of the central highlands of Lewis. One of the qualifying features of the SAC is the otter, which may also occupy the coastal regions within the proposed site. Similarly, the black (*Gavia arctica)* and red throated divers (*G. stellata*), which are protected by the SPA, may occupy the proposed site during the winter months and potentially interact with the devices. Other qualifying species of this SPA are golden eagle, golden plover (*Pluvialis apricaria*) and

merlin (*Falco columbarius*). Lastly, the SPA of Mointeach Scadabhaigh on the coast of south Lewis also supports black and red throated divers.

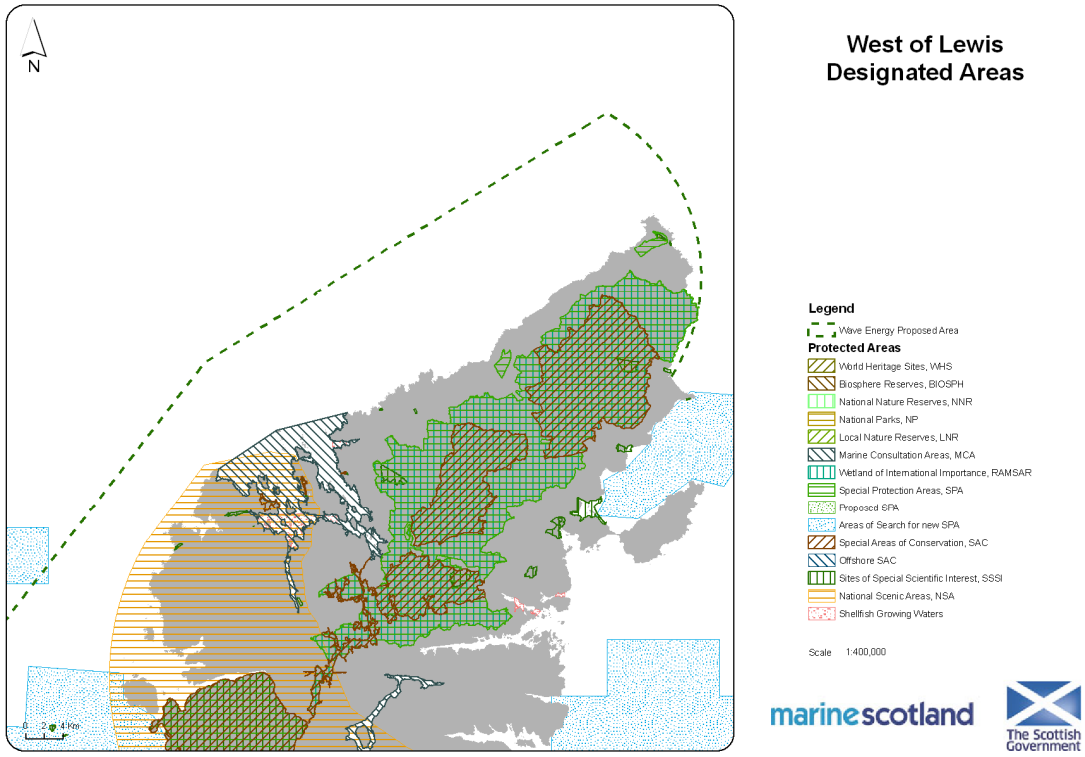

Figure 3.5.11: West of Lewis: Designated areas (source: OS, SeaZone Hydrospatial, SNH, JNCC, SG)

Protected Species

Abundance of seabirds at sea is relatively low but higher off the Butt of Lewis and west of Loch Roag reflecting the pattern of seabird colonies (Fig. 3.5.12). Cetacean abundance appears to be relatively low across much of this site (0.07/hr/km^2) with the exception of around the Butt of Lewis (3.25/hr/km^2) (Fig. 3.5.13). Species documented include minke whale, bottlenose dolphin, Atlantic white-sided dolphin, Risso's dolphin and harbour porpoise. Basking sharks have been sighted relatively frequently along the coastline of Lewis, particularly within East and West Loch Roag.

Protected Habitats

Much of this site may be classed under the BAP habitat, sublittoral sands and gravels (Fig. 3.5.14). With the exception of the southern extent of the site, the seabed takes the form of coarse sediment or sand. There are also a number of protected habitats within the site, particularly within the Loch Roag lagoon complex. These include horse mussel beds, seagrass, maerl and serpulid worms (Fig. 3.5.15).

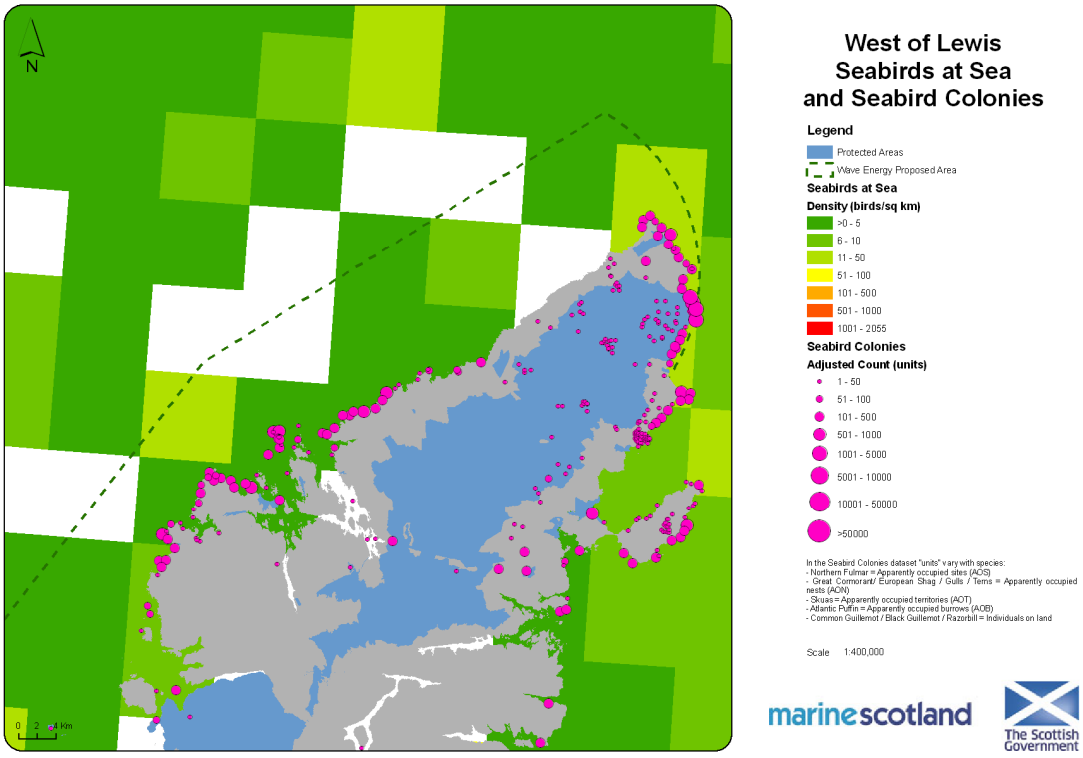

Figure 3.5.12: West of Lewis: Seabirds at sea and seabird colonies (source: OS, JNCC)

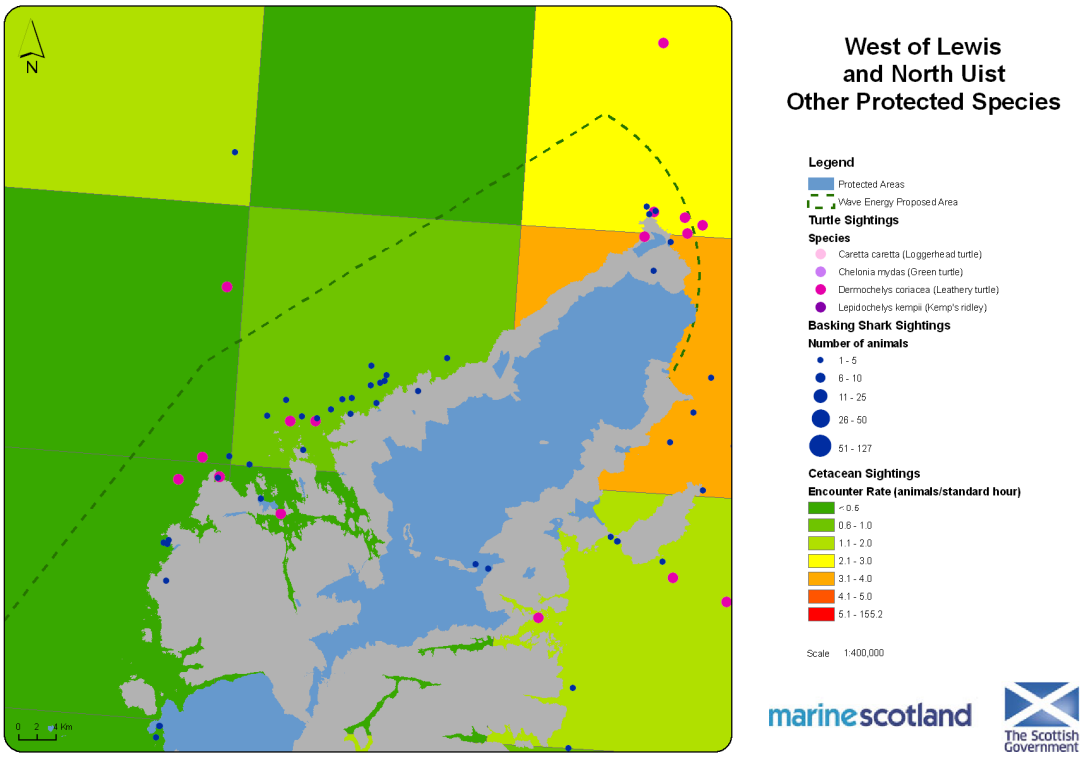

Figure 3.5.13: West of Lewis: Cetaceans, turtles and basking sharks (source: OS, NBN, MCS, JNCC)

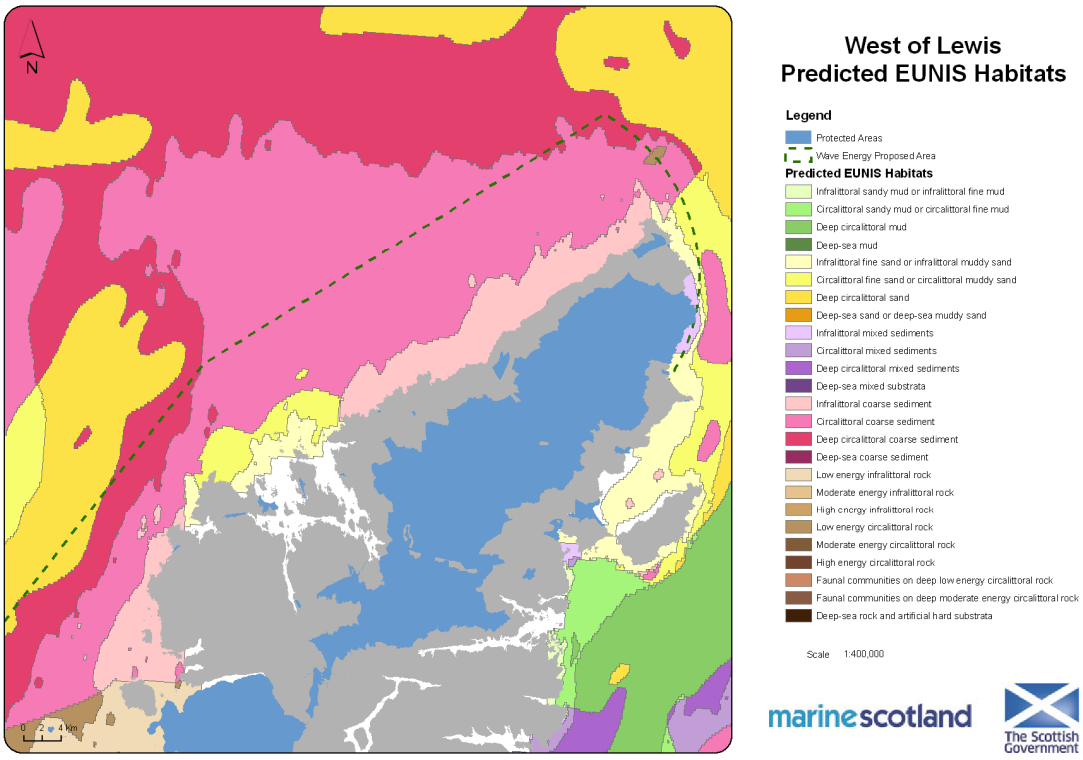

Figure 3.5.14: West of Lewis: Seabed habitats (predicted by EUNIS) (source: OS, JNCC)

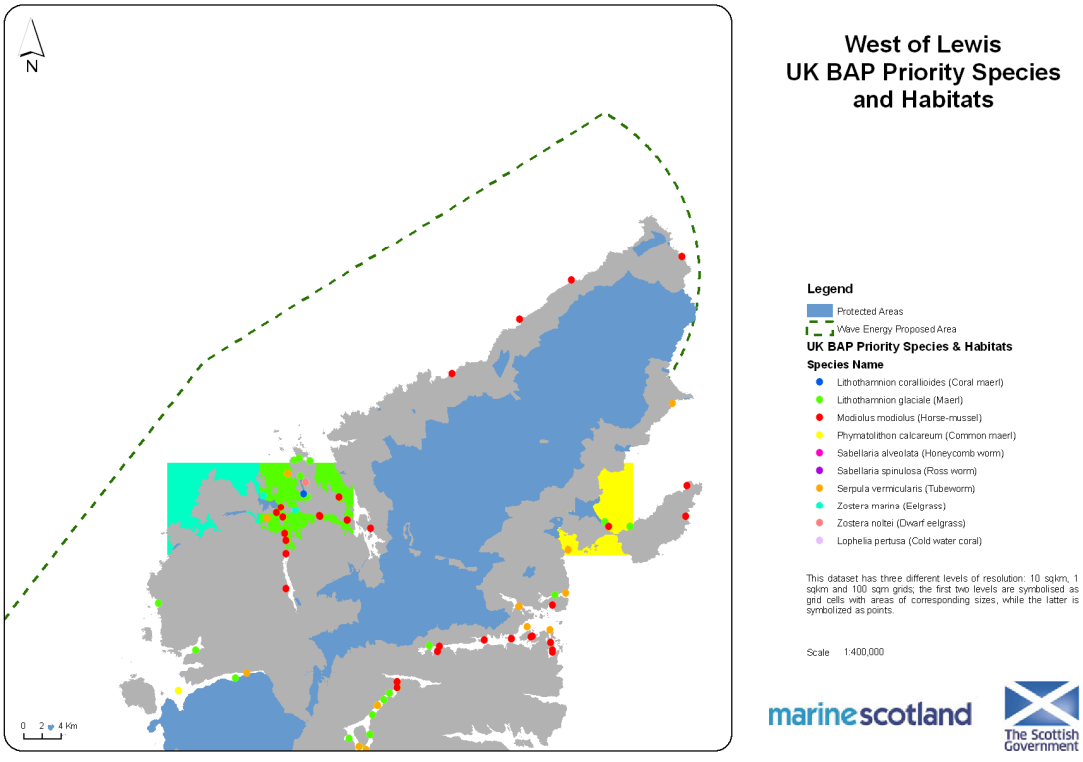

Figure 3.5.15: West of Lewis: UK BAP Priority species and habitats (source: OS, NBN)

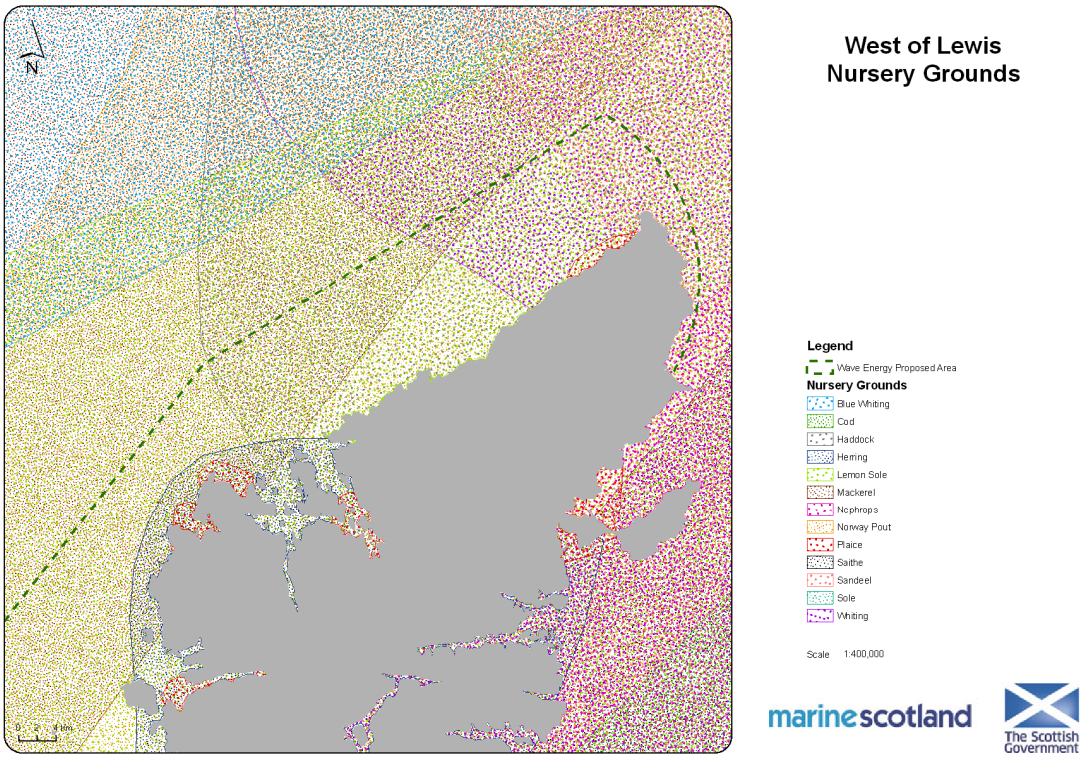

Figure 3.5.16: West of Lewis: Nursery grounds for commercial species (source: OS, MSS, CEFAS)

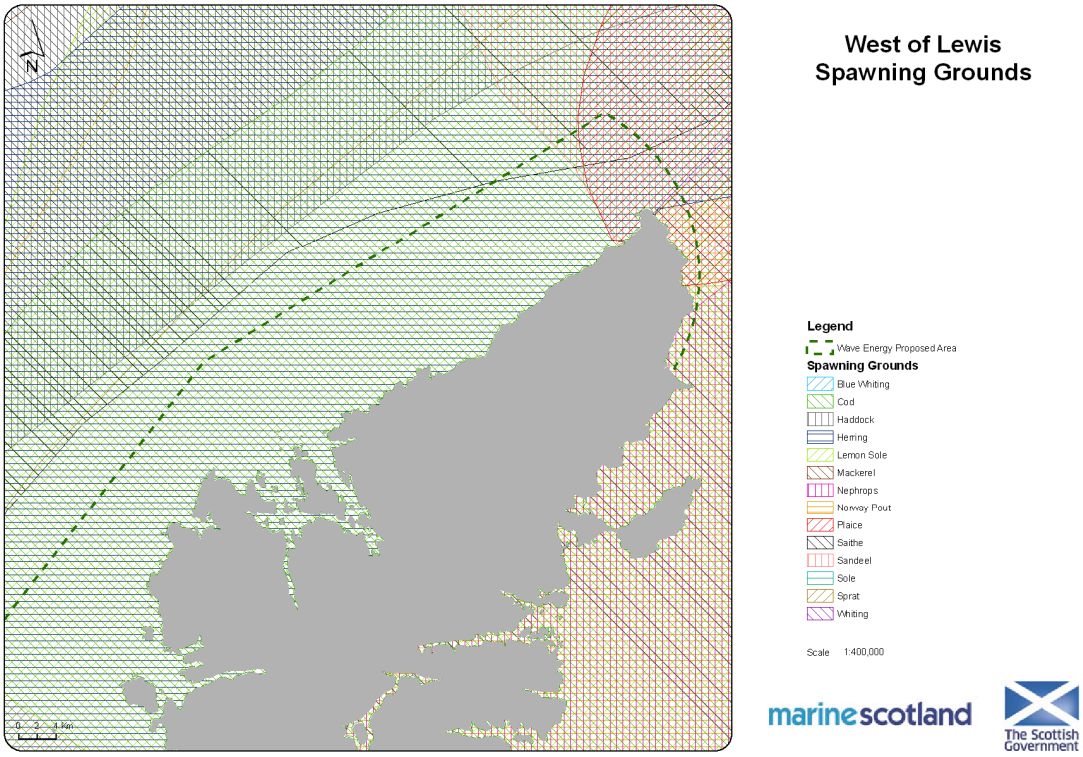

Figure 3.5.17: West of Lewis: Spawning grounds for commercial species (source: OS, MSS, CEFAS)

Sensitive Areas for Commercial Fish

The months of January – April and August - September have been classified as sensitive for commercial fish. Haddock, herring, lemon sole, mackerel, Norway pout, plaice, sandeel and whiting use parts of this site as a nursery ground (Fig. 3.5.16), while cod, herring, lemon sole, Norway pout, plaice, saithe, sandeel, sprat and whiting use the site for spawning (Fig. 3.5.17).

3.5.2.6 Cultural Heritage

This site contains seven marked ship wrecks, although none of these are protected (Fig. 3.5.18). Numerous SAMs are distributed along the west coast of Lewis that may require consideration with regard to onshore infrastructure.

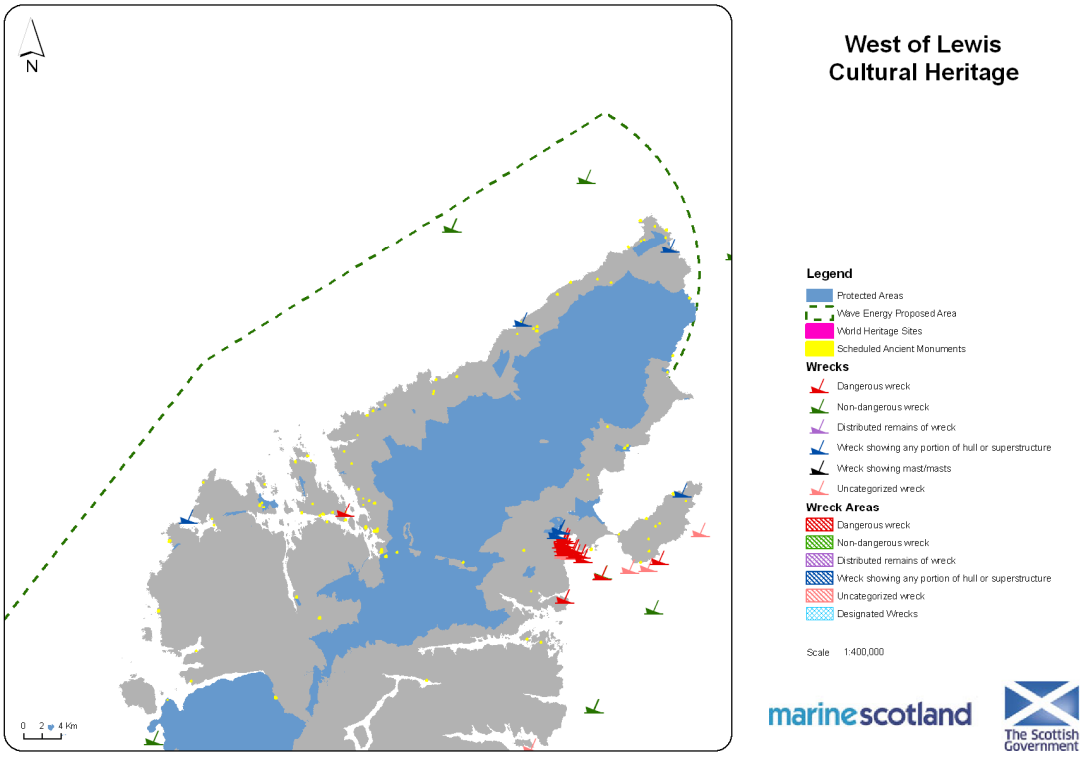

Figure 3.5.18: West of Lewis: Cultural heritage (source: OS, Historic Scotland, SeaZone Hydrospatial)

3.5.2.7 Recreation

There is little that is marked for its recreational value within this site other than sailing (Fig. 3.5.19). A sailing route is marked west of the Hebrides, which transits the length of the site. There are also two routes that join this route from Loch Roag.

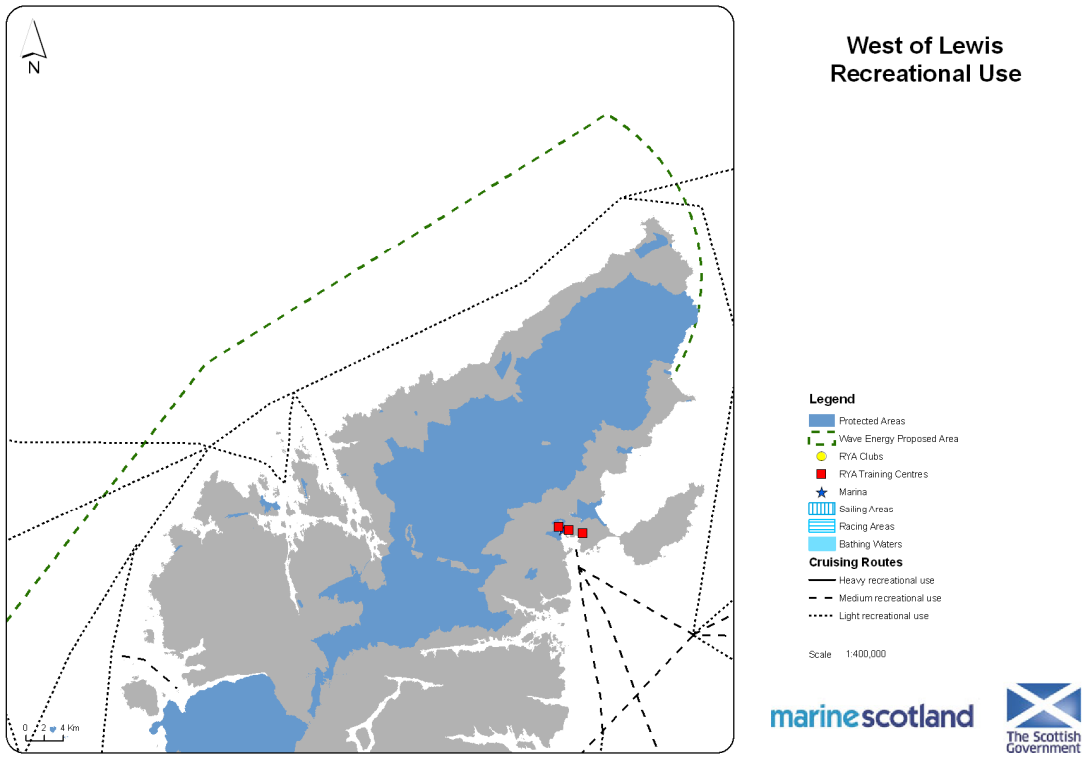

Figure 3.5.19: West of Lewis: Recreational use (source: OS, RYA, SG)

3.6 West of Shetland

Summary

The north-west coast of Mainland Shetland displays a high level of wave resource. The seabed is composed of a variety of habitat types from solid rock, to sands and gravels and the depth in the inshore region is typically between 30 and 50 m. There are a number of suitable ports in the vicinity such as Sullom Voe and Scalloway. The grid is likely to have sufficient capacity to support wave energy generation should the planned improvements take place, although local connections would still be required. There is no marked military activity within the site. However, the area is highly regarded for the species and habitats it supports, particularly the seabirds but also seals, cetaceans, otters and rocky reefs. As such it contains many designated sites for conservation purposes and is under consideration as a new SPA. This is also an important fishing ground for the shellfish and pelagic sector. Much of the inshore section of the site is marked as a sailing area by the RYA. It should be noted that in the case of Shetland, in addition to other licenses, a Works Licence will also be required under the Shetland County Council Act (ZCC Act). The Shetland SSMEI Marine Atlas and Marine Spatial Plan (2010) are valuable resources for further information about site characteristics and the national and regional policy context.

3.6.1 Technological Constraints

3.6.1.1 Wave Resource

The annual mean significant wave height increases further offshore from 2.3 m near the coast of Esha Ness to $\leq$ 2.8 m at a distance of 8 km offshore (Fig. 3.6.2). The summer maximum (1.8 m) is far lower than in winter (3.6 m). Similarly, the mean wave period varies between 8.1 s in winter and 6.3 s in summer. There is little variation within the site however (annual mean wave period is 7.2 to 7.6 s). The wave power mirrors the trend in height and period (Fig. 3.6.1). The annual mean in this area varies between 10.7 and 32.8 kW/m of wave crest. In winter, it is considerably greater ($\leq$ 56.2 kW/m compared to $\leq$ 11.5 kW/m in summer).

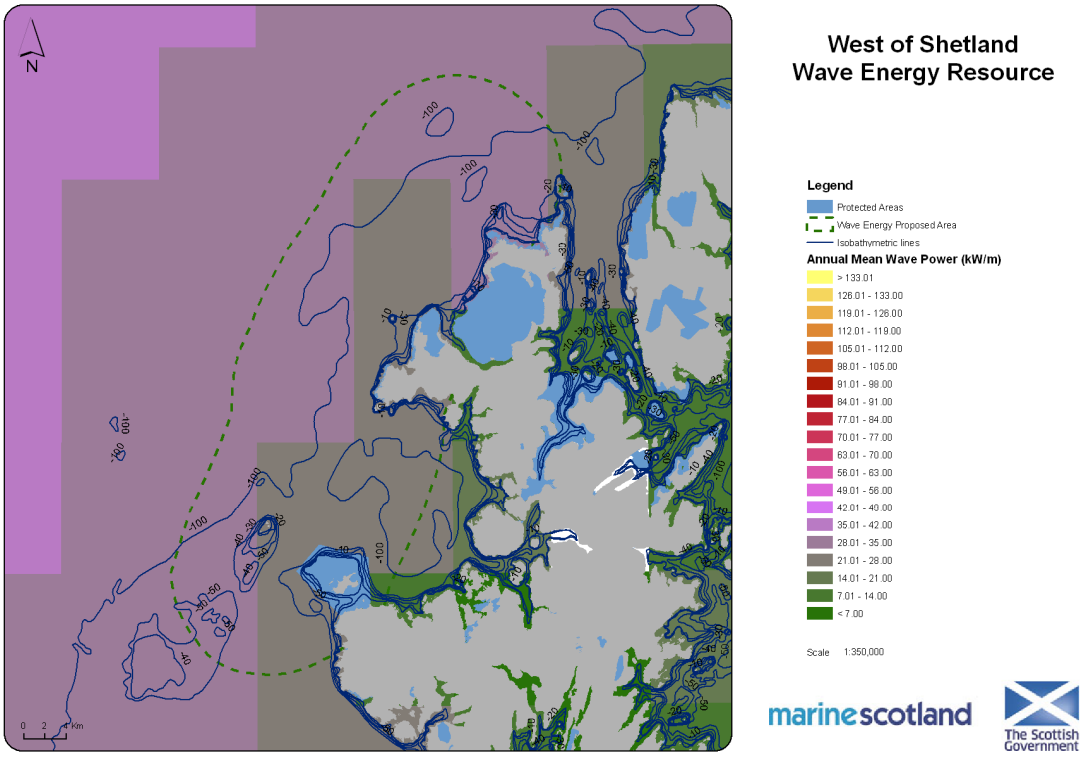

Figure 3.6.1: West of Shetland: Annual mean wave power density (source: OS, BGS, DTI)

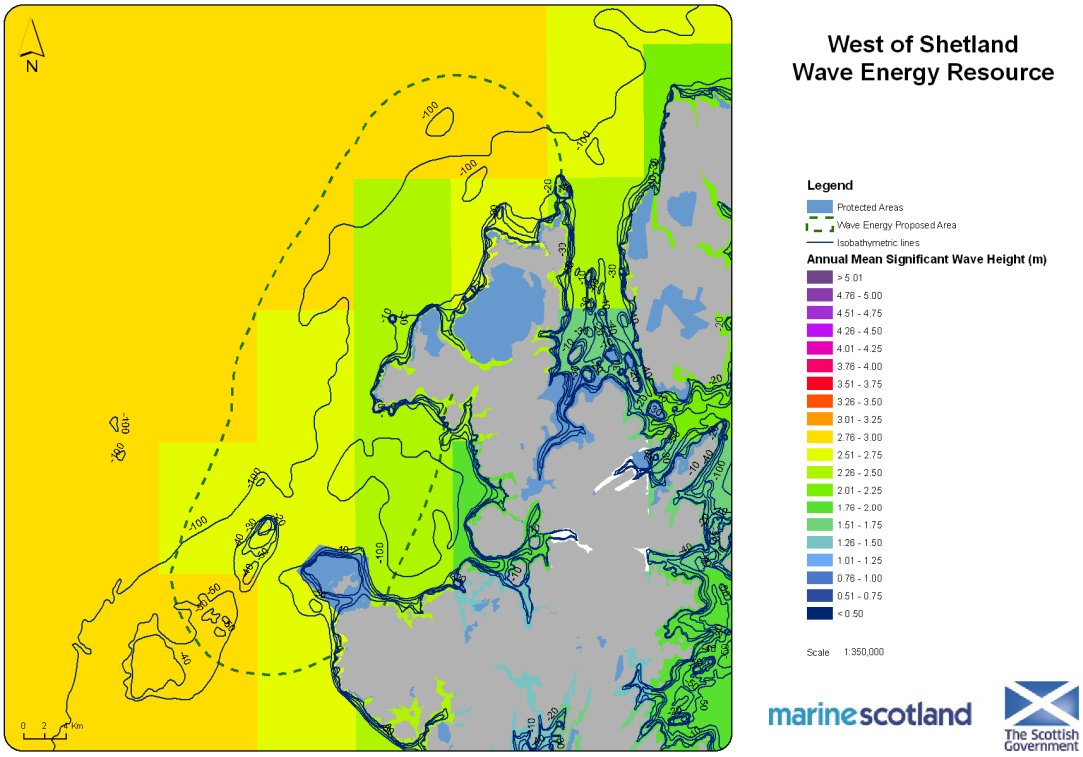

Figure 3.6.2: West of Shetland: Annual mean significant wave height (source: OS, BGS, DTI)

3.6.1.2 Tidal Streams

The tides south-west of the island of Papa Stour are relatively strong (between 1.3 m/s and 0.5 m/s during springs and neaps respectively) (Fig. 3.6.3). The tides in the remaining area are far weaker (between 0.1 and 0.6 m/s). The spring tidal range off the coast of Esha Ness reaches 1.76 m and 1.67 m off the island of Papa Stour.

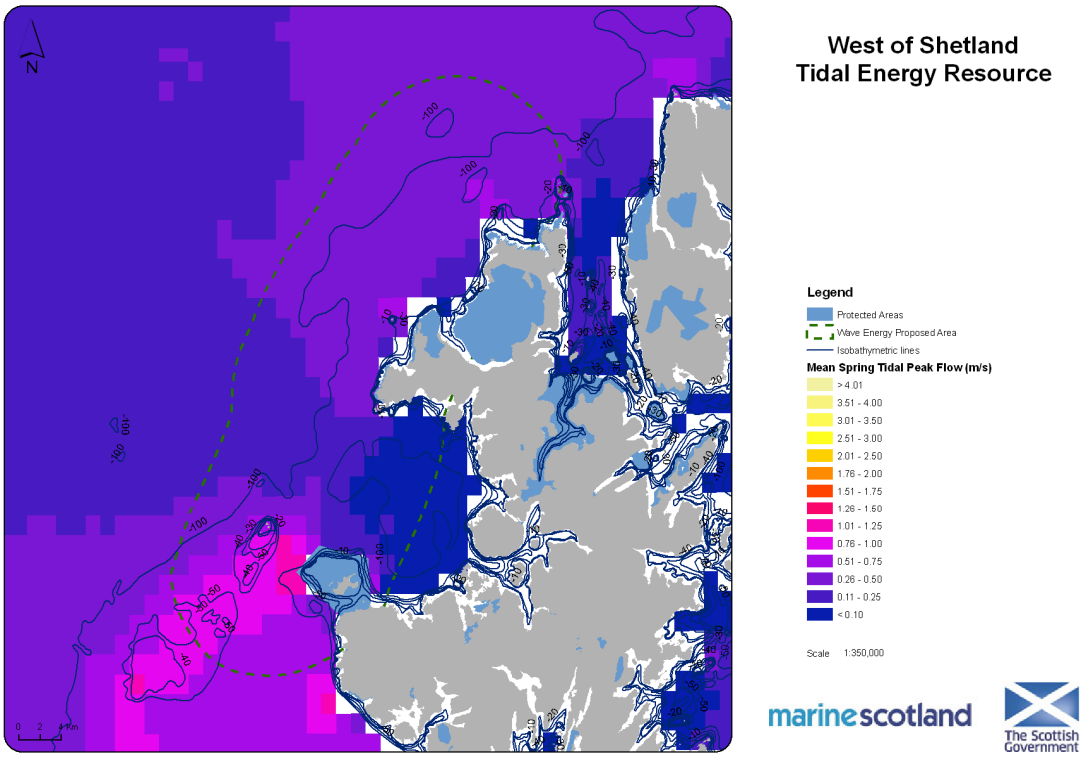

Figure 3.6.3: West of Shetland: Mean spring tidal peak flow (source: OS, BGS, DTI)

3.6.1.3 Bathymetry and Seabed

The seabed in the south-east sector of the site is predominantly sandy gravel and gravelly sand (Fig. 3.6.4). The depth in this region varies between 30 and 50 m. The depth increases further offshore to >100 m. The majority of the mid and northern component of the site is slightly gravelly sand and is a depth of 20 to 100 m. There is an area of sandy gravel off the north-western tip of Mainland Shetland surrounded by a wide expanse of slightly gravelly sand.

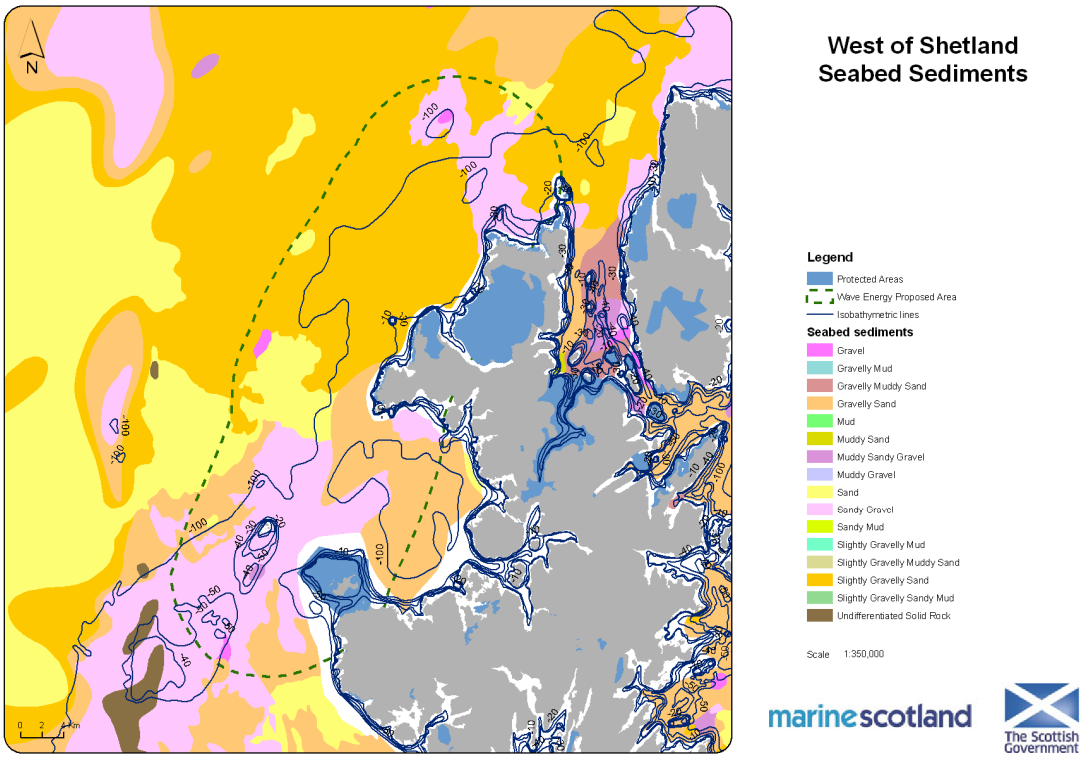

Figure 3.6.4: West of Shetland: Bathymetry and seabed sediments (source: OS, BGS)

3.6.1.4 Existing Infrastructure

Grid connection: There is currently no connection between Shetland and the Scottish mainland. Demand (~50 MW in the Shetland Isles) is mostly met by local power generation, a wind farm and Sullom Voe terminal. SHETL are planning a 600 MW HVDC link to the Scottish mainland to accommodate power generated by the Viking Energy wind farm proposal which has an estimated completion date of October 2014. Connection of wave/tidal devices is contingent on local reinforcement of the existing 33 kV network in Shetland. Whether or not the interconnector proposal proceeds, SSE is planning an energy storage, active network and demand approach on Shetland to start in 2011, in order to accommodate the full demand of Shetland (~50MW) from renewables.

Ports and harbours: Nearby ports that could be used for installation and servicing are located in Scalloway, Sullom Voe, Tofts Voe and on Papa Stour (Fig. 3.6.5). The larger port of Lerwick is >70 km away. Both Sullom Voe and Lerwick have been identified as locations where development of facilities for wave and tidal energy could take place (SE & HIE, 2010).

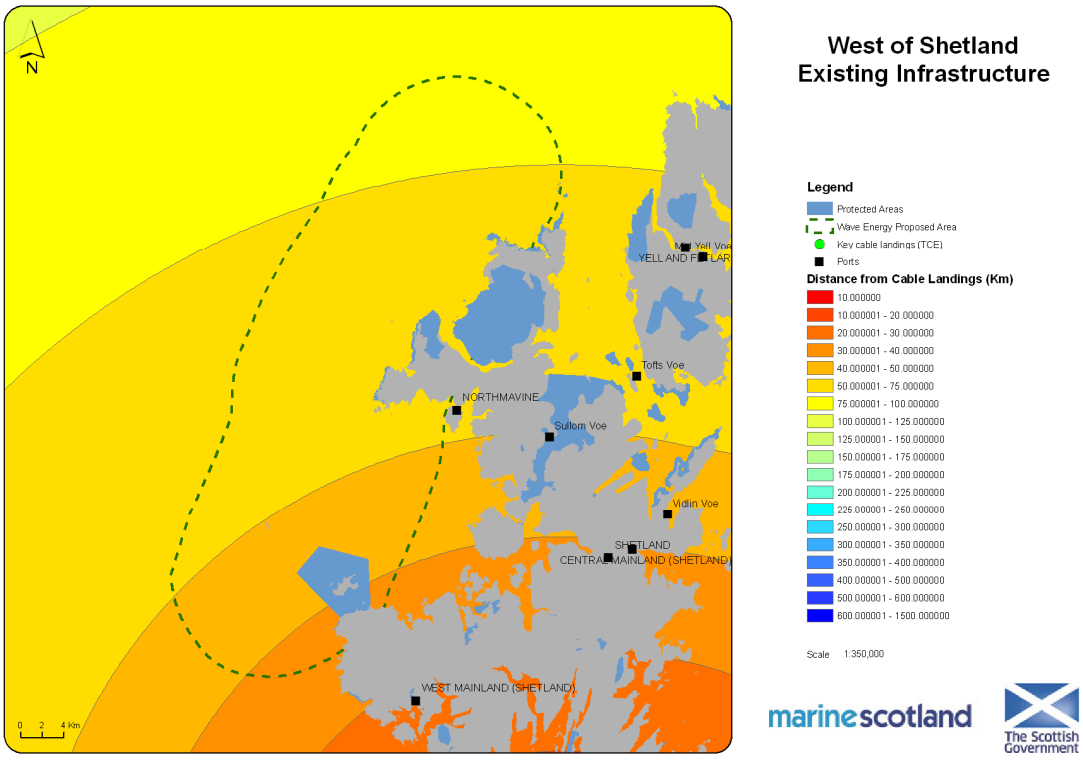

Figure 3.6.5: West of Shetland: Existing infrastructure (ports and cable landings) (source: OS, TCE, DECC)

3.6.2 Other Constraints

3.6.2.1 Commercial Uses

TCE energy leases: There are none within this site (Fig. 3.6.6).

Fish or shellfish farms: There are fish farms in Rona's Voe and Hamna Voe but these are in areas of calmer water with less wave power potential.

Cables or pipelines: There is a submarine pipeline to the north of the proposed site originating from Orka Voe immediately north of Sullom Voe.

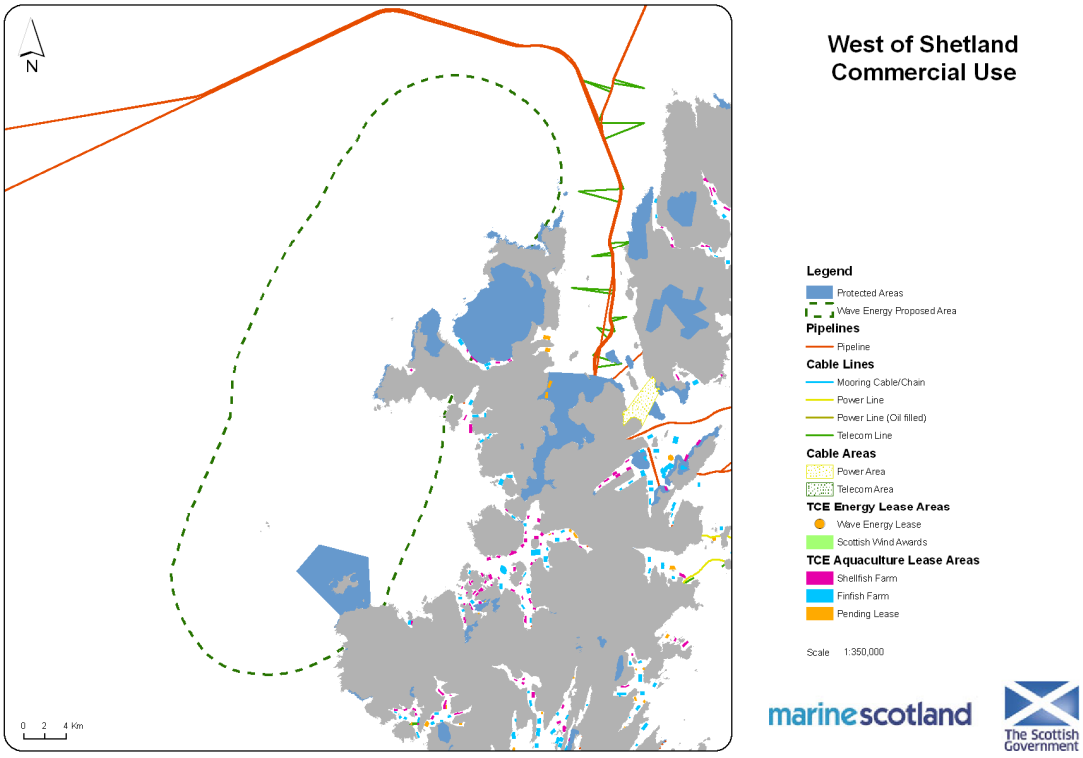

Figure 3.6.6: West of Shetland: Existing commercial use (source: OS, SeaZone Hydrospatial, TCE, Kingfisher)

3.6.2.2 Military

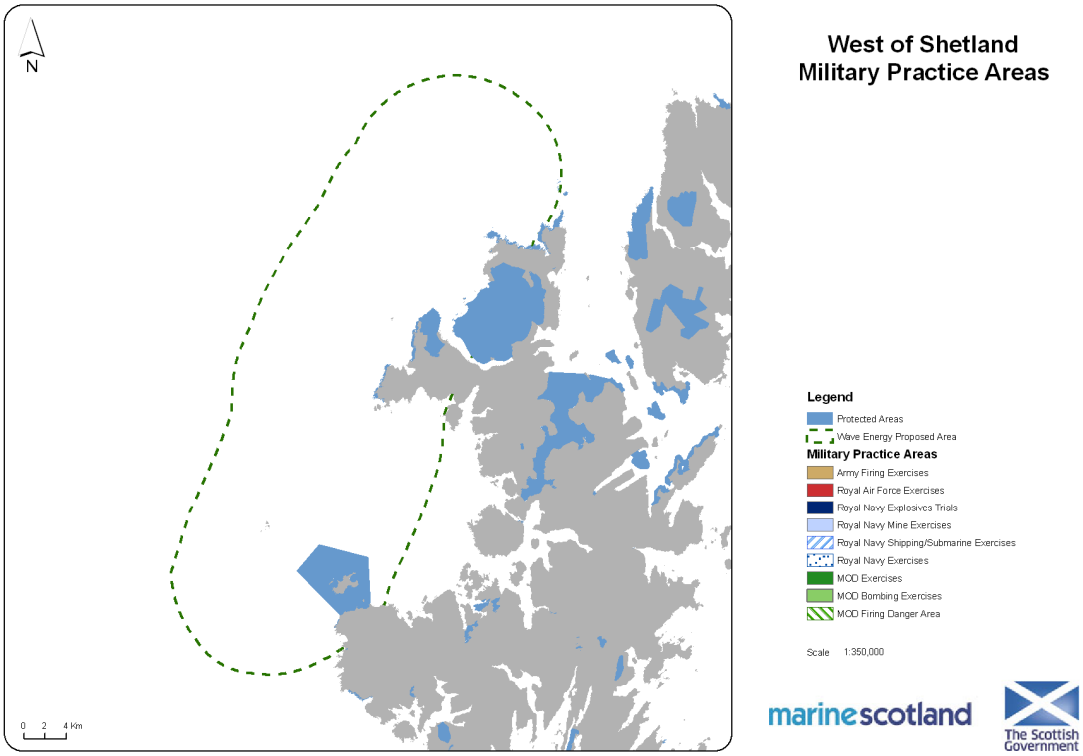

Figure 3.6.7: West of Shetland: Military practice areas (source: OS, SeaZone Hydrospatial) There is no military activity marked within this site.

3.6.2.3 Shipping

The waters around Shetland have been identified by the IMO as an area to be avoided by some types of vessels. As stated on the Admiralty chart,

"To avoid the risk of pollution or severe damage to the environment, all vessels over 5000 GT, carrying or capable of carrying oil or other liquid hazardous cargoes in bulk, should avoid the areas indicated."

Additionally, the northern-most point of Shetland Mainland has been identified as a MEHRA (Fig. 3.6.8).

The density of ships is relatively low in this area to the west of Shetland with numbers ranging from 0 to 23 shipping movements through the site (2009-10). There is a ferry route between the west Mainland and Papa Stour, which runs up to twice a day. There is limited shipping traffic (up to 174 movements/year) between Scalloway in the south-west and the north-west Mainland. Ships also cross the northern edge of the site (up to 95 movements/year) travelling between Sullom Voe to the Foinaven Oil Structures west of northern Shetland.

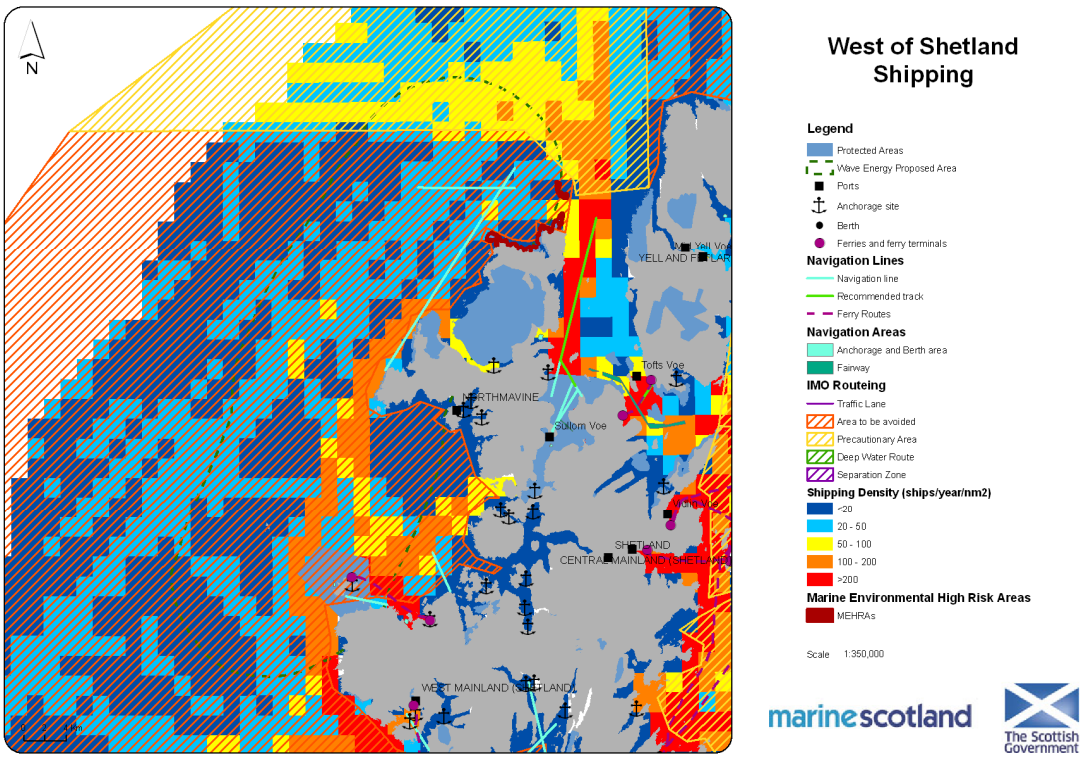

Figure 3.6.8: West of Shetland: Shipping (source: OS, SeaZone Hydrospatial, DECC, Anatec Ltd)

3.6.2.4 Commercial Fishing

Both the data for larger fishing vessels (≥ 15m) and qualitative data from anecdotal evidence (SSMEI Shetland Pilot, 2010), suggest that the west coast of Shetland supports a rich and varied fishery (Fig.s 3.6.9-12). Data from larger vessels demonstrate the site supports a relatively large demersal fishery (plaice, megrim, saithe, whiting, haddock and cod). The SSMEI Pilot (2010) indicates a number of important areas for haddock, saithe, cod and whiting, particularly in St Magnus Bay in the south-east of the site and off the north-west Mainland coast. Fishing for shellfish mostly occurs in the east, closer to shore. The SSMEI Pilot (2010) suggests that the inshore region (within 10 km) is important for edible crab, lobster, scallop and *Nephrops*. Most pelagic fishing takes place to the north and west of the site, but there is evidence of mackerel and monk fish caught in the north-west.

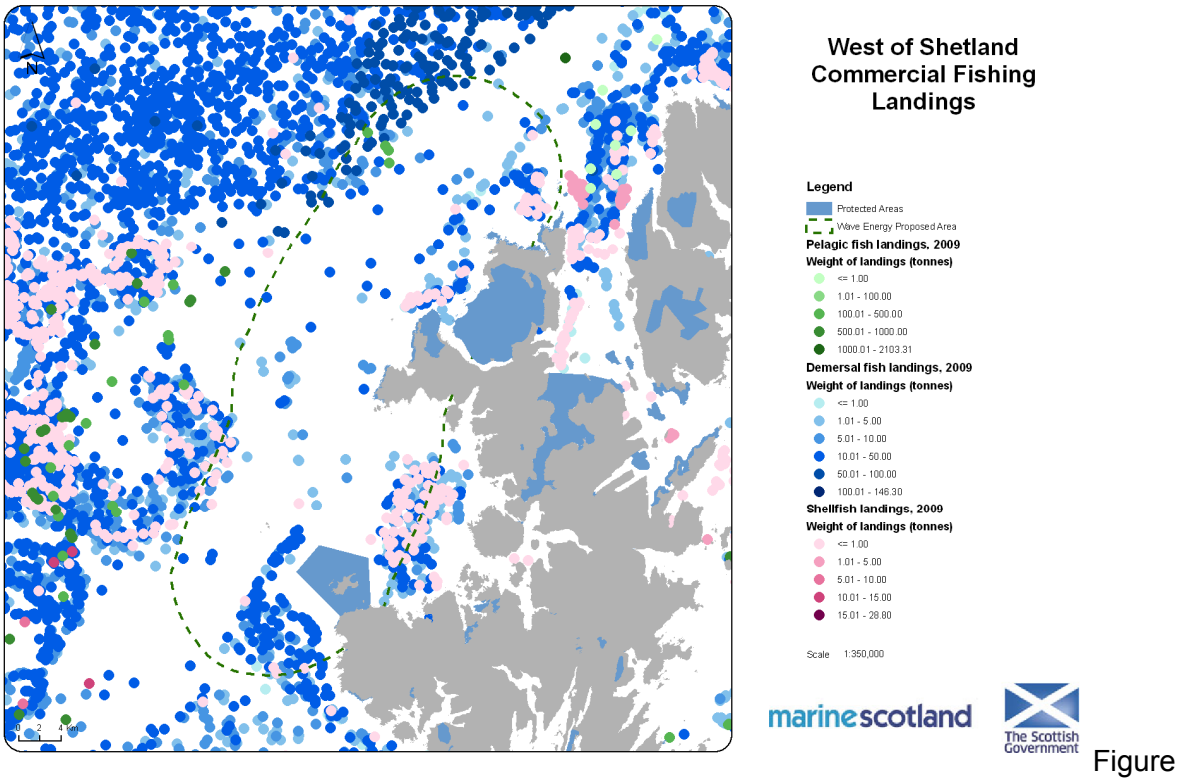

Figure 3.6.9: West of Shetland: Commercial landings (tonnes) of pelagic and demersal fish and shellfish (source: OS, MSS)

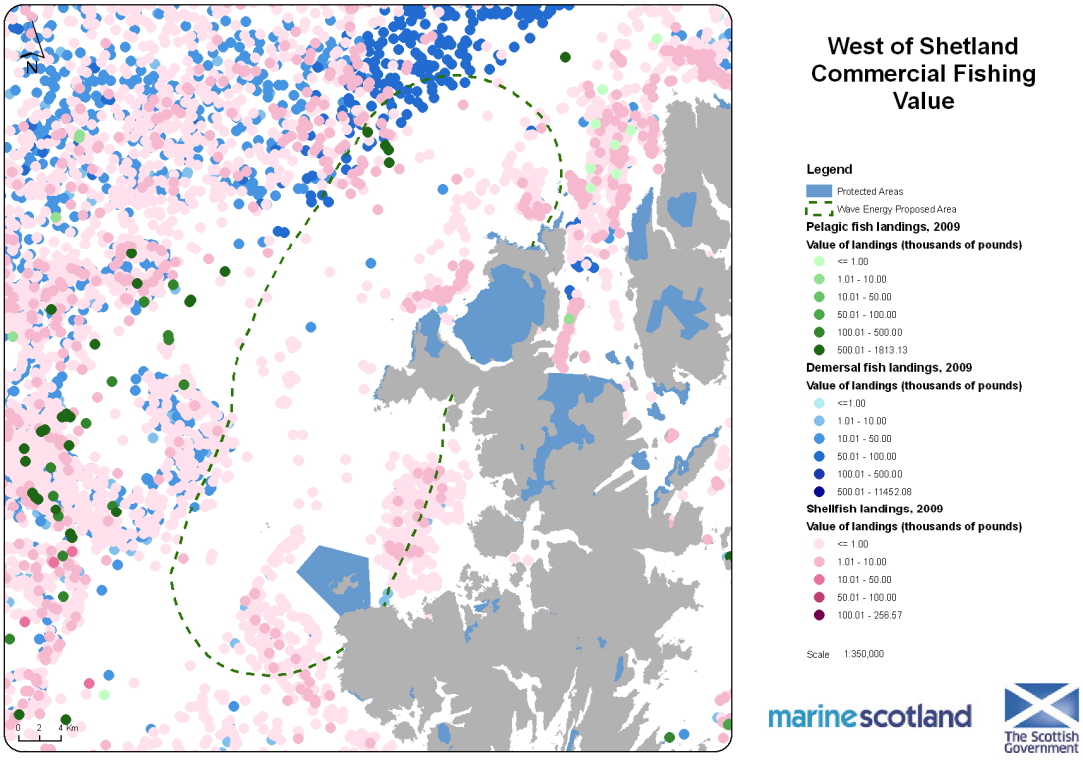

Figure 3.6.10: West of Shetland: Commercial landings (value) of pelagic and demersal fish and shellfish (source: OS, MSS)

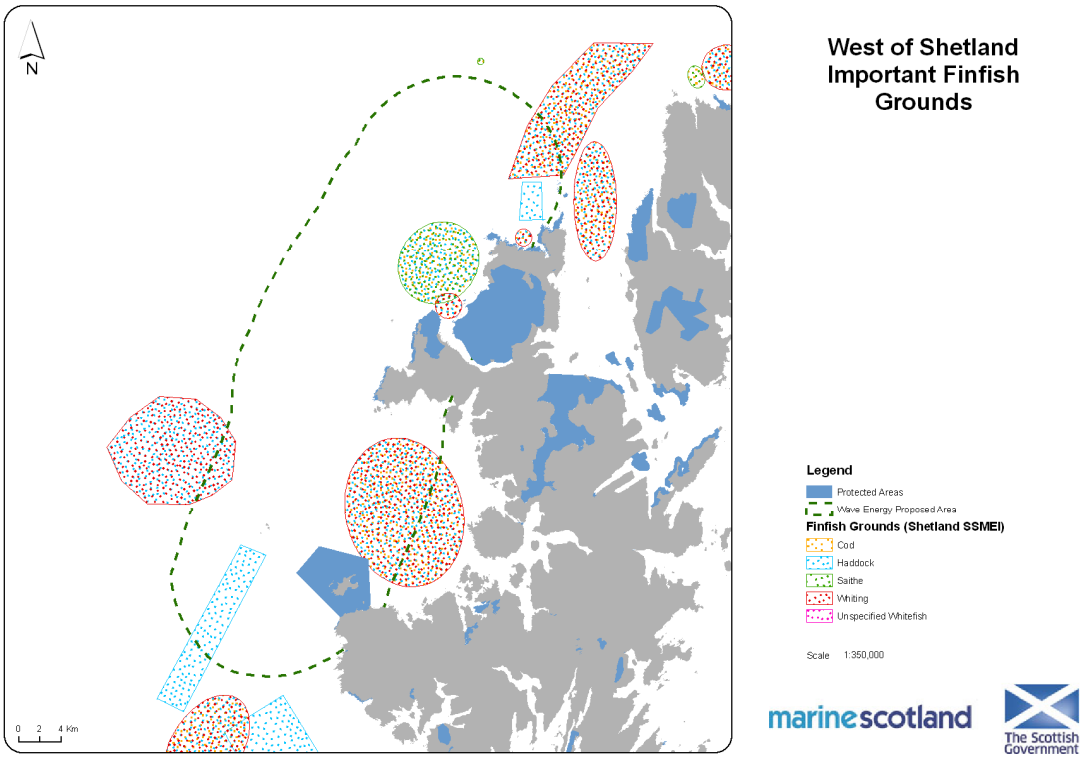

Figure 3.6.11: West of Shetland: Local Shetland fishermen descriptions of location of important finfish grounds (source: OS, SSMEI Shetland Pilot)

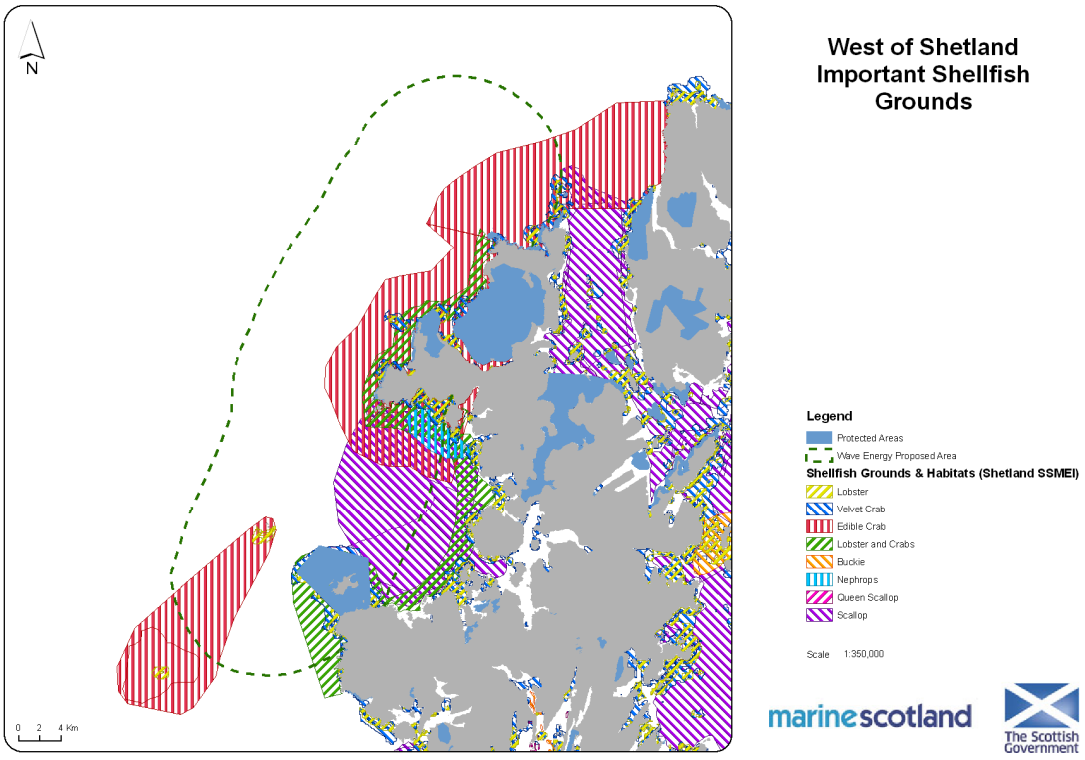

Figure 3.6.12: West of Shetland: Local Shetland fishermen descriptions combined with habitat distribution of important shellfish grounds (source: OS, SSMEI Shetland Pilot)

3.6.2.5 Environment

Designated Areas

There are several designated sites within the boundaries of the proposed area (Fig. 3.6.13). The island of Papa Stour lies in the south of the site and contains multiple designations. It qualifies as an SPA for Arctic tern (*Sterna paradisaea*) and ringed plover (*Charadrius hiaticula*), an SAC for its sea caves and sublittoral reefs and is also a biological SSSI. The SPA of Ronas Hill - North Roe & Tingon in the north Mainland is designated for the red throated diver, which may venture offshore seasonally. At the eastern extent of the site in the west and north-west Mainland, there are two geological SSSIs; Esha Ness coast and the Villains of Hamnavoe. There are also three NSAs on the west and north-west mainland that overlook the site; Muckle Roe, Esha Ness and Fetherland.

South of the site, the SPA encompassing the island of Foula and neighbouring waters harbours a spectacular seabird assemblage including Arctic skua (*Stercorarius parasiticus*), Arctic tern, fulmar, great skua, guillemot, kittiwake, Leach's petrel, puffin and razorbill. Foula is also an SAC, SSSI and NSA. A large component of the southern extent of the site is under consideration by the JNCC as a possible SPA for offshore bird aggregations.

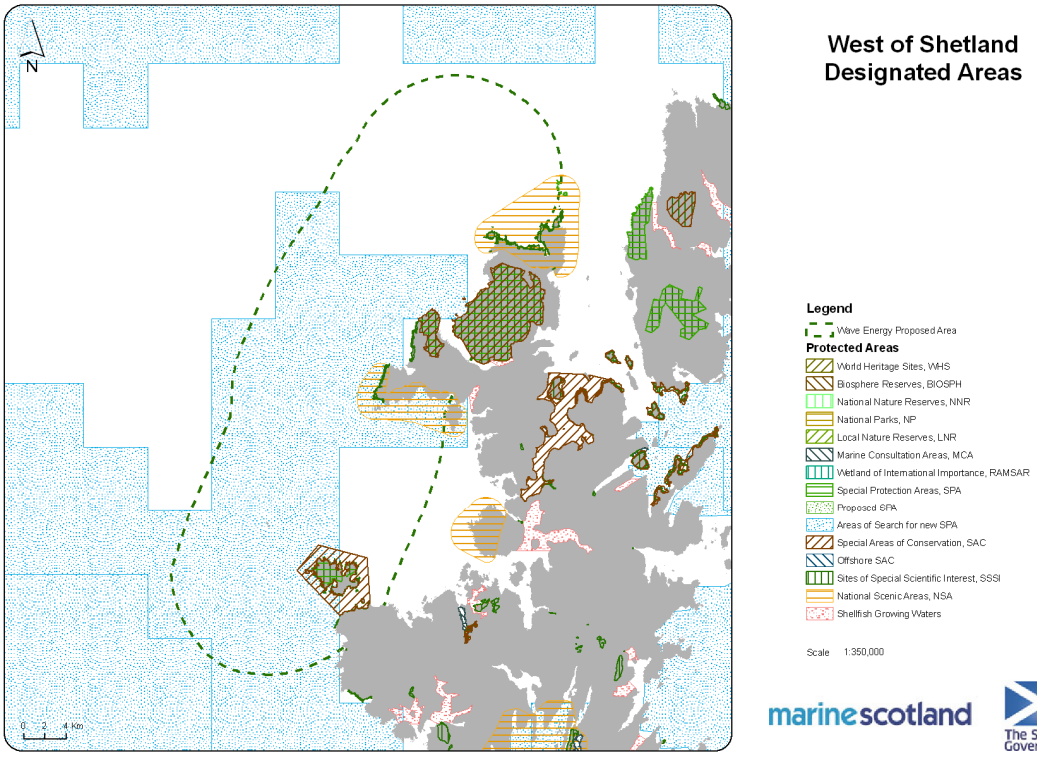

Figure 3.6.13: West of Shetland: Designated areas (source: OS, SeaZone Hydrospatial, SNH, JNCC, SG)

Protected Species

This region harbours numerous seabird colonies, although these are considerably smaller than other locations in the Shetland archipelago such as Foula, Sumburgh Head or Hermaness (Fig. 3.6.14). Prevalence of seabirds at sea is particularly high around the north-west Mainland. Other diving seabirds that could be at higher risk in this area include species such as guillemot, razorbill, gannet, and Manx shearwater. Shetland is one of the most important locations for red-throated divers in the UK. The Cetacean Atlas (2003) suggests that relatively low numbers of cetaceans are found within the site (Fig. 3.6.15). However, contrary to this, the SSMEI (2010) and Weir et al. (2001) highlight the importance of the area for a number of species, such as minke and killer whale, off the coast of Papa Stour and west Mainland. The Atlantic white-sided dolphin is relatively common in the Faroe-Shetland Channel during the summer months (Macleod et al., 2003). Other species recorded in this site are white-beaked dolphin and harbour porpoise (Weir et al., 2001; Cetacean Atlas, 2003).

The SSMEI (2010) marks a number of sites important for seals. Common seal colonies are found on the west coast of Papa Stour and to the north-west around the coast of west and north-west Mainland. Grey seal colonies are also found on the coast of Papa Stour, around Muckle Roe on the west Mainland and in Ronas Voe. The area has not been reported as a notable habitat for otters in the SSMEI (2010), although otters are prevalent throughout much of Shetland.

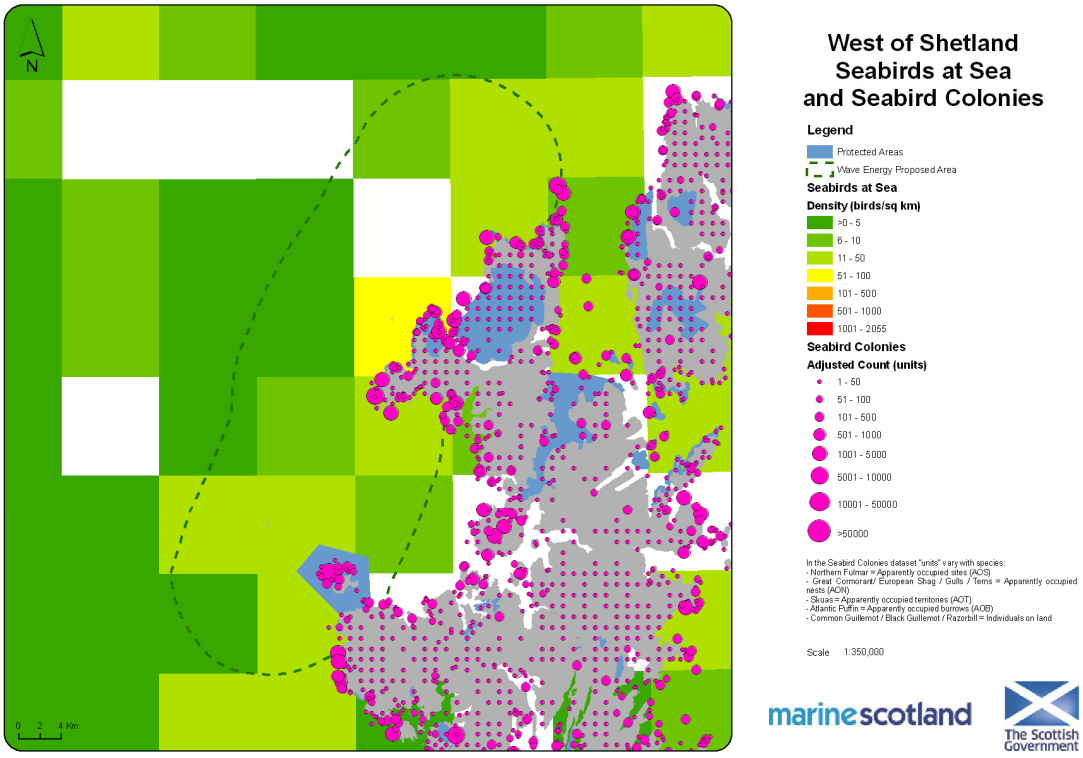

Figure 3.6.14: West of Shetland: Seabirds at sea and seabird colonies (source: OS, JNCC)

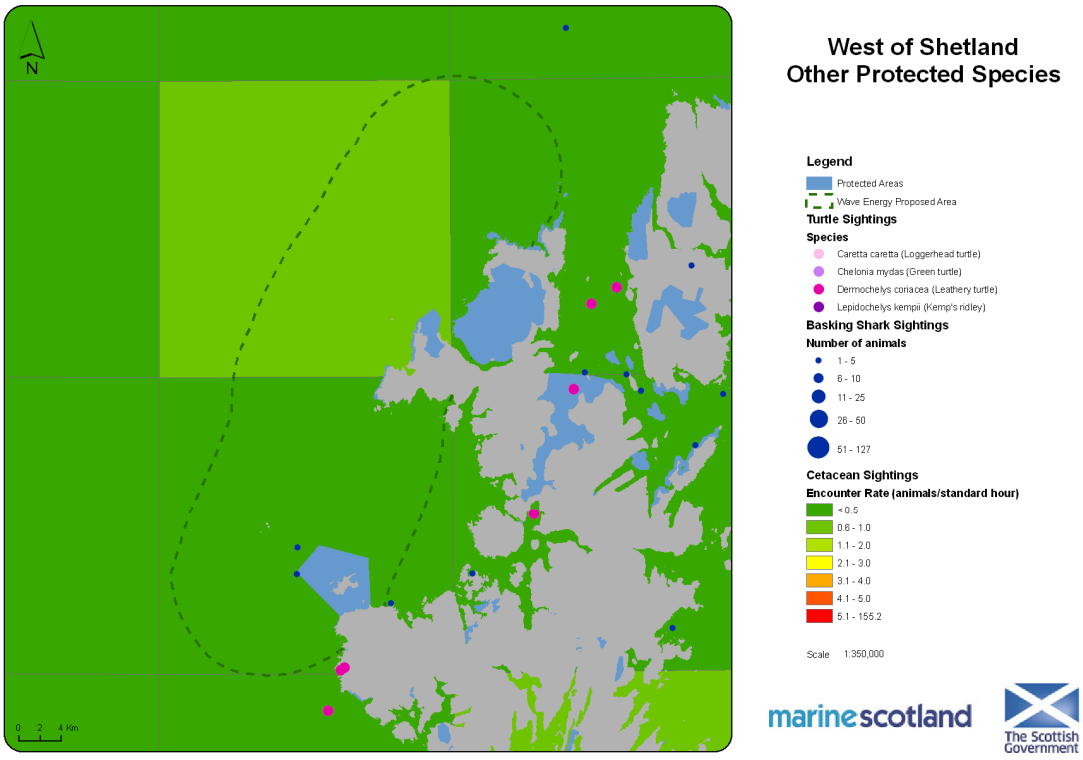

Figure 3.6.15: West of Shetland: Cetaceans, turtles and basking sharks (source: OS, NBN, MCS, JNCC)

Protected Habitats

Much of the seabed in the site qualifies as a UK BAP priority habitat (Fig.s 3.6.16-17). Those found in the site include sublittoral sands and gravels, horse mussel beds and maerl (*L. glaciale*).

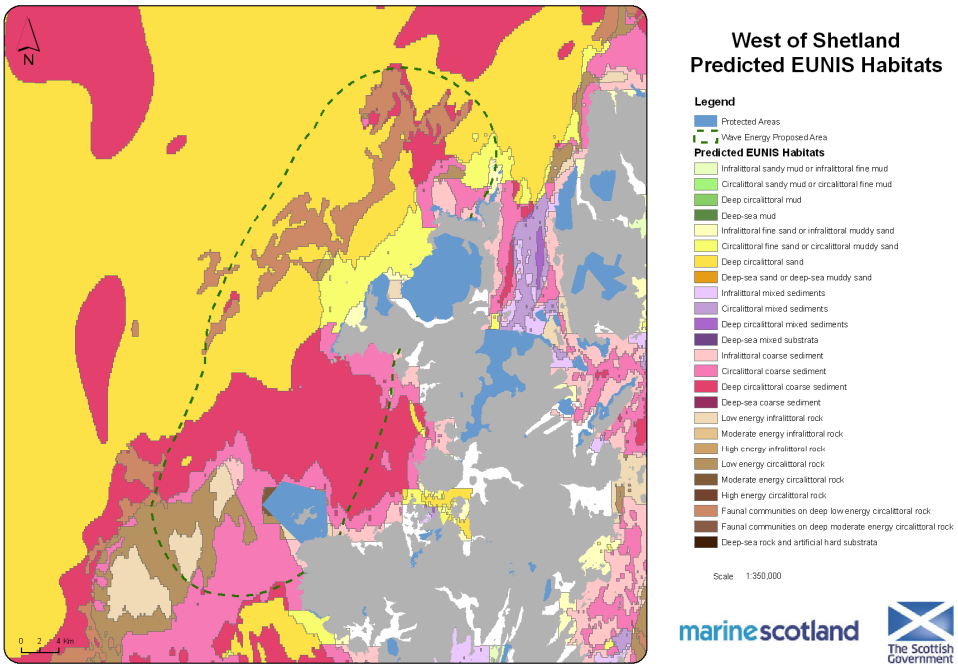

Figure 3.6.16: West of Shetland: Seabed habitats (predicted by EUNIS) (source: OS, JNCC)

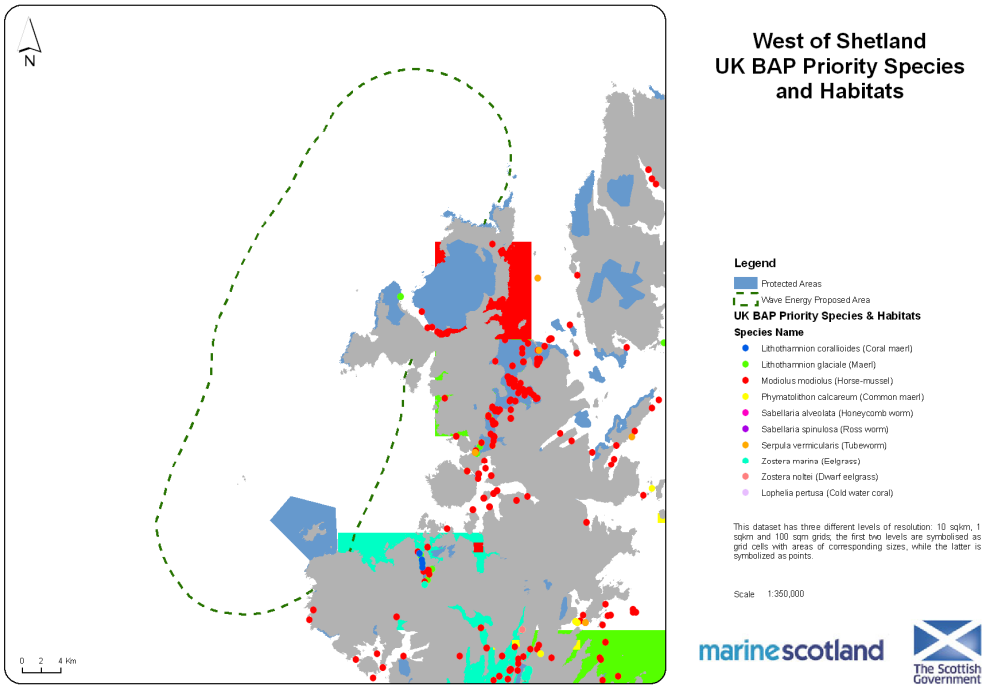

Figure 3.6.17: West of Shetland: UK BAP Priority species and habitats (source: OS, NBN)

Sensitive Areas for Commercial Fish

This area has been noted as a sensitive area for fish during all months with the exception of July or October. The area is used by a large number of species as a nursery site including, blue whiting, haddock, lemon sole, mackerel, Norway pout, saithe and sandeel (Fig. 3.6.18). Many of these species (lemon sole, Norway pout, sandeel and whiting), as well as herring, use this area for spawning (Fig. 3.6.19).

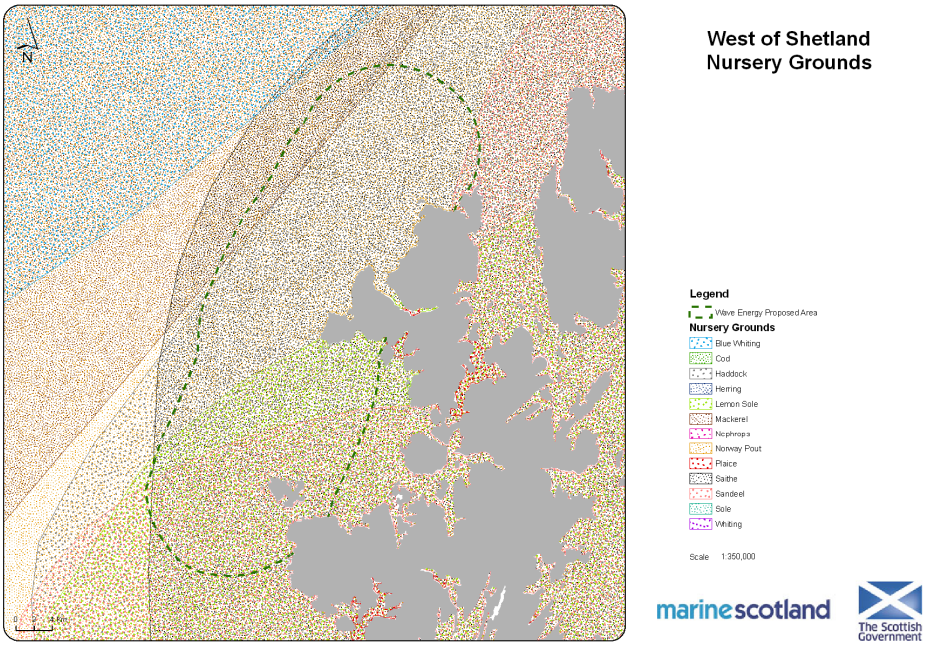

Figure 3.6.18: West of Shetland: Nursery grounds for commercial species (source: OS, MSS, CEFAS)

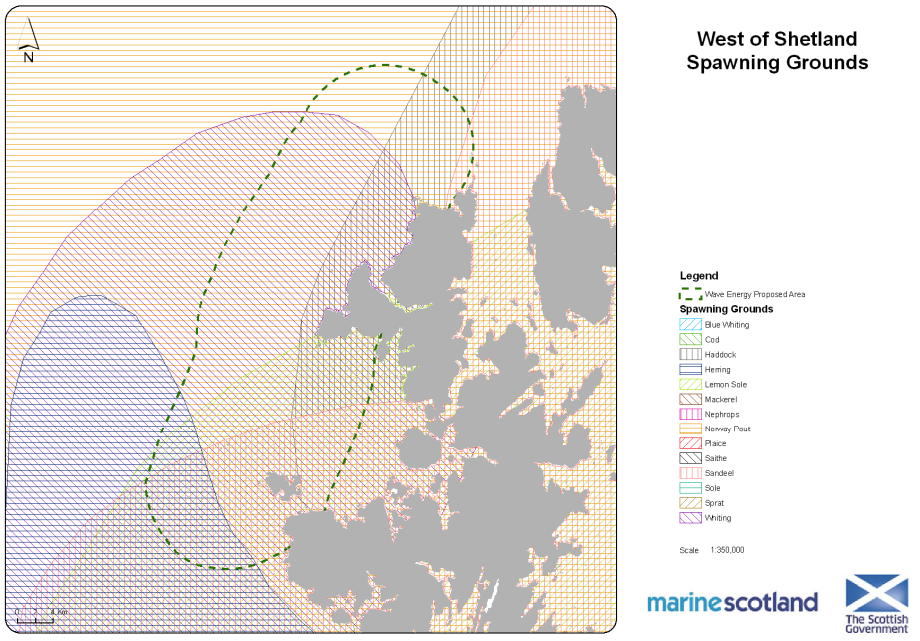

Figure 3.6.19: West of Shetland: Spawning grounds for commercial species (source: MSS, CEFAS)

3.6.2.6 Cultural Heritage

There are many ship wrecks marked within the site, none of which are officially protected (Fig. 3.6.20). There are also a number of SAMs on the adjacent coast, such as the broch of Hamnavoe and Sae broch near Esha Ness and numerous other sites marked for archaeological interest (SSMEI Shetland Pilot, 2010).

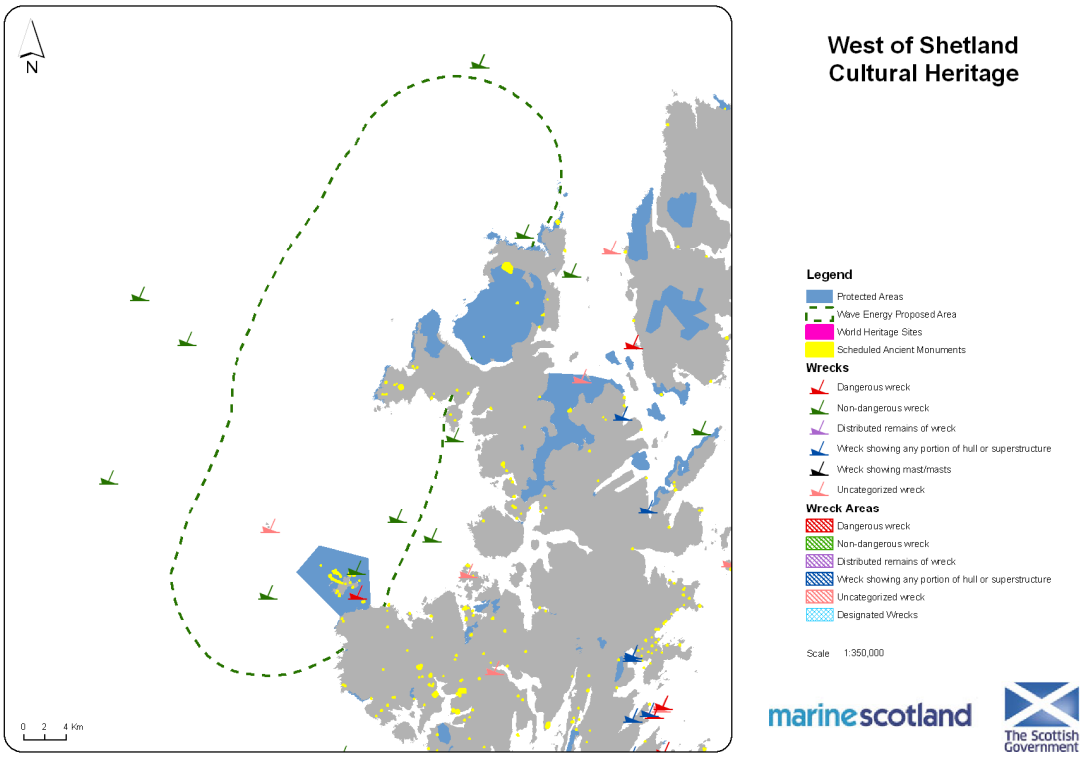

Figure 3.6.20: West of Shetland: Cultural heritage (source: OS, Historic Scotland, SeaZone Hydrospatial)

3.6.2.7 Recreation

The proposed site cuts into the RYA sailing area that surrounds the coast of Shetland (Fig. 3.6.21). A number of sites around this section of coastline have been marked as of interest for recreation by the SSMEI Shetland Pilot (2010) for SCUBA, boating and tour operators. These are located off west Mainland, off Papa Stour, to the north-west of Papa Stour, Esha Ness and north of Fethaland.

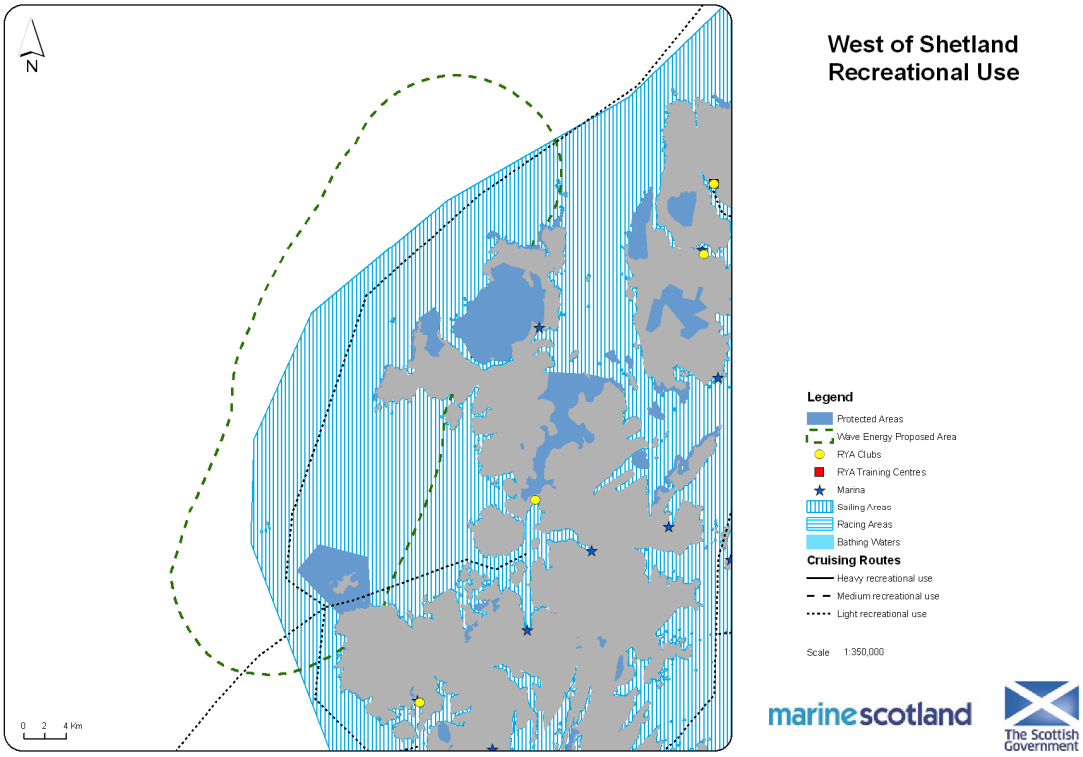

Figure 3.6.21: West of Shetland: Recreational use (source: OS, RYA, SG)

3.5 South-West Shetland

Summary

The region identified to the south-west of Shetland contains a useful level of wave resource with an estimated annual mean of up to 32 kW/m and annual mean wave heights of up to 2.8 m. Tidal currents are generally weak, but increase southwards towards Sumburgh. The seabed is composed of a variety of rock and sand/gravel. Shetland is not part of the UK electricity grid. However, a link to the Scottish Mainland is under consideration.

There is no military activity noted in the area. A well-used coastal shipping route traverses the site from north to south. Demersal fisheries are concentrated in the west and shellfish fisheries throughout. The coastal strip is designated as an NSA and includes sites such as St Ninian's Isle, the largest natural sand tombolo in the UK. There are many seabird colonies along the coast, not to mention the vast colony at Sumburgh Head (an SPA and RSPB reserve) to the south of the site. The area is reported as a spawning and/or nursery location for several commercial fish species. Much of the area is used for recreational sailing.

3.7.1 Technological Constraints

3.7.1.1 Wave Resource

The maximum mean annual wave resource varies between 27.6 kW/m in the south of the site and 15.8 in the north (Fig. 3.7.1). It is also greater offshore ($\leq$ 31.9 kW/m). The maximum wave resource inshore varies between 44.9 kW/m in winter and 8.2 in summer. Mean significant wave height varies similarly ranging from 1.9 m in the inshore region in the north to 2.5 m in the south and 2.8 m offshore (Fig. 3.7.2). Wave height reaches a maximum of 3.5 m in the offshore region in winter. Wave period has not been modelled for the inshore region but offshore the annual mean is 7.5 s.

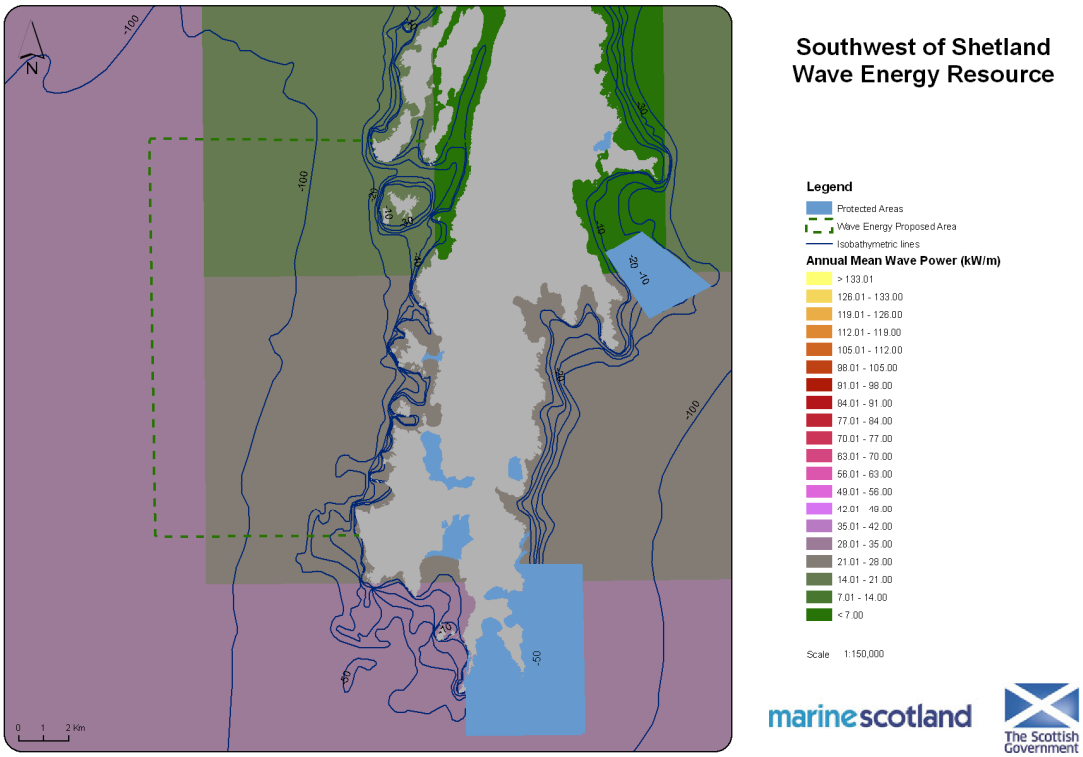

Figure 3.7.1: South-west of Shetland: Annual mean wave power density (source: OS, BGS, DTI)

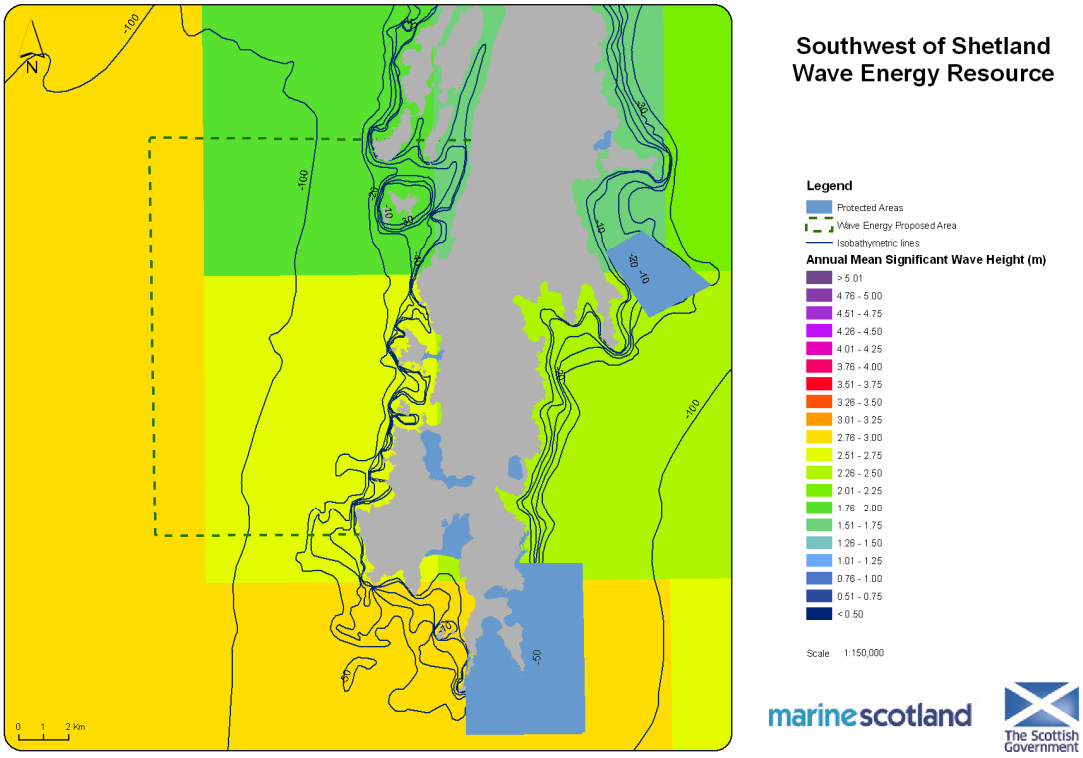

Figure 3.7.2: South-west of Shetland: Annual mean significant wave height (source: OS, BGS, DTI)

3.7.1.2 Tidal Streams

The tidal streams are relatively weak across the mid to northern sectors of the site ranging between 0.32 m/s and 0.15 m/s during spring and neap tides respectively Fig. 3.7.3). The mean spring peak tidal flow reaches up to 1.3 m/s in the south.

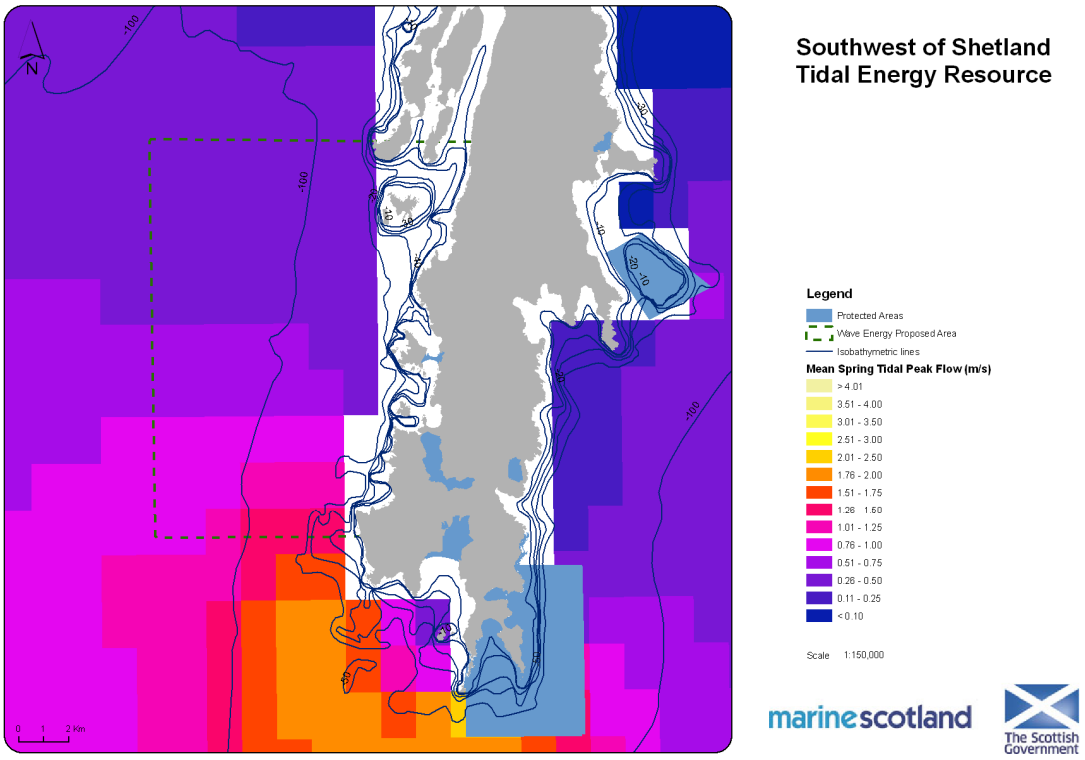

Figure 3.7.3: South-west of Shetland: Mean spring tidal peak flow (source: OS, BGS, DTI)

3.7.1.3 Bathymetry and Seabed

The seabed slopes steeply from the coast to 30 - 40 m, particularly on the steeper sections of coast such as around the island of South Havra and off Fitful Head in the south (Fig. 3.7.4). At a distance of between 1.5 and 2.5 km from the shore, the seabed reaches a depth of 50 m and it reaches 100 m between 4 and 5 km from the shore. The seabed composition is unclear due to discrepancies between the BGS and the EUNIS map (Fig. 3.7.20) over the existence of bedrock along the length of the site at a distance of 1-2 km offshore. The admiralty chart is in agreement with EUNIS, however. The region inshore of the bedrock is composed of coarse sediment. West of the bedrock is gravelly sand in the south and sand in the north.

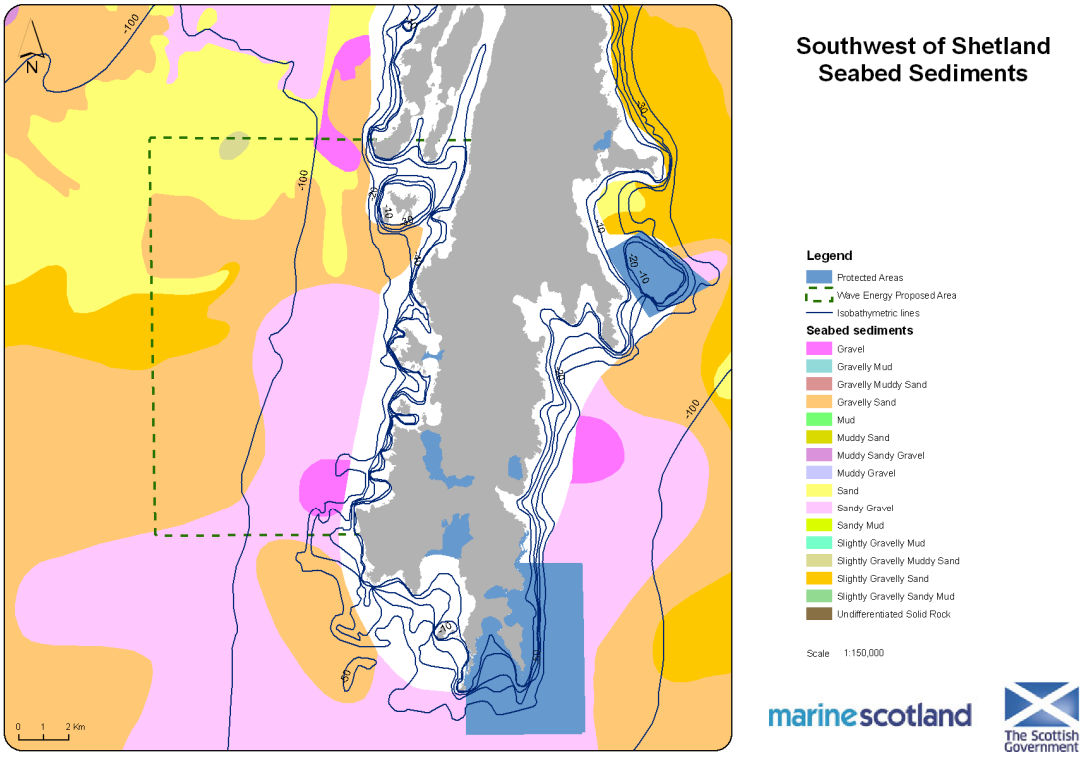

Figure 3.7.4: South-west of Shetland: Bathymetry and seabed sediments (source: OS, BGS)

3.7.1.4 Existing Infrastructure

Grid connection: As in the site to the north-west of Shetland Mainland, there is currently no connection between Shetland and the Scottish mainland. However, access to the existing grid is closer than the north-west of Shetland. Existing demand (~50 MW in the Shetland Isles) is mostly met by local power generation, a wind farm and Sullom Voe terminal. SHETL are planning a 600 MW HVDC link to the Scottish mainland to accommodate power generated by the Viking Energy wind farm proposal, which has an estimated completion date of October 2014. Connection of wave/tidal devices is contingent on local reinforcement of the existing 33 kV network in Shetland. Whether or not the interconnector proposal proceeds, SSE is planning an energy storage, active network and demand approach on

Shetland to start in 2011, in order to accommodate Shetland's full demand (~50MW) from renewables.

Ports and harbours: The nearest large port to this site is Scalloway, a distance of ≥ 8 km (Fig. 3.7.5). The larger port of Lerwick is ≥ 40 km away. Lerwick has been identified as a location where development of wave and tidal industries could take place (SE & HIE, 2010).

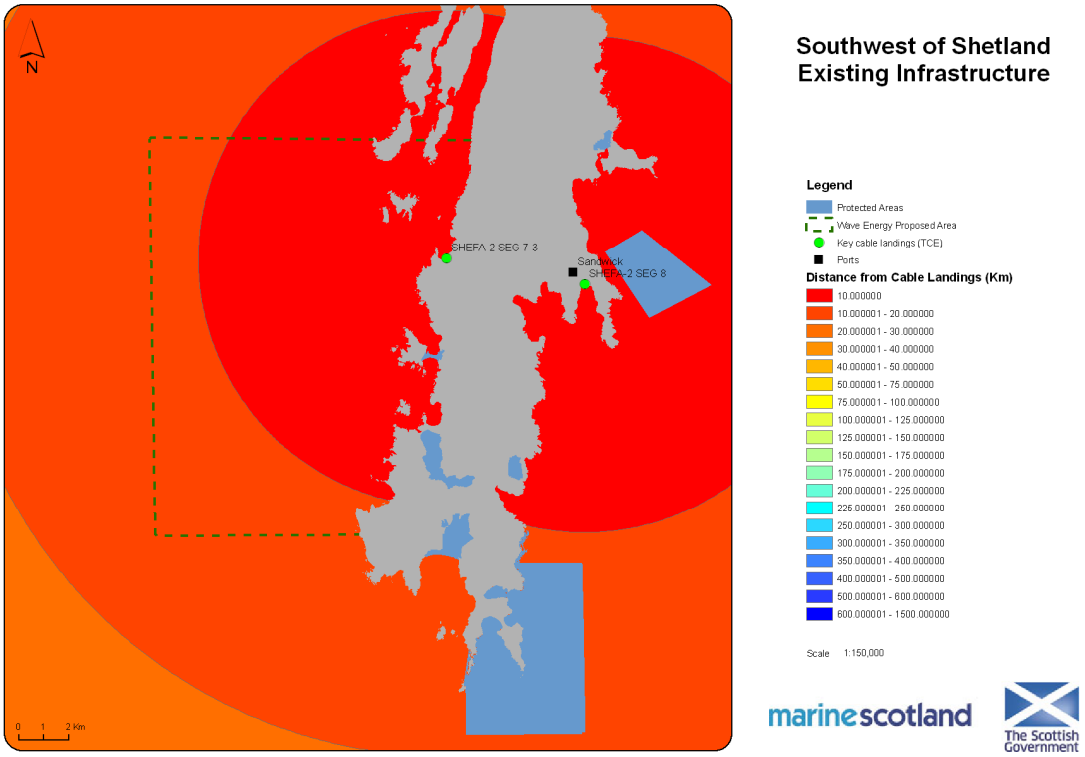

Figure 3.7.5: South-west of Shetland: Existing infrastructure (ports and cable landings) (source: OS, TCE, DECC)

3.7.2 Other Constraints

3.7.2.1 Commercial Uses

TCE energy leases: There are none within this site (Fig. 3.7.6).

Fish or shellfish farms: There are two fish farms within the site, both of which are in sheltered locations.

Cables or pipelines: There is a telecom line running west from the town of Maywick.

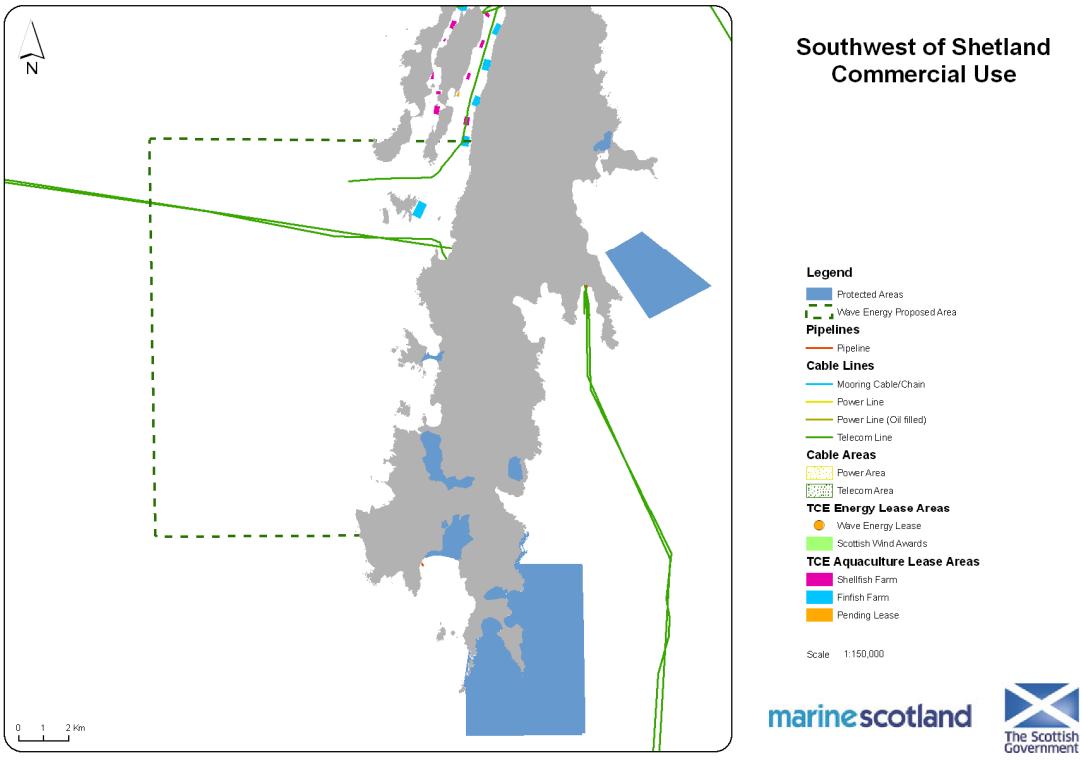

Figure 3.7.6: South-west of Shetland: Existing commercial use (source: OS, SeaZone Hydrospatial, TCE, Kingfisher)

3.7.2.2 Military

There is no military activity marked within this site (Fig. 3.7.7).

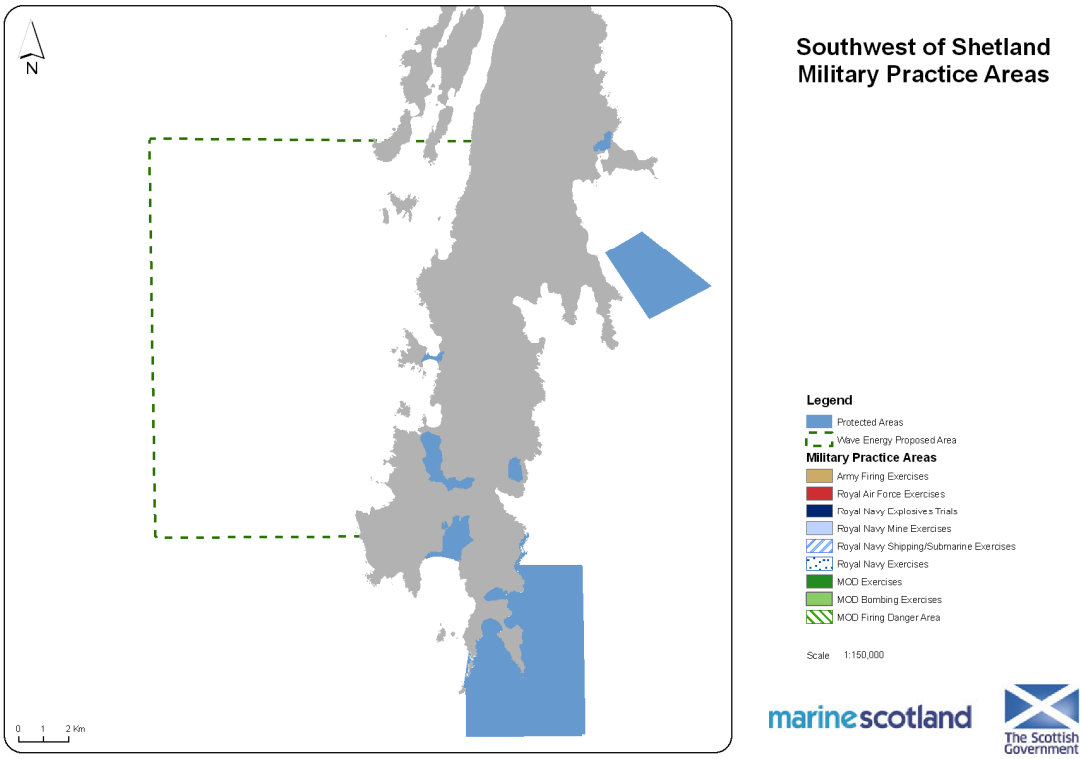

Figure 3.7.7: South-west of Shetland: Military practice areas (source: OS, SeaZone Hydrospatial)

3.7.2.3 Shipping

The waters around Shetland have been identified by the IMO as an area to be avoided due to the risk of pollution to sensitive areas (Fig. 3.7.8). Shipping density is low compared to the east coast of Shetland but there are up to 172 movements / year transiting the length of the site at a distance of 2-3 km offshore. There is a less frequently used route crossing the north-west corner of the site. No known ferry routes exist within the site.

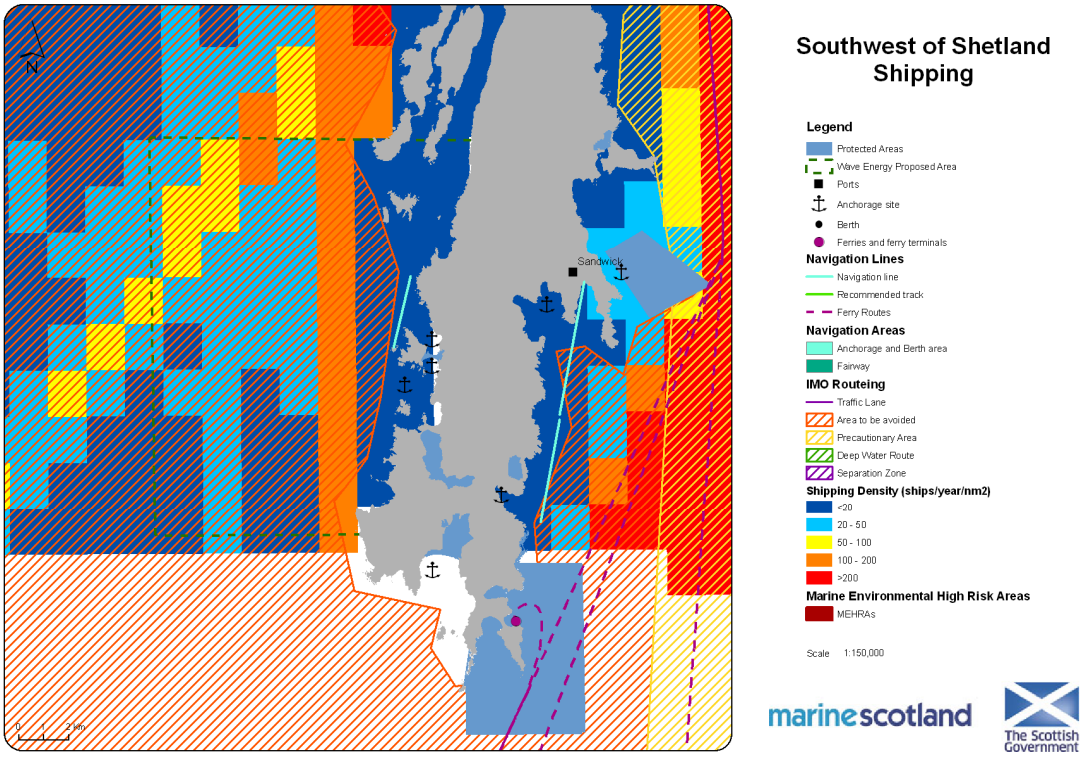

Figure 3.7.8: South-west of Shetland: Shipping (source: OS, SeaZone Hydrospatial, DECC, Anatec Ltd)

3.7.2.4 Commercial Fishing

Commercial fishing activity by larger boats (≥ 15m) generally takes place 2 to 3 km offshore and is mainly the demersal and shellfish sectors (2009-2010). Up to 100 tonnes of demersal fish were caught per trip at a value of ≤ £100 000 (Fig. 3.7.9-10). The main demersal species caught here are haddock, whiting and cod but catches also include plaice, saithe and megrim. This is in broad agreement with anecdotal information (SSMEI Shetland, 2010) on the location of important finfish grounds (Fig. 3.7.11). There is little pelagic fishing reported (Fig. 3.7.12-13). The information presented from larger vessels suggests up to 10 000 tonnes of shellfish (mostly *Nephrops*) were caught per trip, which equates to £10 000 per trip (Fig. 3.7.14-15). The anecdotal information suggests the coastal region also contains important shellfish grounds (Figure 3.7.16). Lobster and velvet crabs are found along most of the coast. The southern headland is important for edible crab and scallop. A limited area in the north of the site may also be of importance to buckie.

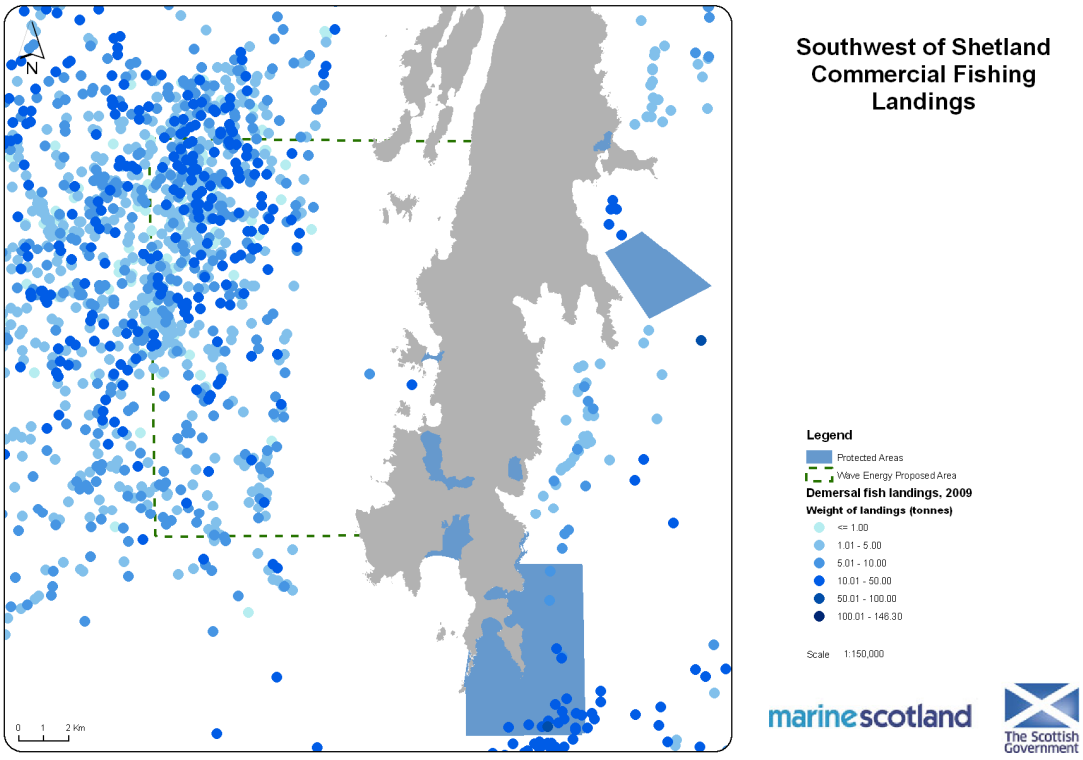

Figure 3.7.9: South-west of Shetland: Commercial landings (tonnes) of demersal fish (source: OS, MSS)

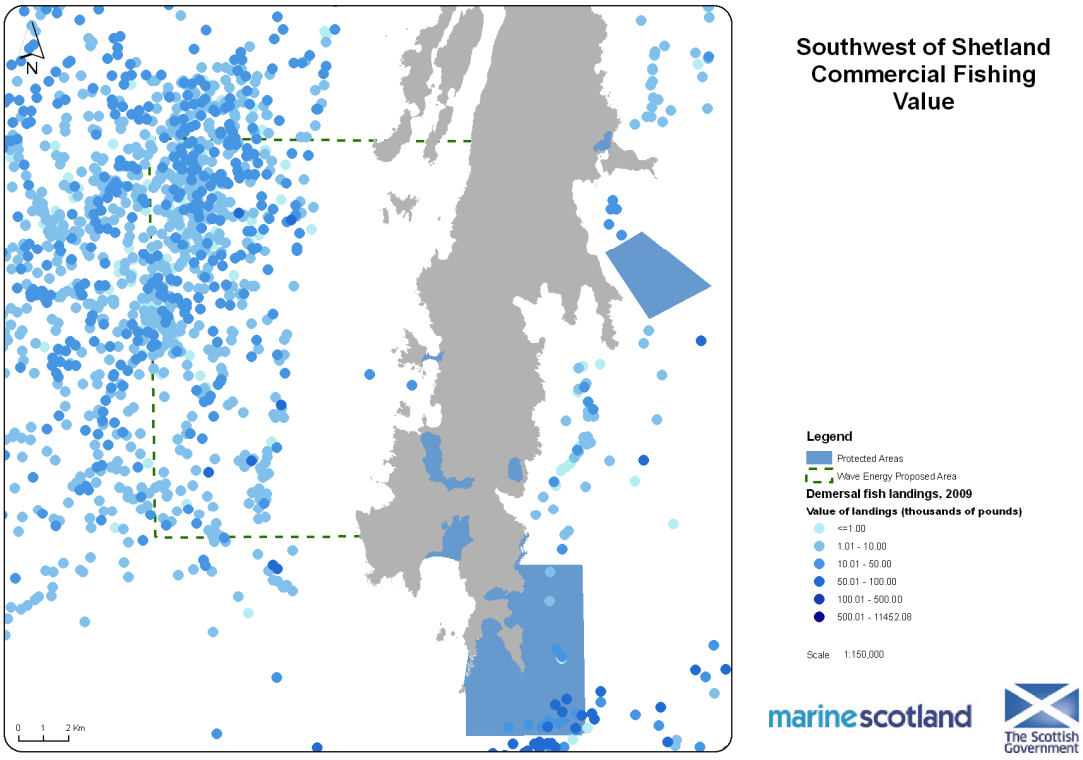

Figure 3.7.10: South-west of Shetland: Commercial landings (value) of demersal fish (source: OS, MSS)

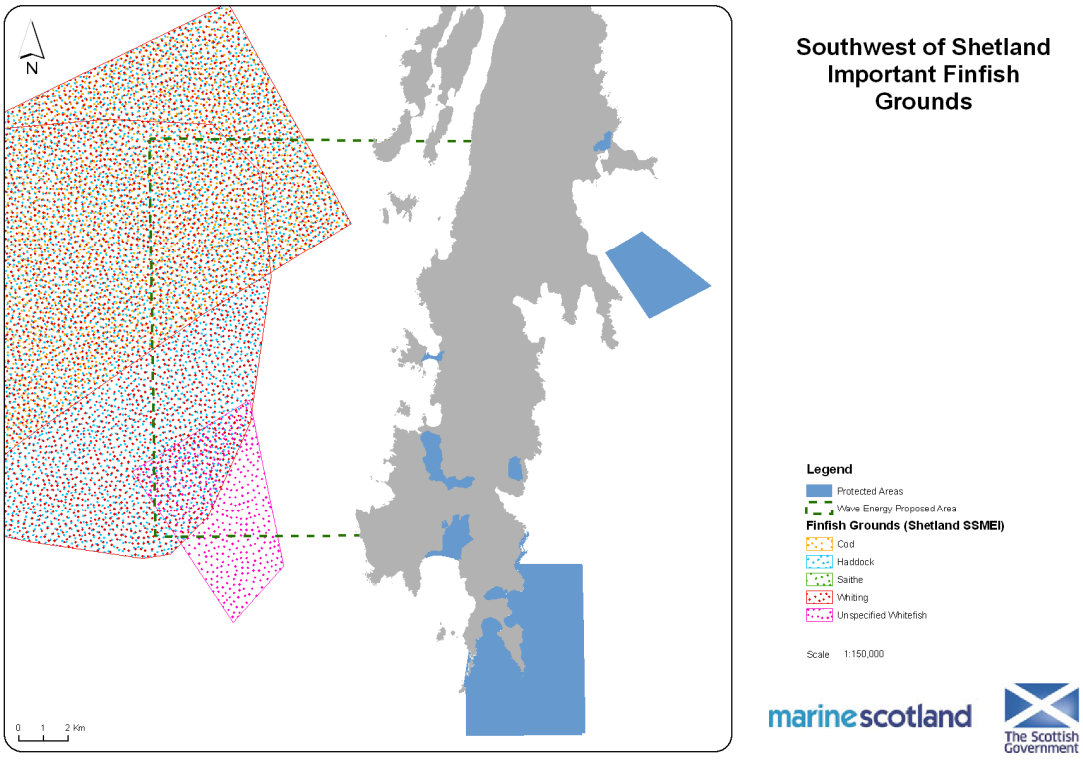

Figure 3.7.11: South-west of Shetland: Local Shetland Fishermen descriptions of location of important finfish grounds (source: OS, SSMEI Shetland Pilot)

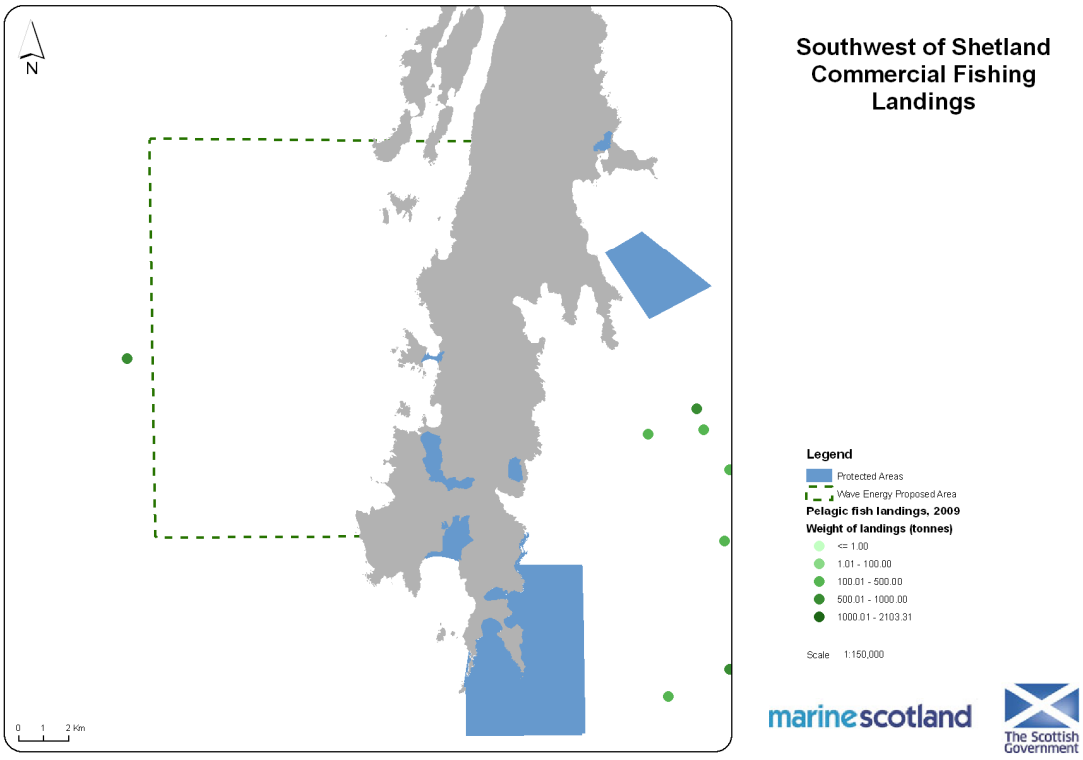

Figure 3.7.12: South-west of Shetland: Commercial landings (tonnes) of pelagic fish (source: OS, MSS)

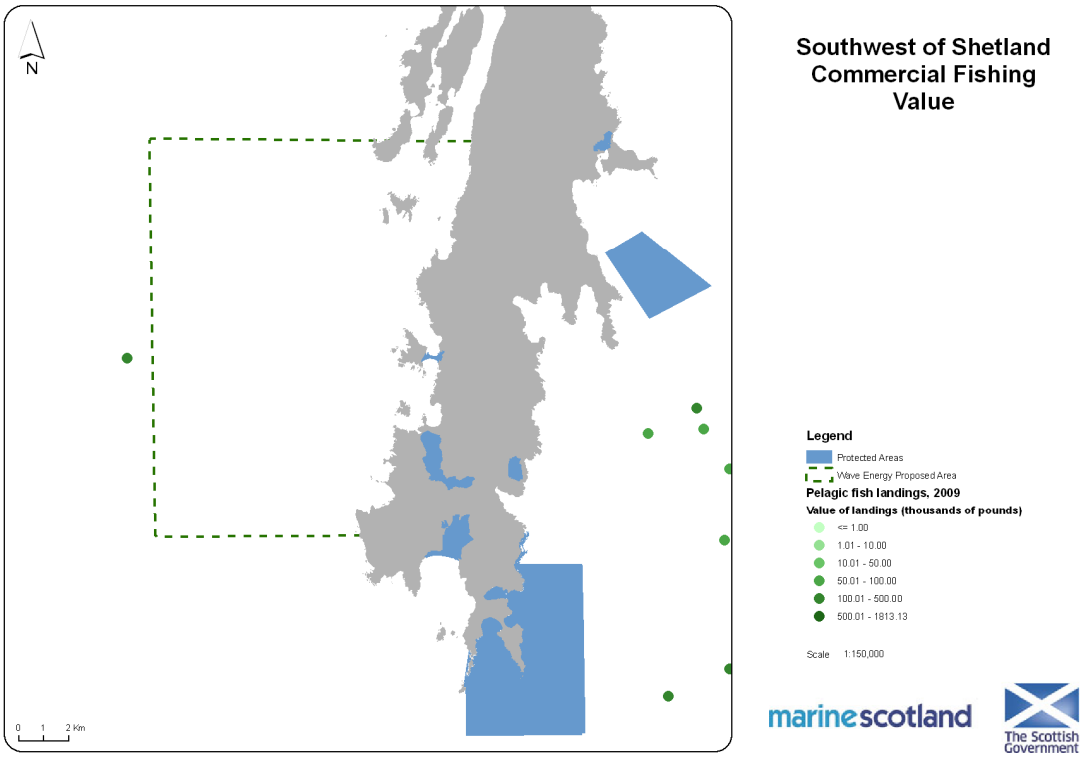

Figure 3.7.13: South-west of Shetland: Commercial landings (value) of pelagic fish (source: OS, MSS)

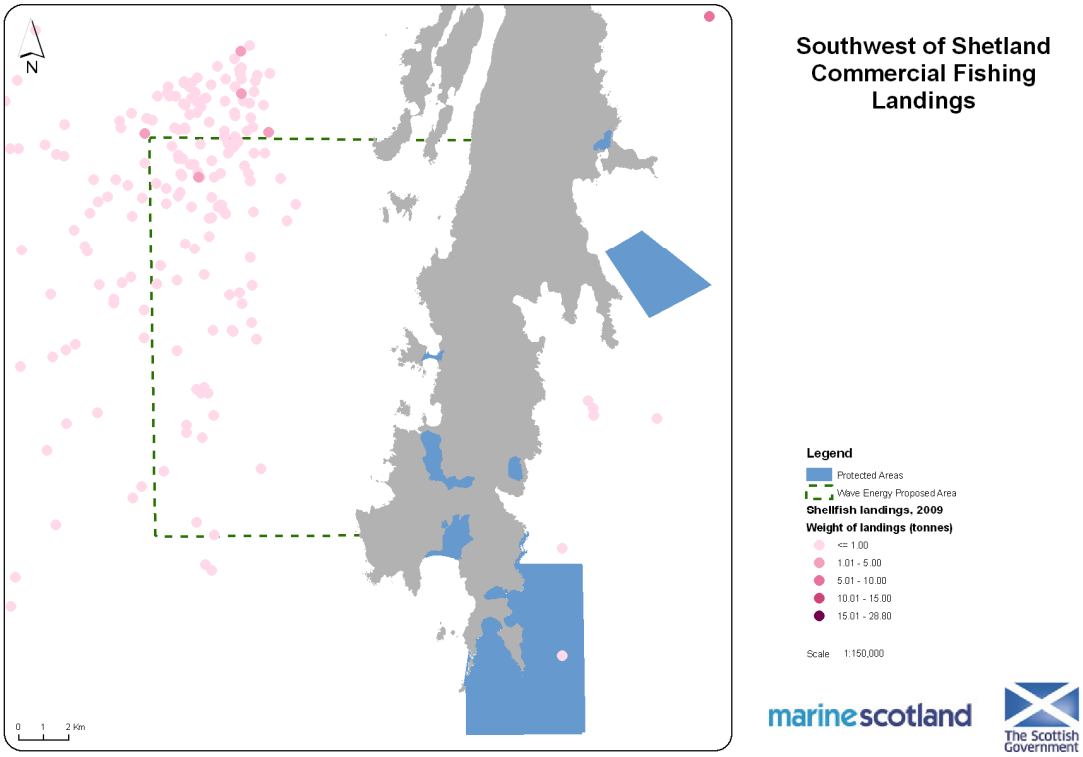

Figure 3.7.14: South-west of Shetland: Commercial landings (tonnes) of shellfish (source: OS, MSS)

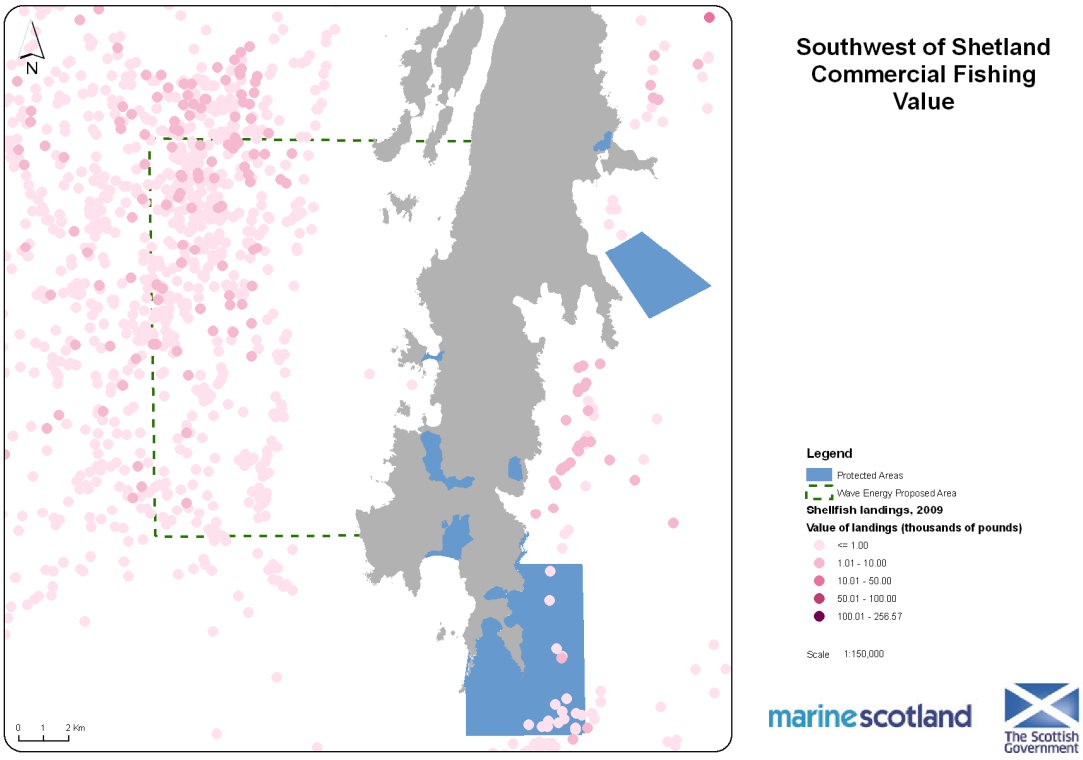

Figure 3.7.15: South-west of Shetland: Commercial landings (value) of shellfish (source: OS, MSS)

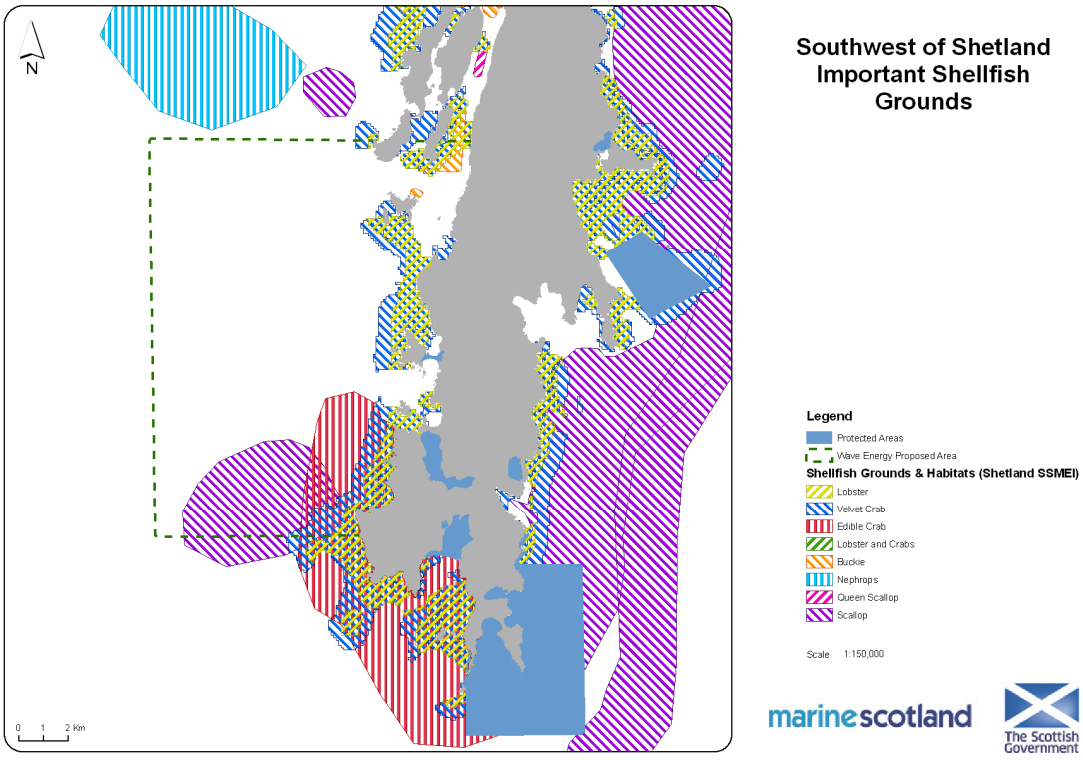

Figure 3.7.16: South-west of Shetland: Local Shetland fishermen descriptions combined with habitat distribution of important shellfish grounds (source: OS, SSMEI Shetland Pilot)

3.6.2.5 Environment

Designated Areas

The inshore area of this site (out to >700 m) is designated as the South West Shetland NSA (Fig. 3.7.17). Sites such as St Ninian's Isle (also a SSSI), the largest natural sand tombolo in the UK, are particularly highly regarded for their geomorphology and aesthetic value. The SPA of Sumburgh Head, which lies 7 km to the south of the site, regularly supports in excess of 20 000 breeding seabirds. Species present include Arctic tern, fulmar, kittiwake, puffin and guillemot. The SPA has been extended to include feeding grounds at sea but some species may travel beyond the SPA boundary into the proposed site. Sumburgh Head is also an RSPB reserve and SSSI for its geology and biology.

The coastline of the proposed site is rich in seabird colonies although not in the numbers present at Sumburgh (Fig. 3.7.18). They are also relatively abundant at sea, particularly in the north and west of the site. As such, much of the site has been identified as a potential site for future SPAs. In land, the Lochs of Spiggie and Brow (also an RSPB reserve) supports a nationally important wintering population of Icelandic whooper swan (*Cygnus cygnus*) and a diverse assemblage of wintering and breeding waterfowl.

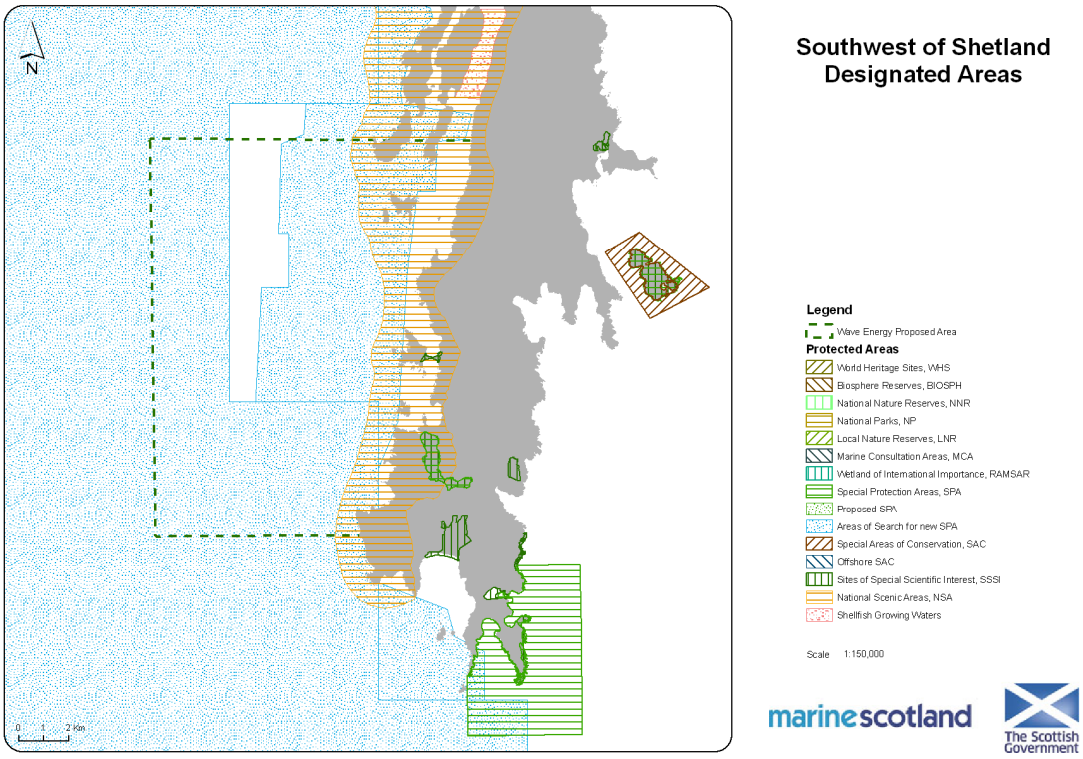

Figure 3.7.17: South-west of Shetland: Designated areas (source: OS, SeaZone Hydrospatial, SNH, JNCC, SG)

Protected Species

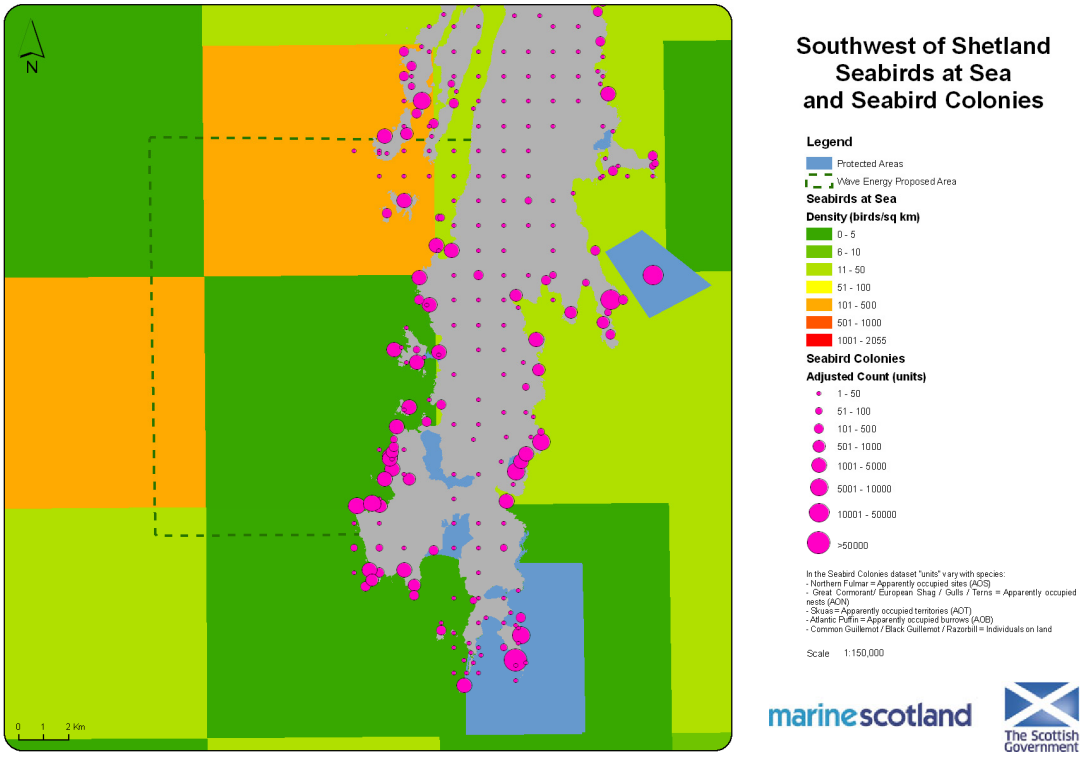

Figure 3.7.18: South-west of Shetland: Seabirds at sea and seabird colonies (source: OS, JNCC)

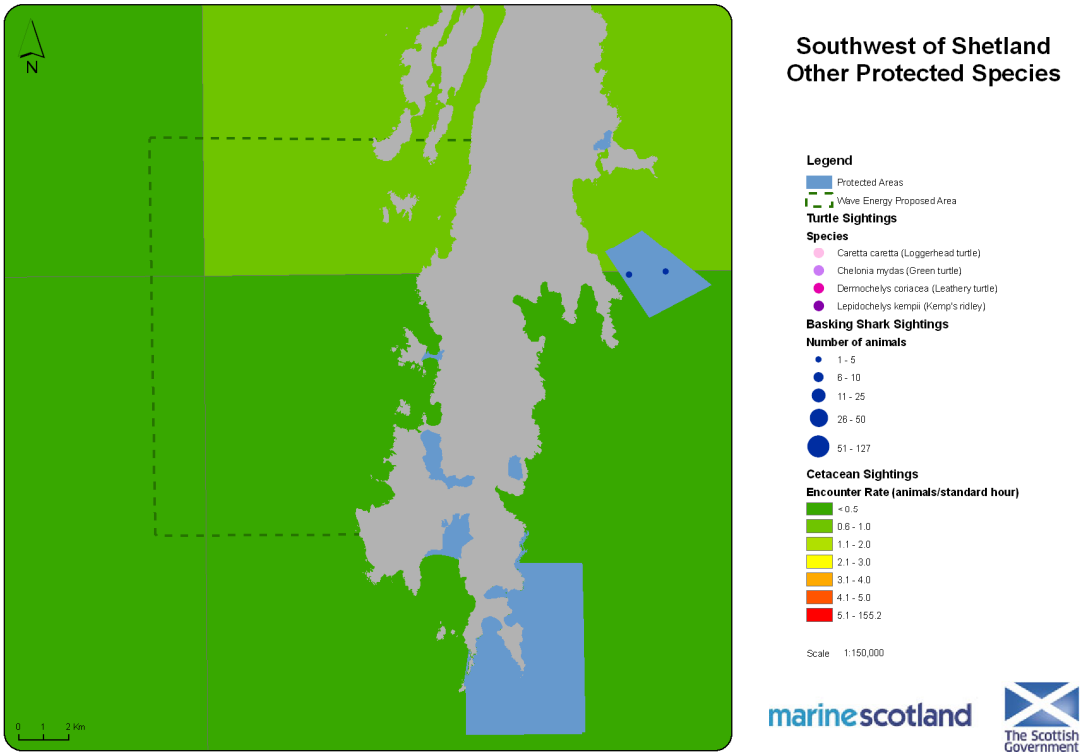

Figure 3.7.19: South-west of Shetland: Cetaceans and turtles and basking sharks (source: OS, NBN, MCS, JNCC)

The data does not suggest that this is a particularly important site for protected species, such as cetaceans, basking sharks or turtles (Fig. 3.7.19). However, this is likely due to the remoteness of the Shetland Isles and a lack of reporting. The SSMEI Shetland Atlas (2010) reports killer whale and porpoise within the site. A number of areas along the coast are documented to be important for common seal and grey seal in the south of the site.

Protected Habitats

The UK BAP priority habitat (Fig.s 3.6.20-21), sublittoral sands and gravels, are present within this site. There is also maerl (*L. glaciale*) reported off St Ninian's Isle and horse mussel beds off east Burra.

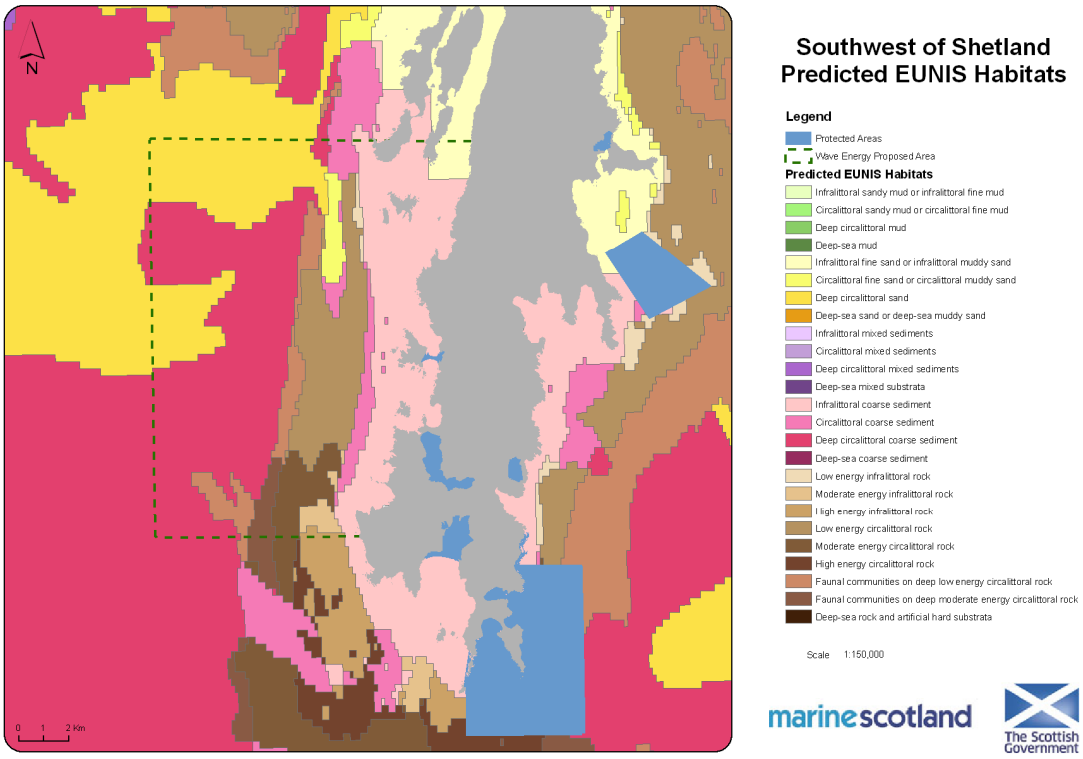

Figure 3.7.20: South-west of Shetland: Seabed habitats (predicted by EUNIS) (source: OS, JNCC)

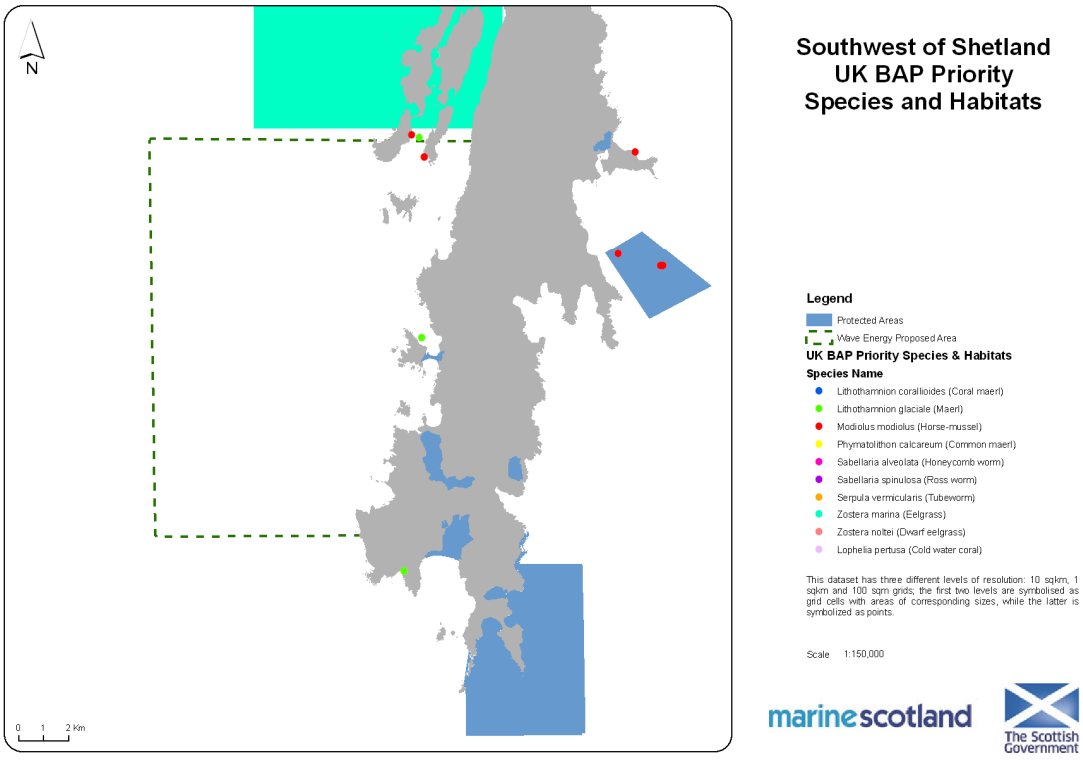

Figure 3.7.21: South-west of Shetland: UK BAP Priority species and habitats (source: OS, NBN)

Sensitive Areas for Commercial Fish

Times of year that are sensitive for commercial fish within the site are all months with the exception of June, July and October. Parts of the site are used as a nursery ground by haddock, lemon sole, Norway pout, saithe and sandeel (Fig. 3.6.22-23). Spawning fish include haddock, lemon sole, Norway pout, plaice, sandeel and sprat.

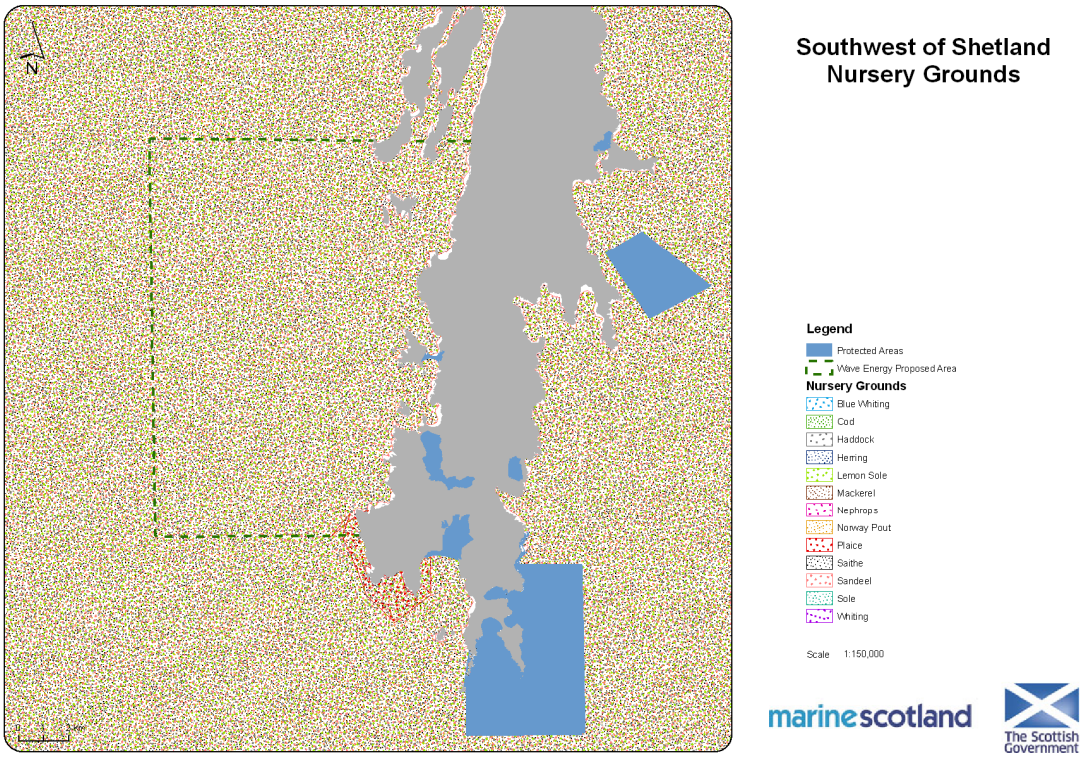

Figure 3.7.22: South-west of Shetland: Nursery grounds for commercial species (source: OS, MSS, CEFAS)

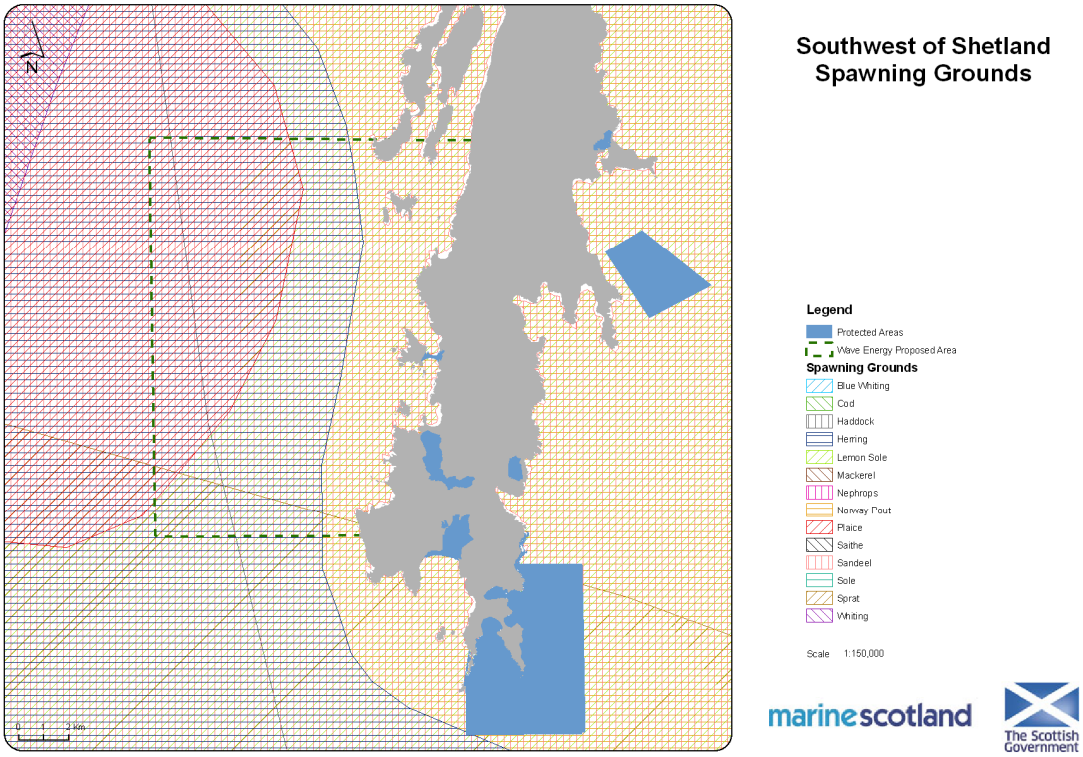

Figure 3.7.23: South-west of Shetland: Spawning grounds for commercial species (source: MSS, CEFAS)

3.6.2.6 Cultural Heritage

There are only two wrecks documented within this site, neither of which are protected (Fig. 3.7.24). Most of the SAMS in the south of Shetland are inland or on the east coast. However, St Ninian's Kirk & burial ground is evident on St Ninian's Isle and Scousburgh broch by the Loch of Spiggie.

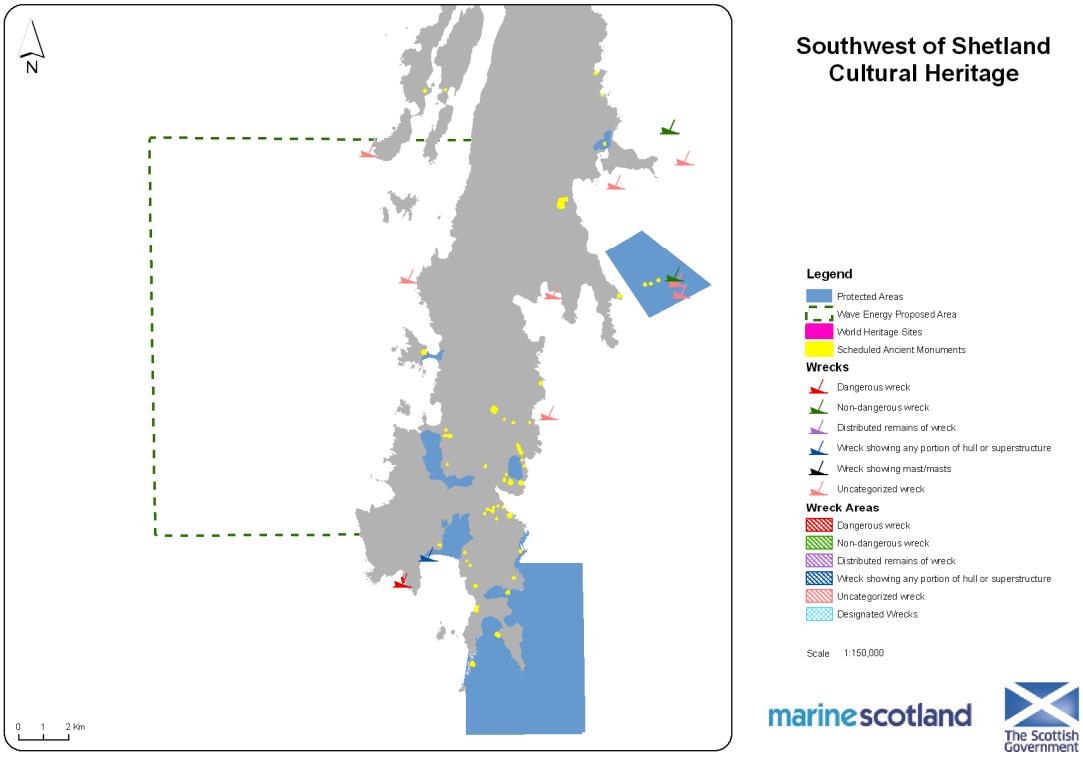

Figure 3.7.24: South-west of Shetland: Cultural heritage (source: OS, Historic Scotland, SeaZone Hydrospatial)

3.6.2.7 Recreation

All but the south-west corner of the site is a part of the RYA sailing area that encircles Shetland (Fig. 3.7.25). The SSMEI Shetland Pilot (2010) highlights three sites as of interest for recreation including, St Ninian's Isle, Fora Ness and the Bay of Scousburgh.

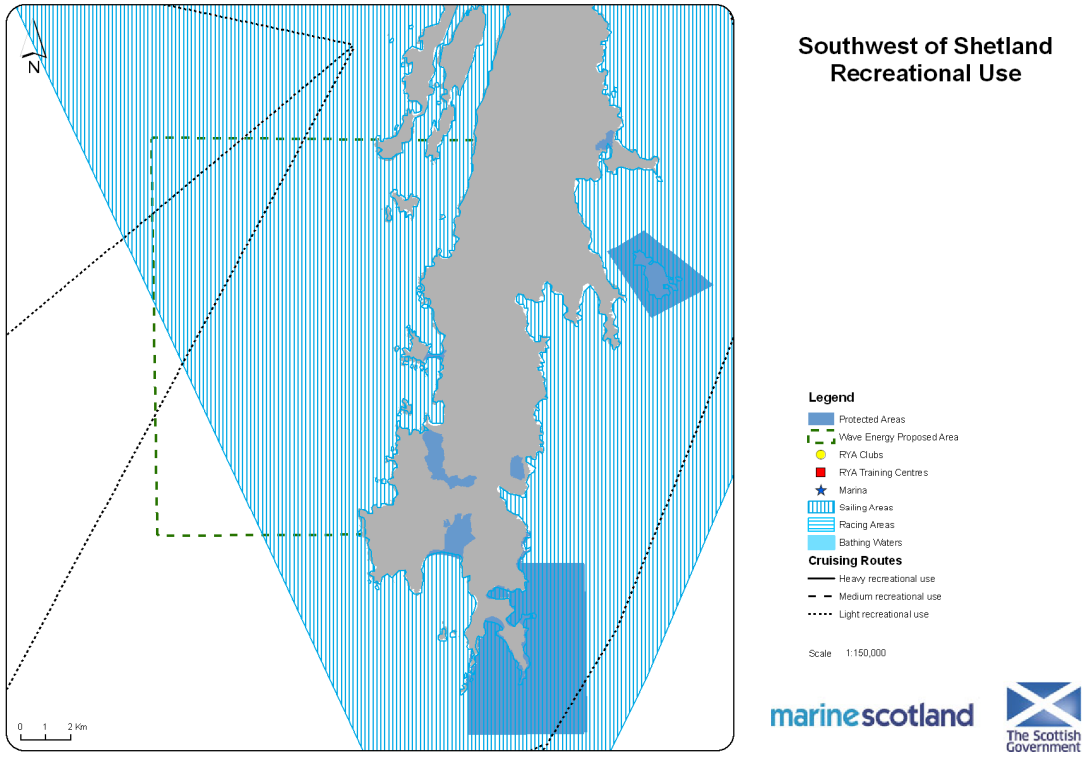

Figure 3.7.25: South-west of Shetland: Recreational use (source: OS, RYA, SG)

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Annex 1 Sources of Data

The details of the datasets used in this document, in order of appearance, including the name, source, date produced, description, address and copyright information when applicable.

Layer name	Layer source(s)	Production date (year)	Abstract	Source address and copyrights
Base map of Scotland and British Isles	Pan 50 & BritIsles respectively	2007	Pan 50 is a map of the outline of Scotland while BritIsles is a map of the whole of the British Isles. Note: different base maps may vary slightly. In some cases, third party datasets have been produced using different base maps to these, which has resulted in layers being offset from the coastline.	Ordnance Survey
Proposed Further Scottish Leasing Round – wave and tidal stream energy sites	The Crown Estate & Marine Scotland	2010	The dataset illustrates the proposed sites for The Crown Estate's Further Scottish Leasing Round (Saltire Prize) for wave and tidal energy. The round will be launched following a consultation period in spring/summer 2010.	The Crown Estate
Protected areas	Derived by MSS. Originally from SeaZone Hydrospatial, JNCC and SNH	2010	This data layer displays all the sites designated for conservation purposes that were excluded from consideration in the Scoping Study (Harrald & Davies, 2010). This includes: SACs, SPAs, proposed SPAs, Ramsar sites, NNRs and LNRs	Sources for each of these layers is presented subsequently
Tidal power density (kW/m^2)	Atlas of UK Marine Renewable Energy Resources, Commissioned by DTI. Produced by: ABP mer, The Met Office, Proudman Oceanographic Laboratory (2008)	2008	1. In areas less than 200 m deep the model cell size is approximately 1.8 km. North of 63°N and west of 12°W the model cell size is approximately 35 km. The model cell size is approximately 12 km in all other areas. 2. The model accuracy is less robust in areas closer than 1 km to land. 3. The tidal model is based on daily predictions throughout one year. The tidal power is calculated per square metre of vertical water column. 4. Tidal power is created for the upper 50% of the water column.	ABP mer (2008), http://www.renewables-atlas.info/. © Crown Copyright. All rights reserved 2008
Mean spring tidal peak flow (m/s)			1-2. As for tidal power density 3. The tidal model is based on daily predictions throughout one year. 4. Tidal flow/range is calculated for the upper 50 % of the water column.	
Mean neap tidal peak flow (m/s)				
Mean spring tidal range (m)			The definition of spring and neap tidal flow is the current at the highest point of the tide or lowest point of the tide (for springs and neaps respectively) averaged over a year. Spring tidal range is the difference in height between low and high waters of a spring tide averaged over a year.	
Wave power density (kW/ m of wave crest)			1. South of 63° N and east of 12° W, the model cell size is approximately 12 km. The model cell size is 60 km in all other areas. 2. The model accuracy is less robust in areas closer than 12 km to land. 3. The wave model is based on hourly predictions throughout three years. 4. Wave power is created for each horizontal metre of wave crest using the energy period calculation (T_E).	

Mean significant wave height (m)			1-3. As for wave power density. Mean significant wave height (SWH) is mean wave height from trough to crest of one third of the largest waves.	
Mean wave period (s)			1-3. As for wave power density 4. Wave period (T_E) is calculated from T_z, zero up-crossing period, using $T_E = 1.14\ T_z$. Wave period is defined as the time for one cycle of an oscillation of a wave	
Bathymetry	DigBath250 (Version 2), British Geological Survey	2006	DigBath250 is a vector attributed digital bathymetry of UK and adjacent European waters. Its purpose is to provide a regional scale digital bathymetry as a primary dataset for GIS, mapping and modelling of the sea bed and sub seabed. The coverage of DigBath250 Version 2.0 includes the whole of the UK continental shelf and slope and extends into adjacent European waters to cover the whole of the Irish Sea and North Sea.	http://www.bgs.ac.uk/products/digbath250/home.html, Reproduced with the permission of the British Geological Survey ©NERC. All rights Reserved
Seabed type	British Geological Survey	2005	The seabed sediments are mapped offshore, where it commonly forms a veneer on the seabed. The map is based on sea-bed grab samples of the top 0.1 m, combined with cores and dredge samples as available. A standard Folk triangle classification has been used based on the gravel percentage and the sand to mud ratio.	http://www.bgs.ac.uk/products/digitalmaps/seabed.html, Reproduced with the permission of the British Geological Survey ©NERC. All rights Reserved
Distance from cable landings	The Crown Estate	2009	Derived	The Crown Estate
Key national cable landings	Department of Energy and Climate Change (DECC) originating from Anatec UK Ltd	2009	Position where underwater cable makes landfall	http://www.maritimedata.co.uk/
Ports	DECC originating from Anatec UK Ltd	2010	This dataset shows all UK ports	
Pipelines, cable lines and cable areas	SeaZone Hydrospatial, originating from S57, HO, UKDEAL) & Kingfisher Information Service	2010	A dataset from SeaZone has been merged with a dataset from Kingfisher SeaZone data displays pipelines, telecom cables and power cables under the category 'Offshore Installations'. Kingfisher Information Service displays positions and route information of submarine cables in the seas around the UK. This datasets shows in-service and recently out-of-service systems (at the time of distribution) along with some systems containing power and telecoms. Source information by the UK Cable Protection Committee (UKCPC).	Kingfisher cables (http://www.kisca.org.uk/charts.htm#option4), British Crown and SeaZone Solutions Limited. All rights reserved. Products Licence No. 122006.004
Wave energy lease areas	The Crown Estate	2009	Position of current and pending leases for wave energy production.	The Crown Estate, © Crown copyright 2006
Scottish Wind Awards	The Crown Estate	2010	This dataset shows the location of Scottish wind farm Exclusivity Award lease applications submitted to The Crown Estate.	

Fish/shellfish farm lease areas	The Crown Estate	2010	This dataset identifies the spatial boundaries of areas currently under lease or leases that are pending for aquaculture purposes. Leases include both finfish and shellfish.	
Military exercise areas	SeaZone Hydrospatial	2010	MoD activities have been grouped into sub-categories within the categories: Army, Navy, RAF and MoD.	www.SeaZone.com/hydrospatial, British Crown and SeaZone Solutions Limited. All rights reserved. Products Licence No. 122006.004
Navigation points, navigation lines, navigation areas	SeaZone Hydrospatial, originating from S57, UKDEAL, HO	2010		
Ferry terminals & ferry routes	Ordnance Survey	2010 & 2008 respectively	Positions of ferry terminals and ferry routes	http://www.ordnancesurvey.co.uk/oswebsite/products/
International Maritime Organisation (IMO) routeings	Department of Energy and Climate Change originating from Anatec UK Ltd	2010	The IMO has established traffic separation schemes and other ship routeing systems in most of the major congested, shipping areas of the world. IMO's responsibility for ships' routeing is enshrined in SOLAS Chapter V (http://www.imo.org/safety/mainframe.asp?topic_id=770)	http://www.maritimedata.co.uk/
Shipping density (ships/year/nm)	Anatec Ltd	2010	The number of ship movements is based on port logs as well as the latest ferry and freight timetables for major operators. The routes taken by ships between ports were obtained from several sources, including radar and AIS surveys, satellite tracking, individual ship passage plans and Admiralty Sailing Directions. The dataset covers merchant ships (vessels above approximately 300 gross tonnes). It excludes vessel activity which is termed as non-routine, i.e., ships not sailing economically between ports but taking part in special operations. This includes military, fishing and recreational vessels, as well as vessels at anchor or moored. The variation in shipping density in the study area has been estimated using a grid of cells. The dataset originated from Mar 2009 to Mar 2010. The grid had an average cell size of 1 nautical mile (north/south) x 1 nautical mile (east/west). (Note: The cell width varies slightly from north to south; cells entirely on land were excluded).	www.anatec.com, data provided by Anatec Ltd in March 2010 under licence to Marine Scotland. Source data reproduced with the permission of Anatec Ltd.
Marine Environmental High Risk Areas (MEHRAs)	Derived from source report	1994	MEHRAs are defined as areas having high environmental sensitivities and being at risk from shipping activity. In due course they will be marked on Admiralty charts as an encouragement to mariners to take extra care in those areas and for their existence to be taken into account during passage planning.	DEFRA. Establishment of Marine Environmental High Risk Areas
Commercial fishing by large vessels	Marine Scotland Science	2009	Vessel Monitoring System (VMS) ping records have been cross-referenced with Fisheries Information Network (FIN) data to produce weight of catch landed and value landed, grouped into demersal, pelagic and shellfish fisheries. In the EU, VMS operates on larger vessels of Member States fishing fleets (≥15 m overall length). The satellite tracking device must automatically transmit the following information at time intervals of 2 hours: vessel identification, geographical position, date/time (UTC) of fixing of position, course and speed.	
Important finfish grounds Important shellfish grounds	Shetland SSMEI Pilot	2010	The location of important fishing grounds for finfish or shellfish around the Shetland Isles has been collated from consultation with local fishermen. The datasets may be incomplete as not all fishermen took part in the survey.	http://www.nafc.ac.uk/SSMEI.aspx, © Crown Copyright. All rights reserved [2010]

Important finfish grounds Important shellfish grounds	Shetland SSMEI Pilot	2010	The location of important fishing grounds for finfish or shellfish around the Shetland Isles has been collated from consultation with local fishermen. The datasets may be incomplete, however, as not all fishermen took part in the survey.	http://www.nafc.ac.uk/SSMEI.aspx, © Crown Copyright. All rights reserved [2010]
World Heritage Sites (WHS)	SeaZone Hydrospatial	2010	The World Heritage List includes 890 properties designated by UNESCO forming part of the cultural and natural heritage which the World Heritage Committee considers as having outstanding universal value. (UNESCO, May 2010: http://whc.unesco.org/en/list)	www.SeaZone.com/hydrospatial, British Crown and SeaZone Solutions Limited. All rights reserved. Products Licence No. 122006.004
Biosphere Reserves	SeaZone Hydrospatial		Biosphere reserves are sites recognised under UNESCO's Man and the Biosphere Programme, which innovate and demonstrate approaches to conservation and sustainable development. (UNESCO, May 2010: http://portal.unesco.org/science/en/ev.php-URL_ID=4801&URL_DO=DO_TOPIC&URL_SECTION=201.html)	
National Nature Reserves (NNRs)	SeaZone Hydrospatial		National Nature Reserves are areas of land set aside for nature, where the main purpose of management is the conservation of habitats and species of national and international significance. (SNH, Jun 2010: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/nnr/)	
National Parks	SeaZone Hydrospatial		In Scotland, national parks are extensive areas of the very highest value to the nation for their scenery and wildlife, and their cultural heritage value. (SNH, Jun 2010: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/national-parks/)	
Local Nature Reserves (LNRs)	SeaZone Hydrospatial		Local nature reserves are areas of at least locally important natural heritage, designated and managed by local authorities. (SNH, Jun 2010: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/local-designations/lnr/)	www.SeaZone.com/hydrospatial, British Crown and SeaZone Solutions Limited. All rights reserved. Products Licence No. 122006.004
Marine Consultation Areas	SeaZone Hydrospatial		A Marine Consultation Area (MCA) is a non-statutory designation - an accolade introduced in the late 1980s to highlight SNH's nature conservation priorities in the near-shore marine environment. The designation recognised high quality and sensitive marine habitats and (SNH, Jun 2010: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/marine-consultation-areas/)	
Wetlands of International Importance (RAMSAR sites)	Joint Nature Conservation Committee	2010	Ramsar sites are sites that are designated as internationally important under the Convention on Wetlands (Ramsar, 1971). These wetlands are commonly known as Ramsar sites. (Ramsar Wetlands, April 2010: http://ramsar.wetlands.org/Default.aspx)	http://www.jncc.gov.uk/protectedsites/SACselection/gis_data/terms_conditions.asp, © Crown copyright. All rights reserved. Scottish Natural Heritage, 100017908 [2010]
Special Protection Areas (SPAs) and proposed SPAs	Scottish Natural Heritage	2010	Special Protection Areas (SPAs) are strictly protected sites classified in accordance with Article 4 of the EC Birds Directive (1979). They are classified for rare and vulnerable birds (as listed on Annex I of the Directive), and for regularly occurring migratory species. (JNCC, April 2010: http://www.jncc.gov.uk/page-162)	© Crown Copyright. All rights reserved [2010].

Areas of Search for new SPAs	Joint Nature Conservation Committee	2010	The JNCC has classified areas of search for classification of new marine SPAs. Four types of marine SPAs are currently being considered by JNCC: 1. Marine extensions to existing seabird breeding colony SPAs In the UK almost all seabirds have some of their breeding sites protected within a network of breeding colony SPAs. This type of SPA is simply extending their existing boundaries into the marine environment, if this is deemed appropriate. The size of the extensions varies depending on the species breeding at the colony. 2. Inshore aggregations of non-breeding waterbirds The UK's coastal environment provides important feeding and moulting areas, as well as migration staging posts for non-breeding waterbirds, such as divers, grebes, and seaduck. 'Inshore' SPAs will provide protection for the most important inshore waterbird aggregations. 3. Offshore aggregations of seabirds All seabirds in the UK rely on various parts of offshore waters throughout the year, particularly for feeding. 'Offshore' SPAs will provide protection for the most important seabird concentrations in the open sea. 4. Other types of SPA Some important areas for marine birds may not be included within the above three categories and will be considered individually.	http://www.jncc.gov.uk/page-4184, © Crown copyright and database right [2010] All rights reserved. Ordnance Survey Licence number 100017955
Special Areas of Conservation (SACs)	Scottish Natural Heritage	2010	Special Areas of Conservation (SACs) are strictly protected sites designated under the EC Habitats Directive. Article 3 of the Habitats Directive requires the establishment of a European network of important high-quality conservation sites that will make a significant contribution to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended). The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds). Of the Annex I habitat types, 78 are believed to occur in the UK. Of the Annex II species, 43 are native to, and normally resident in, the UK. (JNCC, April 2010: http://www.jncc.gov.uk/page-23)	http://www.snh.org.uk/snhi/, © Crown Copyright. All rights reserved [2010].
Offshore SACs	Joint Nature Conservation Committee	2009	Since August 2007 the UK has had the legal mechanism to designate SACs in the UK offshore marine area under the Offshore Marine Conservation (Natural Habitats &c.) Regulations 2007.	http://www.jncc.gov.uk/protectedsites/SACselection/gis_data/terms_conditions.asp, © Crown copyright and database right [2010] All rights reserved. Ordnance Survey Licence number 100017955

Sites of Special Scientific Interest (SSSIs)	Scottish Natural Heritage	2010	In Scotland, Sites of Special Scientific Interest (SSSI) are areas of land and water (to the seaward limits of local authority areas) that SNH considers to best represent our natural heritage - its diversity of plants, animals and habitats, rocks and landforms, or a combinations of such natural features. The national network of SSSIs in Scotland forms part of the wider GB series. SNH designates SSSIs under the Nature Conservation (Scotland) Act 2004. SSSIs are protected by law. (SNH, April 2010: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/sssis/)	http://www.snh.org.uk/snhi/, © Crown Copyright. All rights reserved [2010].
National Scenic Areas (NSAs)	Scottish Government	2010	The 40 National Scenic Areas (NSAs) in Scotland, with their outstanding scenery, represent Scotland's finest landscapes and cover 13% of the land area of Scotland. (SNH, May 2010: http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/nsa/)	http://crtb.sedsh.gov.uk/spatialDataDownload/dload.asp
Shellfish growing waters	Scottish Government	2010	Shellfish growing waters were designated under the EC Shellfish Waters Directive (2006/113/EEC). They require protection to ensure the quality and productivity of shellfish and must meet the minimum environmental quality standards as laid out in the directive. (SEPA, Jun 2010: http://www.sepa.org.uk/water/protected_areas/shellfish_waters.aspx).	http://crtb.sedsh.gov.uk/spatialDataDownload/dload.asp
Seabirds at sea	Joint Nature Conservation Committee	1995	The seabirds at sea atlas presents a comprehensive assessment of seabirds in north-west European waters and comes from a collaboration between several countries. Data were collected from 1979 to 1994 and have been used to describe the seasonal distribution and abundance of over 50 species of seabird, including: gulls; terns; sea ducks; skuas and divers. These are supplemented with detailed summaries of the methods used for the collection, processing and interpretation of the data.	Stone, et al. (1995), http://www.jncc.gov.uk/default.aspx?page=2407
Seabird colonies	Joint Nature Conservation Committee	2010	Abundance of seabirds at colonies from 1986 to present (last updated 10 Feb 2010). The map shows an adjusted count of animals per colony. Counts are in units specified by the qualifier. In order to allow counts expressed with a different qualifiers to be summed, counts for each species were adjusted to a single type of qualifier as follows: - Fulmar: apparently occupied sites - Cormorant/ shag / gulls / terns: Apparently occupied nests - Skuas: apparently occupied territories - Puffin: apparently occupied burrows - Guillemot / black guillemot / razorbill – on land	http://www.jncc.gov.uk/page-4460
Turtles	National Biodiversity Network Gateway	2008	The dataset shows sighting of turtles in British waters, from 1980 to 2008. Data is presented for *Caretta caretta*, *Chelonia mydas*, *Dermochelys coriacea* and *Lepidochelys kempii*. The data originates: Marine Environmental Monitoring, Highland Biological Recording Group, Tullie House Museum, Merseyside BioBank, Marine Biological Association, Suffolk Biological Records Centre and Countryside Council for Wales.	www.searchnbn.net

Basking sharks	Marine Conservation Society	2009	The dataset shows sightings of basking sharks in Scottish waters, from 1980 to 2009.	Bloomfield and Solandt (2008), www.mcsuk.org
Cetacean distribution	Cetacean Atlas (2003) JNCC Support Co., Sea Mammal Research Unit and Sea Watch Foundation	2003	The Cetacean Atlas presents an account of the distribution of all 28 cetacean species that are known to have occurred in the waters off north-west Europe in the last 25 years. The data originates from three main sources: 1. The Seabirds at Sea Team (SAST) have been collecting data over the European Continental Shelf since 1979. European datasets have also been added to form the European Seabirds At Sea (ESAS) database. This contains over 13 000 cetacean records. Data were collected from ships of opportunity when the vessel was steaming at speeds > 5 knots. Full methods are contained within the Cetacean Atlas, 2003. 2. Sea Watch – between the 1960s and 1980s, sightings were mostly opportunistic and not from dedicated watches. Subsequently, sightings have been effort-based from dedicated watches from land and offshore. 3. SCANS data: This survey intended to enable unbiased estimates of abundance to be calculated regardless of cetacean distribution within the area. The survey conducted over the summer of 1994 involved 9 ships and 2 aircrafts which covered 16 sea-area blocks. Only encounter rates were used in the Atlas. The three datasets have been normalised. The maps presented depict the number of individuals by species per unit time of observation resolved to 0.25 of an ICES rectangle (~100 km^2).	Reid, et al. (2003) http://www.jncc.gov.uk/page-3881, the JNCC Support Co., Sea Mammal Research Unit and Sea Watch Foundation bear no responsibility for any further analysis or interpretation of that material, data and/or information.
EUNIS habitats	Joint Nature Conservation Committee	2003	The European Nature Information System (EUNIS) habitat classification is a pan-European system, which was developed between 1996 and 2001 by the European Environment Agency (EEA). It covers all types of natural and artificial habitats, both aquatic and terrestrial. (JNCC, Jun 2010: http://www.jncc.gov.uk/page-3365)	Information contained here has been derived from MESH Consortium webGIS data (www.searchmesh.net).
UK Biodiversity Action Plan (BAP) species	National Biodiversity Network Gateway	2010	The UK BAP, stemming from the Rio Convention (1992), aims to describe the biological diversity resources of the UK, and set out a detailed plan for their conservation. The current list of UKBAP priority species and habitats (published in August 2007) now contains 1150 species and 65 habitats that were considered based on international importance, rapid decline and high risk. (UK BAP, Jun 2010: http://www.ukbap.org.uk). We have presented sightings (presence) of the following (1980 to present): *Modiolus modiolus, Phymatolithon calcareum*, *Lithothamnion corallioides*, *Lithothamnion glaciale*, *Zostera marina, Zostera noltii, Zostera angustifolia*, *Lophelia pertusa, Sabellaria spinulosa, Sabellaria alveolata* and *Serpula vermicularis.* The data originates from: JNCC, MCS, SNH, Marine Biological Association, Conchological Society of Great Britain & Ireland, SEPA, British Phycological Society, Botanical Society of the British Isles.	www.searchnbn.net

Fish nursery and spawning grounds	Fisheries Research Services - FRS (now Marine Scotland Science) and Centre for Environmental, Fisheries and Aquatic Sciences (CEFAS)	1998	Fisheries sensitivity maps have been compiled from data collected and collated by the former FRS and CEFAS. The data are mapped as reported and describe the sensitivities of the main commercial species. The dataset shows the location and extent of nursery and spawning areas for commercial fish species including: whiting, cod, herring, haddock, lemon sole, mackerel, *Nephrops,* Norway pout, plaice, saithe, sole, sprat and sandeel.	Coull et al. (1998)
Wrecks	SeaZone Hydrospatial from S57 /Hydrographic Office	2010	The ruined remains of a stranded or sunken vessel which has been rendered useless.	© Crown copyright and database right [2010] All rights reserved. Ordnance Survey Licence number 100017955
Designated wrecks	Historic Scotland	2009	This dataset shows the position of wrecks designated under Section 1 of the Protection of Wrecks Act 1973 ('the 1973 Act'). This gives powers to Scottish Ministers (through Historic Scotland) to declare historic wrecks and the sites of wrecks in Scotland's territorial waters (out to 12 nautical miles), as protected areas. (Historic Scotland, Jun 2010: http://www.historic-scotland.gov.uk/index/heritage/wrecksites/what-is-a-designated-wreck-site.htm)	http://hsewsf.sedsh.gov.uk/pls/htmldb/f?p=500:1:1874898354961650::NO © Crown Copyright. All rights reserved [2009]
Scheduled Ancient Monuments	Historic Scotland	2009	This dataset shows the boundaries of all scheduled monuments in Scotland. A scheduled monument is a monument of national importance that Scottish Ministers have given protection under the Ancient Monuments and Archaeological Areas Act (1979). (Historic Scotland, Jun 2010: http://www.historic-scotland.gov.uk/index/heritage/searchmonuments.htm)	
Royal Yachting Association (RYA) marinas	RYA	2008	The dataset displays the location of the RYA marinas, most of which are commercial.	http://www.rya.org.uk/infoadvice/planningenvironment/Pages/boatingatlas.aspx © Copyright RYA [2008]
RYA sailing areas			The dataset displays the location of the RYA sailing areas. General sailing areas are defined as areas in extensive use for day sailing by all types of recreational craft but particularly smaller craft such as small cruisers, day-boats, dinghies, sailboards and personal watercraft.	
RYA racing areas			The dataset displays the location of the RYA racing areas. Racing areas are defined as areas in frequent use by large numbers of racing craft normally under sail but also power. Such areas are generally under the control of nearby sailing clubs and may contain temporary or permanent race course marking buoys.	
RYA cruising routes			The dataset displays the location of the RYA cruising routes throughout the UK waters.	
Bathing Waters	Scottish Government	2010	This dataset contains the 2007 EC Identified Bathing Beaches as part of the EC bathing Water Directive (76/160/EEC). All extents are based on results from intensive water sampling system.	http://crtb.sedsh.gov.uk/spatialDataDownload/dload.asp

Annex II

List of Abbreviations

British Geological Survey	BGS
Centre for Environment, Fisheries and Aquaculture Science	CEFAS
Department of Energy and Climate Change	DECC
Department of Trade and Industry (now DECC)	DTI
European Nature Information System habitat classification	EUNIS
European Protected Species	EPS
Fisheries Information Network	FIN
Fisheries Research Services (now Marine Scotland)	FRS
High Voltage Direct Current	HVDC
Joint Nature Conservation Committee	JNCC
Local Nature Reserve	LNR
Marine Conservation Society	MCS
Marine Environmental High Risk Area	MEHRA
Marine Nature Reserve	MNR
Marine Scotland	MS
Marine Scotland Science	MSS
Ministry of Defence	MoD
National Nature Reserve	NNR
National Scenic Area	NSA
Royal Yachting Association	RYA
Royal Society for the Protection of Birds	RSPB
Scottish and Southern Energy	SSE
Scottish Government	SG
Scottish Hydro Electric Transmission Limited	SHETL
Scottish Natural Heritage	SNH
Scottish Sustainable Marine Environment Initiative	SSMEI
Site of Special Scientific Interest	SSSI
Special Area of Conservation	SAC
Special Protection Area	SPA
Strategic Environmental Assessment	SEA
The Crown Estate	TCE
United Kingdom Biodiversity Action Plan priority species/habitats	UKBAP
United Nations Educational, Scientific and Cultural Organisation	UNESCO
Vessel Monitoring System	VMS
World Heritage Site	WHS