

Shapinsay Sound Scale Test Site Gravity Base Anchors:

Marine Licence Application – Supporting Documentation

November 2020



Document History

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1 Introduction

Established in 2003, The European Marine Energy Centre (EMEC) Ltd is the first and only centre of its kind in the world to provide developers of both wave and tidal energy converters with purpose-built, accredited open-sea testing facilities. In addition to EMEC's grid-connected sites, EMEC offers real-sea test sites in the less challenging conditions of Scapa Flow and Shapinsay Sound. These sites provide a more flexible sea space helping close the gap from tank testing and acting as a stepping-stone towards larger scale projects. Such accessible real sea testing enables marine energy developers and suppliers to learn lessons more cheaply, reducing the need for large vessels.

The scale sites are suitable for, but not limited to, the following testing activities:

- Device testing
- Component testing
- New tools, techniques and supply chain solutions
- Monitoring corrosion, biofouling and acoustic instrument packages
- Anchoring, cabling, subsea hub and wet-mate connectors
- Installation tests
- Rehearsal activities
- Testing ROVs and vessel activities
- Operation and maintenance tests
- Training
- Health and safety procedures
- Decommissioning trials
- Research projects

EMEC has various infrastructure available to facilitate testing activities. Bespoke test support buoys can be provided, allowing developers to dissipate electricity generated by their devices and record data. Pre-installed anchor points provide mooring options, and an area of seabed is available for rehearsal or deployment of other tools and techniques. Each test site comprises one berth with pre-laid foundation and attachment points. The pre-laid foundations comprise 5m x 5m x 2m gravity-base frames loaded with densecrete blocks for equipment moorings.

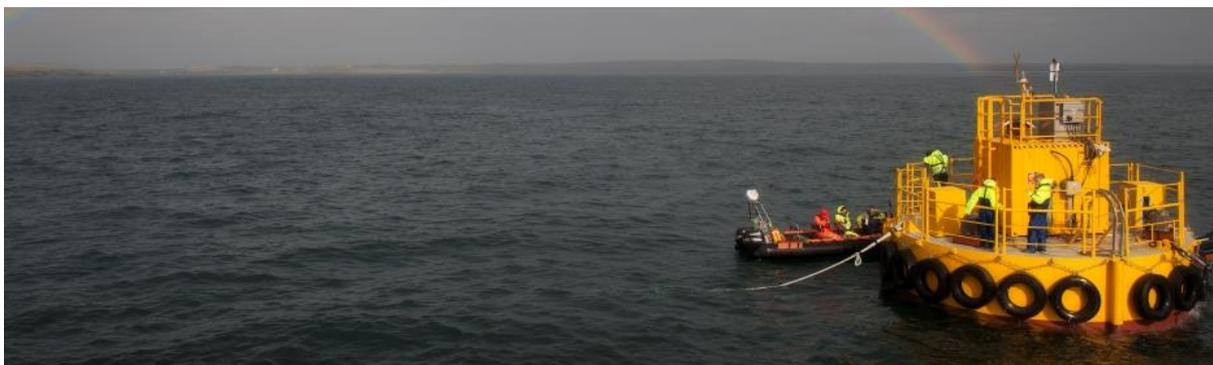


Figure 1. EMEC's test support buoy

This document has been developed to support a marine licence application, under the Marine (Scotland) Act 2010, for the continued deployment and removal of the gravity base anchors at the test site and temporary deployments of an additional gravity base anchor (GBA) when required.

2 Site description

EMEC’s non-grid connected scale test sites are situated adjacent from the Orkney mainland.

2.1 Shapinsay Sound tidal test site

The Shapinsay Sound tidal test site is located offshore from Head of Holland along the south coast of Shapinsay Sound. The significant wave height can reach 2.47m with an average of 0.38m. The site has water depths of between 21-25m and a typical tidal flow of 1.1m/s during spring tides and 0.4m/s during neaps. The area of the test site is approximately 0.36km² (0.4km x 0.9km).

2.1.1 Location

The scale test site is situated offshore from Head of Holland along the south coast of Shapinsay Sound. Table 3 provides the coordinates of the boundary corners of the site.

Table 1. Boundary coordinates (WGS 840 for Scapa Flow scale test site

Test Site	Corner A	Corner B	Corner C	Corner D
Shapinsay Sound	59° 00.45’N	58° 59.72’N	59° 00.20’N	59° 00.00’N
	002° 53.35’W	002° 52.05’W	002° 51.75’W	002° 53.56’W

Figure 2 below shows the location and depth range of the test site. The area within the dark blue rectangle is leased by EMEC from the Crown Estate Scotland for the purpose of operating the scale test site. This marine licence application is for the continued deployment of EMEC’s infrastructure within the boundaries of this area.

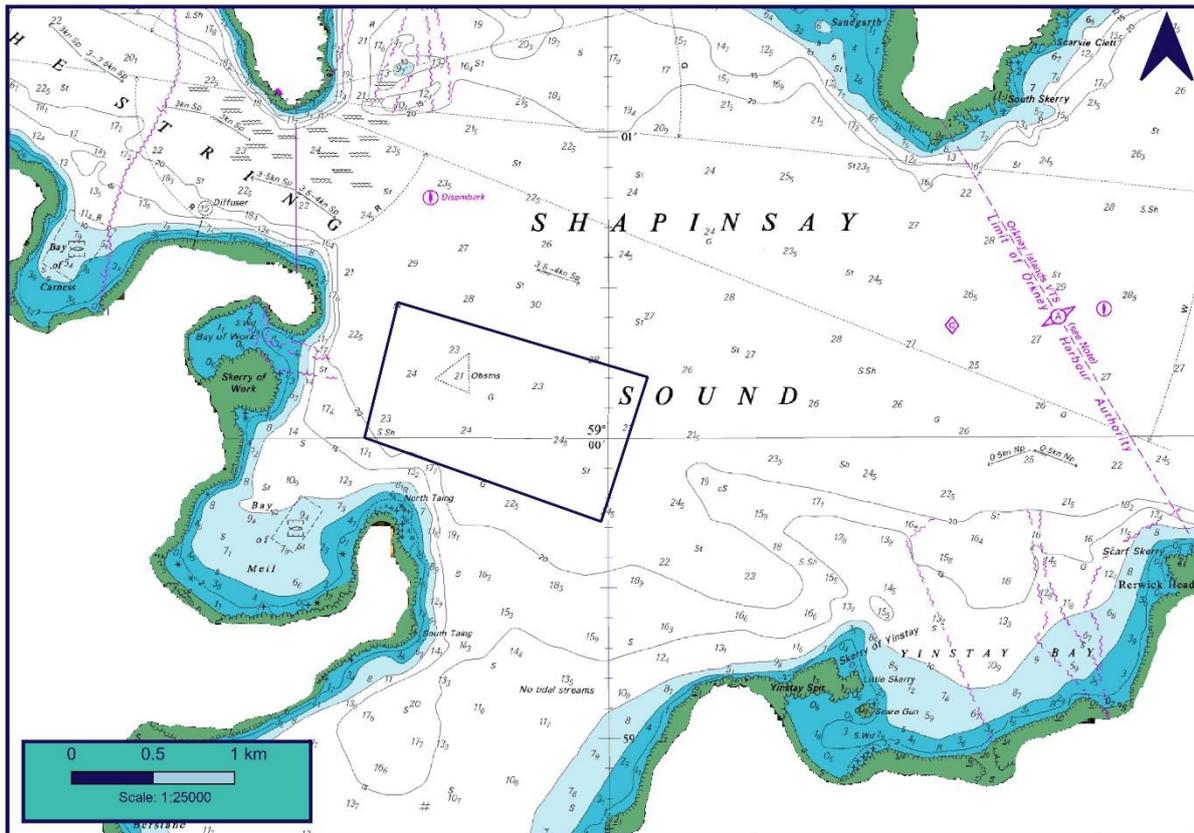


Figure 2. Shapinsay Sound scale test site (marked in dark blue)

2.2 Facilities

The scale test sites offer flexibility to the developers allowing the developers to choose between the following possibilities:

- Use of the leased area, providing own moorings and means of power dissipation
- Use of the leased area and EMEC moorings but providing own power dissipation
- Use of the leased area, EMEC moorings and EMEC test support buoy

2.3 Proposed marine licence boundary

The following figure (Figure 3) shows the proposed marine licence boundary outlined in red and the site boundary outlined in blue.

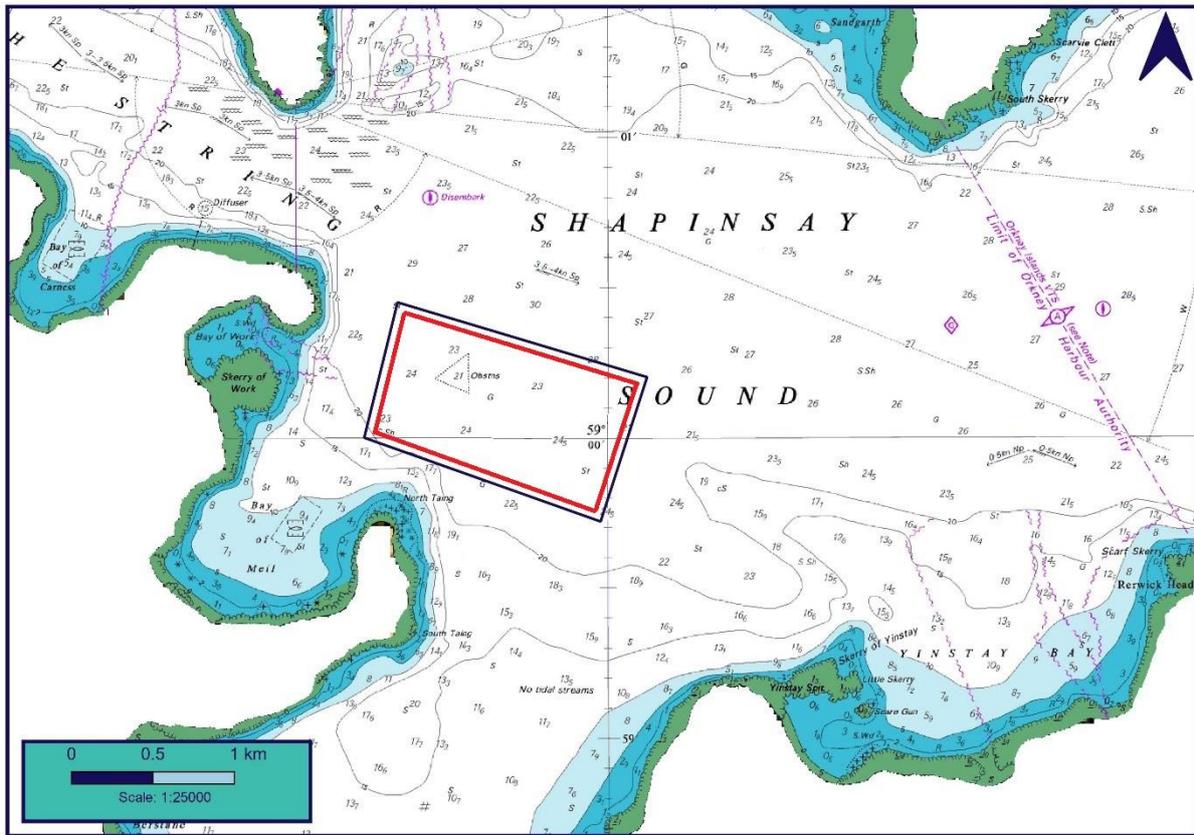


Figure 3. Shows proposed marine licence boundary (red boundary) and site boundary (blue line)

2.3.1 Gravity based anchors

Within the Shapinsay Sound scale test site is three pre-laid foundations with attachment points, otherwise known as gravity base anchors (GBAs). The GBAs comprise 5m x 5m x 2m gravity-based frames loaded with densecrete blocks. The GBAs have been designed and have been utilised to date for equipment, device and infrastructure moorings. They were originally installed at the site with the intention of acting as a ready-to-use berth for device and technology installations that are focusing on device/technology development rather than the seabed attachment mechanisms. However, the number of GBAs utilised and the attachment mechanisms has varied across users. Each GBA has four attachment points with 100mm diameter holes to take shackles for the attachment of device mooring lines. EMEC’s test support buoy is typically moored from three of the permanent GBAs.

The location of each of the GBAs currently deployed at Scapa Flow is outlined in Table 2.

Table 2. Coordinate locations for the deployed gravity based anchors at Shapinsay Sound

WGS84 Mooring Points	Latitude - North		Longitude - West	
	Degrees	Decimal Min	Degrees	Decimal Min
A	59°	12.035'	002°	53.04'
B	59°	09.893'	002°	52.55'
E	59°	15.648'	002°	52.54'

The fourth GBA, which is a temporary deployment, will always be placed within 100m of the three permanent anchors through micro-sitting. This temporary GBA will be removed at the end of the relevant testing schedule.

2.4 Deployment

It is expected that this licence will cover the continued deployment of GBAs A, B, and E. This licence will also cover the deployment of a fourth GBA placed within 100m of A, B, and E. The first deployment is scheduled for January 2021, although this could be delayed slightly, and will be removed after 6-12 months. The schedule for removal of the fourth GBA is dependant on the testing schedule of a novel mooring technology which is covered by another licence.

The fourth GBA will be deployed via a lifting mechanism onboard a multi-cat vessel that will depart from Stromness or Hatston Pier. Two trips out to the site will be required to fully deploy the fourth GBA which should only require one or two days of operations, depending on weather. The marine contractors will follow all necessary precautions as listed in the Environmental Assessment. The blocks will be placed via micro-sitting using a drop-down camera in order to avoid disturbing Priority Marine Features (PMF). The same deployment method will be followed whenever the fourth GBA is required and Marine Scotland will be informed well in advance of any deployment.

2.5 Maintenance schedule

There are various works that may require to be undertaken to ensure the GBAs are maintained in an operable condition. Visual inspections of the infrastructure will be undertaken via drop-cam, ROV survey or a dive survey on a 2-3 year basis. Visual inspection surveys will be undertaken as and when vessels are available and weather conditions are favourable. Depending on other activities that are happening on the site, EMEC will look to conduct simultaneous works in an attempt to reduce the level of vessel traffic onsite.

Marine Scotland will be notified in advance of maintenance activities via a Notice to Mariners.

2.6 Removal and decommissioning

There are no plans to remove the three currently deployed gravity based anchors (A, B, and E) within the lifetime of this licence. The temporary anchor which is being installed as part of this licence will be removed using a lifting mechanism. There will be no debris left on site relating to the temporary GBA once removed.

3 Environmental receptors

An Environmental Description of the site was originally prepared when the site was established. An update of this document is available on request from EMEC, or through it's website (<http://www.emec.org.uk/facilities/scale-test-sites/>)

3.1 Physical conditions

As the Orkney Islands are situated off the north coast of Scotland, they experience high exposure levels with frequent gale force winds and rain. Frequent mobile depressions affect the area with low cloud and rain being the prevailing weather conditions. However, during the winter months, temperatures generally do not fall as low as those experienced across the Scottish mainland; the archipelago of islands benefits from a mild maritime climate.

Water depths across the area compare well with existing Admiralty Chart data, although the 20m contour extends 140m further west than previously thought to be the case. A number of contacts across the area have been identified which were assumed to be boulders or rocks, with the exception of one contact near the centre of the area which may be a wreck.

The site specific benthic survey (Biotikos, 2010) reported that the type of sediment encountered reflects the degree of water movement that the site experiences, with little fines and a variety of rock and shell fragment size. Surficial sediments generally comprised maerl, maerl fragments, coarse sand, shell fragments, large shell fragments and stones. Some Lanice tubes and large stones were present also (Biotikos, 2010).

3.2 Marine mammals

A wildlife observation project commenced at the Scapa Flow test site in April 2010 to gain site description and species data. The observation project was completed in March 2013 as it was deemed that sufficient data had been collected to realise a site characterisation. Fully-trained observers carried out the observations through regular scanning of the test site by telescope (20x - 60x magnification). Further information regarding the observation project can be obtained from the Marine Scotland Information website (<http://marine.gov.scot/>) or can be requested from EMEC.

The following table provides a list of the marine mammal species sighted during the observation project.

Table 3. Marine mammal species counts at the Shapinsay Sound site for the period June 2010 - March 2013 (EMEC, 2013b)

SEALS	Summer	Winter	Total
Harbour seal	145	235	380
Grey seal	174	144	318
Unidentified seal	62	168	230

CETACEANS & OTHER	Summer	Winter	Total
Harbour porpoise	80	45	125
Minke whale	0	0	0
White Sided dolphin	0	0	0
Risso's Dolphin	12	0	12
Orca	5	0	5
Unidentified cetacean	0	0	0
Basking shark	3	0	3
Otter (European)	3	0	3

3.3 Marine birds

The wildlife observation project also captured seabirds sighted across the Scapa Flow test site (EMEC, 2013b). A summary of the observations is provided in the table below.

Table 4. Bird species counts at the Shapinsay Sound site for the period June 2010 - March 2013 (EMEC, 2013b)

BIRDS	Summer	Winter	Total
American Wigeon	0	1	1
Arctic Skua	48	0	48
Arctic tern	2060	0	2060
Black guillemot	9395	7365	16760

BIRDS	Summer	Winter	Total
Black-headed Gull	94	1014	1108
Black scoter	68	285	353
Black throated Diver	0	15	15
Common guillemot	3469	674	4143
Cormorant	191	1727	1918
Diver Sp.	0	66	66
Eider Duck	12590	20770	33360
Fulmar	2462	6567	9029
Gannet	290	324	614
Goldeneye	2	135	137
Great Black-backed Gull	921	1561	2482
Great Crested Grebe	0	3	3
Great Northern Diver	1088	5420	6508
Great Skua	220	3	223
Grey Phalarope	0	1	1
Greylag Goose	5285	2669	7954
Herring Gull	361	1212	1573
Iceland Gull	0	10	10
Kittiwake	142	234	376
Lesser Black-backed Gull	29	2	31
Little Auk	0	5	5
Long Tailed Duck	6117	9197	15314
Mallard	29	355	384
Manx Shearwater	8	0	8
Mew Gull	774	3889	4663
Mute Swan	14	2	16
Northern Shoveler	0	14	14
Puffin	50	2	52
Razorbill	782	81	863
Red Breasted Merganser	478	2294	2772
Red Throated Diver	295	571	866
Sandwich Tern	9	2	11
Shag	7304	17241	24545
Shelduck	113	10	123
Slavonian Grebe	223	2051	2274
Surf scoter	1	9	10
Teal	44	1782	1826
Velvet scoter	1	9	10
Wigeon	44	1782	1826
Unidentified Auk	894	229	1123
Unidentified Diver	1	3	4

BIRDS	Summer	Winter	Total
Unidentified Duck	0	128	128
Unidentified Gull	122	1271	1393
Unidentified Tern	87	290	377
Unidentified Bird	0	0	0

3.4 Fish

Despite few fish studies for the site, generalised statements regarding the fish species present at the site can be inferred from the location of the test site and the known seabed conditions. Species typical of north Scottish waters are expected to inhabit the Shapinsay Sound test site, for instance: pollack *Pollachius pollachius*, saithe *Pollachius virens*, ling *Molva molva*, ballan wrasse *Labrus bergylta* and cuckoo wrasse *Labrus mixtus* (EMEC, 2011). Less abundant species include poor cod *Trisopterus minutus*, goldsinny wrasse *Ctenolabrus rupestris*, conger eel *Conger conger* and cod *Gadus morhua* (which is widely distributed around Orkney in the summer months).

There are also migratory and seasonal species that are expected to inhabit the site, e.g., migratory mackerel *Scomber scombrus*, juvenile and non-spawning adult monkfish *Lophius piscatorius* and gurnard *Triglidae spp.* The site has also overlaps with an area identified as a potential spawning area for commercially important fish species, e.g. herring, lemon sole, sand eels, spratt. Saithe, lemon sole, sandeel and sprat use the area as a nursery ground year-round (Coull *et al.*, 1998).

3.5 Benthos

Moore (2009) report that most sites examined in the Pentland Firth and Orkney area display a community typical of circalittoral tideswept rocky communities. Diversity is low and the community is dominated by a fauna of the acorn barnacle *Balanus crenatus* and the Dahlia anemone *Urticina feline*. The habitats are predominantly sandy, sand-scoured rock or mixed substrates of sand and stones. Considering the location and tidal properties of the site in Shapinsay Sound, it would be expected to support a similar habitat.

The site contained areas of rippled fine or medium sand and mixed substrate areas, with pebbles, cobbles and boulders on a bed of sand. The sandy areas supported a sparse epibiota of portunid crabs, the common starfish *Asterias rubens* and scattered fragments of live maerl. This corresponds to the 'Infralittoral fine sand' biotope (SS.SSa.IFiSa). In the mixed substrate areas the stones were encrusted with barnacles, Pomatoceros (a group of species that deposits calcareous tubes), bryozoans and yellow and red sponges. A patchy turf of the bryozoans *Flustra foliacea* and *Securiflustra securifrons* was also reported. The biota is regarded as a rather poor example of the '*Flustra foliacea* and colonial ascidians on tide-swept exposed circalittoral mixed substrata' biotope (CR.HCR.XFa.FluCoAs.X).



Figure 4. Shapinsay Sound, showing sparse scatter of live epifauna and drift algae



Figure 5. Shapinsay Sound, showing cobbles, boulders and pebbles with erect algae

3.6 Conservation areas

The Shapinsay Sound site is not located within any designated conservation areas. The nearest site is Den Wick SSSI, 8 km from the development site. The site is within approximately 10 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 Shapinsay Sound site and wider Shapinsay Sound area for foraging. It is also important to acknowledge that the test 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 amongst others.

Table 5. Designated sites near to Shapinsay Sound test site

Site and Distance from test site	Details
Mill Dam RSPB Reserve - 4.1 km north north west	Described by the RSPB as an ideal place for birds throughout the year. In summer, large numbers of breeding wildfowl (including pintails, redshanks and wigeons) are present whilst in the winter migrating whooper swans and other birds can be sighted.
Den Wick SSSI - 8 km south east	Designated for its geological interest, Den Wick represents one of the best examples of a multiple till section in Orkney.
Keelylang Hill and Swartabeck Burn SSSI - 8.3 km south west	These moorlands are important for the density and diversity of the bird community they support and in particular for the variety and numbers of birds of prey; more than 18 species of moorland birds breed in the Keelylang/Swartabeck area. Of national importance are the thirty three traditional Hen Harrier sites of which the minimum number occupied in any year is estimated at 7 (~2% of the 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 - 8.3 km south west	The predominant 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 qualifies as a SPA by regularly supporting 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 and the densest in Britain. The short-eared owl is widely dispersed across its British distribution and Orkney Mainland Moors is one of the few sites to support significant numbers.
Mull Head LNR - 8.5 km south east	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.
Hobbister RSPB reserve - 10.8 km south west	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.
Waulkmill SSSI - 11.9 km south west	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, <i>Coleophora vigaureae</i> , occurs here in its only known locality in Orkney. The surrounding areas of mature heather and shrub growth are frequented by breeding moorland birds.

4 Environmental assessment

A full Environmental Impact Assessment has not been completed with respect to this application. As this application is for the continued deployment of infrastructure at the site, with only one additional gravity based anchor, there are not expected to be any additional environmental impacts associated with the works pertaining to this application.

4.1 Environmental monitoring

During the additional gravity base anchor installation and removal, normal precautions will be adhered to. Any necessary changes will be agreed with Marine Scotland in advance.

The following table provides an overview of the proposed mitigation and monitoring measures that will be employed at the site. If there are any unexpected deviations from the proposed measures, these will be reported on no later than 48 hours from the event. Figure 4 provides the location of the designated haul out sites referred to in the proposed measures.

Table 6. Proposed mitigation and monitoring measures

Measure summary	Description
During all vessel movements to and from site, a minimum approach distance will be adhered to when passing designated seal haul-outs.	A distance of greater than 500m from any designated seal haul-out site will be maintained. Such an exclusion zone around haul-out sites will be maintained unless personnel or vessel safety does not permit.
	The sensitive periods for both grey and harbour seals will be considered when planning maintenance work. The sensitive period for grey seals is understood to be between September and December whereas, for harbour seals, it is late May to August.
During all works onsite and vessel movements to and from site, the relevant measures within the Scottish Marine Wildlife Watching Code (SMWWC) will be adhered to.	Vessel speeds will be reduced to 6 knots when marine mammals or birds are sighted within or near transit routes, where personnel or navigational safety is not compromised.
	In the event of a marine mammal approaching a vessel associated with the works, the course of the vessel will be maintained at a steady speed.
	Particular care will be taken to ensure groups and mothers and young are not disturbed/split.
	As stated in the SMWWC, minimum approach distances for vessels will be adhered to.
	Sudden changes in speed, duration and engine noise will be avoided to reduce any disturbance to marine mammals in the vicinity.
	Rafts of birds will not be intentionally flushed.
	If maintenance activity is undertaken during the seabird breeding season (likely to be between April and August), a vessel transit corridor of at least 50m from the shoreline will be maintained.

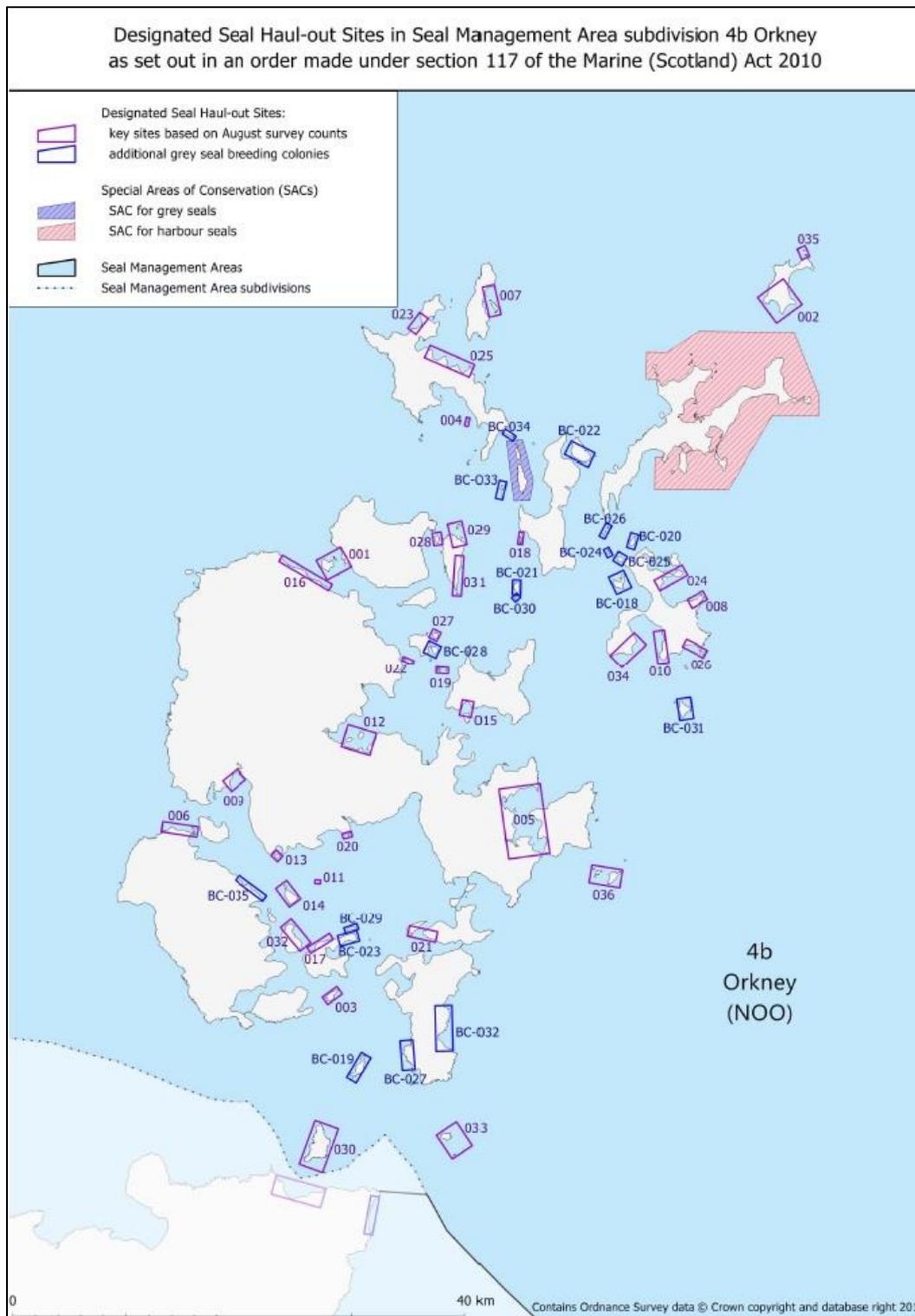


Figure 6. Designated seal haul-out sites in Seal Management Area subdivision 4b Orkney as set out in an order made under section 117 of the Marine (Scotland) Act 2010

5 Navigational risk assessment

A site-wide assessment considering all potential navigational impacts that could occur during operation of a scale test site including the installation, operation, maintenance and decommissioning of a wave device at the Shapinsay Sound test site was conducted. This assessment has been submitted as supporting documentation to this application, see Shapinsay Sound Scale Tidal Site Navigational Risk Assessment (NRA) (EMEC, 2019). As part of the NRA, Automatic Identification System (AIS) and Vessels Monitoring System (VMS) data were used to assess the existing traffic patterns at the test site.

5.1 Shipping and fishing activity/other users

Commercial shipping (mostly tankers) is recorded to the north of the test site. The majority of commercial traffic is associated with cargo transits in and out of the Kirkwall Bay. The majority of commercial vessels on transit are at least 0.2 nm north of the site.

Very few fishing vessels pass through the test area, with the highest densities recorded to the north and west of the site. Those to the west of the site are fish carrier vessels transiting to the aquaculture site within the Bay of Meil. It is known from consultation that smaller vessels may engage in potting very close inshore.

5.2 Assessment

As the site-wide NRA includes EMEC's infrastructure (deployed GBAs and TSB), the assessment will remain true and the appropriate mitigation measures should be applied. These mitigation measures have been summarised in the table below.

Table 7. Embedded mitigation measures

Embedded mitigation measure	Description
PPE Requirement	Maintenance teams to wear suitable PPE when working on the devices, including life jackets.
Training of staff	Staff to be trained to the required standards for their work and have suitable local knowledge of regulations and operations in the Orkney Islands.
ERCoP	ERCoP for site has been developed and agreed with the MCA and SAR bodies.
NTM and Promulgation	In addition to NtM, EMEC's Maritime Safety Information Standard Operating Procedures (SOP) ensures that all key navigational consultees are informed prior to any works. Distribution could include HMCG, Orkney Harbours (available via Orkney Islands Council Marine Services website), Orkney Marina noticeboards (as necessary), Orkney Fisheries Association, Scottish Fisheries Federation and UKHO. Stakeholders are targeted with information about relevant projects based on their activities and location.
Incident monitoring and reporting	EMEC to encourage incident/near miss reporting and monitor any safety issues at the test site. If necessary, risk control to be reviewed. Risk assessments to be reviewed following any incidents.

EMEC Procedures	EMEC has a number of SOPs and standards in place to reduce navigation risks, such as: <ul style="list-style-type: none"> • Task risk assessment; • Control of work <ul style="list-style-type: none"> ○ Permit to work; ○ Permit to access site; • Hazard identification reporting; and • Maritime safety information.
Charting	Site is marked on nautical charts.
Site Monitoring	EMEC's SCADA system provides real-time status information, trends, alarms and remote-control access to facilitate a safe working environment, comprehensive assessment and safe operation of the sites. Note – only relevant if test support buoy is deployed
Liaison with local stakeholders	EMEC regularly liaises with key local stakeholders to identify any potential issues as soon as possible. Regular updates include information regarding upcoming deployments and significant operations at the site.
500m advisory ATBA	A 500m advisory ATBA exists around all test devices located at EMEC test sites.

5.3 Hazard identification and risk

A Hazard Identification and Risk Assessment (HIRA) was conducted as part of the Shapinsay Sound Scale Tidal Site Navigational Risk Assessment (EMEC, 2019). This HIRA included the identification of the hazards and necessary controls associated with the test site infrastructure and deployment of TSB. As this application is for the continued deployment of the GBAs and installation of one additional GBA, it is not expected that an HIRA will be required in connection with any of the work relating to this application.

6 References

EMEC, 2019. Shapinsay Sound Scale Tidal Site Navigational Risk Assessment. European Marine Energy Centre. REP317.

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Annex A: Drawing of Infrastructure

Figure 6 shows the layout of the Shapinsay Sound test site infrastructure. The pink dashed outline is an internal boundary used by EMEC and does not represent the extent of the test site boundary.

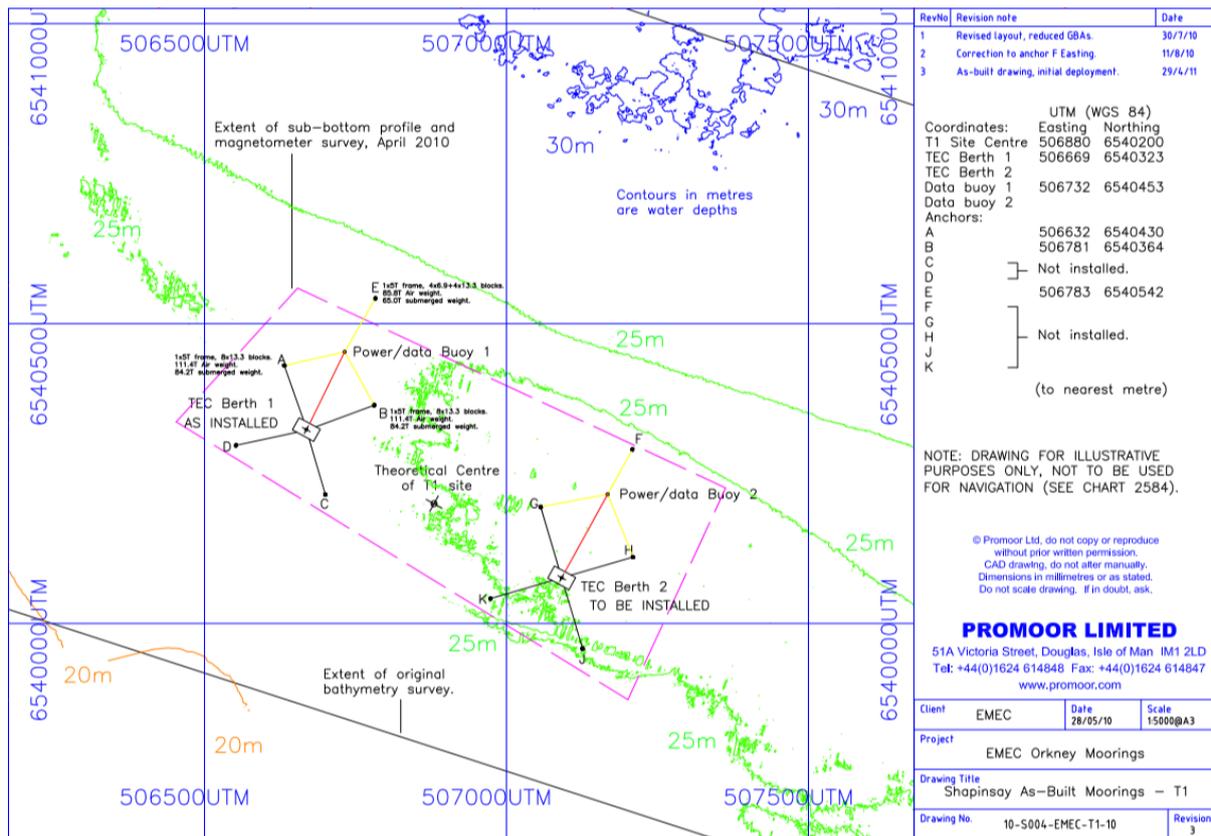


Figure 7. As built layout of the Shapinsay Sound scale test site

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