Scapa Flow Scale Site: Environmental Description



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Registered in Scotland no.SC249331 VAT Registration Number: GB 828 8550 90

UKAS TESTING
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Scapa Flow Scale Site Environmental Description

April 2011

Revision	Date	Description	Originated by	Checked by	Approved by
1.00	June 2010	Initial client accepted version of document.	Xodus Aurora	LF	JN
2.00	April 2011	Inclusion of baseline wildlife monitoring data	DC	JN	JN

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1 PURPOSE AND SCOPE

The function of this environmental description is as supporting documentation to inform applications/consents for a new wave test site. Subject to grant of these licences it will also inform potential developers coming to the European Marine Energy Centre (EMEC) to test their prototype wave energy devices of the environment within which the intermediate scale test site, north west of St Mary's, is located. It will also remind potential developers of their responsibilities towards the receiving environment.

An initial examination of seasonal environmental sensitivities has been undertaken, based on present understanding of the environmental characteristics of the area.

The description covers the character of the physical, biological and human environment as well as conservation areas around St Mary's. The following sections provide background and a detailed description of each important environmental characteristic.

2 CONTEXT

EMEC has secured additional funding from the UK's Department of Energy and Climate Change, DECC, which will allow the creation of nursery or intermediate scale test sites; one for tidal devices and one for wave devices. These have been sited and designed to allow developers to trial smaller scale marine energy devices – as well as full size prototypes – in less challenging sea conditions than those experienced at EMEC's main test sites at Billia Croo and the Fall of Warness.

Funding conditions have been stipulated by DECC including:

- Sites must be constructed in benign conditions;
- Sites must be capable of use for:
  - Testing of large scale prototype wave and tidal machines and/or
  - Rehearsal of wave and tidal operations and deployment techniques;
- Sites must incorporate test berths for both wave and tidal energy devices; and,
- Sites must be equipped with:
  - Ancillary equipment to enable monitoring of devices in situ
  - Load dumping devices for shredding of electricity generated.

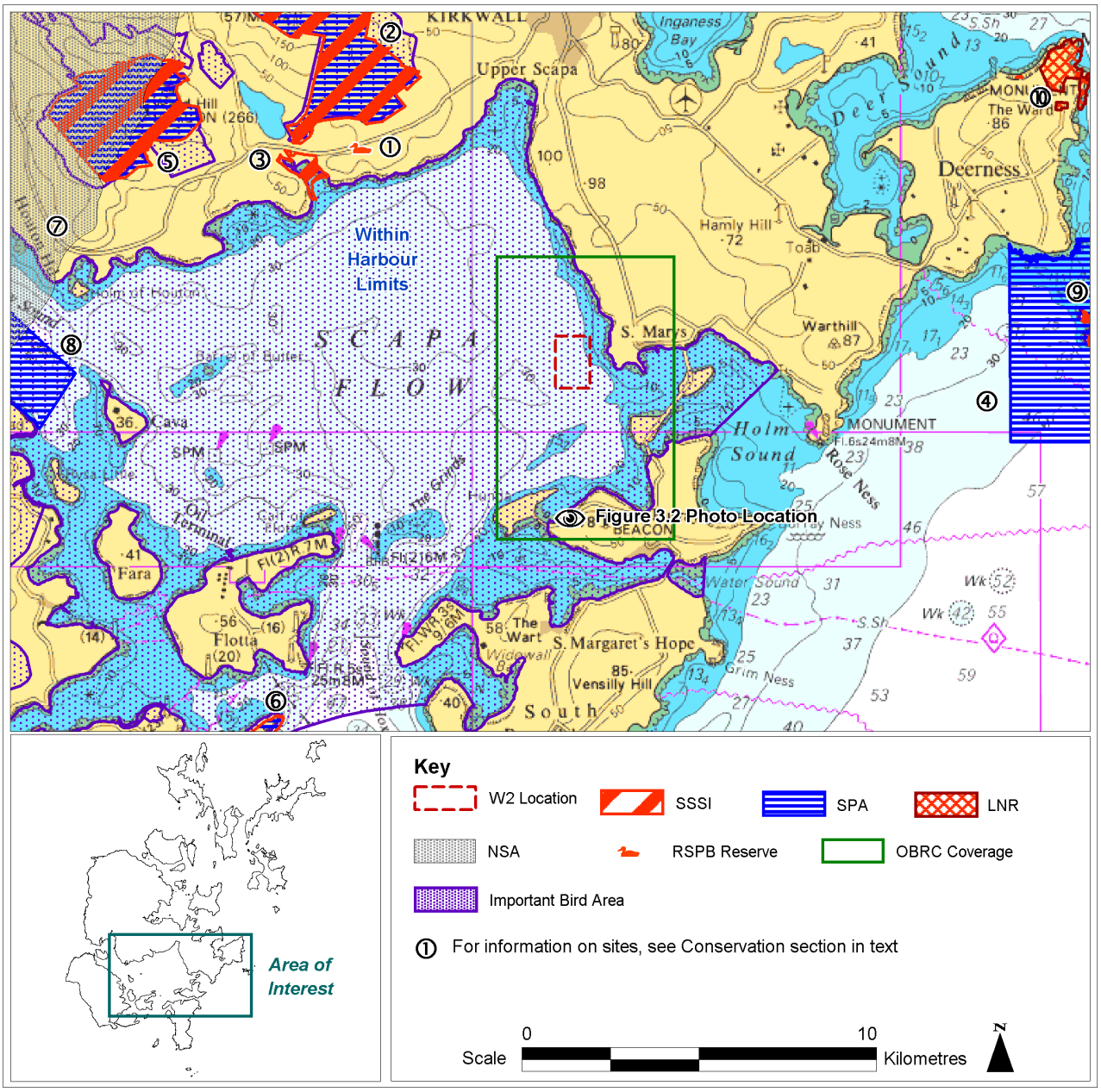
Operational data will be communicated via the SCADA interface; transmitted by air from a communications buoy at each test site. Unlike the larger, established, wave and tidal test sites the nursery sites will not be connected to the grid and there will be no cabling from the berths to shore nor will there be any onshore infrastructure provided by EMEC. Therefore, a description of the intertidal or coastal habitats has not been included in this report.

3 ENVIRONMENTAL DESCRIPTION

3.1 Location

The "W2" wave site is located offshore from Howequoy Head near St Mary's in Scapa Flow; the site is shown in Figure 3.1 in context with the wider area and in relation to sites of conservation interest (discussed further in Section 3.10). The site is within Harbour Limits, with Orkney Islands Council Marine Services being the Competent Harbour Authority. It should be noted that the site boundaries shown on the figures extend further than expected for the final site (the area within which moorings will be deployed will occupy between one-third and one-half of the box shown) but are shown as such to allow flexibility in final deployment of the moorings.

Figure 3.1 Location of W2 Scapa Flow wave site



3.2 Seascape

Most of the Orkney Islands are composed of sedimentary rocks of Devonian age (410 - 360 million before present) and are predominantly Middle and Upper Old Red Sandstone. There are older metamorphic rocks and younger dykes in some places. The nature of the rock and the glacial features help to determine the present day landscape of the coast (Doody, 1997).

Land Use Consultants (1998) report the sea as being very important to the physical and cultural landscapes of Orkney. The same authors also comment that the sea and the coast are key elements of the Orkney landscape. Whilst the west coast is particularly renowned for cliffs, arches, stacks and geos, the lower lying coastal features likely to be found in the vicinity of W2 (such as tilted flags, sand dunes and sandy bays) are considered important for recreation and accessibility (Land Use Consultants, 1998). The coastlines also contain sites of built and natural heritage interest; prehistoric

remains are characteristic features and the cliffs and adjacent heaths are key seabird nesting sites (Land Use Consultants, 1998).

Scott *et al.* (2005) report that the seascape of the eastern half of Orkney (including Scapa Flow) and the outer isles comprises 'Type 12: Deposition Coasts of Islands'. The key characteristics of this classification of seascape are the existence of causeways linking a number of islands, generally low lying coasts backed by open flat pastures and an interplay of land and water that results in a diverse form and changing views as the viewer moves through the landscape. Scott *et al.* (2005) state that the east Orkney area, in which Scapa Flow is situated, has little containment with short distances to the sea and a low lying landform, devoid of woodland and intervening relief with a resulting very open character and large horizontal scale. Closer to shore, scale is smaller as a degree of enclosure occurs between islands and, although few dramatic vertical landform features are present, the indented and highly complex form of inlets and bays and islands/sea are an important feature.

Figure 3.2 illustrates the general nature of the seascape in the vicinity of the proposed development area (see Figure 3.1 for photograph location).

Figure 3.2 View from Burray across Scapa Flow to the eastern end of Scapa Flow

3.3 Seabed habitats

3.3.1 Surveys

The seabed sediments and communities of the W2 area have been the subject of a number of site surveys. As part of the site selection process, EMEC has commissioned both geophysical surveys (Netsurvey Ltd, 2010) and environmental sampling that included the collection of grab samples across the site aimed at determining biota and sediment particle size (Biotikos, 2010). In addition, Marine Scotland collected video and photographic stills imagery from this area of Scapa Flow as part of a wider marine survey programme requested by Scottish Government to inform potential marine renewables development in this region. This information has subsequently been reviewed by SNH (Moore, 2009) to provide a description of the seabed habitats, species assemblages and biotopes.

These surveys have been used to establish an understanding of the baseline physical and biological environment at the W2 site.

3.3.2 Physical

Scapa Flow, in which W2 is situated, is a relatively shallow inland sea, with maximum water depths in the centre of the Flow of 30 - 40 m. Deeper waters are found, but these are located on the opposite side of the Flow to W2 in Bring Deeps, and in Hoxa Sound at the south-easterly entrance to Scapa Flow. The seabed in Scapa Flow exhibits a pronounced shelf; there are relatively shallow areas approximately 5 m deep along the coasts of mainland (and some of the smaller islands) but water depths drop off to approximately 10 – 20 m within a few metres of the coast (UKHO, 2010).

The W2 area was surveyed on 22nd January and 23rd January 2010 by Netsurvey Ltd (2010) (Figure 3.9). Water depths across the area ranged from approximately 15 to 30 m, approximately 1 m deeper than charted depths. A sand wave lying WSW-ENE across the south section of the area was found to rise up to a depth of 14.8 m. The survey also identified a number of contacts across the area which are assumed to be boulders or rocks.

BGS Charts (BGS, 1982) for Scapa Flow show the W2 site to comprise undifferentiated old red sandstone covered by slightly gravelly muddy sand (BGS, 1987).

The site specific survey conducted at W2 (Biotikos, 2010) reports that samples indicate a moderately low energy site that is characterised by stable sands of quite fine consistency. Some mud and appreciable amounts of uniform sized shell fragments are present also, in addition to small stones and patches of red macroalgae that are found at intervals across the site. The habitat may be broadly classified as “Sheltered Muddy Gravels” and subcategorised as “Subtidal Mixed Sediments”. The locations of sediment samples are illustrated in Figure 3.9.

3.3.3 Biological

3.3.3.1 Regional context

Moore (2009) report that most sites examined in the Pentland Firth and Orkney area display a community typical of circalittoral tide-swept rocky communities. However, W2 is located within the relatively sheltered Scapa Flow and thus a substantially different habitat would be expected. As such, the dominance by a fauna of the acorn barnacle *Balanus crenatus* and the Dahlia anemone *Urticina*

feline may not apply, although the diversity is expected still to be low. Habitats around Orkney are predominantly sandy, sand-scoured rock or mixed substrates of sand and stones.

3.3.3.2 Site specific information

Moore (2009) reports the results of three sample sites surveyed to the west of St. Marys on the eastern side of Scapa Flow within and around the W2 site (Figure 3.9). The flat muddy sand seabed was covered with a patchy mat of loose-lying red algae, consisting principally of the red seaweed *Phyllophora crispa* and occasional balls of Trailliella, a life phase of the red algae *Bonnemaisonia hamifera*. This corresponds to the 'Loose-lying mats of *Phyllophora crispa* on infralittoral muddy sediment' biotope (SS.SMP.KSwSS.Pcri) that JNCC (2010) report to occur in very sheltered conditions such as those found in sea lochs and voes. Moore (2009) reports that the infauna observed included sparse occurrences of the sand mason *Lanice conchilega*, the tube anemone *Cerianthus lloydii* and terebellid worms. Epifauna included occasional harbour crab *Liocarcinus depurator*, queen scallop *Aequipecten opercularis* and the common starfish *Asterias rubens*. The results of the Marine Scotland surveys and SNH analysis are summarised in Table 3.1. Selected images made available by Marine Scotland are shown in Figure 3.3 to Figure 3.8. As noted in Section 3.9, the biotope recorded at the W2 site is not listed on the UK Biodiversity Action Plan or the Scottish Biodiversity List.

Table 3.1 Summary of Marine Scotland survey results within and around the W2 site (Moore, 2009)

Site	Substrate	Biota	Biotope
SF/1	Flat muddy sand.	Sediment covered with patchy mat of loose-lying algae, composed principally of *P. crispa*, with balls of Trailliella. Infauna includes sparse *L. conchilega* and *C. lloydii*. Epifauna includes *L. depurator*, *A. rubens* and *A. opercularis*. *Turritella communis* shells on sediment surface.	SS.SMP.KSwSS.Pcri
SF/2	Flat muddy sand.	Sediment covered with patchy mat of algae. Epifauna includes portunid crabs and *A. rubens*.	SS.SMP.KSwSS.Pcri
SF/3	Flat muddy sand with scattered shells and pebbles.	Sediment covered with patchy mat of loose-lying *P. crispa*. Epifauna includes *L. depurator*, *A. rubens*, the sea mouse *Aphrodita aculeata* and Gobiidae. Infauna includes Terebellidae.	SS.SMP.KSwSS.Pcri

The site specific survey conducted at W2 (Biotikos, 2010) reported that a total of 90 taxa were recorded across the survey area. The infaunal community was composed largely of deposit feeding species (mainly polychaetes and bivalve molluscs), with only a few crustaceans present. The taxon best represented was the polychaete *Lumbrineris gracilis* which accounted for approximately 20 - 25% of all individuals found at three of the stations. Another notable contributor in numerical terms was the bivalve *Thyasira flexuosa* which made up approximately 10 - 20% of individuals at all stations. These, and other species, were frequently encountered in areas of slightly enhanced organic input and may thus be termed “transitionary”. This should not be confused with species that are indicators of organic enrichment (of which there are none at the W2 site) and there is no inference that conditions are anything but naturally derived. Trophic indices classify the site “Changed” but it is considered here that the term is a misnomer as the substrata at W2 are almost certainly not undergoing any form of change. It is, rather, a reflection of the relative mix of surface and sub-surface feeding species (in which three deposit feeders are more strongly represented). In terms of species type, tubicolous polychaetes, in particular members of the order Terebellida are very well represented (*Trichobranchus roseus*, *Terebellides stroemi*, plus eight further species). These taxa construct tubes from mud, sand and mucous and, as they are sedentary polychaetes, are found in stable substrata.

Figure 3.3 Site SF/1 (Scapa Flow Tow 1 at W2) showing flat muddy sand and loose algae

Figure 3.4 Site SF/1 (Scapa Flow Tow 1 at W2) showing flat muddy sand and loose algae

Figure 3.5 Site SF/1 (Scapa Flow Tow 1 at W2) showing flat muddy sand and loose algae

Figure 3.6 Site SF/3 (Scapa Flow Tow 3 at W2) showing flat muddy sand, pebbles and loose algae

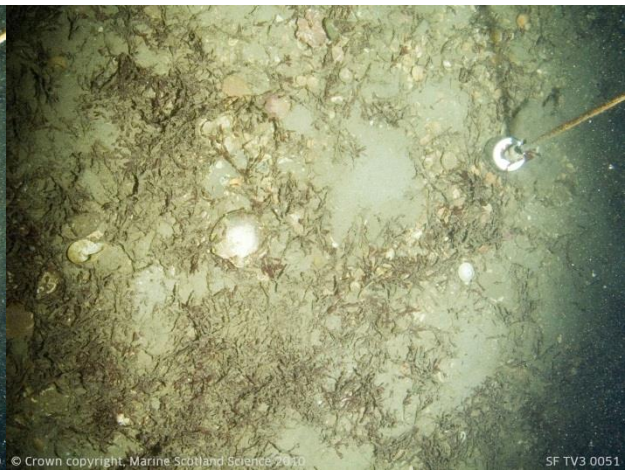


Figure 3.7 Site SF/3 (Scapa Flow Tow 3 at W2) showing flat muddy sand, pebbles and loose algae

Figure 3.8 Site SF/3 (Scapa Flow Tow 3 at W2) showing flat muddy sand, pebbles and loose algae

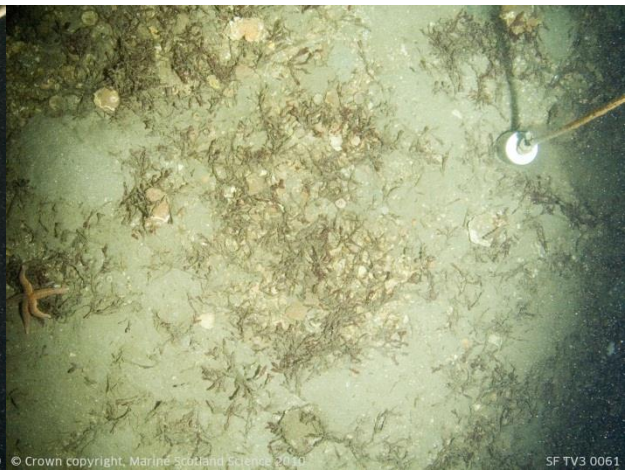
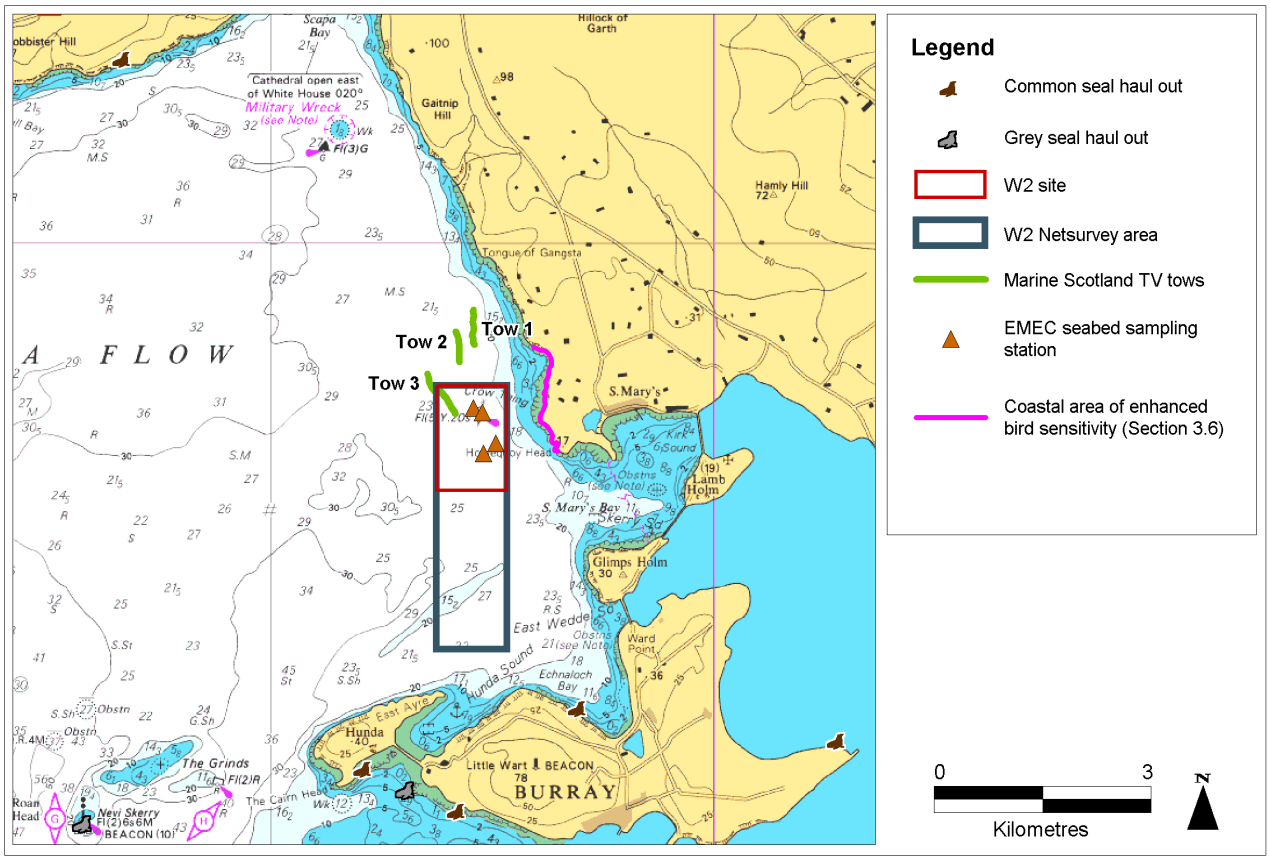


Figure 3.9 Summary of select environmental sensitivities and survey information



3.4 Plankton

Plankton around Orkney is likely to be characterised by coastal (neritic) and mixed (intermediate) water species that are largely influenced by the inflow of Atlantic water (Edwards and John, 1997). The inflow from the Atlantic Ocean along the western edge of the North Sea in late summer/autumn may introduce more oceanic species.

The plankton assemblages in Scapa Flow exhibit the cyclical patterns that are typical of temperate waters; a spring increase of phytoplankton (mainly diatoms) begins in March and peaks between April and May. This is followed by a decline in June to steady levels until another peak in September, with the dominant species present including barnacle larvae. The abundance of zooplankton during autumn is noticeably greater than that for phytoplankton, being dominated by crustaceans (principally copepods) (Jones and Beards, 1983). Nellen and Schadt (1992) report fairly large fluctuations in zooplankton taxa occurring that are considered to be linked to environmental conditions that vary interannually. Fluctuations in weather patterns can also lead to different progressions of plankton species through the year. On a number of occasions, cocolithophores have become particularly dominant in the early summer, resulting in the waters of Scapa Flow turning a turquoise colour. These incidents are apparently transient and the bloom subsides after a period of only a week following changes in weather and hydrographic conditions. Despite these short-term changes, the overall variability in the zooplankton biomass is low, suggesting a relatively stable ecosystem.

Plankton is of fundamental importance as it is the basis of the entire marine ecosystem, forming a vital link in the food chain of larger organisms such as fish, seabirds and cetaceans (whales and dolphins). Zooplankton is key to the survival of fish species such as herring.

There is documented evidence around Orkney of a rise in the incidence of dinoflagellates (such as Gymnodium spp.) with the ability to produce toxins. In particular, the dinoflagellate *Alexandrium tamarense*, a species that is considered involved in paralytic shellfish poisoning (PSP), which has occurred in Orkney regular since 1968 (e.g. Bresnan *et al.*, 2002). A number of potential sources, including vessel traffic and aquaculture, have been suggested as contributors to the occurrence of these unusual blooms as a result of localised nutrient enrichment. However, other studies have suggested that other causes such as increased awareness and monitoring are involved (e.g. Joyce, 2001).

3.5 Fish and Shellfish

3.5.1 Finfish

As with much of UK waters, fish studies of high spatial resolution are poorly represented for this part of Orkney. Despite this, it is possible to make general statements based on the location of the site and known seabed conditions. Fish species that are commonly found in Scapa Flow are typical of north Scottish waters and include pollack *Pollachius pollachius*, saithe *Pollachius virens*, ling *Molva molva*, ballan wrasse (*Labrus bergylta*) and cuckoo wrasse (*Labrus mixtus*). Less abundant species include poor cod (*Trisopterus minutes*), goldsinny (*Ctenolabrus rupestris*), conger eel (*Conger conger*) and cod *Gadus morhua* (which is widely distributed around Orkney in the summer months). Mackerel (*Scomber scombrus*), present during their migratory passage past Orkney, may also be found in the more energetic waters of Hoxa Sound in the south of Scapa Flow. Other species that may be present, albeit seasonally, include juvenile and non-spawning adult monkfish *Lophius piscatorius* and gurnard Triglidae spp. RSPB report that there is a sand eel population within Scapa Flow around the W2 site (RSPB *pers comm.,* 2010).

Orkney Biodiversity Records Centre (OBRC) report the presence of butterfish *Poronotus triacanthus* around the W2 site (Gauld, pers. comm.), whilst the Marine Scotland survey of the benthos within and around the W2 site incidentally recorded the presence of gobies.

Scapa Flow is located within important areas for a number of commercially important fish species. Herring spawn in the area in August and September, lemon sole *Microstomus kitt* between April and September, sand eels *Ammodytes marinus* between November and February and sprat *Sprattus sprattus* between May and August, with a peak in May and June. Saithe, lemon sole, sandeel and sprat use the area as a nursery ground year round (Coull *et al.*, 1998).

It is possible that migratory marine fish species such as eels, salmon *Salmo salar* and trout *Salmo trutta* may move through the wider Orkney area. Whilst the amount of time that salmon spend in the coastal zone is limited (and thus they are unlikely to be found around W2), sea trout spend much longer periods in coastal waters (Faber Maunsell & Metoc, 2007) and there is consequently a higher likelihood of being recorded at W2. Numerous sea lochs, small burns and surrounding coastal seas of Orkney are reported to contain populations of the sea trout (Robson, 1997); sea trout spawn in freshwater during the months of October to January and then migrate out to sea to mature. Although

there are some smaller burns running into Scapa Flow close to the W2 site, Orkney Trout Fishing Association (2009) does not list any of the burns in the vicinity of W2 as having a demonstrable trout population. The closest burn with a possible presence of trout is the St Mary's Burn located within 1 km to the east of the proposed development area, but this presence is currently described as tenuous (Orkney Trout Fishing Association, 2009).

3.5.2 Shellfish

Scapa Flow is of commercial importance for shellfish species, and the commercial shellfishery is described in Section 3.10.1. It is likely that the lobster *Homarus gammarus* and other crustaceans (possibly the brown crab *Cancer Pagurus,* velvet crab *Necora puber* and shrimp *Nephrops norvegicus*) will be present at the site and within Scapa Flow. Indeed, portunid crabs have been reported from recent surveys undertaken at the proposed development site (Section 3.3). Additionally, the queen scallop is known to be present at the site (Moore, 2009) and cockles, common mussels *Mytilus edulis*, flat oyster *Ostrea edulis* and edible crabs are reported by OBRC (Gauld, pers. comm.).

3.6 Ornithology

Much of Orkney's extensive coastline is colonised by seabirds and some sections have several contiguous colonies. Of the seabird colonies in Orkney, in excess of twenty have historically held numbers of seabirds at or above 1% of the total population of the European total for that species (Tasker, 1997). In recent years, however, populations of seabirds around Orkney have been vastly reduced (RPSB, 2010a) and 2008 was reported to have been a poor breeding season (Meek, Undated).

Breeding and resident seabirds, ducks and divers around Scapa Flow will use the marine environment (including around W2) for feeding; a number of important breeding seabird colonies are found around Scapa Flow (for example, see sites designated as SPA, Figure 3.1) and these birds in particular will be found using Scapa Flow.

RSPB reported, during pre-screening for the nursery test sites, that Scapa Flow is a wintering area for a number of species, particularly the Slavonian grebe *Podiceps auritus* and great northern diver *Gavia immer*. This is confirmed by SNH who state that St Mary's Bay is a very important location within Scapa Flow for wintering wildfowl, particularly the Slavonian grebe, great northern diver, red-necked grebe *Podiceps grisegena* and long-tailed duck *Clangula hyemalis*. Sightings of various gulls and waterfowl would also be expected in the area (Tay and Orkney Ringing Groups, 1984). OBRC provided information on species sightings in the vicinity of the W2 site (Gauld, pers. comm.). These data indicate that numerous bird species have been recorded in the waters around W2 and onshore in the vicinity of the coast. In accordance with what would be expected, a large number of observations have been made of gull (e.g. black-headed *Chroicocephalus ridibundus*, herring *Larus argentatus*), auk (little auk *Alle alle*, guillemot *Uria algae*, razorbill *Alca torda*), diver, grebe and duck (e.g. eider *Somateria mollissima*, long-tailed, mallard *Anas platyrhynchos*, merganser, scoter, teal *Anas crecca*, tufted *Aythya fuligula*) species. It is likely that the majority of these birds will be present (to varying degrees) at comparable habitat across the much of the rest of the coastline around Scapa Flow and the wider mainland Orkney.

Dawson *et al*. (2009) report numbers of inshore waterbirds using Scapa Flow during the winter season collected as part of an assessment of the area's potential for qualification as a marine SPA (still under consideration, see Section 3.9). The species recorded during aerial surveys were the common eider, long-tailed duck, common scoter *Melanitta nigra*, common goldeneye *Bucephala clangula*, red-

breasted merganser *Mergus serrator*, red-throated diver *Gavia stellata* and great northern diver. In addition land and boat-based counts documented velvet scoter *Melanitta fusca,* goosander *Mergus merganser*, black-throated diver *Gavia arctica,* little grebe *Tachybaptus ruficollis*, red-necked grebe *Podiceps grisena* and Slavonian grebe. Aquatera (2008) report that boat-based bird surveys conducted in Scapa Flow between June and August 2008 recorded that guillemots, black guillemots and fulmars were the species most often recorded, with greylag geese and European storm petrels in the dominant group of species on some survey occasions.

There are a number of species that are listed on Annex I of the Birds Directive (Directive 2009/147/EC) that have previously been sighted in the wider offshore W2 area. For example, the black throated *Gavia arctica* great northern and red throated divers, the common *Sterna hirundo*, Arctic *Sterna paradisaea* and sandwich *Sterna sandvicensis* terns and the whooper swan *Cygnus cygnus* have all been sighted on numerous occasions. Other Annex I bird species that have been reported but on fewer occasions include the little *Sterna albifrons* and roseate *Sterna dougallii* terns and the European storm petrel *Hydrobates pelagicus*. SNH reported, during the consultation process, that the wider Scapa Flow area is within the foraging range of seabirds breeding at Hoy Special Protection Area (SPA). RSPB highlight that the area from the Bay of Sandoyne to Howquoy is the main area of ornithological interest (Figure 3.9).

The time of year during which the highest population numbers are expected varies depending on the species. For example, the highest numbers of seabirds will occur between April and September when birds are breeding and fledging but species such as divers and grebes over winter in the region and thus sensitivity for these groups will be highest during that time.

3.7 Marine Mammals

3.7.1 Pinnipeds

3.7.1.1 Grey seal

The Natural Environment Research Council's (NERC) Special Committee on Seals (SCOS, 2009) report that approximately 45% of the world's grey seals *Halichoerus grypus* breed in the UK and 90% of these breed at colonies in Scotland with the main concentrations in the Outer Hebrides and in Orkney. Growth has been levelling off in Orkney (as with some other colonies in the northern North Sea) with 18,800 pups born in Orkney in 2008. The rate of increase in Orkney has declined since 2000 although pup production has been relatively constant since 2004.

The sheltered waters of Scapa Flow provide haul-out sites for these seals; data from aerial and other surveys (SMRU, pers. comm.) indicate that the nearest known grey seal haul-out is 4.3 km south at West Burray where 5 animals have been observed (Figure 3.9).

3.7.1.2 Harbour seal

SCOS (2009) report that major declines have been documented in harbour seal *Phoca vitulina* populations around Scotland with declines of up to 50% since 2000 in Orkney. SCOS (2009) state that these latest results suggest that the Orkney harbour seal population declined by 67% since the late 1990s and has been falling at an average rate of over 13% annually since 2001. There were thought to be 2,867 harbour seals in Orkney between 2006 and 2008, but SCOS (2009) commented, in 2008, that repeat surveys of Orkney would be desirable to determine the ongoing trend in numbers.

As for grey seals, the sheltered waters of Scapa Flow act as ideal haul-out sites for these animals; the closest grey seal pupping site (Figure 3.9) is located on Flotta, 7.6 km to the south west, and the closest harbour seal haul-out 3.2 km south at West Burray (SMRU, pers. comm.).

SNH, during the screening process, commented that, although some seals may be present in the proposed development area, this is not a site of concern.

3.7.2 Cetaceans

All species of cetacean are European Protected Species (EPS). SeaWatch (Undated) report that the cetacean fauna of Orkney is one of the richest in the UK, with the majority of sightings being made from the west coast. SeaWatch (Undated) state that, since 1980, seventeen species of cetacean have been recorded along the coast or in nearshore waters and that, of these, seven species are present throughout the year or recorded annually as seasonal visitors. The minke whale *Balaenoptera acutorostrata* is the most frequently observed baleen whale in the region, with the long-finned pilot whale *Globicephala melas* an infrequent visitor. With regard to odontocetes, the killer whale *Orcinus orca* is widely distributed throughout Orkney waters, occurring in all months of the year (peak inshore June - October), with a similar pattern existing for Risso's dolphin *Grampus griseus* (peak in August) and the harbour porpoise *Phocoena phocoena* (peak July and August). The white-beaked dolphin *Lagenorhynchus albirostris* is common and widely distributed, peaking between June and October, whilst the Atlantic white-sided dolphin *Lagenorhynchus acutus* is an infrequent visitor with numbers highest in August. Recent unusual cetacean sightings include the humpback *Megaptera novaeangliae* and sperm whales *Physeter macrocephalus*.

Whilst these species may be present around the Orkney coastline, it is unlikely that the majority will be seen regularly within Scapa Flow since the waters in the Flow are shallower and the large shoals of fish upon which numerous cetaceans prey are likely to be ordinarily absent in such inshore waters. Whilst OBRC data (Gauld, pers. comm.) do show that the majority of the above species (in addition to the fin whale *Balaenoptera physalus*) have been sighted in the immediate vicinity of W2, it is likely that the harbour porpoise and other smaller cetaceans are the most likely species to be regularly sighted in the vicinity of W2. SNH, during the screening process, commented that Risso's and Atlantic white-sided dolphins have been sighted in and around the W2 site.

It should be noted that there are no known resident populations of cetaceans within Scapa Flow or the wider Orkney area.

3.7.3 Otter

Otter are classed as EPS, but whilst otter may be spotted along shorelines, near burns and offshore to approximately 10 m water depth. The absence of any associated landfall with the nursery test site and the depth of around 20 m mean it is unlikely any otter will use the area of water at W2.

3.8 Turtles

DECC (2009) report that of the five species of turtles recorded in UK waters, the vast majority of records (in excess of 80%) are of the leatherback turtle *Dermochelys coriacea*. This species is a regular visitor to Scottish waters and is likely to be the only species sighted with any regularity in Orkney waters. It is considered that this species is at the limits of its northern extent when in UK waters and that most appearances are accidental (DECC, 2009). Pierpont and Penrose (2002) report sightings of this species from Scapa Flow as being in the single figures. The species is most likely to

be sighted between August and November (Booth and Booth, 1994). OBRC data for the W2 site do not show the presence of any turtle species.

3.9 Conservation

The W2 nursery site is not located within any designated conservation areas. The nearest sites are Keelylang Hill and Swartabeck Burn SSSI and the Orkney Mainland Moors SPA, both of which are situated 7.6 km from the development site. Figure 3.1 provides an overall context for the site showing that W2 is within 15 km of a number of locally and nationally important sites; it is possible that some of these sites may support populations of species which use the W2 and wider Scapa Flow area for foraging. It is also important to acknowledge that the W2 site is located within a wider area of Orkney coastline and inshore habitats which represent, in some cases, nationally and internationally important regions of conservation interest which have been identified as Special Areas of Conservation (SACs), Special Protection Areas (SPAs) (including some areas for which extended marine boundaries have recently been established) and National Scenic Areas (NSAs) amongst others.

The Orkney Local Plan (OIC, 2004) identifies some areas onshore as being sites of local nature conservation importance under policy LP/N1. Sites of local importance are representative of important Orkney nature conservation areas and the diversity of habitats and nature interests in the archipelago.

Table 3.2 and Table 3.3 describe the conservation area types shown in the vicinity of W2 (Figure 3.1).

Table 3.2 Details of conservation designations (SNH, 2010a, 2010b)

Conservation Designation	Details
Special Protection Area (SPAs)	A SPA is a site designated under the Birds Directive. that are internationally important for threatened habitats and species. SPAs are selected for a number of rare, threatened or vulnerable bird species listed in Annex I of the Birds Directive, and also for regularly occurring migratory species.
Site of Special Scientific Interest (SSSIs)	SSSIs are those areas of land and water (to the seaward limits of local authority areas) that SNH considers to best represent Scotland's natural heritage - its diversity of plants, animals and habitats, rocks and landforms, or a combinations of such natural features. SNH designates SSSIs under the Nature Conservation (Scotland) Act 2004.
Local Nature Reserve (LNRs)	LNRs are areas of at least locally important natural heritage, designated and managed by local authorities to enhance public access to nature. Local authorities select and designate local nature reserves using their powers under section 21 of the National Parks and Access to the Countryside Act 1949 (as amended).
RSPB Reserve	RSPB reserves across the UK cover a wide range of habitats (including saline lagoons, native pinewoods, shingle and reed beds) and support 30 % of the UK's breeding populations of 13 species of Birds of Conservation Concern.
National Scenic Area (NSA)	NSAs are Scotland's only national landscape designation. They are those areas of land considered of national significance on the basis of their outstanding scenic interest which must be conserved as part of the country's natural heritage. They have been selected for their characteristic features of scenery comprising a mixture of richly diverse

	landscapes including prominent landforms, coastline, sea and freshwater lochs, rivers, woodlands and moorlands. Recent legislation (Planning Etc (Scotland) Act 2006 - Part 10) has given a new statutory basis to the National Scenic Area designation.

Table 3.3 Details of conservation areas within 15 km of W2 (RSPB, 2010b, SNH, 2010c). Circled numbers refer to locations shown on Figure 3.1.

Site and Distance from W2	Details
Hobbister RSPB Reserve - 7.5 km north west ①	This reserve hosts sea cliffs, saltmarsh, moorland and sandflats. Hen harriers, short-eared owls and red-throated divers nest on the moorland. Red-breasted mergansers and black guillemots can be seen also.
Keelylang Hill and Swartabeck Burn SSSI - 7.6 km north north west ②	Moorlands important for the density and diversity of the bird community and for the variety and numbers of birds of prey and moorland breeding birds. 33 traditional Hen Harrier sites of which the minimum number occupied in any year is estimated at 7 (~2% of British population). In addition more than 1% of the national population of Merlin nest on the site along with a significant proportion (~10%) of Orkney's Short-eared Owls. Both species occur at a density higher than elsewhere in the islands.
Orkney Mainland Moors SPA - 7.6 km north north west ②	The habitats include extensive areas of blanket bog, acid grassland, wet and dry heath, acidic raised-mire and calcareous valley mire. Sheltered valleys and dales support willow scrub, tall-herb and flush vegetation. This site regularly supports populations of European importance of the Annex I species hen harrier, red-throated diver and short-eared owl. The hen harrier population on this site is one of the largest in Britain. The Orkney Mainland Moors is one of few sites to support significant numbers of short-eared owl.
Waulkmill SSSI - 7.6 km north west ③	This encompasses a wide range of nature conservation interests including a sandflat and well vegetated shingle spit behind which one of the more extensive areas of saltmarsh in Orkney has developed. Fragments of freshwater marsh also occur at the edge of the saltmarsh. These cliffs are considered to form one of the best general moths and butterfly habitats in Orkney. One species, *Coleophora vigaureae*, occurs here in its only known locality in Orkney. The surrounding areas of mature heather and shrub growth are frequented by breeding moorland birds.
Copinsay SPA - 11.6 km east ④	The islands have a cliffed rocky coastline and maritime vegetation that support large colonies of breeding seabirds. The boundary encompasses a seaward extension approximately 2 km into the marine environment to include the seabed, water column and surface. Qualifying interests include regularly supporting in excess of 20,000 individual seabirds. It regularly supports 70,000 seabirds including nationally important populations of a number of species including the common guillemot *Uria aalge*, black-legged kittiwake *Rissa tridactyla*, greater black-backed gull *Larus marinus* and Northern fulmar *Fulmarus glacialis*.
Orphir and Stenness Hills SSSI - 11.6 km west north west ⑤	The area supports a typical moorland breeding birds community at unusually high density. With 25 known Hen Harrier nest sites, this area of moorland supports approximately 3% of the British breeding population. Botanically the area is characterised by a range of plant communities typical of the Orkney moorland Dales with two colonies of the rare Pyramidal Bugle Ajuga pyramidalis are known to occur.
Switha SSSI - 11.9 km south west ⑥	The small grassy island of Switha supports an internationally important wintering population of Greenland barnacle geese *Branta leucopsis*.
Switha SPA - 11.9 km south west ⑥	Switha has a rocky coastline with cliffs along the north, east and west shores, and is almost totally covered by maritime grassland, with

Site and Distance from W2	Details
	smaller areas of heath and bog. Switha is of importance as a winter roosting site for Greenland Barnacle Goose.

Site and Distance from W2	Details
Hoy and West Mainland NSA - 13.2 km west north west ⑦	The ice-rounded hills of North Hoy dominate the Orkney scene. Their shape, fine grouping, cliffs and headlands, including the stack of the Old Man of Hoy, are almost as important to the Caithness scene as they are in that of Orkney.
Hoy SPA - 13.3 km west ⑧	The site supports an extremely diverse mixture of mire, heath and alpine vegetation, and also Britain's most northerly native woodland. Cliffs provide important breeding sites for a number of seabird species, especially gulls and auks, whilst moorland areas support large numbers of breeding birds. The divers and seabirds feed in the rich waters around Hoy, outside the SPA.
Copinsay SSSI - 13.8 km east ⑨	These cliffs support a nationally important seabird colony with guillemots and Kittiwakes, representing 4% and 2% respectively of the British and Irish population. Smaller numbers of Razorbills, Fulmar and Puffin are present also. The rocky north coast has an abundance of Sea Aster *Aster tripolium* and other grasses. On the adjoining island of Corn Holm is a large colony of Oysterplant *Mertensia maritima* and breeding Black Guillemots occur.
Den Wick SSSI - 13.9 km north east ⑩	Designated for its geological interest, Den Wick represents one of the best examples of a multiple till section in Orkney.
Mull Head LNR - 14.4 km north east ⑩	This site contains coastal grassland heath and sea cliffs that are colonised by hundreds of seabirds. There is a small colony of greater black-backed gull and pairs of great skua. Red-throated diver may be seen here and there is the chance of observing Peregrine also. Seals are a common sight in the seas and it may be possible to observe otters on the shoreline.

With regards to species of conservation significance, a number of species listed on Annex I of the Birds Directive or Annex II of the Habitats Directive are considered to be present in varying numbers at differing times of the year (see Sections 3.5 and 3.6) but the W2 area is not thought to be integral to significant groups of any such species.

Scapa Flow and the western extent of Orkney's mainland moors (Figure 3.1) have been designated as Important Bird Areas by Birdlife International. The mainland moor area is considered important for breeding raptors and other moorland birds whilst Scapa Flow is determined to be important for overwintering water birds. Scapa Flow meets the criteria for SPA status but has not yet been designated as such. The Flow meets these criteria both in winter and summer. In winter, two species, Great Northern Diver and Slavonian Grebe, are present in the Flow in internationally important concentrations while a further 11 species are there in nationally important numbers. In summer, observational work has shown that the Flow is the most important feeding area for the Red-throated Divers that nest within the Hoy SPA. On both these grounds, Scapa Flow awaits SPA status.

Moore (2009) gives a preliminary assessment of the conservation importance and potential sensitivity of seabed habitats to renewable energy schemes of the area using the information collected by Marine Scotland. This report concludes that the three species (*Nucella lapillus, Modiolus modiolus* and *Echinus* esculentus) of recognised conservation importance recorded in the Pentland Firth are unlikely to be adversely impacted by renewable energy developments in the surveyed area. The likely impact of renewable schemes on habitats recorded during the survey is considered to be of low significance

with regards to the conservation of biotopes, considered to be of importance at Scottish or UK levels. The biotope recorded at the W2 site is not listed on either the UK Biodiversity Action Plan or the Scottish Biodiversity List.

3.10 Other Sea Users

3.10.1 Fisheries

There is no commercial white fish industry in Scapa Flow, and fishing activity is based around the important shellfish stocks of the area. Scallops (king scallop and queen scallop) are collected either by divers or mechanical dredging. Dredging for the scallops occurs mainly in the centre of Scapa Flow and through Hoxa Sound and diving for scallops occurs mainly around the north and west coasts of Scapa Flow including the W2 area (see below). Shellfish are landed in three harbours around Scapa Flow, none of which are in close proximity to the W2 site.

Satellite information (Scottish Government, pers. comm.) for 2008 indicates that, as would be expected considering its position within Scapa Flow, the W2 site is isolated from fishing grounds worked by vessels greater than 15 m in length and does not sit on any apparent steaming routes for fishing vessels.

The Orkney Fisheries Association (OFA), however, states that some activity may occur in the south of the site. It is known that approximately six smaller creeling vessels make use of the area in which W2 sits. Possible target species for these creelers include lobster, edible crab, green crab and velvet crabs. It is used by a handful of small creel boats, with activity highest in the summer months.

3.10.2 Aquaculture

A large number of aquaculture sites (mainly used for the farming of Atlantic salmon) are located around the coastal fringes of Scapa Flow. However, these are, currently, exclusively around the west and north west coasts of Scapa Flow.

3.10.3 Commercial and Recreational Traffic

Scapa Flow is a designated harbour area under the Orkney County Council Act 1974. Key activities in the Scapa Flow Harbour Area include oil tanker traffic to and from the Flotta Oil Terminal, ship-to-ship transfer operations, gas tankers and ship bunkering operations. Other vessel traffic is likely to include regular ferry traffic, coastal fuel tankers, cargo vessels, and small commercial craft including salmon farm workboats, dive charter vessels and fishing vessels.

The Navigational Risk Assessment (NRA) conducted as part of the site selection process analysed six weeks of Scapa Flow vessel data from summer 2009 and six weeks from winter 2010 (total of 12 weeks). Plots of the vessel tracks in the vicinity of the W2 site showed a total of three tracks[1] passing through the W2 site boundary during the summer period. Two of these were the Orkney Islands Council's Orkney Towage Company tug *Harald* and the third was the yacht *TS Ocean Spirit.* There were no transits of the site in winter, although the pilot vessel Scapa Pathfinder passed close inshore on one occasion (Figure 3.10 and Figure 3.11). The majority of the AIS tracks within Scapa Flow were associated with the Flotta Marine Oil Terminal (mainly tankers and supporting vessels, such as tugs

[1] Shipping in the vicinity of the W2 site was primarily identified using Automatic Identification System (AIS) tracking data. AIS carriage is mandatory for the vast majority of vessels above 300 tonnes. A proportion of smaller vessels also carry it voluntarily.

and pilot vessels). There is an anchor position located 0.72 km to the west of the site boundary, which was in use by the tanker *Maersk Neptune* during the summer survey. There is also a ship-to-ship position located 1.3 km to the WNW of W2.

Small vessel activity that is not represented on AIS, such as fishing and recreational vessels, was obtained from other data sources and consultation. Scapa Vessel Traffic Service (VTS), operated by OIC Marine Services, set-up a recording box covering the W2 site but extending further south (Figure 3.9). The box was defined based on the larger W2 survey area and therefore the count will over-estimate small vessel activity. A total of 10 vessel tracks crossed the box, corresponding to an average of 2 - 3 per week. This indicates small vessel activity at W2 is low, although it is noted that the data currently only cover the spring period.

Figure 3.10 AIS vessel tracks by type passing W2 site (Summer 2009)

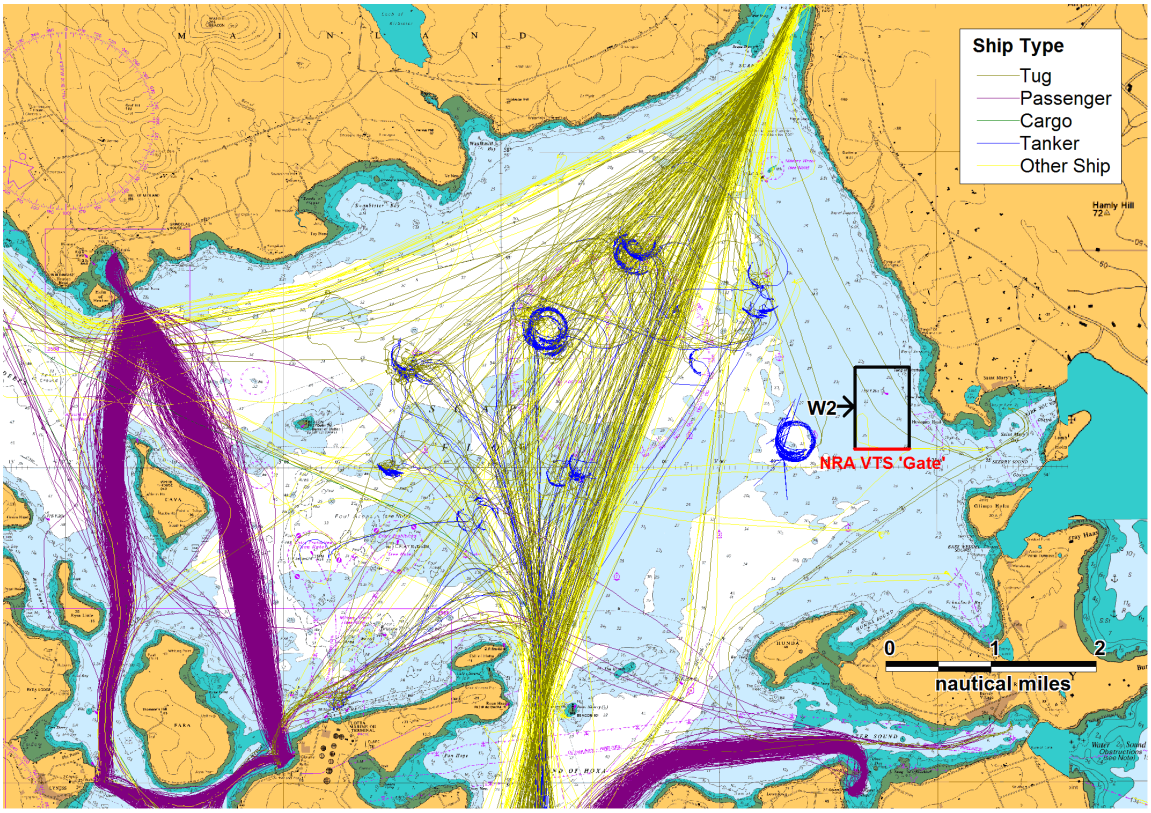
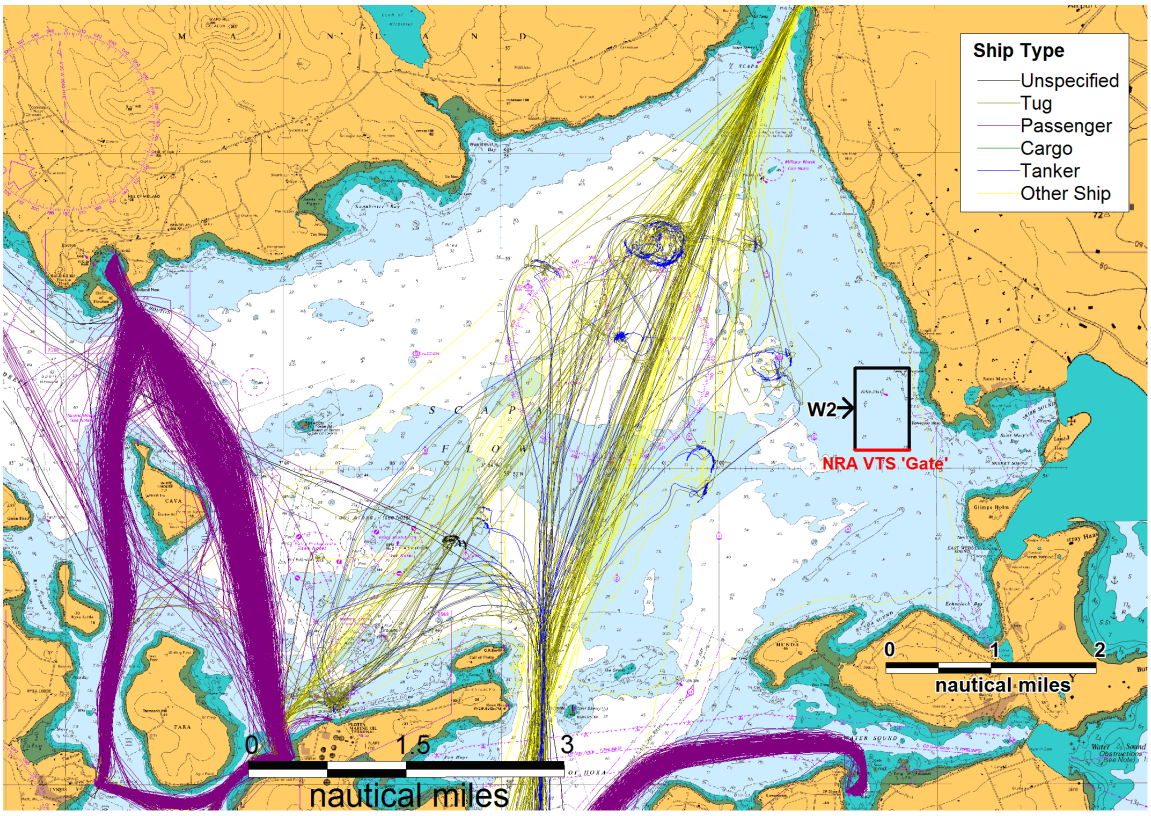


Figure 3.11 AIS vessel tracks by type passing W2 site (Winter 2010)



3.10.4 Recreation

The W2 site and surrounding waters are not a major location for recreational diving, with the Orkney Dive Boat Operators Association stating that the W2 area is not used by dive boats. The NRA notes that dive boats visit wrecks in Kirk Sound and use the pier at Lamb Holm; the W2 site allows access from the south for these activities, which mostly take place in summer months. Sailing vessels are known to pass through the area on passage to and from Stromness marina, but these are occasional movements related to races and are not likely to occur the majority of the time. Recreational vessels, ranging from dinghies to yachts, use Scapa Flow. Indeed, some vessels will transit within or near the W2 site; the RYA indicate this is a lightly-used route. Occasional races also pass through or near the area. The site sits on a popular kayaking route from Scapa to St Mary's Holm but these trips tend to be only in good weather during daylight hours. Some other inshore vessel movements may occur across the south of the site. There is no surfing reported at or near this site.

3.10.5 Archaeology

Scapa Flow was the base for the Royal Navy Home Fleet in both the first (WWI) and second (WWII) World Wars and, as such, a number of both WWI and WWII military remains can be found at points around the coast. As the German High Seas Fleet was scuttled in Scapa Flow at the end of WWI, the remains of relatively intact wrecks are located in the south and west of the Flow, much to the south of W2. Of more site specific interest relative to W2, the remains of HMS Royal Oak is located approximately 4 km to the north.

There is the potential for the presence of submerged landscapes preserved by the accumulation of sediment (Orkney Communities, 2009). However, interrogation of the RCAHMS, Historic Scotland and Local Authority Sites and Monuments Records database (Pastmap, 2010) shows that, whilst there are sites of archaeological interest along the nearby coast, there are no known archaeological sensitivities in the W2 offshore area.

3.10.6 Others

Admiralty charts show a lack of pipelines, cables, foul grounds or wrecks in the W2 area (UKHO, 2010). There are no sea surface military practice and exercise areas (PEXA) in the vicinity of W2, although the area is located in an Air Force PEXA (DECC, 2009).

4 KEY ENVIRONMENTAL SENSITIVITIES

Harbour Seals	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Harbour seals begin to arrive at the breeding grounds in June and most births take place at the end of June and the beginning of July. This seal species moults in August and September. Data from aerial and other surveys indicate that the closest harbour seal haul-out is 3.2 km south at West Burray. The key issues to consider are collision risk and construction/operation/decommissioning disturbance (although SNH comment that although some seals may be present in area this is not a site of concern).												
Grey Seals	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Grey seals begin to arrive at the main breeding beaches towards the middle of September, and pups are born from the end of September until mid-December. Females moult between mid-January to late February, while males moult between mid-February and early April. Data from aerial and other surveys indicate that the nearest known grey seal haul-out is 4.3 km south at West Burray where 5 animals have been observed. The closest grey seal pupping site is located on Flotta, 7.6 km to the south west. The key issues to consider are collision risk and construction/operation/decommissioning disturbance (although SNH comment that despite some seals being present in area this is not a site of concern).												
Harbour Porpoise	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Whilst there are no known resident populations of harbour porpoise in Orkney waters, OBRC data show the harbour porpoise to be the most commonly sighted cetacean in the vicinity of the W2 site. This species has a large ranging nature and it has been suggested that they move offshore during the winter. The key issues to consider are collision risk and construction/operation/decommissioning disturbance.												
Other Cetaceans	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
The minke, long-finned pilot, fin, humpback, sperm and killer whale, Risso's, white-beaked and Atlantic white-sided dolphin, humpback and sperm whales have been sighted in Orkney waters. These species are likely to be sighted in low numbers with variable seasonal occurrence; sightings of most species will be highest between May and October, with the exception of pilot whales which are sighted most often in winter months (Evans, 1997). SNH, during the screening process, commented that Risso's and Atlantic white-sided dolphins have been sighted in the area. The key issues to consider are collision risk and construction/operation/decommissioning disturbance, although it should be noted that there are no known resident populations of cetaceans in the area.												
Birds	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Although bird species are present all year round, the highest population numbers will vary depending on the species. The highest numbers of seabirds are likely to occur between April and September when birds are breeding and fledging. Scapa Flow is a wintering area for species such as Slavonian Grebe and Great Northern Divers, as well as many others. The Bay of Sandoyne to Howquoy is the main area of interest (see Figure 3.9).												
Finfish & Shellfish	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
As with much of Orkney, W2 is located within spawning and nursery areas of a number of fish species. Spawning times vary by species.												
Other Sea Users	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
The NRA showed that fishing activity was low, with activity highest in the summer months. Regarding vessel traffic, the NRA showed few tracks traversing the site in summer but none in winter. Summer months are key for recreational activities.												
Key:	High					Moderate					Low	

Table 4.1 Seasonal variations of key environmental sensitivities

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6 MONITORING AND DATA SOURCES

6.1 Data Available From EMEC

EMEC recognises the importance of environmental monitoring for developers deployed at the intermediate scale test site. Appendix A provides an outline of what monitoring has been undertaken to date, what monitoring is currently taking place and what monitoring is planned for the future. It also discusses who is funding the monitoring, how it is being analysed and identifies potential additional monitoring that might be appropriate for developers to investigate. Further requests for information regarding monitoring and data collection should be directed to Jenny Norris at EMEC.

Appendix B summarises the baseline surface wildlife monitoring data collected for the period 01/06/2010 to 28/02/2011.

The following and additional information as it is acquired will be made available to developers who have signed a Non-Disclosure Agreement with EMEC.

(1) Benthic Survey for the European Marine Energy Centre (EMEC) Ltd. For Crow Taing, Scapa Flow, and Head of Holland, Shapinsay Sound (BIOTIKOS LTD.). This report provides analysis of samples taken in the site area.

(2) Navigation Safety Risk Assessment (NSRA) for St Mary's, Scapa Flow (Anatec).

(3) Geotechnical survey report.

6.2 Other Sources of Environmental Data

The following additional sources of information may be of use to developers:

(1) 'Gates' set up in Scapa Flow at the site to monitor and record vessel traffic in the area. This data would be available to developers to purchase.

(2) Table 6.1 below lists relevant organizations and data (in addition to the data referenced in this report).

Organisation	Information available
British Geological Society	Geological information and publications, hydrogeological information and publications. Seabed sediment reports and maps
Joint Nature Conservation Committee	Marine Nature Conservation Review – sublittoral and coastal survey data
Orkney Biodiversity Records Centre	Report from the OBRC wildlife records database

(3) EMEC has ongoing consultations with the following organizations and appropriate contact details are available:
- Scottish Natural Heritage
- Sea Mammal Research Unit
- Royal Society for the Protection of Birds
- Scottish Environment Protection Agency

- Orkney Islands Council Marine Services
- Orkney Fisheries Association
- Orkney Dive Boat Operators Association
- Orkney Sea Angling Association

APPENDIX A: Monitoring Activities

The following table provides an outline of the monitoring that has taken place to date and that which is planned or in discussion for the future to support development at the intermediate scale test site.

Monitoring Activity	Analysis	Comments
Completed		
E.g. Benthic sampling	*Survey samples sieved and analysed regarding species and abundance*	*Study undertaken to assist in setting up the scale site, no further work deemed necessary unless additional or different types of infrastructure are proposed*
Commenced		
E.g. Marine mammal and bird monitoring	*Power analysis on the ability to detect change in species and abundance using the site area*	*Commenced April 2010*
Potential		
E.g. Marine archaeology and cultural heritage	*Desk based assessment and review of known information and EMEC collected geotechnical data*	

APPENDIX B: Summary of Baseline Surface Wildlife Observations at the Scapa Flow Scale Test Site

Table 1 below summarises the total sightings of the different species of marine mammal observed by month across the observational area for the period 01/06/2010 to 28/02/2011. The counts presented are sighting frequencies as opposed to sighting events and should not be taken as an indication of total abundance of each species at the site. No account has been taken at this stage of specific location of sightings within the test site or possible inaccuracies of sightings due to environmental variables. Figure 1 shows a graphical representation of this data. Detailed analysis of the data using various analytical techniques will be commissioned once a more comprehensive dataset is available.

	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Grey Seal	8	2	8	9	2	12	4	1	1	47
Harbour Porpoise	5	2	2	4	4	2	6	2	0	27
Harbour Seal	0	1	0	0	5	8	15	4	2	35
Unidentified Seal	0	0	1	0	1	4	1	3	1	11
Risso's Dolphin	0	0	0	0	0	1	0	0	0	1

Table 1: Summary of Marine Mammal Sightings at the EMEC Scapa Flow Scale Test Site

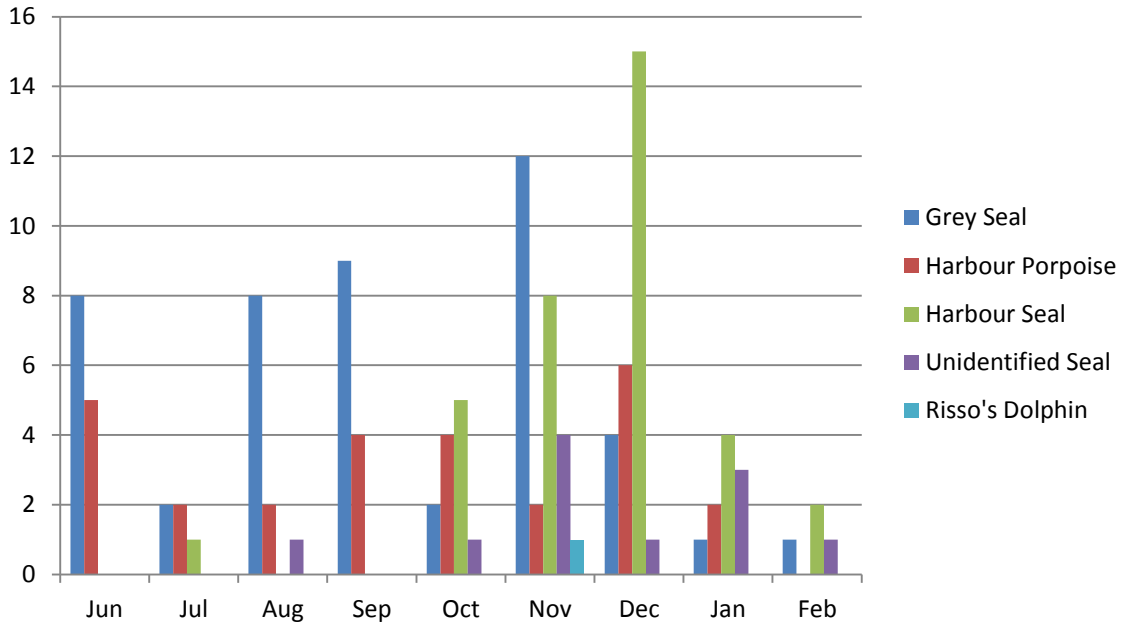


Figure 1: Summary of Marine Mammal Sightings at the EMEC Scapa Flow Scale Test Site

APPENDIX B: Summary of Baseline Surface Wildlife Observations at the Scapa Flow Scale Test Site

Table 2 below summarises the total sightings of the different species of marine birds observed by month across the observational area for the period 01/06/2010 to 28/02/2011. The counts presented are sighting frequencies as opposed to sighting events and should not be taken as an indication of total abundance of each species at the site. No account has been taken at this stage of specific location of sightings within the test site or possible inaccuracies of sightings due to environmental variables. Detailed analysis of the data using various analytical techniques will be commissioned once a more comprehensive dataset is available.

	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Arctic Tern	19	34	0	0	0	0	0	0	0	53
Atlantic Puffin	3	6	3	0	2	2	1	0	1	18
Black Guillemot	195	157	440	221	121	295	87	58	71	1645
Black-legged Kittiwake	0	0	4	10	0	3	1	0	0	18
Black Scoter	0	0	0	0	0	1	1	1	2	5
Black-throated Diver	0	0	0	0	47	81	29	22	8	187
Common Eider	156	51	77	227	308	444	285	140	149	1837
Common Goldeneye	0	0	0	0	0	0	10	5	2	17
Common Guillemot	434	143	89	105	27	31	11	0	0	840
Eurasian Wigeon	0	0	0	0	0	0	100	0	2	102
European Shag	521	212	251	291	108	300	195	71	47	1996
European Storm-petrel	0	0	0	0	3	1	0	0	0	4
Great Black-backed Gull	11	24	8	25	8	51	12	1	10	150
Great Cormorant	0	0	0	0	0	0	1	1	0	2
Great Northern Diver	30	9	7	17	139	835	366	382	239	2024
Great Skua	38	47	14	3	0	0	0	0	0	102
Greylag Goose	0	31	3	525	450	0	35	0	5	1049
Herring Gull	5	0	3	13	2	20	10	9	1	63
Little Auk	0	0	0	0	7	25	6	2	2	42
Long-tailed Duck	0	0	0	0	28	189	207	104	78	606
Manx Shearwater	0	0	2	0	0	0	0	0	0	2

Mew Gull	0	1	2	19	9	114	0	0	2	147
Northern Fulmar	132	144	109	34	0	7	6	143	179	754
Northern Gannet	63	63	38	118	36	45	3	0	0	366
Razorbill	19	4	2	1	7	3	2	4	6	48
Red-breasted Merganser	0	0	0	10	16	29	29	25	10	119
Red-necked Grebe	0	0	0	0	1	3	4	5	4	17
Red-throated Diver	8	7	17	18	4	10	5	0	2	71
Sandwich Tern	1	0	0	0	0	0	0	0	0	1
Slavonian Grebe	0	0	0	0	43	212	141	151	97	644
Unidentified Auk Species	0	13	113	51	60	22	3	10	26	298
Unidentified Diver Species	0	0	0	0	5	0	0	0	0	5
Velvet Scoter	0	0	0	0	2	8	6	38	8	62

Table 2: Summary of Marine Bird Sightings at the EMEC Scapa Flow Scale Test Site

Discussion of Key Environmental Sensitivities

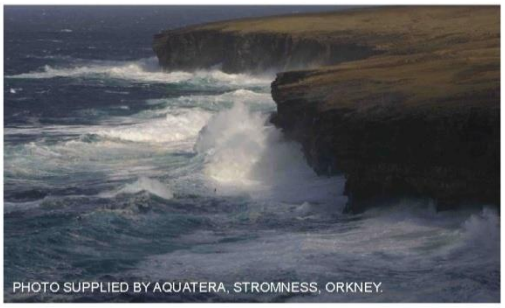
Table 4.1 describes the seasonal variations of key environmental sensitivities at the Scapa Flow scale test site. Any months highlighted in red or orange will be particularly sensitive for each corresponding species and may require appropriate mitigation to be in place by any developer intending to install a device within these periods.

Although some seals have been recorded in the area of the site, SNH have commented that this area is not a site of concern. There have been sporadic sightings of cetaceans within the observation area, in particular Harbour Porpoise and Risso's Dolphin. Scapa Flow is an important wintering area for many species of marine bird, and this can be seen from the increase in observed numbers of some species within the site.

In relation to these species at the sensitive periods, the key issues to be addressed within the developer's environmental monitoring plan are:

- Displacement due to noise (during installation, maintenance, operation and decommissioning of device)
- Displacement due to physical presence of device
- Physical harm caused by collision
- Physical harm caused by entanglement in device moorings
- Physical harm caused by noise

EMEC aims to continue with its wildlife observation programme at the Scapa Flow scale test site, and will also commence a study to determine the baseline acoustic characteristics of the site in April 2011. Outputs from both of these Scottish Government funded programmes will be made available to developers to inform production of their EMP.



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