2.3.3 Target notes

Target Notes and corresponding photographs are shown in Table 2.3. The locations of each of the Target Notes is indicated on the lifeforms map (Figure 2.2). Figure 2.2 also shows the locations of additional photographs as shown in Section 2.7.

Table 2.3 Target notes

Target note No.	Description	Photograph
T1	Test dig 1 – barren sand, no anoxic layer	
T2	Test dig 2 – barren sand slight anoxic colouring	
T3	Test dig 3 – barren sand, no anoxic layer	

Target note No.	Description	Photograph
T4	Test dig 4 – thin sand layer over rocks with polychaetes	
T5	Test dig 5 – shallow sand over bedrock with polychaetes including *Arenicola marina*	
T6	Test dig 6 – slightly deeper sand with abundant polychaetes	

Target note No.	Description	Photograph
T7	Shore to the east shows signs of more shelter with abundant *Ascophyllum nodosum*	
T8, T9 & T10	Higher rocks with *Pelvetia canaliculata* above *Fucus spiralis*	
T11	Emergent rock with greater sand clearance giving opportunity to greater range of species, such as *Littorina littorea*, *Patella vulgata*, *Nucella lapillus*, and *Semibalanus balanoides*	-
T12	Large area of decaying washed up kelp stipes	

Target note No.	Description	Photograph
T13	Man-made block structure at the end of drainage pipe	

2.3.4 Importance of Biotope types

The location of the proposed landfall lies within the East Sanday Coast Special Protection Area (SPA), the Sanday Special Area of Conservation (SAC), the East Sanday Coast Ramsar Site, and the East Sanday Coast Site of Special Scientific Interest (SSSI). Of these, both the SAC and the SSSI have qualifying interests relating to intertidal features, with the SAC designated for intertidal mudflats and sandflats, and the SSSI designated as a site of national importance for its variety of intertidal rock, sand, and muddy sand habitats. This particular area of coast is not an example of the large intertidal sand and mudflats for which the SAC is partially designated, with these being found elsewhere within the SAC, particularly at Otterswick, and Cata Sand and Little Sea within the SSSI. The site does provide good examples of rocky shore communities and diverse species assemblages on the sand-scoured rocks. The dog whelk (*Nucella lapillus*) is an OSPAR species and was found on the intertidal rock. However, the dog whelk is a common species in the UK and is not protected under any other piece of legislation. No UK BAP priority marine species were recorded.

Sanday SAC is also designated for its internationally important population of harbour seal (*Phoca vitulina*) that breed at intertidal haul-out sites at locations around the Sanday coastline during the summer months and forage all-year-round within the nearshore kelp beds that surround the Sanday coast. The survey area is also within East Sanday Coast Special Protection Area (SPA) which has been designated for its internationally important wintering populations of waders including bar-tailed godwit (*Limosa lapponica*), purple sandpiper (*Calidris maritima*) and turnstone (*Arenaria interpres*) which feed on the abundant supplies of small invertebrates within the substantial banks of kelp that are washed ashore in winter. The East Sanday Coast SSSI is also a site of national importance for harbour seals, a vascular plant assemblage and several wintering waders including bar-tailed godwit; purple sandpiper; turnstone; ringed plover (*Charadrius hiaticula*) and sanderling (*Calidris alba*). East Sanday Coast SSSI has additional importance during the spring migration period, as it is an important staging post for turnstones on passage during their migration north to their breeding grounds.

2.4 DISCUSSION

The location of the proposed BMH would mean that the cable landfall would traverse the intertidal zone through a mixture of sand emergent rocks and decaying seaweed. The potential cable route should pass to the west of the large expanses of bedrock at the east of the survey area and depending on the engineering requirements, it maybe possible to route the cable between the higher outcrops of emergent bedrock.

As can be seen from Figure 2.2, a large portion of the area through which the cable could potentially pass consists of a dense area of washed-up kelp. The East Sanday Coast SPA and SSSI is an extensive site which supports internationally

and nationally important populations of wintering waders that forage for invertebrates amongst these banks of kelp that are washed ashore in winter. The locations of the kelp banks are likely to vary on an annual basis, however, to avoid any reduction of the available food source for these species, any substantial banks of kelp should be sensitively relocated to ensure the food source is still available to the wintering birds. The cable-laying works would affect only a very small proportion of the available habitat within the SPA/SSSI. There would not be any permanent impact on this biotope, which should recover quickly with kelp washed ashore in subsequent storms. The short duration of the proposed works may result in short-term disturbance to any foraging birds in the area however this is likely to be a transient effect with no permanent effects anticipated.

2.5 RECOMMENDATIONS

A further Phase 2 intertidal survey is not required at this site. As mentioned above cable-laying activities should aim to relocate any substantial banks of kelp that may need to be disturbed. Any invasive damage to the emergent rock formations should be avoided where possible to minimise the impact on the habitats that these features support. However, these features are found over large areas of the shore, and the extent of cable works should have minimal impact on the overall habitats.

As the area is within Sanday SAC, any locations of harbour seal haul-outs within the vicinity would need to be avoided to avoid disturbance to this species, and may mean avoiding works in the months of June and July which is the particularly sensitive breeding season period.

2.6 REFERENCES

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2.7 PHOTOGRAPHS

The locations of photo points are shown in Figure 2.2.

Photo 1 Eastern beach looking towards high dunes at the back of the shore

Photo 2 Emergent sand-scoured rocks with fucoids on higher elevations

Photo 3 Example of infaunal polychaete *Malacoceros fuliginosus*

Photo 4 *Ulva* spp. on sand-scoured boulders looking back towards the proposed BMH location

Photo 5 Broad band of spiral wrack (*Fucus spiralis*) on the upper rocky shore

Photo 6 Beadlet anemone (*Actinia equina*) on the rocky mid-shore

Photo 7 Green shore crab (*Carcinus maenas*)

Photo 8 Fucoid covered emergent rocks on the western shore

Photo 9 Sand-scoured rocks on the lower western shore

A.7 INTERTIDAL SURVEY REPORT FOR CABLE CORRIDOR 2.4 FAIR ISLE TO BU: FAIR ISLE LANDING POINT

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Phase 1 Habitats (Intertidal and Terrestrial) Survey Report for North Haven, Fair Isle, Shetland

Version 1

Report to Intertek

Issued by Aquatera Ltd

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APPA Asociación de Empresas de Energías Renovables
Scottish Hydrogen & Fuel Cell Association
Australian Ocean Energy Group

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1 INTRODUCTION

Aquatera has been commissioned to carry out Phase 1 habitats surveys covering the intertidal and terrestrial areas at the proposed location for an onshore landfall site at North Haven, Fair Isle, Shetland (Figure 1.1). The area has been identified for the installation of submarine fibre optic cables as part of network improvements to connect a number of islands in the Northern Isles.

The surveys were undertaken by Nick J Riddiford, independent consultant and Fair Isle resident with 40 years ecological experience internationally and at home including former Phase 1 survey on Fair Isle for landowners, The National Trust for Scotland.

The main objectives of these surveys were to:

- Identify and map the intertidal biotopes present within the survey area
- Provide a description of the Phase 1 habitats within the survey area (with accompanying habitat field map and photographs) and to identify any notable or sensitive species, habitats or features that could be affected by the proposed development.
- Identify and map the presence of any rare or protected species within the survey area; and
- Provide target notes to describe key features.
- Provide recommendations for further survey work and/or mitigation if appropriate.

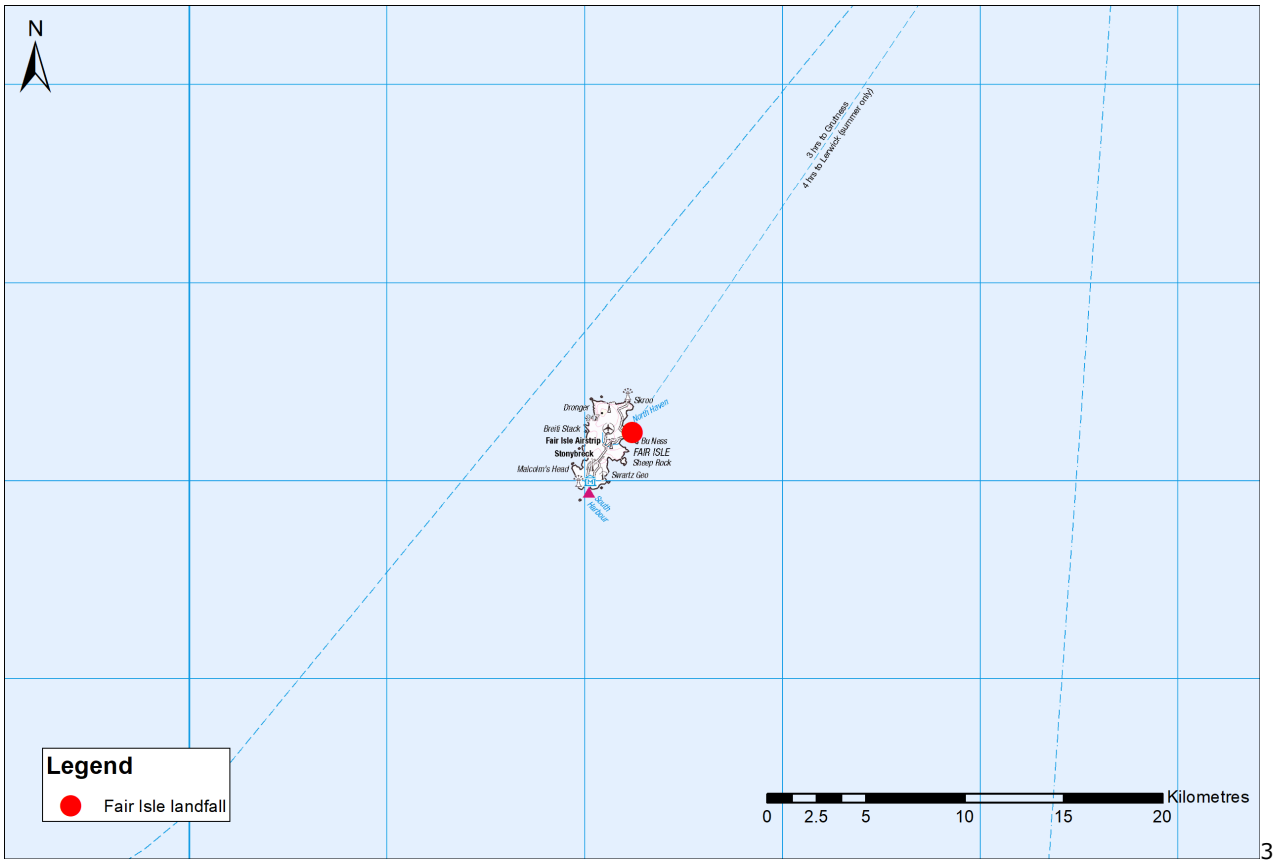


Figure 1.1 Location of North Haven, Fair Isle survey site

2 PHASE 1 INTERTIDAL AND TERRESTRIAL SURVEY

2.1 INTRODUCTION

This report presents the methods and findings of a Phase 1 habitats survey carried out at the proposed landfall site at North Haven, Fair Isle, Shetland.

The survey took place at and either side of low tide on Wednesday 25 August and Thursday 26 August 2021. A summary of the survey conditions on the day are shown in Table 2.1.

Table 2.1 Survey details

Date	25th August 2021	26th August 2021
Time at start	06:05	06:30
Time at finish	09:30	09:45
Low tide (hours)	06:54 BST	07:29 BST
Tide height (m)	0.4	0.5
Lowest Astronomical Tide (m)	0.1	0.1
Mean Low Water Springs (m)	0.6	0.6
Type of Access	Foot	Foot
Sea condition	Still	Still
Weather condition	Cool, overcast, calm	Cool, overcast, light north-westerly wind

2.2 METHODOLOGY

2.2.1 Phase 1 survey method

Intertidal

The intertidal survey was carried out on foot using a variety of survey techniques that are described in the Countryside Council for Wales (CCW) report 'Handbook for Marine Intertidal Phase 1 Biotope Mapping Survey' (Wyn et al., 2000), the 'Marine Nature Conservation Review Rationale and Methods' (Hiscock, 1996) and 'Field Manual: Handbook for Phase 1 habitat survey' (NCC, 1990; revised JNCC, 2016). Prior to commencing the survey in the field, a wireframe map (a basic outline drawing of obvious features and/or changes in habitat) was produced to aid with the recording of biotopes. In the intertidal area, areas of sediment were dug and sampled at various intervals at the upper mid shore, mid shore, and lower shore. All samples were filtered through a 0.65 mm sieve, intercepting all but the smallest meiofauna. For both the sediment and rock areas, target notes and photographs were taken when there was a change in biotope type or zonation. The immediate cable landfall area was surveyed, and target notes taken of habitat type and condition. The inshore sub-tidal habitats were mapped by means of aerial photograph enhanced by observations from shore, cliffs, and piers.

All information was digitised to GIS using ArcMap 10, post survey. Maps were created using the guidance laid out in the CCW methodology. Biotopes were assigned and described with reference to The Marine Habitat Classification for Britain and Ireland (v04.05) (Connor et al., 2004) and the Joint Nature Conservation Committee (JNCC) website's online search facility. All species names were taken from The Marine Life Information Network (MarLIN) and the Algaebase website for certain species of seaweed which were not listed on the MarLIN site.

Terrestrial habitats

The Phase 1 survey was undertaken in accordance with JNCC methodology (JNCC, 2010). This methodology entailed a walkover survey ensuring that each distinct parcel of land within the survey area was visited by a trained surveyor and the vegetation mapped on a 1:10,000 Ordnance Survey map. Aerial photographs were used to assist in the finding of distinct vegetation types.

The standard Phase 1 letter codes and habitat names were marked on a fair copy of the field map and subsequently digitised using ArcGIS.

2.2.2 Survey area

The proposed survey area comprised a 250 m radius centred on the proposed cable landfall and included all onshore areas within this zone and for the intertidal survey, from the splash zone down to the Lowest Astronomical Tide (LAT) (see Figure 2.1). Within that area, detailed survey focussed on the immediate track and adjacent habitats of the planned cable route. The outer zone of the radius is unlikely to be impacted by the planned works, but Target Notes were made of key elements as they include features listed as notable within the Fair Isle Special Area of Conservation (SAC).

2.2.3 Limitations of survey

There were few limitations to the survey. Choice of survey days was limited by availability of sufficiently low tides in the reporting period and their occurrence just after dawn. Therefore, two consecutive days were allocated, the second to fill in any gaps and take advantage of more daylight time. Boat or scuba access was not undertaken as sub-littoral habitat assessment was supported by an aerial photograph improving visual access to the sublittoral zone (Photo 11), complemented by previous knowledge of the site and its ecology.

2.3 SURVEY FINDINGS

2.3.1 Site description

North Haven is a shallow inlet bounded on west and east sides by cliffs approximately 20 m high. Its southern boundary comprises a wide band of sandy beach, approximately 25 m in width for much of its length, measured from mean low tide to its land boundary. On most high tides at least 5 m breadth of sand remains exposed but on highest tides with northerly winds the entire beach can be inundated by the sea. Above the beach, and acting as a natural barrier to land erosion, is a band of medium-sized cobbles, 7 m to 8 m broad for much of the length east of the old slipway.

West of the slipway high tides reach the beach head, which comprises a narrow strip of cobbles and in the western corner low cliff including a couple of short caves.

North Haven and South Haven are separated by a narrow isthmus. A retaining wall runs the length of the isthmus above the strongly fortified South Haven beach and alongside on its northern side is the access road to the North Haven pier. Between the road and the beach is a strip of heavily degraded grey dune apart from a small area of coastal grassland at its eastern end. West of the slipway is unconsolidated foredune comprising sand dredged from North Haven in August 2020 for ferry access maintenance.

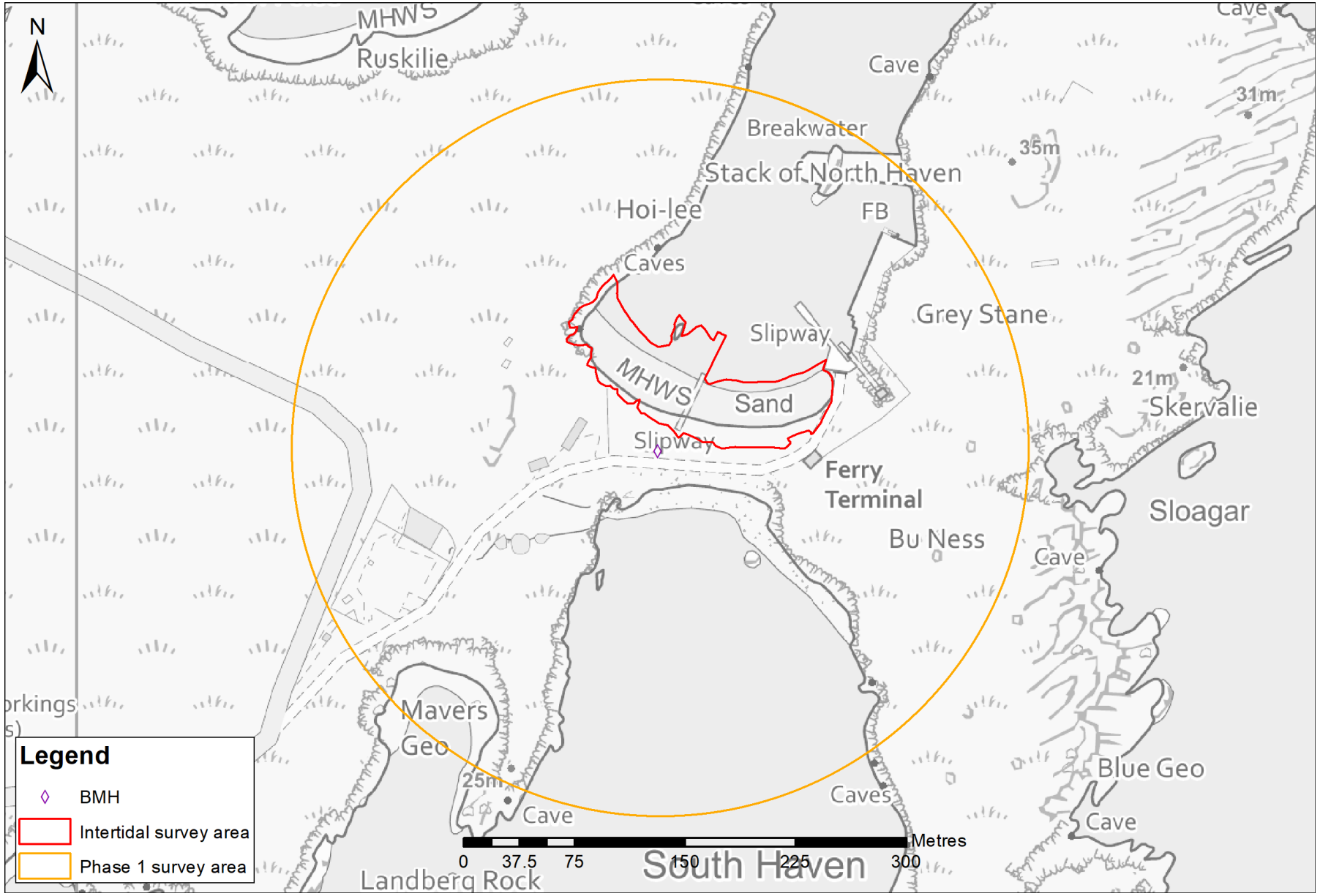


Figure 2.1 Survey area and proposed BMH location at North Haven, Fair Isle (© Crown copyright and database rights 2021 OS 0100040827)

North Haven is sheltered from all but winds from the north-east and has long been used as a secure maritime landing point. Considerable improvements and extensions have seen the original pier (HZ224725) – itself extended – augmented by a more extensive one under the east cliff providing a safe embarkment/disembarkment berth for the *Good Shepherd* ferry as well as for other craft. North of the new pier, a breakwater extends westwards for half the width of the Haven. Composed of large granite blocks, it has further improved levels of shelter. Immediately south of the new pier, a hole has been blasted into the East cliffs to provide a 'noust' for the Good Shepherd ferry, which is taken out of the water on a cradle.

The cliffs, composed of bare to highly vegetated old red sandstone, have ecologically significant features. The cliffs have a series of sea caves including one measured in August 2021 as 80 m long. These have a rich cave-wall marine fauna, a priority conservation feature in Fair Isle's Special Area of Conservation (SAC). *Fucus edentatus sensu stricto* (formerly *Fucus distichus edentatus*) has long been known on rocks along the base of the east cliff. This northern seaweed is at its southernmost limit on the UK side of the North Sea (Burrows, 1963). It is a taxon of sheltered waters, not to be confused with the closely related and equally rare *Fucus evanescens f. anceps* (formerly *Fucus distichus anceps*) which occurs on the nearby North Gavel headland (just outside the survey radius), adapted to conditions of extreme wave action. Both taxa are listed (as *Fucus distichus*) on the British Action Plan (BAP) conservation schedule.

The tidal range in North Haven (and Fair Isle generally), is small, barely reaching two metres at its most extreme. The beach slopes moderately steeply into the sub-littoral but the gradient is such that North Haven remains relatively shallow for its entire length reaching 10 m depth beyond the breakwater and 20 m where North Haven meets the open sea. A narrow, disperse band of small cobbles stretches across the tide line at lowest tides but the substrate beyond is predominantly sand. To the west of the slipway, parallel ridges of rock run out at right angles to the shore and two low emergent rocky 'baas', one a former island now joined to the breakwater, are further indications of bedrock in places at or just below the seabed. However, much of the seabed is compressed glacial till overlaid by sand.

2.3.2 Phase 1 intertidal habitats

A summary of biotopes recorded within the survey area is provided in Table 2.2 and a map of lifeforms is shown in Figure 2.2.

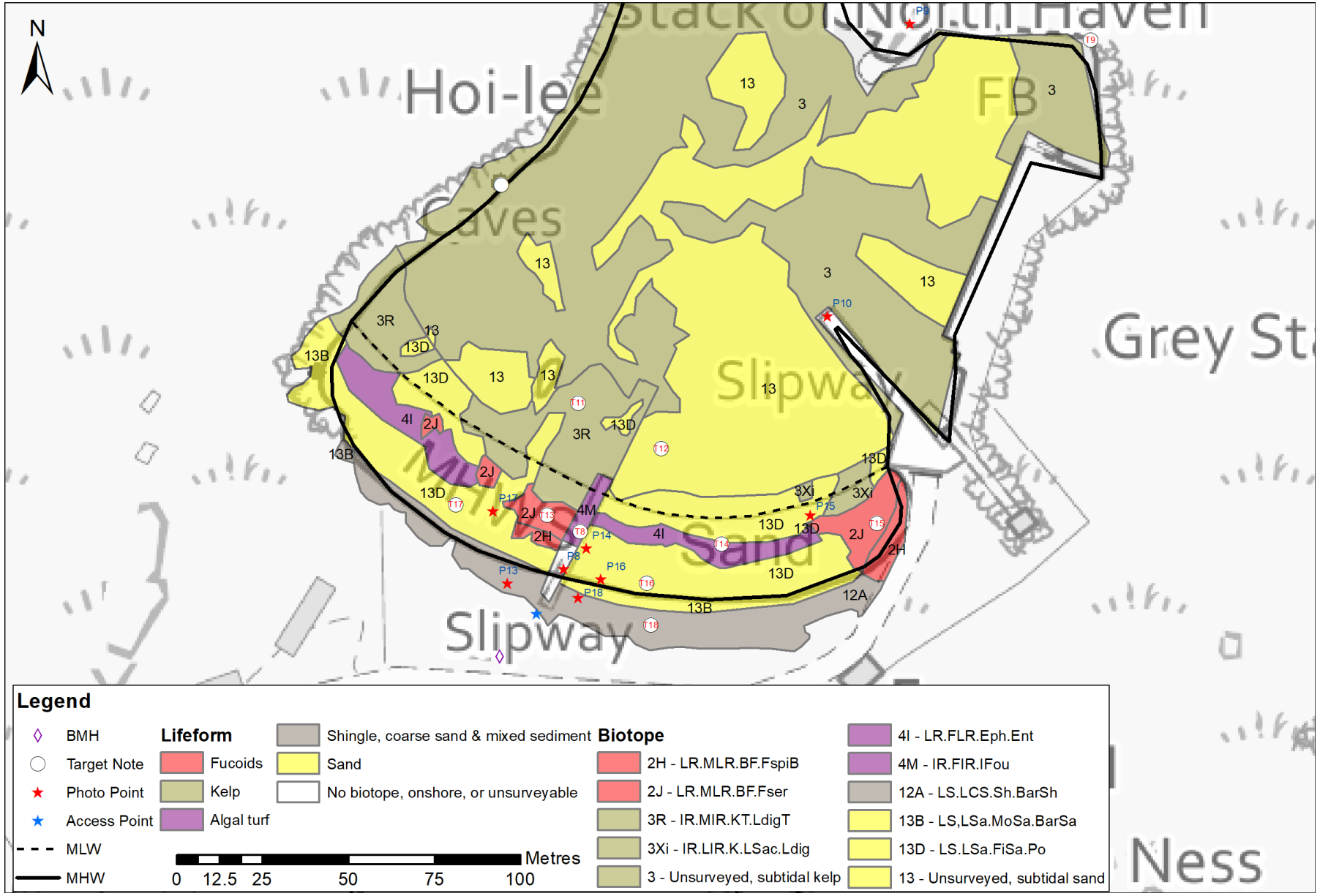


Figure 2.2 Lifeforms map of the North Haven intertidal survey area (© Crown copyright and database rights 2021 OS 0100040827)

Table 2.2 List of Biotopes within the survey area

Biotope code	Biotope description	Occurrence on site	Typical species on site
IR.MIR.KT.LdigT	*Laminaria digitata*, ascidians and bryozoans on tideswept sublittoral fringe rock	Sublittoral patches, Haven (see Photo 11)	*L. digitata* *Saccharina latissima* *Palmaria palmata* *Membranipora membranacea*
IR.LIR.K.Lsac.Ldig	*Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock	Between breakwater and new pier	*L. digitata* *S. latissima* *Chondrus crispus* *Ulva lactuca* *Nucella lapillus*
IR.FIR.SG.CrSp	Sponge crusts on extremely wave-surged infralittoral cave or gully walls	Intertidal-subtidal caves, both cliffs	*Halichondria panicea* *Corallinaceae* *Spirorbidae* *Clathrina coriacea* *Urticina feline* *Corynactis viridis*
IR.FIR.Ifou	Infralittoral fouling communities	Old Slipway, upper shore to sublittoral	*Blidingia minima* *Fucus serratus* *Lithothamnion crust* *Ulva* spp. *Semibalanus balanoides* *Patella vulgata*
LR.MLR.BF.FspiB	Fucus spiralis on full salinity exposed to moderately exposed upper eulittoral rock	Rocks partially exposed at low tide, upper eulittoral	*Fucus spiralis* *Verrucaria maura* *Semibalanus balanoides* *Patella vulgata*
LR.MLR.BF.Fser	Fucus serratus on moderately exposed lower eulittoral rock	Rocks partially exposed at low tide, lower sublittoral	*Fucus serratus* *Ulva* spp. *Mastocarpus stellatus* *Semibalanus. Balanoides* *Patella vulgata* *Dictyosiphon foeniculaceus* *Littorina saxatilis* *Nucella lapillus*
LR.FLR.Eph.Ent	*Enteromorpha* (now *Ulva*) spp. on freshwater influenced and/or unstable upper eulittoral rock	Mid shore boulders and cobbles on both sides of the Old Slipway	*Ulva* spp.

Biotope code	Biotope description	Occurrence on site	Typical species on site
LS.LCS.Sh.BarSh	Barren littoral shingle	Beach backing above mean high water	*Petrobius maritimus* *Strigamia maritima* *Cylindroiulus latestriatus* *Trichoniscus pusillus* Carabids Staphylinids *Cercyon littoralis* other Coleoptera
LS.LSa.MoSa.BarSa	Littoral sands and muddy sands	Upper sandy shore	Very little flotsam, no faunal activity
LS.Lsa.FiSa.PO	Polychaetes in littoral fine sand	Lower shore	*Numerous Capitella capitata, Malacoceros fuliginosus. Also noted Scolelepis squamata, Arenicola marina, Leptosynapta bergensis.*

2.3.3 Phase 1 terrestrial habitats

A summary of the Phase 1 terrestrial habitat types found within the survey area is provided in Table 2.3.

Table 2.3 List of Phase 1 terrestrial habitats found within the survey area

Phase 1 code	Biotope description	Occurrence on site	Typical species on site
D1.1	Dry dwarf shrub heath on acid soils	Cliff top, Hoilie (above west cliff)	*Calluna vulgaris* *Anthoxanthum oduratum* *Molinia caerulea*
H6.5	Dune grassland	Coastal strip immediately east of cable landfall site	*Potentilla anserina* *Lolium perenne* *Festuca rubra* *Cirsium vulgare*
H6.8	Open dune	Coastal strip immediately west of cable landfall	*Poa annua* *Plantago* spp. *Cirsium vulgare*
H8.1	Hard cliff	West and east limits of North Haven	*Silene maritima* *Armeria maritima* *Festuca rubra* *Atriplex glabriuscula*
H8.4	Coastal grassland	Cliff top, Buness (above east cliff) and coastal SE corner of North Haven (above beach)	*Plantago* spp. *Armeria maritima* *Festuca rubra* *Coeloglossum viride* *Euphrasia foulaensis*

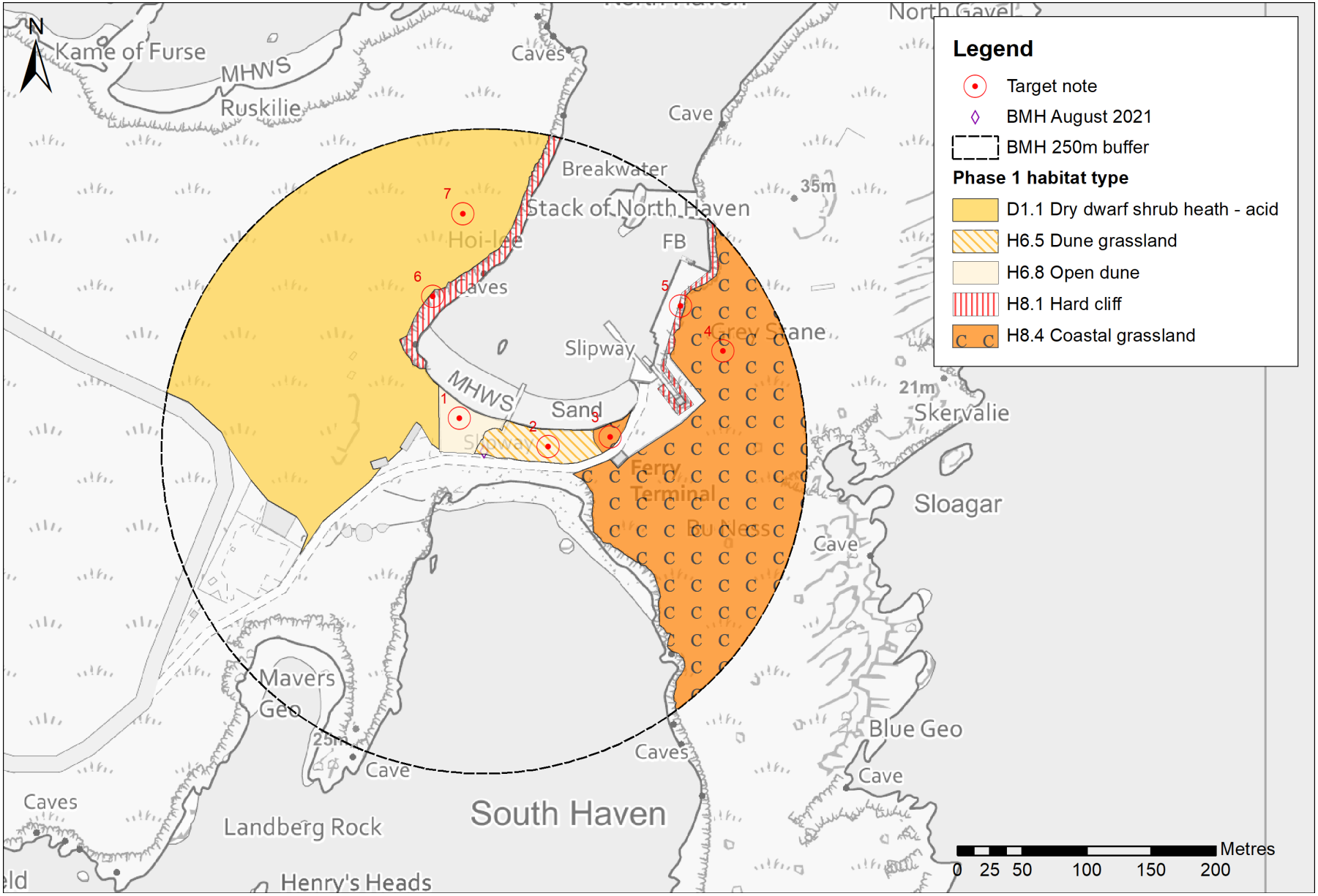
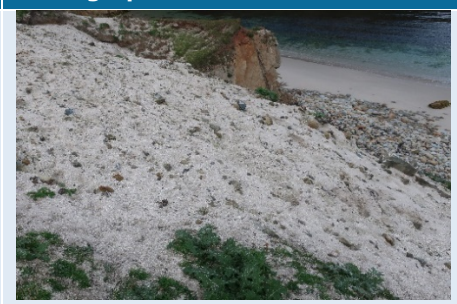


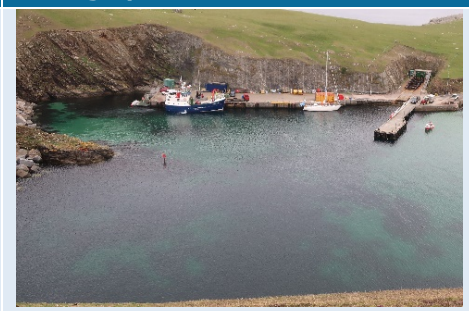
Figure 2.3 Phase 1 habitats map and Target Note locations for North Haven, Fair Isle proposed landfall site

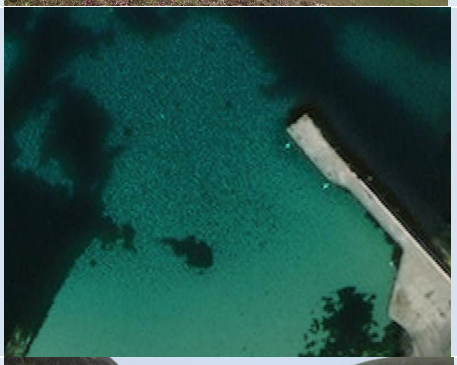
2.3.4 Target notes

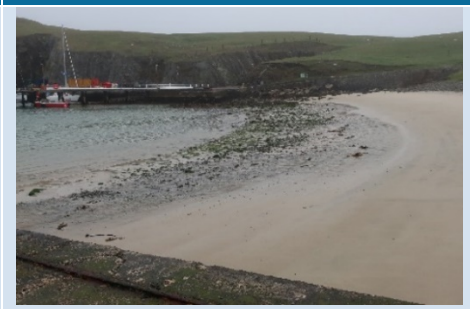
A general impression of the habitats is gained from the target-noted photographs listed in Table 2.4 and shown in Section 2.7. The locations of each of the Target Notes is indicated on the lifeforms map (Figure 2.2) and on the Phase 1 terrestrial habitats map (Figure 2.3). Further details on each of the natural, semi-natural and terrestrial Phase 1 habitats are presented in Table 2.4.

Table 2.4 Target notes

Target Note No.	Location and Description	Photograph
T1	Unconsolidated fore dune, established from North Haven dredging maintenance, August 2020. Bare patches with scattered patches of pioneer colonists, *Poa annua, Plantago coronopus, Plantago lanceolata* coastal form and *Cirsium vulgare*.	
T2	Heavily disturbed area of degraded grey dune, densely vegetated and in most parts dominated by *Potentilla anserina* with frequent *Lolium perenne, Festuca rubra, Agrostis stolonifera and Cirsium arvense*.	
T3	Undisturbed coastal grassland on sandy soil. *Festuca rubra* dominant. Frequent *Euphrasia foulaensis*. ***Notable feature***: E. foulaensis, regional endemic (widespread and numerous in Fair Isle coastal grassland).	
T4	Above east cliff: permanently grazed cliff top coastal grassland. *Plantago maritima* dominant. Frequent *Plantago coronopus, Armeria maritima, Scilla verna*. ***Notable feature***: *Coeloglossum viride* (scattered plants).	

Target Note No.	Location and Description	Photograph
T5	East cliff: maritime hard cliff, old red sandstone, Crevice vegetation 0-50%. Frequent *Silene maritima, Armeria maritima, Festuca rubra*. ***Notable features***: *Fucus edentatus s.s.* (UK BAP plan, as *F distichus*), Sea cave (see T9).	
T6	West cliff: maritime hard cliff, old red sandstone, Crevice vegetation 0-50%. *Silene maritima* dominant. Frequent *Armeria maritima*, *Festuca rubra*, *Atriplex glabriuscula*. **Notable feature**: Sea caves (see T10)	
T7	Above west cliff: Dry dwarf shrub heath (**SAC priority feature**). Permanent grazing. *Calluna vulgaris* dominant. Frequent *Anthoxanthum odoratum*, *Molinia caerulea*, *Potentilla erecta*, *Scilla verna*.	
T8	Old Slipway: zonal vegetation from turf of *Blidingia minima* at uppermost tide limit to dense *Laminaria digitata* in shallow sublittoral.	
T9	Immediately south of breakwater: a narrow sea cave at base of east cliff, not fully explored but thought to be of considerable length. Cave wall fauna (**SAC priority feature**) – sea squirts, sponges, turf-forming bryozoans, cup coral, etc.	

Target Note No.	Location and Description	Photograph
T10	Sea caves, two short, one circa 80 m long sea cave at base of west cliff. Cave wall fauna (**SAC priority feature**).	
T11	Dense patches of kelp, sublittoral: *Laminaria digitata* dominant.	
T12	Largely unvegetated sand, sublittoral: fine to slightly coarse sand. Juvenile *Platichthys flesus* frequent, occasional *Crangon crangon,* small shoals of 0 group sand-eels *Ammodytes* in water column. Very little algal growth. Interstitial fauna known to include the molluscs *Lucina borealis* and *Heteranomia squamula* (both northern species), *Ensis siliqua* and the harbour crab *Liocarcinus depurator*.	
T13	Intertidal-subtidal interface west of old slip: main feature a series of circa 25 rock ridges closely aligned and running parallel from lower shore into the sublittoral (*i.e.*, perpendicular to the beach); substrate inbetween fine to slightly coarser sand. *Dictyosiphon foeniculaceus* dense and dominant inshore, *Laminaria digitata* beyond that. Embedded rocks on mid and upper shore with frequent *Ulva* species and *Fucus spiralis*. Diverse algae on emergent and submerged rock ridges with *D foeniculaceus* dominant, frequent *Ulva linza*.	 

Target Note No.	Location and Description	Photograph
T14	A 15 m band of scattered, embedded cobbles from lower shore into shallow sublittoral and extending the entire length east from the Slip. Cobbles providing substrate for abundant *Dictyosiphon foeniculaceus*, frequent *Ulva linza*, infrequent *Lomentaria articulata*.	
T15	Algae-rich fixed emergent rocks. *Fucus spiralis* dominant, some *Ascophyllum nodosum* on upper shore. *Fucus serratus* dominant on mid and lower shore. *Dictyosiphon foeniculaceus* dominant, *Ulva lactuca* frequent on lower shore rocks. *Laminaria digitata* dominant, *Saccharina latissima* frequent with emergent fronds in shallow sublittoral.	
T16	Beach east of old slip: fine sand to c15 cm depth, grit, and small stones below. High strandline with little flotsam deposition, beach generally clean (*i.e.*, free of loose and fixed material). Lower portion, the first 12 m landward from low tide mark, with worm casts (at c 15 per square metre) Interstitial fauna of abundant polychaetes; also, several *Leptosynapta bergensis* (sea cucumber).	
T17	Beach west of old slip: fine sand to c5 cm depth, dark brown (oily) mud-rich sand below and bedrock in places beneath that. Beach surface generally free of material. Lower portion, the first 5m landward from low tide mark, with worm casts (at c25 per square metre). Interstitial fauna of diverse polychaetes including very abundant *Capitella capitata* and frequent *Malacoceros fuliginosus*.	

Target Note No.	Location and Description	Photograph
		
T18	Band of medium-sized cobbles, roughly layered to 4 cobbles-depth at head of beach, inundated only during strong tide surges. Unvegetated (cobbles too mobile). Abundant invertebrates beneath cobbles including frequent *Petrobius maritimus*, also noted *Strigamia maritima*, *Cylindroiulus latestriatus*, *Trichoniscus pusillus*. Particularly favoured by various Carabids, Staphylinids, *Cercyon littoralis* and other Coleoptera.	

2.3.5 Importance of Phase 1 habitat types

The Fair Isle coastal fringe, including North Haven, is within the Fair Isle Special Area of Conservation (SAC) and Special Protection Area for Birds (SPA). However, there are no biotopes of conservation importance within 30 m of the cable route (nearest cave 31 m). One notable species, the dog whelk *Nucella lapillus* occurs on sublittoral rocks, including close to the cable landfall point. It is an OSPAR species but is common in Fair Isle waters and generally in the UK and is not protected under any other piece of legislation.

One UK BAP priority marine species, *Fucus edentatus sensu stricto* (formerly *Fucus distichus edentatus*) occurs at the base of North Haven's east cliff and sea caves are present within the outer survey area in both the east and west cliff. The SAC lists undersea caves and their rich marine fauna as one of its priority conservations features. Dry dwarf shrub heath above the west cliff is another SAC qualifying conservation feature.

2.4 DISCUSSION

The ecological features of priority conservation interest are associated with the cliffs and are not expected to be affected by the limited disturbance that the installation of the cable will bring. Where the cable is planned to come ashore, the terrestrial vegetation extending the width of the littoral is typical of a heavily disturbed substrate. Heavy equipment and stored materials during a succession of works to improve the harbour and ferry facilities over the last 40 years or so have had a toll on coastal plants which have largely been replaced by *Potentilla anserina*, thistles *Cirsium* and Annual Meadow-grass *Poa annua* – all classic indicators of constantly disturbed land. Recovery to a favourable state is further limited by trampling and nutrient-enrichment through dunging of sheep for whom the site is a favoured resting point.

The cable route through North Haven to the landfall site runs through stands of kelp and bare sand supporting a typical fauna and flora of sheltered northern UK sub-tidal and intertidal habitats. These habitats extend to the cliffs either side and an estimated 80 % in area will not be materially affected, other than perhaps by some light re-distribution of sand or suspension into the water column.

These circumstances lead to a reasonable assessment that the cable installation will impact a narrow band on and either side of the route and will have limited and only short-term environmental impact. There is every prospect and expectation that the ecological communities and their environment will re-establish fully within a short timescale following the installation.

2.5 RECOMMENDATIONS

A further Phase 2 intertidal survey is not required at this site. Those involved in the cable installation process should be cognisant of the priority ecological features associated with the cliffs and prevent the installation works straying beyond the narrow band necessary to lay the cable. Assumption is made that the mapped cable route, coming ashore immediately west of the Old Slipway, has been determined following survey for physical features by those undertaking the work. Potential obstacles may include rock strata and the 7-8 m band of cobbles at the head of the beach. The substrate immediately east of the Old Slip, has a sand rather than rock substrate. Though recent works to dredge accumulated sand suggest a tendency for accretion, it should be noted that the sand within the Haven is mobile so depth and locations of fine sediment can vary from year to year and month to month.

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2.7 PHOTOGRAPHS

Photo 1 **Unconsolidated dune (Target Note 1, Figure 2.3)**

Photo 2 **Degraded grey dune (Target Note 2, Figure 2.3)**

Photo 3 **Coastal grassland (Target Note 3, Figure 2.3)**

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Photo 5 East Cliff (Target Note 5, Figure 2.3)

Photo 6 West Cliff (Target Note 6, Figure 2.3)

Photo 7 Dry dwarf shrub heath (SAC feature) above west cliff (Target Note 7, Figure 2.3)

Photo 8 Old Slipway, North Haven (Target Note 8, Figure 2.2)

Photo 9 Sea Cave, east cliff (Target Note 9, Figure 2.2)

Photo 10 Sea Cave, west cliff (Target Note 10, Figure 2.2)

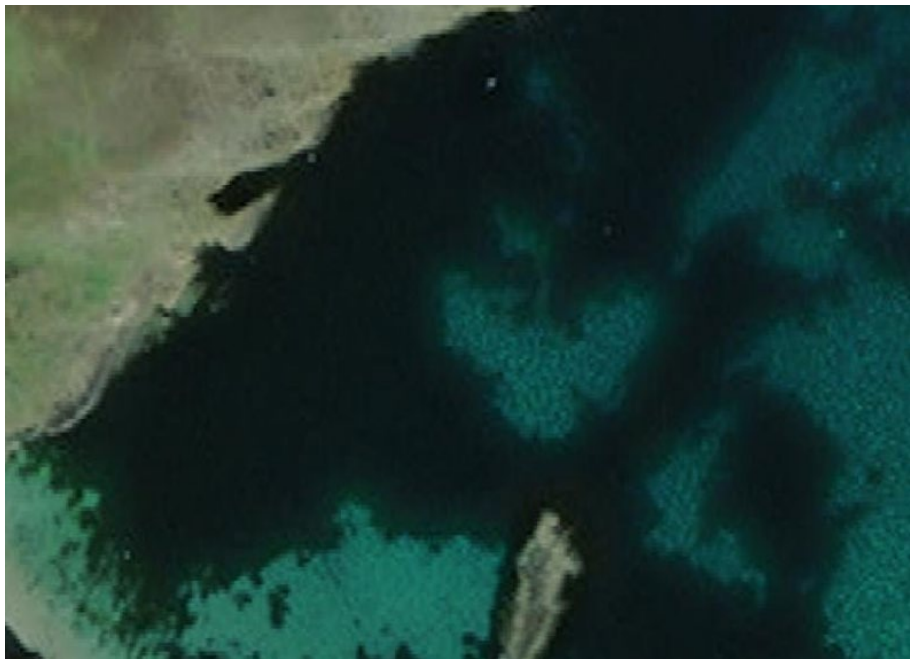

Photo 11 Dense patches of kelp, sublittoral (Target Note 11, Figure 2.2)

Photo 12 Largely unvegetated sand, sublittoral (Target Note 12, Figure 2.2)

Photo 13 Intertidal/subtidal interface west of Old Slipway (Target note 13, Figure 2.2)

Photo 14 Intertidal/subtidal interface east of Old Slipway (Target Note 14, Figure 2.2)

Photo 15 South-east corner, North Haven (Target Note 15, Figure 2.2)

Photo 16 Beach east of Old Slipway (Target Note 16, Figure 2.2)

Photo 17 **Beach west of Old Slipway – note oily substance (Target Note 17, Figure 2.2)**

Photo 18 **Cobbles at head of beach, North Haven (Target Note 18, Figure 2.2)**

A.8 INTERTIDAL SURVEY REPORT FOR CABLE CORRIDOR 2.8 SHETLAND TO WHALSAY: SHETLAND LANDING POINT

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Phase 1 Intertidal Survey Report for Grutness Voe, Sumburgh, Shetland (Route 2.3)

Version 1

Report to Intertek

Issued by Aquatera Ltd

P961 – October 2021

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Members of:

OREF Orkney Renewable Energy Forum
ADEMAR
poet Pacific Ocean Energy Trust
APPA Asociación de Empresas de Energías Renovables
Scottish Hydrogen & Fuel Cell Association
Australian Ocean Energy Group

Contents

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1 INTRODUCTION

Aquatera has been commissioned to carry out a Phase 1 intertidal survey of the shore at Grutness Voe on the east coast of Sumburgh, south Shetland (Figure 1.1). The area has been identified as a suitable location for the onshore landfall and onward connection for fibre optic cables as part of network improvements to connect a number of locations around Shetland.

The objectives of the survey were to:

- Identify and map biotopes present within the survey area;
- Identify and map the presence of any rare or protected species within the study area; and
- Provide target notes to describe key features of the shore

The survey was carried out by Duncan Clarke, a marine biologist experienced in intertidal biological survey and mapping.

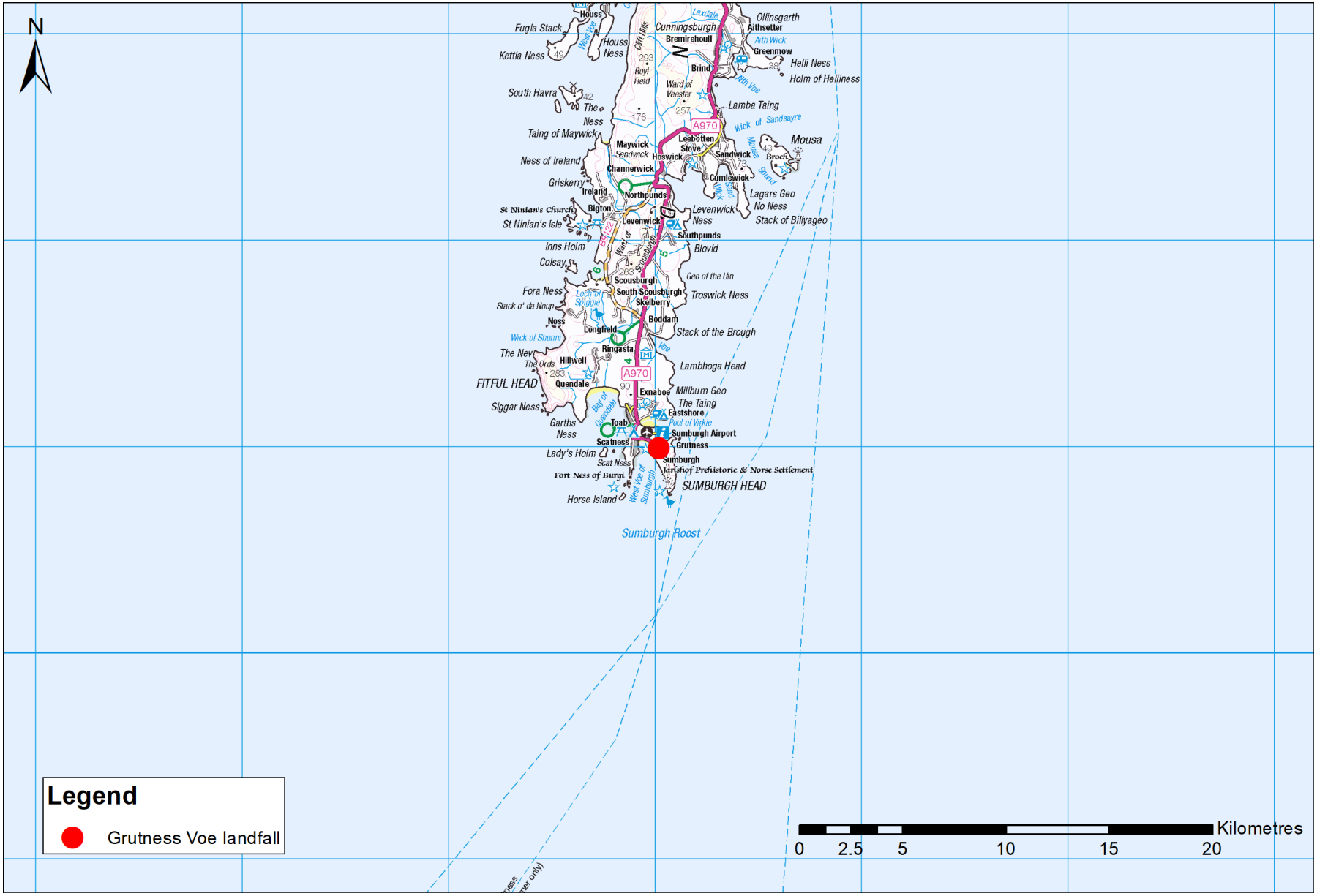

Figure 1.1 Location of the Grutness Voe, Shetland survey site (© Crown copyright and database rights 2021 OS 0100040827)

2 PHASE 1 INTERTIDAL SURVEY

2.1 INTRODUCTION

The survey took place on 19 September 2021, during low spring tides. The survey took place either side of low tide. Table 2.1 below outlines the survey conditions.

Table 2.1 Survey details

Date	19 September 2021
Time at start	15:15
Time at finish	17:00
Low tide (hours)	16:49 BST
Tide height (m)	0.6
Lowest Astronomical Tide (m)	0.0
Mean Low Water Springs (m)	0.4
Type of access	Foot
Sea condition	Choppy, moderate waves breaking on the shore
Weather condition	S5; light rain

2.2 METHODOLOGY

2.2.1 Phase 1 survey method

The survey was carried out on foot using a variety of survey techniques that are described in the Countryside Council for Wales (CCW) report 'Handbook for Marine Intertidal Phase 1 Biotope Mapping Survey' (Wyn *et al.*, 2000) and the 'Marine Nature Conservation Review Rationale and Methods' (Hiscock, 1996).

Prior to commencing the survey in the field, a wireframe map (a basic outline drawing of obvious features and/or changes in habitat was produced to aid with the recording of biotopes.

Areas of sediment were dug and sampled at various intervals at the upper mid shore, mid shore, and lower shore. All samples were filtered through a 5 mm and 0.5 mm sieve. For both the sediment and rock areas, target notes and photographs were taken when there was a change in biotope type or zonation. An iPhone equipped with the ArcGIS app "Field Maps" was used to mark target points and tracks. All information was digitised to GIS using ArcMap 10, post survey. Maps were created using the guidance laid out in the CCW methodology.

Biotopes were assigned and described with reference to The Marine Habitat Classification for Britain and Ireland (v04.05) (Connor *et al.*, 2004) and the Joint Nature Conservation Committee (JNCC) website's online search facility.

All species names were taken from The World Register of Marine Species (WoRMS) website.

2.2.2 Survey area

The proposed survey area comprised an approximate 470 m corridor. This was based on the natural shape of the voe. The survey area extended from the splash zone down to the Lowest Astronomical Tide (LAT) (Figure 2.1).

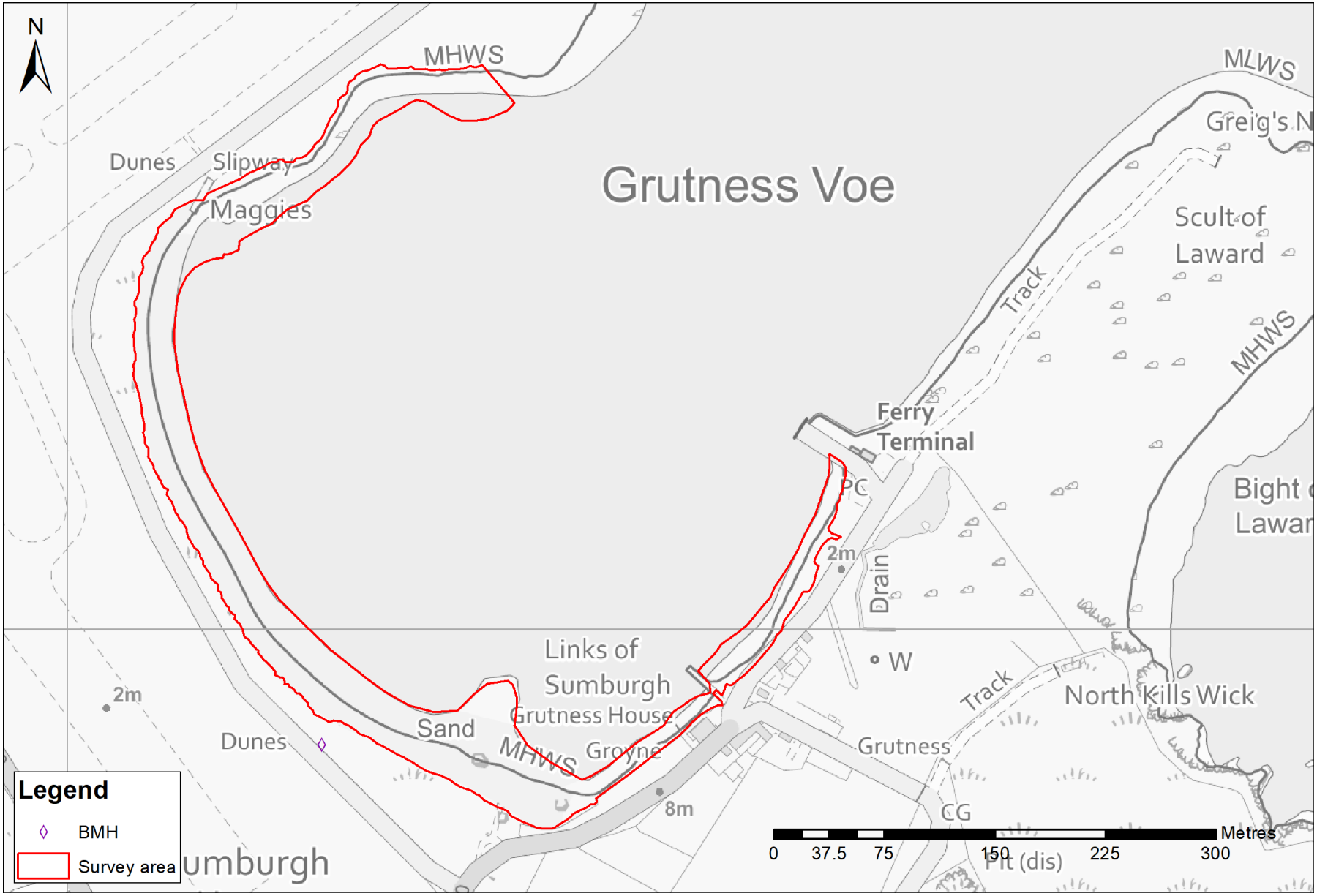

Figure 2.1 Survey area and proposed BMH location at Grutness Voe, Sumburgh (© Crown copyright and database rights 2021 OS 0100040827)

2.2.3 Limitations of survey

Only one low tide window was available in which to complete the survey. However, it was possible to cover the entire survey area during the single survey period.

2.3 SURVEY FINDINGS

2.3.1 Site description

The site at Grutness Voe lies at the south of Shetland on the eastern side of Sumburgh. The voe is open to the northeast but sheltered from all other directions and consists of a large central sandy bay backed by dunes, with the airport immediately to the west and north of the voe. The northern and southern shores of the voe are rocky in nature, with the southern shore hosting a pier that the Fair Isle passenger ferry uses on alternate days through the week. The beach, even though sheltered appears to be mobile in nature with large amounts of kelp washed up and large undulations from sediment depositions carried in the breaking waves.

2.3.2 Biotopes

A summary of biotopes recorded within the survey area is provided in Table 2.2, and a map of lifeforms is shown in Figure 2.2.

Table 2.2 List of Biotopes found within the survey area

Biotope code	Biotope description	Occurrence on site	Typical species on site
LR.FLR.Lic.YG	Yellow and grey lichens on supralittoral rock	Rock spit on the northern edge of the survey area. Also found on natural bedrock on the northern coastline.	*Caloplaca* spp. Grey lichens
LR.FLR.Lic.Ver	*Verrucaria maura* on littoral fringe rock	Found on the lower edges of the rock spit below the yellow and grey lichens, and also on the upper shore rocks between the pier and Grutness House.	*Verrucaria maura*
LR.MLR.BF.PelB	*Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock	Sparse band on the upper shore rocks between the pier and Grutness House.	*Semibalanus balanoides* *Pelvetia canaliculata* *Verrucaria maura*
LR.MLR.BF.FspiB	*Fucus spiralis* on exposed to moderately exposed upper eulittoral rock	Sparse band below the *Pelvetia canaliculata* band above.	*Semibalanus balanoides* *Patella vulgata* *Fucus spiralis* *Verrucaria maura*

Biotope code	Biotope description	Occurrence on site	Typical species on site
LR.MLR.BF.FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock	Mid shore rocks on the south-eastern shore between the pier and the beach.	*Actinia equina* *Semibalanus balanoides* *Patella vulgata* *Littorina obtusata* *Nucella lapillus* *Fucus vesiculosus* *Ulva* spp. *Cladophora rupestris*
LR.MLR.BF.Fser	*Fucus serratus* on moderately exposed lower eulittoral rock	Lower shore rocks below LR.MLR.BF.FvesB and also on the rock outcrop at the south-eastern end of the beach.	*Semibalanus balanoides* *Patella vulgata* *Nucella lapillus* *Fucus serratus* *Ulva* spp. *Cladophora rupestris*
LR.LLR.F.Pel	*Pelvetia canaliculata* on sheltered littoral fringe rock	Occurs as a mosaic with *Fucus spiralis* biotopes below Grutness House and on the north-western rocky shore.	*Pelvetia canaliculata* *Verrucaria maura*
LR.LLR.F.Fspi	*Fucus spiralis* on sheltered upper eulittoral rock	Occurs as a mosaic with LR.LLR.F.Pel.	*Patella vulgata* *Fucus spiralis* *Verrucaria maura*
LR.LLR.F.Fves	*Fucus vesiculosus* moderately exposed to sheltered mid eulittoral rock	Broad band on the mid, north-western, rocky shore.	*Actinia equina* *Semibalanus balanoides* *Carcinus maenas* *Patella vulgata* *Littorina obtusata* *Nucella lapillus* *Ascophyllum nodosum* *Fucus vesiculosus* *Ulva* spp.
LR.LLR.F.Fserr	*Fucus serratus* on sheltered lower eulittoral rock	Found below the LR.LLR.F.Fves biotope on the north-western rocky shore.	*Semibalanus balanoides* *Patella vulgata* *Nucella lapillus* *Mastocarpus stellatus* *Fucus serratus* *Ulva* spp. *Cladophora rupestris*
LR.FLR.Eph.Ent	*Enteromorpha* spp. on freshwater and/or unstable upper eulittoral rock	Small patches below outflow pipes on each side of the voe.	*Ulva* spp.

Biotope code	Biotope description	Occurrence on site	Typical species on site
LR.FLR.Eph.EntPor	*Porphyra purpurea* and *Enteromorpha* spp. on sand-scoured mid or lower eulittoral rock	Found at the two ends of the beach where there is a build of sand-scoured cobbles and pebbles.	*Ulva* spp.
LS.LCS.Sh.BarSh	Barren littoral shingle	Provides a backing to the northern shore, starting at the top of the beach and continuing round the northern shore	None
LS.LSa.St.Tal	Talitrids on the upper shore and strand-line	Large areas of decaying kelps, predominantly *Laminaria digitata* and *Saccorhiza polyschides*. Provides a feeding ground for a variety of waders such as sanderlings (*Calidris alba*) and turnstones (*Arenaria interpres*)	Talitridae
LS.LSa.MoSa.BarSa	Barren littoral coarse sand	The entire beach with the exception of a small area of polychaete dominated sand sheltered behind an area of rocks.	None
LS.LSa.FiSa.Po	Polychaetes in littoral fine sand	Small section of the beach behind an area of emergent rocks in the littoral fringe. The shelter afforded by the rocks prevents the constant movement of sediments and allows a number of polychaetes to thrive.	*Arenicola marina* *Malacoceros fuliginosus*

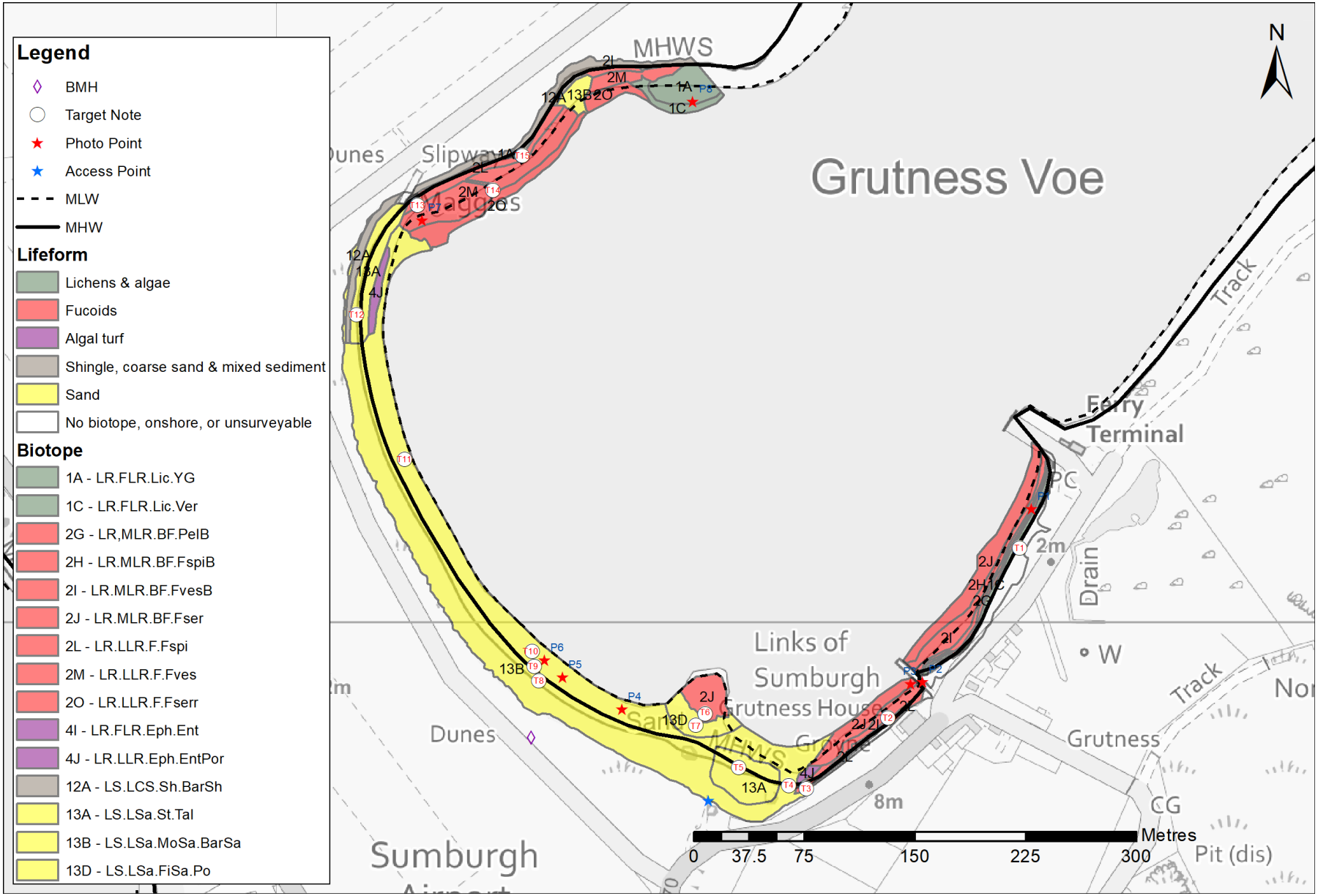

Figure 2.2 Lifeforms map of the Grutness Voe intertidal survey area (© Crown copyright and database rights 2021 OS 0100040827)

2.3.3 Target notes

Target Notes and corresponding photographs are shown in Table 2.3. The locations of each of the Target Notes is indicated on the lifeforms map (Figure 2.2). Figure 2.2 also shows the locations of additional photographs as shown in Section 2.7.

Table 2.3 Target notes

Target note No.	Description	Photograph
T1	Mooring bollard	
T2	Outflow pipe below Grutness House	

Target note No.	Description	Photograph
T3	Southern end of seawall below Grutness House with outflow pipe	 
T4	Test Dig 1 – Mobile barren sand (LS.LSa.MoSa.BarSa)	
T5	Large area of washed-up kelp (LS.LSa.St.Tal)	 

Target note No.	Description	Photograph
T6	Emergent rocks at low water and below (LR.MLR.BF.Fser)	
T7	Test Dig 2 – Medium fine sand with polychaetes (LS.LSa.FiSa.Po). Bottom picture is of *Malacoceros fuliginosus*	 
T8	Test Dig 3 – Mobile barren sand (LS.LSa.MoSa.BarSa)	

Target note No.	Description	Photograph
T9	Test Dig 4 – Mobile barren sand (LS.LSa.MoSa.BarSa)	
T10	Test Dig 5 – Mobile barren sand (LS.LSa.MoSa.BarSa)	
T11	Test Dig 6 – Mobile barren sand (LS.LSa.MoSa.BarSa)	
T12	Large area of washed-up kelp	

Target note No.	Description	Photograph
T13	Patch of Barren sand (LS.LSa.MoSa.BarSa)	
T14	Large bore outflow pipe	 
T15	Bedrock outcrop on upper shore holding a mosaic of the biotopes LR.FLR.Lic.YG; LR.FLR.Lic.Ver; and LR.LLR.F.Pel	

2.3.4 Importance of Biotope types

There were no biotopes of conservation importance found within the survey area. The dog whelk (Nucella lapillus) is highlighted by OSPAR as a threatened/declining species and was found occasionally on the intertidal rock. However, the dog whelk is a common species in the UK and is not protected under any other piece of legislation. No UK Biodiversity Action Plan (BAP) priority marine species, or species/habitats on the Scottish list of Priority Marine Features were recorded. The site, however, does fall within the Sumburgh Head SPA, designated for the protection of breeding colonies of Arctic terns (*Sterna paradisaea*), Fulmars (*Fulmarus glacialis*), guillemots (*Uria aalge*), and kittiwakes (*Rissa tridactyla*). The installation through the beach here would have no adverse effects on these species, which nest on the cliffs further south on Sumburgh Head and use the waters around the voe for feeding. The beach is also backed by sand dunes, which are a UK Biodiversity Action Plan priority habitat. This will be covered separately in the accompanying Phase 1 report.

2.4 DISCUSSION

From a biological perspective, there are no reasons that would prevent the landing of a cable at the proposed location, or anywhere within the survey area. However, above the high water mark the beach is backed by dunes. It should be noted that the sediment over the whole beach and its backing is mobile and subject to movement and re-distribution according to weather.

2.5 RECOMMENDATIONS

A further Phase 2 intertidal survey is not required at this site. It is also understood that the sediments on this shore are mobile and that locations of sediment deposits can vary from year to year and month to month.

2.6 REFERENCES

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2.7 PHOTOGRAPHS

The locations of photo points are shown in Figure 2.2.

Photo 1 Pier at the north-eastern edge of the survey area

Photo 2 Small pier close to Grutness House

Photo 3 Shore below Grutness House

Photo 4 Sand dunes behind the beach

Photo 5 View of the beach looking northwest

Photo 6 View of the beach looking southeast

Photo 7 Rocky shore on the northern edge of the voe

Photo 8 Rocky spit at the northern edge of the survey area

A.9 INTERTIDAL SURVEY REPORT FOR CABLE CORRIDOR 2.8 SHETLAND TO WHALSAY: WHALSAY LANDING POINT

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Phase 1 Intertidal Survey Report for Symbister, Whalsay, Shetland (Route 2.8)

Version 1

Report to Intertek

Issued by Aquatera Ltd

P961 – October 2021

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V1	8 Oct 2021	First draft issued to client

Members of:

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ADEMAR
poet Pacific Ocean Energy Trust
APPA Asociación de Empresas de Energías Renovables
Scottish Hydrogen & Fuel Cell Association
Australian Ocean Energy Group

Contents

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1 INTRODUCTION

Aquatera has been commissioned to carry out a Phase 1 intertidal survey of the shore at Symbister on the west coast of the island of Whalsay, Shetland (Figure 1.1). The area has been identified as a suitable location for the onshore landfall and onward connection for fibre optic cables as part of network improvements to connect a number of locations around Shetland.

The objectives of the survey were to:

- Identify and map biotopes present within the survey area;
- Identify and map the presence of any rare or protected species within the study area; and
- Provide target notes to describe key features of the shore

The survey was carried out by Duncan Clarke, a marine biologist experienced in intertidal biological survey and mapping.

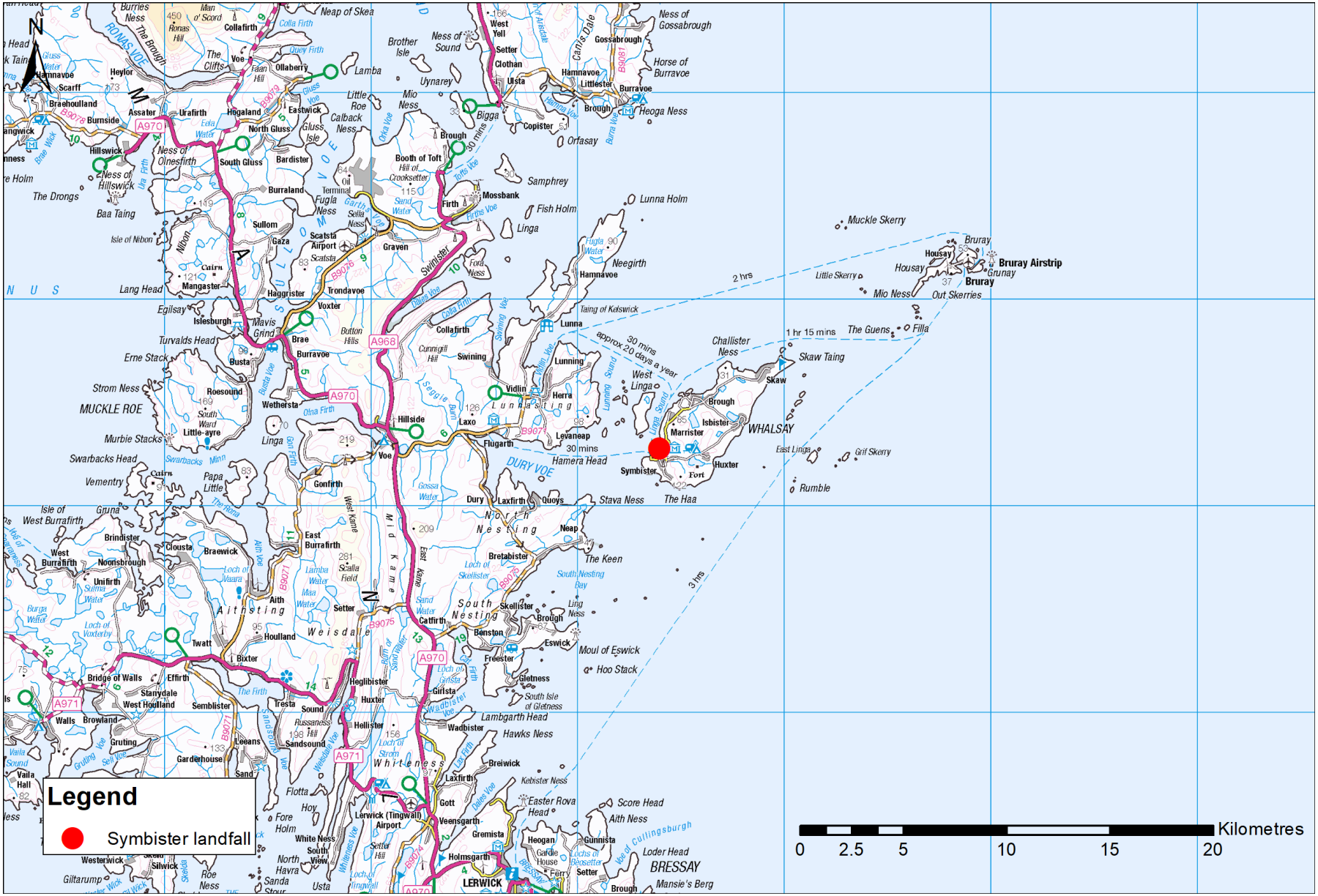

Figure 1.1 Location of the Symbister, Shetland survey site (© Crown copyright and database rights 2021 OS 0100040827)

2 PHASE 1 INTERTIDAL SURVEY

2.1 INTRODUCTION

The survey took place on 23 September 2021, during low spring tides. The survey took place either side of low tide. Table 2.1 below outlines the survey conditions.

Table 2.1 Survey details

Date	23 September 2021
Time at start	17:15
Time at finish	19:00
Low tide (hours)	18:56 BST
Tide height (m)	0.4
Lowest Astronomical Tide (m)	-0.4
Mean Low Water Springs (m)	0.3
Type of access	Foot
Sea condition	Calm
Weather condition	W3; Dry

2.2 METHODOLOGY

2.2.1 Phase 1 survey method

The survey was carried out on foot using a variety of survey techniques that are described in the Countryside Council for Wales (CCW) report 'Handbook for Marine Intertidal Phase 1 Biotope Mapping Survey' (Wyn *et al.*, 2000) and the 'Marine Nature Conservation Review Rationale and Methods' (Hiscock, 1996).

Prior to commencing the survey in the field, a wireframe map (a basic outline drawing of obvious features and/or changes in habitat was produced to aid with the recording of biotopes.

Areas of sediment were dug and sampled at various intervals at the upper mid shore, mid shore, and lower shore. All samples were filtered through a 5 mm and 0.5 mm sieve. For both the sediment and rock areas, target notes and photographs were taken when there was a change in biotope type or zonation. An iPhone equipped with the ArcGIS app "Field Maps" was used to mark target points and tracks. All information was digitised to GIS using ArcMap 10, post survey. Maps were created using the guidance laid out in the CCW methodology.

Biotopes were assigned and described with reference to The Marine Habitat Classification for Britain and Ireland (v04.05) (Connor *et al.*, 2004) and the Joint Nature Conservation Committee (JNCC) website's online search facility.

All species names were taken from The World Register of Marine Species (WoRMS) website.

2.2.2 Survey area

The proposed survey area comprised an approximate 1,230 m corridor. This was based on the provided areas of search for the proposed cable route with an additional 25 m added on to the east and west edges to allow for any movement

of the beach manhole (BMH) and cable within this corridor. The survey area extended from the splash zone down to the Lowest Astronomical Tide (LAT) (Figure 2.1)

Figure 2.1 Survey area and proposed BMH location at Symbister, Whalsay (© Crown copyright and database rights 2021 OS 0100040827)

2.2.3 Limitations of survey

Only one low tide window was available in which to complete the survey. However, it was possible to cover the entire survey area during the single survey period. The shore west of the harbour could not be surveyed fully due to shore type and the quarry immediately above high water. Biotope types here were assigned based on a combination of aerial photography and knowledge of likely biotopes from areas that could be accessed.

2.3 SURVEY FINDINGS

2.3.1 Site description

The survey site on the island of Whalsay is centred around the main settlement and harbour at Symbister. The harbour itself is quite large for an island of this size and has the capacity to berth large trawlers, serve as the ferry terminal for the connecting boat to the Shetland mainland, and host a marina. The outer walls of the harbour are composed of large concrete blocks and rocks with little algal or faunal growth, other than lichens and barnacles at the low tide end. Within the harbour the biotopes are either present of narrow cobbled shores or clinging to the sides of the vertical harbour walls. Species here tend to be dominated by sheltered fucoid species with some infaunal communities present in small pockets of sediments.

To the west of the harbour, the rock armouring continues, mixed with deposited debris and earth from the quarry sited above. Further west along this shore there are more examples of steep bedrock biotopes, with kelps lying in the sublittoral zone just below.

To the east of the harbour, the shore is more natural with a mix of steep ragged bedrock, cobble bays, and flat rock peninsulas of fucoids and barnacle mosaics. There is still evidence of human activity with numerous outflow pipes and fence lines present on the shore below the nearby houses.

2.3.2 Biotopes

A summary of biotopes recorded within the survey area is provided in Table 2.2, and a map of lifeforms is shown in Figure 2.2.

Table 2.2 List of Biotopes found within the survey area

Biotope code	Biotope description	Occurrence on site	Typical species on site
LR.FLR.Lic.YG	Yellow and grey lichens on supralittoral rock	Rock armouring within the harbour area and to the west below the quarry and on upper splash zone bedrock to the east of the harbour.	*Caloplaca* spp. *Ramalina siliquosa* Grey lichens
LR.FLR.Lic.Ver	*Verrucaria maura* on littoral fringe rock	Immediately below the LR.FLR.Lic.Ver biotope.	*Verrucaria maura*

Biotope code	Biotope description	Occurrence on site	Typical species on site
LR.MLR.BF.FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed upper eulittoral rock	Flat peninsulas of rock extending out from the headland immediately north of the proposed BMH.	*Actinia equina* *Semibalanus balanoides* *Carcinus maenas* *Patella vulgata* *Littorina obtusata* *Nucella lapillus* *Mastocarpus stellatus* *Ascophyllum nodosum* *Fucus vesiculosus* *Ulva* spp. *Cladophora rupestris*
LR.MLR.BF.Fser	*Fucus serratus* on moderately exposed lower eulittoral rock	Lower shore rock on the western facing coast between the harbour and the headland north of the proposed BMH.	*Actinia equina* *Semibalanus balanoides* *Patella vulgata* *Nucella lapillus* *Mastocarpus stellatus* *Fucus serratus* *Ulva* spp. *Cladophora rupestris*
LR.LLR.F.Pel	*Pelvetia canaliculata* on sheltered littoral fringe rock	Forms a mosaic with the LR.FLR.Lic.Ver biotope on the north facing shore at the eastern extent of the survey area.	*Pelvetia canaliculata* *Verrucaria maura*
LR.LLR.F.Fspi	*Fucus spiralis* on sheltered upper eulittoral rock	West facing shore of the harbour, north of the Old Pier House museum, and the north facing shore at the eastern end of the survey area.	*Patella vulgata* *Fucus spiralis* *Verrucaria maura*
LR.LLR.F.Fspi.X	*Fucus spiralis* on full salinity upper eulittoral mixed substrata	Upper reaches of the cobble shore at the back of the harbour, south of the Old Pier House museum.	*Patella vulgata* *Fucus spiralis*
LR.LLR.F.Fves	*Fucus vesiculosus* on moderately exposed to sheltered mid eulittoral rock	West facing shore of the harbour north of the Old Pier House museum, small section of shore between the two main piers at the west of the harbour, and the north facing shore at the eastern edge of the survey area.	*Carcinus maenas* *Patella vulgata* *Littorina obtusata* *Ascophyllum nodosum* *Fucus vesiculosus*
LR.LLR.F.Asc.X	*Ascophyllum nodosum* on full salinity mid eulittoral mixed substrata	Harbour shore south of the Old Pier House museum, the small sub-harbour at the museum, and a small area to the east of the headland on the north facing shore.	*Patella vulgata* *Littorina obtusata* *Ascophyllum nodosum*

Biotope code	Biotope description	Occurrence on site	Typical species on site
LR.LLR.F.Fserr	*Fucus serratus* on sheltered lower eulittoral rock	Lower shore areas below the LR.LLR.F.Fves biotope.	*Patella vulgata* *Fucus serratus* *Ulva* spp. *Cladophora rupestris*
LR.LLR.F.Fserr.X	*Fucus serratus* on full salinity lower eulittoral mixed substrata	Immediately below the LR.LLR.F.Asc.X biotope.	*Fucus serratus* *Ulva* spp. *Cladophora rupestris*
IR.MIR.KR.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe rock	Sublittoral fringe, exposed at extreme low tides from the eastern edge of the harbour round to the headland north of the proposed BMH.	*Laminaria digitata*
LR.FLR.Rkp.Cor	Coralline crust-dominated shallow eulittoral rockpools	Occur withing the LR.FLR.Lic.Ver biotope on the rocky headland just north of the proposed BMH.	*Patella vulgata* Corallinaceae *Cladophora* spp.
LR.FLR.Ent.EphPor	*Porphyra purpurea* and *Enteromorpha* (now *Ulva*) spp. on sand-scoured mid or lower eulittoral rock	Lower reaches of slipways within the harbour area and mid to lower shore cobbles within the bay directly below the proposed BMH.	*Porphyra purpurea* *Ulva* spp.
LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides*, *Patella vulgata* and *Littorina* spp. on exposed to moderately exposed ore vertical sheltered eulittoral rock	Areas of steeper bedrock and lower rock armouring west and east of the harbour, forming a band between the LR.FLR.Lic.Ver and IR.MIR.KR.Ldig biotopes.	*Semibalanus balanoides* *Patella vulgata* *Nucella lapillus*
LS.LCS.Sh.BarSh	Barren littoral shingle	Small embayments scattered throughout the survey area, often flanked by bedrock.	None
LS.LMx.GvMu.HedMx	*Hediste diversicolor* in littoral gravelly muddy sand and gravelly sandy mud	Small area immediately east of a boat yard and slip way within the harbour.	*Hediste diversicolor*
LS.LSa.St.Tal	Talitrids on the upper shore and strand-line	Decaying seaweed washed up, overlying the cobble bay at the site of the proposed cable landfall.	Talitridae
LS.LSa.FiSa.Po	Polychaetes in littoral fine sand	Small patch of sand on the north facing shore at the eastern edge of the survey area.	*Arenicola marina*

Biotope code	Biotope description	Occurrence on site	Typical species on site
LS.LSa.MuSa.CerPo	*Cerastoderma edule* and polychaetes in littoral muddy sand	Small patch of muddy sediment directly next to the LS.Lmx.GvMu.Hed.Mx biotope.	*Cerastoderma edule* *Arenicola marina*

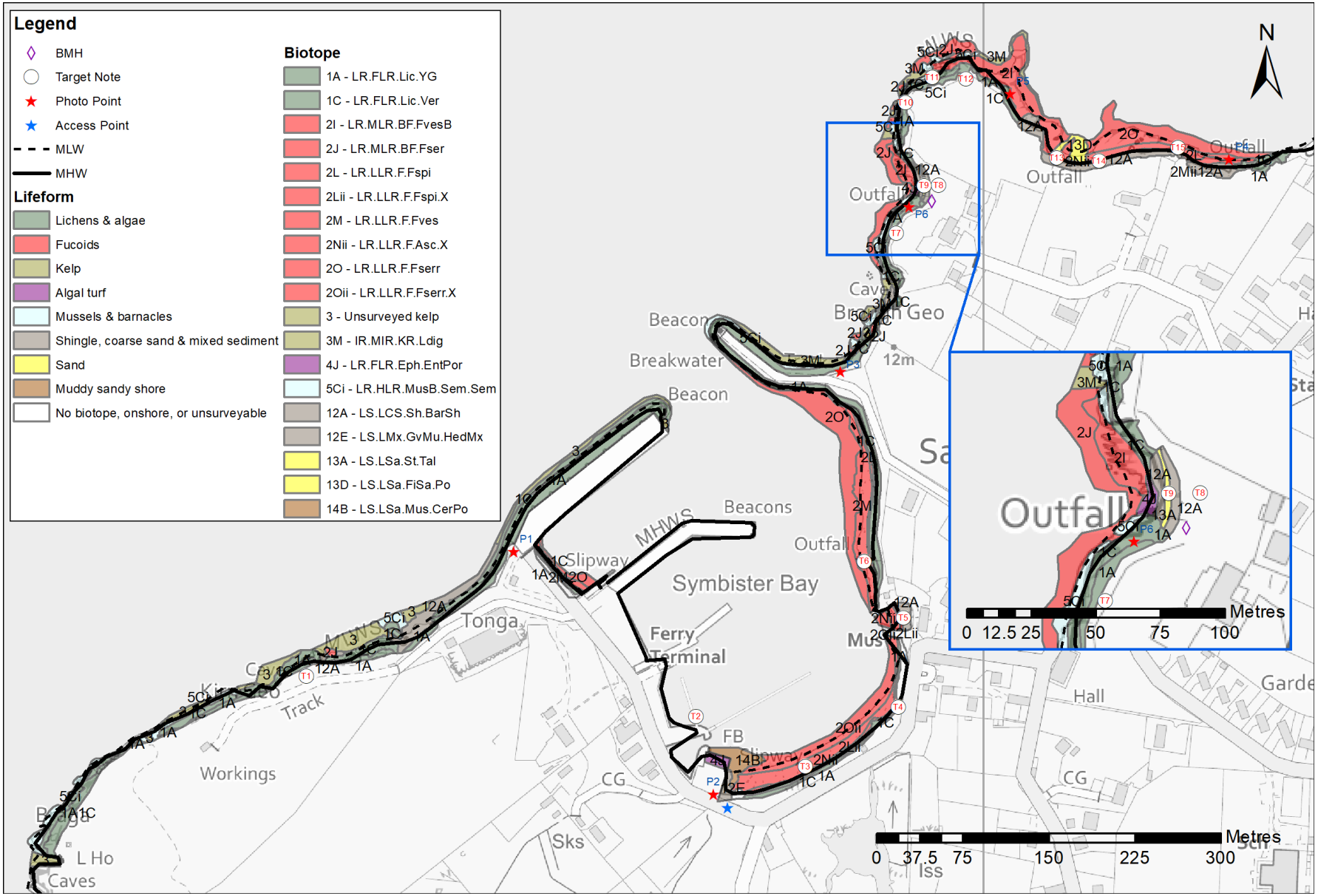

Figure 2.2 Lifeforms map of the Symbister intertidal survey area (© Crown copyright and database rights 2021 OS 0100040827)

2.3.3 Target notes

Target Notes and corresponding photographs are shown in Table 2.3. The locations of each of the Target Notes is indicated on the lifeforms map (Figure 2.2). Figure 2.2 also shows the locations of additional photographs as shown in Section 2.7.

Table 2.3 Target notes

Target note No.	Description	Photograph
T1	Quarry west of the harbour. Shore here and further west could not be fully surveyed.	
T2	Marina within the harbour.	
T3	Seaweed covered cobble bay backed by small sheds boats and creel pots. Evidence of numerous rubbish fires on the upper shore.	

Target note No.	Description	Photograph
T4	Small eroded concrete slipway flanked by stone walls.	
T5	Small harbour area at the site of the Old Pier House museum.	
T6	Outflow pipe.	
T7	Outflow pipe.	

Target note No.	Description	Photograph
T8	Manhole cover.	
T9	Proposed cable landfall area.	
T10	Steep cliff shoreline.	
T11	Gully cutting into the rocks, with coralline rockpool above.	

Target note No.	Description	Photograph
T12	Stone dyke running along the cliff edge on the rocky headland.	
T13	Fishing net dividing shore with old machinery alongside.	
T14	Outflow pipe with dumped concrete and building materials at the top of the shore.	 

2.3.4 Importance of Biotope types

There were no biotopes of conservation importance found within the survey area. The dog whelk (*Nucella lapillus*) is highlighted by OSPAR as a threatened/declining species and was found frequently on the intertidal rock. However, the dog whelk is a common species in the UK and is not protected under any other piece of legislation. No UK Biodiversity Action Plan (BAP) priority marine species, or species/habitats on the Scottish list of Priority Marine Features were recorded.

2.4 DISCUSSION

From a biological perspective, there are no reasons that would prevent the landing of a cable at the proposed location, or anywhere within the survey area.

2.5 RECOMMENDATIONS

A further Phase 2 intertidal survey is not required at this site.

2.6 REFERENCES

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2.7 PHOTOGRAPHS

The locations of photo points are shown in Figure 2.2.

Photo 1 Trawlers berthed within Symbister harbour

Photo 2 The southeast harbour shore

Photo 3 Example of the west facing rocky shore between the harbour and the headland

Photo 4 The north facing rocky shore east of the headland

Photo 5 **Peninsula of flat fucoid covered rock**

Photo 6 **The proposed landfall site**

A.10 BENTHIC SURVEY REPORT FOR CABLE CORRIDOR 2.1 YELL TO UNST

R100 Benthic Surveys

Sep / 2021

Benthic Habitat Assessment Final Report

Site

Yell–Unst Shetland

Prepared for

Global Marine Group

Prepared by

ENVISION

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PREPARED FOR	Global Marine Group
TITLE	Yell-Unst Benthic Habitat Assessment Final Report
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NOTES

CONTENTS

FIGURES

1. Introduction

A cable route is proposed between Yell and Unst, as part of a programme to update the telecommunications infrastructure for islands around Scotland. The cable corridor/route intersects with the Fetlar to Haroldswick NCMPA (Nature Conservation Marine Protected Area) (Figure 1), which is designated for benthic features including circalittoral sand and coarse sediment communities; horse mussel (*Modiolus modiolus*) beds; kelp and seaweed communities on sublittoral sediment; maerl beds; and shallow tide-swept coarse sands with burrowing bivalves. Marine licence applications are to be submitted and appropriate environment parameters assessed as part of this application.

In order to support the marine licence application a survey of the marine environment has been undertaken using a drop-down video (DDV) system. A drop-down video camera has been deployed to collect information on the biology of the seafloor and to verify the physical nature of the seafloor. This methodology provides a suitable, non destructive sampling technique in areas where sensitive species or habitats are thought to occur and data suitable for assessment of a wide range of habitat types.

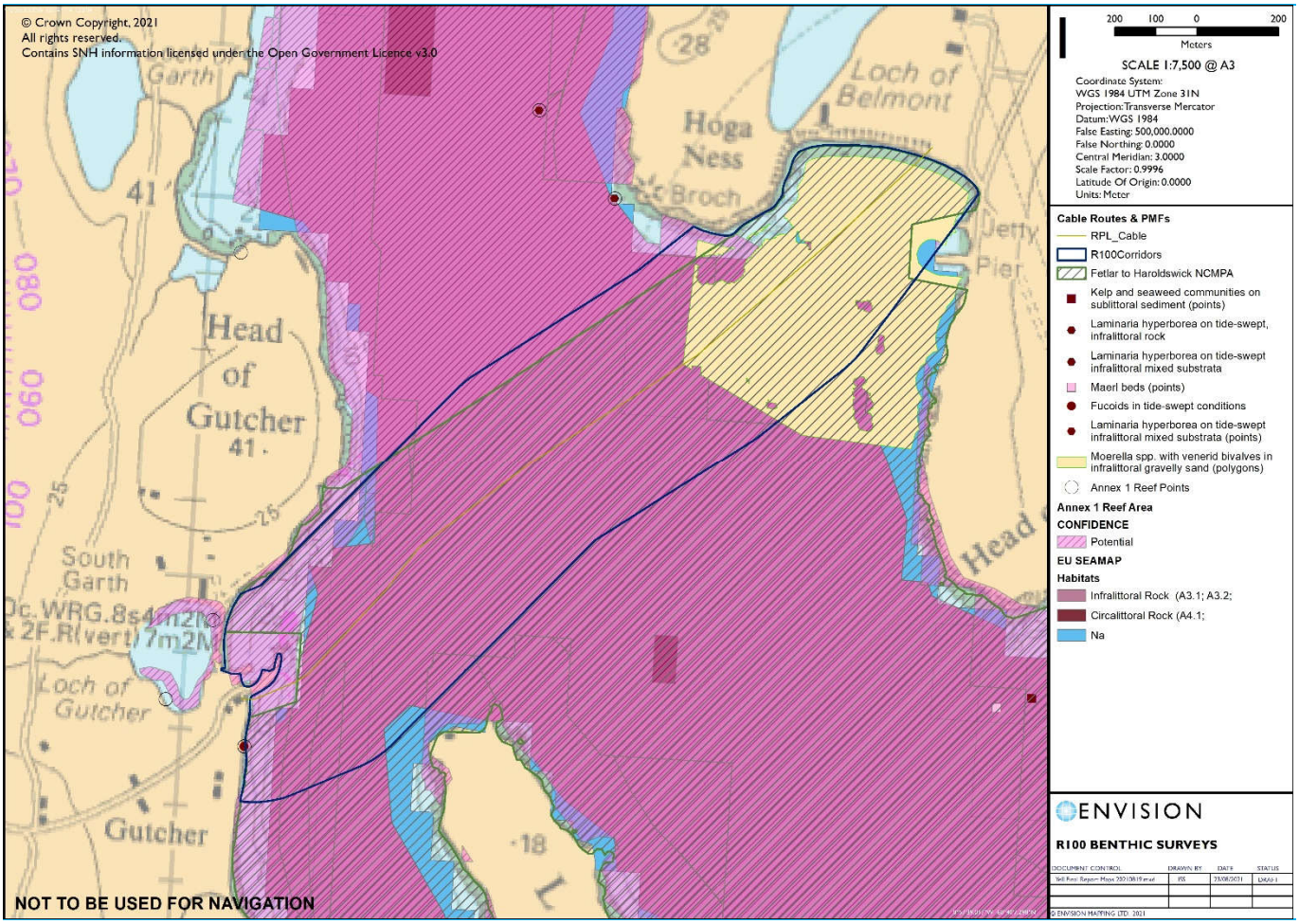

Figure 1.

Location of the proposed cable route, Yell-Unst, with existing Annex 1/Priority Marine Features (PMF) records

2. Survey

Sampling was planned[1] by reviewing the available data within UK, Scottish and European data centres. These data consisted of existing sample data and habitat maps, which have been collated nationally, and have been plotted and referred to when planning sample location and distributions. Samples were selected using a pattern which was adapted to ensure that:

1. The samples were representative of the range of potential habitats and acoustic ground types in the area of interest identified from the segmentation approach.
2. The samples were focused on potentially important habitats.
3. The samples were geographically spread to be representative.
4. The samples were located to assess the level of spatial heterogeneity of a habitat.

The 15 sample locations are shown in Figure 2.

[1] *Envision (2021). R100 Benthic Survey Plan: Drop-down Video. Prepared for Global Marine Group and BT. Pp12*

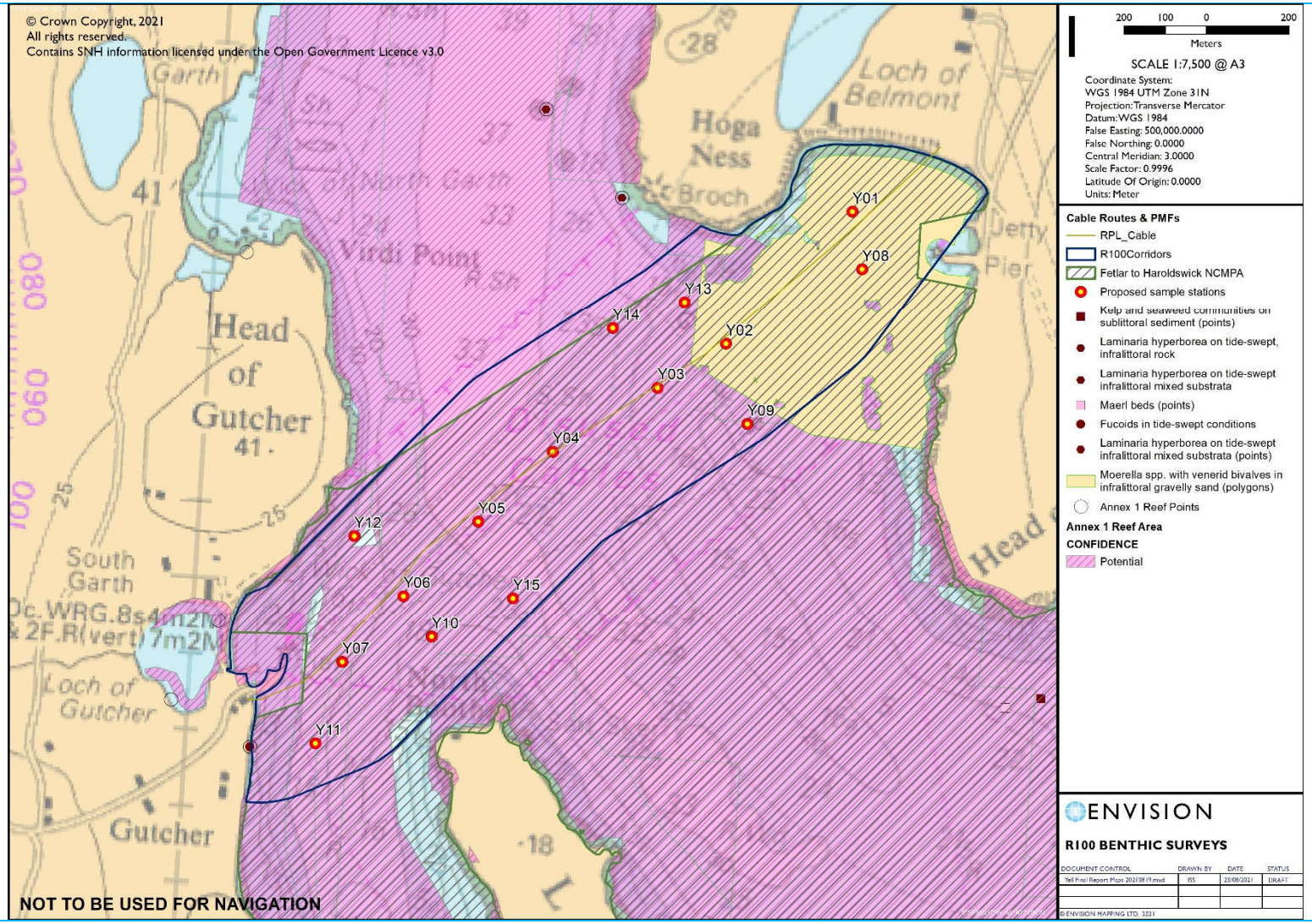

Figure 2.

Proposed sample stations for drop-down video survey, Yell-Unst

2.1. Drop-down Video Methodology

A DDV camera was deployed to collect information on the biology of the seabed and to verify the physical and biological nature of the seabed. ENVISION designs, builds and operates a range of camera systems tailored to the local environmental conditions within the proposed survey areas. The system used on this survey was built specifically for benthic survey in rugged environments and is shown in Figure 3. Its robust structure was designed to enable it to maintain position in strong current as well as to glide easily over a variety of substrates without snagging.

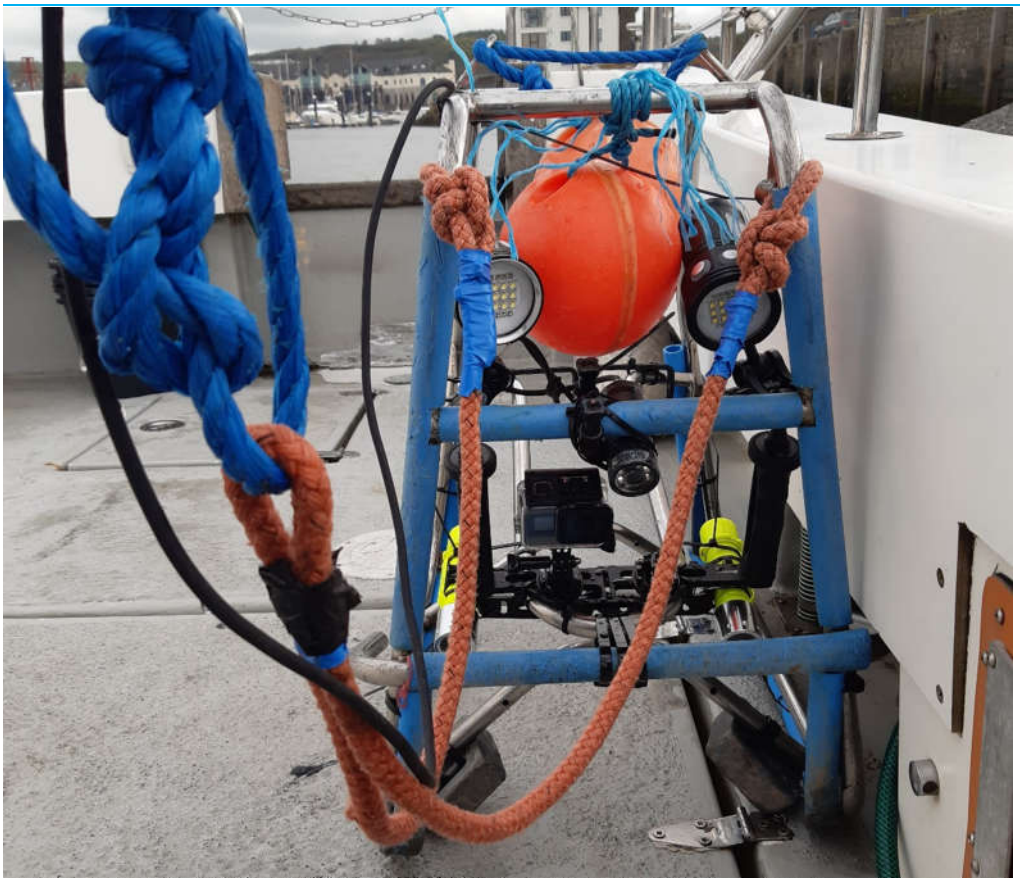

Figure 3.
The camera system designed by ENVISION for benthic survey

The system comprised two video cameras: a high-resolution CCTV camera connected to the surface via an umbilical and a high definition (HD) camera. The CCTV camera was connected to a screen and a digital capture device and was used primarily for real-time viewing, allowing the operator of the camera frame to view its progress and adjust height and speed over the seabed as required. Figure 4 shows an example of the topside equipment.

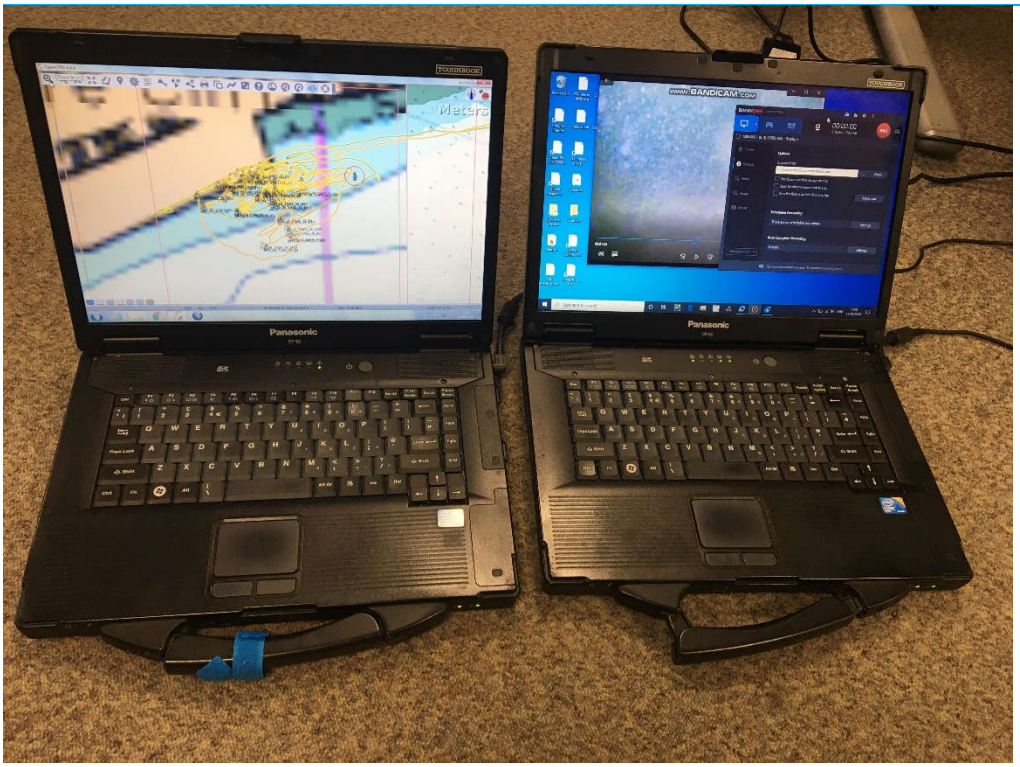

Figure 4.
Video and position fixing surface equipment

The digital capture device also provided a back-up system in case of any problem with the high-definition camera. However, the main camera used for recording video was a small solid state HD camera which produced high quality images.

At each sampling station the camera system was lowered to the seabed and allowed to drift, or be towed, behind the vessel for approximately 5 minutes. The position of each drop was located using a dGPS and plotting system.

The system was operated so that the camera frame periodically remained stationary on the seabed. These stops provide the opportunity to capture high quality still images. The still images and video footage will be reviewed to identify biota and to gather substrate information.

Each video drop was numbered and recorded using a digital capture device, for subsequent analysis, and the position and time at the start and end of each deployment were logged. The positions were recorded using a differentially corrected GPS (dGPS) system. These were displayed on the video capture system. A written record of positions for the stations was recorded during the survey as part of the survey log.

Within the Yell-Unst Shetland site, all footage collected was reviewed for QC purposes during the survey. At one station imagery was found to be of low quality due to fast currents, and a repeat sample was collected from this station which was good quality. This resulted in imagery being collected at a total of 15 sample stations on this route.

3. Data Analysis

3.1. Interpretation of Imagery

Video and still images were reviewed, processed and analysed in accordance with national guidelines, such as the standards for analysis in Visual Seabed Surveys (BS EN 16260:2012) and Turner *et al*., 2016[2]. The imagery has also been reviewed for Annex I reef assessment following the appropriate JNCC guidance notes (Gubbay, 2007[3]; Irving, 2009[4]; Golding et al., 2020[5]). The main purpose of the analysis of the imagery was to identify what fauna and broadscale habitats exist in a video record or still image, provide quantitative and semi-quantitative data and to note where one substrate type changes to another.

The video record was initially viewed rapidly in order to segment it into sections representing different substrates. At normal speed, the start and end points of each segment were logged, and each segment treated as a separate record and subsequently subjected to more detailed analysis. Brief changes in substrate type lasting less than 5m were considered as incidental patches are recorded as part of the habitat description, or as a 'habitat mosaic'.

The video footage was then viewed at normal or slower than normal speed, noting the physical and biological characteristics, such as substrate type and percent cover (in line with MNCR guidelines), seabed character, conspicuous taxa and life forms along with any modifiers or visible impacts present. Taxa are identified to the most detailed taxonomic level possible and quantified with abundance counts for erect species and percent cover for colonial/encrusting species. Where appropriate, any relevant features of conservation interest or Habitats Directive Annex I Habitats were noted at each sample location.

Taxa are identified to the most detailed taxonomic level possible, and quantified using categories based upon the MNCR SACFOR abundances scale (http://jncc.defra.gov.uk/page-2684), with abundance counts for erect species and percent cover for colonial/encrusting species. Where appropriate, any relevant features of conservation interest or Habitats Directive Annex I Habitats were noted at each sample location.

All data were recorded as each video clip or still image was analysed and a proforma spreadsheet was used to input imagery data and metadata, with reference to the latest species dictionary from the World Register of Marine Species (WoRMS) database.

[2] *Turner, J.A., Hitchin, R., Verling, E., van Rein, H. 2016. Epibiota remote monitoring from digital imagery: Interpretation guidelines.*

[3] *GUBBAY, S. 2007. Defining and managing Sabellaria spinulosa reefs. Report of an interagency workshop. JNCC Report No. 405.*

[4] *Irving, R. 2009. The identification of the main characteristics of stony reef habitats under the Habitats Directive. Summary report of an inter-agency workshop 26-27 March 2008. JNCC Report No. 432*

[5] *Golding. N., Albrecht. J., McBreen. F. 2020. Refining criteria for defining areas with a 'low resemblance' to Annex I stony reef; Workshop Report. JNCC Report No. 656, JNCC, Peterborough, ISSN 0963-8091.*

Abundance counts for solitary and erect taxa were added as point annotations in BIIGLE for still images, but for video analysis these counts were performed manually and recorded directly in the proforma spreadsheet. Where percentage covers of colonial/encrusting taxa were to be recorded, point annotations were attached to still images in BIIGLE and then double tagged with percentage cover categories (associated with SACFOR) and the data exported. Percentage cover of cobbles/boulders was annotated with the polygon tool to aid assessment of stony reefs. For video analysis, these categories were estimated visually for each video segment. Annotations from BIIGLE were exported in Excel spreadsheets and translated into the results proforma spreadsheet as required.

A reference collection was built as the analysis progressed with good quality images noted and collated to aid consistency and quality of analysis, with each taxon or species highlighted. In addition to a species/taxon reference collection, a habitat/biotope reference collection was also built with good images of each habitat or biotope and for reference purposes.

3.2. Priority Marine Feature and Annex I Assessment

The video footage has been reviewed and analysed in accordance with current UK guidelines and any potential Annex I features identified. For biogenic or stony reefs Turner *et a*l. 2016[6], Gubbay, 2007[7]; Irving, 2009[8]; Golding *et al*., 2020[9] assessment methods are used. Priority Marine Features[10] (PMFs) habitats and species have also been assessed and identified where present.

[6] *Turner, J.A., Hitchin, R., Verling, E., van Rein, H. 2016. Epibiota remote monitoring from digital imagery: Interpretation guidelines.*

[7] *GUBBAY, S. 2007. Defining and managing Sabellaria spinulosa reefs. Report of an interagency workshop. JNCC Report No. 405.*

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[9] *Golding. N., Albrecht. J., McBreen. F. 2020. Refining criteria for defining areas with a 'low resemblance' to Annex I stony reef; Workshop Report. JNCC Report No. 656, JNCC, Peterborough, ISSN 0963-8091.*

[10] *https://www.nature.scot/doc/priority-marine-features-scotlands-seas-habitats*

4. Results

A total of 15 video tows and associated (77) still images were analysed, from 15 stations. The video quality was 'good' at all 15 stations. All still imagery quality was 'good' and a minimum of one video tow and five stills were analysed for each station.

Figure 5 shows the location of the video samples for which data were collected during the survey.

The imagery has been reviewed and selected still images are shown in Appendix A, with associated data shown in Appendix B.

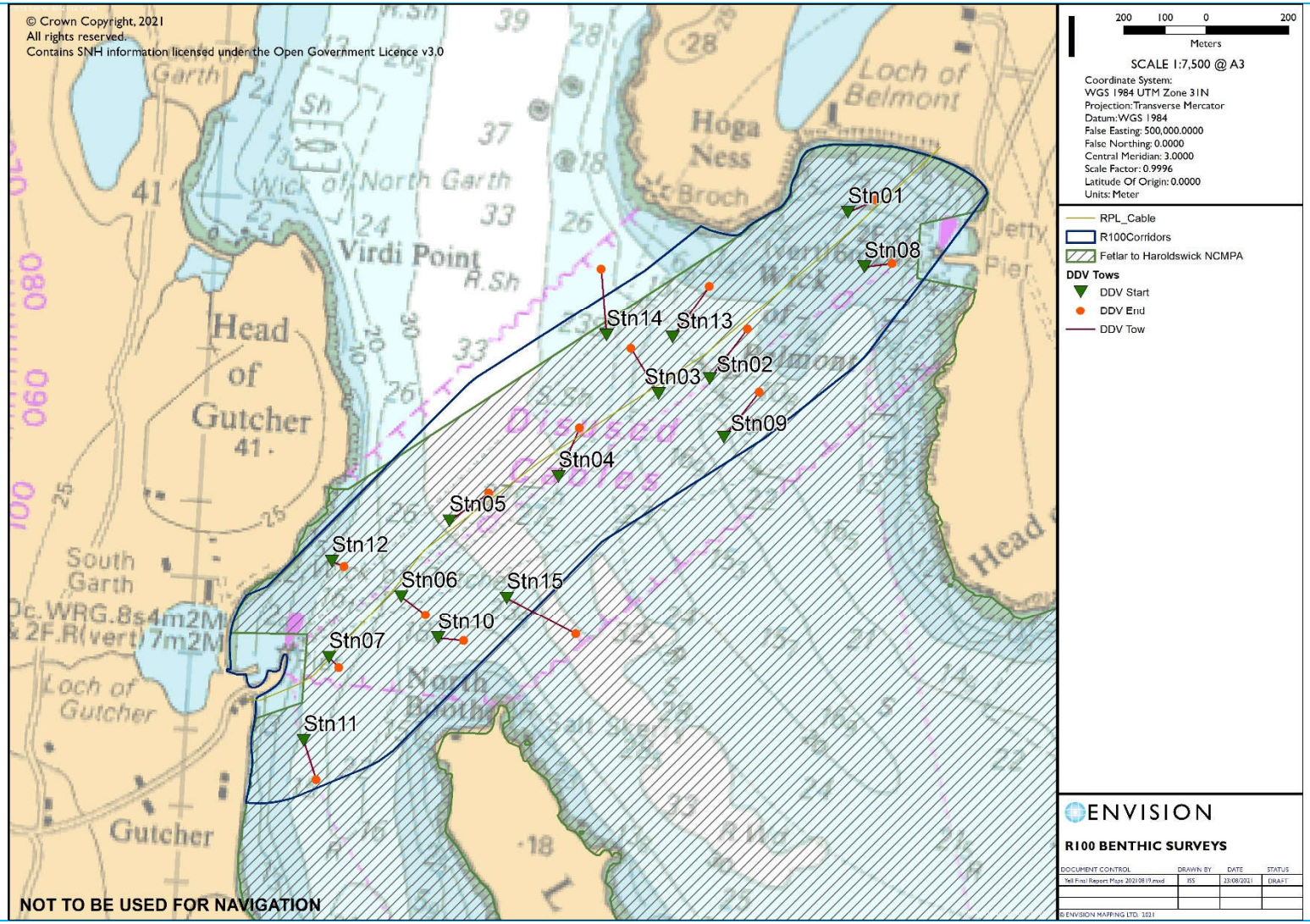


Figure 5.

Location of video stations surveyed within Yell-Unst cable route, 17th – 21st July 2021, with station numbers and start and end locations of each video 'tow'

4.1. Yell-Unst General Description

The results from DDV show cobbles, boulders and coarse sediment with kelp at the stations near to shore at Yell. A deep channel (~20m) occurs between Yell and the small island of Linga, where brittlestar beds are found on a coarse substrate of gravel and pebbles, with patches of maerl observed at station 07. In the central section of the cable corridor, the substrate is dominated by rock habitats with encrusting taxa (principally pink coralline algal crusts), some erect hydroids and mixed faunal turf along with brittlestars and other echinoderms, and *Alcyonium digitatum*, which is particularly dense at stations 05 and 15. Approaching the Unst nearshore area, the substrate is comprised of mobile coarse sediments, with occasional brittlestar beds, and kelp and macroalgae with some brief patches of maerl (station 02) occurring in shallower depths on coarse substrates of shell and pebbles. At the most easterly sites, in the bay at Belmont, macroalgae and kelp are found on sandy substrate.

4.2. Habitat/Biotope Allocation

A total of seven habitats/biotopes were observed within the subtidal area surveyed by DDV in the Yell-Unst cable corridor. At three stations, habitat changes along the video tow resulted in imagery being split into two segments with different biotopes allocated to each segment. All habitats/biotopes were found in both the still images and the video footage.

The biotope IR.MIR.KR.LhypTX.Pk ('*Laminaria hyperborea* park and foliose red seaweeds on tide-swept lower infralittoral mixed substrata') is recorded at three locations (stations 11, 12, 13) where kelp (*Laminaria hyperborea* and *Saccharina latissima*) were present and dominated by *Laminaria hyperborea*. At one of these stations (station 13) dense patches of brittlestars also occurred, and '*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment' (SS.SMx.CMx.OphMx) was allocated as a secondary biotope. Where kelp species could not be quantified as separate taxa due to overlapping fronds and cover, these are recored as *Laminariales* within the quantitative data and taxon lists.

The biotope IR.MIR.KT.XKTX ('Mixed kelp and red seaweeds on infralittoral boulders, cobbles and gravel in tidal rapids') was recorded at one station (station 02) where macroalgae and kelp were observed on coarse sediment, with brittlestars and patches of maerl also present.

Brittlestar beds (SS.SMx.CMx.OphMx, '*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment') were recorded as a primary biotope at six stations (stations 02, 05, 06, 07, 09, 10). Both species of brittlestars were observed, however stations 07 and 09 were dominated by *Ophiocomina nigra*, and urchins (*Echinus esculentus*), starfish and crustacea were also common. Secondary biotopes were added to two of these stations, where habitat mosaics occurred with 'Circalittoral coarse sediments' (SS.SCS.CCS) at station 09 and 'Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock' (CR.MCR.EcCr.FaAlCr) at station 10.

'Sublittoral macrophyte-dominated communities on sediments' (SS.SMp) were found at two stations (stations 01, 08).

'Circalittoral coarse sediments' (SS.SCS.CCS) was recorded as a primary biotope at three stations (stations 03, 07, 14), which was comprised of either coarse sand and shell with sparse epifauna, or shell, pebbles and cobbles with calcareous pink algae and some faunal turf of hydroids and bryozoans along with echinoderms (urchins, starfish and brittlestars).

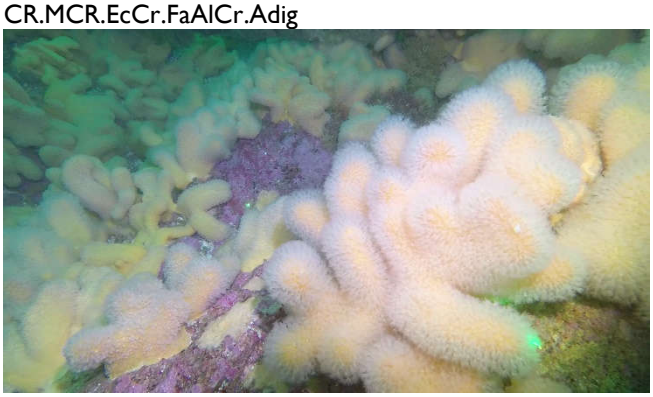
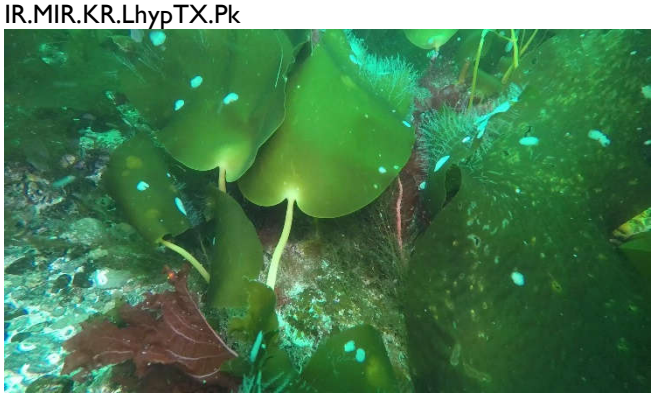
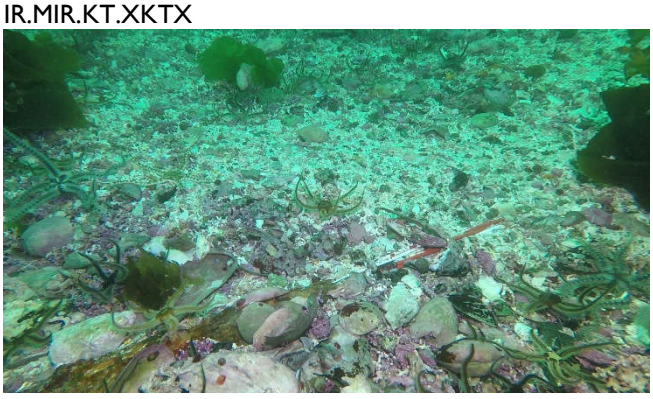
'Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock' (CR.MCR.EcCr.FaAlCr) was recorded as a primary biotope at one station (station 04) and the biotope variant '*Alcyonium digitatum*, *Pomatoceros triqueter*, algal and bryozoan crusts on wave-exposed circalittoral rock' (CR.MCR.EcCr.FaAlCr.Adig) was allocated at two locations where dense *Alcyonium digitatum* was present (stations 05, 15). Both biotopes also had a hydroid and faunal turf component, as well as calcareous algal and faunal crusts, echinoderms and crustacea.

These habitats/biotopes identified are presented in Table 1 and example images shown in Table 2, with the spatial distribution presented in Figure 6 and a summary of biotope, habitats and conservation features in Table 3.

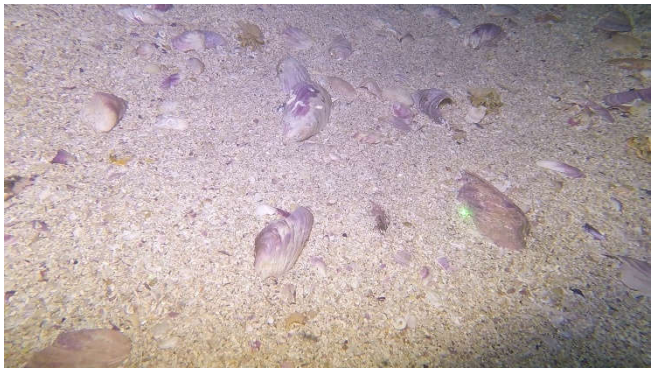
Table 1. *Habitat types identified from the video and still imagery analysis for Yell-Unst cable corridor*

Biotope/Habitat (MNCR Code)	EUNIS Code	MNCR Classification
CR.MCR.EcCr.FaAlCr	A4.214	Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock
CR.MCR.EcCr.FaAlCr.Adig	A4.2142	*Alcyonium digitatum*, *Pomatoceros triqueter*, algal and bryozoan crusts on wave-exposed circalittoral rock
IR.MIR.KR.LhypTX.Pk	A3.2132	*Laminaria hyperborea* park and foliose red seaweeds on tide-swept lower infralittoral mixed substrata
IR.MIR.KT.XKTX	A3.223	Mixed kelp and red seaweeds on infralittoral boulders, cobbles and gravel in tidal rapids
SS.SCS.CCS	A5.14	Circalittoral coarse sediment
SS.SMp	A5.5	Sublittoral macrophyte-dominated communities on sediments
SS.SMx.CMx.OphMx	A5.445	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment

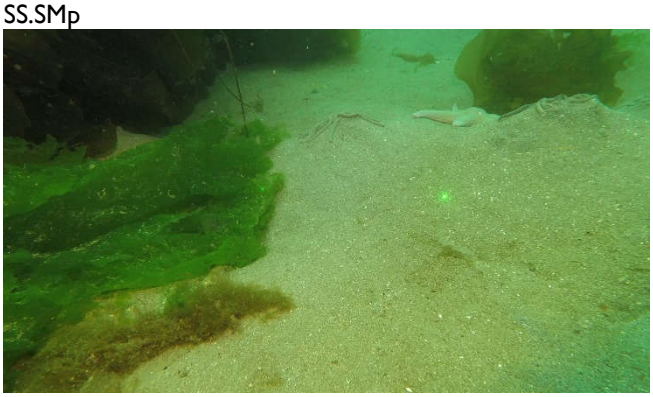
Table 2. *Frame captures illustrating the biotope/habitats observed during analysis of imagery from Yell-Unst cable corridor*

CR.MCR.EcCr.FaAlCr	CR.MCR.EcCr.FaAlCr.Adig
	
IR.MIR.KR.LhypTX.Pk	IR.MIR.KT.XKTX
	

SS.SCS.CCS



SS.SMp



SS.SMx.CMx.OphMx

Table 3.
Sample station information, EUNIS classification, broadscale habitat, MNCR code, PMFs and presence of Annex I habitats for Yell-Unst cable corridor

STN	Depth (m)	EUNIS Code	Broadscale Habitat	MNCR Biotope Code	PMF	Annex I
01	7.0	A5.5	Subtidal Coarse Sediment	SS.SMp		
02.1	19.0	A5.445	Subtidal Coarse Sediment	SS.SMx.CMx.OphMx		
02.2	19.0	A3.223	Subtidal Coarse Sediment	IR.MIR.KT.XKTX		
03	23.0	A5.14	Subtidal Coarse Sediment	SS.SCS.CCS	*Sandeels*	
04	34.0	A4.214	Moderate Energy Circalittoral Rock	CR.MCR.EcCr.FaAlCr		Reef
05.1	36.0	A5.445	Subtidal Coarse Sediment	SS.SMx.CMx.OphMx		
05.2	36.0	A4.2142	Moderate Energy Circalittoral Rock	CR.MCR.EcCr.FaAlCr.Adig		Reef
06	24.0	A5.445	Subtidal Coarse Sediment	SS.SMx.CMx.OphMx		
07.1	19.0	A5.445	Subtidal Coarse Sediment	SS.SMx.CMx.OphMx		
07.2	19.0	A5.14	Subtidal Coarse Sediment	SS.SCS.CCS		

STN	Depth (m)	EUNIS Code	Broadscale Habitat	MNCR Biotope Code	PMF	Annex I
08	11.0	A5.5	Subtidal Coarse Sediment	SS.SMp		
09	22.0	A5.445 / A5.14	Subtidal Coarse Sediment	SS.SMx.CMx.OphMx / SS.SCS.CCS		
10	23.0	A5.445 / A4.214	Subtidal Coarse Sediment	SS.SMx.CMx.OphMx / CR.MCR.EcCr.FaAlCr		Reef
11	12.0	A3.2132	Subtidal Coarse Sediment	IR.MIR.KR.LhypTX.Pk	Tide-swept algal communities; Kelp beds	
12	11.0	A3.2132	Subtidal Coarse Sediment	IR.MIR.KR.LhypTX.Pk	Tide-swept algal communities; Kelp beds	
13	22.0	A3.2132 / A5.445	Subtidal Coarse Sediment	IR.MIR.KR.LhypTX.Pk / SS.SMx.CMx.OphMx	Tide-swept algal communities; Kelp beds	
14	26.0	A5.14	Subtidal Coarse Sediment	SS.SCS.CCS		
15	32.0	A4.2142	Moderate Energy Circalittoral Rock	CR.MCR.EcCr.FaAlCr.Adig		Reef

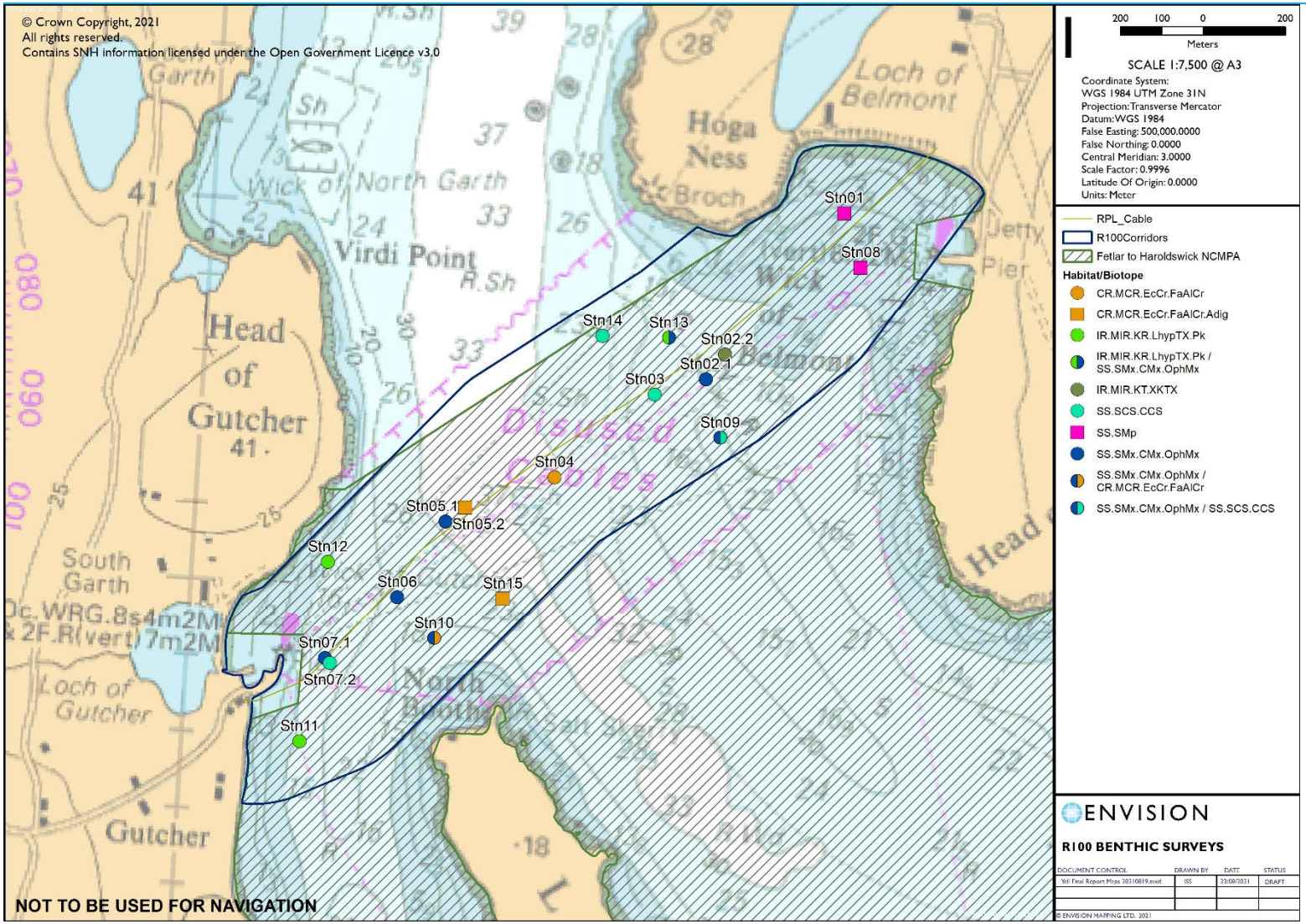


Figure 6.
Sampling stations surveyed with drop-down video along the proposed cable route between Yell-Unst showing marine habitats at each location

4.3. Priority Marine Features

The biotope '[Laminaria hyperborea] park and foliose red seaweeds on tide-swept lower infralittoral mixed substrata' (IR.MIR.KR.LhypTX.Pk) was recorded at three stations within the Port Appin-Lismore cable route (stations 11, 12 13), shown in Figure 7, and this is a component of two Priority Marine Features: 'Tide-swept algal communities' and 'Kelp beds'. These were all observed in the central section of the cable route.

A second PMF, sandeels, was observed during the analysis, with the presence of *Ammodytes* recorded at station 03 (Figure 7) where the 'Circalittoral coarse sediments' (SS.SCS.CCS) habitat was recorded.

4.4. Annex I Features

Potential Annex I reef was present in four stations (stations 04, 05, 10, 15), as shown in Figure 8. The biotopes which occur at these stations ('Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock' (CR.MCR.EcCr.FaAlCr) and '*Alcyonium digitatum*, *Pomatoceros triqueter*, algal and bryozoan crusts on wave-exposed circalittoral rock' (CR.MCR.EcCr.FaAlCr.Adig)) are found on moderate energy circalittoral rock, which is potential Annex I reef.

From the distribution of Annex I features and PMFs within the cable route (Figure 9) and throughout the entire Fetlar to Haroldswick NCMPA (Figure 10), the distribution within the sample stations is found to coincide with the known distribution of these features. However, whilst the entire cable route and majority of the Bluemull sound is predicted as 'potential' Annex I reef, results from this survey show that Annex I reef is present in the deeper area of the central section of the cable route, with mixed coarse sediments (coarse sands, shell, gravel, pebbles and cobbles) also present at the edges of the channels in slightly shallower waters.

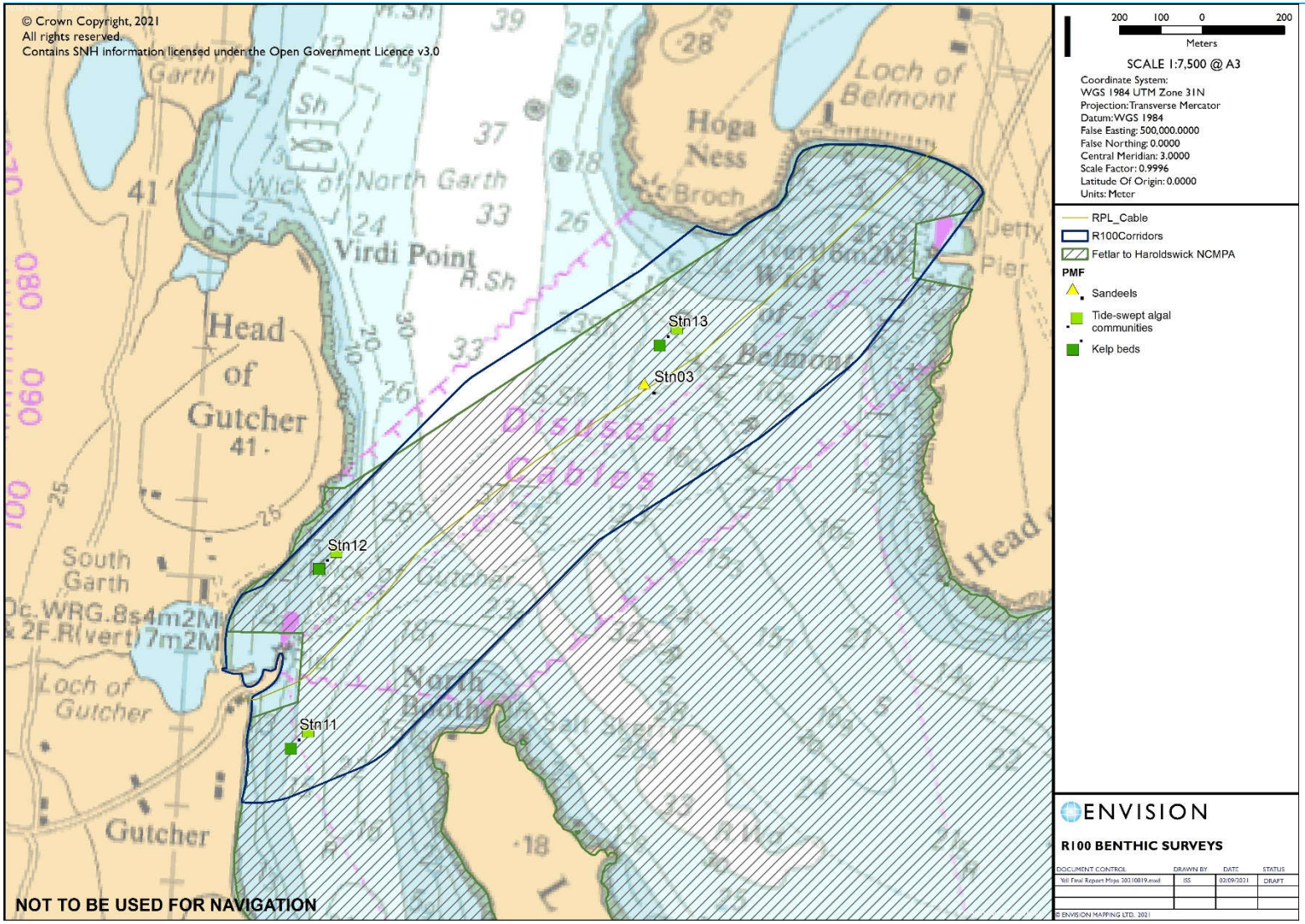


Figure 7.
Priority Marine Features along the proposed cable corridor within the Yell-Unst cable corridor

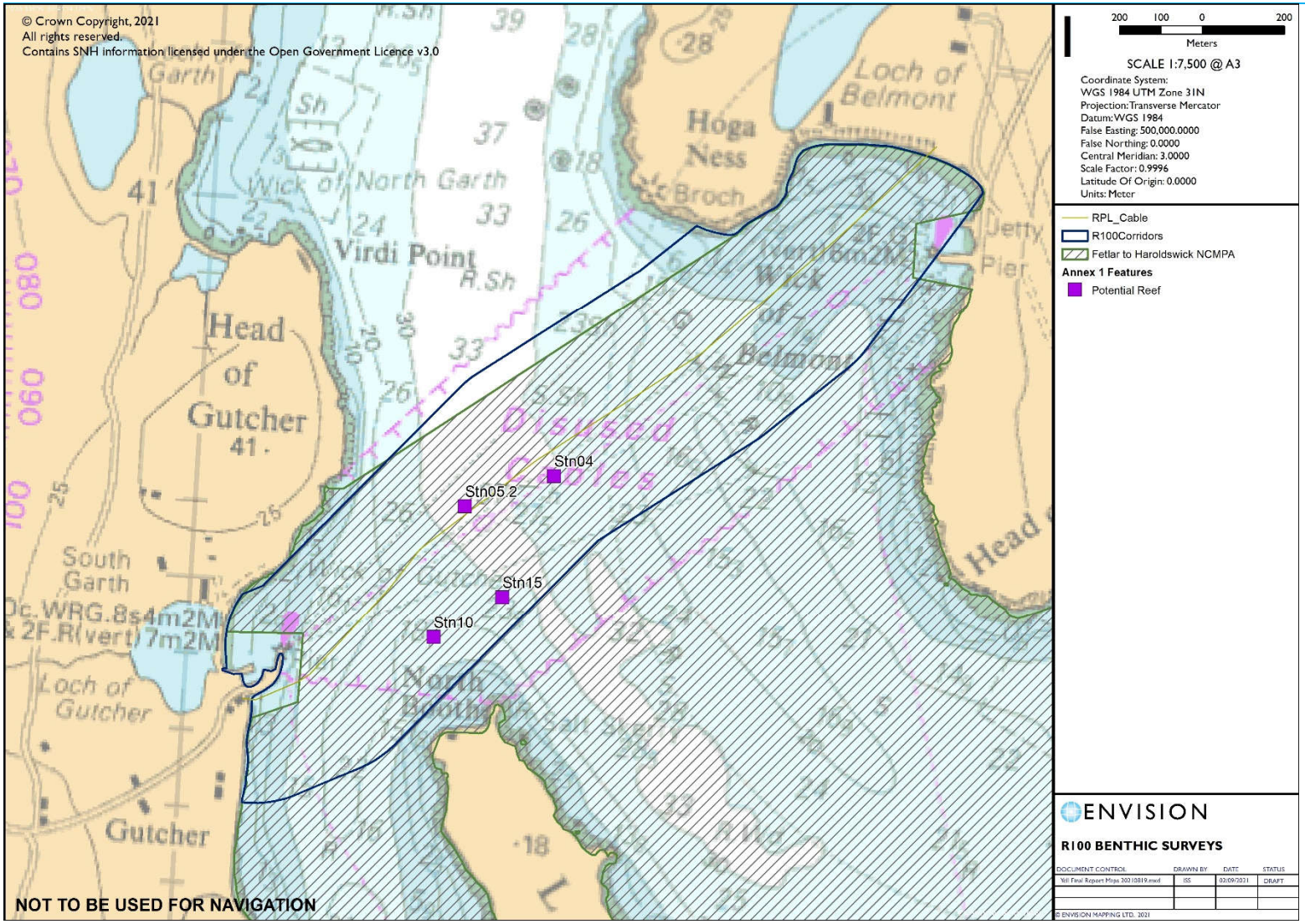


Figure 8.
Potential Annex 1 reef features along the proposed cable corridor within the Yell-Unst cable corridor

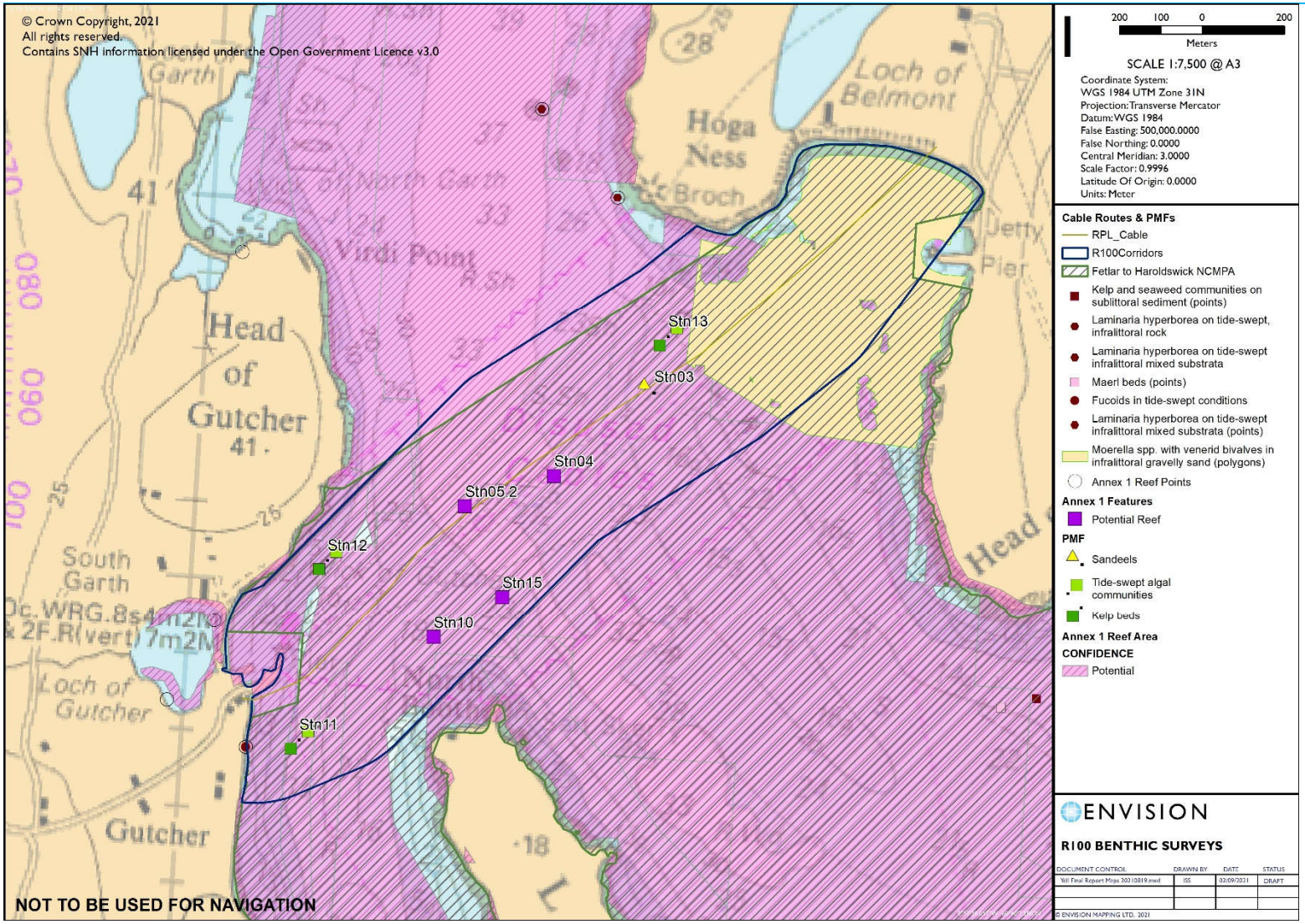


Figure 9.
Yell-Unst cable corridor with PMFs and Annex 1 features from video survey and existing samples and distributions

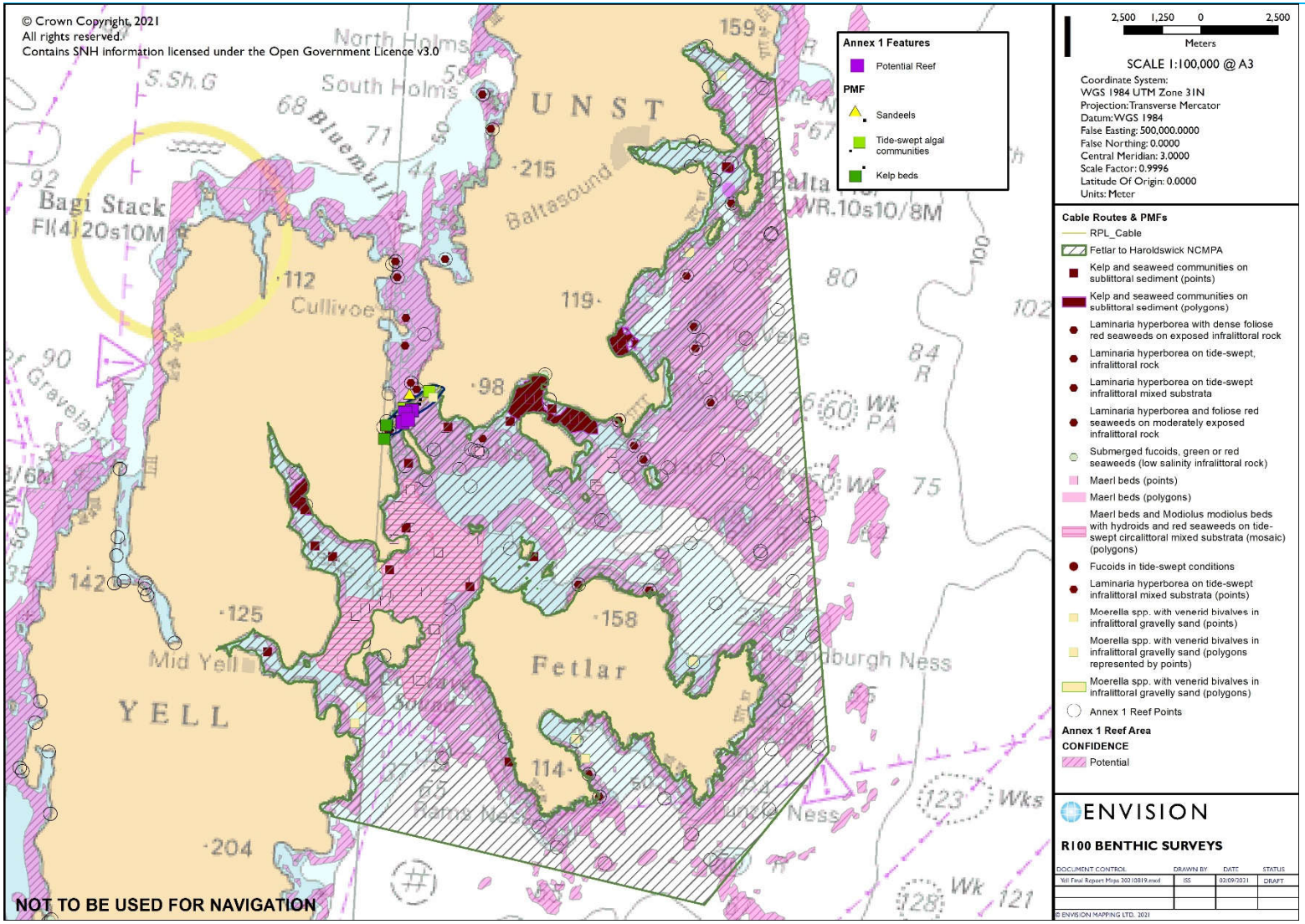


Figure 10.
Yell-Unst cable corridor with PMFs and Annex 1 features from video survey and existing samples and distributions within Fetlar to Haroldswick NCMPA

4.5. Reference Collection

A reference collection of still images from video footage has been compiled to produce example imagery for the species/taxa observed: the collection includes 63 images of 62 taxa/morphologies, and seven images as examples of the seven habitat/biotope types identified.

NB: Where taxon have been identified to a high taxonomic level (Family or higher) then an example of that taxon has been provided e.g., Asteroidea. However, this taxon can cover a wide range of species, and it should not be considered as the only potential example.

4.6. Quality Control of Imagery Analysis

Quality control (QC) was carried out on 100% of the annotations on the still images with a second analyst reviewing the imagery and results. QC was carried out on 10% of the videos (from two sample stations), and the results compared and reviewed by both analysts. The degree of consistency in the results between the original analysers and the QC analyser reflects a confidence in the quality of the analysis and full QC details are provided in Appendix C.

5. Summary

The objective of this survey was to identify conspicuous fauna and substrate types and record any Annex I habitats and other seabed features of conservation importance. This was completed using underwater imagery from drop-down video survey. Benthic sampling was representative of the range of potential habitats in the area of interest, identified using a structured sample plan. A total of 15 stations were surveyed.

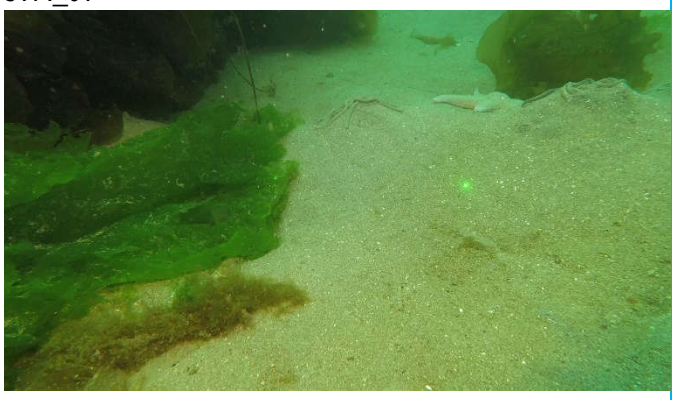
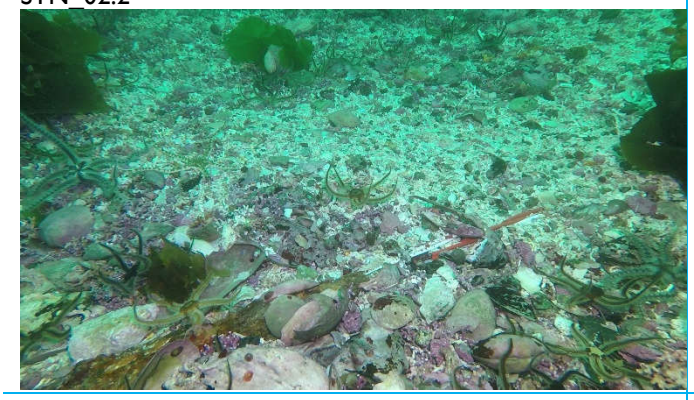
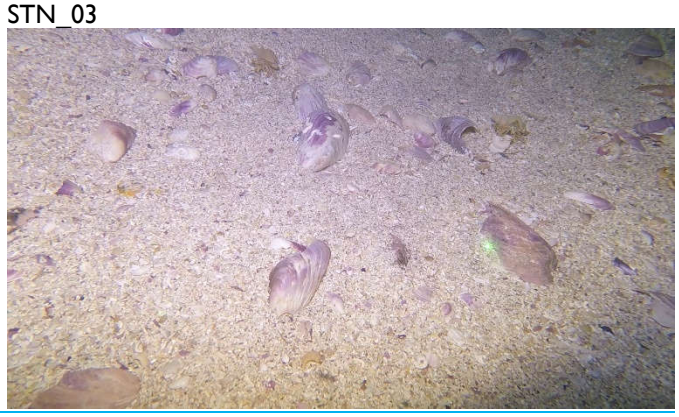
Seven biotopes/habitats were allocated to the DDV sample stations. Three stations were split into two segments due to habitat changes within the video tow, and at another three stations a secondary biotope was recorded where habitats occurred in a patchy distribution, or habitat mosaic.

The habitats within the cable corridor show a distribution of kelp and algal dominated habitats in the shallower areas and moderate energy circalittoral rock with pink crusts and epifaunal communities in the deeper channels at the centre of the cable route. At the edges of the channels in slightly shallower areas, mixed coarse sediments of gravel, pebbles and cobbles were dominated by brittlestar beds.

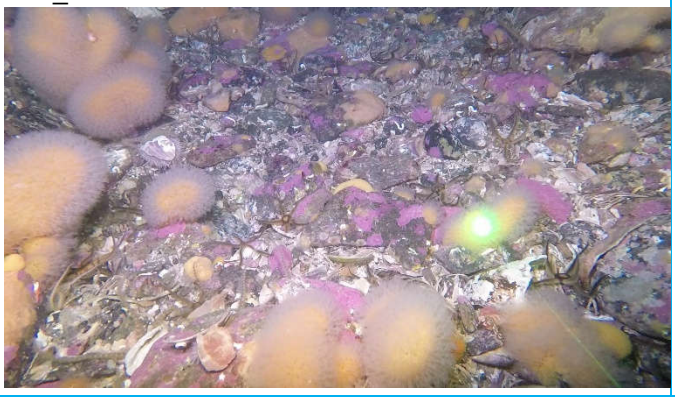
The imagery has been reviewed in order to identify any 'features of conservation importance or significance' and four stations were found to have potential Annex I Reef present, namely the biotope 'Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock' and a similar variant biotope '*Alcyonium digitatum*, *Pomatoceros triqueter*, algal and bryozoan crusts on wave-exposed circalittoral rock'. A kelp park biotope was recorded (IR.MIR.KR.LhypTX.Pk) at three stations, is a component of two Priority Marine Features: 'Tide-swept algal communities' and 'Kelp beds'. Sandeels, *Ammodytes,* were observed at one other station and are a Priority Marine Feature.

6. Appendix A: Example Images

Table 4.
Still video images from the 15 DDV stations located in the Yell to Unst cable route survey area

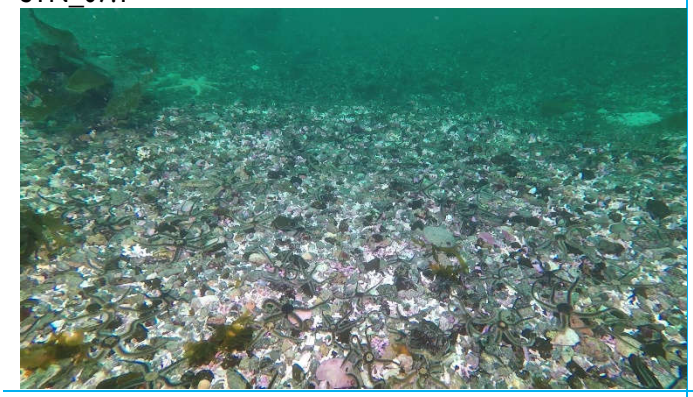
STN_01 	STN_02.1 
STN_02.2 	STN_03 
STN_04 	STN_05.1 

STN_05.2



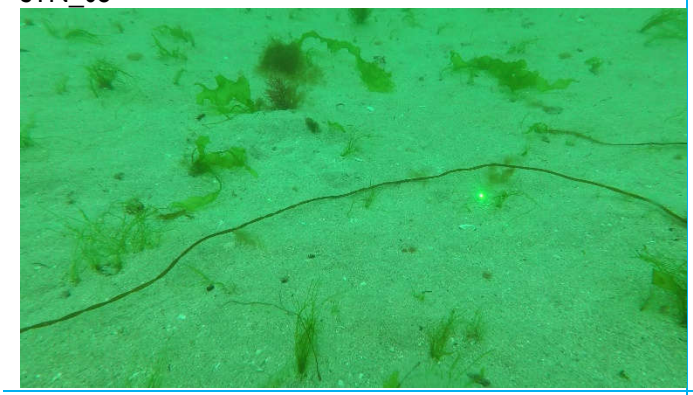
STN_06

STN_07.1

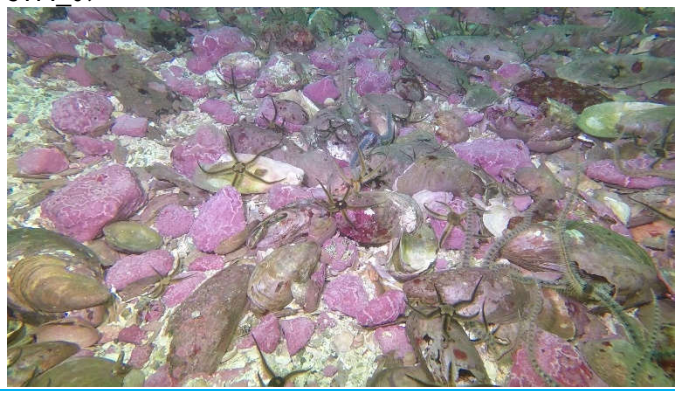


STN_07.2

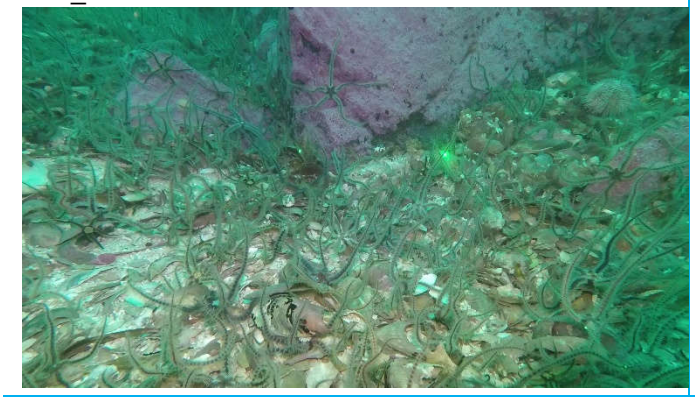
STN_08



STN_09

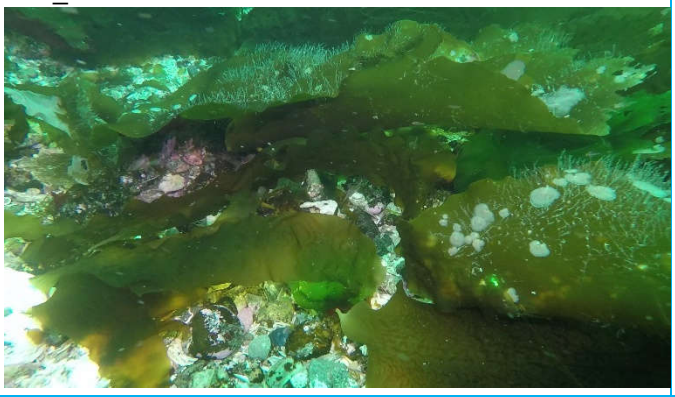


STN_10

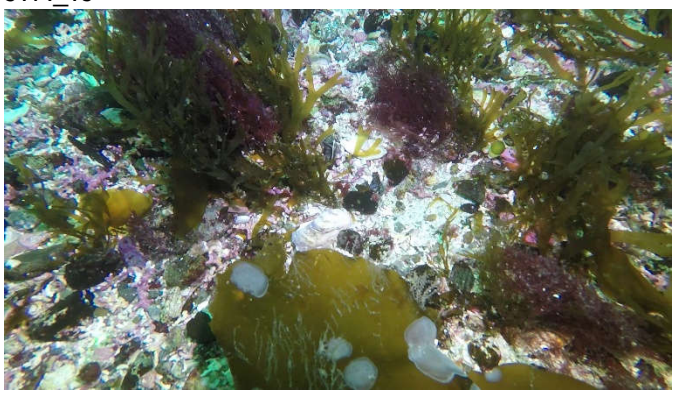


STN_11

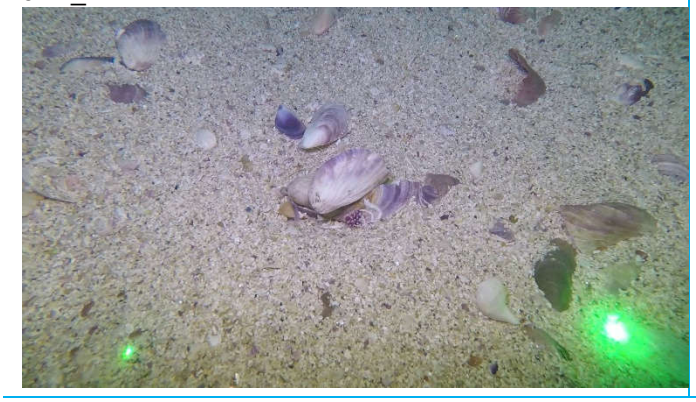
STN_12



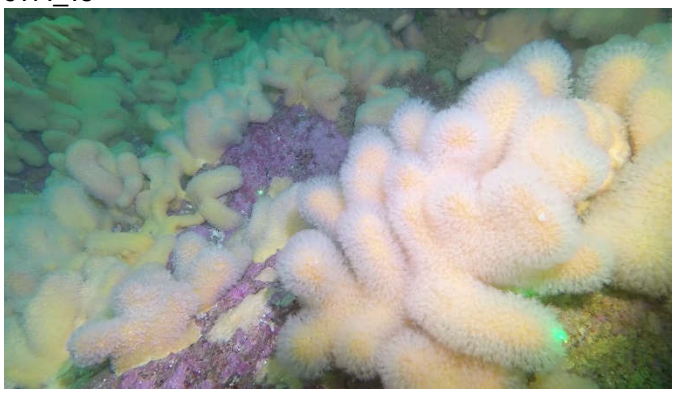
STN_13



STN_14



STN_15



7. Appendix B: Data Tables

Table 5.
Video station information for Yell-Unst route (Eastings and Northings provided in OSGB 1936, Latitudes and Longitudes provided in WGS 1984)

STN	Site	Easting start	Northing start	Latitude start	Longitude start	Easting end	Northing end	Latitude end	Longitude end	Depth approx. (m)
01	Yell-Unst	456249.1	1200508.55	60.683838	-0.972063	456206.3	1200475.96	60.684145	-0.970867	7
02.1	Yell-Unst	455945.36	1200079.93	60.680033	-0.977745	455986.44	1200143.33	60.680597	-0.976975	19
02.2	Yell-Unst	455986.44	1200143.33	60.680597	-0.976975	455919.94	1200139	60.68116	-0.976205	19
03	Yell-Unst	455823.86	1200033.86	60.679637	-0.979982	455641.47	1200070.62	60.680585	-0.981322	23
04	Yell-Unst	455596.75	1199815.34	60.677707	-0.9842	455531.41	1199868.98	60.67879	-0.983393	34
05.1	Yell-Unst	455341.06	1199688.3	60.676602	-0.988915	455386.02	1199725.76	60.676932	-0.988082	36
05.2	Yell-Unst	455386.02	1199725.76	60.676932	-0.988082	455323.47	1199695.53	60.677262	-0.987248	36
06	Yell-Unst	455237.91	1199496.22	60.674892	-0.990857	455193.43	1199387.96	60.674518	-0.989715	24
07.1	Yell-Unst	455074.17	1199334.03	60.673458	-0.993898	455087.37	1199322.73	60.673355	-0.99366	19
07.2	Yell-Unst	455087.37	1199322.73	60.673355	-0.99366	454993.1	1199243.8	60.673252	-0.993422	19
08	Yell-Unst	456299.1	1200379.74	60.682675	-0.971185	456258.36	1200326.03	60.682792	-0.969957	11
09	Yell-Unst	455990.15	1199940.26	60.678773	-0.976965	455960.43	1199989.07	60.679808	-0.975507	22
10	Yell-Unst	455334.63	1199401.72	60.67403	-0.989113	455290.55	1199332.28	60.674005	-0.987953	23
11	Yell-Unst	455028.22	1199128.18	60.671617	-0.994797	454958.44	1198967.96	60.67078	-0.994133	12
12	Yell-Unst	455063.48	1199568.56	60.675565	-0.994028	454986.49	1199490.79	60.67547	-0.993473	11
13	Yell-Unst	455847.65	1200172.93	60.680882	-0.979507	455819.45	1200236.57	60.68205	-0.978017	22
14	Yell-Unst	455687.05	1200165.6	60.680838	-0.982448	455554.71	1200258.45	60.682283	-0.982857	26
15	Yell-Unst	455493.6	1199512.04	60.674998	-0.986173	455560.81	1199369.68	60.674303	-0.982997	32

Table 6.
Video station information for Yell-Unst route, EUNIS classification, broadscale habitat, MNCR code and description, PMF and presence of Annex I habitats, comments

STN	Depth (m)	EUNIS Code	Broadscale Habitat	MNCR Biotope Code	Description	PMF	Annex I	Comments
01	7	A5.5	Subtidal Coarse Sediment	SS.SMp	Sediment with macroalgae, crabs and fish			
02.1	19	A5.445	Subtidal Coarse Sediment	SS.SMx.CMx.OphMx	Sand, shells, cobbles, boulders with encrusting red algae and dense brittlestars			
02.2	19	A3.223	Subtidal Coarse Sediment	IR.MIR.KT.XKTX	Sand, shells, cobbles, boulders with encrusting red algae, maerl and kelp			Patches of maerl
03	23	A5.14	Subtidal Coarse Sediment	SS.SCS.CCS	Coarse sand in waves with hermit crabs and fish	*Ammodytes*		Sand waves
04	34	A4.214	Moderate Energy Circalittoral Rock	CR.MCR.EcCr.FaAlCr	Cobbles with encrusting red macroalgae, Alcyonium, crabs, brittlestars and unidentifiable turf		Reef	potential Reef
05.1	36	A5.445	Subtidal Coarse Sediment	SS.SMx.CMx.OphMx	Sediment with shell, encrusting red macroalgae and brittlestars			Potential item 01:58
05.2	36	A4.2142	Moderate Energy Circalittoral Rock	CR.MCR.EcCr.FaAlCr.Adig	Dense Alcyonium on rock with shell, encrusting red macroalgae and brittlestars		Reef	potential Reef
06	24	A5.445	Subtidal Coarse Sediment	SS.SMx.CMx.OphMx	Shell with some rock and boulders, echinus, encrusting red macroalgae and some brittlestars			Cable at 05:26
07.1	19	A5.445	Subtidal Coarse Sediment	SS.SMx.CMx.OphMx	Shell and gravel with brittlestars, encrusting			Patch of maerl

STN	Depth (m)	EUNIS Code	Broadscale Habitat	MNCR Biotope Code	Description	PMF	Annex I	Comments
					macroalgae, echinus, macroalgae and starfish			
07.2	19	A5.14	Subtidal Coarse Sediment	SS.SCS.CCS	Shell and gravel with some encrusting red macroalgae			
08	11	A5.5	Subtidal Coarse Sediment	SS.SMp	Sand with macroalgae and hermit crabs			
09	22	A5.445 / A5.14	Subtidal Coarse Sediment	SS.SMx.CMx.OphMx / SS.SCS.CCS	Shell and gravel with brittlestars, encrusting macroalgae, echinus and starfish			
10	23	A5.445 / A4.214	Subtidal Coarse Sediment	SS.SMx.CMx.OphMx / CR.MCR.EcCr.FaAlCr	Shell and gravel on rock with dense brittlestars, encrusting red macroalgae, echinus and starfish		Reef	Patch of outcropping Annex I Reef (bedrock)
11	12	A3.2132	Subtidal Coarse Sediment	IR.MIR.KR.LhypTX.Pk	Kelp and macroalgae on coarse sediment with some brittlestars	Tide-swept algal communities; Kelp beds		
12	11	A3.2132	Subtidal Coarse Sediment	IR.MIR.KR.LhypTX.Pk	Dense kelp with macroalgae and echinus	Tide-swept algal communities; Kelp beds		
13	22	A3.2132 / A5.445	Subtidal Coarse Sediment	IR.MIR.KR.LhypTX.Pk / SS.SMx.CMx.OphMx	Kelp and macroalgae with echinus and hermit crabs	Tide-swept algal communities; Kelp beds		
14	26	A5.14	Subtidal Coarse Sediment	SS.SCS.CCS	Coarse sediment with some cobbles, shell, unidentifiable turf and hermit crabs			
15	32	A4.2142	Moderate Energy Circalittoral Rock	CR.MCR.EcCr.FaAlCr.Adig	Dense Alcyonium on rock with encrusting red algae and fish		Reef	pipe at 02:42, Annex I

STN	Depth (m)	EUNIS Code	Broadscale Habitat	MNCR Biotope Code	Description	PMF	Annex I	Comments
								Reef (bedrock)

Table 7.
Abundance of taxa identified at each DDV station for Yell-Unst cable route.

Species (or common name)	STN01	STN02.1	STN02.2	STN03	STN04	STN05.1	STN05.2	STN06	STN07.1	STN07.2	STN08	STN09	STN10	STN11	STN12	STN13	STN14	STN15
Actiniaria					5													
Adamsia palliata		1																
Alcyonidium diaphanum					<1%													
Alcyonium digitatum		<1%			10-19%	<1%	40-79%					<1%		<1%		<1%		80-100%
Ammodytes				20														
Anthozoa	3		3								2							
Asterias rubens	2	1	1		41			2	1	2		12	3			2		1
Asteroidea	3	5	1		37	2		1	2	4	1	6		1		1		2
Bivalvia														1		1		
Botryllus schlosseri					<1%													
Brachyura	6				2						3							
Buccinidae			1															
Burrows	8										8							
Callionymidae			1								1					1		
Calliostoma		2		1	12							7		1	1			6
Campanulariidae	<1%	<1%	<1%						<1%			<1%		1-4%	1-4%	<1%		
Cancer pagurus					4													
Casts	60										4							
Caridea											1							
Crossaster papposus						1	2	1				1	6	2		2		5
Decapoda		1			6													
Echinoidea					5							2	13	1				
Echinus esculentus		59	11		56	1	26	32	3	4		25	51		4	65	3	90

Species (or common name)	STN01	STN02.1	STN02.2	STN03	STN04	STN05.1	STN05.2	STN06	STN07.1	STN07.2	STN08	STN09	STN10	STN11	STN12	STN13	STN14	STN15
Flustridae					<1%							<1%						<1%
Gastropoda	1	5	4		2				2			7	3	14		10	1	2
Henricia					16													
Hydrozoa		<1%			5-9%			<1%					<1%	<1%			<1%	5-9%
Laminaria hyperborea		1-4%	5-9%					<1%	1-4%					10-19%	20-39%	20-39%		
Laminariales	<1%	1-4%	1-4%						<1%		<1%	<1%		1-4%	20-39%	1-4%		
Liocarcinus deperator	2																	
Luidia ciliaris		7						1	1			12		1		2		
Macroalgae Branching	<1%	<1%						<1%	1-4%		<1%	1-4%		10-19%	1-4%	1-4%	<1%	
Macroalgae Encrusting Red Calcareous		20-39%	20-39%		20-39%	<1%	10-19%	5-9%	1-4%	5-9%		20-39%	20-39%	<1%	<1%	20-39%	<1%	20-39%
Macroalgae Filamentous	1-4%	<1%									<1%							
Macroalgae Rope-like	<1%										1-4%							
Macroalgae Sheet-like Membranous	1-4%	<1%							<1%		1-4%		<1%	<1%	<1%	<1%		
Macroalgae Turf	<1%																	
Maerl		<1%	10-19%						5-9%			<1%				<1%		
Membraniporoidea		<1%									<1%			1-4%	1-4%	<1%		
Metridium					1													
Myxicola infundibulum											10							
Nudibranchia					1													
Ophiocomina nigra		P	P		P	P	P	P	P			P	P	P		P		P
Ophiothrix fragilis		P	P		P	P	P	P	P			P	P	P		P		P
Ophiuroidea	<1%	40-79%	10-19%		<1%	1-4%	5-9%	20-39%	5-9%	1-4%		20-39%	80-100%	5-9%		10-19%		5-9%
Paguroidea	3	6	7	18	5					4	25	12	2	2		11	3	

Species (or common name)	STN01	STN02.1	STN02.2	STN03	STN04	STN05.1	STN05.2	STN06	STN07.1	STN07.2	STN08	STN09	STN10	STN11	STN12	STN13	STN14	STN15
Pagurus prideaux		1																
Pisces	5			2	2		1		2	1	2	1		1		1		2
Pisces shoal																		300+
Pleuronectiformes	3										4							
Saccharina	1-4%	1-4%	1-4%								1-4%			10-19%	10-19%	<1%		
Sagartiidae					3													
Scyliorhinus			2															
Serpulidae		<1%	<1%	<1%	1-4%	<1%	1-4%	<1%	<1%	<1%		1-4%	1-4%	<1%		<1%	<1%	<1%
Terebellidae									1									
Tubulariidae					<1%								<1%	<1%				1-4%
Uncertain Biota F_actiniaria					57													
Unidentifiable Crust		1-4%	1-4%		10-19%	<1%	1-4%	1-4%	1-4%	1-4%		1-4%	1-4%	<1%	<1%		<1%	5-9%
Unidentifiable Turf	<1%	<1%	<1%		5-9%	<1%	<1%	<1%	<1%	<1%		<1%	1-4%			<1%	<1%	5-9%
Urticina					1											2	1	

8. Appendix C: Quality Control of Imagery Analysis

The degree of consistency in the results between the original analysers and the QC analyser reflects a confidence in the quality of the analysis. Where there were discrepancies between the conclusions of the original analyst and the QC analyst, the issues were explored and are discussed below. The checks and amendments made during QC of the analysis are recorded in a spreadsheet detailing all QC procedures.

8.1.1. Still Imagery

Quality control (QC) was carried out on 100% of the annotations on the still images with a second analyst reviewing the imagery and results within BIIGLE and using the LARGO function (Label Review Grid Overview). LARGO[11] allows annotations with the same annotation label to be viewed as thumbnails in a regular grid, which can then be selected to change, attach new or delete labels more efficiently. Substrate composition was reviewed for different analysts and results were consistent for the majority of still imagery.

8.1.2. Video Imagery

QC was carried out on 10% of the videos (two sample stations), and the results compared and reviewed by both analysts.

8.1.3. Discrepancies

The majority of discrepancies in the video analysis were with taxa of a small size or a cryptic nature, which meant they could be missed during faster moving sections of video, or imagery sections of lower quality, or where epifauna was distant. Examples of such taxa are small or uncertain topshells, other gastropods, hermit crabs , urchins or starfish. There were also some discrepancies in percentage cover for unidentifiable turf/hydroids, encrusting taxa (serpulidae and calcareous encrusting macroalgae) and macroalgae/kelp between analysts, which could be borderline between two different SACFOR categories but never differed by more than one category. Occasionally differences in SACFOR categories were due to dense patches of individuals (e.g., brittlestars) which then had to be averaged over the entire video tow. A potential overlap between macroalgal categories was also noted.

With the imagery in general, there were some discrepancies due to uncertain views of encrusting/colonial fauna, with some of these being included within the 'faunal crust'. There was potential overlap between hydroids and unidentifiable turf, as it wasn't always possible to distinguish clearly between the two categories. Some epifauna which was initially identified at more detailed levels was moved to a broader taxonomic category due to uncertainty, and vice versa.

[11] *https://biigle.de/manual/tutorials/largo/largo*

A.11 BENTHIC SURVEY REPORT FOR CABLE CORRIDOR 2.3 SANDAY NEARSHORE

R100 Benthic Surveys

Sep / 2021

Benthic Habitat Assessment Final Report

Site

Sanday Nearshore

Prepared for

Global Marine Group

Prepared by

ENVISION

Author(s)

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PREPARED FOR	Global Marine Group
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CONTRACT REF.	4700091651
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NOTES

CONTENTS

FIGURES

1. Introduction

A cable route has been proposed with landfall at Sanday, Orkney, as part of a programme to update the telecommunications infrastructure for islands around Scotland. Marine licence applications are to be submitted and appropriate environmental parameters assessed as part of this application.

The cable route and landfall intersect with the Sanday Special Area of Conservation (SAC) which is designated for Annex 1 Reef features, and includes Priority Marine Features which could potentially be affected by cable laying activities (Figure 1).

In order to support the marine licence application, a survey of the marine environment has been undertaken using a drop-down video (DDV) system. A drop-down video camera has been deployed to collect information on the biology of the seafloor and to verify the physical nature of the seafloor, and this provides a valuable option in areas where sensitive species or habitats are thought to occur. A total of 15 video samples were collected during the survey from 15 stations This method produces data suitable for assessment of a wide range of habitat types.

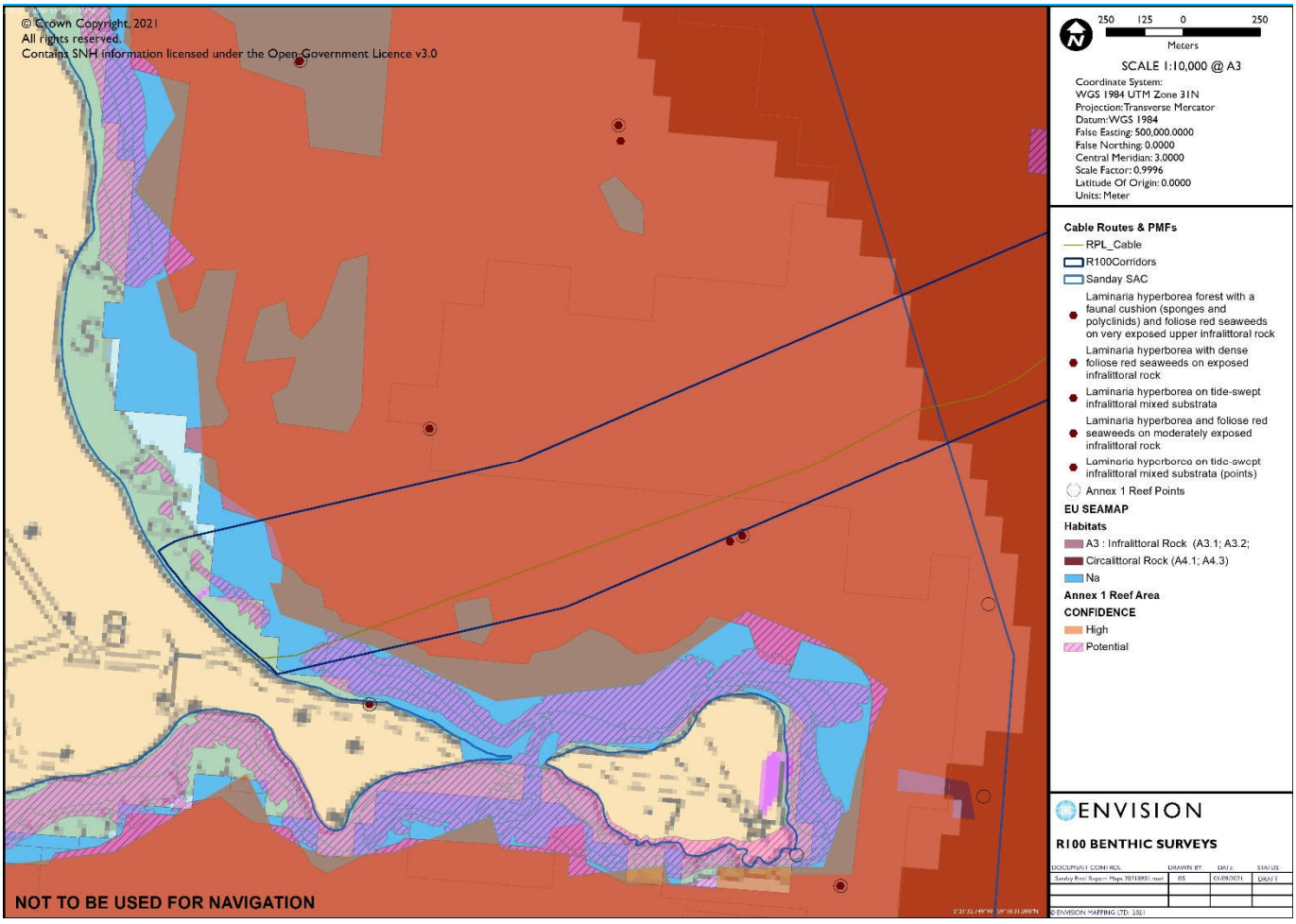


Figure 1.

Location of the proposed cable route, Sanday nearshore, with existing Annex 1/Priority Marine Features (PMF) records

2. Survey

Sampling was planned[1] by reviewing the available data within UK, Scottish and European data centres. These data consisted of existing sample data and habitat maps, which have been collated nationally, and have been plotted and referred to when planning sample location and distributions. Samples were selected using a pattern which was adapted to ensure that:

1. The samples were representative of the range of potential habitats and acoustic ground types in the area of interest identified from the segmentation approach.
2. The samples were focused on potentially important habitats.
3. The samples were geographically spread to be representative.
4. The samples were located to assess the level of spatial heterogeneity of a habitat.

The 15 sample locations are shown in Figure 2.

[1] *Envision (2021). R100 Benthic Survey Plan: Drop-down Video. Prepared for Global Marine Group and BT. Pp12*

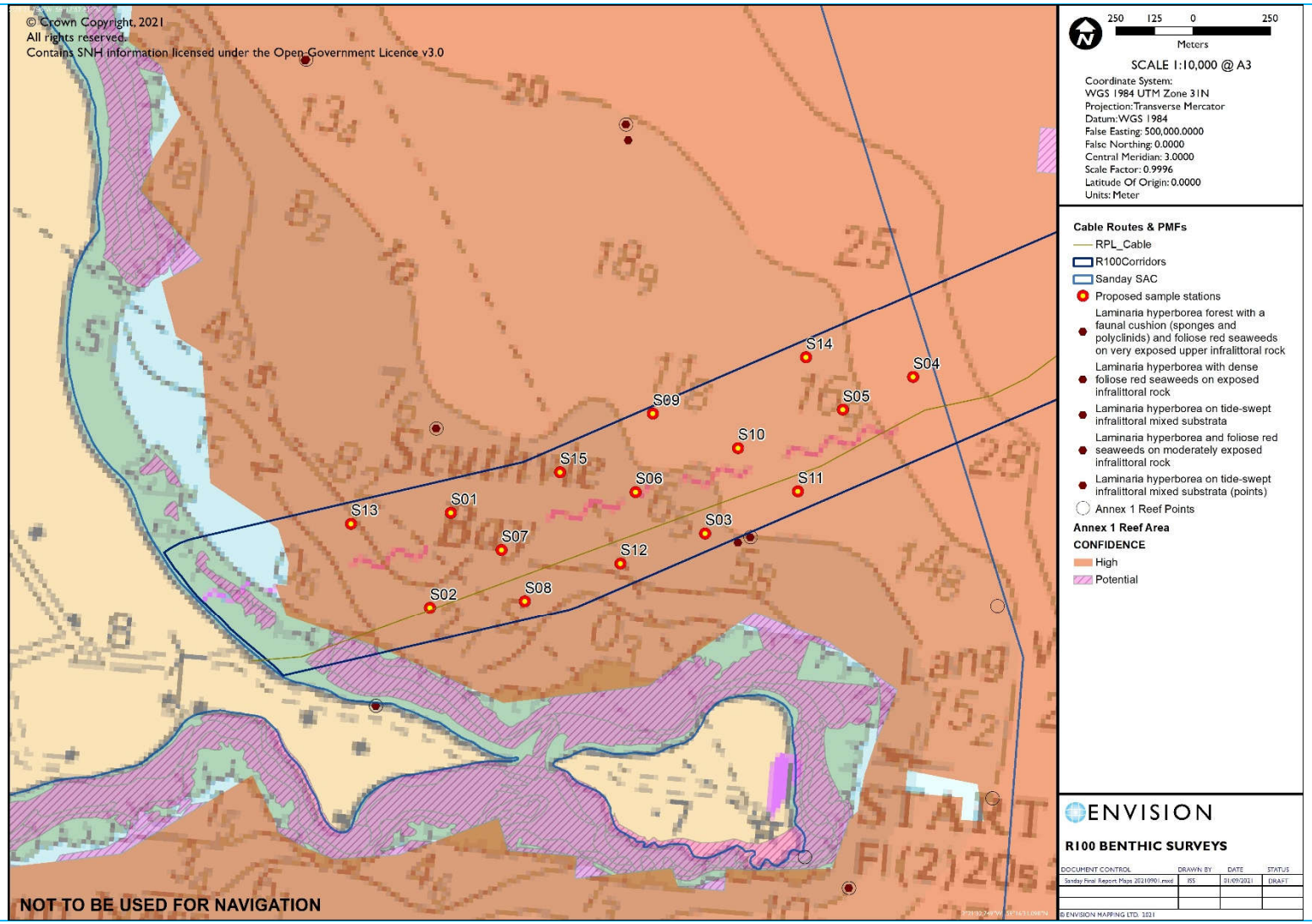


Figure 2.

Proposed sample stations for drop-down video survey, Sanday nearshore

2.1. Drop Down Video Methodology

A DDV camera was deployed to collect information on the biology of the seabed and to verify the physical and biological nature of the seabed. ENVISION designs, builds and operates a range of camera systems tailored to the local environmental conditions within the proposed survey areas. The system used on this survey was built specifically for benthic survey in rugged environments and is shown in Figure 3. Its robust structure was designed to enable it to maintain position in strong current as well as to glide easily over a variety of substrates without snagging.

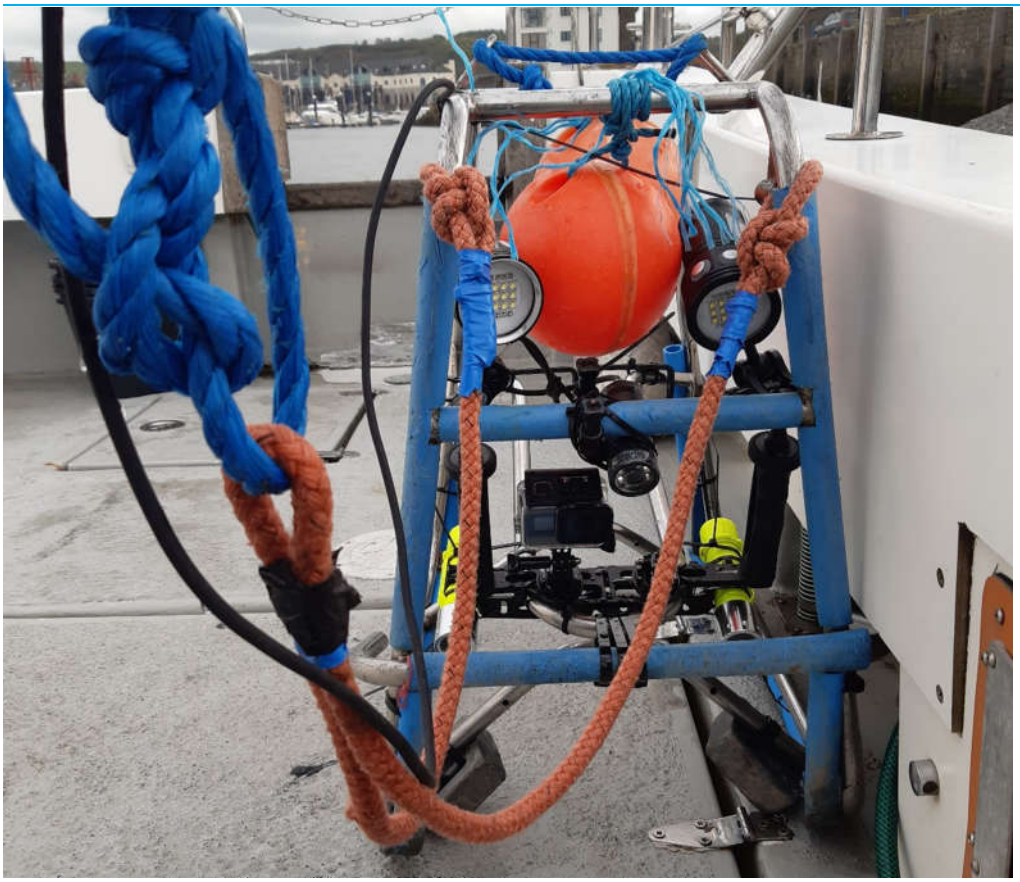


Figure 3.
The camera system designed by ENVISION for benthic survey.

The system comprised two video cameras: a high resolution CCTV camera connected to the surface via an umbilical and a high definition (HD) camera. The CCTV camera was connected to a screen and a digital capture device and was used primarily for real-time viewing, allowing the operator of the camera frame to view its progress and adjust height and speed over the seabed as required. Figure 4 shows an example of the topside equipment.

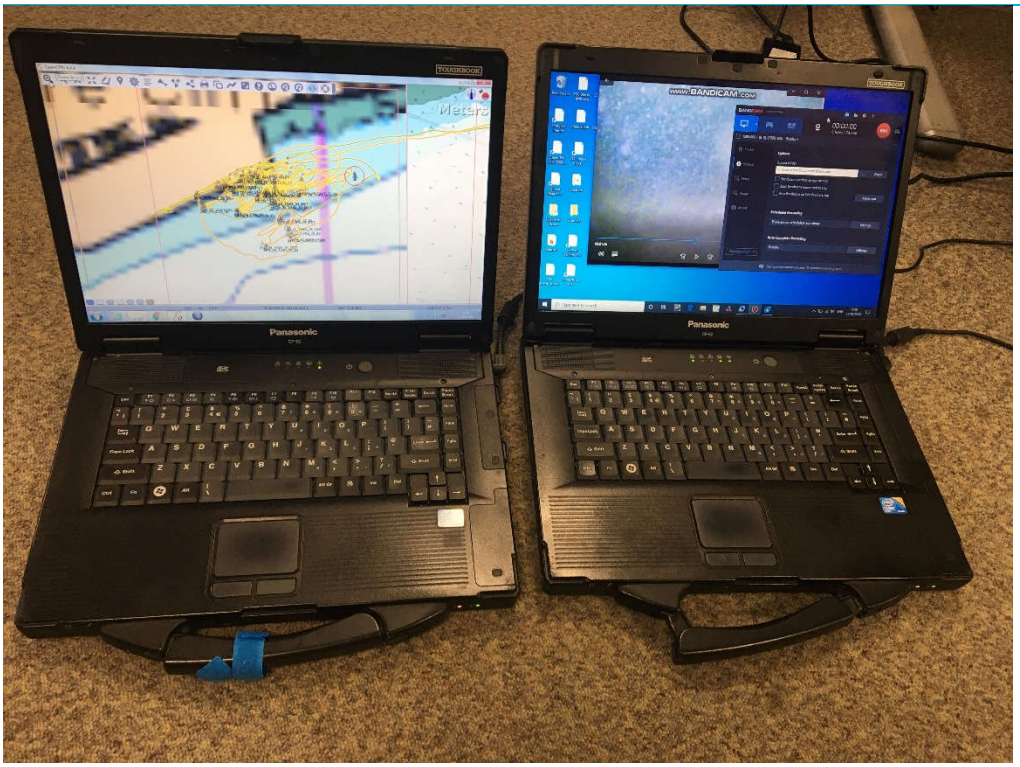


Figure 4.
Video and position fixing surface equipment.

The digital capture device also provided a back-up system in case of any problem with the high definition camera. However, the main camera used for recording video was a small solid state HD camera which produced high quality images.

At each sampling station the camera system was lowered to the seabed and allowed to drift, or be towed, behind the vessel for approximately 5 minutes. The position of each drop was located using a dGPS and plotting system.

The system was operated so that the camera frame periodically remained stationary on the seabed. These stops provide the opportunity to capture high quality still images. The still images and video footage will be reviewed to identify biota and to gather substrate information.

Each video drop was numbered and recorded using a digital capture device, for subsequent analysis, and the position and time at the start and end of each deployment were logged. The positions were recorded using a differentially corrected GPS (dGPS) system. These were displayed on the video capture system. A written record of positions for the stations was recorded during the survey as part of the survey log.

3. Data Analysis

3.1. Interpretation of video and still images

Video and still images were reviewed, processed and analysed in accordance with national guidelines, such as the standards for analysis in Visual Seabed Surveys (BS EN 16260:2012) and Turner *et al*., 2016[2]. The imagery has also been reviewed for Annex I reef assessment following the appropriate JNCC guidance notes (Gubbay, 2007[3]; Irving, 2009[4]; Golding et al., 2020[5]). The main purpose of the analysis of the imagery was to identify what fauna and broadscale habitats exist in a video record or still image, provide quantitative and semi-quantitative data and to note where one substrate type changes to another.

The video record was initially viewed rapidly in order to segment it into sections representing different substrates. At normal speed, the start and end points of each segment were logged, and each segment treated as a separate record and subsequently subjected to more detailed analysis. Brief changes in substrate type lasting less than 5m were considered as incidental patches are recorded as part of the habitat description, or as a 'habitat mosaic'.

The video footage was then viewed at normal or slower than normal speed, noting the physical and biological characteristics, such as substrate type and percent cover (in line with MNCR guidelines), seabed character, conspicuous taxa and life forms along with any modifiers or visible impacts present. Taxa are identified to the most detailed taxonomic level possible and quantified with abundance counts for erect species and percent cover for colonial/encrusting species. Where appropriate, any relevant features of conservation interest or Habitats Directive Annex I Habitats were noted at each sample location.

Taxa are identified to the most detailed taxonomic level possible, and quantified using categories based upon the MNCR SACFOR abundances scale (http://jncc.defra.gov.uk/page-2684), with abundance counts for erect species and percent cover for colonial/encrusting species. Where appropriate, any relevant features of conservation interest or Habitats Directive Annex I Habitats were noted at each sample location.

All data were recorded as each video clip or still image was analysed and a proforma spreadsheet was used to input imagery data and metadata, with reference to the latest species dictionary from the World Register of Marine Species (WoRMS) database.

[2] *Turner, J.A., Hitchin, R., Verling, E., van Rein, H. 2016. Epibiota remote monitoring from digital imagery: Interpretation guidelines.*

[3] *GUBBAY, S. 2007. Defining and managing Sabellaria spinulosa reefs. Report of an interagency workshop. JNCC Report No. 405.*

[4] *Irving, R. 2009. The identification of the main characteristics of stony reef habitats under the Habitats Directive. Summary report of an inter-agency workshop 26-27 March 2008. JNCC Report No. 432*

[5] *Golding. N., Albrecht. J., McBreen. F. 2020. Refining criteria for defining areas with a 'low resemblance' to Annex I stony reef; Workshop Report. JNCC Report No. 656, JNCC, Peterborough, ISSN 0963-8091.*

Abundance counts for solitary and erect taxa were added as point annotations in BIIGLE for still images, but for video analysis these counts were performed manually and recorded directly in the proforma spreadsheet. Where percentage covers of colonial/encrusting taxa were to be recorded, point annotations were attached to still images in BIIGLE and then double tagged with percentage cover categories (associated with SACFOR) and the data exported. Percentage cover of cobbles/boulders was annotated with the polygon tool to aid assessment of stony reefs. For video analysis, these categories were estimated visually for each video segment. Annotations from BIIGLE were exported in Excel spreadsheets and translated into the results proforma spreadsheet as required.

A reference collection was built as the analysis progressed with good quality images noted and collated to aid consistency and quality of analysis, with each taxon or species highlighted. In addition to a species/taxon reference collection, a habitat/biotope reference collection was also built with good images of each habitat or biotope and for reference purposes.

3.2. Priority Marine Feature and Annex I Assessment

The video footage has been reviewed and analysed in accordance with current UK guidelines and any potential Annex I features identified. For biogenic or stony reefs Turner *et a*l. 2016[6], Gubbay, 2007[7]; Irving, 2009[8]; Golding *et al*., 2020[9] assessment methods are used. Priority Marine Features[10] (PMFs) habitats and species have also been assessed and identified where present.

[6] *Turner, J.A., Hitchin, R., Verling, E., van Rein, H. 2016. Epibiota remote monitoring from digital imagery: Interpretation guidelines.*

[7] *GUBBAY, S. 2007. Defining and managing Sabellaria spinulosa reefs. Report of an interagency workshop. JNCC Report No. 405.*

[8] *Irving, R. 2009. The identification of the main characteristics of stony reef habitats under the Habitats Directive. Summary report of an inter-agency workshop 26-27 March 2008. JNCC Report No. 432*

[9] *Golding. N., Albrecht. J., McBreen. F. 2020. Refining criteria for defining areas with a 'low resemblance' to Annex I stony reef; Workshop Report. JNCC Report No. 656, JNCC, Peterborough, ISSN 0963-8091.*

[10] *https://www.nature.scot/doc/priority-marine-features-scotlands-seas-habitats*

4. Results

A total of 15 video tows and associated (78) still images were analysed, from 15 stations. The video quality was good with the exception of a single tow where the tidal current caused the video footage to be fast moving. Still imagery quality ranged from 'good' (76) to 'poor' (2), with reduction in quality scores due to the onsite conditions and turbidity. A minimum of one video tow and five stills were analysed for each station.

Figure 5 shows the location of the video samples for which data were collected during the survey.

The imagery has been reviewed and selected still images are shown in Appendix A, with associated data shown in Appendix B.

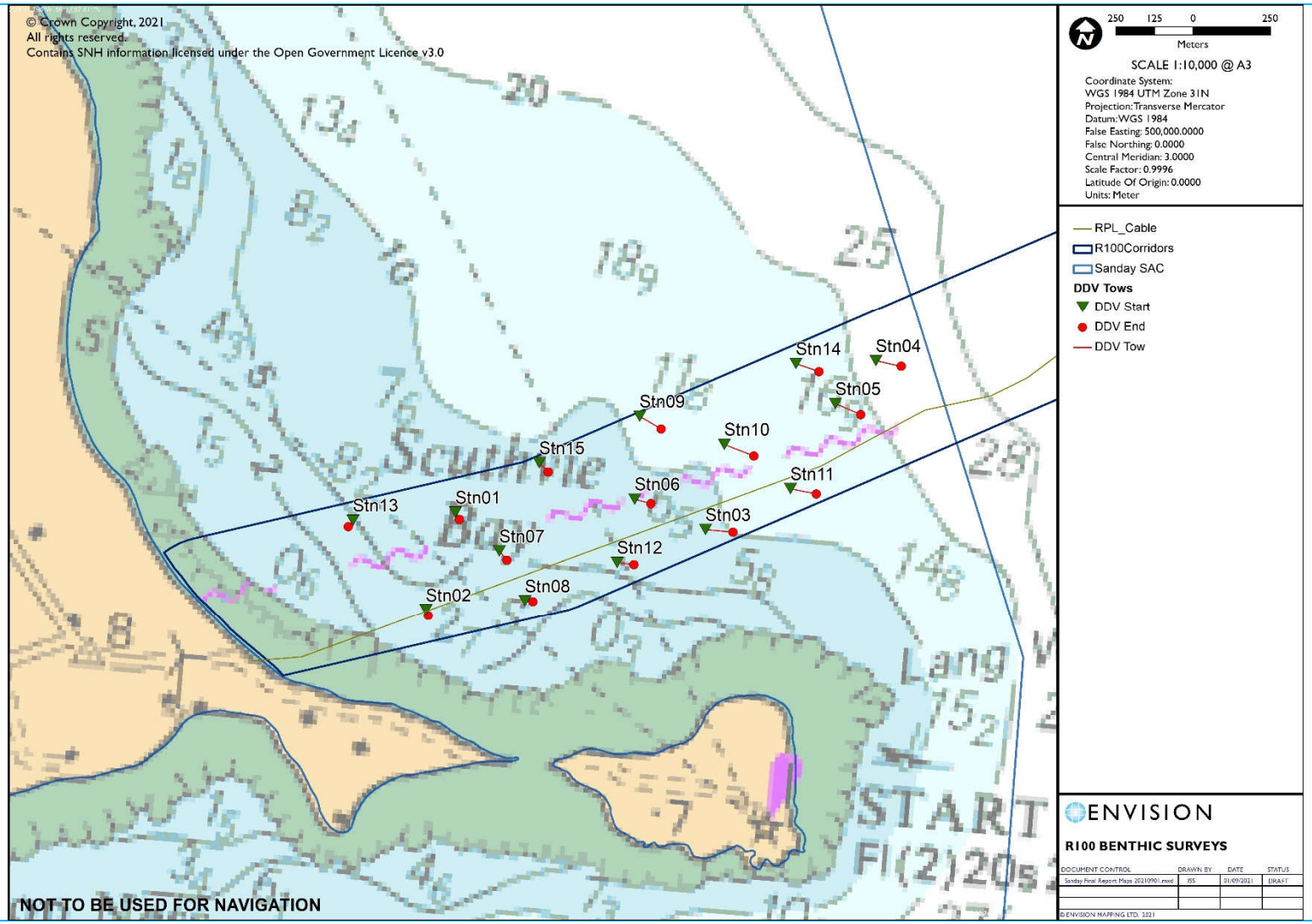


Figure 5.

Location of video stations surveyed at Sanday nearshore, 30th June – 4th July 2021, with station numbers shown along with start and end locations of each video 'tow'

4.1. Sanday Nearshore Area General Description

In general, the epiflora observed in the imagery from the sample stations at Sanday nearshore was dominated by kelp (*Laminaria spp.*) and red seaweeds. Inshore habitats (<10m depth) were characterised by kelp forests and habitats between 10m and 25m were kelp park. The main substrate was rock, with small patches of sediment found to occur (stations 07 & 13) which showed signs (casts) of infauna. The understory of the kelp park and forests was dominated by foliose red seaweeds, sponges (cushion and encrusting) and echinoderms (starfish, brittlestars and sea urchins).

4.2. Habitat/Biotope Allocation

A total of 6 habitats/biotopes were observed within the subtidal area surveyed by drop down video in the Sanday nearshore area. However, two were only identified within still imagery as it can be challenging to identify habitats to the same hierarchical level as identifed from video footage and still images were often attributed with a broader habitat. At one station (07), a habitat change along the video tow resulted in imagery being split into two segments with different biotopes allocated to each segment.

Laminaria hyperborea forest or park with dense foliose red seaweeds on exposed upper infralittoral rock (IR.HIR.KFaR.LhypR.Ft or IR.HIR.KFaR.LhypR.Pk) was recorded at the majority of stations (14), with some associated still images from these stations attributed as "High energy infralittoral rock" (IR.HIR) or as "Kelp with cushion fauna and/or foliose red seaweeds" (IR.HIR.KFaR).

'Sublittoral sands and muddy sands' (SS.SSa) were recorded at two stations (stations 07 & 13). Within Station 14 one still image was attributed as "Sublittoral coarse sediment" (SS.SCS) which was a small patch of substrate at the edge of kelp habitat.

These habitats/biotopes identified are presented in Table 1 and example images shown in Table 2, with the spatial distribution presented in Figure 5 and a summary of biotope, habitats and conservation features in Table 3.

Table 1. *Habitat types identified from the video and still imagery analysis for nearshore Sanday cable route.*

Biotope/Habitat (MNCR Code)	EUNIS Code	MNCR Classification
IR.HIR	A3.1	High energy infralittoral rock
IR.HIR.KFaR	A3.11	Kelp with cushion fauna and/or foliose red seaweeds
IR.HIR.KFaR.LhypR.Ft	A3.1151	*Laminaria hyperborea* forest with dense foliose red seaweeds on exposed upper infralittoral rock
IR.HIR.KFaR.LhypR.Pk	A3.1152	*Laminaria hyperborea* park with dense foliose red seaweeds on exposed lower infralittoral rock
SS.SCS	A5.1	Sublittoral coarse sediment
SS.SSa	A5.2	Sublittoral sands and muddy sands

Table 2. *Frame captures illustrating the biotope/habitats observed during analysis*

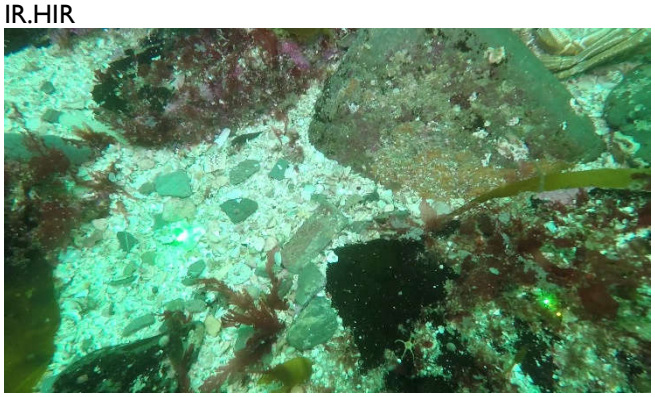
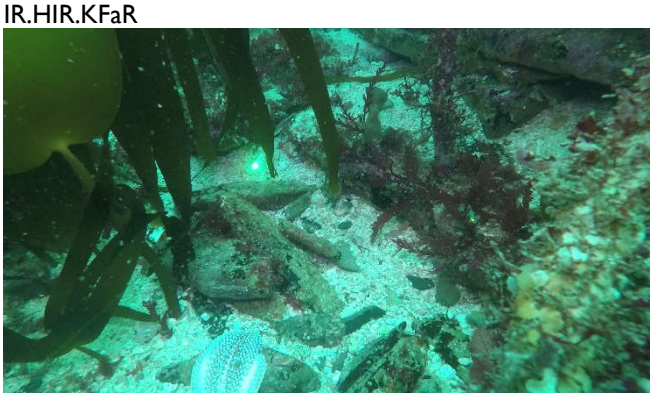
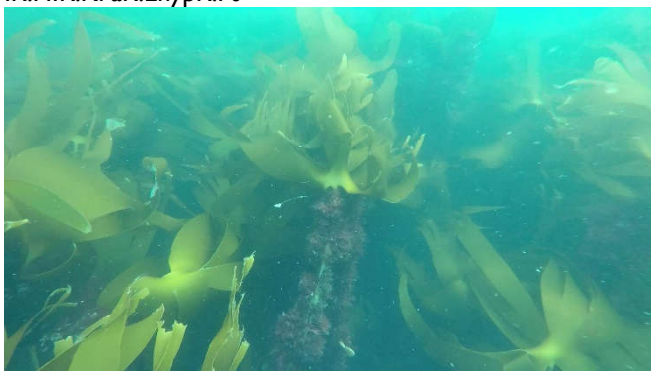
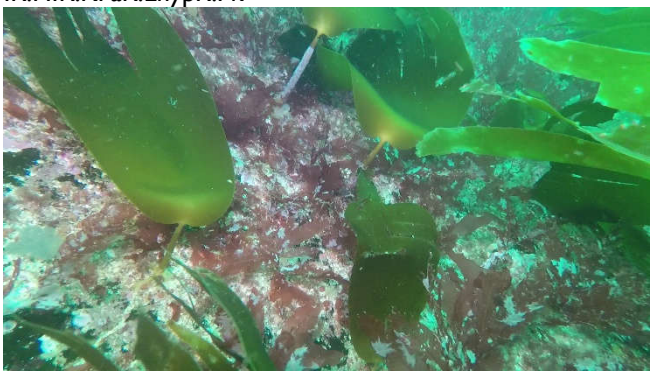
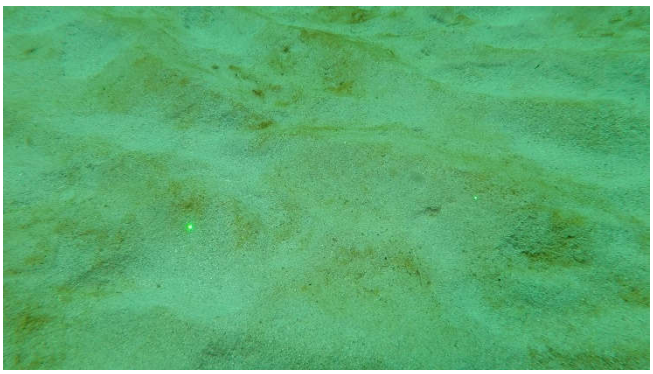
IR.HIR 	IR.HIR.KFaR 
IR.HIR.KFaR.LhypR.Ft 	IR.HIR.KFaR.LhypR.Pk 
SS.SCS 	SS.SSa 

Table 3.
Sample station information, EUNIS classification, broadscale habitat, MNCR code, PMFs and presence of Annex 1 habitats for Sanday nearshore cable corridor.

STN	Depth (m)	EUNIS Code	Broadscale Habitat	MNCR Biotope Code	PMF	Annex 1
01	8	A3.1151	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Ft	Kelp Beds	Bedrock Reef Sub-feature
02	5	A3.1151	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Ft	Kelp Beds	Bedrock Reef Sub-feature
03	9.5	A3.1151	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Ft	Kelp Beds	Bedrock Reef Sub-feature
04	23.0 - 25.0	A3.1152	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Pk	Kelp Beds	Bedrock Reef Sub-feature
05	20.0 - 21.0	A3.1152	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Pk	Kelp Beds	Bedrock Reef Sub-feature
06	10.5	A3.1151	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Ft	Kelp Beds	Bedrock Reef Sub-feature
07	8	A3.1151	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Ft	Kelp Beds	Bedrock Reef Sub-feature
07	8	A5.2	Subtidal Sand	SS.SSa		
08	6	A3.1151	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Ft	Kelp Beds	Bedrock Reef Sub-feature
09	14	A3.1152	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Pk	Kelp Beds	Bedrock Reef Sub-feature
10	16	A3.1152	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Pk	Kelp Beds	Bedrock Reef Sub-feature
11	16	A3.1152	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Pk	Kelp Beds	Bedrock Reef Sub-feature
12	11	A3.1151	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Ft	Kelp Beds	Bedrock Reef Sub-feature
13	8	A5.2	Subtidal Sand	SS.SSa		
14	22	A3.1152	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Pk	Kelp Beds	Bedrock Reef Sub-feature
15	10.5	A3.1151	High Energy Intertidal Rock	IR.HIR.KFaR.LhypR.Ft	Kelp Beds	Bedrock Reef Sub-feature

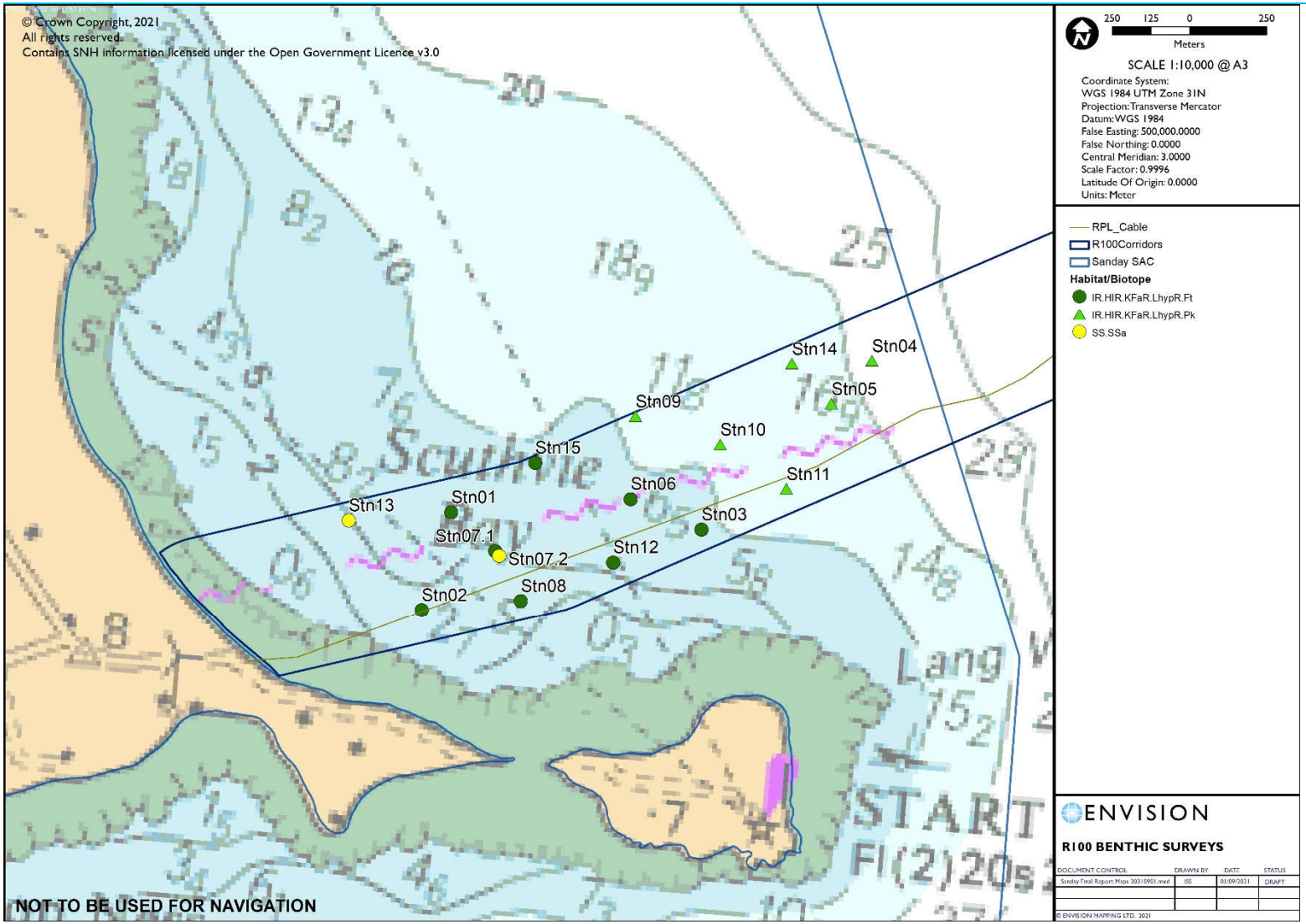


Figure 6.
Sampling stations surveyed with drop down video along the proposed cable route at Sanday nearshore showing marine habitats at each location

4.3. Features of Importance or Conservation Significance

The only Priority Marine Feature (PMF) present was 'Kelp Beds', which was observed in 14 stations with station 13 being the single location where the feature was not found (Figure 7).

One taxon observed that could be considered a PMF species were 2 'dogfish' in station 09, but the imagery did not allow for identification further than 'Chondrichthyes'. The spiny dog fish (*Squalus acanthias*) is considered a PMF species.

4.4. Annex I Features

Potential Annex I bedrock reef was present in 14 stations, as shown in Figure 8, and the biotopes which occur at these stations are sub-features of Annex I bedrock reef. No biogenic or stony reef was recorded.

From the distribution of Annex I reefs in Figure 9, the habitat is found throughout the cable corridor area which is to be expected as this is the predominant habitat within Sanday SAC.

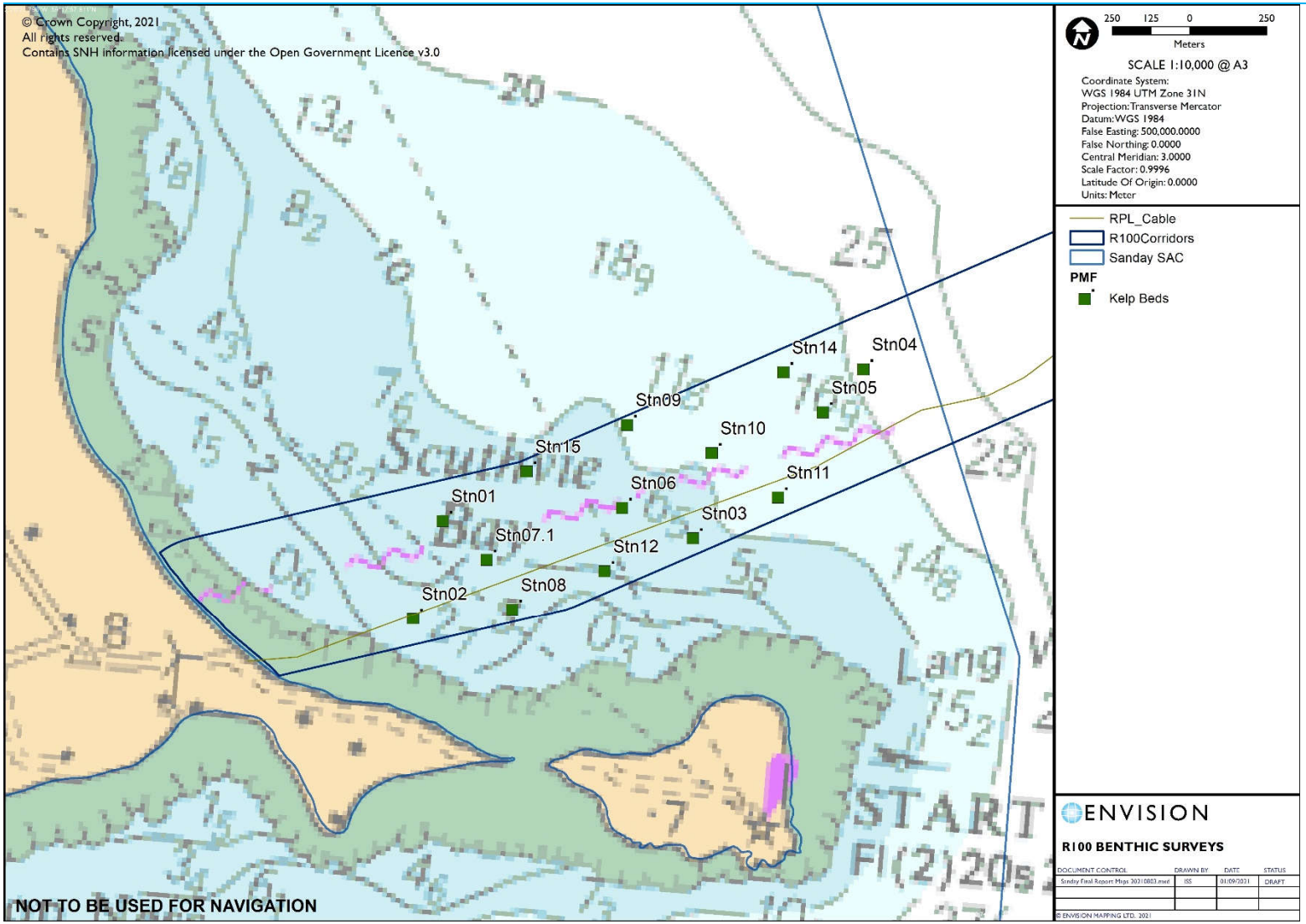


Figure 7.
Priority Marine Features along the proposed cable corridor within the Sanday nearshore area.

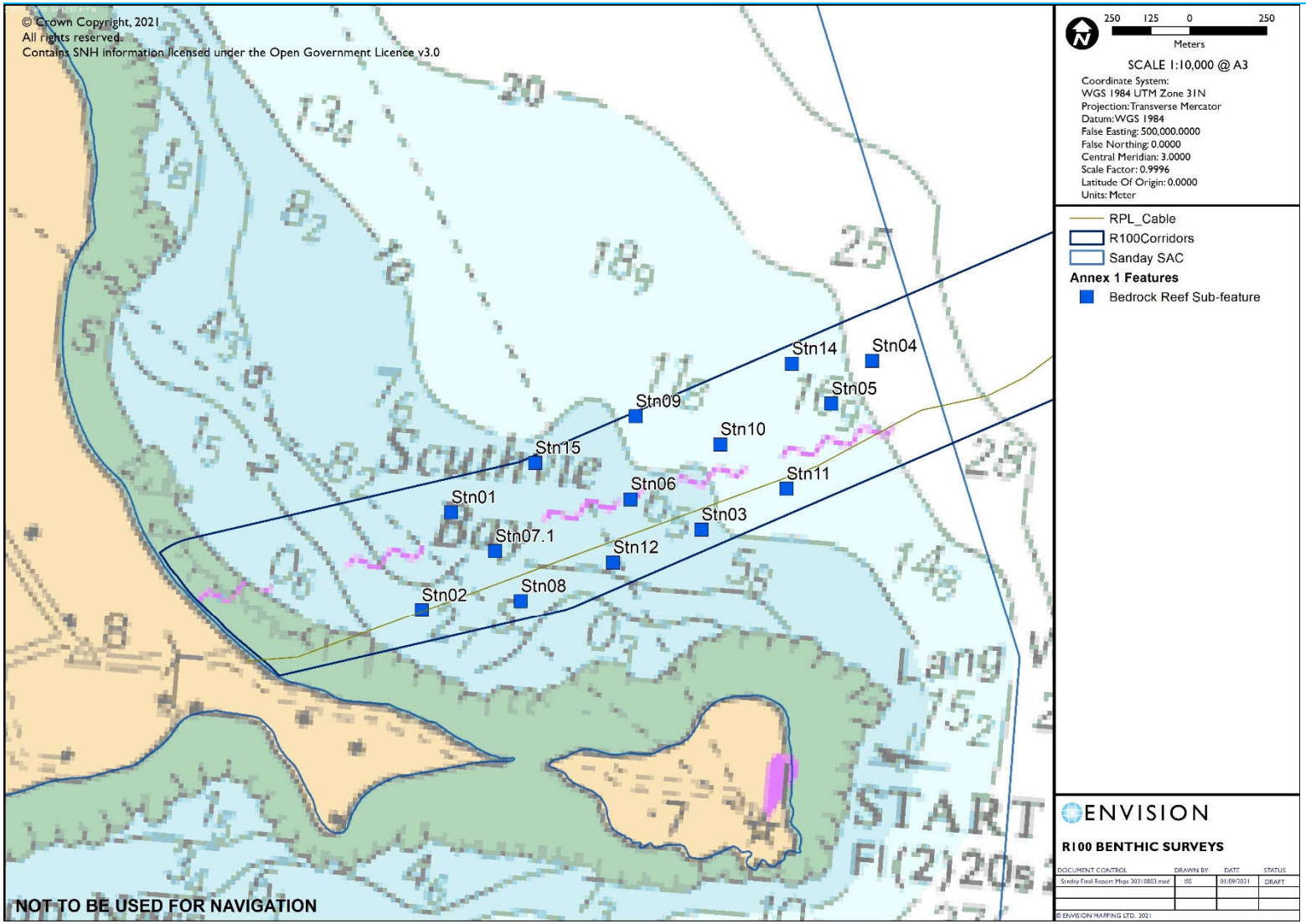


Figure 8.
Annex 1 reef features along the proposed cable corridor within the Sanday nearshore area.

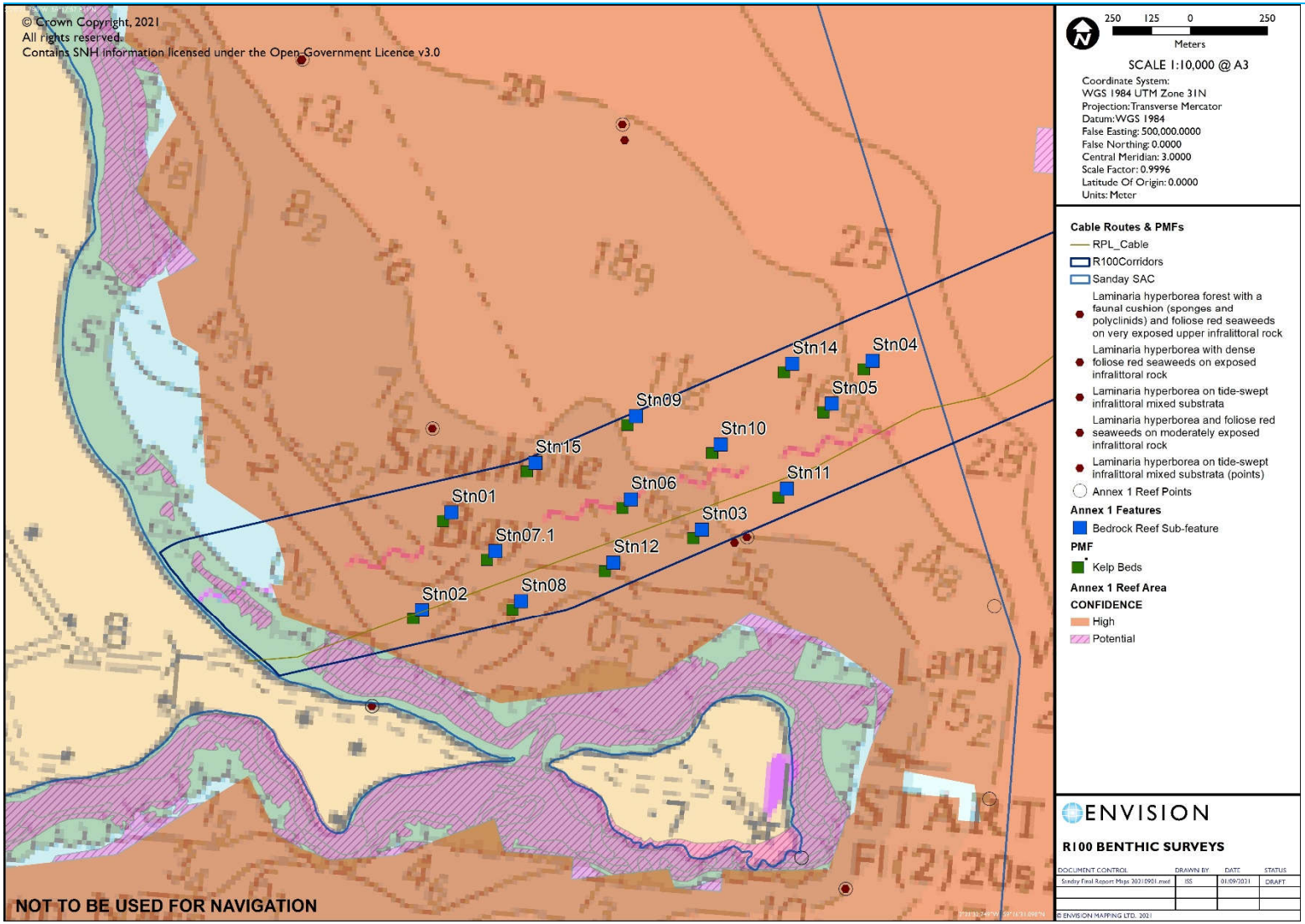


Figure 9.
Sanday SAC and Annex1 bedrock reef and PMFs in the area along with proposed cable corridor and drop-down video samples

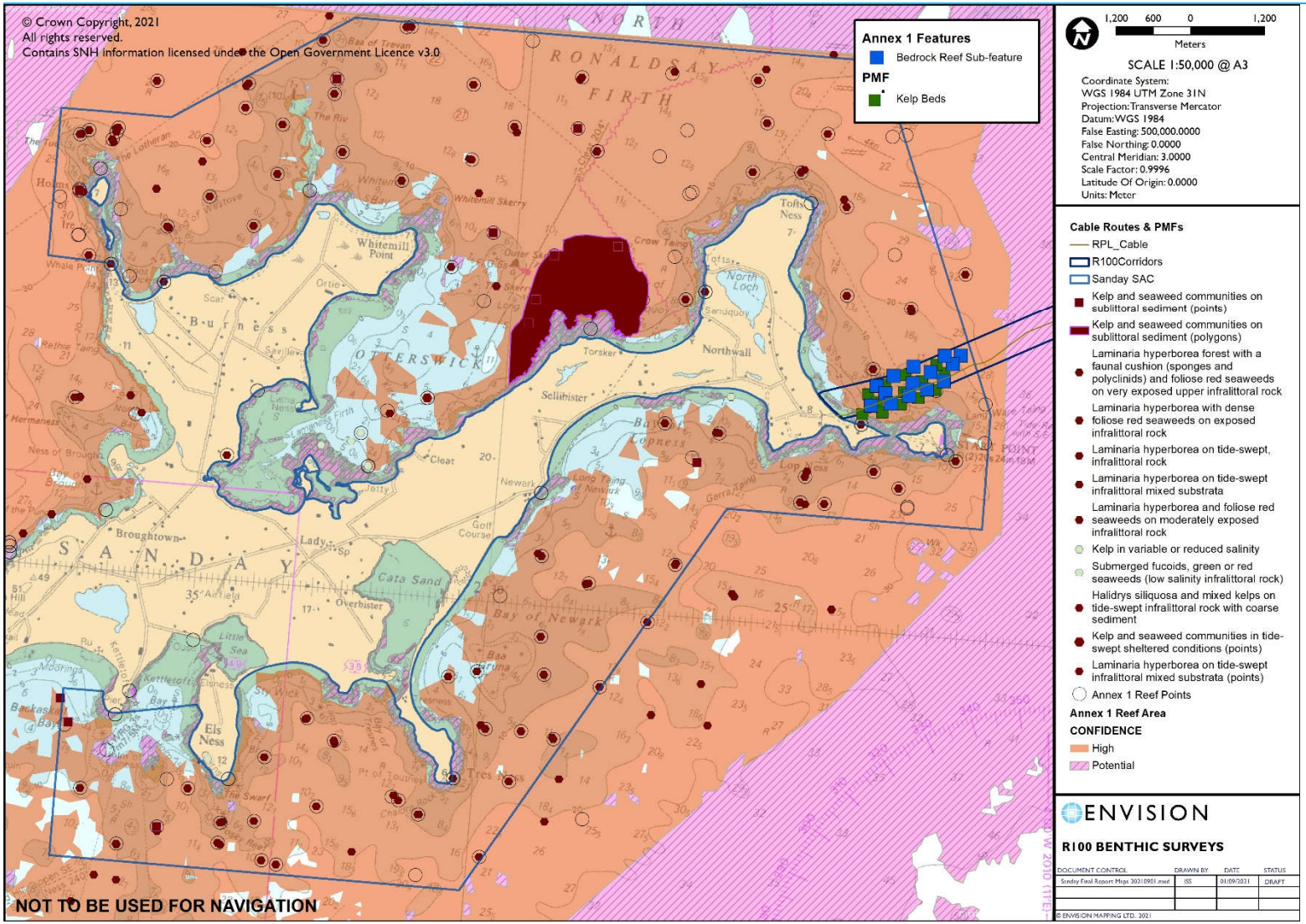


Figure 10.
Annex1 bedrock reef and PMFs along with proposed cable corridor and drop-down video samples within Sanday SAC

4.5. Reference Collection

A reference collection of still images from video footage has been compiled to produce example imagery for the species/taxa observed: the collection includes 51 images of 51 taxa, and six images as examples of the six habitat/biotope types identified.

NB: Where taxon have been identified to a high taxonomic level (Family or higher) then an example of that taxon has been provided e.g., Asteroidea. However, this taxon can cover a wide range of species, and it should not be considered as the only potential example.

4.6. Quality control of video and still analysis.

Quality control (QC) was carried out on 100% of the annotations on the still images with a second analyst reviewing the imagery and results. QC was carried out on 10% of the videos (from two sample stations), and the results compared and reviewed by both analysts. The degree of consistency in the results between the original analysers and the QC analyser reflects a confidence in the quality of the analysis and full QC details are provided in Appendix C.

5. Summary

The objective of this survey was primarily to identify conspicuous fauna and substrate types and record any Annex 1 habitats and other seabed features of conservation importance. This was completed using underwater imagery, from drop-down video survey. Benthic sampling was representative of the range of potential habitats in the area of interest, identified using a structured sample plan. A total of 15 stations were surveyed.

3 biotopes/habitats were allocated to the DDV sample stations, including one station with two biotopes/habitats allocated.

One taxon observed that could be considered a 'Feature of Conservation Importance' was 2 dogfish in station 22, but the imagery did not allow for identification further than 'Chondrichthyes'.

Inshore, the substrate was comprised largely of high energy infralittoral rock, much of which was colonised with Kelps and a dense understorey of red seaweeds, with kelp and red seaweed communities observed at all but one of the stations. As distance increased from the shore, kelp forest thinned into kelp park and kelp was present to a depth of 25 metres.

The imagery has been reviewed in order to identify any 'features of conservation importance or significance' and 14 stations were found to have sub-features of Annex 1 Reef (bedrock) present, namely *Laminaria hyperborea* forest and park with dense foliose red seaweeds on exposed upper infralittoral rock forest. These biotopes are also considered a Priority Marine Feature, "Kelp Beds".