

10. TEST SITES FOR DEVELOPING TECHNOLOGIES

10.1 Introduction

10.1.1 The Regional Locational Guidance (RLG) for Offshore Wind seeks to illustrate the interactions between areas of planned offshore wind developments with existing users of the sea.

10.1.2 Developments that may occur in the future can be included into the RLG to ensure that in the event of their construction their effect has been already been taken into account.

10.2 Technologies

10.2.1 Technologies used to harvest offshore wind are evolving and will continue to do so. One technological development that could further offshore wind energy development is floating wind turbines. These generate energy from the wind resource but do not require expensive foundations attached to the seabed as do those currently used offshore. Instead these turbines are designed to float and are fixed to the seabed using mooring chains.

10.2.2 Free from fixed foundations the depth range of this technology is greatly increased. Further benefits include reduced visual impact from the coast and a stronger, more constant resource.

10.2.3 This technology is currently at an early stage relative to the rest of the offshore wind industry. Prototypes have been going through the testing process in various locations around the world. Scottish near-shore waters offer a range of locations that could accommodate not only testing sites for these technologies but also enough space to expand the sites to commercial size once the technology proves itself.

10.3 Site Selection Process

10.3.1 To this purpose, sites around Scotland were investigated using GIS for the conditions required to satisfactorily install and test this type of turbines. Conditions investigated, in order of importance were: resource (wind), depth, grid connectivity, distance from coast, , potential for expansion, wave action.

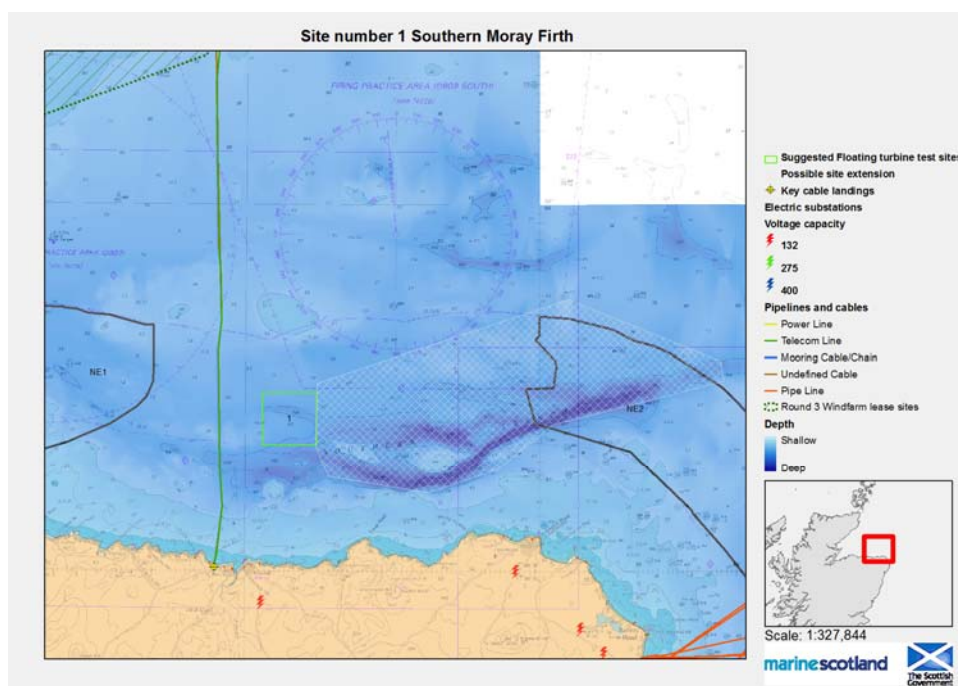
10.3.2 An initial number of sites were picked using the criteria listed above. All sites were chosen initially by spatially selecting:

- depths between 80-120 m;
- wind resource > 9 ms⁻¹ mean annual wind speed;
- relative proximity to electrical substation or cable connection;
- relatively low wave activity; and
- proximity to a harbour.

- 10.3.3 The size of each site was 30 km², chosen to be able to fit 20-30 turbines or 100 MW.
- 10.3.4 Sites in this exercise have been chosen for depths of over 80 m. This approach is more inclusive in terms of technology as some floating turbines require a substantial vertical clearance below water level.
- 10.3.5 If floating turbine technology that does not require such high clearance became the preferred selection of the industry the choices for sites would increase greatly in number.

10.4 Site 1 Southern Moray Firth

Figure 10.1 Southern Moray Firth Site

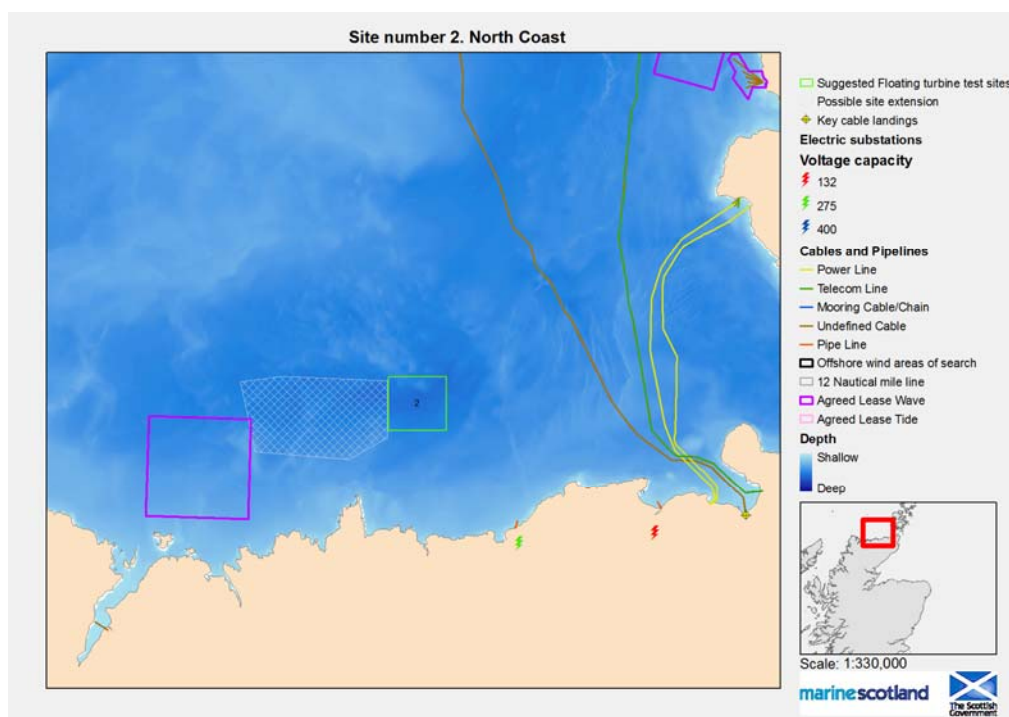


- 10.4.1 This site sits in water of mean depth 80-85 m. Water of the same and higher depth lies to the north east. Distance from shore is approximately 12 Km.
- 10.4.2 The site has mean annual wind speeds of 9.15 ms^{-1} , mean summer wind speeds of 7.09 ms^{-1} and mean winter speeds of 11 ms^{-1} .
- 10.4.3 Wave significant height shows an annual mean of 1.49 m. In summer this is 1.02 m and in winter 1.87 m.
- 10.4.4 Conditions that fall within the required parameters exist along this trench to the east up till offshore wind area of search North East 2 (NE2).
- 10.4.5 Connection could potentially be achieved co-using the telecom cable infrastructure that exists approximately 4 km west of site 1 and meets land at Banff.
- 10.4.6 Electrical substations can be found at Macduff and further east at Fraserburgh. Both these have a 132V capacity.
- 10.4.7 Commercial expansion could be realised in an easterly direction along the deep Moray Firth trench, as marked with the gridded polygon in Fig 10.1.
- 10.4.8 Principal expected constraints from other users of the sea would be from fishing (scallop, nephrops and squid) and shipping in and out of Peterhead and Fraserburgh harbour.

10.4.9 Automatic Identification System (AIS) data from 2010 shows that shipping is heavier towards the middle of offshore wind area of search NE2 than at its north extent, so developments would be less constrained by shipping in the expansion area suggested.

10.5 Site 2 North Coast

Figure 10.2 North Coast Site

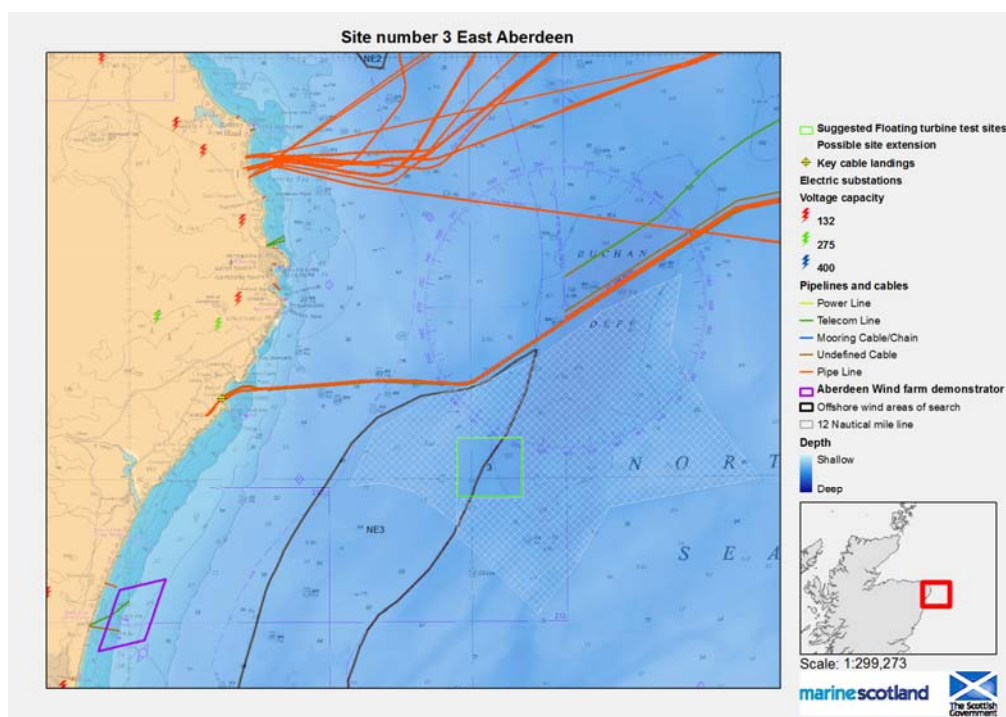


- 10.5.1 Site 2 sits in water of between 90-116 m depth.
- 10.5.2 Wind resource is good with annual wind speeds of 9.25 ms^{-1} . Summer mean wind speeds are 6.95 ms^{-1} and winter mean speeds 11.08 ms^{-1}
- 10.5.3 Wave annual mean significant height is less than 2 m. This shows a mean of 1.2 m in summer months and 2.5 m in winter months.
- 10.5.4 Submerged power line cables exist at 27 km east. These connect the Scottish mainland to Orkney and meet land at the mid and eastern extent of Thurso Bay.
- 10.5.5 Substations can be found 13 km south east at sites located 10 km west of Thurso (275 V) or in Thurso itself (132 V)
- 10.5.6 This site is 13 km east of the Farr point wave demonstration lease site. This potentially opens avenues for collaborative use of technical resources.
- 10.5.7 Constraints in this site will predominantly come from shipping as a busy route crosses east-west through this site. This factor may limit the potential for commercial expansion to anywhere but an easterly direction within the 70+ depth contour.
- 10.5.8 To a lesser degree of constraint there is a seasonal herring fishery from late summer to autumn in this general area.

10.5.9 Further east tides increase to high levels as the site gets closer to the Pentland firth.

10.6 Site 3 East Aberdeen

Figure 10.3 East Aberdeen Site



- 10.6.1 This site has an average depth of 95 m and it is situated 21 km south west of Peterhead on the north east coast.
- 10.6.2 Wind resource is strong with an annual mean of 9.5 ms^{-1} . This drops in summer to a mean of 7.45 ms^{-1} and rises to a mean of 11.5 ms^{-1} in winter months.
- 10.6.3 Mean wave height is around 1.79 m, although the summer mean is around 1.23 m and the winter mean is 2.29 m.
- 10.6.4 Four electrical substations exist in relatively close proximity at 23-27 km in the vicinity of Peterhead. Two of these are 275 V and two are 132 V.
- 10.6.5 Between Newburgh and Aberdeen lies the Aberdeen Bay wind turbine test centre.. This possibly presents an option to share technical resources.
- 10.6.6 Another cable landing currently not being used exist at Peterhead (23 km from site). North of Aberdeen a further six substations exist at distances between 40 and 50 km from site 3, voltages are mostly 132 V.
- 10.6.7 Harbour facilities could be provided at Aberdeen or Peterhead.
- 10.6.8 Shipping is of low density where this site is located. AIS data averaged over one week from January, March, July and September 2010 gives eight vessel movements per week.

10.6.9 Scallop dredging occurs in the vicinity of this site.

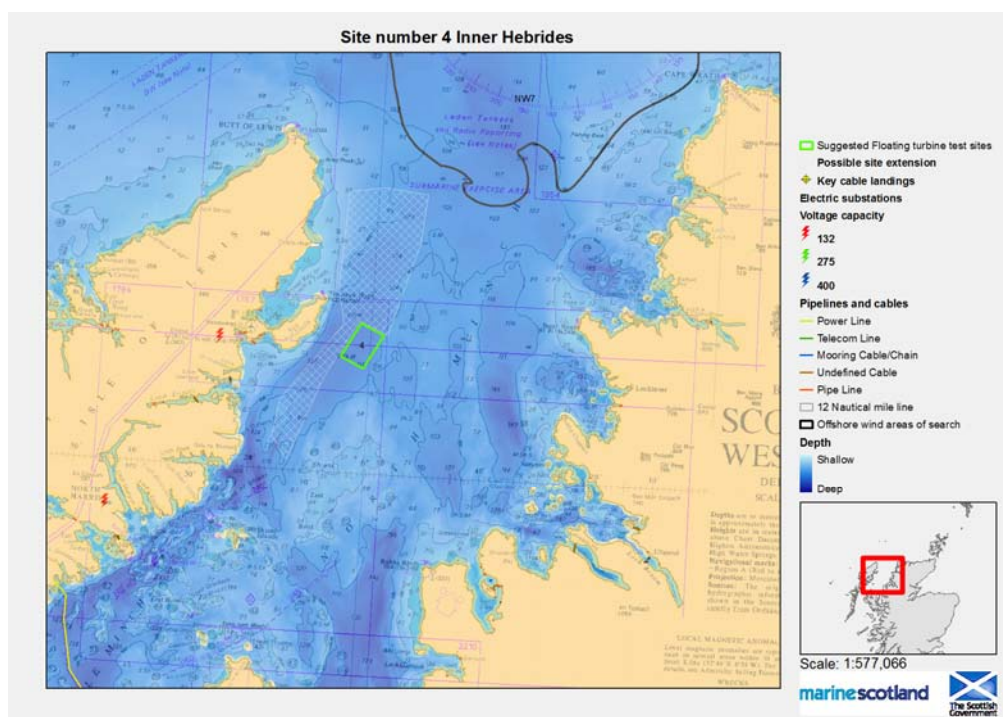
10.6.10 Pelagic vessels fish for herring in late summer and autumn close to this site.

10.6.11 Safety and personnel transport helicopter routes for the offshore oil and gas industry exist to the north of this site and would present an interaction to expansion in an eastward direction.

10.6.12 Potential for commercial expansion is good with suitable water depths within the north of area of search North East 3 (NE3). Also to the north east and east, limited possibly, in the north east, by the eastward pipeline and submerged power cable.

10.7 Site 4 Inner Hebrides

Figure 10.4 Inner Hebrides Site



- 10.7.1 Depth at this site is higher than sites 1-3, with an average depth of 115 m.
- 10.7.2 Wind resource is good with an annual mean wind speed of 9.3 ms^{-1} . Seasonal variability makes the wind speed in summer less at 7.5 ms^{-1} and higher in winter at 11.11 ms^{-1} .
- 10.7.3 Mean annual wave height is 1.5 m. In summer this is 1.04 m and in winter 1.9 m.
- 10.7.4 A 132 V substation exists south of Stornoway. Data available shows a possible location for connectivity south west of site 4, the suitability of this connection would have to be investigated further.
- 10.7.5 Constraints exist from fishing, there is an active mobile nephrops, seasonal pelagic and creel brown crab fishery and to a lesser degree a scallop fishery within the area chosen.
- 10.7.6 Shipping may also present a lesser constraint as site 4 is located at a less busy section of the North Minch shipping passage.
- 10.7.7 Military activities, mainly submarine exercises are performed in the general North Minch area, data suggests the risk of interaction is low.
- 10.7.8 The location of site 4 is overlapped by the 17 km safety buffer from the Stornoway civil aviation aerodrome.

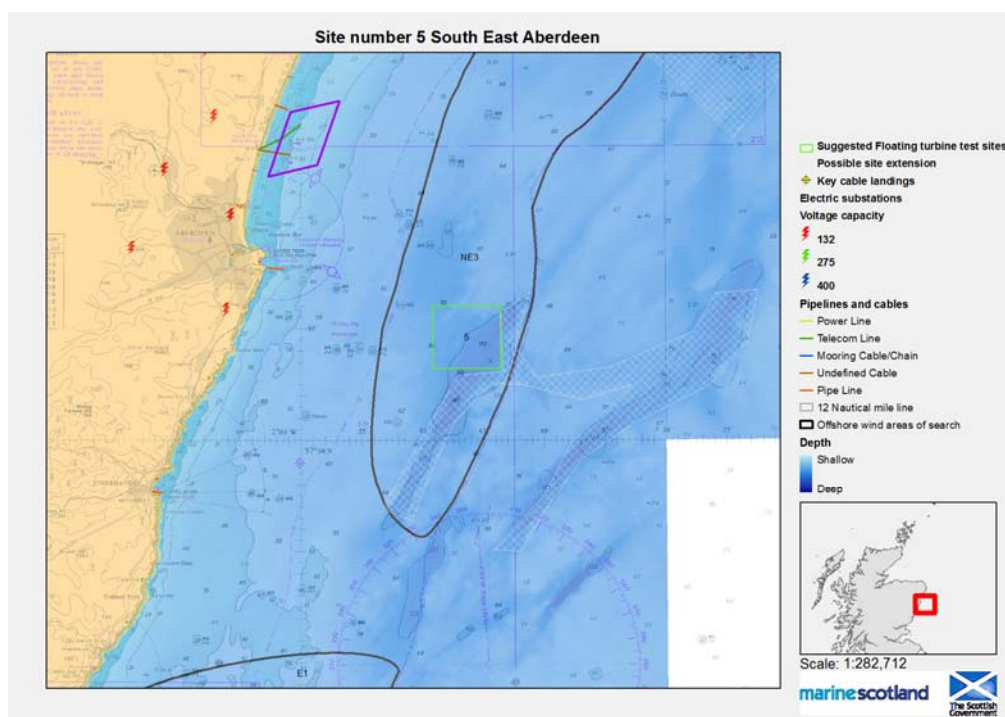
10.7.9 Recreational sailing takes place within the Inner Hebrides, but UK wide surveys of RYA members have revealed that up to 80% have not found the presence of offshore wind turbines disturbing to their sailing experience.

10.7.10 The depth required for commercial expansion exists to the north and to the south. Wind resource is suitable all through the North Minch channel but reduces in the areas closer to land.

10.7.11 Interest in the general area in the North Minch has been expressed by other enterprises with a view to establishing a floating turbine test centre. It is not known at this time if any definite sites will go forward but should this occur the possibility of co-operation and technical resource sharing would become an option.

10.8 Site 5 South East Aberdeen

Figure 10.5 South East Aberdeen Site



10.8.1 This site has an average depth of 87 m and in some charts is known as the "Dog hole".

10.8.2 The wind resource shows a mean annual wind speed of 9.33 ms^{-1} . Summer wind speed is 7.3 ms^{-1} which rises to a mean of 11.3 ms^{-1} in the winter months.

10.8.3 Site 5 lies squarely inside offshore wind area of search North East 3 (NE3)

10.8.4 Wave significant height has a mean annual height of 1.54 m, a summer mean significant height of 1.05 m and a winter mean significant height of 1.94 m.

10.8.5 Connectivity options are numerous with electrical substations available in the vicinity of Aberdeen city. The closest are at 17 km from the site with four others at between 24-28 km all these run at 132 V. A 275 V substation lies north west of Aberdeen at approximately 30 km.

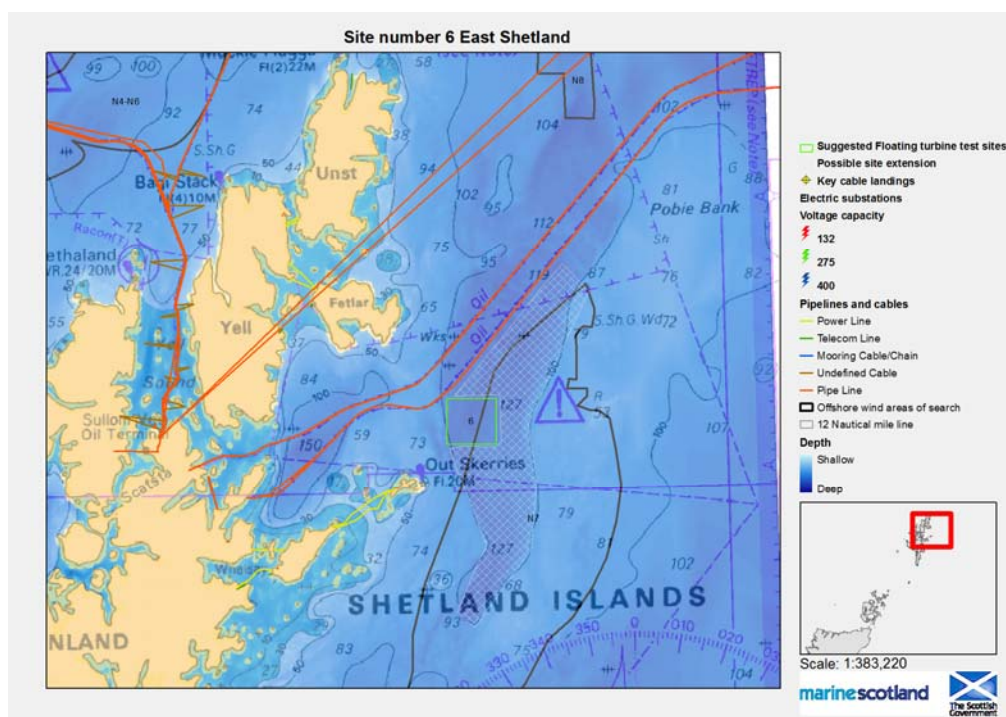
10.8.6 Seazone data reveals that disused cable landings exist in Aberdeen Bay 20 km from site 5.

10.8.7 This site lies entirely within area of search NE3 as recognized through the scoping study for offshore wind. Constraints generated by other users of the sea have been deemed of an acceptable level for developments to go ahead within this area.

- 10.8.8 Harbour facilities could be provided at Aberdeen.
- 10.8.9 Shipping is of low intensity at this site despite its proximity to Aberdeen harbour.
- 10.8.10 Fishing in this area that may present a potential constraint is scallop dredging. The 2007-2011 amalgamated fishing intensity data show that this is the only fishing that overlaps with site 5. Although this should not discount variable seasonal fisheries like herring or squid.
- 10.8.11 Recreational sailing data from the Royal Yachting Association shows some light use sailing tracks cross through this area.
- 10.8.12 The extent of potential radar interference calculated at 140 m height extends over site 5.
- 10.8.13 Constraints potentially exist from aviation as the 30 km buffer zone for civil aviation aerodromes overlaps the western half of this site.
- 10.8.14 This site could be expanded by utilising the deep stretch of water that extends from the eastern flank of site 5 in a south west direction.
- 10.8.15 Another stretch of suitably deep water exists approximately 15 km from site 5 and is connected via a channel of around 80 m depth. This space could provide additional room for expansion.

10.9 Site 6 East Shetland

Figure 10.6 East Shetland Site



- 10.9.1 This site sits over the deepest water of all chosen sites at an average of 130 m depth.
- 10.9.2 Wind resource is strong with an annual mean of 10.51 ms^{-1} . The summer wind speed averages at 7.95 ms^{-1} and the winter speeds at 12.67 ms^{-1} .
- 10.9.3 Wave annual mean height is 2.3 m. In summer this is 1.43 m and in winter 2.88 m.
- 10.9.4 The eastern part of site 6 lies within area of search N7, the easternmost Shetland area identified in the offshore wind scoping study. This option has not been included entirely into area N7 to gain more
- 10.9.5 No electrical substations are available in the Shetland isles according to National Grid data.
- 10.9.6 Power cable landings exist 7 km south west at the Outer Skerries, also further on the same line south west between Whalsay and the mainland at 22 km.
- 10.9.7 Port facilities will be available at these locations.
- 10.9.8 The most obvious constraints will be generated by the pipelines that lie directly north of this site and carry hydrocarbon products to Sullom Voe terminal from offshore oil and gas platforms.

- 10.9.9 The Shetland isles have an active and varied fishing industry. The pelagic landings alone make up a substantial proportion of the weight and the value landed in Scotland annually. Demersal fishing is also highly active around the suggested site. In addition to this, to a lesser degree, dredging and diving for scallops, trawling for squid and creeling for lobsters mean fishing is an important constraint to be considered at this location.
- 10.9.10 Areas of cultural heritage would have to be considered also prior to any development taking place as sensitive coastal archaeology and protected ship wrecks exist in site 6. A draft and a possible SAC extent is currently under consideration due east of site 6.
- 10.9.11 An obvious area for expansion presents itself to the north and to the south of this site where the depths are consistently above 100 m. The same constraints exist as with site 6 to the potential area of expansion, ie: pipelines and fishing activity.