



Brims Tidal Array Ltd Project Intertidal Survey Report

Intertidal Survey Report

Scottish and Southern Energy Renewables and
OpenHydro

V2: 21st July 2014

Final Report

PB2561



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SUMMARY

Royal HaskoningDHV has been commissioned by Scottish and Southern Energy renewables (SSER) and OpenHydro to undertake an intertidal survey in relation to the proposed Brims Tidal Array Ltd (BTAL) project. The purpose of this study was to map intertidal communities in and near to the development site, and assess the importance of them to nature conservation.

The intertidal survey was undertaken by two Royal HaskoningDHV ecologists on 21st – 23rd August 2012.

The survey aimed to identify intertidal habitats and species, with particular regard to notable or rare habitats or species that were present within the study area. Then the survey aimed to make recommendations with regard to the planned work and identify any further surveys that may be necessary. The findings of this survey will be used to inform the EIA process for the project.

The survey identified four biotopes of conservation importance. However, whilst important, they are all relatively common around the UK.

Large areas of the coast were inaccessible for health and safety reasons, therefore these could not be surveyed.

Recommendations are made to mitigate the potential impacts of the development to the intertidal communities identified. This primarily consists of a construction method statement with regard to sensitive intertidal communities.

After viewing the display boards at Burstall a few weeks ago, I was asked to fill out a feedback form. I had two main points; firstly I asked if, while planning the route of the buried cables anyone had sought a joint project with any other utilities, such as BT for the laying of optic fibres to rural areas. Secondly I asked if the tree screen areas around the site would be accessible to the public, with a right to roam... This would provide an excellent resource to the local population at little cost, and might encourage a positive attitude to further development in the area.

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1 INTRODUCTION

1.1 Purpose of report

Scottish and Southern Energy Renewables (SSER), a wholly owned subsidiary of Scottish and Southern Energy together with OpenHydro intends to develop a tidal energy conversion array in the Pentland Firth, located off the north of Scottish mainland. Royal HaskoningDHV were commissioned by SSER and OpenHydro to conduct onshore ecological studies in support of an Environmental Impact Assessment (EIA) for the proposed development. This document reports on the intertidal survey conducted by Royal HaskoningDHV, which will be used to inform the EIA.

All species names, both scientific and common, are taken from the Marine Life Information Network MarLIN (www.marlin.ac.uk) or in the case of seaweeds, from the Seasearch Guide to Seaweeds of Britain and Northern Ireland (Bunker *et. al.*, 2010) unless otherwise stated.

1.2 The proposed development

BTAL is a 50-50 partnership between SSE Renewables UK Limited (SSER) and OpenHydro to jointly develop the Brims tidal site. The aim of the Project is to harness tidal energy to generate clean, renewable electricity on a commercial scale from the specific site within the Pentland Firth and Orkney Waters.

BTAL was awarded an Agreement for Lease by the Crown Estate in November 2008, which gives exclusive rights to develop the Brims site to the south of Hoy, Orkney with an installed capacity of up to 200MW.

The preferred technology to be installed on the site is OpenHydro's Open Centre Turbine (OCT). However, alternative technologies are also being considered as part of the consenting strategy.

Installation will require associated electrical infrastructure including an export cable coming ashore, landfall and onshore cable corridor to an onshore substation. BTAL's consent application will not include the onshore substation or onward connection to the grid, which is the responsibility of SHE-T and will be subject to its own application. The onshore substation is, however, likely to be located in the footprint of the onshore cable corridor area of search.

1.3 Scope of works

The intertidal survey is comprised of four objectives which collectively enable a preliminary ecological assessment of the study area to be undertaken and include:

- The identification of the habitats and communities present within the survey area (Figure 1.1);
- The identification and location of the presence of any rare or protected species within the study area boundaries,
- The provision of target notes of each biotope, including characterising, rare, protected and non-native species encountered; and
- The production of digitised maps showing the location of identified biotopes.

This survey was completed in conjunction with an Extended Phase 1 Survey (Royal HaskoningDHV, 2012a) which assesses the terrestrial habitats inshore of the intertidal survey (**Figure 1.1**), as well as a dedicated otter survey, which is reported in (Royal HaskoningDHV 2012b).

1.4 Conditions during survey

The survey was completed during low water spring tides on the 21st to the 23rd of August 2012. Weather was variable throughout the survey period ranging from moderate north westerly winds with heavy rain during the morning of 21st and 23rd to calm sunny periods on the afternoon of the 22nd. The conditions did not inhibit the surveyors in any way.

Sea state remained calm (seastate 1 or 2) throughout the survey and tidal conditions during the survey are shown in **Table 1.1**.

Table 1.1 Tidal conditions experienced during the intertidal survey

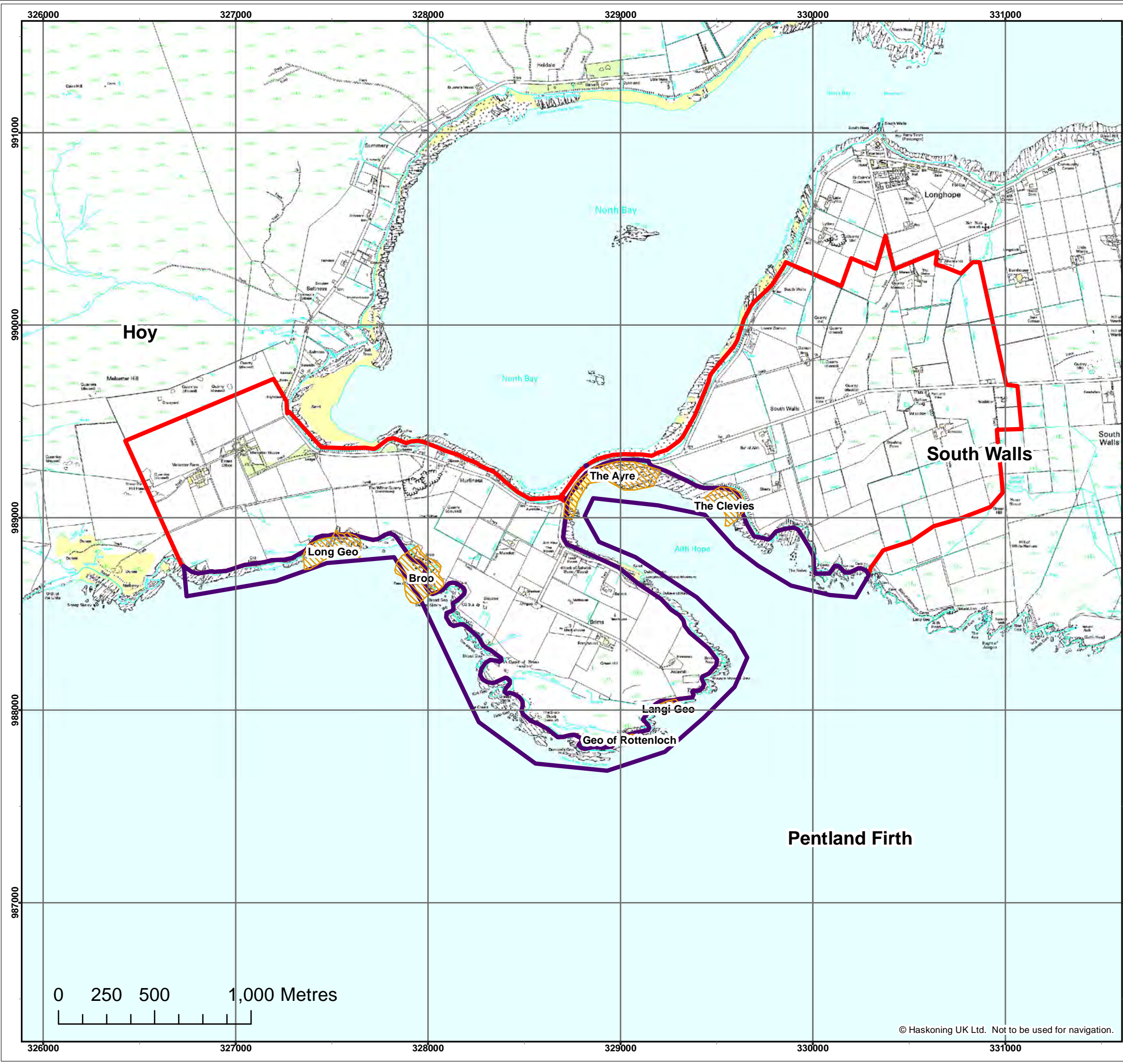
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	Time (BST)	Height (m)	Time	Height	Time	Height
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22 th	06:50	0.9	14:53	3.1	19:21	1.1
23 rd	07:58	1.0	15:37	3	20:33	1.2

1.5 Study area

The Extended Phase 1 Habitat Survey was conducted over the area outlined in red in **Figure 1.1**. Hereafter, this area shall be referred to as the 'study area'.

1.6 Limitations

Access was restricted in areas that featured large cliffs, these were mainly in the most eastern and western extents of the survey area. (**Figure 1.1**). Where access was not possible an attempt was made to view the intertidal area from the cliff top. Where a line of sight could not be established from the cliff top, biotopes have not been assigned. If a line of sight was achieved then biotopes were assigned based on what could be viewed through binoculars and experience from other parts of the nearby survey area.



Legend:

- Potential landfall locations
- Onshore study area
- Intertidal study area

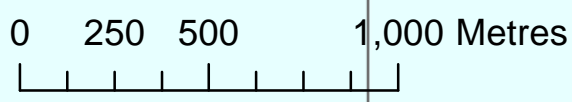
Client:	Project:
BTAL	Brims Tidal Array

Title:
Survey Areas, Landfall and Substation Locations

Figure: 1.1	Drawing No:				
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2 METHODOLOGY

The field survey was completed by two experienced ecologists operating on foot, using a number of methods and techniques, based upon those specified in the Countryside Council for Wales (CCW) report 'CCW Handbook for marine intertidal Phase 1 mapping' (Wyn *et al.*, 2000) and the 'Marine Nature Conservation Review: Rationale and methods' (Hiscock, 1996).

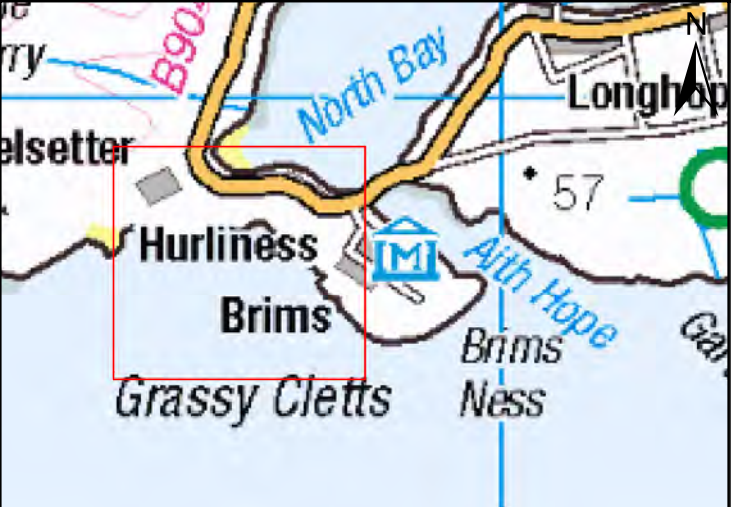
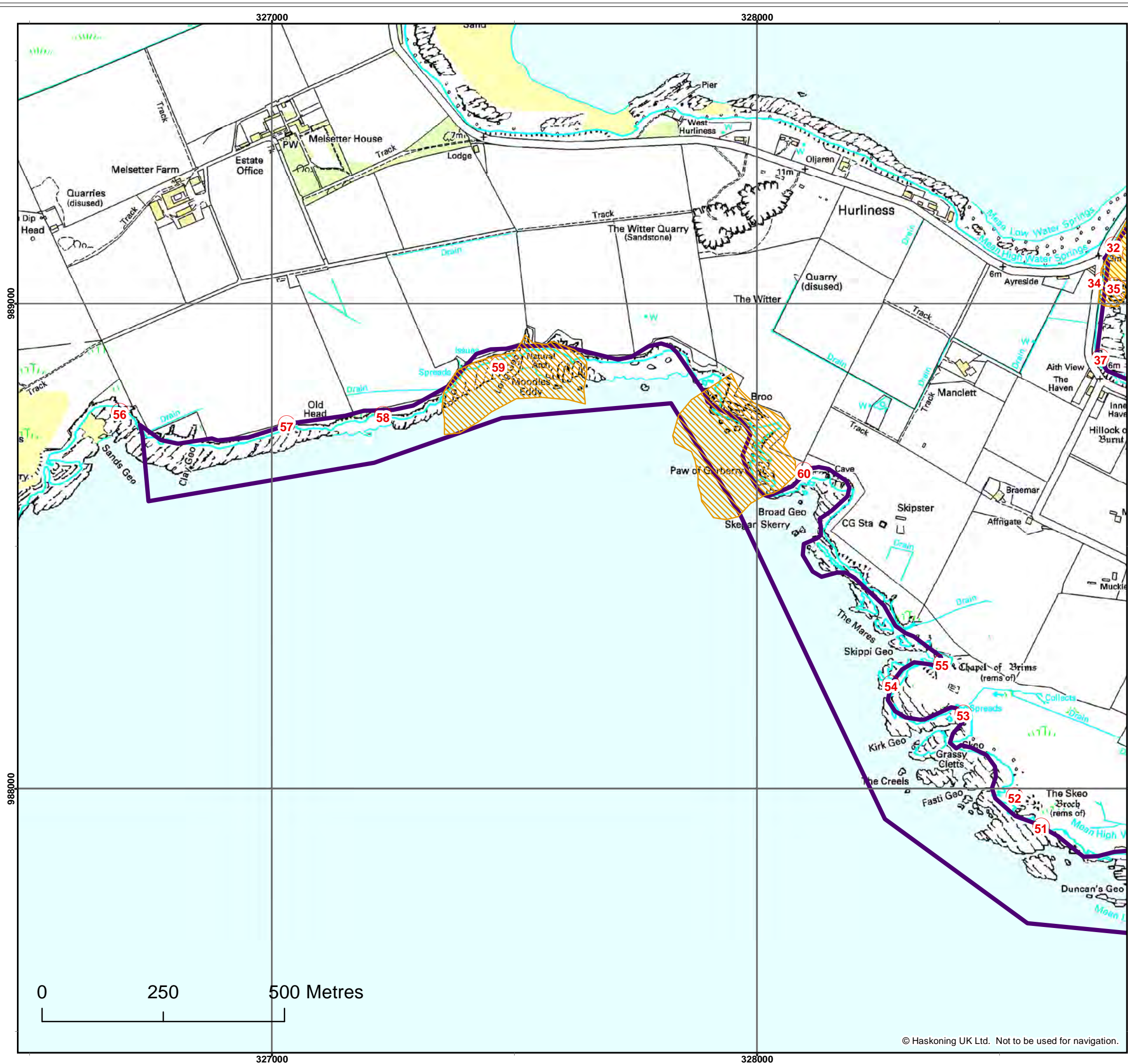
Target notes (**Appendix A**) were recorded and photos taken wherever a change in either the biological zonation or physiological conditions appeared to occur. A hand held Garmin Global Positioning System (GPS) was used to provide positioning data for each target note which were then mapped using ArcGIS 10 after the survey was completed.

A biotope code should be associated with each target note using the Marine Habitat Classification for Britain & Ireland (v04.05) (Connor *et.al.*, 2004). This was conducted using a combination of methods including the use of Bioscribe tool and the online search facility available on the JNCC website.

3 RESULTS

3.1 Main findings

A total of 60 target notes were recorded within the study area during the intertidal survey, the locations of which are presented in **Figures 3.1** and **3.2**, with details of the notes provided in **Appendix A**.



Legend:

- Potential landfalls locations
- Intertidal study area
- Target notes

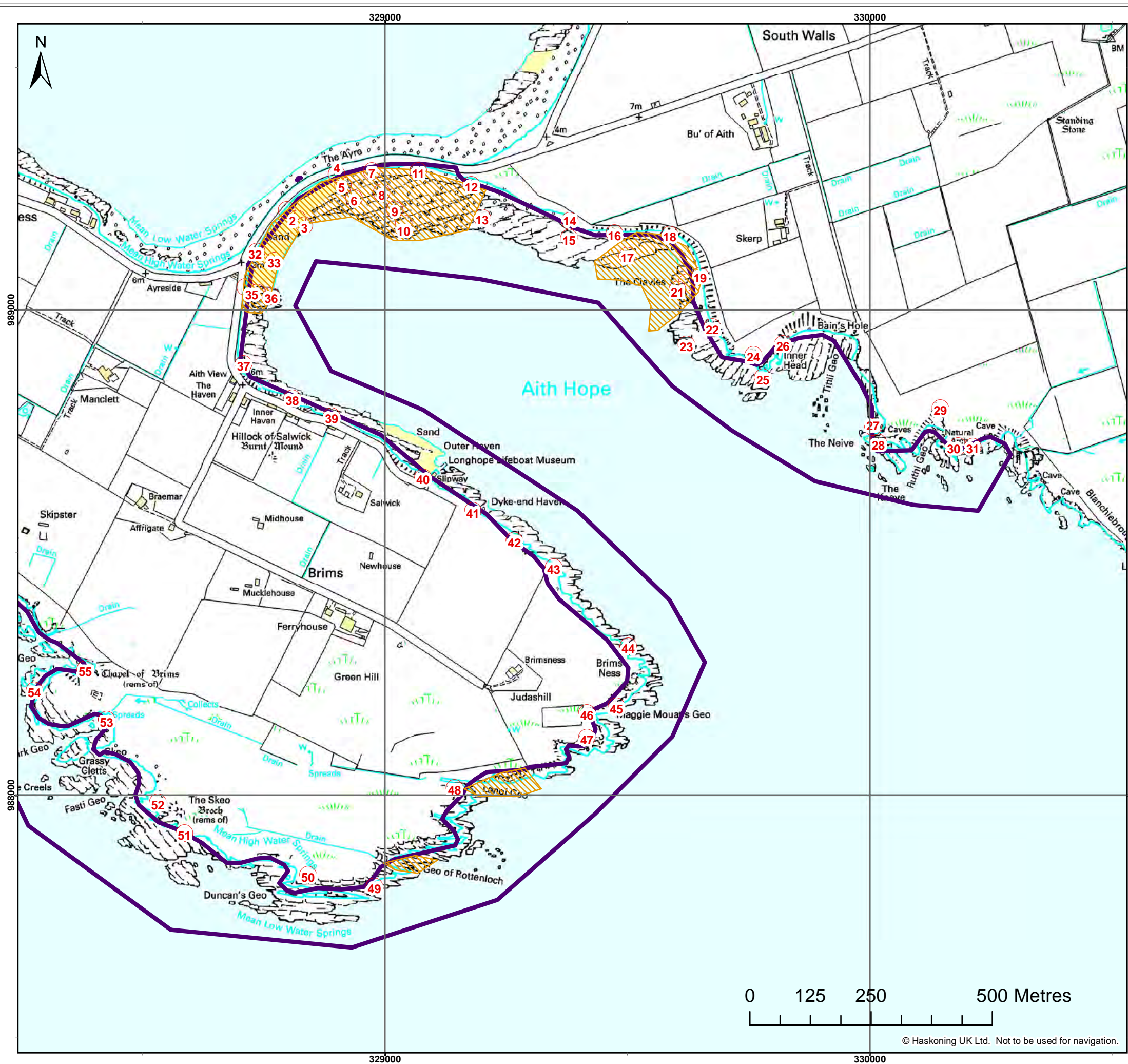
Client:	BTAL	Project:	Brims Tidal Array
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Title: Target Note Locations (Western Part of Study Area)

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Legend:

- Potential landfalls locations
- Intertidal study area
- Target notes

Client:	Project:
BTAL	Brims Tidal Array

Title: Target Note Locations
(Eastern Part of the Study Area)

Figure: 3.2	Drawing No:				
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00	19/09/12	DCT	JT	A3	1:8,000
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The intertidal zone, within the study area, was composed of a mixture of substrates, ranging from solid bedrock in the more exposed locations, through to cobbles and sand in the more sheltered environments of Aith Hope. The range of habitats supported a large mixture of biotopes some of which such as the barren shingle and sand supported very few species and others such as the bedrock and boulder biotopes supported a large number of species.

3.2 Biotope mapping

34 different biotopes were recorded over the 60 different target notes (**Table 3.1**). Often multiple biotopes were recorded within a single target note and therefore 88 biotope positions were recorded. The locations of biotopes recorded during the survey are displayed in **Figures 3.3 to 3.5** below.

Table 3.1 Biotopes recorded during the intertidal survey

Biotope	Description	Target Note locations identified
IR.HIR.KFaR.Ala.Ldig	<i>Alaria esculenta</i> and <i>Laminaria digitata</i> on exposed sublittoral fringe bedrock	5
IR.HIR.KSed	Sand or gravel-affected or disturbed oarweed (<i>Laminaria digitata</i>) and seaweed communities	2
IR.MIR	Moderate energy infralittoral rock	2
IR.MIR.KR.Ldig.Bo	<i>Laminaria digitata</i> and under-boulder fauna on sublittoral fringe boulders	1
IR.MIR.KR.Ldig.Ldig	<i>Laminaria digitata</i> on moderately exposed sublittoral fringe rock	9
LR	Littoral rock	1
LR.FLR.Eph.EntPor	<i>Porphyra purpurea</i> and <i>Enteromorpha</i> spp. on sand-scoured mid or lower eulittoral rock	2
LR.FLR.Lic	Lichens or small green algae on supralittoral and littoral fringe rock	1
LR.FLR.Lic.Ver	<i>Verrucaria maura</i> on very exposed to very sheltered upper littoral fringe rock	5
LR.FLR.Lic.Ver.Ver	<i>Verrucaria maura</i> on very exposed to very sheltered upper littoral fringe rock	2
LR.FLR.Rkp	Rockpools	1
LR.FLR.Rkp.G ^{so}	Green seaweeds (<i>Enteromorpha</i> spp. and <i>Cladophora</i> spp.) in shallow upper shore rockpools	1
LR.HLR	High energy littoral rock	3
LR.HLR.FR.Him ^{so}	<i>Himantalia elongata</i> and red seaweeds on exposed to moderately exposed lower eulittoral rock	1
LR.HLR.MusB.Cht.Cht	<i>Chthamalus</i> spp. on exposed upper eulittoral rock	2
LR.HLR.MusB.Sem.FvesR	<i>Semibalanus balanoides</i> , <i>Fucus vesiculosus</i> and red seaweeds on exposed to moderately exposed eulittoral rock	4
LR.HLR.MusB.Sem.Sem	<i>Semibalanus balanoides</i> , <i>Patella vulgata</i> and <i>Littorina</i> spp. on exposed to moderately exposed eulittoral rock	9
LR.LLR.F.Asc.FS	<i>Ascophyllum nodosum</i> on full salinity mid eulittoral rock	5
LR.LLR.F.Fserr.X	<i>Fucus serratus</i> on full salinity lower eulittoral mixed substrata	1
LR.LLR.F.Fspi.X	<i>Fucus spiralis</i> on full salinity upper eulittoral mixed substrata	1
LR.LLR.F.Fves.X ^{so}	<i>Fucus vesiculosus</i> on mid eulittoral mixed substrata	7
LR.LLR.F.Pel	<i>Pelvetia canaliculata</i> on sheltered littoral fringe rock	1

Biotope	Description	Target Note locations identified
LR.MLR.BF.Fser.Bo ^{*∞}	<i>Fucus serratus</i> and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders	4
LR.MLR.BF.FspiB	<i>Fucus spiralis</i> on exposed to moderately exposed upper eulittoral rock	1
LR.MLR.BF.FvesB	<i>Fucus vesiculosus</i> and barnacle mosaics on moderately exposed mid eulittoral rock	2
LR.MLR.BF.PelB	<i>Pelvetia canaliculata</i> and barnacles on moderately exposed littoral fringe rock	1
LR.MLR.MusF	Mussels and fucoids on moderately exposed shores	1
LS	Littoral sediment	1
LS.LCS	Littoral coarse sediment	4
LS.LCS.Sh	Shingle (pebble) and gravel shores	2
LS.LCS.Sh.BarSh	Barren littoral shingle	2
LS.LMx	Littoral mixed sediment	1
LS.LSa.FiSa.Po	Polychaetes in littoral fine sand	1
LS.LSa.MoSa.BarSa [∞]	Barren littoral coarse sand	1
LS.LSa.St	Strandline	1

* UK Bap habitat, ∞ Habitats Directive.

A summary of the biotopes within the study area is presented below and the details of all target notes recorded in the field are presented in **Appendix A**. The summary below starts at the western end of the study area and works east. Note the target notes within **Appendix A** do not follow this pattern; they presented in the chronological order in which they were taken.

The western most end of the study area was characterised by large cliffs, often over 20m in height. Although the intertidal was accessed at Target Note (TN) 56, outwith the study area, further access was not possible until TN 55. At TN 56 a large, accessible, wave cut platform was present (**Plate 1**), however, further to the east this petered out and the sea met the cliffs even at low water (**Plate 2**).



Plate 1. Large wave cut platform at TN56 **Plate 2.** High sandstone cliffs

Although direct access was not possible to this stretch of coastline the intertidal could occasionally be viewed from above using Bushnell 8 X 42 H20 Binoculars. From two vantage points it was clear that the intertidal area was almost vertical. Although there is less confidence when using this remote method, based on results from other nearby

locations we can be reasonably confident that the main biotopes along this stretch of coastline are likely to be “*Fucus spiralis* on exposed to moderately exposed upper eulittoral rock (LR.MLR.BF.FspiB) in the upper shore and “*Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock” (IR.HIR.KFaR.Ala.Ldig) in the lower shore.

One exception to this general habitat type and set of associated biotopes was noted at Moodies Eddy and Long Geo (**Figure 3.3**), where the cliffs were shorter (approximately 5m) and less steep. The intertidal area at this point extended for approximately 20m and although not accessed directly, the shore appeared to be relatively species poor, with a large *Verrucaria* zone in the uppershore (FLR.Lic.Ver), a midshore dominated by barnacles (LR.HLR.MusB.Sem.Sem) and patches of bare rock and a lower shore supporting dabberlocks *Alaria esculentus* oarweed (IR.HIR.KFaR.Ala.Ldig). Oarweed was probably also present, but not recorded.

In the middle of Moodies Eddy, Long Geo cuts back further inland. This is a long narrow boulder filled geo and although the view was obstructed, it was thought that the intertidal area does not extend far into the geo.



Plate 3. Moodies Eddy viewed from the west
Plate 4. View down Long Geo.

Further along the coast at Broad Geo the cliffs are again very high, approximately 30m and access to the intertidal area was not possible. However, when viewed from the cliff top, on the western side of the geo there was only a very narrow intertidal zone as the steep cliffs plunged straight into the sea.

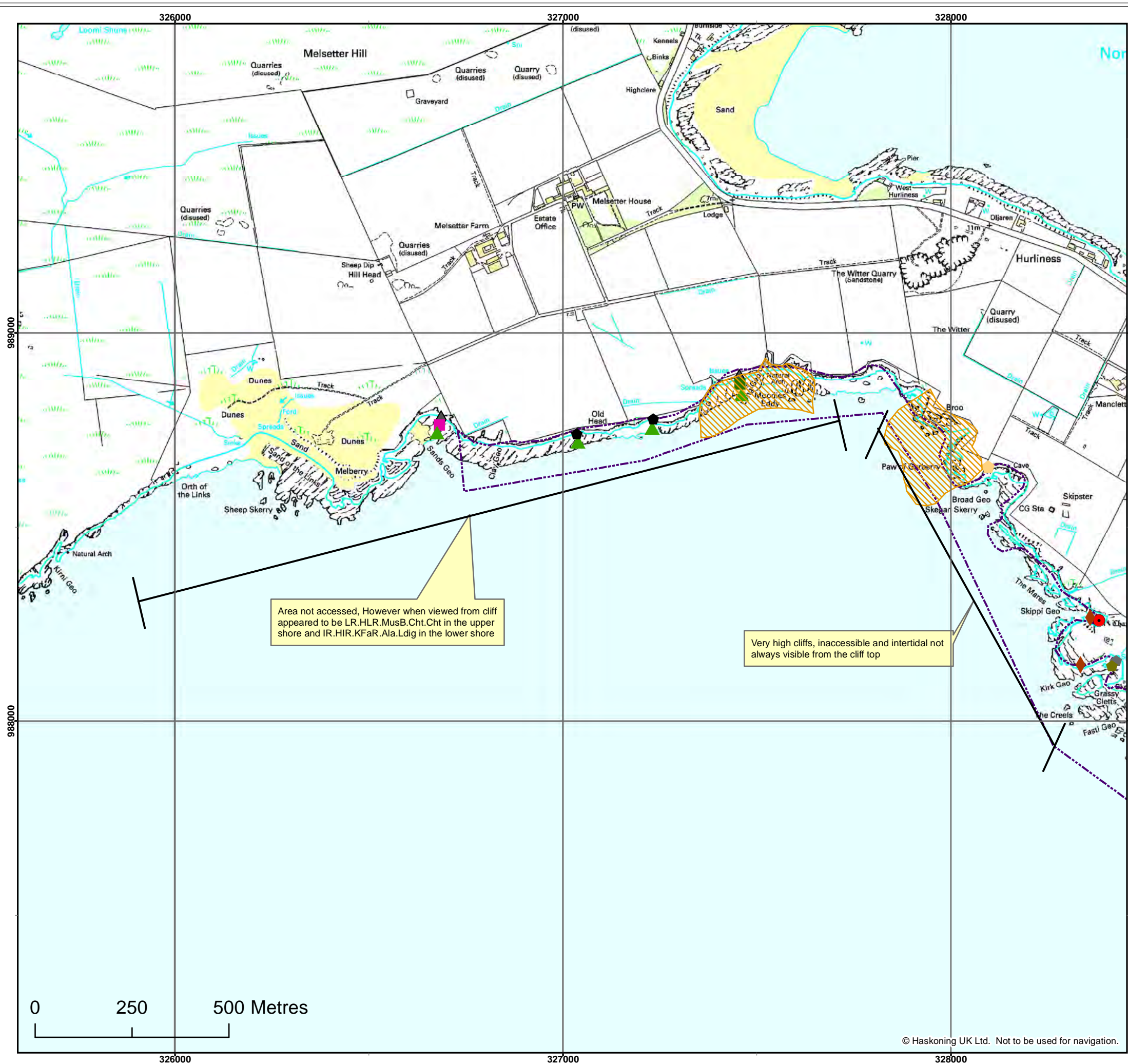
As the coast line turned north the height of the cliffs become less and access to the shore was possible at Skippi Geo (TN 55 **Plate 5**). Although this is long relatively sheltered geo the presence of large mats of purple laver *Porphyra sp.* indicated that this area is regularly disturbed by the sea. The boulder beach at this location supported low biodiversity (**Plate 6**).



Plate 5. Skippi Geo at TN55

Plate 6. Uppershore boulder beach with low biodiversity

From Skippi Geo to the most southerly point of the Brims peninsular the coastline becomes very broken with a complex of small islets, bays and inlets, which resulted in a complex matrix of different intertidal biotopes over a very small area. Access without contravening the risk assessment was not possible for safety reasons on the cliffs and as a result this area was surveyed remotely, at low resolution. However, the target note taken at 49 (**Figure 3.2** and **Appendix A**) is thought to be widely representative of most of this area. Here biotopes ranged from “*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed eulittoral rock” and “green seaweeds (*Enteromorpha* spp. and *Cladophora* spp.) in shallow upper shore rockpools” (LR.FLR.Rkp.G) in the upper shore, to “*Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock” (IR.HIR.KFaR.Ala.Ldig), in the lower shore.



Legend:

- Potential landfalls locations
- Intertidal Study Area

Target notes

- LR.HLR.FR.Him
- LR.HLR.MusB.Cht.Cht
- LR.HLR.MusB.Sem.FvesR
- LR.HLR.MusB.Sem.Sem
- LR.LLR.F.Asc.FS
- LR.LLR.F.Fserr.X
- LR.LLR.F.Fspi.X
- LR.LLR.F.Fves.X
- LR.LLR.F.Pel
- LR.MLR.BF.Fser.Bo
- LR.MLR.BF.FspiB
- LR.MLR.BF.FvesB
- LR.MLR.BF.PelB
- LR.MLR.MusF
- LS
- LS.LCS
- LS.LCS.Sh
- LS.LCS.Sh.BarSh
- LS.LMx
- LS.LSa.FiSa.Po
- LS.LSa.MoSa.BarSa

Biotope Code

- IR.HIR.KFaR.Ala.Ldig
- IR.HIR.KSed
- IR.MIR
- IR.MIR.KR.Ldig.Bo
- IR.MIR.KR.Ldig.Ldig
- LR
- LR.FLR.Eph.EntPor
- LR.FLR.Lic
- LR.FLR.Lic.Ver
- LR.FLR.Lic.Ver.Ver
- LR.FLR.Rkp
- LR.FLR.Rkp.G
- LR.HLR

Client:	Project:
BTAL	Brims Tidal Array

Title: Intertidal Survey: Biotopes (Western Part of Study Area)

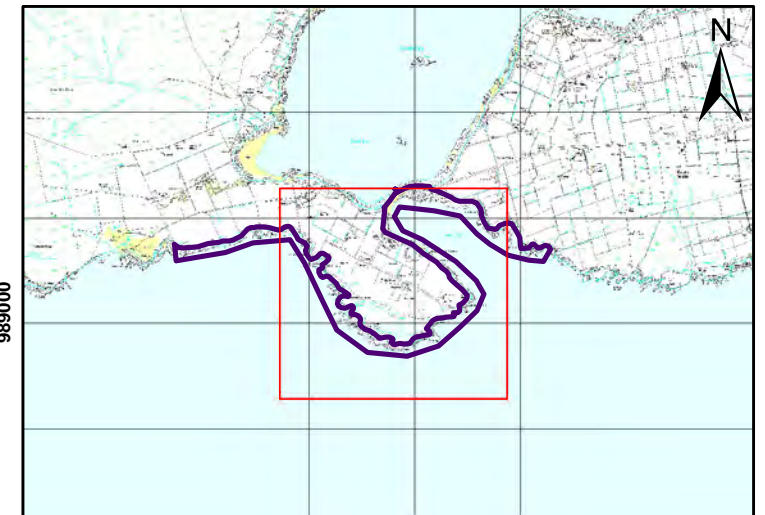
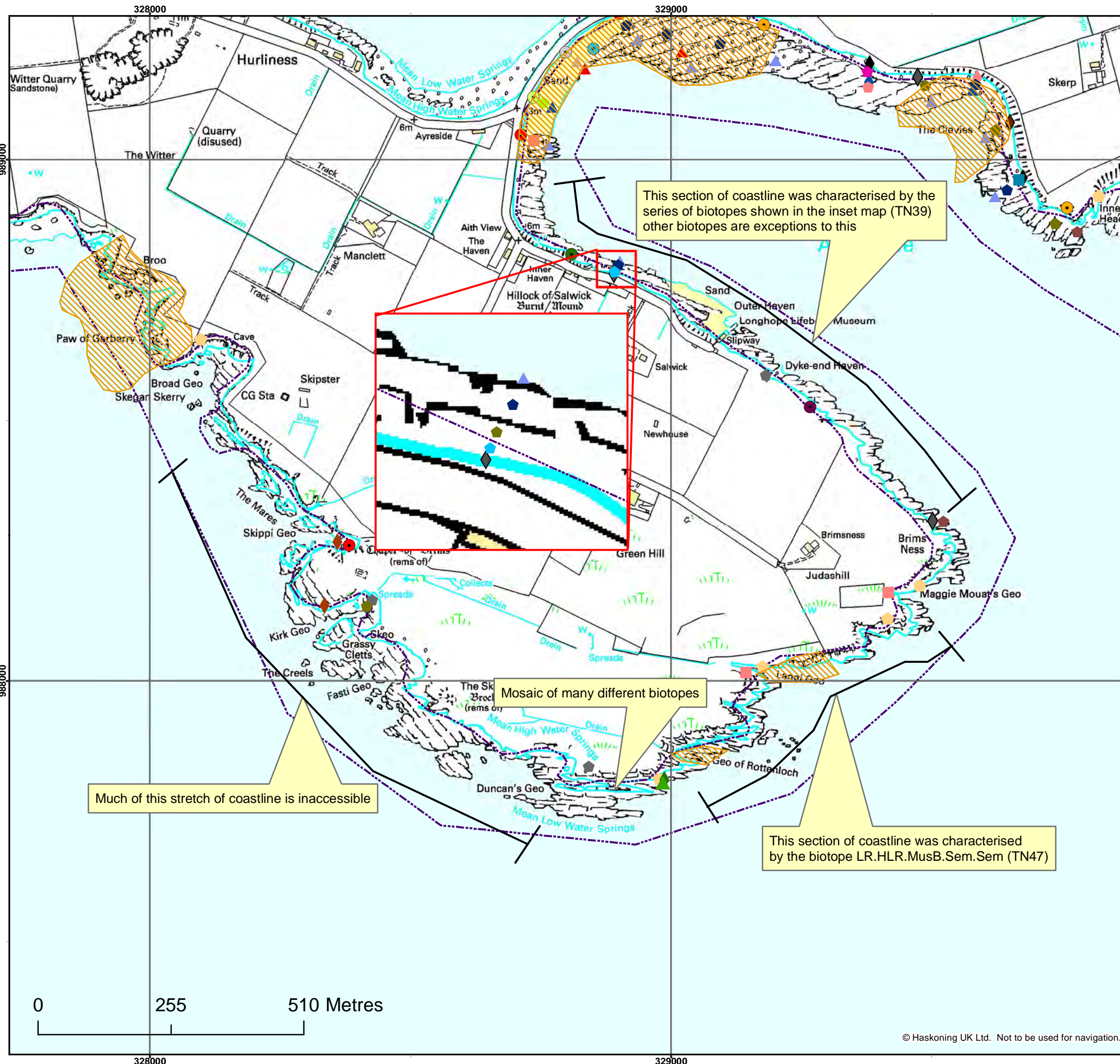
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Legend:

- Potential landfalls locations
- Intertidal Study Area
- Target notes**
- Biotope Code**
- IR.HIR.KFaR.Ala.Ldig
- IR.HIR.KSed
- IR.MIR
- IR.MIR.KR.Ldig.Bo
- IR.MIR.KR.Ldig.Ldig
- LR
- LR.FLR.Eph.EntPor
- LR.FLR.Lic
- LR.FLR.Lic.Ver
- LR.FLR.Lic.Ver.Ver
- LR.FLR.Rkp
- LR.FLR.Rkp.G
- LR.HLR
- LR.HLR.FR.Him
- LR.HLR.MusB.Cht.Cht
- LR.HLR.MusB.Sem.FvesR
- LR.HLR.MusB.Sem.Sem
- LR.LLR.F.Asc.FS
- LR.LLR.F.Fser.X
- LR.LLR.F.Fspi.X
- LR.LLR.F.Fves.X
- LR.LLR.F.Pel
- LR.MLR.BF.Fser.Bo
- LR.MLR.BF.FspiB
- LR.MLR.BF.FvesB
- LR.MLR.BF.PelB
- LR.MLR.MusF
- LS
- LS.LCS
- LS.LCS.Sh
- LS.LCS.Sh.BarSh
- LS.LMx
- LS.LSa.FiSa.Po
- LS.LSa.MoSa.BarSa

Client: BTAL Project: Brims Tidal Array

Title: Intertidal Survey: Biotopes (Central Part of Study Area)

Figure: 3,4 Drawing No:

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The south eastern coast of the Brims peninsula was characterised by exposed bed rock, much of it vertical or close to in nature (**Plate 7**). Here the barnacles *Semibalanus balanoides* and *Chthamalus montagui* dominated with the only seaweed present in the upper and midshore being stunted channel wrack *Pelvetia canaliculata*. In the very low shore dabberlocks (**Plate 8**) and oarweed *Laminaria digitata* were present.

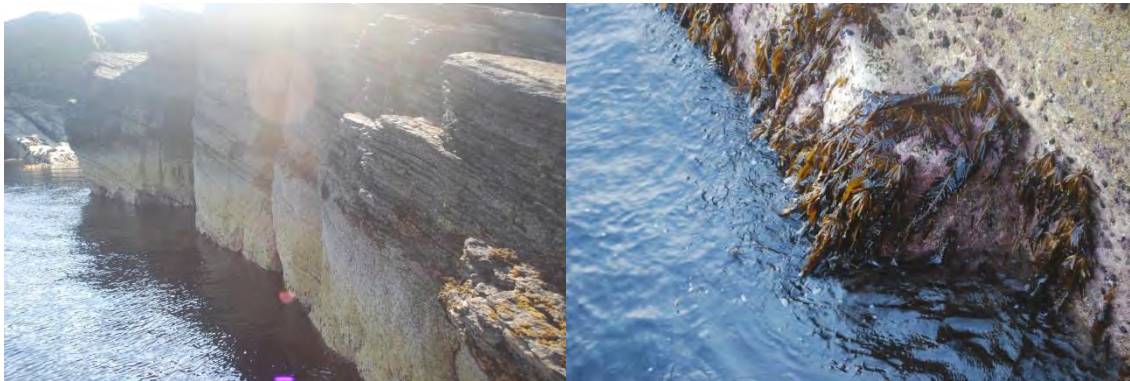


Plate 7. Barnacle dominated exposed rock **Plate 8.** Oarweeds in the very low shore

Although these biotopes persisted in a easterly direction until Brims Ness (**Figure 3.4**) there were a number of exceptions, including Langi Geo (**Plate 9**) and Maggie Mouats Geo (**Plate 10**), where boulders within the Geos supported the biotopes “*Fucus serratus* and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders” (LR.MLR.BF.Fser.Bo).



Plate 9. Langi Geo

Plate 10. Maggie Mouats Geo

The south western side of Aith Hope from approximately 200m northwest of Brims Ness (TN43 displayed in **Figure 3.2**) to Aith View (TN37) was more homogenous than the more exposed coastline to the west. The zonation in this section of the shore was very clear with five biotopes present running along the shore in consecutive bands. **Figure 3.6** illustrates the positioning of the biotopes on the shore starting at the top of the shore and working down.

<i>Verrucaria maura</i> on very exposed to very sheltered upper littoral fringe rock* (LR.FLR.Lic.Ver)	Upper shore
<i>Fucus spiralis</i> on full salinity upper eulittoral mixed substrata LR.LLR.F.Fspi.X	
<i>Ascophyllum nodosum</i> on full salinity mid eulittoral rock LR.LLR.F.Asc.FS	Mid shore
<i>Fucus vesiculosus</i> on mid eulittoral mixed substrata LR.LLR.F.Fves.X	
<i>Laminaria digitata</i> on moderately exposed sublittoral fringe rock IR.MIR.KR.Ldig.Ldig;	Low shore

Figure 3.6 structure of the biotopes present on the south western side of Aith Hope

There were a few exceptions to the general pattern of biotopes recorded, and these occurred when there was a significant change in substrate. This occurred at TNs 38 (**Plate 11**), 41 (**Plate 12**) and 42 (**Plate 13**), where small embayments broke the uniform nature of the surrounding area. These small bays were characterised by a low number of species and different biotopes and supported the following “Littoral mixed sediment” (LS.LMx), “High energy littoral rock” (LR.HLR) and “Barren littoral coarse sand” (LS.LSa.MoSa.BarSa) consecutively (**Figure 3.4**).



Plate 11. Taken at TN 38



Plate 12. Taken at TN 41



Plate 13. Taken at TN 42

At the apex of Aith Hope, the substrate was made up of sediments (**Plate 14**), mainly sand gravel and cobbles. This created a number of different sediment type biotopes. The upper shore was dominated by sand and mixed sediment biotopes such as LS.LCS.Sh.BarSh, and LS.LSa.FiSa.Po, which are generally species poor.



Plate 14. Sand dominated biotopes in the upper shore of the apex of Aith Hope



Plate 15. View down the shore at the apex of Aith hope

In the mid and lower shore, large cobbles and rock substrates were present, supporting biotopes such as *Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders (IR.MIR.KR.Ldig.Bo), as well as *Fucus serratus* on full salinity lower eulittoral mixed substrata (LR.LLR.F.Fserr.X).

Further round the bay (to the east), rock slabs and ledges supported a more diverse range of biotopes, here the intertidal area covers a much larger area than in any other part of the survey area. The furoid zone is extensive (**Plate 17**), and unlike that recorded on the western side of Aith Hope, the zonation is less clear. However, barren sediment dominated biotopes were still recorded in the very upper shore (**Plate 16**) such as “Shingle (pebble) and gravel shores” (LS.LCS.Sh). The biotopes “*Fucus vesiculosus* on mid eulittoral mixed substrata” (LR.LLR.F.Fves.X) dominated the mid shore and the presence of oarweed in the low shore gave rise to the biotope “*Laminaria digitata* on moderately exposed sublittoral fringe rock” (IR.MIR.KR.Ldig.Ldig).



Plate 16. Upper shore with barren boulders and shingle



Plate 17. Furoids dominating the mid shore

A similar situation was found in the bay at The Clevies (**Figure 3.5**), however here the oarweed zone was more influenced by sediment giving rise to the biotope “Sand or

gravel-affected or disturbed oarweed and seaweed communities” (IR.HIR.KSed). On either sides of the bay the biotopes were mirrored, with a zone dominated by the lichen *Verrucaria* (LR.FLR.Lic.Ver) in the upper shore (**Plate 18**) a large furoid zone (**Plate 19**) comprising mainly of the Furoid *Ascophyllum nodosum* (LR.LLR.F.Asc.FS) and a oarweed zone in the lower shore (IR.HIR.KFaR.Ala.Ldig).

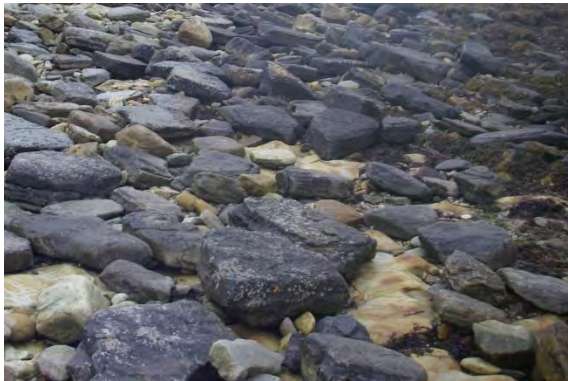


Plate 18. *Verrucaria* zone in the upper shore



Plate 19. Fucoids dominating the mid shore

Further south and east the pattern continued in much the same fashion, with the exception being the presence of a narrow zone of channelled wrack now recorded between the *Verrucaria* zone and the furoid zone (**Figure 3.5**).

No access to the intertidal was possible between the western edge of Tittli Geo (**Plate 20**) and the eastern edge of the survey area therefore biotopes were recorded using binoculars and as a result the identification will be less accurate. The outer edges of both Tittli Geo (**Plate 20**) and Ruthi Geo (**Plate 21**) were characterised by barnacle dominate biotopes similar to those seen in the more exposed western part of the survey area. In the inner parts of each geo were what appeared to be mosaics of fucoids and barnacles which gave rise to the biotope “*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock” (LR.MLR.BF.FvesB). Note, however, that without accessing the shore directly it’s difficult to be fully confident in the biotope assignments.



Plate 20. Tittli Geo



Plate 21 Ruthi Geo

4 DISCUSSION

4.1 Habitats

Four biotopes of conservation importance were identified within the study area. These are displayed in **Table 3.1**. However, although these biotopes have been identified as of conservation importance, they are all relatively common around the UK and although damage to these biotopes should be avoided if possible, it is unlikely they the presence of these will constrain development of the Brims Tidal Array.

4.2 Species

A list of all species identified during the survey is provided in Section 6 below. Few species of conservation importance were identified within the intertidal study area. The dog whelk *Nucella lapillus*, an OSPAR species (on a list of threatened and/or declining species and habitats in the North-East Atlantic, created under the OSPAR Convention for the protection of the marine environment of the North East Atlantic), was found throughout the survey area. Dog whelk is a common species in the UK and is not protected under any other pieces of legislation.

Fucus distichus was potentially identified just outwith the western boundary of the survey study area at TN 56. *Fucus distichus* is a UK Bap species which has a limited distribution in the north and west of Scotland. This species was not found to be present within the study area.

4.3 Potential constraints at landfall

The potential impacts from this proposed development on intertidal ecology in the area include:

- Habitat loss through installation of the cables and associated infrastructure across the intertidal zone; and
- Changing the coastal processes thus creating different intertidal conditions for the species and biotopes present

The intertidal ecology interests present within each potential landfall option and any key potential constraints to development have been identified (**Table 4.1**).

Table 4.1 Intertidal Ecology interests and possible constraints for each potential landfall option¹

Landfall Option	Species/ Habitats of conservation importance.	Potential constraints
Long Geo	No habitats of conservation importance were identified however direct access to the geo was not possible.	<ul style="list-style-type: none"> • Steep cliffs, very uneven boulder and bedrock shore. • Access for large vehicles may be difficult • Biotopes and species of conservational importance may be present • Distance from road greater than

¹

		others options
Geo of Rottenloch	LR.FLR.Rkp.G identified at TN 49 to the west of this potential landfall is a UK BAP habitat and is listed under the EC Habitats Directive. However this biotope is very common in the UK. <i>Nucella lapillus</i> is an OSPAR species.	<ul style="list-style-type: none"> Protected habitat and species removal/disturbance. Rapid tidal flows, immediately adjacent to the shore – may cause challenge during construction/ damage to surface laid cables Very uneven rock in the intertidal Other habitats of conservation importance may be present. But was not directly accessed
Langi Geo	LR.MLR.BF.Fser.Bo identified at TN 48 is a UK BAP habitat and is listed under the EC habitats directive. However this biotope is very common in the UK. <i>Nucella lapillus</i> is an OSPAR species	<ul style="list-style-type: none"> Protected habitat and species removal/disturbance. Large boulders to negotiate. Access for large vehicles may be difficult
The Ayre	LR.MLR.BF.Fser.Bo, identified at TN 35 is a UK BAP habitat and is listed under the EC habitats directive. However this biotope is very common in the UK and due to the size of the potential landfall area at Ayre this could easily be avoided.	<ul style="list-style-type: none"> Protected habitat and species removal/disturbance, however easily avoided. Rudimentary sea defences may need to be negotiated or removed
The Cleives	LR.LLR.F.Fves.X identified at TN 18 is listed under the EC habitats directive However this biotope is very common in the UK.	<ul style="list-style-type: none"> Protected habitat and species removal/disturbance Access for large vehicles may be difficult Large boulders and uneven bedrock to negotiate

5 RECOMMENDATIONS

Scottish Natural Heritage published a draft list of Marine Priority Features, for which consultation is ongoing. None of the intertidal features found on the survey are present on the list. The species and habitats recorded in this survey should be checked against the latest version of this list as part of the environmental impact assessment.

Construction activities should keep a distance of 50m from the coastline wherever possible.

During construction, good working practices and SEPA protocols should eliminate risk of exposure to oil, chemicals and other harmful materials.

Construction areas should be left in a safe condition during periods of inactivity, with chemicals and construction materials stored safely, with appropriate bunding, in accordance with SEPA's Pollution Prevention and Chemical Guidelines (PPG2 - Above ground oil storage tanks, and PPG5 – Works in, near or liable to affect watercourses).

A construction method statement should be created and implemented that adopts the relevant good practise guidance set out in CIRIA The Coastal and marine environmental site guide (C584).

Material removed from the intertidal habitat should be stored and replaced within the same intertidal zone following the trenching / pinning of the cables.

6 SPECIES LIST

All common names are sourced from the marine life information network (MarLIN) website (Marlin, undated.) or in the case of Seaweeds The Seasearch guide to Seaweeds of Britain and Ireland (Maggs *et. al.*, 2010).

Common Name	Latin Name
Animalia	
whelk eggs	
Sea lemon	<i>Archidoris pseudoargus</i>
lug worm	<i>Arenicola marina</i>
A sea slug	<i>Cadlina laevis</i>
painted top shell	<i>Calliostoma zizyphinum</i>
common shore crab	<i>Carcinus maenas</i>
Montagu's stellate barnacle	<i>Chthamalus montagui</i>
Grey top shell	<i>Gibbula cineraria</i>
Breadcrumb sponge	<i>Halichondria panicea</i>
Ragworm	<i>Hediste diversicolor</i>
Bloody Henry	<i>Henricia sp.</i>
Shanny	<i>Lipophrys pholis</i>
common periwinkle	<i>Littorina Littorea</i>
flat periwinkle	<i>Littorina obtusata</i>
Rough periwinkle	<i>Littorina saxatilis</i>
Sea mat	<i>Membranipora membranacea</i>
Common mussel	<i>Mytilus edulis</i>
dog whelk ^α	<i>Nucella lapillus</i>
Hermit crab	<i>Pagurus bernhardus</i>
common limpet	<i>Patella vulgata</i>
Lobe shell	<i>Philine aperta</i>
butter fish	<i>Pholis gunnellus</i>
chitons	Polyplacophora
acorn barnacle	<i>Semibalanus balanoides</i>
A tubeworm	<i>Spirorbis spirorbis</i>
beadlet anemone,	<i>Actinia equina</i>
Plantae	
Dabberlocks	<i>Alaria esculenta</i>
Thrift,	<i>Armeria maritima</i>
Knotted wrack	<i>Ascophyllum nodosum</i>
Orange lichen	<i>Caloplaca littorea</i>
Orange sea lichen	<i>Caloplaca marina</i>
Red filermentous algae	<i>Ceramium sp.</i>

carrageen	<i>Chondrus crispus</i>
sea lace	<i>Chorda filum</i>
A green seaweed	<i>Cladophora rupestris</i>
Green sea fingers	<i>Codium fragile</i>
Coral weed	<i>Corallina officinalis</i>
pink coralline algae	<i>Corallinaceae sp.</i>
brown seaweed*	<i>Fucus distichus</i>
toothed wrack	<i>Fucus serratus</i>
Spiral wrack	<i>Fucus spiralis</i>
bladder wrack	<i>Fucus vesiculosus</i>
red seaweed	<i>Furcellaria lumbricalis</i>
Sea oak	<i>Halidrys siliquosa</i>
thong weed	<i>Himantalia elongata</i>
Oarweed	<i>Laminaria digitata</i>
Tangle or curvie	<i>Laminaria hyperborea</i>
Punctured ball weed	<i>Leathesia difformis</i>
False Irish moss	<i>Mastocarpus stellatus</i>
Pepper dulse	<i>Osmundea pinnatifida</i>
A dulse	<i>Palmaria palmata</i>
Channelled wrack	<i>Pelvetia canaliculata</i>
sea plantain	<i>Plantago maritima</i>
red epiphytic seaweed	<i>Polysiphonia lanosa</i>
Purple laver	<i>Porphyra sp.</i>
Sea ivory	<i>Ramalina siliquosa</i>
purple hair weed	<i>Rhodochorton purpureum</i>
red seaweed	<i>Rhodothamniella floridula</i>
Sugar oarweed	<i>Saccharina latissima</i>
cordgrass	<i>Spartina</i>
Gut weed	<i>Ulva intestinalis</i>
Sea lettuce	<i>Ulva lactuca</i>
Tar lichen	<i>Verrucaria maura</i>

* UK Bap habitat. ^a OSPAR

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8

APPENDICES:

8.1 Appendix A: Target notes as recorded in the field.

The order of the target notes are generally following the surveyor down the shore.

Traget Note	Grid Ref		Description (common names taken from MarLIN or Bunker <i>et. al.</i> , 2010) SA= Superabundant, A= Abundant, C= Common, O= Occasional and R=Rare.	Photos (N) = North (S)= South etc.	Biotope in Bold is the primary (illustrated on the Maps)
	Lat	Long			
1	58 47.072	3 14.003	<p>Cobbles in the very uppershore. The strandline is very high, near to the vegetation of the terrestrial environment and is broken consisting of thong weed <i>Himanthalia elongata</i> and fucoids.</p> <p>Below the strandline a thin veneer of sand covers cobbles and boulders. This sandy zone is approximately 10 metres (m) wide.</p> <p>Below the sand is a zone of boulders 20m wide (approx.) which supports Gut weed <i>Ulva intestinalis</i>, toothed wrack <i>Fucus serratus</i> and sea lace <i>Chorda filum</i>.</p> <p>Further to the east of the target note lug worm <i>Arenicola marina</i> casts are present in the sand zone (approx. 10 per m²) and <i>Ulva lactuca</i> sea lettuce is also present.</p>	<p>DSC 013 N DSC 014 S DSC 015 W DSC 016 E DSC 017 (sand zone) DSC 018 (fucoid zone)</p>	<p>LS</p> <p>LS.LCS.Sh.BarSh</p> <p>And LS.LSa.St</p> <p>LS.LSa.FiSa.Po</p>
2	58 47.062	3 13.979	<p>Substrate: sand between pebbles. Narrow band of toothed wrack about 3m wide, the fucoid zone then merges with the kelp zone.</p> <p>The Laminaria zone: Kelp <i>Laminaria digitata</i> C, toothed wrack A, carrageen, <i>Chondrus crispus</i>, <i>Cladophora rupestris</i> A, bladder wrack <i>Fucus vesiculosus</i>, in the understory acorn barnacle <i>Semibalanus balanoides</i>, Grey topshell <i>Gibbula cineraria</i>, The tubeworm spirorbis and sea lettuce.</p>	DSC 019, DSC 020	IR.MIR.KR.Ldig.Bo
3	58 47.055	3 13.964	False Irish moss <i>Mastocarpus stellatus</i> , red filamentous algae indet, pink coralline algae Corallinaceae sp. on the rocks		IR.MIR
4	58 47.113	3 13.898	Sand extends up to the sea defence, where a dispersed strandline is present, consisting mainly of fucoids. The sea defences consist of rock filled gabions and miscellaneous concrete blocks.	DSC 021, DSC 022, DSC 023.	LS.LCS

			The sandy zone 10m wide, below which is a gravel zone which is also 10m wide. Below the gravel is another sand zone 4m wide which exhibits abundant lug worm casts.	DSC 024	
5	58 47.100	3 13.883	<u>Boundary between the sand zone and the Furoid zones.</u> 1 st Seaweed zone is mainly bladder wrack and knotted wrack <i>Ascophyllum nodosum</i> . The substrate is comprises of cobbles and boulders in A sandy matrix. Seaweeds and growing on the boulders and cobbles. The dulse <i>Palmaria palmata</i> , toothed wrack C, lug worms cast C, red filamentous algae indet C, <i>Cladophora rupestris</i> (C)and sea lettuce.	DSC 026	LR.LLR.F.Fves.X
6	58 47.086	3 13.859	<u>Middle of the furoid zone.</u> Substrate boulders and cobbles, species poor. Understory flat periwinkle <i>Littorina obtusata</i> , butter fish <i>Pholis gunnellus</i> , <i>Cladophora rupestris</i> , toothed wrack toward the bottom of the furoid zone, Punctured ball weed <i>Leathesia difformis</i> , Lower shore: Substrate: boulders and cobbles. The kelp zone starts lower than at the previous target note kelp C, bladder wrack and toothed wrack, common limpet <i>Patella vulgata</i> , coralline algae on rock. Generally species poor		LR.LLR.F.Fves.X IR.MIR.KR.Ldig.Ldig
7	58 47.117	3 13.822	End of the exposed and obvious sea defences (although they may continue east, they have been overgrown and look to have merged with a natural bank. Upper Shore: Deep sand up to the vegetation that backs the shore. The sandy zone is narrower than at IT4, here it is approximately 10m wide.	DSC 028 DSC 029 view down the shore	LS.LCS
8	58 47.093	3 13.801	Furoid zone: Bladder wrack A, Spiral wrack <i>Fucus spiralis</i> and knotted wrack all growing attached to pebbles and cobbles buried within the sand. Lug worm casts, further into the furoid zone (down the shore) the sand gives way to cobbles and pebbles and the zone extends for approximately 60m past the way point. At the bottom of the furoid zone: toothed wrack, dog whelk <i>Nucella lapillus</i> , flat periwinkle, whelk eggs, common limpet, beadlet anemone <i>Actinia equina</i> , <i>Cladophora rupestris</i> and punctured ball weed. Also present were common shore crab <i>Carcinus maenas</i> , Coralline algae and Carrageen	DSC 030 under boulder communities DSC 031 Green actinia? DSC 032	LR.LLR.F.Fves.X

9	58 47.075	3 13.772	<u>Large Rock Pool:</u> with a sandy gravelly bottom displaying lugworm casts. Oar weed abundant with sea lace, carrageen and <i>Cladophora rupestris</i> and an unidentified red algae	DSC 033 unidentified red algae	IR.MIR
10	58 47.059	3 13.752	<u>Kelp Zone</u> Access to the kelp zone was not possible however kelp and Tangle or cuvie <i>Laminaria hyperborea</i> were identified from higher on the shore. Toothed wrack and bladder wrack were also common well into the kelp zone.	DSC 032	IR.MIR.KR.Ldig.Ldig
11	58 47.118	3 13.722	<u>End of the sand zone</u> (moving east)		
12	58 47.104	3 13.609	<u>Upper shore:</u> Cobble and boulders in gravel matrix, very little macro algal growth. Rough periwinkle <i>Littorina saxatilis</i> (A), <i>Tar lichen Verrucaria maura</i> , small Channelled wrack <i>Pelvetia canaliculata</i> (O) on the boundary of the Furoid zone. Furoid zone: Substrate: boulders and cobbles in a gravelly matrix giving way to larger boulders on the lower shore. Spiral wrack (A), channelled wrack(R) and at the top of the zone, knotted wrack bladder wrack, flat periwinkle, unidentified brown filamentous algae indet. C, <i>Chladophora rupestris</i> , Common limpet O, Acorn barnacle, the red epiphytic seaweed <i>Polysiphonia lanosa</i> , dog whelks and pink coralline algae.	DSC 034-036 DSC 037-039 DSC 40 DSC 041W 042E	LS.LCS.Sh LR.LLR.F.Fves.X
13	58 47.067	3 13.584	<u>Kelp zone:</u> could not properly access the kelp zone due to the tide, however, Kelp was present and China limpet <i>Patella ulyssiponensis</i> ,(R) were found on the edge of this zone.		IR.MIR.KR.Ldig.Ldig
14	58 47.066	3 13.397	<u>Uppershore:</u> Boulders and cobbles present up as far as the vegetation that backs the shore Verrucaria zone: tar lichen present along with the orange lichen <i>Caloplaca littorea</i> and the grey lichen <i>Ochrolechia parella</i> , Thrift <i>Armeria maritima</i> , cordgrass <i>Spartina sp.</i> and sea plantain <i>Plantago maritima</i> were all growing within this zone Pelvetia zone: this zone has not been evident at the previous way points and it is approximately 20m wide. Channelled wrack, Rough periwinkles A, tar lichen(A) and the first common periwinkles <i>Littorina Littorea</i> were found at the bottom of this zone. Acorn barnacles are locally abundant as are spiral wrack and <i>Cladophora rupestris</i> .	DSC 044 DSC 045-046 DSC 043	LR.FLR.Lic.Ver.Ver LR.LLR.F.Pel
15	58 47.046	3 13.397	<u>Furoid zone:</u> The Furoid zone extends for approximately 40m in width and the substrate consists of rock ledges, a rock pool contains toothed wrack, carrageen, Coral weed <i>Corallina officinalis</i> , large common periwinkle, beadlet anemones and common limpets, Green sea fingers <i>Codium fragile</i> . Away from the rook pool Toothed wrack (A), Acorn barnacles, thong weed, are present mainly toward the bottom of the furoid zone. Also present in the furoid zone are carrageen, false Irish moss, breadcrumb sponge <i>Halichondria panicea</i> , flat	DSC 051, 052 DSC 053,054 Green sea fingers <i>Codium fragile</i>	LR.FLR.Rkp LR.HLR.FR.Him

			periwinkle, collaline algae, very large common periwinkle, dog whelks, Lobe shell <i>Philine aperta</i> , Pepper dulse <i>Osmundea pinnatifida</i> coral weed and common limpet.	DSC 059 sponge DSC 060-63 lobe shell.	
16	58 47.053	3 13.300	<u>Uppershore:</u> the substrate consists of sandstone rock ledges backed by a low crumbling cliff and a very narrow ledge above the MHW mark. Patches of tar lichen and the purple hair seaweed <i>Rhodochorton purpureum</i> were present on boulders. Fucoid zone: The very top edge of this zone is lined with channelled wrack, further in knotted wrack is abundant. Numerous rock pools are present among the rock ledges and boulders. Flat periwinkle, Shanny <i>Lipophrys pholis</i> C, common limpet, acorn barnacles, tar lichen on the top of boulders, toothed wrack increases in abundance further down the shore, brown filamentous seaweed indet., dog whelk, pepper dulse, <i>Cladophora rupestris</i> , carrageen, toothed wrack. The fucoid cover in the mid shore is 100%. The understory contains common periwinkle A, encrusting pink algae, first and second year thong weed, <i>Polysiphonia lanosa</i> and butter fish <i>Pholis gunnellus</i> .	IMGP0366, 0367 IMGP0366	LR.FLR.Lic.Ver LR.LLR.F.Asc.FS
17	58 47.028	3 13.272	Upper margin of the kelp zone: Kelp, corraline algae (SA), large common periwinkle, breadcrumb sponge and carrageen, but generally the understory is not very diverse.	IMGP0369, IMGP0370 looking east	IR.MIR.KR.Ldig.Ldig
18	58 47.049	3 13.187	<u>Uppershore:</u> Wide boulder and cobble shore mostly comprised of bare rock with occasional acorn barnacles. Fucoid Zone: Narrow fucoid zone (4m approx.) comprised of spiral wrack, bladder wrack and toothed wrack as well as many red and green filamentous seaweeds indet. Also present were sea lettuce, common periwinkle, beadlet anemone, chitons Polyplacophora, much of the fucoids are covered in the tubeworm <i>Spirorbis spirorbis</i> . Kelp zone: not very dense, sandy substrate with lugworm casts, could not access kelp zone due to tide.	IMGP0371, 0372 IMGP0374 IMGP0373	LR LR.LLR.F.Fves.X IR.HIR.KSed
19	58 47.007	3 13.115	Uppershore: substrate composed of boulders, the Verrucaria zone is narrow 3m wide with orange and grey lichens probably <i>Caloplaca littorea</i> and the <i>Ochrolechia parella</i> respectively, no barnacles. No Pelvetia zone.	IMGP0375 IMGP0376	LR.FLR.Lic
20	58 46.999	3 13.144	<u>Fucoid zone:</u> substrate comprised of rocky ledges with boulders on top. Spiral wrack, Knotted wrack (A), at top of zone, common limpet, flat periwinkle, gut weed, dog whelk, Toothed wrack increases with distance down the shore, pink encrusting coralline algae dominates the understory with a few unidentified filamentous red algae, <i>Cladophora rupestris</i> , <i>Ceramium Sp.</i> acorn barnacles dogwhelks common shore crab and toothed wrack also present.	IMGP0377 IMGP0378	LR.LLR.F.Asc.FS
21	58 46.991	3 13.163	<u>Kelp Zone:</u> Kelp (A), the understory contained toothed wrack, <i>Cladophora rupestris</i> , coralline pink algae (A), Red filamentous algae, Bloody henry starfish <i>Henricia sp.</i> , flat periwinkle, painted top shell <i>Calliostoma zizyphinum</i> , Sea mat <i>Membranipora membranacea</i> and breadcrumb sponge.	IMGP0379- 0383	IR.MIR.KR.Ldig.Ldig

22	58 46.950	3 13.087	<p><u>Rock promontory creating a small peninsula:</u> Verrucaria zone: extends almost up to the base of the cliff, other lichens present include grey, white and the Orange sea lichen <i>Caloplaca marina</i>. Pelvetia zone: is very narrow (2m) and is composed mainly of channelled wrack. Barnacles are absent Fucoid zone: Substrate consists of rocky ledges and outcrops up to 1m high Spiral wrack (A), channelled wrack on the higher outcrops, gutweed in rock pools, flat periwinkle, <i>Cladophora rupestris</i>, brown filamentous algae indet. Common limpet. A large rocky gully leads to the lower shore, here less algae are present and what seaweed is present is mostly gut weed. Dog whelk and acorn barnacles dominate and punctured ball weed.</p>	<p>IMGP0384 IMGP0385</p> <p>IMGP0387</p> <p>IMGP0388</p>	<p>LR.FLR.Lic.Ver.Ver</p> <p>LR.MLR.BF.PeIB</p> <p>LR.LLR.F.Fves.X</p>
23	58 46.931	3 13.142	<p><u>Lowershore/ seaward end of the rocky promontory:</u> Kelp (A) thong weed (A), <i>Palmaria palmata</i>, carrageen, dogwhelks, acorn barnacles, common limpet, breadcrumb sponge, common shore crab.</p>	<p>IMGP0389 IMGP0390 Breadcrumb sponge</p>	<p>IR.MIR.KR.Ldig.Ldig</p>
<p>From it22 and 23 eastward the shore becomes much more rugose, with the intertidal area being composed of short steep outcrops of rock with steep sided deep gullies that lead right up to the base of the cliffs. The outcrops of rock are dominated by limpets and barnacles and the gullies are full of fucoids. Similar species as previous, however the habitat is very difficult to map as it is so 3-dimensional. This type of habitat continues moving east with the other target notes an exception and not the norm.</p>			<p>IMGP0392 IMGP0393</p>		
24	58 46.914	3 13.004	<p><u>Small cove with boulder beach:</u> Fucoids reach high up the shore in the cove so indicating that it must be completely tidal. Below the cove knotted wrack dominates the midshore, with spiral wrack and abundant just above, <i>Polysiphonia lanosa</i>, and gutweed are present in rock pools. Below the cove is a cobble filled gully which leads to the lower shore where it may be possible to bring a cable(s) a shore. Beadlet anemones (C), Common limpet acorn barnacles and dog whelks (F) are present on the gully walls.</p>	<p>IMGP0394 IMGP0395</p>	<p>LS.LCS.Sh</p> <p>LR.LLR.F.Asc.FS</p>
25	58 46.896	3 12.977	<p><u>Western side of large Cove:</u> Further east from It24 a large cove is enclosed by tall cliffs, access any further east from this point would have been extremely risky. Here the intertidal zone become very compressed and is mostly restricted to the bottom of the cliff. Barnacles and Limpets dominate with seaweeds almost absent from the upper and midshore, thong weed and kelp are present in the lower shore.</p>	<p>IMGP0396- IMGP0398 looking east into Titli Geo</p>	<p>LR.HLR.MusB.Sem.FvesR</p>
26	58 46.933	3 12.935	<p><u>Narrow cove viewed from cliff top:</u> Viewed from above the cove is approximately 15m wide by 30m recessed from the coast and 20m deep (top to bottom). The cove has a boulder beach, with a narrow fucoid zone (approximately 10m) the lower shore is more exposed and is dominated by barnacles and occasional kelps.</p> <p>Looking east from It25 there was a good vantage point looking into the Tilli Geo. On the western side of the Geo a large intertidal wave cut platform extends out from a</p>	<p>IMGP0401 IMGP0402</p>	<p>LR.HLR.MusB.Sem.Sem</p> <p>LR.MLR.BF.FvesB</p>

			<p>boulder beach. The pelvitia zone is generally narrow, but does extend down the rocky ribs. The mid shore is dominated by furoids, and is quite wide (approximately 40m) kelps are only visible in the centre of the bay.</p> <p>On the eastern edge of the Geo the intertidal is the on sheer rock cliff, it is very difficult to identify species at such a distance, however it appears that the mid shore is dominated by barnacles and only the lower shore supports algae which are likely to be kelp and potentially Dabberlocks <i>Alaria esculenta</i>.</p>	<p>IMGP0409</p> <p>IMGP0415</p>	<p>LR.HLR.MusB.Sem.FvesR</p>
27	58 46.859	3 12.727	Further east below a semi collapsed arch there is a clear furoid zone is present on the boulders created when the arch collapsed and kelp are just visible in the waters below the boulders.	IMGP0421 and 0423	LR.MLR.BF.Fser.Bo
28	58 46.825	3 12.728	<p><u>Headland:</u> craggy islands rather than outcrops make up the intertidal here Typical rock shore zonation's seems to be occurring on the lee sides of the island. Again this can only be viewed from the cliff top as access would be risky.</p> <p>Pelvitia zone at the top, furoid zone in the mid shore, and barnacle zone below that and kelps in the subtidal. The intertidal is more vertical than horizontal and on the sheltered area Toothed wrack dominated with gutweed and Thongweed also present. Kelp was absent from much of this area. To the east of this TN the algae become less abundant and then disappear altogether as the cliffs steepen.</p>		LR.HLR.MusB.Sem.Sem
29	58 46.865	3 12.597	<u>Small narrow steep cove:</u> large furoid zone on the sheltered on the eastern side behind a rocky headland	IMGP0424 and 0425 moving from west to east.	LR.MLR.BF.FvesB
30	58 46.823	3 12.557	<p><u>Rocky headland:</u> The cliff at this point was 15m high clear kelp zone present beneath the barnacle zone,</p>	IMGP0426 to 0428	LR.HLR.MusB.Sem.Sem IR.MIR.KR.Ldig.Ldig
31	58 46.823	3 12.525	<p><u>Final Geo within the Study area:</u> Viewed from the top of cliff on the western edge of geo. Geo composed of rocky ledges backed by high (20m) cliffs. Western edge of the geo has a large Verrucaria zone, pockets of furoids in sheltered areas, elsewhere barnacles dominant across most of the shore. Kelp zone is just visible below the water.</p>	IMGP0429 to 0434	LR.HLR.MusB.Sem.FvesR
Survey Day two					
32	58 47.025	3 14.065	<p><u>Apex of Aith hope:</u> Narrow intertidal area Uppershore substrate is Pebbles and cobbles, the strand line is adjacent to the vegetation very scattered strandline across much of the uppershore but no obvious mega flora or fauna growing in the uppershore. This zone is approximately 8m wide. Below the cobbles is a sandy zone, the sand is deep at this point and the sandy zone</p>	<p>IMGP0237- IMGP0439 IMGP440 W IMGP441 E</p>	LS.LCS.Sh.BarSh

			is approximately 15m wide and is bare of fauna and flora apart from scattered strand. Fucoid zone: Substrate on the lowershore, small boulders and cobbles in a sandy matrix toothed wrack and gutweed cling to boulders. Between the boulders is a mass of brown filamentous algae, which is not attached. Kelp zone: Small stunted Dabberlocks and sea lace are also present on cobbles and boulders, Kelp (R). The sandy substrate continues seaward as far as visible. Potentially the best place within the entire survey area to bury a cable.	IMGP442 and 0443	LR.LLR.F.Fserr.X
33	58 47.015	3 14.027	Low water mark for transect described in It32	IMGP0444	IR.HIR.KSed
34	58 46.985	3 14.089	<u>Western side of Aith Hope:</u> Rudimentary sea defences appear to be maintaining cobbles on the shore to the east. To the west of this point a very narrow band of sand is present below the cobbles. A very dispersed strand is present on the uppershore. The sand is quite finely grained, with gutweed attached to the occasional cobbles.	IMGP0445	LS.LCS
35	58 46.979	3 14.063	<u>End of sand zone and start of rocky ledges:</u> At this TN the sand zone is ended when rocky ledges emerge in the midshore. Fucoid zone: toothed wrack (A) and knotted wrack (O) forming the canopy with carrageen, <i>Cladophora rupestris</i> , <i>Polysiphonia lanosa</i> , acorn barnacle and common limpets present in the understory. Fucoids make up 95% cover, however on exposed rock dogwhelks are present. Unidentified brown seaweed was also present. Also present were Starfish (probably Bloody henry) and Nudibranch (potentially A sea slug <i>Cadlina laevis</i>) Pink coralline algae. Brown porifera indet. Breadcrumb sponge. Sea lemon <i>Archidoris pseudoargus</i> . Eggs indet? Ragworm <i>Hediste diversicolor</i> , common shore crab, Beadlet anemone? Hermit crab <i>Pagurus bernhardus</i> , no littorinds. Red seaweed <i>Furcellaria lumbricalis</i> also recorded.	IMGP0448 and 0449 (<i>Furcellaria lumbricalis</i>) IMGP0457 eggs indet, IMGP0459 beadlet?	LR.MLR.BF.Fser.Bo
36	58 46.976	3 14.033	Kelp Zone: difficult to access as mostly underwater Kelp,	IMGP0454 -0454	IR.MIR.KR.Ldig.Ldig
			<u>Sea defences near the apex of Aith Hope.</u>	IMGP0460 -0462	
37	58 46.900	3 14.089	<u>End of rocky outcrops and ledges:</u> The last set of rocky ledges are the most pronounced (1.5 m high approx.). Strand is washed up behind the outcrops. To the south of this TN the intertidal becomes narrower and straighter with less rocky outcrop and ledges	IMGP0465 S IMGP0466 uppershore IMGP0467 E IMGP0468	End of previous set of biotopes
38	58 46.863	3 13.984	<u>Small embayment:</u> Used for launching small boats. The Bay is Atypical of this stretch of coastline, and most of this part of coast from IT	IMGP0469-0470	LS.LMx

			<p>37 to IT43 should be characterised by IT 39 apart from other TNS when stated. Uppershore: cobbles and pebbles with acorn barnacles (C), Midshore: Gutweed (C), bladderwrack (C) Lower midshore: sand and gravel with bladder wrack and toothed wrack growing on cobbles.</p> <p>Just to the south of here a small concrete slipway services a residential property</p>		
39	58 46.844	3 13.898	<p><u>Key TN represents IT37 to It 43 for characterising much of the western side of Aith Hope:</u> Here the intertidal zone is very narrow, backed by grassy cliff of about 2m high. Upper shore: Rock platforms sloping at approximately 20°. Verrucaria zone: Is narrow (1m) and includes grey and orange lichens Pelvetia zone: very narrow and merges with Verrucaria zone Fucoid zone: Clear band of spiral wrack 2m wide, Common limpet (C) Verrucaria maura growing on rocks, dog whelks (O), acorn barnacle (O), flat periwinkle Ascophyllum zone: clear zonation of this species 3m wide. Knotted wrack, Polysiphonia lanosa, Cladophora rupestris, beadlet anemone, flat periwinkle. Mixed fucoid zone: Bladderwrack, toothed wrack, knotted wrack, Angle of the shore eases and becomes more jagged and ledgy (6m) gravel and pebbles are trapped between ledgy bits. <i>Cladophora rupestris</i>, Carageen, flat periwinkle, breadcrumb sponge (C) beadlet anemone (C), common shore crab, gutweed, Kelp zone: Kelp, no access but looks to be quite narrow but dense</p>	<p>IMGP0471- 0472</p> <p>IMGP0473 (Verrucaria zone) IMGP0474(Pelvetia) IMGP0475(Spiralis zone)</p> <p>IMGP0477</p> <p>IMGP0478</p>	<p>LR.FLR.Lic.Ver</p> <p>LR.LLR.F.Fspi.X</p> <p>LR.LLR.F.Asc.FS</p> <p>LR.LLR.F.Fves.X</p> <p>IR.MIR.KR.Ldig.Ldig</p>
40	58 46.778	3 13.701	<p>The direction of the rock ledges change slightly close to the location of the lifeboat station and a small bay is formed between the ledges. However the clear zonation and species are similar to those that characterise this stretch of coastline (IT 39).</p>	<p>IMGP0479 IMGP0480, IMGP0483</p>	<p>No biotopes needed just annotate</p>
41	58 46.741	3 13.592	<p><u>Bolder bay (10m wide):</u> This is an exception to the main biotopes that characterise this coastline, Boulders cobbles and pebbles form the upper shore. Rough periwinkle and is the only fauna with the occasional tar lichen. Fucoid zone: there are boulders and small rocky outcrops with sand in between. Bladderwrack, spiral wrack at top of zone (O) and Knotted wrack (O), toothed wrack (O) and Gutweed (O), Common limpet (O) flat periwinkle beadlet anemone, red filamentous algae indet, Common shore crab</p>	<p>IMGP0486 -0487</p> <p>IMGP0491</p>	<p>LR.HLR</p>
42	58 46.709	3 13.503	<p><u>Small sandy gully again the exception and not the norm:</u> No mega intertidal fauna and flora.</p>	<p>IMGP0492-0494</p>	<p>LS.LSa.MoSa.BarSa</p>
43	58 46.681	3 13.418	<p><u>End of the area characterised by IT 39</u> Rock platforms become more broken and the coast line more convoluted from this point to the south west.</p>	<p>IMGP0495 N 0496 E, 0497 W</p>	<p>This is the end of the Key biotopes.</p>

44	58 46.596	3 13.252	<p><u>Southern edge of wide bay viewed from cliff top:</u> Rocky ledges. Large Verrucaria zone, narrow pelvitia zone (1m), Clear zonation of spiral wrack, knotted wrack and bladderwrack. Thongweed on lower shore, kelp just visible on the lowershore, the more exposed rock is dominated by acorn barnacles and Common limpet. To the north of this TN the ledges are flatter and more exposed, dominated by barnacles and limpets indicating that it is far more exposed</p>	DSC 164 DSC 165	LR.FLR.Lic.Ver LR.HLR.MusB.Sem.FvesR
45	58 46.527	3 13.277	<p>Very narrow intertidal, mostly barnacle dominated and very fragmented, Uppershore: large Verrucaria zone, gutweed growing in rockpools, beadlet anemones, common limpet, coral weed. Very stunted knotted wrack and a thin band of very stunted channelled wrack on the solid rock cliff. Scattered spiral wrack (R), small red filamentous sp. Indet., Thongweed and kelp in the lower shore, no gastropods, very exposed.</p>	DSC 166 DSC 167 DSC 170, DSC 171	LR.HLR.MusB.Sem.Sem
46	58 46.519	3 13.341	<p><u>Narrow boulder filled gulley that was viewed from the cliff</u> The substrate of the floor of the gulley was comprised of boulders and the wall were solid rock. A strand line was present high on the shore below which a clear zonation occurred. A very narrow (less than a 1m) <i>Verrucaria</i> zone led to a narrow spirals zone which in turn led to a wide <i>Ascophyllum</i> zone and then a <i>Fucus serratus</i> zone. Larger boulders were dominated by barnacles and limpets. Alaria is present on the walls of the gulley with oar weed lower on the walls</p>	DSC 172 -174 DSC 175	LR.MLR.BF.Fser.Bo
47	58 46.492	3 13.340	<p><u>Square cut corner in the cliff.</u> Tar lichen covered the majority of the rock in the uppershore, elsewhere acorn barnacles and Montagu's stellate barnacle <i>Chthamalus montagui</i>. Stunted channelled wrack, beadlet anemone and limpets on the east of the corner oar weed dominates, and on the west side dabberlocks</p>	DSC 177-179 DSC 180 DSC 181-182	LR.HLR.MusB.Sem.Sem
48	58 46.434	3 13.621	<p><u>Narrow inlet:</u> Sheer rock on the northern bank and less steep approximately 30° on the southern bank. On the sloping side a: Pelvitia zone is present 1m, Furoid zone 2m, acorn barnacles (C) beadlet anemone, common limpet (C) <i>Palmaria palmata</i>, serrated wrack (C), sea lettuce, dog whelk and carageen. Below which an Alaria zone is present.</p> <p>On the sheer rock wall: barnacles dominate the upper shore a narrow furoid zone was present in the midshore which included False Irish moss. Below this was a Kelp zone. After the inlet the rocky shore continues as before.</p>	DSC 187-189	LR.MLR.BF.Fser.Bo LR.HLR.MusB.Sem.Sem

49	58 46.331	3 13.807	<p>Up until this point the biotopes have been the same IT 47 unless a target note is taken which refers to a specific feature. Here the situation changes, as the angle and direction of the rocks has changed. Ridges of rock run almost parallel with the waterline and different biotopes occur on the front and the back of the ridges.</p> <p>In the very uppershore thrift Sea ivory <i>Ramalina siliquosa</i>, as well as yellow and grey lichens. In a sheltered rock pool in the lower uppershore the following species were present: channelled wrack, dogwhelk, beadlet anemone, toothed wrack, spiral wrack, thongweed, Sea oak <i>Halidrys siliquosa</i>, gut weed, coral weed, and several other species of seaweed including filamentous reds and browns, punctured ball weed, green sea fingers.</p> <p>The sheltered side of the rock ridges supports a clear pelvitia zone.</p> <p>The whole area is a kind of wave cut platform, crevices are packed with beadlet anemones, dogwhelks, and common mussel <i>Mytilus edulis</i>, barnacles just about dominate but in more sheltered sections fucoids are common, lots of species of algae are present.</p> <p>The rock here must be soft and the limpet home scares are deep.</p> <p>In the lower shore, all the species from the rock pool are present along with dabberlocks, kelp <i>Palmaria palmata</i> and Sugar kelp <i>Saccharina latissima</i>. The sheer outer edge of the wave cut platform was dominated dabberlocks and Kelp.</p>	<p>DSC 194-95</p> <p>DSC 199</p> <p>DSC 200</p>	<p>Vast mosaic of biotopes due to uneven nature of the wave cur platform ranging from</p> <p>LR.HLR.MusB.Sem.Sem</p> <p>LR.FLR.Rkp.G</p> <p>To IR.HIR.KFaR.Ala.Ldig in the lower shore</p>
50	58 46.334	3 13.931	<p><u>Boulder beach:</u> Possible point at which a cable could be bought a shore.</p>	DSC 203	LR.HLR
51	58 46.378	3 14.197	<p>Access was not possible at this TN so photos were taken from a vantage point Looks similar to IT49</p>	DSC 205SE, 206 S, 207SW	Do same as 49
52	58 46.411	3 14.255	<p>Access was not possible at this TN so photos were taken from a vantage point Looks similar to IT49</p>	DSC 208W, 209 S, 210SE	Do same as 49
53	58 46.485	3 14.334	<p><u>Boulder beach:</u> This is an exception to the main biotopes on this piece of coastline which are IT 49. Uppershore above intertidal <i>Verrucaria</i> and Pelvitia mixed in with furoid zone, Furoid zone: knotted wrack (A), bladder wrack (C), common limpet (o) arcorn barnacle (R), beadlet anemone, Cladophera. Lowershore: Bladder wrack, gutweed with <i>Porphyra</i> mat over the gut weed. Photo looking out to sea</p>	<p>DSC 213</p> <p>DSC 213</p> <p>DSC 212</p> <p>DSC 211</p> <p>DSC 211</p>	<p>LR.HLR</p> <p>LR.LLR.F.Asc.FS</p> <p>LR.FLR.Eph.EntPor</p>
54	58 46.529	3 14.483	<p>This target note is a vantage point on top of the cliff looking down on the shore</p>	DSC 215 E, 216 SE, 217 S and 218 W	

55	58 46.555	3 14.374	<p><u>Narrow inlet:</u> Uppershore: boulders and cobbles and acorn barnacles and no tar lichen. Lowershore: still on boulders and cobbles. Stunted spiral wrack and bladder wrack, gut weed with a mat of Pophyra.</p> <p>Sides of inlet: similar to the open coast in previous TNs, although no Kelp, or dabberlocks. Purple jelly fish and fish eating midges off the surface.</p>	DSC 219-221 (overview of inlet) DSC 223	LS.LCS LR.FLR.Eph.EntPor
Day 3: Starting from sands Geo and working east					
56	58 46.819	3 16.185	<p><u>Flat wave cut platform at the base of large sheer cliffs:</u> Substrate is sandstone bedrock and large boulder Uppershore: soft sandstone rock, tar lichen (C) but no other lichen present. Small Rough periwinkles. Midshore: Spiral wrack (C), gutweed, common limpet (O) with white lichen, knitted wrack (F), <i>Polysiphonia lanosa</i>, beadlet anemone, dogwhelk, acorn barnacle (O). Large amounts of bare rock. The brown seaweed <i>Fucus distichus(R)?</i>, <i>Palmaria palmata</i>, gut weed, Toothed wrack (C) lower down, sand binder weed <i>Rhodothamniella floridula</i>, False Irish moss, coral weed, Punctured ball weed. Lowershore: Dabberlocks, Kelp and Tangle weed, toothed wrack (A), gutweed, <i>Palmaria palmata</i>, <i>Rhodothamniella floridula</i>, sea lettuce, thong weed, chladophera, red seaweed indet. No gastropods common apart from dogwhelks,</p> <p>Access to the west of this point would be very hazardous as it would only be along the wave cut platform and high water was well above this. I.e well up the cliff.</p> <p>West side of sand geo used to dump rubbish</p>	IMGP0498 IMGP0499 IMGP0500-0502 DSC 003-005 DSC 001	LR.FLR.Lic.Ver LR.MLR.MusF IR.HIR.KFaR.Ala.Ldig
57	58 46.809	3 15.827	<p><u>Vantage point:</u> Boulders at the bottom of a tall steep cliff. Spiral wrack and gutweed dominate the mid shore, and dabber locks the lower shore.</p>	DSC 0014	LR.HLR.MusB.Cht.Cht IR.HIR.KFaR.Ala.Ldig
58	58 46.821	3 15.622	<p><u>Vantage point:</u> Narrow wave cut platform dominated by barnacles, Spiral wrack present on midshore, and dabberlocks on low shore,</p>	DSC 0041 W	LR.HLR.MusB.Cht.Cht IR.HIR.KFaR.Ala.Ldig
59			<p><u>Moodies Eddy and Long Geo:</u> Moodies Eddy is a wide open bay with an intertidal area of up to 20m. Access to the intertidal here was not possible. Cliffs are less high and steep but access would have contravened H&S. The substrate consists of a mixture of bedrock and boulder. A wide Verrucaria zone in the upper shore leads to a narrow and broken bank of spiral</p>	DSC 0077 taken from the western side of the bay looking east. DSC 088 View	LR.FLR.Lic.Ver LR.MLR.BF.FspiB

			wrack The mid shore is dominated by barnacles and few other species, <i>Ulva intestinalis</i> was present on the sheltered side of boulders but a lot of bare rock was present. The low shore appears to support Dabberlocks and thong weed, however this was difficult to confirm from distance	down long geo	LR.HLR.MusB.Sem.Sem IR.HIR.KFaR.Ala.Ldig
60	58 46.768	3 14.719	<u>Western edge of broad geo:</u> Sheer cliffs boulders on the inside of the geo, but very narrow intertidal on the outer edge of geo. Looks like similar communities to IT 49 with the angled rocks.	DSC 0088	LR.HLR.MusB.Sem.Sem

8.2 Appendix B: Photographs

A digital folder has been submitted with this report containing all digital photos mentioned within the report