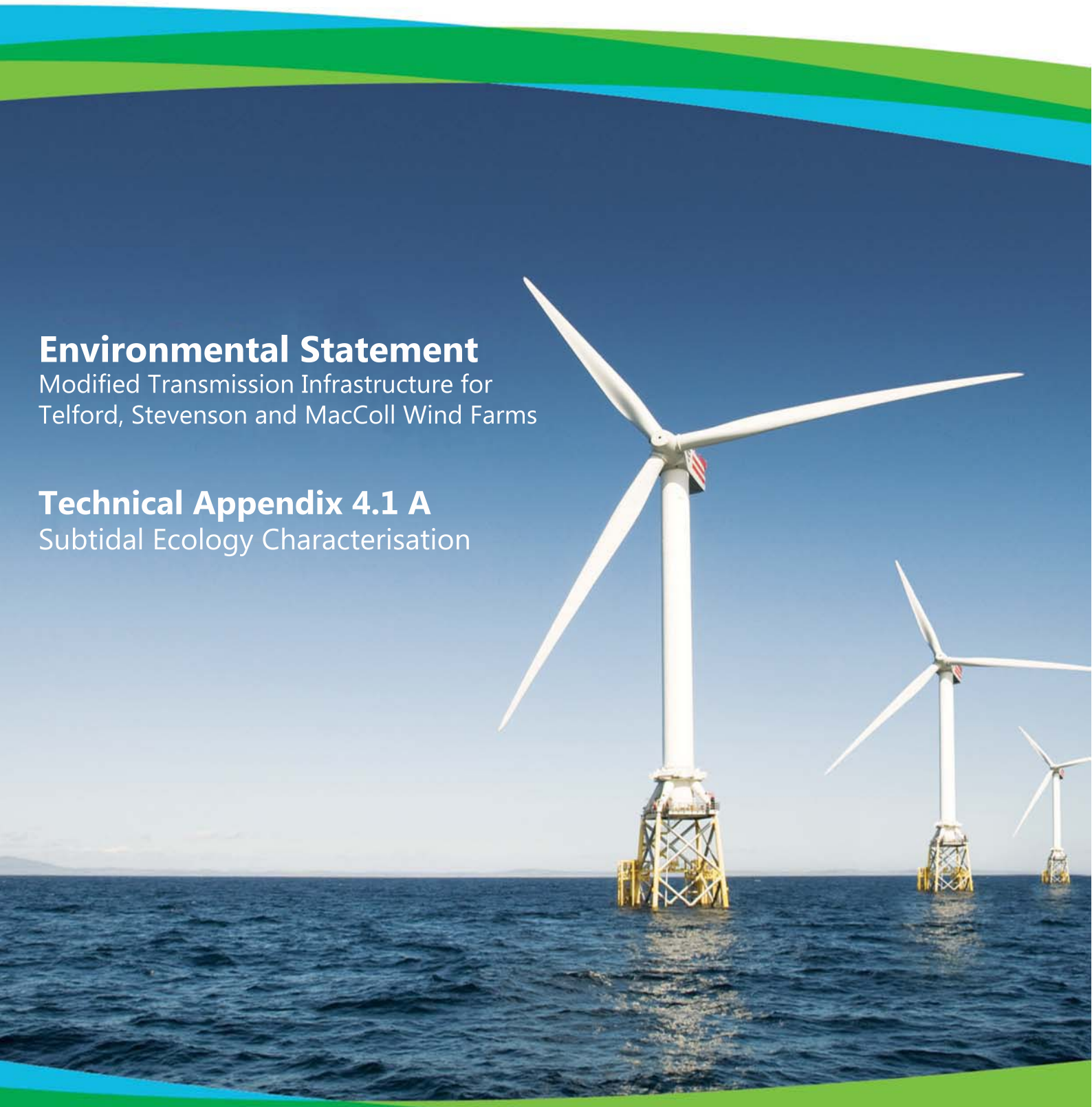
moray offshore renewables ltd

Developing Wind Energy In The Outer Moray Firth



Environmental Statement

Modified Transmission Infrastructure for
Telford, Stevenson and MacColl Wind Farms

Technical Appendix 4.1 A

Subtidal Ecology Characterisation

edp renewables

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moray offshore renewables limited

4th Floor
40 Princes Street
Edinburgh
EH2 2BY

Tel: +44 (0)131 556 7602

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1 Introduction

1.1 Study Background

1.1.1 Following recent consent award for the development of the Telford, Stevenson and MacColl sites offshore wind farm, Moray Offshore Renewables Ltd. (MORL) (a consortium developer comprising EDP Renovaveis and Repsol Nuevas Energias UK (formerly SeaEnergy Renewables) was subsequently offered an alternative grid connection. Accordingly, MORL commissioned a series of additional technical studies to support a further consent application and associated Environmental Statement (ES) for a new proposed cable route corridor and transmission infrastructure (the modified TI).

1.1.2. This document presents a characterisation of the subtidal benthic ecology of the modified TI. It describes the seabed video survey and grab sampling and analysis methods used to acquire characterisation data along the proposed route corridor of the export cable and provides an interpretation of the subtidal benthic environment in terms of the seabed habitats and conspicuous epifaunal communities observed.

1.1.3. The proposed cable route corridor is approximately 52 km long and runs in an approximately southerly direction between the three consented wind farms and the proposed landfall site at Inverboyndie. The cable route corridor survey results are presented within this Technical Report as indicated in Figure 1.1 (Chart Appendix). Water depths throughout the length of cable range from <10 to >90m below chart datum.

1.2 Aims of the study

1.2.1. Study aims included;

- Characterisation of seabed substrates, features and associated subtidal epifaunal communities within the study area; and
- Collection of sediment samples for chemistry and particle size distribution (PSD) analyses to further aid assessment of potential wind farm impacts.

1.2.2. Benthic ecological characterisation of the three consented wind farm sites (offshore generating station) have been reported previously (MORL, 2012). The intertidal benthic ecology at the new proposed landfall site is presented in Technical Appendix 4.5 A. This report relates solely to the modified TI corridor and close environs.

1.3 The background physical and biological environment

1.3.1. Irving (1996) could not provide any great detail for the sublittoral sediments of the Moray Firth stating only that sand and mixed sediments dominate offshore and that the near shore is often a reflection of the littoral environment to certain degrees.

1.3.2. The predictive MESH seabed habitat map for the Moray Firth area (Figure 1.2 – Chart Appendix) provides a guide to broad seabed habitat types likely to be encountered and indicates that along the modified offshore export cable route corridor deep circalittoral sand dominates with some deep circalittoral and circalittoral / infralittoral coarse sediment, these latter two evident in the nearshore area (Figure 1.2 – Chart Appendix). However, biological community boundaries are unlikely to be so neatly delineated (Eleftheriou *et al*., 2004).

1.3.3. The water depth in the Moray Firth is generally less than 80 m with the exception of the southeast corner where depths of more than 200 m can occur in fault-related deeps (Adams and Martin, 1986). This is the area known as the Southern Trench which is currently delineated as one of four Marine Protected Area (MPA) Search locations identified by the Scottish Government (Figure 1.3 - see below). The trench is 10 km north of Fraserburgh, reaches at least 250 m in depth and is more than 120 km in length (Holmes *et al*., 2004). This is where a historical record of the cold-water coral *Lophelia pertusa* has been reported (Wilson 1979) although there is no recent evidence to suggest colonies of potential conservation interest exist in the Moray Firth (DTI 2004; Hall-Spencer and Stehfest 2009; Marine Scotland 2012).

1.3.4. Shallow shelf seas have close bentho-pelagic coupling and, therefore, the benthic invertebrate fauna play an important role in nutrient cycling, detrital decomposition as well as providing food for higher trophic levels (Reiss *et al.*, 2009). Furthermore the spatial distribution of species in the different regions of the North Sea is significantly correlated to the food availability (Kröncke, 2006). Wieking and Kröncke (2005) state that in shallow shelf seas, like the North Sea, the major source of organic material is from primary production and benthic organisms must rely on this for their energy and nitrogen requirements.

1.3.5. Hartley and Bishop (1986) investigated the macrobenthos of the Beatrice field from survey work carried out in 1977, 1980 and 1981. Some taxa such as *Spiophanes bombyx* and *Cochlodesma praetenue*, were found across the survey area. The shallower northeast of the sampling grid in this study was on the Smith Bank. Species restricted to these sites, or occuring at the greatest densities here, included the polychaetes *Travisia forbesii* and *Ophelia borealis*, the amphipod *Bathyporeia* spp. and the bivalve molluscs, *Crenella decussata* and *Tellina pygmaea* each of which are characteristic of sand / coarse sand sediments. Taxa widely recorded but absent or at low abundances in the northeast of the grid showed a preference muddier mixed sediments. These included the polychaetes *Pholoe minuta*, *Goniada maculata*, the amphipod *Urothoe elegans*, the bivalve molluscs *Nucula tenuis*, *Dosinia lupinus* and the brittlestar, *Acrocnida brachiata*. While examples of taxa restricted to the deeper stations to the west were the tube building polychaete *Myriochele* sp., the cumacean, *Eudorella truncatula* and the bivalve mollusc *Thyasira flexuosa*. Other benthic fauna with a preference for clean mixed sands, such as the bivalve molluscs *Gari fervensis*, *Abra prismatica* and *Tellina fabula* tended to be reduced or absent from both the coarser shallower sediments of the northeast and the deeper, muddier, stations to the west. Hartley and Bishop (1986) note that the species richness encountered at individual stations was more similar to inshore areas such as Sullom Voe, Shetland than offshore areas of the North Sea.

1.3.6. ERT (2005) also found high species richness from a survey of the Beatrice wind farm demonstrator site. Sites across the survey area were characterised by the polychaetes *Chaetozone setosa, Lumbrineris gracilis* and *Exogone hebes,* the amphipods *U. elegans, Ampelisca tenuicornis* and *Bathyporeia* spp., the bivalve mollusc *T. fabula* and the pea urchin *E. pusillus.* One site which had a high coverage of dead shell recorded species such as the squat lobster *Galathea intermedia,* the chiton *Leptochiton asellus* and the brittle star *Amphipholis squamata* as well as an abundance of the small fanworm *Jasminiera caudata*.

1.3.7. Samples of medium to coarse sands taken just north-east of the Beatrice oilfield for the Jacky oilfield development (Ithaca Energy, 2008) were mostly dominated by *S. bombyx*, *T. pygmaea*, *C. pratenue* and *E. pusillus*. Two stations with high proportions of gravel and pebbles were dominated by epifaunal species such as *G. intermedia* and *L. asellus*.

1.3.8. Historically, benthic studies within the Moray Firth have focused on the Smith Bank and the Beatrice Field (Eleftheriou *et al*., 2004). The communities studied on the Smith Bank and Beatrice field have shown considerable persistence in the medium term (Eleftheriou *et al*., 2004). This suggests relatively stable environments.

1.3.9. The Clean Seas Environment Monitoring Programme (CSEMP) site in the outer Moray Firth (previous name Station 105) located just inside the southern edge of the western development area was found to be dominated by *Myriochele* sp. (18%) and the mollusc *Circomphalus casina* (9%) (UK NMP 1994).

1.3.10. Cefas (2005), in a study of the benthic ecology of the western North Sea identified two clusters in the northern North Sea with sites in the Moray Firth clustered in Group F. The top five characterising species were *Galathowenia oculata*, *Goniada maculata*, *Spiophanes kroeyeri*, *Amphiura filiformis* and *Paramphinome jeffreysii*.

1.3.11. Rees *et al*. 2007 in their analysis of the North Sea Benthos Project 2000 data grouped sites in the Moray Firth with those in the central and northern North Sea at depths >50m (mean depth of 96m). These sites were composed of muddy sand and fine sand and had *Myriochele* sp., *A*. *filiformis* and *Spiophanes* spp. as the dominant fauna (Rees *et al.*, 2007; Reiss *et al.*, 2009).

1.3.12. Calloway *et al*. (2002) in a study of the epibenthos of the North Sea identified a northern North Sea station cluster which occurred between 50-100 m (within which the Moray Firth site was found). The characterising species were whelks such as *Neptunea antiqua* and *Colus gracilis*, the hermit crabs *Pagurus pubescens* and *Anapagurus laevis* as well as other species such as *Hydroides norvegica*, *Hyas coarctatus*, *Flustra foliacea* and *Epizoanthus papillosus*. Jennings *et al*. (1999) identified some similar species as well as *Asterias rubens*, *Crangon allmani* and *Astropecten irregularis*. Attached species accounting for similarity within the northern North Sea cluster were the hydroids *Flustra foliacea*, *Hydrallmania falcata*, *Lafoea dumosa*, the sponge *Suberites ficus*, the sea-squirt *Ciona intestinalis* and the bryozoan *Alcyonidium diaphanum* (Jennings *et al.*, 1999).

1.3.13. Beatrice Offshore Wind Ltd (BOWL) undertook a comparable cable route video survey just over 20 km west of the proposed corridor as part of the EIA investigations and development application for the Beatrice Offshore Wind Farm (BOWL, 2012 and 2013). The Beatrice study found burrowed mud and fine-medium sand with shell fragments dominated their study area. In the offshore area the burrowed mud habitat, although with a low density of sea pens, was identified as the biotope SS.SMu.CFiMu.SpnMeg - Sea pens and burrowing megafauna in circalittoral. Inshore areas were mainly fine-medium sands and gravels with small patches of cobble reef. This area was considered to be a fairly rich example of the biotope SS.SCS.CCS.PomB Pomatoceros triqueter with barnacles, coralline algae and bryozoan crusts on unstable circalittoral cobbles and pebbles. It was noted that the biotope may be considered as being potential Annex I cobble reef (Irving, 2009). The sublittoral area closest to the shore was recorded as being composed very clean fine sand with no visible epifauna.

1.3.14. The Marine (Scotland) Act 2010 makes provision for the publication of certain species and habitats that are considered important for nature conservation. These are referred to as Priority Marine Features (PMFs). There are fourteen invertebrate species referred to in the current draft recommended PMF list (eight in the species list and nine associated with a particular biotope in the habitat PMF list). Of those seventeen species only three are regarded to have some likelihood of being found in the area of the offshore infrastructure study area. These are the European spiny lobster (*Palinurus elephas*), the Ocean quahog (*Arctica islandica*) (both PMF species) and the mud burrowing amphipod *Maera loveni* which is associated with a burrowed mud PMF habitat. Figure 1.3 presents the distribution of these species.

1.3.15. The OSPAR Threatened and Declining (T&D) habitat 'Sea-pen and burrowing megafauna communities' has been found across the southern half of the Moray Firth (Figure 1.4 – Chart Appendix). This habitat broadly equates to the burrowed mud MPA search feature. Burrowed mud extends across the southern half of the Moray Firth and as such is likely to intersect with the cable route. The biotope 'Seapens and burrowing megafauna in circalittoral soft mud' SS.SMu.CFiMu.SpnMeg (Connor *et al.*, 2004) is considered a component of both the OSPAR T&D and PMF "burrowed mud" habitat features. Furthermore, Greathead *et al.* (2007) have maps showing the location of seapens around Scotland with both *Pennatula phosphorea* and *Virgularia mirabilis* found at various locations in the Moray Firth.

1.3.16. Hydrography clearly helps shape the glacially derived sedimentary environment in this area and although sediment plays an important role in defining biological communities (Eleftheriou *et al.*, 2004), benthic biotopes can only really be adequately mapped through survey work. Therefore from the predicted habitats map (Figure 1.2 – Chart Appendix) the extent of the seapen and burrowing megafauna habitat, typically found in a range of sediments from muddy sands with varying mixtures of shell and gravel to fine, clay-dominated muds (Hughes, 1998) might not be guessed at (Figure 1.4 – Chart Appendix).

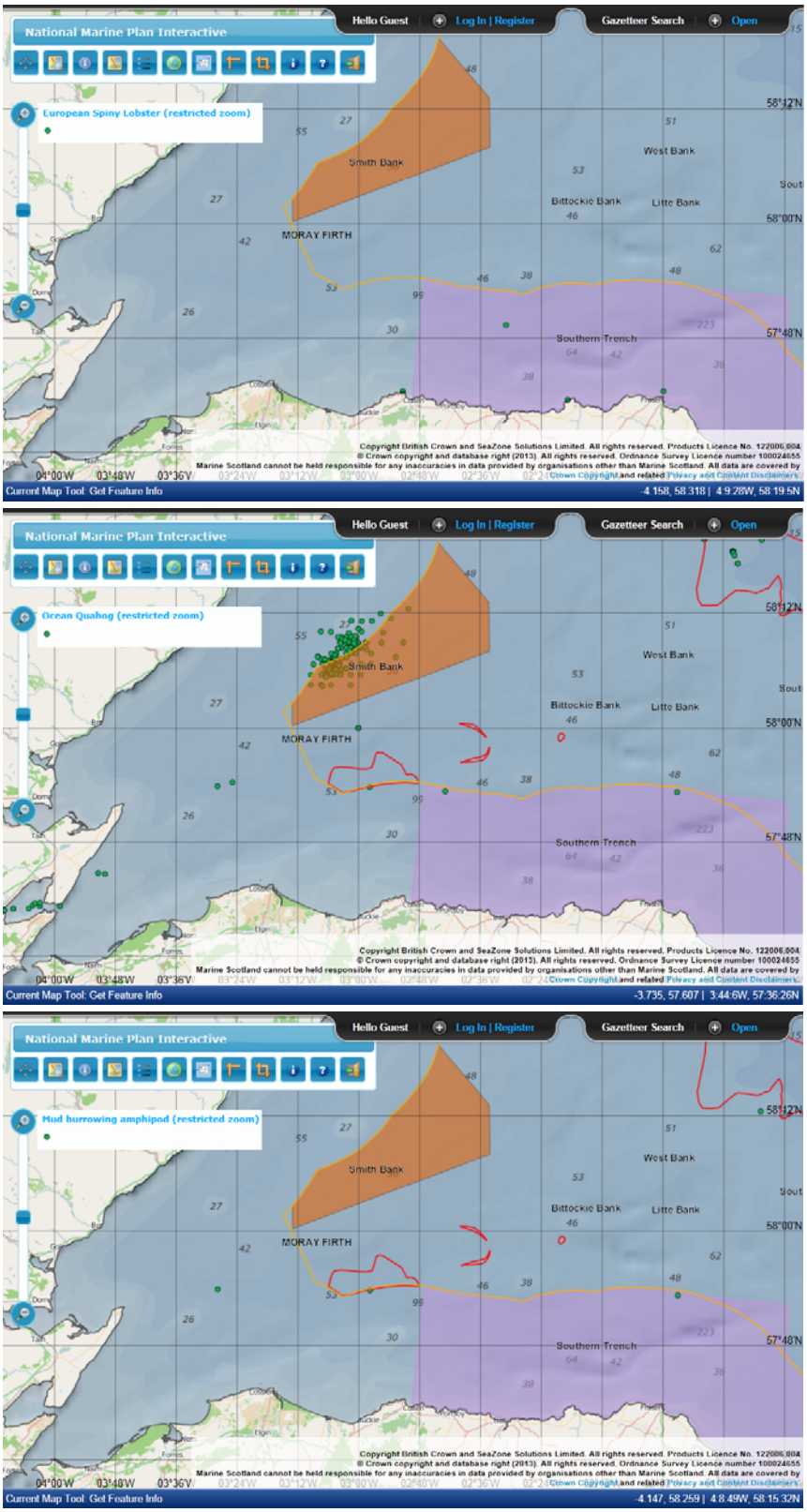


Figure 1.3: Distribution maps of PMF species (area in pink is an MPA 'Search location'; area in orange is the R3 zone; area outlined in red is 'offshore deep sea muds'; snapshots taken from Marine Scotland's interactive National Marine Plan).

2 Method

2.1 Survey Design

2.1.1. Following receipt of advice from Marine Scotland a seabed video survey of the entire proposed cable route was undertaken with samples of seabed sediment taken at selected points for PSD analysis and sediment chemistry. Survey specifications, sample analyses and data analyses were agreed with Marine Scotland prior to mobilisation to ensure statutory requirements were addressed (Fugro EMU, 2014). Table 2.1 summarises the sampling effort. The vessel track and sampling array is presented in Figure 2.1 (Chart Appendix).

Table 2.1: Summary of sample stations.

Sampling techniques	No. stations	Purpose	Representative photograph of kit
Seabed digital video and stills photography	n/a	Collection of seabed images to inform habitat and epifaunal community assessment.	
0.1 m^2 Day Grab sampling	10	Collection of seabed sediment samples for sediment chemistry analysis and associated PSD.	

2.1.2. The survey was conducted over ten days (16th - 26th of May, 2014). All survey work was undertaken on board the survey vessel MV Ocean Dawn. Summary survey logs are provided in Appendix I.

Sample positioning for each of the grabs and seabed video samples was achieved using Fugro EMU's Hemisphere Crescent V100 DGPS which has a stated horizontal accuracy of <0.6 m (95% confidence). Navigation and position recording was achieved using Trimble's HYDROPro software version 2.30.844.

2.1.3. Observer records were collated throughout each video deployment including substrate type and conspicuous epifauna together with any observations of burrows and tubes, (i.e. *Nephrops* burrows).

2.1.4. Upon return from the field, the seabed digital video footage was fully reviewed on Fugro EMU's office video editing suite to identify and describe the characterising habitat types and associated epifauna.

2.1.5. The subtidal benthic ecology survey was conducted following the Cefas Guidelines described in Ware & Kenny (2011). Methods also followed those applied at the three consented wind farms and at Beatrice to ensure data compatibility across the Moray developments and to permit a consistent EIA and cumulative effects assessment (MORL, 2012, BOWL, 2012).

2.1.6. The survey array was designed to provide adequate coverage of the predicted direct and indirect effects of the installation, operation and decommissioning of the export cables and representing the main characterising habitats present as determined from the following data sources:

- Admiralty chart data;
- Desk review/gap analysis (drawing upon scoping report); and
- Consultation with Marine Scotland Science and Scottish Natural Heritage (SNH).

2.1.7. The subtidal survey included the following techniques;

- seabed imagery via drop down video for habitat assessment; and
- single 0.1m^2 Day sample at selected sample locations for PSD and sediment chemical analyses.

2.1.8. Geophysical data was not available to inform the subtidal benthic ecology survey. The subtidal ecology survey was therefore a continuous seabed digital video tow, with collection of photographic stills, along the centre line of the proposed cable corridor. In this way the presence, status and distribution of epibenthic species, biotopes and potential sensitive receptors, such as PMF or Annex I features, was recorded throughout the entire length of the proposed subtidal portion of the export cable corridor up to an inshore point where the bathymetry allowed safe vessel access (typically around the 5 m contour). Photographs were collected to represent each habitat, community and feature type.

2.1.9. In the event that the subsequent geophysical data identifies a seabed feature not covered by the video survey, then a pre-construction video survey shall be undertaken to ground-truth the feature and inform any micro-siting, as necessary.

2.2 Seabed video and photographic stills

2.2.1. All video footage and photographic stills were geo-referenced and used to assign epibenthic biotopes based on the habitat and species present.

2.2.2. Species were identified and semi-quantified using the SACFOR abundance scale from both the video footage and selected representative photographic stills (Table 2.2). Substrate composition was recorded based upon principal sediment characteristic (i.e. rippled fine sand, coarse sand etc). Epibenthic biotope classification was then conducted using the JNCC Marine Habitat Classifications for Britain and Ireland (Connor *et al*., 2004) based on those communities present. Classified epibenthic biotopes, were mapped throughout the export cable corridor. The extents of the boundaries will be interpolated using acoustic data drawn from the geophysical surveys, once available. Any sensitive features, such as PMF or Annex I habitats will be recorded and shown on the biotope map.

Table 2.2: SACFOR abundance scales (Source Hiscock, 1996).

Growth Form			Size of individuals/colonies				Density
%cover	Crust/Meadow	Massive/Turf	<1cm	1-3cm	3-15cm	>15cm	
>80%	S		S				>1/0.001 m^2
40-79%	A	S	A	S			1-9/0.001 m^2
20-39%	C	A	C	A	S		1-9/0.01 m^2
10-19%	F	C	F	C	A	S	1-9/0.1 m^2
5-9%	O	F	O	F	C	A	1-9/ m^2
1-5% or density	R	O	R	O	F	C	1-9/10 m^2
<1% density	R	R		R	O	F	1-9/100 m^2
					R	O	1-9/1000 m^2
						R	<1/1000 m^2

Key: S = Superabundant, A = Abundant, C = Common, F = Frequent, O = Occasional, R = Rare, P = present (used when the abundance of an organism could not be estimated accurately).

2.3 Sediment Grab Sampling

2.3.1. At all 10 stations, a 0.1m^2 Day grab with stainless steel buckets was successfully deployed to obtain sediment samples for laboratory chemistry and PSD analyses (see Figure 2.1 – Chart Appendix). Prior to deployment at each station the metal sample bucket of the grab was cleaned with pentane to prevent cross contamination between samples.

2.3.2. Upon retrieval of each sample on board the vessel a sub-sample of between 200-500 g was collected for PSD analysis. In addition, the top few centimetres of sediment was also sub-sampled and carefully placed in pre-treated labelled sample jars depending upon the chemical analysis required and stored frozen prior to laboratory testing for the following parameters:

- Metals - Arsenic (As) , Cadmium (Cd), Chromium (Cr), Copper (Cu), Mercury (Hg), Nickel (Ni), Lead (Pb), Tin (Sn), Zinc (Zn);
- Organotins (Dibutyl Tin, Dioctyl Tin, Diphenyl Tin, Tetrabutyl Tin, Tributyl Tin, Triphenyl Tin)
- Total petroleum hydrocarbons;
- Polycyclic aromatic hydrocarbons (PAHs) – (16 US EPA Priority Pollutants); and
- Polychlorinated biphenyls (PCBs), ICES 7 congeners (PCB 28, 52, 101, 118, 138, 153, 180).

2.4 Laboratory methods

Particle Size Distribution (PSD) Analysis

2.4.1. PSD analysis was undertaken at Fugro EMU's sediment laboratory using in house methods based on BS1377: Parts 1 – 3: 1990 (dry sieving) and BS13320: 2009 (laser diffraction). The latter method was used to analyse the <63 µm sediment fraction.

2.4.2. Representative sub-samples of each sediment sample were oven dried to constant weight at 105 ±5°C before routinely wet sieving to remove silt and clay-sized particles of <63 µm. The remaining coarser material was again oven dried to constant weight at 105 ±5°C followed by dry sieving through a series of mesh apertures corresponding to 0.5 Phi units as described by the Wentworth scale. The <63 µm sediment fraction was routinely subjected to further analysis via laser diffraction at 0.5 Phi intervals to determine the proportion and distribution of the silt/clay components. The weight of the sediment fraction retained on each mesh was subsequently measured and recorded and merged with the laser diffraction data.

Sediment Chemistry analyses

2.4.3. Samples taken for sediment chemistry analyses were sub-contracted to an experienced UKAS accredited chemistry laboratory. Results were compared to Cefas Action Levels (AL), OSPAR Coordinated Environmental Monitoring Programme (CEMP) criteria as laid out by the UK Clean Seas Environmental Monitoring Programme (CSEMP) and Canadian guideline values to aid assessment of the possible ecological significance of the levels of contaminants found.

2.4.4. Cefas (2003) guidelines are represented by a set of non-regulatory Action Levels which form part of a wider body of evidence for assessment of disposal of dredged materials to sea. Marine Scotland requires, in general, concentrations of contaminants below Revised Cefas Action Level 1 as these are considered of little concern with respect to possible effects on the marine environment. Concentrations above Revised Action Level 2 however suggest that the material is unsuitable for disposal at sea. Values between Levels 1 and 2 may prompt further investigatory work prior to disposal of the material to sea.

2.4.5. Canadian guidelines (CCME 2001) are presented in the form of Interim Sediment Quality Guidelines (ISQGs), principally Threshold Effects Levels (TEL) and Probable Effect Levels (PEL). Generally, concentrations below the TEL are considered the minimal effect range within which adverse effects rarely occur. Above the PEL is the range within which adverse effects frequently occur while between the TEL and PEL is the possible effect range within which adverse effects occasionally occur.

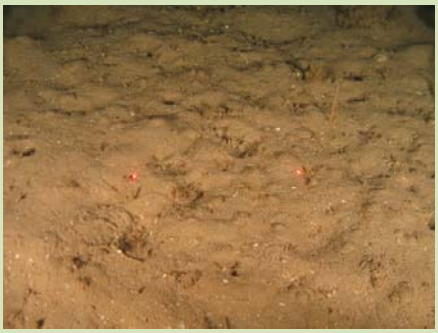
3 Results

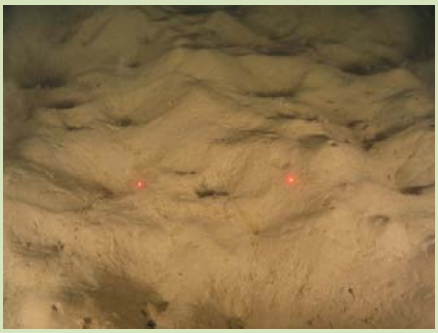
3.1 Biological conditions

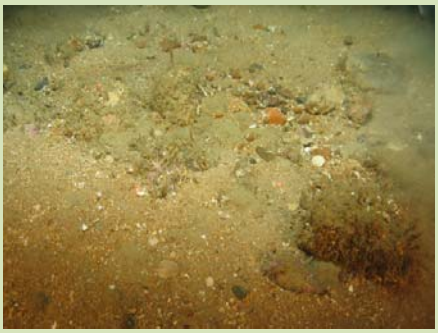
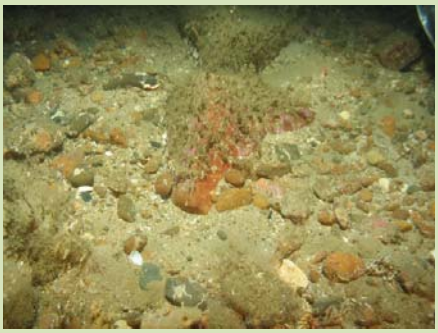
3.1.1. Full results of the image analysis including sediment habitat types, conspicuous epifauna and associated biotope classifications for the video survey are presented in Appendix 3. The Appendix comprises two parts; (1) an initial spreadsheet showing SACFOR species abundance data and sediment data and (2) biotope descriptions drawing upon the initial spreadsheet information. Summary seabed habitat, species and biotope information is presented in Table 3.1 (the order roughly equates to traversing the proposed cable route from the offshore to the nearshore environment).

Table 3.1: Summary of habitat, species and biotope information from video and static image data.

Sediment habitat type and biotope classification	Characteristic epibenthic species	Areas recorded	Representative seabed image
Slightly shelly, slightly muddy sand. Small areas of dense coarse shelly sand forming small patches of coarse sand waves with coarse shell aggregations in the recesses. **Sublittoral sand SS.SSA** Not enough mud evident to allocate a muddy sand biotope (SS.SSA.CMuSa)	?*Pleuronectes platessa* *Alcyonidium diaphanum* *Alcyonium digitatum* *Asterias rubens* Asteroidea Callionymidae *Chaetopterus* tubes Decapoda Diatomaceous aggregation *Flustra foliacea* Gadiformes Hydroid/Bryozoan mixed substrate Inachinae *Luidia ciliaris* *Microchirus variegatus* Paguridae *Pecten maximus* PLEURONECTIFORMES Triglidae	Offshore area. At the start of the proposed cable route. See Figure 3.1 (Chart Appendix)	
Slightly shelly, slightly muddy rippled sand. Coarse shelly sand waves occur across the area, with coarse mixed sediment of gravel pebbles and cobbles within the recesses. Regular outcrops of larger areas of coarse mixed sediment **Sublittoral sand SS.SSa with Circalittoral mixed sediment SS.SMx.CMx**	?*Pleuronectes platessa* ?*Thuiaria thuja* *Alcyonium digitatum* Ammodytidae *Aphrodita aculeata* *Asterias rubens* ASTEROIDEA *Astropecten irregularis* *Buccinum undatum* Callionymidae *Cancer pagurus* CARIDEA *Chaetopterus* tubes *Crossaster papposus* Diatomaceous aggregation *Tubularia indivisa* *Echinus esculentus* *Flustra foliacea* Gadiformes *Hydrallmania falcata* Hydroid/Bryozoan mixed substrate *Liocarcinus spp.* *Luidia sarsi*	Offshore area. Two sections in the northern area towards the start of the proposed cable route See Figure 3.1 (Chart Appendix)	

Sediment habitat type and biotope classification	Characteristic epibenthic species	Areas recorded	Representative seabed image
	Metridium senile *Microchirus variegatus* *Ophiura ophiura* Paguridae *Pecten maximus* PLEURONECTIFORMES Plumulariidae *Securiflustra securifrons* *Spirobranchus* sp. Triglidae *Trisopterus lamarkii*		
Slightly shelly, slightly muddy rippled sand. Small holes and small burrows evident across the area. Larger fractions of shell hash visible in places. **Seapens and burrowing megafauna in circalittoral fine mud SS.SMu.CFiMu.SpnMeg** Coarse variant with *Virgularia mirabilis* dominant.	*Alcyonium digitatum* *Asterias rubens* *Astropecten irregularis* Callionymidae *Chaetopterus* tubes Diatomaceous aggregation Echinoidea *Henricia* sp. Hydroid/Bryozoan mixed substrate *Ophiura ophiura* Paguridae *Pecten maximus* *Pennatula phosphorea* PLEURONECTIFORMES Triglidae *Virgularia mirabilis*	Offshore. See Figure 3.1 (Chart Appendix)	
Area dominated by coarse mixed sediment forming small to approx. 0.5m high coarse gravelly shelly sand waves in places. Large shell hash and gravelly pebbles deposited within the recesses with the occasional cobble. One small boulder seen. Area interspersed with slightly shelly, slightly muddy rippled sand. **Sublittoral sand and muddy sands SS.SSa, with circalittoral mixed sediments SS.SMx.CMx**	*?Abietinaria abietina* *?Thuiaria thuja* *Asterias rubens* *Atelecyclus rotundatus* Bryozoa crust Callionymidae Diatomaceous aggregation *Flustra foliacea* Gadiformes Hydroid/Bryozoan mixed substrate *Luidia ciliaris* *Munida rugosa* *Ophiura ophiura* Paguridae *Pecten maximus* PLEURONECTIFORMES *Sertularia* sp. *Spirobranchus* sp? *Trisopterus lamarkii* *Urticina* sp.	Offshore. See Figure 3.1 (Chart Appendix)	
Area dominated by coarse mixed sediment forming small to approx. 0.5m high coarse gravelly shelly sand waves in places. Large shell hash and gravelly pebbles deposited within the recesses with the occasional cobble. **Circalittoral mixed sediments SS.SMx.CMx**	*Agonus cataphractus* *Alcyonium digitatum* Buccinidae Callionymidae *Flustra foliacea* Hydroid/Bryozoan mixed substrate *Luidia sarsi* *Munida rugosa* *Ophiura ophiura* Paguridae *Pecten maximus* *Sertularia* spp.	Offshore. See Figure 3.1 (Chart Appendix)	

Sediment habitat type and biotope classification	Characteristic epibenthic species	Areas recorded	Representative seabed image
Sandy mud/muddy sand with burrows, mounds and holes. Area of dense bioturbation. **Seapens and burrowing megafauna in circalittoral fine mud SS.SMu.CFiMu.SpnMeg**	?*Echinocardium cordatum* *Anguilla anguilla/Myxine glutinosa* *Anseropoda placenta* *Asterias rubens* ASTEROIDEA Asteroidea (?*Leptasterias muelleri*) *Astropecten irregularis* Callionymidae *Cancer pagurus* *Chaetopterus* tubes Gadiformes Gobiidae *Henricia* Hydroid/Bryozoan mixed substrate *Liocarcinus* *Lumpenus lampretaeformis* *M.merlangus* or *T.minutus* Majoidea *Nephrops norvegicus* *Ophiura ophiura* Paguridae *Pennatula phosphorea* PLEURONECTIFORMES Triglidae *Tubularia indivisa* *Virgularia mirabilis*	Offshore. Note that in the more southerly areas, the burrowed mud had the occasional hydroid cluster and outcrop of *Tubularia*. The fish that are noted were more prevalent to the north. See Figure 3.1 (Chart Appendix)	
Low lying, relatively even sandy mud/muddy sand and large sections of coarse mixed sediment with boulders and cobbles. **Circalittoral mixed sediments. SS.SMx.CMx** (within areas of SS.SMu.CFiMu.SpnMeg)	*Cancer pagurus* *Ceramaster/Hippasteria* *Echinus esculentus* *Hydrallmania falcata* Hydroid/Bryozoan mixed substrate *Munida rugosa* *Nemertesia ramosa* *Pecten maximus* *Sertularia* *Spirobranchus* *Tubularia indivisa*	Offshore. See Figure 3.1 (Chart Appendix)	
Low lying, relatively even sandy mud/muddy sand with small burrows, small mounds and holes. Within this area, large sections of coarse mixed sediment with boulders and cobbles. **Circalittoral mixed sediments SS.SMx.CMx, within Seapens and burrowing megafauna in circalittoral fine mud SS.SMu.CFiMu.SpnMeg**	*Tubularia indivisa* *Hydrallmania falcata* *Sertularia* *Nemertesia ramosa* Hydroid/Bryozoan mixed substrate *Spirobranchus* *Munida rugosa* *Cancer pagurus* *Pecten maximus* *Ceramaster/Hippasteria* *Echinus esculentus*	Offshore. See Figure 3.1 (Chart Appendix)	

Sediment habitat type and biotope classification	Characteristic epibenthic species	Areas recorded	Representative seabed image
Area of hard ground, potentially bedrock in places. Area over-laid with a very coarse mixture of shelly silty sandy, gravelly pebbly cobble matrix with the occasional boulder. A thin covering of mobile sand of varying depths evident over the hard ground. **Circalittoral mixed sediments SS.SMx.CMx.**	*Alcyonium digitatum* *Asterias rubens* ASTEROIDEA Bryozoa crust *Cancer pagurus* Corallinaceae *Echinus esculentus* *Flustra foliacea* Hydroid/Bryozoan mixed substrate *Liocarcinus* *Metridium senile* *Munida rugosa* Paguridae *Pecten maximus* Plumulariidae *Sabella* tube *Spirobranchus* *Tubularia indivisa* *Urticina*	Offshore. See Figure 3.1 (Chart Appendix)	
Area of what appears to be hard ground in places, over-laid with a very coarse mixture of shelly sandy, gravelly pebbly cobble matrix with a few boulders in places coupled with extensive patches of rippled sand. **Circalittoral mixed sediments SS.SMx.CMx with Sublittoral sand and muddy sands SS.SSA**	?*Omalosecosa ramulosa* *Agonus cataphractus* *Alcyonium digitatum* Ammodytidae Bryozoa crust Callionymidae *Cancer pagurus* *Chaetopterus* tubes *Crossaster papposus* *Echinus esculentus* *Flustra foliacea* Gobiidae Henricia Hydroid/Bryozoan mixed substrate *Lanice conchilega* *Liocarcinus* *Metridium senile* *Munida rugosa* Paguridae *Pecten maximus* PLEURONECTIFORMES Plumulariidae *Porania pulvillus* PORIFERA *Spirobranchus* Triglidae *Trisopterus esmarkii* Tubes in Sediment (Oweniidae) *Tubularia indivisa* *Urticina*	Offshore. See Figure 3.1 (Chart Appendix)	 

Sediment habitat type and biotope classification	Characteristic epibenthic species	Areas recorded	Representative seabed image
Inshore area of rippled sand with a few holes and a biofilm (?diatom) evident across the area which transitions to bedrock and boulder reef with algae further inshore. Sublittoral sand and muddy sands SS.SSA Faunal and algal crusts with Pomatoceros triqueter and sparse Alcyonium digitatum on exposed to moderately wave-exposed circalittoral rock CR.MCR.EcCr.FaAlCr.Pom (sheltered inshore variant) Bedrock and boulder reef CR.MCR.EcCr.FaAlCr.Pom Faunal and algal crusts with Pomatoceros triqueter and sparse Alcyonium digitatum on exposed to moderately wave-exposed circalittoral rock	**Sand** ASTEROIDEA PLEURONECTIFORMES Biofilm **Reef** ?*Abietinaria abietina* Hydroid/Bryozoan mixed substrate *Alcyonium digitatum* *Urticina* *Metridium senile* *Spirobranchus* *Munida rugosa* *Cancer pagurus* *Gibbula* Bryozoa crust ASTEROIDEA *Marthasterias glacialis* *Crossaster papposus* *Echinus esculentus* Labridae Corallinaceae Encrusting Brown Algae	Inshore area. See Figure 3.1 (Chart Appendix)	
Coarse rippled sand becoming finer inshore with a few holes. Sublittoral sand and muddy sands.SS.SSA (Section 3)	DECAPODA (?*Liocarcinus*) Paguridae *Cancer pagurus* *Astropecten irregularis* ASTEROIDEA *Lophius piscatorius* Ammodytidae Gadiformes Gobiidae PLEURONECTIFORMES	Inshore area. See Figure 3.1 (Chart Appendix)	

3.1.2. A total of four biotopes were classified along the modified offshore export cable route corridor occurring both singly and as twinned mosaics in some instances. The biotopes encountered included one EUNIS Level 3 Main habitat (SS.SSA), one Level 4 Biotope complex (SS.SMx.CMx), one Level 5 Biotope (SpnMeg) and one Level 6 Sub-biotope (FaAlCr.Pom). The 'Seapens and burrowing megafauna in circalittoral fine mud', SS.SMu.CFiMu.SpnMeg, dominated across the area and occurred in two variant forms. In the inshore area where the rock biotope CR.MCR.EcCr.FaAlCr.Pom was encountered it was also found in two forms.

3.1.3. Other Level 5 sediment biotopes will have been present in the area would require grab sampling in order to discriminate them with any confidence. One Level 5 biotope that was indicated to a degree was '*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment', SS.SMx.CMx.FluHyd (Appendix 3). However, in the corridor surveyed the evidence for it was weak at best and therefore, while it was noted it was not considered definitive enough to be included in the habitat list.

3.1.4. Figure 3.1 (Chart Appendix) shows the distribution of the classified biotopes (biotope map). Once the side scan sonar data from the geophysical survey becomes available this figure will also indicate the interpolated extent of the biotopes within the corridor.

3.1.5. The biotope map (Figure 3.1 – Chart Appendix) shows that the offshore benthic environment was dominated by sand and muddy sand (SSA), fine mud (SS.SMu.CFiMu) and mixed sediment (SS.SMx.CMx) biotopes. Typical epifauna noted from the seabed video for the offshore SSA habitats were large Pagurid crabs and an array of fish including gurnards, thick backed sole, flat fish, (often plaice) and gadiform fish, largely unidentifiable due to quality of image. A few King scallop (*Pecten maximus*) were seen and small numbers of starfish (common starfish (*Asterias rubens*), Seven-armed starfish (*Luidia ciliaris*)). The hydroid/bryozoan mixed turf and very small occurrences of hornwrack *Flustra foliacea*, were rarely seen, found on small amounts of slightly coarser sediment. Across the area, a gelatinous, filamentous substance was observed, believed to be a diatomaceous floc.

3.1.6. This area of sand and muddy sand was followed in the offshore area by a region where SSA occurred with SS.SMx.CMx. The fauna on the sediment here largely comprised Pagurid crabs, a few small crabs (notably *Liocarcinus*) and a selection of flat fish including plaice and thick backed sole. A variety of starfish were distributed across the area including the sand star (*Astropecten irregularis*), the sun star (*Crossaster papposus*), *Luidia sarsi* and common starfish (*A. rubens*). The foliose hydroid/bryozoan turf including *Hydrallmania* and *Flustra* were largely concentrated on the areas of coarse mixed sediment. A rare occurrence of *Metridium senile* was seen on a large cobble. *Pecten maximus* were more notable across both the sandy and coarser sediments of the site.

3.1.7. When first encountered the sea pen and burrowing megafauna community SS.SMu.CFiMu.SpnMeg occurred in the form of a coarse sediment variation of this biotope. SpnMeg was clearly indicated but the sedimentary conditions excluded the classical representation associated with *Nephrops* grounds. The main fauna noted were flat fish, gurnards, a few starfish and pagurid crabs. Hydroid/bryozoan turf of largely indefinable composition was scattered throughout. King scallop occurred sporadically. The diatomaceous floc was again present across the area. Of particular note was the abundance of the slender sea pen *Virgularia mirabilis* which was very evident and occurred frequently whilst only one phosphorescent sea pen *Pennatula phosphorea* was noted.

3.1.8. The sea pen habitat was followed by another mosaic of SSA and SS.SMx.CMx. Here the main fauna noted were hydroid/bryozoan turf, including hornwrack (*F. foliacea*), *Sertularia*, *Abietinaria* and potentially, the bottle-brush hydroid (*Thuiaria thuja*). Flat fish, a few starfish and pagurid crabs were evident, along with the round crab (*Atelecyclus rotundatus*). The rugose squat lobster (*Munida rugosa*) was occasionally seen in the coarse sediment. King scallop was noted as occurring in higher densities here occurring relatively regularly throughout.

3.1.9. The SSa/CMx area gave way to an area of solely SS.SMx.CMx comprising coarse gravelly shelly sand waves in places. The main fauna noted were foliose hydroid/bryozoan turf, including *Flustra*, and *Sertularia*. A few starfish and pagurid crabs were evident, along with *M. rugosa* which was occasionally seen in the coarse sediment. King scallop occurred only rarely.

3.2.0. The typical SS.SMu.CFiMu.SpnMeg occurred extensively in the offshore area. Burrowing megafauna were clearly evident, including the phosphorescent sea pen and in some areas, slender sea pen (*Virgularia mirabilis*). Norway lobster (*Nephrops norvegicus*) was sporadically seen. Flat fish were present and a few starfish including goose foot starfish (*Anseropoda placenta*). Pagurid crabs and the occasional decapod (possibly *Liocarcinus*), were in evidence. Gurnards and a few small gadoid fish were also present. Additionally, the edible crab (*Cancer pagurus*) was observed.

3.2.1. A more low-lying form of the SpnMeg biotope was also seen here. In these areas there was a relatively even sandy mud/muddy sand substrate with small burrows and small mounds and holes. Bioturbation was therefore evident but not as deep or dense as those areas more suited to Norway lobster. Occasional small boulders and areas of coarser sediment, with a few cobbles, and mixed pebbles and large shell hash occurred in places. Burrowing megafauna were evident, including the phosphorescent sea pen. Flat fish and a few starfish were also seen, as well as a few large King scallop. The coarser substrate had more dense aggregations of hydroid/bryozoan turf and a very small amount of oaten pipes hydroid *Tubularia indivisa*. Boulders with the plumose anemone *Metridium senile* were present. Sediment with small polychaete tubes forming a 'mat' in places were believed to be a species in the family Oweniidae. Of particular note in this region was the rare occurrence of what is thought to be the burrowing sea anemone *Arachnanthus sarsi*, a PMF in Scotland (Plate 1). Unfortunately, the quality of the image is such that a degree of caution is necessary with respect to the identification which has been recorded as ?*Arachnanthus sarsi*. No previous records of the species on the east coast of mainland Scotland could be found. The site where it was observed was roughly 400 m from a grab sampling station (KPA 30). The sediment at this location had a Folk class of slightly gravelly muddy sand and the highest recorded percentage of mud for any of the ten stations sampled at 43.14%.

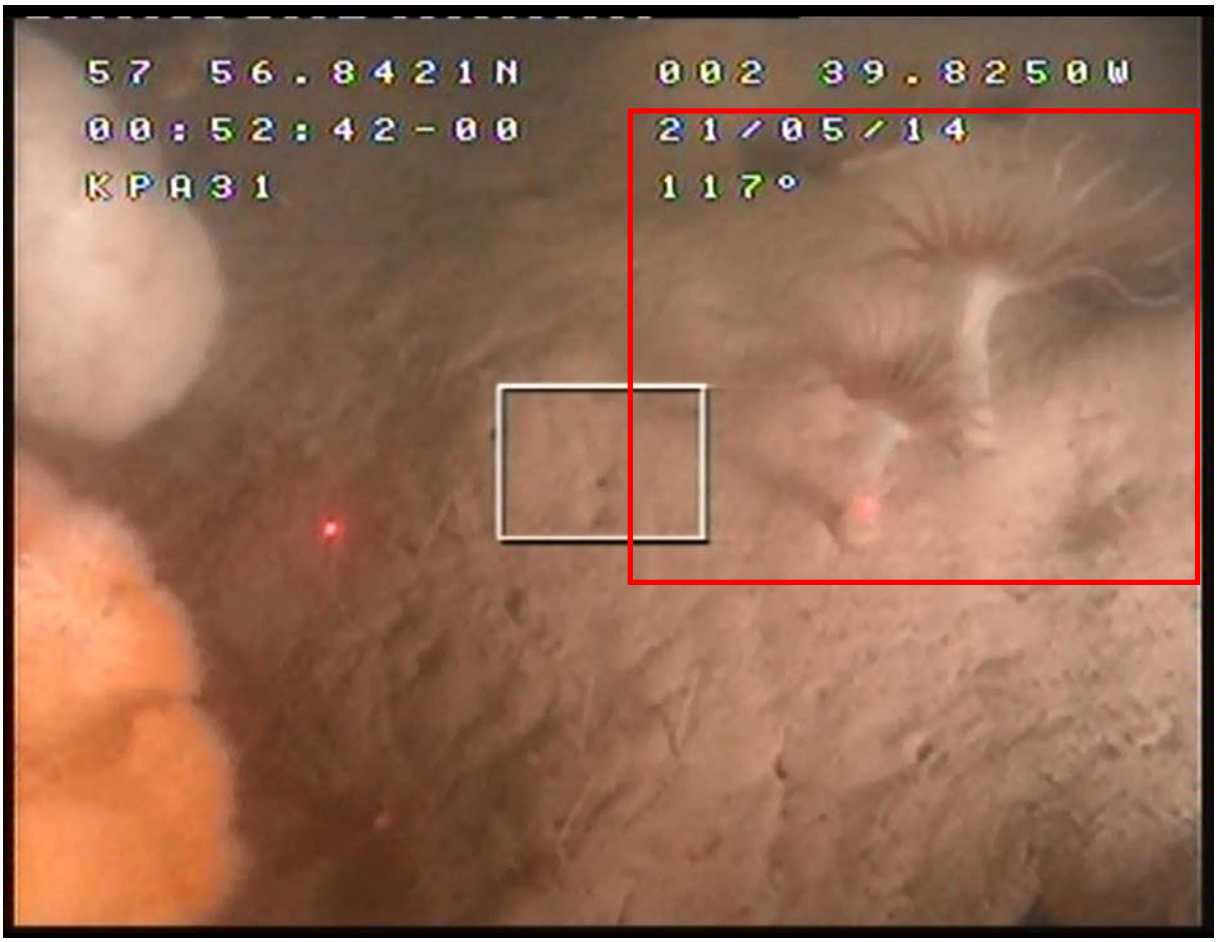


Plate 1 ?*Arachnanthus sarsi (red box)*

3.2.2. Areas of CMx sometimes occurred within SpnMeg habitat. Within this area, large sections of coarse mixed sediment with boulders and cobbles was seen. Burrowing megafauna was still evident in the areas of softer sediment but the bioturbation was not as deep or dense as areas more suited to *Nephrops*. These coarser sections were dominated by hydroid/bryozoan turf, small amounts of oaten pipes hydroid *T. indivisa* and, a notable amount of the rugose squat lobster under the boulders and cobbles. Occasional edible sea urchin (*Echinus esculentus*) and a few King scallop were seen as was one edible crab.

3.2.3. Once the SpnMeg was no longer present the CMx habitat with a reduced amount of mud in evidence, had a fauna largely comprised of coralline algae and bryozoan crusts with sparse outcrops of foliose hydroid/bryozoan turf including hornwrack *Flustra foliacea* and Plumulariidae, with rare oaten pipes hydroid *T. indivisa*. Very small outcrops of dead man's fingers (*Alcyonium digitatum*) were present and rare edible sea urchin. Rugose squat lobster were present under many of the boulders and cobbles, with small crabs such as *Liocarcinus* also evident. Occasionally a large edible crab was seen and a very occasional King scallop. Small starfish were scattered across the area. Discarded fishing rope debris was also present.

3.2.4. The area of CMx gave way to a mixed region of CMx and SSa. In this area what appeared to be hard ground in places was over-laid with a very coarse mixture of shelly sandy, gravelly pebbly cobble matrix with a few boulders in places. Mobile sand of varying depths provided a thin covering over the hard ground and in places, extensive patches of rippled sand occurred, before returning to coarse mixed sediment. Where this occurred further offshore the sand became coarser and thicker in nature, forming coarse sand waves with large shell debris within the recesses. The coarse ground had sparse hydroid/bryozoan turf with a few starfish, small amounts of the soft coral *A. digitatum*, rare oaten pipes hydroid and *Urticina* anemones. Boulders were particularly covered in dense hydroid/bryozoan turf, with large clusters of hornwrack. Rugose squat lobster were regularly seen across the area under the coarser sediment. King scallop were often seen as well as the occasional edible crab. In some sand patches tubes of the sand mason worm (*Lanice conchilega*) became evident, mixed with smaller tubes believed to be of the family Oweniidae. In the deeper coarser sand waves, sand eels were present.

3.2.5. In the CMx/SSA habitat small colonies of serpulid worms thought to be either *Salmacina dysteri* or *Filograna implexa* were noted (Plate 2). Video data were not sufficient to confirm species identity in this instance. It may be that the species is in fact *S. dysteri* but it would require sampling and closer taxonomical analysis to confirm this identity. These clusters were only present within a short area of the transect suggesting a sparse distribution.

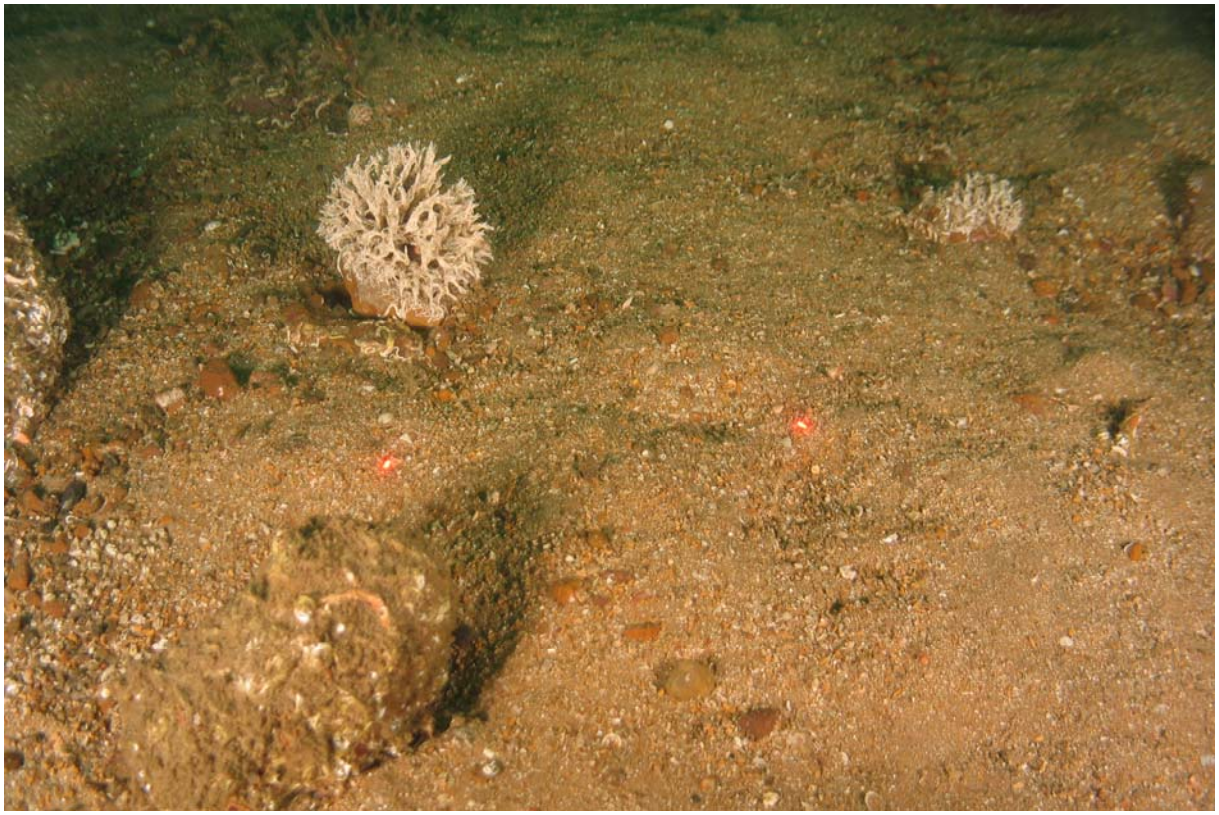


Plate 2 Serpulid colonies (note stills image taken from a transect to the west of the video track reported here but in similar habitat and used because of the clarity of the image).

3.2.6. Across the inshore area rippled sand, with a few holes, was encountered with a thin biofilm in evidence across the area. Only a few flat fish were evident here. This area of inshore sand, gradually gave way to a bedrock and boulder reef. Small outcrops of rock with the brown alga *Saccharina latissima* and long foliose red and brown algal fronds were seen. Where the reef became more established, only foliose red algal fronds remained (i.e. ?*Delesseria sanguinea*, sea beech), before the algal cover disappeared completely. The area then became a bedrock, boulder and cobble reef, undulating and rising to around 1-2.0m approx. in height at its greatest point. A cobble, pebble and gravelly sand matrix was evident within the recesses in places. There were small areas where a thin film of sediment was evident on the hard rock surfaces.

3.2.7. The bedrock and boulder reef was densely covered by a crust of what is believed to be a brown alga, with coralline algae and bryozoan crusts also strongly present. *Spirobranchus* worm tubes were clearly visible. The edible urchin *E. esculentus* was very common across the area, along with a frequent presence of the soft coral *A. digitatum*. Small starfish recorded as Asteroidea but probably the common starfish *A. rubens* were often seen. Sun star were very frequent here and the edible crab was noted as occasional.

3.2.8. The area of reef gave way to coarse rippled sand which gradually became finer closer inshore with a few holes. A few starfish are scattered across the area along with large pagurid crabs, flat fish and gadoid fish in places. One monkfish *Lophius piscatorius* was seen. In the coarser sand, sand eel were more apparent.

3.2 Features of conservation interest

3.2.1. The extensive presence of the biotope SS.SMu.CFiMu.SpnMeg Seapens and burrowing megafauna in circalittoral fine mud along the proposed cable corridor indicated the presence of the PMF burrowed mud across the area survey. This habitat is also captured by the Scottish biodiversity list (under Scotlands Biodiversity strategy) as ‘Mud habitats in deep water’.

3.2.2. In the inshore area the rock biotope CR.MCR.EcCr.FaAlCr.Pom Faunal and algal crusts with *Pomatoceros triqueter* and sparse *Alcyonium digitatum* on exposed to moderately wave-exposed circalittoral rock was encountered and is illustrative of the Annex I (Habitats Directive) Reef. This was found over a distance of approximately 1.1 km.

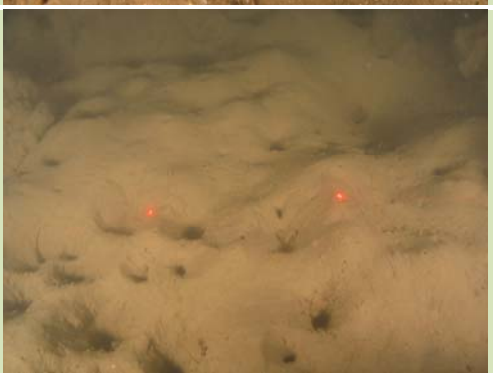
3.2.3. The presence of what appears to be the burrowing anemone *Arachnanthus sarsi* was also noted. This species is on the Scottish biodiversity list and has been recommended as a PMF.

3.2.4. The deep water coral *Lophelia pertusa*, which has previously been recorded to the east in the area of the Moray Firth called the Southern Trench (Hall-Spencer & Stehfest, 2009), was not observed at any point from the video survey of the proposed cable route.

3.3 Sediment type (PSD)

3.3.1. Full results of the particle size distribution analyses of the grab samples are presented in Appendix IV and are summarised in Figure 3.3 (Chart Appendix). A total of five Folk sediment classifications (Folk, 1954) were identified following laboratory analysis as summarised in Table 3.3 below.

Table 3.3 Summary of the grab sample sediment analyses

Folk classification	Number of stations (n=10) Sediment description	Representative seabed photograph
Gravelly sand gS	1 station (KPA45) % gravel = 18.93 % sand = 79.26 % mud = 1.82 Poorly sorted	
Slightly gravelly sand (g)S	2 stations (KPA50, KPA58) Mean % gravel = 1.19 Mean % sand = 94.99 Mean % mud = 3.82 Moderately sorted	
Slightly gravelly muddy sand (g)mS	5 stations (KPB12, KPA37, KPA30, KPA21, KPA17) Mean % gravel = 0.04 Mean % sand = 72.75 Mean % mud = 27.21 Poorly sorted	

Folk classification	Number of stations (n=10) Sediment description	Representative seabed photograph
Muddy sand mS	1 station (KPA12) % gravel = 0 % sand = 76.91 % mud = 23.09 Poorly sorted	
Muddy sandy gravel msG	1 station (KPB7) % gravel = 56.62 % sand = 35.37 % mud = 8.02 Very poorly sorted	

3.3.2. The grab sample data are consistent with the expected distribution, as indicated by both the predicted habitats (Figure 1.2 – Chart Appendix) and the seabed video surveillance, with coarser sediments at the start and end of the proposed cable route and muddier sediments in the midsection. The dominant sediment fractions were very fine to medium grade sands (particles of diameter between 63-500 µm). With two exceptions the gravel component was considerably less than 2%. Station KPB7, closest to shore, had the largest percentage of gravel of any of the samples at 56.62%. Video evidence confirmed the coarser stonier nature of the inshore sediments. The sample from the offshore Station KPA45 had 18.93% gravel, though as the grab photo illustrates this was shell gravel (Appendix II).

3.3.3. Levels of mud particles (<63 µm diameter) ranged from 1.82% at station KPA45 in the offshore deep circalittoral coarse sediments to 43.14% at station KPA30 in the midsection of the proposed cable route. The five muddiest stations (slightly gravelly muddy sand) occurred consecutively over a distance of just over 25 km from the offshore area to within about 10 km of the coast (Table 3.4, Figure 3.3 – Chart Appendix). Video data showed that this, more silty sediment supported burrowing fauna as evidenced by the density of burrows and mounds. Two species of seapens, *Pennatula phosphorea* and *Virgularia mirabilis,* also typified the sediments in this area. These observations accord with historic findings of burrowed muddy seabed habitats with sea pens as illustrated in Figure 1.4 (Chart Appendix). The biotope classification **SS.SMu.CFiMu.SpnMeg** has been attributed to this sediment habitat (which describes sea pens and burrowing megafauna in circalittoral fine mud) and is clearly supported by the increased mud fraction found. It is a component biotope of the "burrowed mud" Scottish PMF and therefore represents a habitat of potential conservation importance in Scotland.

3.4 Sediment chemistry

3.4.1. Full results of the sediment chemistry analyses are presented in Appendix 5. A summary of the results are provided in Tables 3.4 to 3.6.

Table 3.4 Summary results of the sediment chemistry analyses for metals, organotins and total hydrocarbons

Determinand	Units	KPA58 (52.0m)	KPA50 (51.2m)	KPA45 (54.8m)	KPA37 (70.0m)	KPA30 (87.1m)	KPA21 (75.1m)	KPA17 (84.3m)	KPA12 (94.0m)	KPB12 (37.4m)	KPB7 (20.0m)
Mercury : Dry Wt	mg/kg	0.00352	0.00381	0.00538	0.0113	0.0134	0.0113	0.0165	0.0184	0.0235	<0.002
Aluminium, HF Digest : Dry Wt	mg/kg	16700	19200	6770	21400	29800	31000	13700	15600	37300	19600
Barium, HF Digest : Dry Wt	mg/kg	259	257	115	308	320	347	339	419	436	270
Arsenic, HF Digest : Dry Wt	mg/kg	5.46	3.2	***24.6***	4.07	4.9	4.75	4.91	5.94	***11.2***	4.87
Cadmium, HF Digest : Dry Wt	mg/kg	0.056	0.042	0.038	0.171	0.141	0.14	0.132	0.148	0.151	0.07
Chromium, HF Digest : Dry Wt	mg/kg	25	12.5	10.2	***67.1***	***70.7***	***53.6***	46.8	***58.8***	***52.7***	11.4
Copper, HF Digest : Dry Wt	mg/kg	3.51	2.52	2.05	6.36	6.01	6.28	6.67	7.4	10.6	2.04
Lead, HF Digest : Dry Wt	mg/kg	9.62	7.89	8.86	9.04	9.99	10.1	10.8	12.2	17.3	6.65
Nickel, HF Digest : Dry Wt	mg/kg	4.19	3.7	3.64	14.6	15.6	14.7	15.5	17.2	19.7	3.3
Tin, HF Digest : Dry Wt	mg/kg	0.806	0.553	<0.5	1.2	1.25	1.28	1.24	1.38	1.93	0.74
Zinc : HF Digest : Dry Wt	mg/kg	10.2	8.4	10	26.5	28.7	28.5	31.3	33.4	48.2	13.6
Dibutyl Tin : Dry Wt as Cation	ug/kg	<4	<4	<4	<4	<5	<4	<4	<4	<4	<4
Dioctyl Tin : Dry Wt as Cation	ug/kg	<4	<4	<4	<4	<5	<4	<4	<4	<4	<4
Diphenyl Tin : Dry Wt as Cation	ug/kg	<3	<3	<2	<3	<3	<3	<3	<3	<3	<2
Tetrabutyl Tin : Dry Wt as Cation	ug/kg	<3	<3	<2	<3	<3	<3	<3	<3	<3	<2
Tributyl Tin : Dry Wt as Cation	ug/kg	<4	<4	<4	<4	<5	<4	<4	<4	<4	<4
Triphenyl Tin : Dry Wt as Cation	ug/kg	<3	<3	<2	<3	<3	<3	<3	<3	<3	<2
Hydrocarbons : Total : Dry Wt as Ekofisk	mg/kg	0.502	0.436	0.801	1.63	2.63	1.52	2.36	1.87	3.21	0.14

Below all guideline values
Above Cefas AL1 (below OSPAR)
Above Canadian TEL
LOD below guideline value

Metals

3.4.2. All results were below OSPAR, Cefas and Canadian action levels with the exception of Arsenic and Chromium (Appendix 5; Table 3.4).

3.4.3. The concentration of Arsenic was above the Cefas revised AL1 (20 mg/kg) and the Canadian TEL (7.24 mg/kg) in the sample taken from Site KPA45 (24.6 mg/kg) and above the Canadian TEL in the sample taken from Site KPB12 (11.2 mg/kg). However, all results for the concentration of Arsenic were below the OSPAR Background Assessment Concentration (BAC) of 25 mg/kg.

3.4.4. The concentration of Chromium was above the Cefas revised AL1 (50 mg/kg) and the Canadian TEL (52.3 mg/kg) in the samples taken from Sites KPA37 (67.1 mg/kg), KPA 30 (70.7 mg/kg), KPA21 (53.6 mg/kg), KPA12 (58.8 mg/kg) and KPB12 (52.7 mg/kg). However, all results for the concentration of Chromium were below the OSPAR Background Assessment Concentration (BAC) of 81 mg/kg.

Organotins

3.4.5. The Cefas AL1 for Tributyltin (TBT, DBT and MBT) is 100 µg/kg. The concentrations of organotins for all samples were below the limit of detection (LOD) available from the analyses. Marine Scotland requires a LOD of 10 µg/kg of TBT (Appendix 5; Table 3.4). The LOD achieved for TBT by the analytical laboratory used to assess the samples was <4 µg/kg.

3.4.6. OSPAR (2009) states that the, '*large majority of the* [TBT] *concentrations fall into assessment classes B and C, and would not be expected to affect the reproductive capability of sensitive gastropod species*'. Class C concentrations of TBT in sediments are in the range 2 µg/kg–<50 µg/kg and, therefore, the concentrations found from the proposed cable route samples are unlikely to present a problem in this respect.

Total Hydrocarbons

3.4.7. The concentration of hydrocarbons was low in all samples, ranging from 0.14 mg/kg at Site KPA7 to 2.63 mg/kg at Site KPA30, well below the revised Cefas AL1 of 100 mg/kg (Appendix 5; Table 3.4).

PAHs

3.4.7. PAH concentrations were low in samples from all sites with the majority below the LOD available from the analyses. All results were below the available guideline values (Appendix 5; Table 3.5).

PCBs

3.4.8. PCB concentrations were below the LOD available from the analyses in all cases. All results were below the available guideline values (Appendix 5; Table 3.6).

Table 3.5 Summary results of the sediment chemistry analyses for PAHs

Determinand	Units	KPA58 (52.0m)	KPA50 (51.2m)	KPA45 (54.8m)	KPA37 (70.0m)	KPA30 (87.1m)	KPA21 (75.1m)	KPA17 (84.3m)	KPA12 (94.0m)	KPB12 (37.4m)	KPB7 (20.0m)
Acenaphthene : Dry Wt	ug/kg	<2	<2	<2	<2	2.07	<2	<2	<2	2.34	<2
Acenaphthylene : Dry Wt	ug/kg	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Anthracene : Dry Wt	ug/kg	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Benzo(a)anthracene : Dry Wt	ug/kg	<2	<2	<2	<2	<2	<2	2.39	<2	<2	<2
Benzo(a)pyrene : Dry Wt	ug/kg	<2	<2	<2	2.24	3.3	2.13	3.93	2.74	2.16	<2
Benzo(b)fluoranthene : Dry Wt	ug/kg	<10	<10	<10	<10	<10	<10	10.5	<10	<10	<10
Benzo(e) pyrene : Dry Wt	ug/kg	<5	<5	<5	<5	6.72	<5	7.7	<5	<5	<5
Benzo(ghi)perylene : Dry Wt	ug/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Benzo(j)fluoranthene : Dry Wt	ug/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Benzo(k)fluoranthene : Dry Wt	ug/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chrysene/Triphenylene: Dry Wt	ug/kg	<3	<3	<3	<3	3.3	<3	4.08	<3	<3	<3
Chrysene : Dry Wt	ug/kg	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Dibenzo(ah)anthracene: Dry Wt	ug/kg	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dibenzothiophene : Dry Wt	ug/kg	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Fluoranthene : Dry Wt	ug/kg	<2	<2	<2	2.87	4.29	3.07	6.99	3.96	4.26	<2
Fluorene : Dry Wt	ug/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Indeno(1,2,3-c,d)pyrene: DryWt	ug/kg	<10	<10	<10	<10	10.1	<10	<10	<10	<10	<10
Naphthalene : Dry Wt	ug/kg	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
Perylene : Dry Wt	ug/kg	<5	<5	<5	<5	<5	<5	9.11	5.33	24.4	7.57
Phenanthrene : Dry Wt	ug/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Pyrene : Dry Wt	ug/kg	<3	<3	<3	<3	3	<3	4.77	<3	3.12	<3

Below all guideline values
LOD below guideline values

Table 3.6 Summary results of the sediment chemistry analyses for PCBs

Determinand	Units	KPA58 (52.0m)	KPA50 (51.2m)	KPA45 (54.8m)	KPA37 (70.0m)	KPA30 (87.1m)	KPA21 (75.1m)	KPA17 (84.3m)	KPA12 (94.0m)	KPB12 (37.4m)	KPB7 (20.0m)
PCB - 028 : Dry Wt	ug/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PCB - 052 : Dry Wt	ug/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PCB - 101 : Dry Wt	ug/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PCB - 118 : Dry Wt	ug/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PCB - 138 : Dry Wt	ug/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PCB - 153 : Dry Wt	ug/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PCB - 180 : Dry Wt	ug/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

LOD below guideline values

4 Discussion and Conclusions

4.1 This study has characterised the epibenthic habitats and associated faunal communities within the proposed modified offshore export cable route corridor. These data are used to inform the EIA to be provided in support of the development application.

4.2 A total of 4 biotopes were classified along the proposed offshore export cable route corridor occurring both singly and as twinned mosaics in some instances. The biotopes encountered included one EUNIS Level 3 Main habitat (SS.SSA), one Level 4 Biotope complex (SS.SMx.CMx), one Level 5 Biotope (SpnMeg) and one Level 6 Sub-biotope (FaAlCr.Pom).

4.3 The 'Seapens and burrowing megafauna in circalittoral fine mud', SS.SMu.CFiMu.SpnMeg, biotope dominated across the area and occurred in two variant forms, a typical form with highly conspicuous mounds and burrows and a slightly coarser sediment with lower-lying mounds expression. In the inshore area where the rock biotope CR.MCR.EcCr.FaAlCr.Pom was encountered it was also found in two forms one of which was the sheltered variant noted by Connor *et al*. (2004). Biotopes were mapped and a figure produced to illustrate the distribution of habitats recorded along the proposed cable route.

4.4 A number of the classified biotopes related to potential habitats of nature conservation significance including the following:

- Burrowed mud (recommended priority marine feature); and
- Stony and rocky reefs (EC Habitats Directive Annex I habitat 'Reefs').

4.5 In addition the possible presence of a species also listed as a PMF, *Arachnanthus sarsi* the burrowing anemone which lives in a parchment-like tube was noted. From the available records it appears that the species has not been recorded from the east coast of mainland Scotland previously.

4.6 A total of five Folk sediment classifications (Folk, 1954) were identified from the ten stations sampled for PSA. These included gravelly sand, slightly gravelly sand, slightly gravelly muddy sand, muddy sand and muddy sandy gravel. The dominant sediment fractions were very fine to medium grade sands and the five muddiest stations occurred in the area where the sea pen communities were recorded.

4.7 All sediment chemistry results for metals were below the guideline OSPAR, Cefas and Canadian values with the exception of Arsenic and Chromium. For these two determinands levels at some stations breached both Cefas AL1 and Canadian TEL guideline concentrations but in all cases were below the corresponding OSPAR guideline value. The concentrations of organotins for all samples were below the limit of detection (LOD) available from the analyses. The LOD achieved by the analytical laboratory was better than that required by Marine Scotland for the analysis of TBT. Furthermore in accordance with OSPAR (2009) the concentrations of TBT in sediments analysed from the modified export cable route corridor would be not be expected to affect the reproductive capability of any sensitive gastropod species and hence were considered unlikely to present a problem in this respect. The concentration of total hydrocarbons was low in all samples and well below the revised Cefas AL1. The concentration of PAHs and PCBs were below the LOD in most instances and below the available guideline values in all cases.

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Appendix 1 – Survey logs

Appendix I Grab Log

Moray Cable Route 2014 J/3/03/2610

(1 Sheet)

Site No.	Date	Grab Logsheet No.	Depth (m BCD)	UTM WGS84 Z30 N		Sample Size	Metals Sample	Hydrocarbons Sample	PSA	Photograph of sample?	*In-situ* sediment description	Sediment features (includes: burrows, tubes, casts, smell)	Sediment anoxia (includes: None, streaks, patches, layers, depth of layer)	Anthropogenic features (includes: sewage derived material, other)	Conspicuous Fauna
				Eastings	Northings										
KPA02	24/05/14	6	19.4	515861.0	6395296.0	1/2	1	3	Yes	Yes	Slightly shelly sand	None	None	None	None
KPA12	24/05/14	5	95.0	519091.8	6404741.0	Full	1	3	Yes	Yes	Sandy mud	Tubes	None	None	None
KPA17	24/05/14	4	85.6	520622.7	6409510.0	Full	1	3	Yes	Yes	Sandy mud	Tubes	None	None	*Echinocardium cordatum, Liocarcinus holsatus*
KPA21	24/05/14	4	76.6	520421.9	6413497.0	1/2	1	1	Yes	Yes	Sandy mud	Tubes	None	None	None
KPA21	24/05/14	4	76.1	520421.6	6413507.0	3/4	-	2	No	No	Sandy mud	Tubes	None	None	None
KPA30	24/05/14	2	88.7	519972.5	6422475.0	Full	1	3	Yes	Yes	Sandy mud	None	Patches	None	None
KPA37	24/05/14	2	71.4	519624.2	6429477.0	2/3	1	3	Yes	Yes	Sandy mud	Tubes	Layer	None	None
KPA45	24/05/14	2	55.8	519214.3	6437467.0	Full	1	3	Yes	Yes	Slightly gravelly, shelly sand (Shell hash)	Tubes	None	None	*Lanice* sp. tubes
KPA50	24/05/14	1	52.0	518964.3	6442465.0	2/3	1	3	Yes	Yes	Silty shelly sand	None	Patches	None	Hydroid
KPA58	24/05/14	1	52.0	518558.2	6450451.6	3/4	1	3	Yes	Yes	Silty sand	Tubes	None	None	None
KPB07	24/05/14	6	49.1	523024.3	6398324.0	3/4	1	3	Yes	Yes	Silty, gravelly, shelly sand	None	None	None	Plumularidae
KPB12	24/05/14	5	87.4	520345.4	6402541.0	1/2	1	1	Yes	Yes	Sandy mud	Tubes	None	None	None
KPB12	24/05/14	5	87.4	520349.9	6402533.0	3/4	-	2	No	No	Sandy mud	None	None	None	None

Appendix I Grab Quality Log

Moray Cable Route 2014 J/3/03/2610

(1 Sheet)

Site No.	Attempts	Successful sample collected (Y/N)	Brief description of problems with sample	Size of sample retained	Additional Notes on Quality of Retained Samples
KPA07	3	N	The first attempt was water only, the second attempt had a pebble in the grab jaw and the third attempt was a scraping	N/A	
KPA23	3	N	First attempt was a scraping, attempts 2 and 3 had a pebble in the grab jaw	N/A	The third sample was taken 100m south of the original site in an effort to acquire a successful sample
KPA50	2	Y	First attempt had a shell in the grab jaw, sample was washed out	2/3	
KPB04	1	N	The attempt had a cobble in the grab jaw	N/A	

Appendix I Static Image Log

Moray Cable Route J/3/03/2610

(12 Sheets)

Stills PICT No.	Date	UTM WGS84 Z30N	
		Eastings	Northings
A116	18/05/2014	516716.6	6398178.0
A117	18/05/2014	516706.0	6398167.4
A118	18/05/2014	516679.7	6398142.2
A119	18/05/2014	516669.5	6398128.0
A120	18/05/2014	516648.8	6398100.3
A121	18/05/2014	516628.5	6398072.6
A122	18/05/2014	516604.6	6398016.8
A123	18/05/2014	516584.0	6397962.2
A124	18/05/2014	516570.4	6397881.1
A125	18/05/2014	516569.1	6397853.6
A126	18/05/2014	516562.7	6397834.4
A127	18/05/2014	516559.4	6397782.9
A128	18/05/2014	516557.5	6397769.4
A129	18/05/2014	516552.6	6397681.2
A130	18/05/2014	516543.7	6397639.0
A131	18/05/2014	516533.0	6397574.3
A132	18/05/2014	516530.4	6397564.1
A133	18/05/2014	516529.6	6397559.3
A134	18/05/2014	516495.4	6397504.7
A135	18/05/2014	516488.5	6397478.6
A136	18/05/2014	516482.2	6397466.3
A137	18/05/2014	516460.7	6397397.0
A138	18/05/2014	516430.9	6397275.7
A139	18/05/2014	516432.4	6397213.6
A140	18/05/2014	516440.5	6397147.1
A141	18/05/2014	516467.2	6396974.3
A142	18/05/2014	516483.1	6396921.9
A143	18/05/2014	516498.7	6396886.4
A144	18/05/2014	516508.2	6396865.7
A145	18/05/2014	516465.5	6396793.2
A146	18/05/2014	516411.0	6396759.3
A148	18/05/2014	516360.4	6396678.1
A149	18/05/2014	516370.8	6396494.4
A150	18/05/2014	516319.1	6396459.2
A151	18/05/2014	516289.1	6396454.5
A152	18/05/2014	516269.4	6396458.6
A153	18/05/2014	-	-
A154	18/05/2014	-	-
A155	18/05/2014	-	-
A156	18/05/2014	516070.0	6396233.9
A157	18/05/2014	516069.0	6396224.9
A158	18/05/2014	516070.2	6396206.2
A159	18/05/2014	516044.9	6396122.1
A160	18/05/2014	516015.0	6396035.0
A161	18/05/2014	516013.6	6396024.0
A162	18/05/2014	516003.8	6395919.8
A163	18/05/2014	515999.3	6395889.5
A164	18/05/2014	515998.4	6395872.9
A165	18/05/2014	515991.4	6395838.8
A166	18/05/2014	515990.9	6395816.9
A167	18/05/2014	515936.1	6395648.1
A168	18/05/2014	515882.1	6395463.9
A169	18/05/2014	515874.1	6395436.3
A172	18/05/2014	515854.0	6395344.9
A173	18/05/2014	515869.3	6395217.5
A174	18/05/2014	515714.3	6394807.1
A175	18/05/2014	515674.9	6394702.0
A176	18/05/2014	515632.9	6394549.7
A177	18/05/2014	515622.4	6394542.9
A178	18/05/2014	515513.8	6394200.6
A179	18/05/2014	515508.9	6394191.4
A180	18/05/2014	515482.4	6394134.9
A183	18/05/2014	522713.1	6399106.2
A184	18/05/2014	522702.9	6399127.0
A185	18/05/2014	522691.1	6399152.1
A186	18/05/2014	522671.9	6399178.6
A187	18/05/2014	522645.3	6399210.5
A188	18/05/2014	522638.1	6399220.8
A189	18/05/2014	522567.0	6399285.6
A190	18/05/2014	522549.8	6399299.4
A191	18/05/2014	522516.6	6399336.5
A192	18/05/2014	522494.5	6399363.0
A193	18/05/2014	522442.8	6399443.3

Stills PICT No.	Date	UTM WGS84 Z30N	
		Eastings	Northings
A194	18/05/2014	522305.3	6399510.0
A195	18/05/2014	522214.1	6399563.9
A196	18/05/2014	521900.0	6399767.8
A197	18/05/2014	521893.9	6399783.8
A198	18/05/2014	521883.0	6400528.2
A199	18/05/2014	521754.6	6400625.4
A200	18/05/2014	521673.2	6400703.6
A201	18/05/2014	521454.3	6400888.7
A202	18/05/2014	521433.2	6400908.3
A203	18/05/2014	521404.9	6400934.0
A204	18/05/2014	521359.9	6400970.6
A205	18/05/2014	521203.1	6401147.5
A209	18/05/2014	523011.3	6398362.6
A210	18/05/2014	523002.1	6398370.1
A211	18/05/2014	522992.7	6398376.5
A212	18/05/2014	522973.3	6398390.8
A213	18/05/2014	522963.4	6398401.8
A214	18/05/2014	522893.3	6398443.2
A215	18/05/2014	522880.9	6398449.3
A216	18/05/2014	522870.6	6398453.8
A217	18/05/2014	522860.3	6398455.8
A218	18/05/2014	522844.3	6398480.6
A219	18/05/2014	522834.0	6398522.6
A220	18/05/2014	522822.7	6398533.6
A221	18/05/2014	522823.1	6398554.1
A222	18/05/2014	522832.9	6398591.4
A223	18/05/2014	522836.0	6398601.9
A224	18/05/2014	522843.7	6398617.5
A225	18/05/2014	522861.5	6398637.3
A226	18/05/2014	522877.5	6398647.9
A227	18/05/2014	522901.1	6398661.9
A228	18/05/2014	522940.7	6398737.1
A229	18/05/2014	522920.4	6398789.3
A230	18/05/2014	522885.8	6398842.3
A231	18/05/2014	522862.5	6398864.8
A232	18/05/2014	522783.7	6398916.1
A233	18/05/2014	522716.5	6398950.7
A234	18/05/2014	522689.9	6398964.9
A235	18/05/2014	522673.8	6398972.6
A236	18/05/2014	522628.9	6398993.5
A237	18/05/2014	522551.9	6399037.7
A238	18/05/2014	522523.2	6399052.6
A240	18/05/2014	524638.5	6395841.7
A241	18/05/2014	524616.0	6395874.5
A242	18/05/2014	524607.8	6395886.9
A243	18/05/2014	524584.9	6395914.6
A244	18/05/2014	524558.9	6395948.2
A245	18/05/2014	524489.8	6396044.9
A246	18/05/2014	524478.8	6396062.7
A247	18/05/2014	524461.0	6396088.0
A248	18/05/2014	524456.2	6396101.1
A249	18/05/2014	524440.9	6396123.7
A250	18/05/2014	524419.0	6396158.1
A251	18/05/2014	524386.7	6396233.3
A252	18/05/2014	524356.0	6396276.8
A253	18/05/2014	524134.4	6396608.0
A254	18/05/2014	524122.4	6396640.2
A255	18/05/2014	524114.2	6396659.1
A256	18/05/2014	524092.4	6396688.7
A257	18/05/2014	524086.8	6396728.2
A258	18/05/2014	524084.3	6396746.8
A259	18/05/2014	523957.1	6397172.3
A260	18/05/2014	523637.0	6397520.2
A261	18/05/2014	523612.0	6397538.8
A262	18/05/2014	523523.7	6397596.6
A263	18/05/2014	523517.7	6397601.1
A264	18/05/2014	523387.0	6397750.1
A265	18/05/2014	523377.4	6397766.1
A266	18/05/2014	523366.0	6397794.4
A267	18/05/2014	523167.0	6398233.5
A269	18/05/2014	525657.8	6394139.3
A270	18/05/2014	525649.5	6394151.4
A271	18/05/2014	525643.0	6394160.9
A272	18/05/2014	525636.2	6394170.2
A273	18/05/2014	525629.4	6394178.8
A274	18/05/2014	525623.1	6394187.1
A275	18/05/2014	525605.8	6394204.4

Stills PICT No.	Date	UTM WGS84 Z30N	
		Eastings	Northings
A276	18/05/2014	525595.9	6394212.5
A277	18/05/2014	525586.1	6394219.6
A278	18/05/2014	525579.2	6394225.4
A279	18/05/2014	525568.0	6394236.8
A280	18/05/2014	525562.6	6394244.8
A281	18/05/2014	525540.3	6394277.2
A282	18/05/2014	525523.3	6394289.2
A283	18/05/2014	525508.4	6394299.1
A284	18/05/2014	525497.2	6394308.5
A285	18/05/2014	525487.1	6394321.6
A286	18/05/2014	525445.6	6394371.4
A287	18/05/2014	525432.2	6394391.1
A288	18/05/2014	525409.7	6394446.9
A289	18/05/2014	525406.9	6394456.1
A290	18/05/2014	525195.4	6394919.1
A291	18/05/2014	524717.2	6395710.4
A292	18/05/2014	524680.8	6395750.8
A293	18/05/2014	524624.7	6395829.2
A294	18/05/2014	524616.9	6395839.5
B015	19/05/2014	526206.4	6393330.0
B016	19/05/2014	526203.0	6393338.3
B017	19/05/2014	526194.6	6393396.2
B018	19/05/2014	526194.7	6393400.0
B019	19/05/2014	526177.0	6393434.9
B020	19/05/2014	526173.6	6393438.7
B021	19/05/2014	526140.2	6393484.7
B022	19/05/2014	526091.8	6393578.8
B023	19/05/2014	526089.6	6393583.6
B024	19/05/2014	526075.0	6393612.7
B025	19/05/2014	526073.0	6393617.2
B026	19/05/2014	526069.3	6393624.5
B027	19/05/2014	526059.9	6393645.7
B028	19/05/2014	526053.2	6393667.7
B029	19/05/2014	526050.0	6393675.1
B030	19/05/2014	526045.8	6393684.8
B031	19/05/2014	526040.7	6393694.8
B032	19/05/2014	526036.8	6393700.5
B033	19/05/2014	526022.0	6393728.3
B034	19/05/2014	526017.8	6393740.1
B035	19/05/2014	526011.4	6393757.2
B036	19/05/2014	526002.0	6393781.5
B037	19/05/2014	525998.9	6393790.2
B038	19/05/2014	525996.8	6393799.2
B039	19/05/2014	525991.6	6393824.6
B040	19/05/2014	525986.4	6393862.8
B041	19/05/2014	525986.5	6393871.5
B042	19/05/2014	525985.7	6393880.9
B043	19/05/2014	525985.4	6393895.3
B044	19/05/2014	525984.8	6393899.9
B045	19/05/2014	525981.1	6393913.5
B046	19/05/2014	525975.5	6393930.2
B047	19/05/2014	525973.5	6393947.1
B048	19/05/2014	525970.3	6393969.1
B049	19/05/2014	525963.9	6393984.3
B050	19/05/2014	525959.8	6393989.9
B051	19/05/2014	525957.8	6393992.9
B052	19/05/2014	525937.3	6394016.5
B053	19/05/2014	525934.8	6394020.8
B054	19/05/2014	525915.1	6394039.4
B055	19/05/2014	525897.0	6394057.1
B056	19/05/2014	525883.4	6394074.9
B057	19/05/2014	525868.4	6394093.1
B058	19/05/2014	525857.1	6394109.8
B059	19/05/2014	525843.3	6394133.3
B060	19/05/2014	525836.3	6394143.4
B061	19/05/2014	525835.0	6394148.8
B062	19/05/2014	525821.0	6394169.2
B063	19/05/2014	525811.2	6394181.4
B064	19/05/2014	525805.2	6394193.5
B066	19/05/2014	521252.7	6401104.3
B067	19/05/2014	521253.7	6401111.4
B068	19/05/2014	521230.4	6401290.4
B069	19/05/2014	521228.2	6401296.3
B070	19/05/2014	521211.4	6401336.4
B071	19/05/2014	521148.8	6401426.8
B072	19/05/2014	521113.9	6401474.2
B076	19/05/2014	521036.7	6401593.7

Stills PICT No.	Date	UTM WGS84 Z30N	
		Eastings	Northings
B077	19/05/2014	520929.6	6401693.5
B078	19/05/2014	520787.6	6401826.6
B079	19/05/2014	520599.2	6402106.8
B080	19/05/2014	520438.9	6402308.8
B081	19/05/2014	520025.1	6402997.9
B082	19/05/2014	519914.5	6403204.7
B083	19/05/2014	519906.1	6403217.2
B084	19/05/2014	519814.4	6403364.7
B085	19/05/2014	519666.2	6403545.6
B086	19/05/2014	519491.8	6403771.4
B087	19/05/2014	519487.7	6403795.4
B088	19/05/2014	519468.8	6403922.5
B089	19/05/2014	519357.7	6404174.3
B090	19/05/2014	519304.6	6404212.2
B091	19/05/2014	519250.9	6404253.3
B092	19/05/2014	519168.6	6404359.6
B093	19/05/2014	519155.9	6404422.1
B094	19/05/2014	519150.0	6404481.2
B095	19/05/2014	519149.9	6404491.7
B096	19/05/2014	519148.0	6404639.8
B097	19/05/2014	519141.8	6404663.5
B098	19/05/2014	519112.5	6404749.8
B099	19/05/2014	519167.0	6404866.0
B100	19/05/2014	519163.4	6404909.0
B102	19/05/2014	516877.0	6398237.4
B103	19/05/2014	516890.1	6398255.9
B104	19/05/2014	516902.1	6398275.3
B105	19/05/2014	516907.5	6398286.2
B106	19/05/2014	516917.9	6398309.2
B107	19/05/2014	516929.4	6398382.1
B108	19/05/2014	516945.2	6398431.2
B109	19/05/2014	516986.7	6398500.2
B110	19/05/2014	517007.1	6398542.1
B111	19/05/2014	517025.2	6398579.5
B112	19/05/2014	517045.4	6398609.3
B113	19/05/2014	517035.2	6398703.7
B114	19/05/2014	517029.8	6398712.8
B115	19/05/2014	517042.5	6398787.5
B116	19/05/2014	517125.0	6398929.5
B117	19/05/2014	517210.5	6399170.1
B118	19/05/2014	517216.2	6399188.2
B119	19/05/2014	517488.4	6400006.9
B120	19/05/2014	517508.3	6400078.2
B121	19/05/2014	517526.8	6400136.2
B122	19/05/2014	517539.9	6400178.1
B123	19/05/2014	517557.2	6400265.6
B124	19/05/2014	517575.7	6400339.2
B125	19/05/2014	517576.6	6400351.7
B126	19/05/2014	517578.4	6400365.1
B127	19/05/2014	517579.9	6400372.9
B128	19/05/2014	517608.9	6400432.5
B129	19/05/2014	517658.0	6400572.3
B130	19/05/2014	517688.0	6400671.7
B131	19/05/2014	517691.9	6400686.3
B132	19/05/2014	517695.2	6400695.6
B133	19/05/2014	517699.4	6400709.1
B134	19/05/2014	517703.5	6400725.1
B135	19/05/2014	517716.3	6400784.1
B136	19/05/2014	517746.2	6400862.9
B138	19/05/2014	517810.5	6401012.5
B139	19/05/2014	517815.5	6401022.9
B140	19/05/2014	517828.2	6401044.3
B141	19/05/2014	517849.4	6401085.8
B142	19/05/2014	517853.3	6401102.2
B143	19/05/2014	517898.0	6401246.9
B144	19/05/2014	517902.4	6401263.4
B145	19/05/2014	517911.4	6401301.9
B146	19/05/2014	518345.9	6402542.5
B147	19/05/2014	518351.1	6402559.7
B148	19/05/2014	518452.1	6402845.2
B152	19/05/2014	518797.6	6403755.0
B153	19/05/2014	518807.3	6403768.0
B154	19/05/2014	518843.4	6403832.0
B155	19/05/2014	518877.3	6403921.9
B156	19/05/2014	518885.0	6403944.3
B157	19/05/2014	518895.3	6404010.9
B158	19/05/2014	518932.4	6404176.0

Stills PICT No.	Date	UTM WGS84 Z30N	
		Eastings	Northings
B159	19/05/2014	518938.7	6404240.2
B160	19/05/2014	518961.6	6404339.3
B161	19/05/2014	519057.0	6404580.4
B162	19/05/2014	519107.1	6404723.8
B164	19/05/2014	519150.8	6404871.8
B165	19/05/2014	519147.7	6404893.4
B166	19/05/2014	519347.7	6405452.8
B167	19/05/2014	519355.6	6405500.5
B168	19/05/2014	519699.1	6406621.5
B169	19/05/2014	519902.8	6407016.9
B174	19/05/2014	520133.8	6407751.4
B175	19/05/2014	520138.2	6407765.2
B176	19/05/2014	520144.4	6407779.2
B177	19/05/2014	520263.7	6408053.0
B178	19/05/2014	520348.4	6408438.6
B179	19/05/2014	520350.2	6408446.0
B180	19/05/2014	520353.4	6408455.7
B181	19/05/2014	520448.5	6408697.5
B182	19/05/2014	520583.3	6409066.6
B183	19/05/2014	520609.3	6409146.5
B184	19/05/2014	520672.1	6409372.0
B185	19/05/2014	520657.7	6409418.0
B186	19/05/2014	520645.4	6409449.8
B187	19/05/2014	520626.2	6409534.5
B188	19/05/2014	520593.1	6409798.6
B189	19/05/2014	520593.1	6409807.1
B190	20/05/2014	520575.0	6410129.2
B191	20/05/2014	520572.3	6410140.4
B192	20/05/2014	520571.5	6410149.8
B193	20/05/2014	520570.6	6410159.7
B194	20/05/2014	520578.4	6410421.2
B213	20/05/2014	520622.1	6410571.2
B214	20/05/2014	520614.5	6410783.9
B215	20/05/2014	520612.2	6410813.7
B216	20/05/2014	520583.4	6410934.8
B217	20/05/2014	520567.6	6411003.4
B218	20/05/2014	520554.4	6411038.6
B219	20/05/2014	520523.8	6411342.9
B220	20/05/2014	520523.4	6411776.0
B221	20/05/2014	520516.1	6412219.5
B222	20/05/2014	520463.1	6412591.0
B223	20/05/2014	520458.6	6413133.2
B224	20/05/2014	520459.1	6413147.0
B225	20/05/2014	520451.0	6413339.0
B226	20/05/2014	520452.5	6413361.1
B228	20/05/2014	520458.1	6413526.3
B229	20/05/2014	520457.2	6413533.6
B230	20/05/2014	520418.5	6413646.6
B231	20/05/2014	520411.9	6413722.3
B232	20/05/2014	520413.3	6413774.2
B233	20/05/2014	520432.7	6413966.1
B234	20/05/2014	520432.3	6413975.2
B235	20/05/2014	520428.2	6414064.7
B236	20/05/2014	520484.8	6414309.5
B237	20/05/2014	520495.1	6414611.8
B238	20/05/2014	520481.0	6414689.6
B239	20/05/2014	520476.1	6414707.4
B240	20/05/2014	520469.1	6414724.0
B241	20/05/2014	520462.7	6414766.6
B242	20/05/2014	520459.2	6414785.0
B243	20/05/2014	520453.7	6414815.5
B244	20/05/2014	520452.0	6414833.9
B245	20/05/2014	520434.4	6414950.1
B246	20/05/2014	520429.3	6415281.7
B247	20/05/2014	520418.9	6415363.6
B248	20/05/2014	520403.3	6415423.6
B249	20/05/2014	520401.9	6415431.3
B250	20/05/2014	520400.1	6415452.7
B251	20/05/2014	520395.7	6415509.4
B252	20/05/2014	520397.6	6415522.6
B253	20/05/2014	520402.6	6415548.1
B254	20/05/2014	520374.5	6415929.5
B257	20/05/2014	520277.3	6416536.9
B258	20/05/2014	520240.3	6416749.8
B259	20/05/2014	520240.8	6416951.5
B260	20/05/2014	520215.7	6417219.2
B261	20/05/2014	520215.1	6417228.0

Stills PICT No.	Date	UTM WGS84 Z30N	
		Eastings	Northings
B262	20/05/2014	520200.8	6417283.4
B265	20/05/2014	520104.3	6419432.6
B266	20/05/2014	520110.1	6419421.1
B267	20/05/2014	520112.6	6419254.5
B268	20/05/2014	520115.7	6419239.7
B269	20/05/2014	520117.5	6419230.4
B270	20/05/2014	520118.9	6419225.0
B271	20/05/2014	520120.8	6419218.1
B272	20/05/2014	520122.6	6419209.8
B273	20/05/2014	520123.8	6419195.7
B274	20/05/2014	520133.1	6419149.7
B275	20/05/2014	520131.2	6419130.7
B276	20/05/2014	520127.1	6419121.4
B277	20/05/2014	520119.9	6419081.4
B278	20/05/2014	520120.0	6419077.3
B279	20/05/2014	520121.3	6419069.0
B280	20/05/2014	520122.3	6419052.4
B281	20/05/2014	520127.7	6418999.2
B282	20/05/2014	520159.3	6418305.0
B283	20/05/2014	520160.0	6418300.7
B284	20/05/2014	520159.9	6418292.2
B285	20/05/2014	520140.0	6418254.4
B286	20/05/2014	520128.7	6418243.5
B287	20/05/2014	520198.0	6417547.2
B289	20/05/2014	519920.7	6421913.4
B290	20/05/2014	520105.2	6421179.2
B291	20/05/2014	520034.2	6421035.0
B292	20/05/2014	520050.2	6421025.3
B293	20/05/2014	520042.9	6420016.9
B294	20/05/2014	520037.9	6419958.5
D002	20/05/2014	519847.8	6424253.2
D004	21/05/2014	519628.2	6428446.8
D005	21/05/2014	519629.1	6428437.5
D006	21/05/2014	519656.1	6428245.5
D007	21/05/2014	519685.9	6428107.1
D008	21/05/2014	519745.4	6427630.9
D009	21/05/2014	519773.1	6427351.2
D010	21/05/2014	519805.9	6426954.7
D011	21/05/2014	519807.9	6426935.2
D012	21/05/2014	519811.1	6426890.1
D013	21/05/2014	519813.0	6426858.1
D016	21/05/2014	519544.5	6431157.3
D017	21/05/2014	519566.6	6430874.6
D018	21/05/2014	519591.7	6430541.9
D019	21/05/2014	519594.3	6430369.0
D020	21/05/2014	519612.0	6430151.7
D021	21/05/2014	519612.6	6429936.6
D022	21/05/2014	519599.4	6429645.0
D023	21/05/2014	519606.3	6429373.1
D024	21/05/2014	519634.1	6429136.0
D025	21/05/2014	519643.0	6429107.9
D026	21/05/2014	519647.3	6429097.1
D027	21/05/2014	519651.7	6429084.0
D028	21/05/2014	519652.3	6429080.9
D029	21/05/2014	519658.3	6429046.0
D032	21/05/2014	519402.2	6434346.5
D033	21/05/2014	519426.3	6434029.7
D034	21/05/2014	519426.0	6434024.4
D035	21/05/2014	519425.9	6434019.7
D036	21/05/2014	519503.9	6433190.3
D037	21/05/2014	519488.4	6432873.1
D038	21/05/2014	519486.7	6432865.1
D039	21/05/2014	519493.0	6432588.0
D040	21/05/2014	519504.8	6432290.7
D041	21/05/2014	519504.8	6432281.0
D044	21/05/2014	519240.0	6437552.9
D045	21/05/2014	519244.6	6437547.0
D046	21/05/2014	519255.0	6437537.2
D047	21/05/2014	519274.0	6437517.2
D048	21/05/2014	519278.6	6437510.1
D049	21/05/2014	519285.2	6437499.7
D050	21/05/2014	519301.3	6437488.2
D051	21/05/2014	519310.3	6437472.7
D052	21/05/2014	519322.5	6437417.2
D053	21/05/2014	519320.3	6437352.1
D054	21/05/2014	519303.5	6437255.6
D055	21/05/2014	519298.6	6437235.0

Stills PICT No.	Date	UTM WGS84 Z30N	
		Eastings	Northings
D056	21/05/2014	519283.2	6437107.1
D057	21/05/2014	519280.2	6437097.6
D058	21/05/2014	519274.2	6437065.3
D059	21/05/2014	519315.8	6435838.3
D060	21/05/2014	519309.7	6435711.8
D061	21/05/2014	519304.8	6435487.0
D076	21/05/2014	519101.2	6440342.2
D077	21/05/2014	519106.6	6440306.1
D078	21/05/2014	519111.3	6440251.3
D079	21/05/2014	519112.2	6440235.4
D080	21/05/2014	519111.5	6440218.7
D081	21/05/2014	519110.1	6440200.8
D082	21/05/2014	519109.8	6440181.8
D083	21/05/2014	519109.9	6440153.8
D084	21/05/2014	519109.8	6440133.0
D085	21/05/2014	519108.2	6440115.5
D086	21/05/2014	519095.0	6439977.4
D087	21/05/2014	519091.4	6439917.8
D088	21/05/2014	519091.2	6439903.9
D089	21/05/2014	519090.9	6439673.5
D090	21/05/2014	519091.3	6439596.1
D091	21/05/2014	519117.9	6439369.9
D092	21/05/2014	519119.2	6439354.8
D093	21/05/2014	519133.8	6439243.4
D094	21/05/2014	519132.9	6439229.4
D095	21/05/2014	519146.8	6438956.9
D096	21/05/2014	519147.7	6438934.3
D097	21/05/2014	519148.4	6438907.5
D098	21/05/2014	519142.2	6438810.7
D099	21/05/2014	519144.7	6438677.3
D100	21/05/2014	519146.0	6438668.2
D101	21/05/2014	519148.5	6438656.8
D102	21/05/2014	519159.1	6438616.5
D103	21/05/2014	519186.2	6438544.4
D104	21/05/2014	519198.1	6438508.2
D105	21/05/2014	519200.3	6438494.1
D106	21/05/2014	519196.0	6438247.9
D107	21/05/2014	519194.6	6438225.9
D108	21/05/2014	519177.4	6438117.4
D109	21/05/2014	519173.2	6438096.8
D110	21/05/2014	519162.8	6438000.2
D111	21/05/2014	519165.6	6437960.8
D112	21/05/2014	519167.9	6437947.6
D113	21/05/2014	519193.6	6437344.8
C003	21/05/2014	519080.3	6440402.8
C004	21/05/2014	519073.4	6440409.4
C005	21/05/2014	519069.2	6440427.6
C006	21/05/2014	519068.7	6440439.1
C007	21/05/2014	519066.8	6440494.1
C008	21/05/2014	519068.1	6440557.8
C009	21/05/2014	519068.7	6440577.0
C010	21/05/2014	519061.2	6440662.6
C011	21/05/2014	519047.5	6441075.5
C013	21/05/2014	518965.6	6442596.1
C014	21/05/2014	518963.3	6442611.3
C015	21/05/2014	518963.9	6442620.2
C016	21/05/2014	518965.5	6442638.9
C017	21/05/2014	518964.3	6442661.0
C018	21/05/2014	518956.0	6442818.7
C019	21/05/2014	518841.0	6444233.9
C020	21/05/2014	518836.0	6444241.3
C021	21/05/2014	518830.4	6444247.0
C022	21/05/2014	518832.3	6444302.0
C023	21/05/2014	518824.7	6444323.1
C024	21/05/2014	518824.6	6444329.3
C025	21/05/2014	518826.3	6444335.7
C026	21/05/2014	518841.3	6444363.6
C027	21/05/2014	518844.0	6444569.6
C028	21/05/2014	518850.3	6444581.8
C029	21/05/2014	518851.3	6444588.8
C030	21/05/2014	518828.6	6444699.4
C031	21/05/2014	518822.6	6444721.2
C032	21/05/2014	518824.9	6444755.9
C033	21/05/2014	518809.7	6444966.8
C034	21/05/2014	518819.8	6445090.6
C035	21/05/2014	518819.6	6445095.0
C036	21/05/2014	518829.6	6445145.4

Stills PICT No.	Date	UTM WGS84 Z30N	
		Eastings	Northings
C037	21/05/2014	518790.5	6445434.4
C038	21/05/2014	518790.6	6445442.0
C039	21/05/2014	518793.0	6445454.3
C040	21/05/2014	518794.1	6445462.4
C045	21/05/2014	518822.3	6445534.2
C046	21/05/2014	518813.8	6445572.9
C047	21/05/2014	518793.7	6445606.9
C048	21/05/2014	518785.6	6445636.6
C049	21/05/2014	518773.6	6445675.1
C050	21/05/2014	518759.9	6445772.9
C051	21/05/2014	518759.9	6445777.3
C052	21/05/2014	518758.7	6445851.2
C053	21/05/2014	518767.7	6445971.6
C054	21/05/2014	518771.8	6445998.0
C055	21/05/2014	518771.7	6446015.9
C056	21/05/2014	518778.1	6446138.1
C057	21/05/2014	518778.4	6446152.6
C058	21/05/2014	518777.9	6446158.1
C059	21/05/2014	518779.5	6446184.3
C060	21/05/2014	518786.9	6446265.4
C061	21/05/2014	518785.7	6446319.3
C062	21/05/2014	518786.1	6446323.4
C063	22/05/2014	518784.2	6446398.8
C064	22/05/2014	518742.4	6446554.7
C065	22/05/2014	518691.0	6446741.7
C066	22/05/2014	518690.8	6446805.8
C067	22/05/2014	518683.9	6446823.4
C068	22/05/2014	518679.9	6446835.9
C069	22/05/2014	518693.0	6446886.1
C070	22/05/2014	518698.4	6446985.9
C071	22/05/2014	518668.6	6447021.8
C072	22/05/2014	518712.4	6447103.1
C073	22/05/2014	518743.1	6447135.4
C074	22/05/2014	518765.5	6447162.5
C075	22/05/2014	518780.6	6447200.4
C076	22/05/2014	518786.4	6447258.9
C077	22/05/2014	518776.6	6447278.6
C078	22/05/2014	518763.2	6447330.9
C079	22/05/2014	518742.7	6447391.3
C080	22/05/2014	518743.4	6447424.1
C081	22/05/2014	518695.6	6447558.3
C082	22/05/2014	518670.7	6447765.7
C083	22/05/2014	518668.3	6447774.7
C084	22/05/2014	518677.0	6447874.5
C085	22/05/2014	518681.9	6447903.3
C086	22/05/2014	518687.2	6447932.0
C087	22/05/2014	518691.1	6447949.6
C088	22/05/2014	518723.8	6448140.5
C089	22/05/2014	518718.5	6448180.8
C090	22/05/2014	518711.5	6448259.4
C092	22/05/2014	518651.0	6448610.8
C093	22/05/2014	518650.2	6448623.1
C094	22/05/2014	518648.7	6448633.0
C095	22/05/2014	518642.0	6448725.4
C096	22/05/2014	518633.0	6448814.2
C097	22/05/2014	518637.3	6448974.0
C098	22/05/2014	518637.3	6449037.0
C099	22/05/2014	518630.7	6449193.6
C100	22/05/2014	518610.2	6449384.7
C101	22/05/2014	518606.5	6449529.8
C102	22/05/2014	518608.0	6449553.3
C103	22/05/2014	518597.6	6449834.9
C104	22/05/2014	518578.4	6449999.7
C105	22/05/2014	518572.3	6450037.2
C106	22/05/2014	518560.3	6450256.9
C107	22/05/2014	518559.0	6450263.0
C108	22/05/2014	518558.3	6450269.4
C109	22/05/2014	518553.8	6450388.6

Appendix I Video Log

Moray Cable Route 2014 J/3/03/2610

(1 Sheet)

Start Site	End Site	Date	Video (V) Logsheet No.	Start Time (GMT)	Start Depth (m BCD)	WGS84 UTM Z30N			
						Start Position		End Position	
						Eastings	Northings	Eastings	Northings
KPA5	KPA3	18/05/2014	1-3	06:27	39.3	516822.9	6398288.3	516411.0	6396759.3
KPA3	KPA2	18/05/2014	3-6	18:15	23.4	516439.1	6396863.2	515863.0	6395394.8
KPA2	KPA0	18/05/2014	7	11:40	19.6	515859.6	6395385.6	515390.5	6393942.7
KPB8	KPB11	18/05/2014	8-10	14:35	59	522720.9	6399090.3	521132.7	6401332.2
KPB7	KPB8	18/05/2014	11-13	17:20	49.4	523025.9	6398341.6	522469.4	6399078.3
KPB4	KPB2	18/05/2014	14-18	19:10	37.9	524649.6	6395791.5	523046.7	6398333.1
KPB2	KPB0	18/05/2014	19-21	21:59	18.8	525663.9	6394130.6	524616.9	6395839.5
KPB0	KPB2	19/05/2014	22-23	04:06	5.1	526212.7	6393308.0	525798.8	6394200.5
KPB10	KPB14	19/05/2014	24-26	06:09	71.3	521248.3	6401081.9	519142.1	6404962.4
KPA5	KPA8	19/05/2014	27-31	11:40	36.1	516859.0	6398210.1	517794.7	6400989.6
KPA8	KPA11	19/05/2014	32-33	14:29	56.5	517798.3	6400983.2	518753.4	6403743.4
KPA10	KPA12	19/05/2014	34-35	17:36	96	518790.8	6403725.5	519125.5	6404833.0
KPA12	KPA15	19/05/2014	36-37	19:14	94.9	519134.0	6404813.5	520085.2	6407641.5
KPA15	KPA18	19/05/2014	38-39	21:57	90.7	520055.8	6407585.6	520586.3	6410556.3
KPA18	KPA21	20/05/2014	40-41	01:22	92.5	520624.6	6410480.4	520468.1	6413559.3
KPA21	KPA24	20/05/2014	42-43	04:23	76.6	520457.7	6413469.7	520425.7	6416526.3
KPA24	KPA25	20/05/2014	44	07:31	65.1	520253.3	6416472.5	520065.9	6417568.3
KPA27	KPA25	20/05/2014	45-47	09:31	64.4	520108.9	6419539.5	520241.4	6417436.2
KPA30	KPA28/27	20/05/2014	48-49	11:50	90.5	519911.5	6422462.6	520137.6	6419491.7
KPA33	KPA32	20/05/2014	50	14:50	79.5	519760.5	6425659.1	519845.4	6424715.8
KPA32	KPA30	20/05/2014	51-52	23:41	81.2	519801.8	6424640.2	519685.9	6428107.1
KPA36	KPA33	21/05/2014	53	03:24	80.1	519745.4	6427630.9	519868.7	6425488.9
KPA39	KPA36	21/05/2014	54	05:24	69.6	519525.5	6431560.3	519698.7	6428430.9
KPA42	KPA39	21/05/2014	55-56	08:26	65.9	519362.6	6434505.2	519530.1	6431545.0
KPA45	KPA42	21/05/2014	57-58	11:53	55.4	519225.9	6437562.9	519354.7	6434475.8
KPA48	KPA46	21/05/2014	59-61	14:37	55.6	519094.5	6440429.3	519040.1	6437353.7
KPA49	KPA50	21/05/2014	62	17:20	55.1	519122.9	6440372.5	519161.3	6442713.2
KPA50	KPA53	21/05/2014	63-66	19:50	51.8	518972.3	6442404.9	518650.4	6445630.5
KPA53	KPA56	21/05/2014	67-69	23:15	50.6	518791.3	6445445.5	518680.7	6448524.9
KPA56	KPA58	22/05/2014	70	02:38	50.3	518682.8	6448466.0	518547.0	6450525.4

Appendix 2 – Grab photographs

Station ID		
KPA12		
KPA17		
KPA21		
KPA30		

Station ID		
KPA37		
KPA45		
KPA50		
KPA58		

Station ID		
KPB7		
KPB12		

Appendix 3 – Video analysis

SACFOR species abundance data and sediment data

Moray Firth Cable Route 2014 Video Analysis
AMB May 2014

Biotope Code	SS.SSa	SS.SSa with areas of SS.SMx.CMx	SS.SSa (Section 2)	SS.SMu.CFiMu.SpnMeg (coarser variant)	SS.SSa with areas of SS.SMx.CMx	SS.SMu.CFiMu.SpnMeg	SS.SMx.CMx
Site areas	KPA 56/57/58	KPA 52/53/54/55/56	KPA 49/50/51/52	KPA 48/49/50	KPA 48/49	KPA 39/40/42/43/44/48	KPA 45/44
Video analysis undertaken by:	AMB	AMB	AMB	AMB	AMB	AMB	AMB
Physical characteristics.							
% Bedrock							
% Boulder V. Large (>1024mm)							
% Boulder Large (>512mm)							
% Boulder Small (>256mm)							
% Cobbles (>64mm)		4			1		1
% Gravel and Pebbles combined (>4mm to 64mm)		15	1	1	20		20
% Shell	3	10	15	15	15		15
% Sand	97	71	84	84	64		64
Biogenic Reef							
Muddy sand/sandy mud (Burrowed mud biotope)						100	
Total	100	100	100	100	100	100	100
% Total Sand, Gravel & Pebbles	97	86	85	85	84	0	84

Feature on 1-5 scale for rock	SS.SSa	SS.SSa with areas of SS.SMx.CMx	SS.SSa (Section 2)	SS.SMu.CFiMu.SpnMeg (coarser variant)	SS.SSa with areas of SS.SMx.CMx	SS.SMu.CFiMu.SpnMeg	SS.SMx.CMx
Surface relief (even - rugged)							
Stability (stable - mobile)							

Feature on 1-5 scale for sediments	SS.SSa	SS.SSa with areas of SS.SMx.CMx	SS.SSa (Section 2)	SS.SMu.CFiMu.SpnMeg (coarser variant)	SS.SSa with areas of SS.SMx.CMx	SS.SMu.CFiMu.SpnMeg	SS.SMx.CMx
Surface relief (even - rugged)	2	3	2	2	3	3	3
Stability (stable - mobile)	3	3	3	3	3	4	3

Species abundance based on SACFOR scale

Biological characteristics	SACFOR	Code							
Porifera									
Porifera	Crust %	C0001							
Cnidaria									
Tubularia indivisa	Turf %	D0166		R					
?Abietinaria abietina	Turf %	D0409					R		
Hydrallmania falcata	Turf %	D0424		R	R		R		
Sertularia	Turf %	D0433					P		P
?Thuiaria thuja	Turf %	D0443		R			R		
Plumulariidae	Turf %	D0447		R					
Nemertesia ramosa	3-15cm	D0466							
Hydroid/Bryozoan mixed substrate	Turf %		R	O	R	O	O	R	O
Anthozoa									
Alcyonium digitatum	Turf %	D0597	R	R		R			R
Virgularia mirabilis	3-15cm	D0618				F			
Pennatula phosphorea	3-15cm	D0623				R		O	
?Arachnanthus sarsi	3-15cm	D0641							
Urticina	3-15cm	D0684					R		
Metridium senile	3-15cm	D0710		R					
Polychaeta									
Aphrodita aculeata	3-15cm	P0019		R	R				
Chaetopterus tubes	3-15cm	P0811	P	P		P		P	
Tubes in Sediment (Oweniidae)	Meadow	P1090							
Lanice conchilega	1-3cm	P1195							
Sabella tube	3-15cm	P1257							
Sabella	3-15cm	P1257							
Spirobranchus	1-3cm	P1339		P			P		
Salmacina tube mass	3-15cm	P1360							

Biotope Code			SS.SSa	SS.SSa with areas of SS.SMx.CMx	SS.SSa (Section 2)	SS.SMu.CFiMu.SpnMeg (coarser variant)	SS.SSa with areas of SS.SMx.CMx	SS.SMu.CFiMu.SpnMeg	SS.SMx.CMx
Site areas			KPA 56/57/58	KPA 52/53/54/55/56	KPA 49/50/51/52	KPA 48/49/50	KPA 48/49	KPA 39/40/42/43/44/48	KPA 45/44
Crustacea									
CIRRIPEDIA	Crust %	R0074							
DECAPODA (?Liocarcinus)	3-15cm	S1276	O	R				R	
CARIDEA	1-3cm	S1293		P					
Nephrops norvegicus	>15cm	S1402							
Paguridae	3-15cm	S1436	O	F	O	O	O	O	O
Munida rugosa	3-15cm	S1478					R		R
Majoidea	3-15cm	S1514						R	
Inachinae	3-15cm	S1520	R						
Macropodia	1-3cm	S1529							
Atelecyclus rotundatus	3-15cm	S1555					R		
Cancer pagurus	>15cm	S1566		O					
Liocarcinus	3-15cm	S1577		R	R			R	
Mollusca									
Gibbula	1-3cm	W0157							
Buccinidae	3-15cm	W0702							R
Pectinidae	3-15cm	W1768		R	R				
Pecten maximus	3-15cm	W1771	R	O	R	O	O		R
Sepia officinalis	>15cm	W2307							
Bryozoa									
Bryozoa crust	Crust %	Y0001					P		
Alcyonidium diaphanum	3-15cm	Y0076	R						
Flustra foliacea	Turf %	Y0187	R	R	R		R		P
Securiflustra securifrons	Turf %	Y0194		R					
?Omalosecosa ramulosa	3-15cm	Y0508							
Echinodermata									
Antedon bifida	3-15cm	ZB0010							
ASTEROIDEA	>15cm	ZB0018	O	O				O	
ASTEROIDEA (?Leptasterias muelleri)	>15cm	ZB0018							
ASTEROIDEA (Asterias or ?Leptasterias muelleri)	>15cm	ZB0018							
Luidia ciliaris	>15cm	ZB0022	O				O		
Luidia sarsi	>15cm	ZB0023		O					O
Astropecten irregularis	3-15cm	ZB0026		R	R	R			
Ceramaster/Hippasteria	3-15cm	ZB0045							
Porania pulvillus	3-15cm	ZB0054							
Anseropoda placenta	3-15cm	ZB0062						O	
Solaster endeca	>15cm	ZB0072							
Crossaster papposus	>15cm	ZB0075		O					
Henricia	3-15cm	ZB0082				R			
Asterias rubens	>15cm	ZB0100	O	F	O	O	O		
Marthasterias glacialis	>15cm	ZB0104						R	
Ophiura ophiura	3-15cm	ZB0170		R	R	R	R		R
ECHINOIDEA	3-15cm	ZB0181				R			
Echinus esculentus	3-15cm	ZB0198		R					
?Echinocardium cordatum	3-15cm	ZB0223							
PISCES									
Juvenile fish (shoal of fry)	1-3cm	ZE0002							
Triakidae (Mustelus)	>15cm	ZF0033				O			
Anguilla anguilla/Myxine glutinosa	>15cm	ZG0011/ZE0006							
Lophius piscatorius	>15cm	ZG0094						O	
GADIFORMES	>15cm	ZG0104	O	O	O		O		
M.merlangus/T.minutus	>15cm	ZG0123/ZG0144							
Trisopterus esmarkii	>15cm	ZG0142		O			O		
Trisopterus minutus	>15cm	ZG0144							
?Merluccius merluccius	>15cm	ZG0149						O	
Triglidae	>15cm	ZG0260	O	O	R	O			
Agonus cataphractus	3-15cm	ZG0291							R
Labridae	>15cm	ZG0386							
Lumpenus lampretaeformis	>15cm	ZG0429							
Ammodytidae	>15cm	ZG0441		P				O	
Callionymidae	>15cm	ZG0450	R	R	O	O	O		O
Gobiidae	3-15cm	ZG0455							
PLEURONECTIFORMES	>15cm	ZG0545	O	O	O	O	O	O	
?Pleuronectes platessa	>15cm	ZG0578	O	O	O				
Microchirus variegatus	>15cm	ZG0588	R	O	O				
ALGAE									
Red and brown algal turf - long	Turf %	Z0001							
Diatomaceous aggregation	Turf %	Z0001	F	O	O	O	R		
Corallinaceae	Crust %	ZM0194							
?Delesseria sanguinea	Turf %	ZM0594							
Encrusting Brown Algae	Crust %	ZR0002							
Saccharina latissima	Turf %	ZR0354							
Biofilm	Crust								
Miscellanea									
Trawl hawsers/fishing debris									
Erect tubes									

Moray Firth Cable Route 2014 Video Analysis
AMB May 2014

Biotope Code	SS.SMu.CFiMu.SpnMeg	SS.SMu.CFiMu.SpnMeg (coarser variant)	SS.SMu.CFiMu.SpnMeg with SS.SMx.CMx	CR.MCR.EcCr.FaAlCr.Pom	SS.SMx.CMx	SS.SSa	CR.MCR.EcCr.FaAlCr.Pom (sheltered shore variant)	SS.SSa (Section 3)	SS.SMx.CMx (with SSa)
Site areas	**KPA 8/9/10/11/12/13/14/15 /16/17/18/19/20/21/22/ 23/26/27/28/29/30/31 /32/33/34/35/37/38/39 /40/41/42/44/**	**KPA 24/26/27/28/29**	**KPA 26/27**	**KPB 0/2**	**KPB 3/4**	**KPB 0**	**KPB 0**	**KPB 2**	**KPB 4/5/7/8**
Video analysis undertaken by:	**AMB**	**AMB**	**AMB**	**AMB**	**AMB**	**AMB**	**AMB**	**AMB**	**AMB**
Physical characteristics.									
% Bedrock				35			35		
% Boulder V. Large (>1024mm)									
% Boulder Large (>512mm)				10	2		10		
% Boulder Small (>256mm)		1	5	15	5		15		1
% Cobbles (>64mm)		2	25	15	48		15		15
% Gravel and Pebbles combined (>4mm to 64mm)	1	3	30	15	23		15		54
% Shell	1	3	5		2			5	5
% Sand			35	10	20	100	10	95	25
Biogenic Reef									
Muddy sand/sandy mud (Burrowed mud biotope)	98	91							
Total	100	100	100	100	100	100	100	100	100
% Total Sand, Gravel & Pebbles	1	3	65	25	43	100	25	95	79

Feature on 1-5 scale for rock	SS.SMu.CFiMu.SpnMeg	SS.SMu.CFiMu.SpnMeg (coarser variant)	SS.SMu.CFiMu.SpnMeg with SS.SMx.CMx	CR.MCR.EcCr.FaAlCr.Pom	SS.SMx.CMx	SS.SSa	CR.MCR.EcCr.FaAlCr.Pom (sheltered shore variant)	SS.SSa (Section 3)	SS.SMx.CMx (with SSa)
Surface relief (even - rugged)				4			4		
Stability (stable - mobile)				2			2		

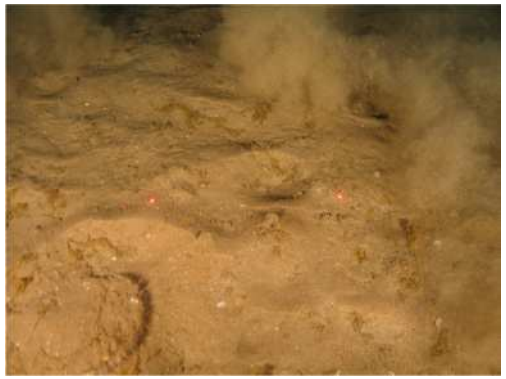
Feature on 1-5 scale for sediments	SS.SMu.CFiMu.SpnMeg	SS.SMu.CFiMu.SpnMeg (coarser variant)	SS.SMu.CFiMu.SpnMeg with SS.SMx.CMx	CR.MCR.EcCr.FaAlCr.Pom	SS.SMx.CMx	SS.SSa	CR.MCR.EcCr.FaAlCr.Pom (sheltered shore variant)	SS.SSa (Section 3)	SS.SMx.CMx (with SSa)
Surface relief (even - rugged)	3-2	2	3		4	2		2	3
Stability (stable - mobile)	4-3	3	2		2	4		4	3

Species abundance based on SACFOR scale

Biological characteristics	SACFOR	Code									
Porifera											
Porifera	Crust %	C0001									R
Cnidaria											
Tubularia indivisa	Turf %	D0166	R	R	R		R				R
?Abietinaria abietina	Turf %	D0409				P			P		
Hydrallmania falcata	Turf %	D0424			P						
Sertularia	Turf %	D0433			P						
?Thuiaria thuja	Turf %	D0443									
Plumulariidae	Turf %	D0447					R				P
Nemertesia ramosa	3-15cm	D0466			R						
Hydroid/Bryozoan mixed substrate	Turf %		R	O	C	R	R		R		O
Anthozoa											
Alcyonium digitatum	Turf %	D0597				F	R		F		R
Virgularia mirabilis	3-15cm	D0618	O								
Pennatula phosphorea	3-15cm	D0623	F	F							
?Arachnanthus sarsi	3-15cm	D0641	R								
Urticina	3-15cm	D0684				R	O		R		O
Metridium senile	3-15cm	D0710	R	R		R	R		R		R
Polychaeta											
Aphrodita aculeata	3-15cm	P0019									
Chaetopterus tubes	3-15cm	P0811	P								P
Tubes in Sediment (Oweniidae)	Meadow	P1090	P	F							P
Lanice conchilega	1-3cm	P1195		p							P
Sabella tube	3-15cm	P1257	R				R				
Sabella	3-15cm	P1257	R								
Spirobranchus	1-3cm	P1339			P	P	P		P		P
Salmacina tube mass	3-15cm	P1360									P

Biotope Code			SS.SMu.CFiMu.SpnMeg	SS.SMu.CFiMu.SpnMeg (coarser variant)	SS.SMu.CFiMu.SpnMeg with SS.SMx.CMx	CR.MCR.EcCr.FaAlCr.Pom	SS.SMx.CMx	SS.SSa	CR.MCR.EcCr.FaAlCr.Pom (sheltered shore variant)	SS.SSa (Section 3)	SS.SMx.CMx (with SSa)
Site areas			KPA 8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/26/27/28/29/30/31/32/33/34/35/37/38/39/40/41/42/44/	KPA 24/26/27/28/29	KPA 26/27	KPB 0/2	KPB 3/4	KPB 0	KPB 0	KPB 2	KPB 4/5/7/8
Crustacea											
CIRRIPEDIA	Crust %	R0074									
DECAPODA (?Liocarcinus)	3-15cm	S1276	R							O	O
CARIDEA	1-3cm	S1293									
Nephrops norvegicus	>15cm	S1402	O								
Paguridae	3-15cm	S1436	O	R	R		O			O	O
Munida rugosa	3-15cm	S1478	R	O	F	F	F		F		O
Majoidea	3-15cm	S1514	R								
Inachinae	3-15cm	S1520									
Macropodia	1-3cm	S1529	R								
Atelecyclus rotundatus	3-15cm	S1555	R								
Cancer pagurus	>15cm	S1566	R		R	F	O		F	O	O
Liocarcinus	3-15cm	S1577	R				R				P
Mollusca											
Gibbula	1-3cm	W0157				P			P		
Buccinidae	3-15cm	W0702									
Pectinidae	3-15cm	W1768									
Pecten maximus	3-15cm	W1771	O	R	O		O				O
Sepia officinalis	>15cm	W2307									
Bryozoa											
Bryozoa crust	Crust %	Y0001				O	P		O		P
Alcyonidium diaphanum	3-15cm	Y0076	R								
Flustra foliacea	Turf %	Y0187	R				R				O
Securiflustra securifrons	Turf %	Y0194									R
?Omalosecosa ramulosa	3-15cm	Y0508									R
Echinodermata											
Antedon bifida	3-15cm	ZB0010									
ASTEROIDEA	>15cm	ZB0018	O			F	F	O	F	O	
ASTEROIDEA (?Leptasterias muelleri)	>15cm	ZB0018	R								
ASTEROIDEA (Asterias or ?Leptasterias muelleri)	>15cm	ZB0018	O	R							
Luidia ciliaris	>15cm	ZB0022									
Luidia sarsi	>15cm	ZB0023									
Astropecten irregularis	3-15cm	ZB0026	R							R	
Ceramaster/Hippasteria	3-15cm	ZB0045		R	O						
Porania pulvillus	3-15cm	ZB0054	R								R
Anseropoda placenta	3-15cm	ZB0062	O								
Solaster endeca	>15cm	ZB0072									
Crossaster papposus	>15cm	ZB0075				F			F		O
Henricia	3-15cm	ZB0082	O								O
Asterias rubens	>15cm	ZB0100	O	O			O				
Marthasterias glacialis	>15cm	ZB0104	R			O			O		
Ophiura ophiura	3-15cm	ZB0170									
ECHINOIDEA	3-15cm	ZB0181									
Echinus esculentus	3-15cm	ZB0198		R	R	F	O		F		O
?Echinocardium cordatum	3-15cm	ZB0223	R								
PISCES											
Juvenile fish (shoal of fry)	1-3cm	ZE0002									P
Triakidae (Mustelus)	>15cm	ZF0033									
Anguilla anguilla/Myxine glutinosa	>15cm	ZG0011/ZE0006	R								
Lophius piscatorius	>15cm	ZG0094	O							P	O
GADIFORMES	>15cm	ZG0104	R							P	
M.merlangus/T.minutus	>15cm	ZG0123/ZG0144	R								
Trisopterus esmarkii	>15cm	ZG0142	O								O
Trisopterus minutus	>15cm	ZG0144									
?Merluccius merluccius	>15cm	ZG0149	O								
Triglidae	>15cm	ZG0260									O
Agonus cataphractus	3-15cm	ZG0291									O
Labridae	>15cm	ZG0386				R			R		
Lumpenus lampretaeformis	>15cm	ZG0429	O								
Ammodytidae	>15cm	ZG0441	O							P	P
Callionymidae	>15cm	ZG0450	O	R							O
Gobiidae	3-15cm	ZG0455	O							P	P
PLEURONECTIFORMES	>15cm	ZG0545	O	O				R		O	O
?Pleuronectes platessa	>15cm	ZG0578									
Microchirus variegatus	>15cm	ZG0588									
ALGAE											
Red and brown algal turf - long	Turf %	Z0001							R		
Diatomaceous aggregation	Turf %	Z0001									
Corallinaceae	Crust %	ZM0194				F	P		F		P
?Delesseria sanguinea	Turf %	ZM0594							O		
Encrusting Brown Algae	Crust %	ZR0002				F			F		
Saccharina latissima	Turf %	ZR0354							R		
Biofilm	Crust							P			
Miscellanea											
Trawl hawsers/fishing debris						P	P				
Erect tubes			P	P							

Biotope descriptions

Biotope	Sediment and Fauna Description	Species	Representative Images
Biotope SS.SSa (Offshore Area) Sublittoral sand and muddy sands.	**Sediment Description** Slightly shelly, slightly muddy sand. Small holes regularly seen across the area. Fauna within them not evident. Small areas of dense coarse shelly sand forming small patches of coarse sand waves with coarse shell aggregations in the recesses. **Fauna** Main fauna seen were large Pagurid crabs, and an array of fish including gurnards, thick backed sole, flat fish, (often plaice), and gadiform fish, largely unidentifiable due to quality of image. A few *Pecten maximus* were seen, and small numbers of starfish. The hydroid/bryozoan mixed turf and very small occurrences of *Flustra,* were rarely seen, found on small amounts of slightly coarser sediment. Across the area, a gelatinous, filamentous substance was observed, believed to be a diatomaceous aggregation It occurred as small oozes from the sediment, and formed long filaments. At times, it was observed as a coating on other hydroid/bryozoan growths.	?*Pleuronectes platessa* *Alcyonidium diaphanum* *Alcyonium digitatum* *Asterias rubens* Asteroidea Callionymidae *Chaetopterus* tubes Decapoda Diatomaceous aggregation *Flustra foliacea* Gadiformes Hydroid/Bryozoan mixed substrate Inachinae *Luidia ciliaris* *Microchirus variegatus* Paguridae *Pecten maximus* PLEURONECTIFORMES Triglidae	  

Biotope

SS.SSa with SS.SMx.CMx

Sublittoral sand and muddy sands with Circalittoral mixed sediment.

(Offshore Area)

Additional FluHyd may be appropriate in some areas.

Sediment Description

Slightly shelly, slightly muddy rippled sand. Coarse shelly sand waves occur across the area, with a coarse mixed sediment of gravel pebbles and cobbles within the recesses. Regular outcrops of larger areas of coarse mixed sediment occurred, with greater epifaunal cover of foliose hydroids and bryozoans. Small holes and small burrows evident across the area.

Fauna

Fauna on the sediment largely comprised Pagurid crabs, a few small crabs (notably *Liocarcinus*) and a selection of flat fish including plaice and thick backed sole. A variety of starfish were distributed across the area. The foliose hydroid/bryozoan turf including *Flustra* and *Hydrallmania* were largely concentrated on the areas of coarse mixed sediment. A rare occurrence of *Metridium senile* was seen on a large cobble. *Pecten maximus* were more notable across both the sandy and coarser sediments of the site. One gadoid fish was seen, potentially hake.

Note

Area noted for sand eels.
WGS84 Degminsdecmins
58 09.2191N 002 40.8778W
To
58 09.2923N 002 40.8623W

Area with noted greater density of Pecten maximus
58 09.4445N 002 40.8467W

?*Pleuronectes platessa*
?*Thuiaria thuja*
Alcyonium digitatum
Ammodytidae
Aphrodita aculeata
Asterias rubens
ASTEROIDEA
Astropecten irregularis
Buccinum undatum
Callionymidae
Cancer pagurus
CARIDEA
Chaetopterus tubes
Crossaster papposus
DECAPODA (?*Liocarcinus*.)
Diatomaceous aggregation
Tubularia indivisa
Echinus esculentus
Flustra foliacea
Gadiformes
Hydrallmania falcata
Hydroid/Bryozoan mixed substrate
Liocarcinus
Luidia sarsi
Metridium senile
Microchirus variegatus
Ophiura ophiura
Paguridae
Pecten maximus
PLEURONECTIFORMES
Plumulariidae
Securiflustra securifrons
Spirobranchus
Triglidae
Trisopterus lamarkii

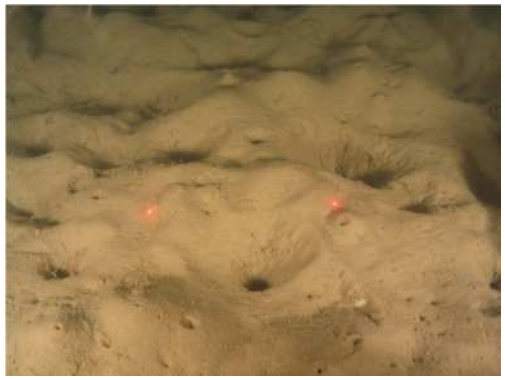
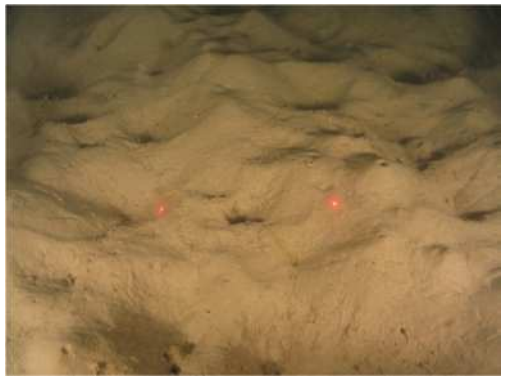
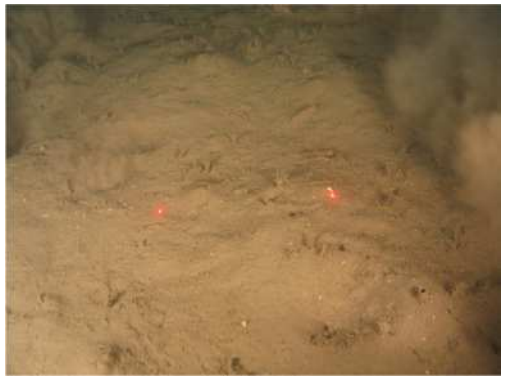
			  

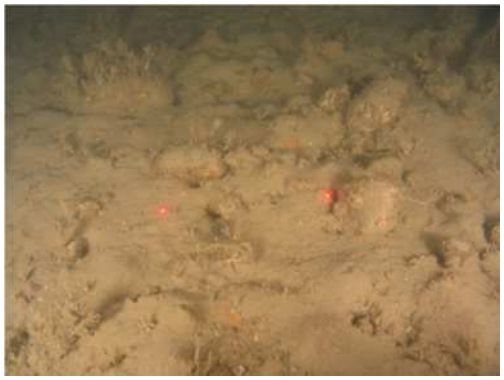
Biotope SS.SSa (Section2) Sublittoral sand and muddy sands	**Sediment Description** Slightly shelly, slightly muddy rippled sand. Coarse shelly sand waves occurred infrequently across the area, with large shell hash notable within the recesses, with a few scattered pebbles. Small holes and small burrows evident across the area. **Fauna** The main fauna noted were flat fish, gurnards, a few gadiform fish, a few starfish and pagurid crabs. Hydroid/bryozoan turf of largely indefinable composition was scattered throughout. One *Ophiura ophiura* was seen, and one sea mouse (*Aphrodita*). The diatomaceous aggregation was present across both sand and coarse sand wave areas. As the coarse sand waves had an ephemeral appearance, it was decided to leave the biotope allocation at SSa. The coarser areas did not appear to warrant a separate biotope, so have been noted here as a feature only.	?*Pleuronectes platessa* *Aphrodita aculeata* *Asterias rubens* *Astropecten irregularis* Callionymidae Diatomaceous aggregation *Flustra foliacea* Gadiformes *Hydrallmania falcata* Hydroid/Bryozoan mixed substrate *Liocarcinus* *Microchirus variegatus* *Ophiura ophiura* Paguridae *Pecten maximus* Pectinidae PLEURONECTIFORMES Triglidae	 

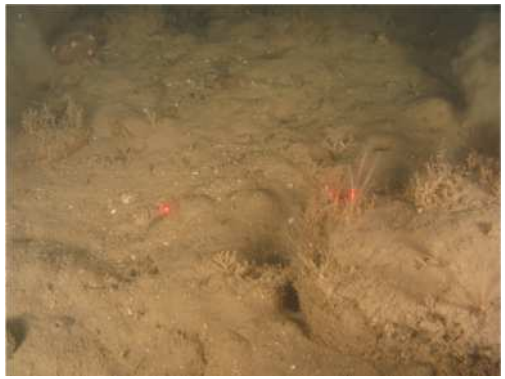
Biotope SS.SMu.CFiMu.SpnMeg (coarser variant) Seapens and burrowing megafauna in circalittoral fine mud	**Sediment Description** Slightly shelly, slightly muddy rippled sand. Small holes and small burrows evident across the area. Larger fractions of shell hash visible in places. **Fauna** The main fauna noted were flat fish, gurnards, a few starfish and pagurid crabs. Hydroid/bryozoan turf of largely indefinable composition was scattered throughout. One *Ophiura ophiura* was seen. *Pecten maximus* occurred sporadically. The diatomaceous aggregation was present across the area. The seapen *Virgularia mirabilis* was very evident, and occurred frequently. Only one *Pennatula* was noted.	*Alcyonium digitatum* *Asterias rubens* *Astropecten irregularis* Callionymidae *Chaetopterus* tubes Diatomaceous aggregation Echinoidea *Henricia* Hydroid/Bryozoan mixed substrate *Ophiura ophiura* Paguridae *Pecten maximus* *Pennatula phosphorea* PLEURONECTIFORMES Triglidae *Virgularia mirabilis*	 

Biotope	**Sediment Description**	?*Abietinaria abietina* ?*Thuiaria thuja* *Asterias rubens* *Atelecyclus rotundatus* Bryozoa crust Callionymidae Diatomaceous aggregation *Flustra foliacea* Gadiformes Hydroid/Bryozoan mixed substrate *Luidia ciliaris* *Munida rugosa* *Ophiura ophiura* Paguridae *Pecten maximus* PLEURONECTIFORMES *Sertularia* *Spirobranchus* *Trisopterus lamarkii* *Urticina*	 
SS.SSa with SS.SMx.CMx Sublittoral sand and muddy sands with Circalittoral mixed sediment. CMx, forming waves, dominated the area. Some support for the additional FluHyd allocation in places. Although biotope already allocated in the offshore area, kept separate here due to denser coarse waves rather than coarse sediment patches.	Area dominated by coarse mixed sediment forming small to approx. 0.5m high coarse gravelly shelly sand waves in places. Large shell hash and gravelly pebbles deposited within the recesses with the occasional cobble. One small boulder seen. Area interspersed with slightly shelly, slightly muddy rippled sand. Small holes and small burrows evident across the area. **Fauna** The main fauna noted were hydroid/bryozoan turf, including *Flustra*, *Sertularia*, *Abietinaria* and potentially *Thuiaria thuja*. Flat fish, a few starfish and pagurid crabs were evident, along with the round crab *Atelecyclus rotundatus*. *Munida rugosa* was occasionally seen in the coarse sediment. One *Ophiura ophiura* was noted. *Pecten maximus* occurred relatively regularly throughout. Note. *Pecten maximus* noted in higher density in this area.		

Biotope SS.SMx.CMx Circalittoral mixed sediment. Some support for the additional FluHyd allocation in places.	**Sediment Description** Area dominated by coarse mixed sediment forming small to approx. 0.5m high coarse gravelly shelly sand waves in places. Large shell hash and gravelly pebbles deposited within the recesses with the occasional cobble. One small boulder seen. **Fauna** The main fauna noted were foliose hydroid/bryozoan turf, including *Flustra*, and *Sertularia*. A few starfish and pagurid crabs were evident, along with *Munida rugosa* which was occasionally seen in the coarse sediment. One *Ophiura ophiura* was noted. *Pecten maximus* occurred rarely**.**	*Agonus cataphractus* *Alcyonium digitatum* Buccinidae Callionymidae *Flustra foliacea* Hydroid/Bryozoan mixed substrate *Luidia sarsi* *Munida rugosa* *Ophiura ophiura* Paguridae *Pecten maximus* *Sertularia*	 

Biotope SS.SMu.CFiMu.SpnMeg Seapens and burrowing megafauna in circalittoral fine mud Note that in the more southerly areas, the burrowed mud had the occasional hydroid cluster and outcrop of *Tubularia*. The fish that are noted were more prevalent to the north**.**	**Sediment Description** Sandy mud/muddy sand with burrows, mounds and holes. Area of dense bioturbation. In some areas, a low lying form was observed, a relatively even sandy mud/muddy sand with small burrows, small mounds and holes. Bioturbation evident but not as deep or dense as areas more suited to *Nephrops norvegicus*. Occasional small boulder, and areas of coarser sediment, with a few cobbles, and mixed pebbles and large shell hash in places. **Fauna** Burrowing megafauna evident, including the sea pen *Pennatula phosphorea* and in some areas, *Virgularia mirabilis*. *Nephrops* sporadically seen. Flat fish present and a few starfish including *Anseropoda placenta*. Pagurid crabs and the occasional Decapod (?*Liocarcinus*), seen. Gurnards and a few small gadoid fish also present. *Cancer pagurus* observed. In the low-lying form of the biotope, burrowing megafauna evident, including the seapen *Pennatula phosphorea*. Flat fish and a few starfish seen, as well as a few large scallops. The coarser substrate had more dense aggregations of hydroid/bryozoan turf, and a very small amount of *Tubularia indivisa*. Boulder with *Metridium senile* present. Sediment with small polychaete tubes forming a 'mat' in places, believed to be Oweniidae**.**	?*Echinocardium cordatum* *Anguilla anguilla/Myxine glutinosa* *Anseropoda placenta* *Asterias rubens* ASTEROIDEA Asteroidea (?*Leptasterias muelleri*) *Astropecten irregularis* Callionymidae *Cancer pagurus* *Chaetopterus* tubes DECAPODA (?*Liocarcinus*) Gadiformes Gobiidae Henricia Hydroid/Bryozoan mixed substrate *Liocarcinus* *Lumpenus lampretaeformis* *M.merlangus* or *T.minutus* Majoidea *Nephrops norvegicus* *Ophiura ophiura* Paguridae *Pennatula phosphorea* PLEURONECTIFORMES Triglidae *Tubularia indivisa* *Virgularia mirabilis* **Low lying and coarser area** *Asterias rubens* Asteroidea (*Asterias* or ?*Leptasterias muelleri*) Callionymidae *Ceramaster/Hippasteria* *Echinus esculentus*	  

		Hydroid/Bryozoan mixed substrate *Lanice conchilega* *Metridium senile* *Munida rugosa* Paguridae *Pecten maximus* *Pennatula phosphorea* PLEURONECTIFORMES *Porania pulvillus* Tubes in Sediment (Oweniidae) *Tubularia indivisa*	

Biotope SS.SMx.CMx Within SS.SMu.CFiMu.SpnMeg Circalittoral mixed sediment. within Seapens and burrowing megafauna in circalittoral fine mud There may be some support for the additional FluHyd allocation in places.	**Sediment Description** Low lying, relatively even sandy mud/muddy sand with small burrows, small mounds and holes. Bioturbation evident but not as deep or dense as areas more suited to *Nephrops norvegicus*. Within this area, large sections of coarse mixed sediment with boulders and cobbles. **Fauna** Burrowing megafauna evident in the softer sediment. Coarse section dominated by hydroid/bryozoan turf, small amounts of *Tubularia indivisa,* and a notable amount of *Munida rugosa* under the boulders and cobbles. Occasional *Echinus esculentus* and a few *Pecten maximus* seen. One *Cancer pagurus* seen.	*Cancer pagurus* *Ceramaster/Hippasteria* *Echinus esculentus* *Hydrallmania falcata* Hydroid/Bryozoan mixed substrate *Munida rugosa* *Nemertesia ramosa* *Pecten maximus* *Sertularia* Spirobranchus *Tubularia indivisa*	  

Biotope	**Sediment Description**	*Alcyonium digitatum* *Asterias rubens* ASTEROIDEA Bryozoa crust *Cancer pagurus* Corallinaceae *Echinus esculentus* *Flustra foliacea* Hydroid/Bryozoan mixed substrate *Liocarcinus* *Metridium senile* *Munida rugosa* Paguridae *Pecten maximus* Plumulariidae *Sabella* tube *Spirobranchus* *Tubularia indivisa* *Urticina*	 
SS.SMx.CMx Circalittoral mixed sediment. Fauna not considered dense enough to support the additional allocation of FluHyd. However it could be described as an impoverished form.	Area of hard ground, potentially bedrock in places. Area over-laid with a very coarse mixture of shelly sandy, gravelly pebbly cobble matrix with the occasional boulder. A thin covering of mobile sand of varying depths evident over the hard ground. **Fauna** Fauna largely comprised of coralline algae and bryozoan crusts with sparse outcrops of foliose hydroid/bryozoan turf including *Flustra foliacea* and Plumulariidae, with rare *Tubularia indivisa*. Very small outcrops of *Alcyonium digitatum* were present, and rare *Echinus esculentus*. Lots of *Munida rugosa* were present under the boulders and cobbles, with small crabs such as *Liocarcinus* evident. Occasionally a large edible crab, *Cancer pagurus* was seen and a very occasional *Pecten maximus*. Small starfish were scattered across the area. Debris of fishing ropes present.		

Biotope	**Sediment Description**	?*Omalosecosa ramulosa* *Agonus cataphractus* *Alcyonium digitatum* Ammodytidae Bryozoa crust Callionymidae *Cancer pagurus* *Chaetopterus* tubes *Crossaster papposus* DECAPODA (?*Liocarcinus*) *Echinus esculentus* *Flustra foliacea* Gobiidae *Henricia* Hydroid/Bryozoan mixed substrate *Lanice conchilega* *Liocarcinus* *Metridium senile* *Munida rugosa* Paguridae *Pecten maximus* PLEURONECTIFORMES Plumulariidae *Porania pulvillus* PORIFERA *Spirobranchus* Triglidae *Trisopterus esmarkii* Tubes in Sediment (Oweniidae) *Tubularia indivisa* *Urticina*	Lanice and Oweniidae  Coarse mixed sediment  

SS.SMx.CMx with SS.SSa

Circalittoral mixed sediment with Sublittoral sand and muddy sands

Fauna not considered dense enough to support the additional allocation of FluHyd. Small areas could potentially be called an impoverished form.

Area of what appears to be hard ground in places, over-laid with a very coarse mixture of shelly sandy, gravelly pebbly cobble matrix with a few boulders in places. A thin covering of mobile sand of varying depths evident over the hard ground. In places, extensive patches of rippled sand occurred, before returning to coarse mixed sediment. In places and particularly further offshore, the sand became coarser and thicker in some areas, forming coarse sand waves with large shell debris within the recesses.

Fauna

The coarse ground had sparse hydroid/bryozoan turf with a few starfish, small amounts of the soft coral *Alcyonium digitatum*, rare *Tubularia indivisa*, and *Urticina.* Boulders were particularly covered in dense hydroid/bryozoan turf, with large clusters of *Flustra foliacea*. *Munida rugosa* were regularly seen across the area under the coarser sediment. *Pecten maximus* often seen, and the occasional *Cancer pagurus*. In some sand patches, *Lanice conchilega* tubes became evident, mixed with smaller tubes believed to be of the family Oweniidae. In the deeper coarser sand waves, sand eel activity became very noticeable.

Note area of sand eels.

INSHORE AREA

Biotope

Inshore Sand
SS.SSa

Sublittoral sand and muddy sands.

Bedrock and boulder reef with algae
CR.MCR.EcCr.FaAlCr.Pom (sheltered inshore variant)

Bedrock and boulder reef
CR.MCR.EcCr.FaAlCr.Pom

Faunal and algal crusts with *Pomatoceros triqueter* and sparse *Alcyonium digitatum* on exposed to moderately wave-exposed circalittoral rock

Sediment Description

Inshore area a rippled sand with a few holes, with a biofilm evident across the area.

From the inshore sand, the area gradually became a bedrock and boulder reef, with a small outcrop of rock with the brown alga *Saccharina latissima* and long foliose red and brown algal fronds. Where the reef became more established, only foliose red algal fronds remained, namely ?*Delesseria sanguinea*, before the algae reduced completely. The area then became a bedrock, boulder and cobble reef, undulating and rising to around 1 to 2.0m approx. in height at its greatest point. A cobble pebble and gravelly sand matrix evident within the recesses in places. There were small areas where a thin film of sediment was evident on the hard rock surfaces.

Fauna

Only a few flat fish were evident on the inner shore sand area.

Bedrock and boulder reef densely covered by a crust of what is believed to be a brown alga, with coralline algae and bryozoan crusts strongly present. *Spirobranchus* worm tubes very visible. The urchin *Echinus esculentus* very common across the area, along with a frequent presence of the soft coral *Alcyonium digitatum*. Small starfish (Asteroidea) very noticeable, probably *Asterias rubens* but confirmation difficult. *Crossaster papposus* very frequent. *Cancer pagurus* noticed occasionally.

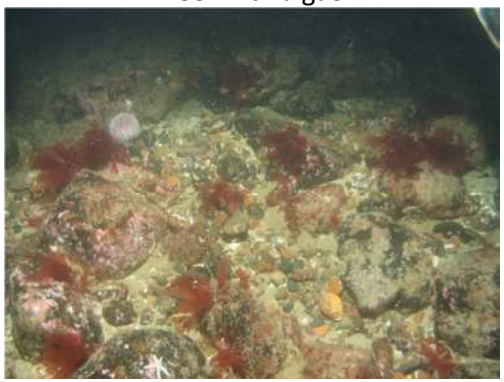
Sand
ASTEROIDEA
PLEURONECTIFORMES
Biofilm

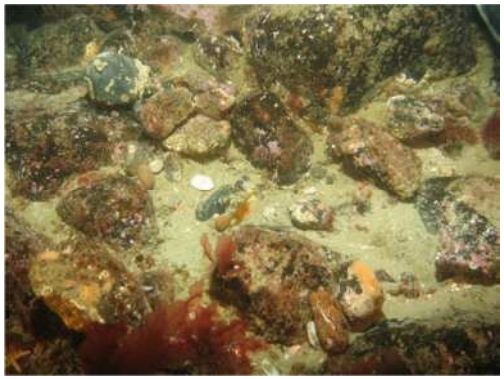
Algae additions to reef
Saccharina latissima
?*Delesseria sanguinea*
Red and brown algal turf - long

Reef
?*Abietinaria abietina*
Hydroid/Bryozoan mixed substrate
Alcyonium digitatum
Urticina
Metridium senile
Spirobranchus
Munida rugosa
Cancer pagurus
Gibbula
Bryozoa crust
ASTEROIDEA
Marthasterias glacialis
Crossaster papposus
Echinus esculentus
Labridae
Corallinaceae
Encrusting Brown Algae

Inshore sand with biofilm

Reef with algae





			Reef   

Biotope SS.SSa (Section 3) Sublittoral sand and muddy sands.	**Sediment Description** Rippled sand with a few holes, becoming gradually coarser further offshore. Ripples becoming more mixed and larger in form. **Fauna** A few starfish are scattered across the area, with large pagurid crabs, a few flat fish and a few gadoid fish in places. One monkfish seen. As the sand became coarser, sand eel activity became more apparent.	DECAPODA (?*Liocarcinus*) Paguridae *Cancer pagurus* *Astropecten irregularis* ASTEROIDEA *Lophius piscatorius* Ammodytidae Gadiformes Gobiidae PLEURONECTIFORMES	

Appendix 4 – PSD results

Certificate Number:	EP/14/4578	**Fugro EMU Job Number:**	J/3/08/2610
Job Reference:	Moray Offshore Renewables Ltd - Moray Firth Benthic Ecology Characterisation (Offshore Transmission Infrastructure)		

Prepared For	**Prepared By**
Peter Moore **Moray Offshore Renewables Ltd.** 4th floor 40 Princes Street EH2 2BY Edinburgh United Kingdom	**James Hutchinson** **Fugro EMU Limited** Trafalgar Wharf (Unit 16) Hamilton Road Portchester Portsmouth PO6 4PX United Kingdom
Phone: +44 (0) 1315 567602 **Email:** Peter.Moore@edpr.com **Web:** www.morayoffshorerenewables.com	**Phone:** +44 (0) 2392 205500 **Email:** sediment@fugroemu.com **Web:** www.fugroemu.com

Sampling Undertaken By:	Fugro EMU	**Sampling Date:**	24/05/2014
Date of Receipt:	26/05/2014	**Date of Analysis:**	28/05/2014 – 05/06/2014
Sample Matrix:	Marine Sediments		
Method Reference:	Particle Size Distribution by Dry Sieving – Fugro EMU MET/01 based on BS1377: 1990: Parts 1 – 2, and Fugro EMU MET/48 based on the NMBAQC PSA SOP for supporting biological data. *Particle Size Distribution by Laser Diffraction – Fugro EMU MET/50 based on BS ISO 13320: 2009.		
Test Results:	Refer to page 2 of 2		
Laboratory Comments:	**Deviating Codes:** None		
Authorised Signature:	J. R. Hut		
Name:	James Hutchinson		
Position:	Sediment Laboratory Manager		
Issue Date:	06/06/2014		

- Further information on methods of analysis may be obtained from the above address
- Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
- *Indicates determinand not included in UKAS accreditation
- Test results reported relate only to those items tested
- Sub indicates subcontracted test

A UKAS TESTING LABORATORY

UKAS TESTING 1272

FUGRO EMU LIMITED
CERTIFICATE OF ANALYSIS

Test Results: Particle Size Distribution by Dry Sieving (63000 - 1000 µm) and Laser Diffraction (< 1000 - < 0.09 µm) @ 0.5 Phi Intervals
Fugro EMU Job Number: J/3/08/2610
Job Reference: Moray Offshore Renewables Ltd - Moray Firth Benthic Ecology Characterisation (Offshore Transmission Infrastructure)

SAMPLE ID:	KPB 12	KPB 7	KPA 58	KPA 50	KPA 45	KPA 37	KPA 30	KPA 21	KPA 17	KPA 12	KPA 2
LAB ID:	12543	12544	12589	12590	12591	12592	12593	12594	12595	12596	12598
Aperture [µm]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]	Fractional [%]
63000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22400	0.00	6.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16000	0.00	5.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11200	0.00	10.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8000	0.00	6.16	0.22	0.27	0.72	0.00	0.00	0.00	0.00	0.00	0.00
5600	0.00	5.49	0.04	0.04	0.53	0.00	0.00	0.00	0.00	0.00	0.00
4000	0.00	7.33	0.26	0.17	1.01	0.00	0.00	0.00	0.00	0.00	0.00
2800	0.00	7.15	0.39	0.17	5.52	0.04	0.05	0.04	0.00	0.00	0.04
2000	0.02	7.20	0.47	0.36	11.15	0.02	0.00	0.02	0.00	0.00	0.02
1400	0.01	6.63	0.75	0.67	17.05	0.01	0.04	0.01	0.00	0.02	0.10
1000	0.04	5.19	0.93	0.72	18.99	0.04	0.02	0.03	0.06	0.04	0.28
707	0.90	2.91	0.95	0.06	15.40	0.42	0.36	0.85	0.86	0.51	0.00
500	2.77	2.53	3.05	1.85	11.90	0.27	0.71	0.73	3.07	2.00	2.58
354	6.03	2.70	11.07	10.70	7.53	0.01	0.66	1.55	6.39	4.44	17.16
250	10.58	3.75	23.15	24.35	4.07	0.97	1.09	5.94	9.82	8.12	35.28
177	15.76	4.58	28.14	29.47	2.07	8.02	4.36	14.51	12.58	13.26	31.78
125	18.92	3.96	19.78	19.78	1.16	19.15	11.47	21.88	14.12	17.93	11.91
88	16.62	2.24	7.09	6.43	0.70	25.32	18.53	21.16	13.52	18.04	0.85
63	9.74	0.86	0.64	0.42	0.37	20.56	19.58	13.24	10.50	12.57	0.00
44.19	3.46	0.46	0.00	0.01	0.19	9.96	13.83	5.31	6.51	5.77	0.00
31.25	0.98	0.60	0.30	0.52	0.16	2.44	6.66	1.75	3.55	1.95	0.00
22.10	1.23	0.79	0.74	0.90	0.19	0.65	2.87	1.47	2.37	1.35	0.00
15.63	1.95	0.90	0.53	0.62	0.22	1.53	2.49	1.89	2.36	1.89	0.00
11.05	2.19	0.99	0.28	0.39	0.24	2.14	3.14	1.92	2.64	2.20	0.00
7.81	2.12	1.06	0.26	0.42	0.24	1.98	3.34	1.74	2.73	2.17	0.00
5.52	1.95	1.01	0.34	0.52	0.22	1.64	3.00	1.59	2.55	2.04	0.00
3.91	1.66	0.82	0.34	0.51	0.18	1.41	2.44	1.41	2.13	1.82	0.00
2.76	1.22	0.56	0.26	0.39	0.13	1.16	1.82	1.09	1.56	1.43	0.00
1.95	0.75	0.33	0.04	0.25	0.02	0.81	1.22	0.71	0.99	0.95	0.00
1.38	0.42	0.18	0.00	0.01	0.00	0.49	0.75	0.42	0.58	0.56	0.00
0.98	0.27	0.12	0.00	0.00	0.00	0.33	0.54	0.28	0.40	0.37	0.00
0.69	0.24	0.11	0.00	0.00	0.00	0.30	0.51	0.25	0.36	0.32	0.00
0.49	0.17	0.08	0.00	0.00	0.00	0.26	0.42	0.20	0.29	0.25	0.00
0.35	0.00	0.00	0.00	0.00	0.00	0.07	0.11	0.00	0.07	0.01	0.00
0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
< 0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL:	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Test Results: Particle Size Distribution by Dry Sieving (63000 - 1000 µm) and Laser Diffraction (< 1000 - < 0.09 µm) @ 0.5 Phi Intervals

Fugro EMU Job Number: J/3/08/2610

Job Reference: Moray Offshore Renewables Ltd - Moray Firth Benthic Ecology Characterisation (Offshore Transmission Infrastructure)

	SAMPLE ID:	KPB 12	KPB 7	KPA 58	KPA 50	KPA 45	KPA 37	KPA 30	KPA 21	KPA 17	KPA 12	KPA 2
	LAB ID:	12543	12544	12589	12590	12591	12592	12593	12594	12595	12596	12598
TEXTURAL GROUP	SAMPLE TYPE:	Unimodal, Poorly Sorted	Polymodal, Very Poorly Sorted	Unimodal, Moderately Sorted	Unimodal, Moderately Sorted	Unimodal, Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Poorly Sorted	Unimodal, Moderately Well Sorted
	FOLK [1954 ORIGINAL]:	Slightly Gravelly Muddy Sand	Muddy Sandy Gravel	Slightly Gravelly Sand	Slightly Gravelly Sand	Gravelly Sand	Slightly Gravelly Muddy Sand	Slightly Gravelly Muddy Sand	Slightly Gravelly Muddy Sand	Slightly Gravelly Muddy Sand	Muddy Sand	Slightly Gravelly Sand
	FOLK [BGS MODIFIED]:	Muddy Sand	Muddy Sandy Gravel	Slightly Gravelly Sand	Slightly Gravelly Sand	Gravelly Sand	Muddy Sand	Muddy Sand	Muddy Sand	Muddy Sand	Muddy Sand	Sand
	SEDIMENT NAME:	Slightly Very Fine Gravelly Very Coarse Silty Fine Sand	Medium Silty Sandy Medium Gravel	Slightly Very Fine Gravelly Fine Sand	Slightly Very Fine Gravelly Fine Sand	Very Fine Gravelly Very Coarse Sand	Slightly Very Fine Gravelly Very Coarse Silty Very Fine Sand	Slightly Very Fine Gravelly Very Coarse Silty Very Fine Sand	Slightly Very Fine Gravelly Very Coarse Silty Fine Sand	Slightly Very Fine Gravelly Very Coarse Silty Fine Sand	Very Coarse Silty Fine Sand	Slightly Very Fine Gravelly Medium Sand
METHOD OF MOMENTS Arithmetic [µm]	MEAN:	174.04	6376.52	326.48	303.02	1381.44	106.69	89.56	140.17	161.01	150.03	288.93
	SORTING:	151.01	7802.01	598.47	596.75	1204.09	112.55	123.39	138.93	156.88	134.64	139.66
	SKEWNESS:	2.30	1.39	10.60	12.12	3.14	13.74	12.78	8.20	1.87	2.22	7.43
	KURTOSIS:	15.85	3.91	143.97	174.83	19.04	337.04	295.16	152.75	8.56	11.96	131.02
METHOD OF MOMENTS Geometric [µm]	MEAN:	104.50	1715.59	223.71	207.20	963.03	72.42	50.87	90.60	84.27	88.21	264.43
	SORTING:	3.53	9.00	2.22	2.34	2.65	2.95	3.51	3.13	4.06	3.61	1.45
	SKEWNESS:	-1.47	-1.01	-0.83	-1.56	-1.76	-1.85	-1.19	-1.64	-1.12	-1.41	0.46
	KURTOSIS:	5.18	3.62	11.18	12.09	9.80	7.14	4.49	6.29	3.98	5.00	4.73
METHOD OF MOMENTS Logarithmic [Phi]	MEAN:	3.26	-0.78	2.16	2.27	0.05	3.79	4.30	3.46	3.57	3.50	1.92
	SORTING:	1.82	3.17	1.15	1.23	1.41	1.56	1.81	1.65	2.02	1.85	0.53
	SKEWNESS:	1.47	1.01	0.83	1.56	1.76	1.85	1.19	1.64	1.12	1.41	-0.46
	KURTOSIS:	5.18	3.62	11.18	12.09	9.80	7.14	4.49	6.29	3.98	5.00	4.73
FOLK AND WARD METHOD [µm]	MEAN:	123.86	1943.49	226.43	218.43	1032.70	87.62	50.66	105.85	87.60	99.86	264.88
	SORTING:	3.04	9.10	1.72	1.64	2.25	2.37	3.29	2.63	3.96	3.19	1.45
	SKEWNESS:	-0.31	-0.32	0.06	-0.05	-0.15	-0.35	-0.45	-0.34	-0.35	-0.33	0.00
	KURTOSIS:	1.70	0.97	1.13	1.06	1.09	1.93	1.45	1.81	1.30	1.70	0.98
FOLK AND WARD METHOD [Phi]	MEAN:	3.01	-0.96	2.14	2.19	-0.05	3.51	4.30	3.24	3.51	3.32	1.92
	SORTING:	1.60	3.19	0.78	0.71	1.17	1.24	1.72	1.39	1.99	1.67	0.54
	SKEWNESS:	0.31	0.32	-0.06	0.05	0.15	0.35	0.45	0.34	0.35	0.33	0.00
	KURTOSIS:	1.70	0.97	1.13	1.06	1.09	1.93	1.45	1.81	1.30	1.70	0.98
FOLK AND WARD METHOD [Description]	MEAN:	Very Fine Sand	Very Coarse Sand	Fine Sand	Fine Sand	Very Coarse Sand	Very Fine Sand	Very Coarse Silt	Very Fine Sand	Very Fine Sand	Very Fine Sand	Medium Sand
	SORTING:	Poorly Sorted	Very Poorly Sorted	Moderately Sorted	Moderately Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Moderately Well Sorted
	SKEWNESS:	Very Fine Skewed	Very Fine Skewed	Symmetrical	Symmetrical	Fine Skewed	Very Fine Skewed	Very Fine Skewed	Very Fine Skewed	Very Fine Skewed	Very Fine Skewed	Symmetrical
	KURTOSIS:	Very Leptokurtic	Mesokurtic	Leptokurtic	Mesokurtic	Mesokurtic	Very Leptokurtic	Leptokurtic	Very Leptokurtic	Leptokurtic	Very Leptokurtic	Mesokurtic
	MODE 1 [µm]:	150.89	13600.00	213.39	213.39	1200.00	106.69	75.44	150.89	150.89	106.69	301.78
	MODE 2 [µm]:	0.00	4800.00	0.00	0.00	0.00	0.00	9.43	0.00	9.43	0.00	0.00
	MODE 3 [µm]:	0.00	2400.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MODE 1 [Phi]:	2.75	-3.74	2.25	2.25	-0.24	3.25	3.75	2.75	2.75	3.25	1.75
	MODE 2 [Phi]:	0.00	-2.24	0.00	0.00	0.00	0.00	6.75	0.00	6.75	0.00	0.00
	MODE 3 [Phi]:	0.00	-1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	D10 [µm]:	13.34	105.06	120.10	115.98	347.57	14.19	7.12	16.79	8.96	11.19	163.13
	D50 [µm]:	137.06	2724.42	224.50	220.60	1091.91	93.71	70.57	116.24	115.47	116.44	263.78
	D90 [µm]:	350.91	18475.96	455.84	415.88	2618.21	176.15	162.86	245.12	361.09	311.10	434.27
	(D90 / D10) [µm]:	26.30	175.87	3.80	3.59	7.53	12.41	22.88	14.60	40.31	27.81	2.66
	(D90 - D10) [µm]:	337.57	18370.90	335.74	299.91	2270.65	161.95	155.74	228.33	352.14	299.92	271.15
	(D75 / D25) [µm]:	2.88	23.55	1.99	1.93	2.85	2.16	3.15	2.43	4.36	2.93	1.67
	(D75 - D25) [µm]:	147.25	9762.26	158.68	148.04	1143.55	72.13	75.90	101.95	168.82	127.22	135.18
	D10 [Phi]:	1.51	-4.21	1.13	1.27	-1.39	2.51	2.62	2.03	1.47	1.68	1.20
	D50 [Phi]:	2.87	-1.45	2.16	2.18	-0.13	3.42	3.82	3.10	3.11	3.10	1.92
	D90 [Phi]:	6.23	3.25	3.06	3.11	1.52	6.14	7.13	5.90	6.80	6.48	2.62
	(D90 / D10) [Phi]:	4.12	-0.77	2.70	2.46	-1.10	2.45	2.72	2.91	4.63	3.85	2.17
	(D90 - D10) [Phi]:	4.72	7.46	1.92	1.84	2.91	3.63	4.52	3.87	5.33	4.80	1.41
	(D75 / D25) [Phi]:	1.71	-0.36	1.60	1.56	-0.85	1.38	1.52	1.51	1.97	1.65	1.47
	(D75 - D25) [Phi]:	1.52	4.56	0.99	0.95	1.51	1.11	1.66	1.28	2.12	1.55	0.74
	% GRAVEL [63000 - 2000 µm]:	0.02	56.62	1.37	1.01	18.93	0.06	0.05	0.06	0.00	0.00	0.06
	% SAND [< 2000 - 63 µm]:	81.37	35.37	95.54	94.45	79.26	74.77	56.81	79.90	70.92	76.91	99.94
	% MUD [< 63 µm]:	18.61	8.02	3.09	4.54	1.82	25.17	43.14	20.03	29.08	23.09	0.00
	% V COARSE GRAVEL:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	% COARSE GRAVEL:	0.00	12.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	% MEDIUM GRAVEL:	0.00	17.03	0.22	0.27	0.72	0.00	0.00	0.00	0.00	0.00	0.00
	% FINE GRAVEL:	0.00	12.82	0.30	0.21	1.54	0.00	0.00	0.00	0.00	0.00	0.00
	% V FINE GRAVEL:	0.02	14.36	0.85	0.53	16.67	0.06	0.05	0.06	0.00	0.00	0.06
	% V COARSE SAND:	0.05	11.81	1.67	1.39	36.04	0.05	0.06	0.04	0.07	0.05	0.38
	% COARSE SAND:	3.68	5.45	4.00	1.91	27.30	0.70	1.07	1.58	3.93	2.51	2.58
	% MEDIUM SAND:	16.61	6.45	34.22	35.05	11.61	0.98	1.75	7.49	16.21	12.55	52.44
	% FINE SAND:	34.68	8.54	47.92	49.24	3.23	27.17	15.82	36.39	26.69	31.19	43.68
	% V FINE SAND:	26.36	3.11	7.73	6.85	1.08	45.88	38.11	34.40	24.01	30.61	0.85
	% V COARSE SILT:	4.44	1.06	0.30	0.53	0.36	12.40	20.49	7.06	10.05	7.73	0.00
	% COARSE SILT:	3.18	1.69	1.27	1.52	0.42	2.18	5.36	3.36	4.73	3.24	0.00
	% MEDIUM SILT:	4.31	2.05	0.54	0.81	0.49	4.12	6.48	3.66	5.37	4.38	0.00
	% FINE SILT:	3.62	1.83	0.69	1.04	0.41	3.06	5.43	3.00	4.68	3.86	0.00
	% V FINE SILT:	1.98	0.89	0.29	0.64	0.15	1.97	3.04	1.81	2.55	2.38	0.00
	% CLAY:	1.10	0.50	0.00	0.01	0.00	1.45	2.34	1.15	1.70	1.51	0.00

Appendix 5 – Sediment chemistry results

Cefas (2003) guideline values

	Existing AL 1	Existing AL 2	Revised AL1	Revised AL2
Arsenic (As)	20	50-100	20	70
Cadmium (Cd)	0.4	2	0.4	4
Chromium (Cr)	40	400	50	370
Copper (Cu)	40	400	30	300
Mercury (Hg)	0.3	3	0.25	1.5
Nickel (Ni)	20	200	30	150
Lead (Pb)	50	500	50	400
Zinc (Zn)	130	800	130	600
Tributyltin (TBT,DBT,MBT)	0.1	1	0.1	0.5
Polychlorinated Biphenyls (PCBs)	0.02	0.2	0.02	0.18
Polyaromatic Hydrocarbons				
Acenaphthene			0.1	
Acenaphthylene			0.1	
Anthracene			0.1	
Fluorene			0.1	
Naphthalene			0.1	
Phenanthrene			0.1	
Benzo[a]anthracene			0.1	
Benzo[b]fluoranthene			0.1	
Benzo[k]fluoranthene			0.1	
Benzo[g]perylene			0.1	
Benzo[a]pyrene			0.1	
Benzo[g,h,i]perylene			0.1	
Dibenzo[a,h]anthracene			0.01	
Chrysene			0.1	
Fluoranthene			0.1	
Pyrene			0.1	
Indeno(1,2,3cd)pyrene			0.1	
Total hydrocarbons	100		100	

Note: All results presented as mg.kg-1 (ppm) dry weight

OSPAR CSEMP metal guideline values taken from:
http://www.bodc.ac.uk/projects/uk/merman/assessments_and_data_access/csemp/help/assessment_criteria/sediment/metals.html

	BAC	ERL
Arsenic	25	8.2
Cadmium	0.31	1.2
Chromium	81	81
Copper	27	34
Mercury	0.07	0.15
Nickel	36	21
Lead	38	47
Zinc	122	150

Notes:

- all concentrations are expressed as mg kg-1> dw
- BACs are normalised to 5% aluminium
- for arsenic and nickel, the ERLs are below the OSPAR Background Concentrations of 15 and 30 mg/kg-1 respectively; concentrations are only assessed against the BAC
- for chromium, the ERL equals the BAC; concentrations are only assessed against the ERL

OSPAR CSEMP PAH guideline values taken from:
http://www.bodc.ac.uk/projects/uk/merman/assessments_and_data_access/csemp/help/assessment_criteria/sediment/polycyclic_aromatic_hydrocarbons.html

	BAC	ERL
Naphthalene	8	160
C1-naphthalene	-	155
C2-naphthalene	-	150
Phenanthrene	32	240
C1-phenanthrene	-	170
C2-phenanthrene	-	200
Anthracene	5	85
Dibenzothiophene	-	190
C1-dibenzothiophene	-	85
Fluoranthene	39	600
Pyrene	24	665
Benz[a]anthracene	16	261
Chrysene (Triphenylene)	20	384
Benzo[a]pyrene	30	430
Benzo[ghi]perylene	80	85
Indeno[123-cd]pyrene	103	240

Notes

- all concentrations are expressed as µg kg-1 dw
- BACs are normalised to 2.5% organic carbon in all subregions
- the ERL for C2-naphthalene is the sum of the ERLs for 1-methyl naphthalene and 2-methyl naphthalene

Canadian (CCME 2001) guideline values:

Metals	Units	ISQG / TEL	PEL
Arsenic	$mg.kg^{-1}$	7.24	41.6
Cadmium	$mg.kg^{-1}$	0.7	4.2
Chromium	$mg.kg^{-1}$	52.3	160
Copper	$mg.kg^{-1}$	18.7	108
Lead	$mg.kg^{-1}$	30.2	112
Mercury	$mg.kg^{-1}$	0.13	0.7
Zinc	$mg.kg^{-1}$	124	271
PAH	**Units**	**ISQG / TEL**	**PEL**
2-Methylnaphthalene	$\mu g.kg^{-1}$	20.2	201
Acenaphthene	$\mu g.kg^{-1}$	6.71	88.9
Acenaphthylene	$\mu g.kg^{-1}$	5.87	128
Anthracene	$\mu g.kg^{-1}$	46.9	245
Benz(a)anthracene	$\mu g.kg^{-1}$	74.8	693
Benzo(a)pyrene	$\mu g.kg^{-1}$	88.8	763
Chrysene	$\mu g.kg^{-1}$	108	846
Dibenz(a,h)anthracene	$\mu g.kg^{-1}$	6.22	135
Fluoranthene	$\mu g.kg^{-1}$	113	1494
Fluorene	$\mu g.kg^{-1}$	21.2	144
Naphthalene	$\mu g.kg^{-1}$	34.6	391
Phenanthrene	$\mu g.kg^{-1}$	86.7	544
Pyrene	$mg.kg^{-1}$	153	1398

Analytical Results

National Laboratory Service

Analytical Report

Partial Reports - results awaited - awaiting LSM approval

Report ID - 20065720 - 1

UKAS TESTING
0754

Batch description: J/3/08/2610 - Moray Sediment Analysis

Reported on:
11-Jun-2014

James Hutchinson
Fugro EMU Ltd
Trafalgar Wharf - Unit 16
Hamilton Road
Portchester
Porstmouth
PO6 4PX

Dear James

Please find attached the results for the batch of 11 samples described below.

Samples Registered on:	28-May-2014
Analysis Started on:	29-May-2014
Analysis Completed on:	11-Jun-2014
Results for Batch Number	20065720
Your Purchase Order Number:	E42027

You will be invoiced shortly by our accounts department.

If we can be of further assistance then please do not hesitate to contact us.

Yours sincerely

William Fardon
Customer Services Team Manager
Tel: (0113) 231 2177
nls@environment-agency.gov.uk

National Laboratory Service

Analytical Report

Partial Reports - results awaited - awaiting LSM approval

Report ID - 20065720 - 1

UKAS TESTING 0754

Batch description: J/3/08/2610 - Moray Sediment Analysis

Reported on: 11-Jun-2014

Client: Fugro EMU Ltd

Project: P Moray Sediment

Sample Point Name: CC Fugro EMU Ltd

Folder No: 002801373

Sampled on: 24-May-14 @ (Time not supplied)

Comments: KPA58 (LR- 12599) - 52.0m

Quote No: 11244

Matrix: Sediment

Analyte	Result	Units	Flag	MRV	Accred	Lab ID	Testcode
Hydrocarbons : Total : Dry Wt as Ekofisk	0.502	mg/kg		0.05	UKAS	LE	402
Mercury : Dry Wt	0.00352	mg/kg		0.002	UKAS	LE	1082
Aluminium, HF Digest : Dry Wt	16700	mg/kg		50	UKAS	LE	756
Barium, HF Digest : Dry Wt	259	mg/kg		20	None	LE	756
Arsenic, HF Digest : Dry Wt	5.46	mg/kg		0.4	UKAS	LE	341
Cadmium, HF Digest : Dry Wt	0.0560	mg/kg		0.03	UKAS	LE	341
Chromium, HF Digest : Dry Wt	25.0	mg/kg		3	UKAS	LE	341
Copper, HF Digest : Dry Wt	3.51	mg/kg		1	UKAS	LE	341
Lead, HF Digest : Dry Wt	9.62	mg/kg		3	UKAS	LE	341
Nickel, HF Digest : Dry Wt	4.19	mg/kg		1	UKAS	LE	341
Tin, HF Digest : Dry Wt	0.806	mg/kg		0.5	None	LE	341
Zinc : HF Digest : Dry Wt	10.2	mg/kg		5	UKAS	LE	341
Dibutyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dioctyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Diphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	None	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tetrabutyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tributyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Triphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dry Solids @ 30°C	71.7	%		0.5	None	LE	1130

National Laboratory Service

Analytical Report

Partial Reports - results awaited - awaiting LSM approval

Report ID - 20065720 - 1

UKAS TESTING 0754

Batch description: J/3/08/2610 - Moray Sediment Analysis

Reported on: 11-Jun-2014

Client: Fugro EMU Ltd

Project: P Moray Sediment

Sample Point Name: CC Fugro EMU Ltd

Folder No: 002801374

Sampled on: 24-May-14 @ (Time not supplied)

Comments: KPA50 (LR- 12600) - 51.2m

Quote No: 11244

Matrix: Sediment

Analyte	Result	Units	Flag	MRV	Accred	Lab ID	Testcode
Hydrocarbons : Total : Dry Wt as Ekofisk	0.436	mg/kg		0.05	UKAS	LE	402
Mercury : Dry Wt	0.00381	mg/kg		0.002	UKAS	LE	1082
Aluminium, HF Digest : Dry Wt	19200	mg/kg		50	UKAS	LE	756
Barium, HF Digest : Dry Wt	257	mg/kg		20	None	LE	756
Arsenic, HF Digest : Dry Wt	3.20	mg/kg		0.4	UKAS	LE	341
Cadmium, HF Digest : Dry Wt	0.0420	mg/kg		0.03	UKAS	LE	341
Chromium, HF Digest : Dry Wt	12.5	mg/kg		3	UKAS	LE	341
Copper, HF Digest : Dry Wt	2.52	mg/kg		1	UKAS	LE	341
Lead, HF Digest : Dry Wt	7.89	mg/kg		3	UKAS	LE	341
Nickel, HF Digest : Dry Wt	3.70	mg/kg		1	UKAS	LE	341
Tin, HF Digest : Dry Wt	0.553	mg/kg		0.5	None	LE	341
Zinc : HF Digest : Dry Wt	8.40	mg/kg		5	UKAS	LE	341
Dibutyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dioctyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Diphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	None	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tetrabutyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tributyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Triphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dry Solids @ 30°C	75.2	%		0.5	None	LE	1130

National Laboratory Service

Analytical Report

Partial Reports - results awaited - awaiting LSM approval

Report ID - 20065720 - 1

UKAS TESTING 0754

Batch description: J/3/08/2610 - Moray Sediment Analysis

Reported on: 11-Jun-2014

Client: Fugro EMU Ltd

Project: P Moray Sediment

Sample Point Name: CC Fugro EMU Ltd

Folder No: 002801375

Sampled on: 24-May-14 @ (Time not supplied)

Comments: KPA45 (LR- 12601) - 54.8m

Quote No: 11244

Matrix: Sediment

Analyte	Result	Units	Flag	MRV	Accred	Lab ID	Testcode
Hydrocarbons : Total : Dry Wt as Ekofisk	0.801	mg/kg		0.05	UKAS	LE	402
Mercury : Dry Wt	0.00538	mg/kg		0.002	UKAS	LE	1082
Aluminium, HF Digest : Dry Wt	6770	mg/kg		50	UKAS	LE	756
Barium, HF Digest : Dry Wt	115	mg/kg		20	None	LE	756
Arsenic, HF Digest : Dry Wt	24.6	mg/kg		0.4	UKAS	LE	341
Cadmium, HF Digest : Dry Wt	0.0380	mg/kg		0.03	UKAS	LE	341
Chromium, HF Digest : Dry Wt	10.2	mg/kg		3	UKAS	LE	341
Copper, HF Digest : Dry Wt	2.05	mg/kg		1	UKAS	LE	341
Lead, HF Digest : Dry Wt	8.86	mg/kg		3	UKAS	LE	341
Nickel, HF Digest : Dry Wt	3.64	mg/kg		1	UKAS	LE	341
Tin, HF Digest : Dry Wt	<0.5	mg/kg		0.5	None	LE	341
Zinc : HF Digest : Dry Wt	10.0	mg/kg		5	UKAS	LE	341
Dibutyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dioctyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Diphenyl Tin : Dry Wt as Cation	<2	ug/kg		2	None	LE	897
Tetrabutyl Tin : Dry Wt as Cation	<2	ug/kg		2	UKAS	LE	897
Tributyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Triphenyl Tin : Dry Wt as Cation	<2	ug/kg		2	UKAS	LE	897
Dry Solids @ 30°C	83.9	%		0.5	None	LE	1130

National Laboratory Service

Analytical Report

Partial Reports - results awaited - awaiting LSM approval

Report ID - 20065720 - 1

UKAS TESTING 0754

Batch description: J/3/08/2610 - Moray Sediment Analysis

Reported on: 11-Jun-2014

Client: Fugro EMU Ltd

Project: P Moray Sediment

Sample Point Name: CC Fugro EMU Ltd

Folder No: 002801376

Sampled on: 24-May-14 @ (Time not supplied)

Comments: KPA37 (LR- 12602) - 70.0m

Quote No: 11244

Matrix: Sediment

Analyte	Result	Units	Flag	MRV	Accred	Lab ID	Testcode
Hydrocarbons : Total : Dry Wt as Ekofisk	1.63	mg/kg		0.05	UKAS	LE	402
Mercury : Dry Wt	0.0113	mg/kg		0.002	UKAS	LE	1082
Aluminium, HF Digest : Dry Wt	21400	mg/kg		50	UKAS	LE	756
Barium, HF Digest : Dry Wt	308	mg/kg		20	None	LE	756
Arsenic, HF Digest : Dry Wt	4.07	mg/kg		0.4	UKAS	LE	341
Cadmium, HF Digest : Dry Wt	0.171	mg/kg		0.03	UKAS	LE	341
Chromium, HF Digest : Dry Wt	67.1	mg/kg		3	UKAS	LE	341
Copper, HF Digest : Dry Wt	6.36	mg/kg		1	UKAS	LE	341
Lead, HF Digest : Dry Wt	9.04	mg/kg		3	UKAS	LE	341
Nickel, HF Digest : Dry Wt	14.6	mg/kg		1	UKAS	LE	341
Tin, HF Digest : Dry Wt	1.20	mg/kg		0.5	None	LE	341
Zinc : HF Digest : Dry Wt	26.5	mg/kg		5	UKAS	LE	341
Dibutyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dioctyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Diphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	None	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tetrabutyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tributyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Triphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dry Solids @ 30°C	67.2	%		0.5	None	LE	1130

National Laboratory Service

Analytical Report

Partial Reports - results awaited - awaiting LSM approval

Report ID - 20065720 - 1

UKAS TESTING 0754

Batch description: J/3/08/2610 - Moray Sediment Analysis

Reported on: 11-Jun-2014

Client: Fugro EMU Ltd

Project: P Moray Sediment

Sample Point Name: CC Fugro EMU Ltd

Folder No: 002801377

Sampled on: 24-May-14 @ (Time not supplied)

Comments: KPA30 (LR- 12603) - 87.1m

Quote No: 11244

Matrix: Sediment

Analyte	Result	Units	Flag	MRV	Accred	Lab ID	Testcode
Hydrocarbons : Total : Dry Wt as Ekofisk	2.63	mg/kg		0.05	UKAS	LE	402
Mercury : Dry Wt	0.0134	mg/kg		0.002	UKAS	LE	1082
Aluminium, HF Digest : Dry Wt	29800	mg/kg		50	UKAS	LE	756
Barium, HF Digest : Dry Wt	320	mg/kg		20	None	LE	756
Arsenic, HF Digest : Dry Wt	4.90	mg/kg		0.4	UKAS	LE	341
Cadmium, HF Digest : Dry Wt	0.141	mg/kg		0.03	UKAS	LE	341
Chromium, HF Digest : Dry Wt	70.7	mg/kg		3	UKAS	LE	341
Copper, HF Digest : Dry Wt	6.01	mg/kg		1	UKAS	LE	341
Lead, HF Digest : Dry Wt	9.99	mg/kg		3	UKAS	LE	341
Nickel, HF Digest : Dry Wt	15.6	mg/kg		1	UKAS	LE	341
Tin, HF Digest : Dry Wt	1.25	mg/kg		0.5	None	LE	341
Zinc : HF Digest : Dry Wt	28.7	mg/kg		5	UKAS	LE	341
Dibutyl Tin : Dry Wt as Cation	<5	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dioctyl Tin : Dry Wt as Cation	<5	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Diphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	None	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tetrabutyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tributyl Tin : Dry Wt as Cation	<5	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Triphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dry Solids @ 30°C	63.6	%		0.5	None	LE	1130

National Laboratory Service

Analytical Report

Partial Reports - results awaited - awaiting LSM approval

Report ID - 20065720 - 1

UKAS TESTING 0754

Batch description: J/3/08/2610 - Moray Sediment Analysis

Reported on: 11-Jun-2014

Client: Fugro EMU Ltd

Project: P Moray Sediment

Sample Point Name: CC Fugro EMU Ltd

Folder No: 002801378

Sampled on: 24-May-14 @ (Time not supplied)

Comments: KPA21 (LR- 12604) - 75.1m

Quote No: 11244

Matrix: Sediment

Analyte	Result	Units	Flag	MRV	Accred	Lab ID	Testcode
Hydrocarbons : Total : Dry Wt as Ekofisk	1.52	mg/kg		0.05	UKAS	LE	402
Mercury : Dry Wt	0.0113	mg/kg		0.002	UKAS	LE	1082
Aluminium, HF Digest : Dry Wt	31000	mg/kg		50	UKAS	LE	756
Barium, HF Digest : Dry Wt	347	mg/kg		20	None	LE	756
Arsenic, HF Digest : Dry Wt	4.75	mg/kg		0.4	UKAS	LE	341
Cadmium, HF Digest : Dry Wt	0.140	mg/kg		0.03	UKAS	LE	341
Chromium, HF Digest : Dry Wt	53.6	mg/kg		3	UKAS	LE	341
Copper, HF Digest : Dry Wt	6.28	mg/kg		1	UKAS	LE	341
Lead, HF Digest : Dry Wt	10.1	mg/kg		3	UKAS	LE	341
Nickel, HF Digest : Dry Wt	14.7	mg/kg		1	UKAS	LE	341
Tin, HF Digest : Dry Wt	1.28	mg/kg		0.5	None	LE	341
Zinc : HF Digest : Dry Wt	28.5	mg/kg		5	UKAS	LE	341
Dibutyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dioctyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Diphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	None	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tetrabutyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tributyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Triphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dry Solids @ 30°C	71.9	%		0.5	None	LE	1130

National Laboratory Service

Analytical Report

Partial Reports - results awaited - awaiting LSM approval

Report ID - 20065720 - 1

UKAS TESTING 0754

Batch description: J/3/08/2610 - Moray Sediment Analysis

Reported on: 11-Jun-2014

Client: Fugro EMU Ltd

Project: P Moray Sediment

Sample Point Name: CC Fugro EMU Ltd

Folder No: 002801379

Sampled on: 24-May-14 @ (Time not supplied)

Comments: KPA17 (LR- 12605) - 84.3m

Quote No: 11244

Matrix: Sediment

Analyte	Result	Units	Flag	MRV	Accred	Lab ID	Testcode
Hydrocarbons : Total : Dry Wt as Ekofisk	2.36	mg/kg		0.05	UKAS	LE	402
Mercury : Dry Wt	0.0165	mg/kg		0.002	UKAS	LE	1082
Aluminium, HF Digest : Dry Wt	13700	mg/kg		50	UKAS	LE	756
Barium, HF Digest : Dry Wt	339	mg/kg		20	None	LE	756
Arsenic, HF Digest : Dry Wt	4.91	mg/kg		0.4	UKAS	LE	341
Cadmium, HF Digest : Dry Wt	0.132	mg/kg		0.03	UKAS	LE	341
Chromium, HF Digest : Dry Wt	46.8	mg/kg		3	UKAS	LE	341
Copper, HF Digest : Dry Wt	6.67	mg/kg		1	UKAS	LE	341
Lead, HF Digest : Dry Wt	10.8	mg/kg		3	UKAS	LE	341
Nickel, HF Digest : Dry Wt	15.5	mg/kg		1	UKAS	LE	341
Tin, HF Digest : Dry Wt	1.24	mg/kg		0.5	None	LE	341
Zinc : HF Digest : Dry Wt	31.3	mg/kg		5	UKAS	LE	341
Dibutyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dioctyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Diphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	None	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tetrabutyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tributyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Triphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dry Solids @ 30°C	69.6	%		0.5	None	LE	1130

National Laboratory Service

Analytical Report

Partial Reports - results awaited - awaiting LSM approval

Report ID - 20065720 - 1

UKAS TESTING 0754

Batch description: J/3/08/2610 - Moray Sediment Analysis

Reported on: 11-Jun-2014

Client: Fugro EMU Ltd

Project: P Moray Sediment

Sample Point Name: CC Fugro EMU Ltd

Folder No: 002801380

Sampled on: 24-May-14 @ (Time not supplied)

Comments: KPA12 (LR- 12606) - 94.0m

Quote No: 11244

Matrix: Sediment

Analyte	Result	Units	Flag	MRV	Accred	Lab ID	Testcode
Hydrocarbons : Total : Dry Wt as Ekofisk	1.87	mg/kg		0.05	UKAS	LE	402
Mercury : Dry Wt	0.0184	mg/kg		0.002	UKAS	LE	1082
Aluminium, HF Digest : Dry Wt	15600	mg/kg		50	UKAS	LE	756
Barium, HF Digest : Dry Wt	419	mg/kg		20	None	LE	756
Arsenic, HF Digest : Dry Wt	5.94	mg/kg		0.4	UKAS	LE	341
Cadmium, HF Digest : Dry Wt	0.148	mg/kg		0.03	UKAS	LE	341
Chromium, HF Digest : Dry Wt	58.8	mg/kg		3	UKAS	LE	341
Copper, HF Digest : Dry Wt	7.40	mg/kg		1	UKAS	LE	341
Lead, HF Digest : Dry Wt	12.2	mg/kg		3	UKAS	LE	341
Nickel, HF Digest : Dry Wt	17.2	mg/kg		1	UKAS	LE	341
Tin, HF Digest : Dry Wt	1.38	mg/kg		0.5	None	LE	341
Zinc : HF Digest : Dry Wt	33.4	mg/kg		5	UKAS	LE	341
Dibutyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dioctyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Diphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	None	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tetrabutyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tributyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Triphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dry Solids @ 30°C	69.3	%		0.5	None	LE	1130

National Laboratory Service

Analytical Report

Partial Reports - results awaited - awaiting LSM approval

Report ID - 20065720 - 1

UKAS TESTING 0754

Batch description: J/3/08/2610 - Moray Sediment Analysis

Reported on: 11-Jun-2014

Client: Fugro EMU Ltd

Project: P Moray Sediment

Sample Point Name: CC Fugro EMU Ltd

Folder No: 002801381

Sampled on: 24-May-14 @ (Time not supplied)

Comments: KPA2 (LR- 12608) - 86.6m

Quote No: 11244

Matrix: Sediment

Analyte	Result	Units	Flag	MRV	Accred	Lab ID	Testcode
Hydrocarbons : Total : Dry Wt as Ekofisk	1.67	mg/kg		0.05	UKAS	LE	402
Mercury : Dry Wt	0.0230	mg/kg		0.002	UKAS	LE	1082
Aluminium, HF Digest : Dry Wt	16100	mg/kg		50	UKAS	LE	756
Barium, HF Digest : Dry Wt	434	mg/kg		20	None	LE	756
Arsenic, HF Digest : Dry Wt	6.07	mg/kg		0.4	UKAS	LE	341
Cadmium, HF Digest : Dry Wt	0.149	mg/kg		0.03	UKAS	LE	341
Chromium, HF Digest : Dry Wt	55.0	mg/kg		3	UKAS	LE	341
Copper, HF Digest : Dry Wt	7.82	mg/kg		1	UKAS	LE	341
Lead, HF Digest : Dry Wt	13.5	mg/kg		3	UKAS	LE	341
Nickel, HF Digest : Dry Wt	16.1	mg/kg		1	UKAS	LE	341
Tin, HF Digest : Dry Wt	1.62	mg/kg		0.5	None	LE	341
Zinc : HF Digest : Dry Wt	36.2	mg/kg		5	UKAS	LE	341
Dibutyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dioctyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Diphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	None	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tetrabutyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tributyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Triphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dry Solids @ 30°C	70.6	%		0.5	None	LE	1130

National Laboratory Service

Analytical Report

Partial Reports - results awaited - awaiting LSM approval

Report ID - 20065720 - 1

UKAS TESTING 0754

Batch description: J/3/08/2610 - Moray Sediment Analysis

Reported on: 11-Jun-2014

Client: Fugro EMU Ltd

Project: P Moray Sediment

Sample Point Name: CC Fugro EMU Ltd

Folder No: 002801382

Sampled on: 24-May-14 @ (Time not supplied)

Comments: KPB12 (LR- 12648) - 37.4m

Quote No: 11244

Matrix: Sediment

Analyte	Result	Units	Flag	MRV	Accred	Lab ID	Testcode
Hydrocarbons : Total : Dry Wt as Ekofisk	3.21	mg/kg		0.05	UKAS	LE	402
Mercury : Dry Wt	0.0235	mg/kg		0.002	UKAS	LE	1082
Aluminium, HF Digest : Dry Wt	37300	mg/kg		50	UKAS	LE	756
Barium, HF Digest : Dry Wt	436	mg/kg		20	None	LE	756
Arsenic, HF Digest : Dry Wt	11.2	mg/kg		0.4	UKAS	LE	341
Cadmium, HF Digest : Dry Wt	0.151	mg/kg		0.03	UKAS	LE	341
Chromium, HF Digest : Dry Wt	52.7	mg/kg		3	UKAS	LE	341
Copper, HF Digest : Dry Wt	10.6	mg/kg		1	UKAS	LE	341
Lead, HF Digest : Dry Wt	17.3	mg/kg		3	UKAS	LE	341
Nickel, HF Digest : Dry Wt	19.7	mg/kg		1	UKAS	LE	341
Tin, HF Digest : Dry Wt	1.93	mg/kg		0.5	None	LE	341
Zinc : HF Digest : Dry Wt	48.2	mg/kg		5	UKAS	LE	341
Dibutyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dioctyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Diphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	None	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tetrabutyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Tributyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Triphenyl Tin : Dry Wt as Cation	<3	ug/kg		2	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dry Solids @ 30°C	76.0	%		0.5	None	LE	1130

National Laboratory Service

Analytical Report

Partial Reports - results awaited - awaiting LSM approval

Report ID - 20065720 - 1

UKAS TESTING 0754

Batch description: J/3/08/2610 - Moray Sediment Analysis

Reported on: 11-Jun-2014

Client: Fugro EMU Ltd

Project: P Moray Sediment

Sample Point Name: CC Fugro EMU Ltd

Folder No: 002801383

Sampled on: 24-May-14 @ (Time not supplied)

Comments: KPB7 (LR- 12649) - 20.0m

Quote No: 11244

Matrix: Sediment

Analyte	Result	Units	Flag	MRV	Accred	Lab ID	Testcode
Hydrocarbons : Total : Dry Wt as Ekofisk	0.140	mg/kg		0.05	UKAS	LE	402
Mercury : Dry Wt	<0.002	mg/kg		0.002	UKAS	LE	1082
Aluminium, HF Digest : Dry Wt	19600	mg/kg		50	UKAS	LE	756
Barium, HF Digest : Dry Wt	270	mg/kg		20	None	LE	756
Arsenic, HF Digest : Dry Wt	4.87	mg/kg		0.4	UKAS	LE	341
Cadmium, HF Digest : Dry Wt	0.0700	mg/kg		0.03	UKAS	LE	341
Chromium, HF Digest : Dry Wt	11.4	mg/kg		3	UKAS	LE	341
Copper, HF Digest : Dry Wt	2.04	mg/kg		1	UKAS	LE	341
Lead, HF Digest : Dry Wt	6.65	mg/kg		3	UKAS	LE	341
Nickel, HF Digest : Dry Wt	3.30	mg/kg		1	UKAS	LE	341
Tin, HF Digest : Dry Wt	0.740	mg/kg		0.5	None	LE	341
Zinc : HF Digest : Dry Wt	13.6	mg/kg		5	UKAS	LE	341
Dibutyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Dioctyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Diphenyl Tin : Dry Wt as Cation	<2	ug/kg		2	None	LE	897
Tetrabutyl Tin : Dry Wt as Cation	<2	ug/kg		2	UKAS	LE	897
Tributyl Tin : Dry Wt as Cation	<4	ug/kg		3	UKAS	LE	897
		ELEVATED_MRV : Dry weight calculation					
Triphenyl Tin : Dry Wt as Cation	<2	ug/kg		2	UKAS	LE	897
Dry Solids @ 30°C	78.0	%		0.5	None	LE	1130

National Laboratory Service

Analytical Report

Partial Reports - results awaited - awaiting LSM approval

Report ID - 20065720 - 1

Batch description: J/3/08/2610 - Moray Sediment Analysis

UKAS TESTING
0754

Reported on:
11-Jun-2014

Method Description Summary for all samples in batch Number 20065720

341	LL ME ICPMS 12.1 & 12.4 - Metals - HF Digest Open Vessel Hotplate Digest, determined by ICPMS, sieved to <63um
402	NLS I UVF 10.2 - HCs - methanol digested; pentane xch; by UV fluorescence spectrometry
756	LL ME ICPOES 22.1 & 22.2 - Metals - Open Vessel Hotplate HF digest, determined by ICPOES, sieved to <63um
897	LE O Organotins (GCMS) 01 - acetic acid/methanol extracted; derivatised; determined GCMS (SIM); from "as received" sample
1082	LL ME Hg 10.8 - Mercury - microwave aqua regia digested; acidic SnCl2 reduced; determined by CV-AFS, sieved to <63um.
1130	LE P Soil Preparation 01: The sample is air-dried at <30ºC in a controlled environment until a constant weight it achieved.

Steve Moss
Laboratory Site Manager

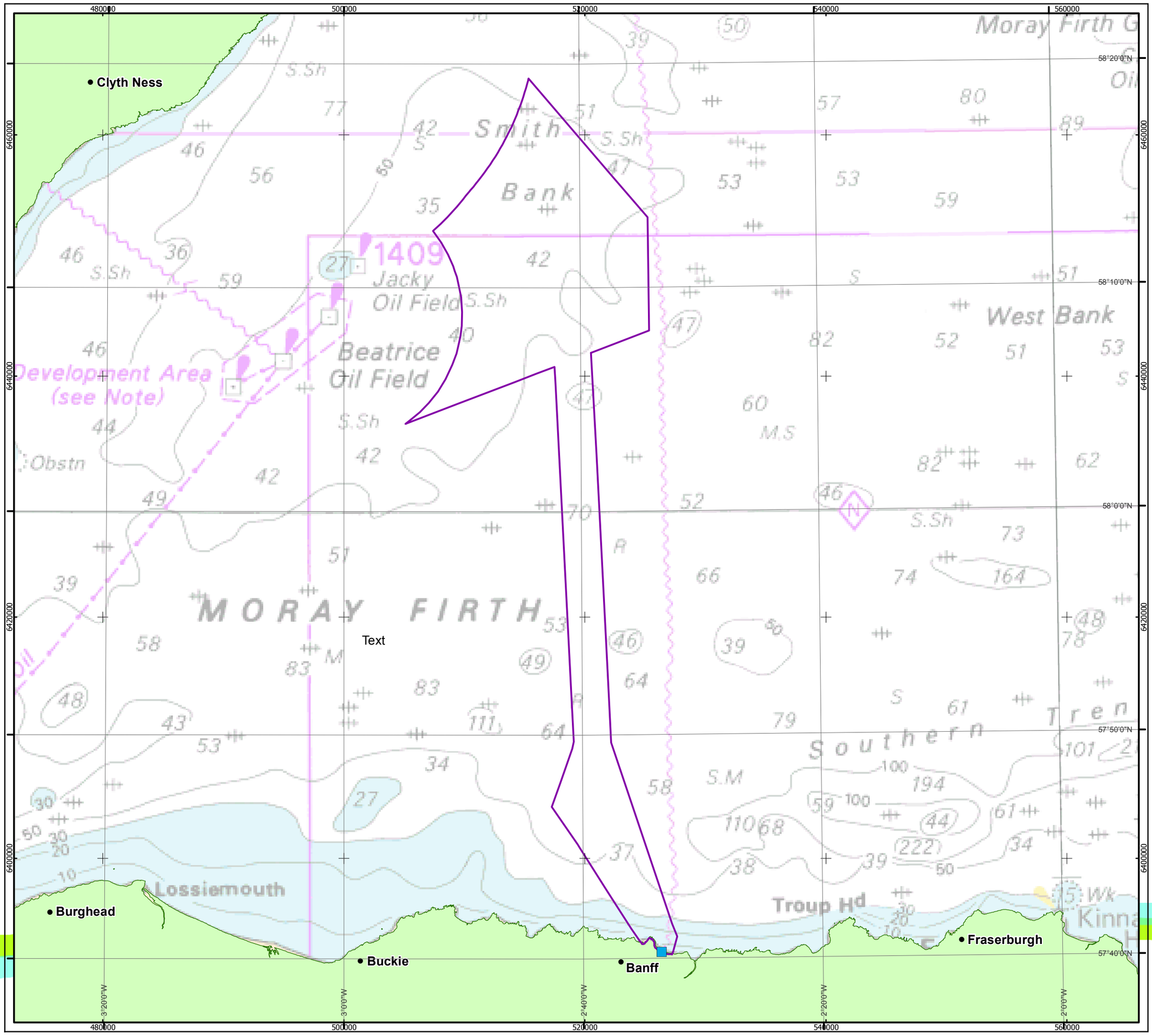
All reporting limits quoted are those achievable for clean samples of the relevant matrix. No allowance is made for instances when dilutions are necessary owing to the nature of the sample or insufficient volume of the sample being available. In these cases higher reporting limits may be **00:00:00**quoted and will be above the MRV.
Solid sample results are determined on a "dried" sample fraction except for parameters where the method description identifies that "as received" sample was used.

The analysis start date specified is the date of the first test, dates for other analysis are available on request.

Please note all samples will be retained for 10 working days for aqueous samples and 30 working days for solid samples after reporting unless otherwise agreed with Customer Services
Key to Accreditation: UKAS = Methodology accredited to ISO/IEC 17025:2005, MCertS = Methodology accredited to MCertS Performance Standard for testing of soils, none = Methodology not accredited
Key to Lab ID: LE = Leeds, NM = Nottingham, SX = Starcross, SC = Sub-Contracted outside NLS, FI = Field Data - outside NLS, NLS = Calculated
Any subsequent version of this report denoted with a higher version number will supersede this and any previous versions

END OF TEST REPORT

Chart Appendix



edp renewables
REPSOL

Moray Offshore Renewables Ltd

KEY

- Modified OfTI
- Cable Route Landing Site

Horizontal Scale: 1:300,000 A3 Chart

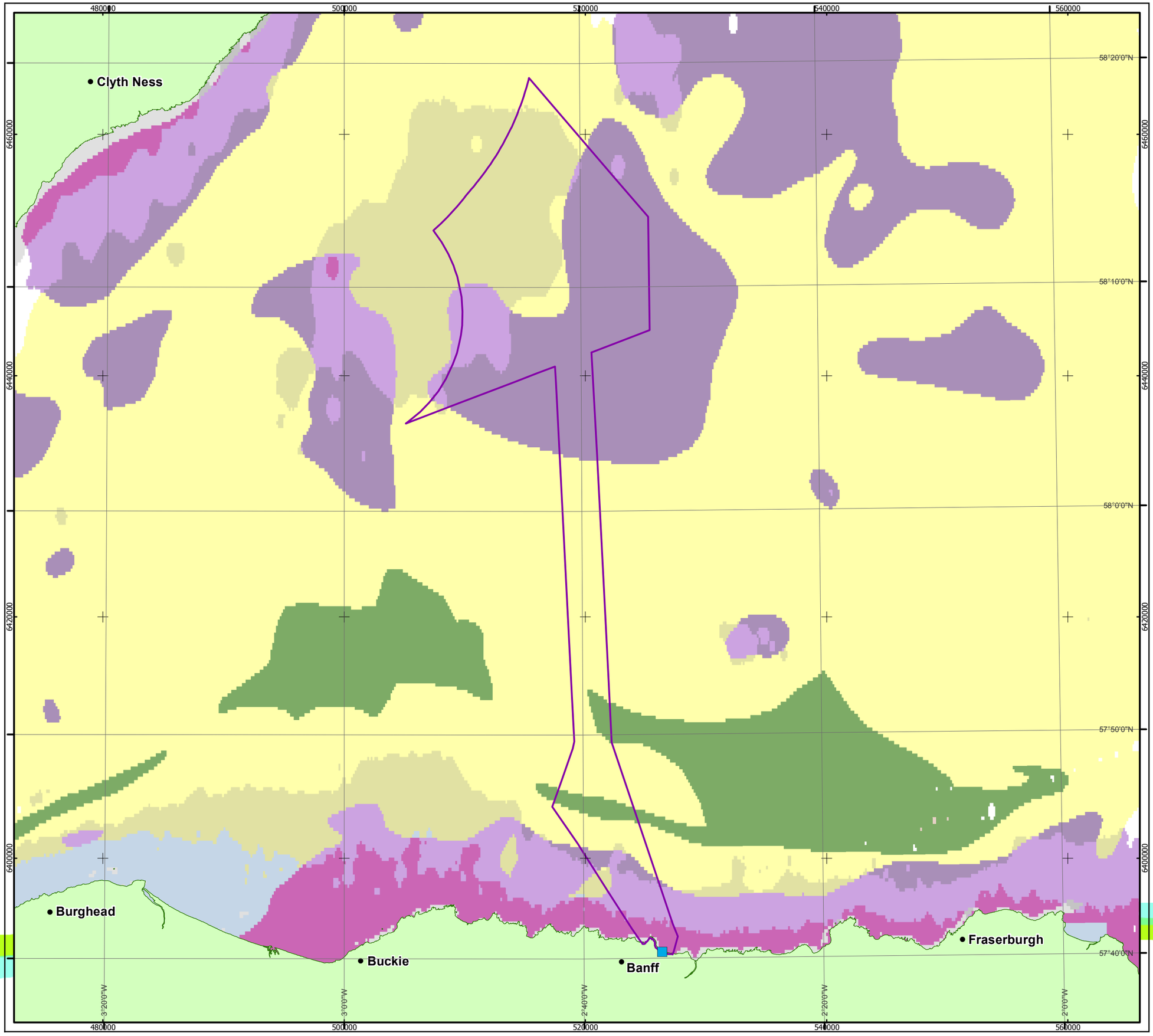
0 5,000 10,000 Metres

N

Geodetic Parameters:	WGS84 UTM Zone 30N
Produced: IMR Reviewed: ES Approved: CR	
Date: 13/06/2014	Revision: A
REF: 8460001-PSO0131-EMU-MAP-005	

Figure 1.1
Location Plot

Moray Offshore Renewables Ltd



edp renewables

REPSOL

Moray Offshore Renewables Ltd

KEY

- Modified OfTI
- Cable Route Landing Site

Potential EUNIS Habitats

- Circalittoral Coarse Sediment
- Infralittoral Coarse Sediment
- Deep Circalittoral Coarse Sediment
- Deep Circalittoral Sand
- Circalittoral Fine Sand or Circalittoral Muddy Sand
- Infralittoral Fine Sand or Infralittoral Muddy Sand
- Circalittoral Sandy Mud or Circalittoral Fine Mud
- Deep Circalittoral Mud
- Low Energy Circalittoral Rock
- Low Energy Infralittoral Rock

Horizontal Scale: 1:300,000 A3 Chart

0 5,000 10,000 Metres

N

Geodetic Parameters:	WGS84 UTM Zone 30N
Produced: IMR Reviewed: ES Approved: CR	
Date: 13/06/2014	Revision: A
REF: 8460001-PSO0131-EMU-MAP-006	

Figure 1.2
Potential MESH Habitats

Moray Offshore Renewables Ltd

480000 500000 520000 540000 560000

58°20'0"N
58°10'0"N
58°0'0"N
57°50'0"N
57°40'0"N

6460000
6440000
6420000
6400000

3°20'0"W 3°0'0"W 2°40'0"W 2°20'0"W 2°0'0"W

Clyth Ness
Burghead
Buckie
Banff
Fraserburgh

edp renewables
REPSOL

Moray Offshore Renewables Ltd

KEY

- Modified OfTI
- Cable Route Landing Site

OSPAR Habitats 2014

- *Lophelia pertusa* Reefs
- Sea-pen and Burrowing Megafauna Communities

Horizontal Scale: 1:300,000 A3 Chart

0 5,000 10,000 Metres

N

Geodetic Parameters: WGS84 UTM Zone 30N

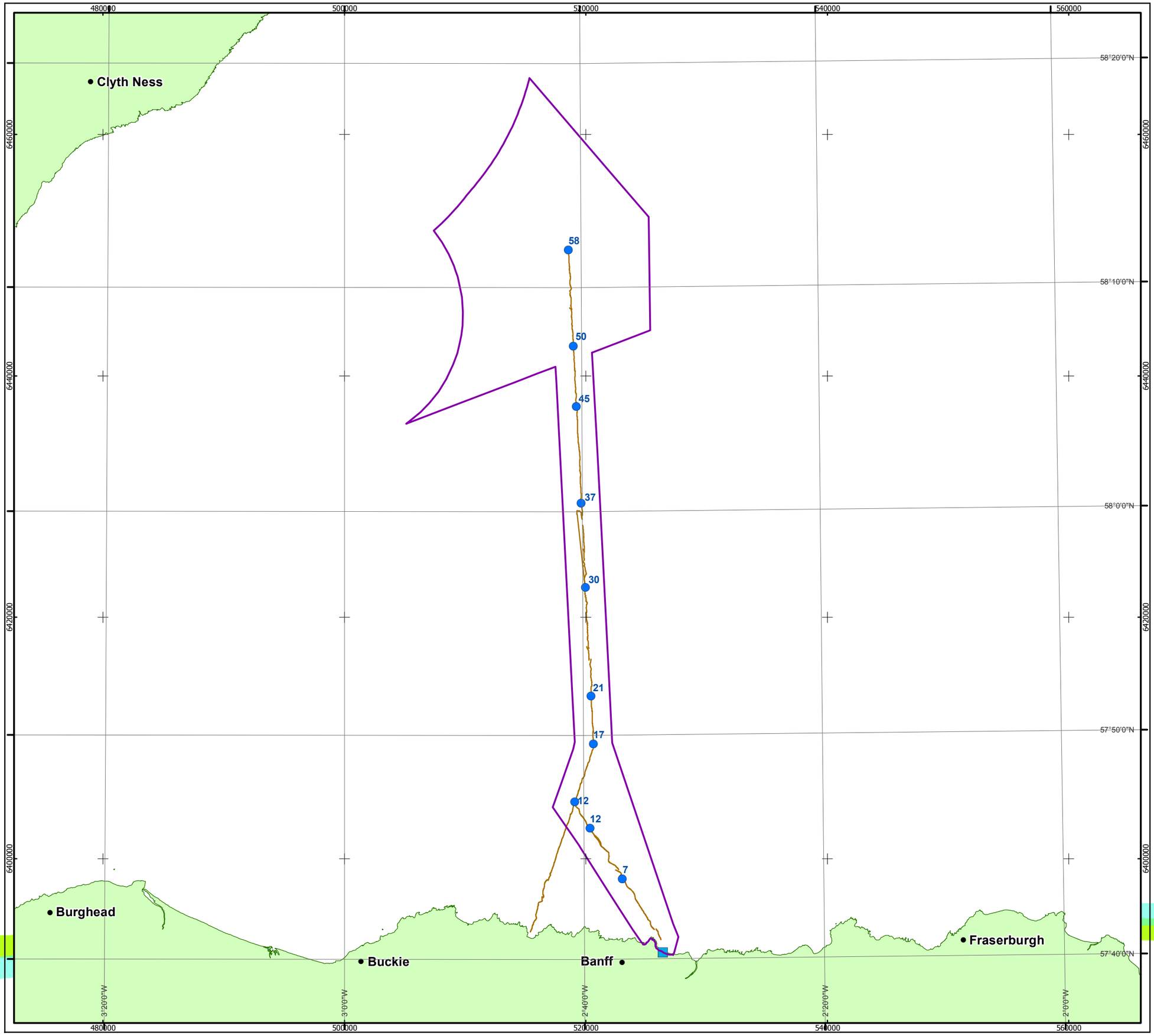
Produced: IMR
Reviewed: ES
Approved: CR

Date: 13/06/2014 | Revision: A

REF: 8460001-PSO0131-EMU-MAP-007

Figure 1.4
OSPAR Habitats

Moray Offshore Renewables Ltd



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REPSOL

Moray Offshore Renewables Ltd

KEY

- Modified OfTI
- Cable Route Landing Site

Benthic Sampling Array

- Grab Site
- Video Transect

Horizontal Scale: 1:300,000 A3 Chart

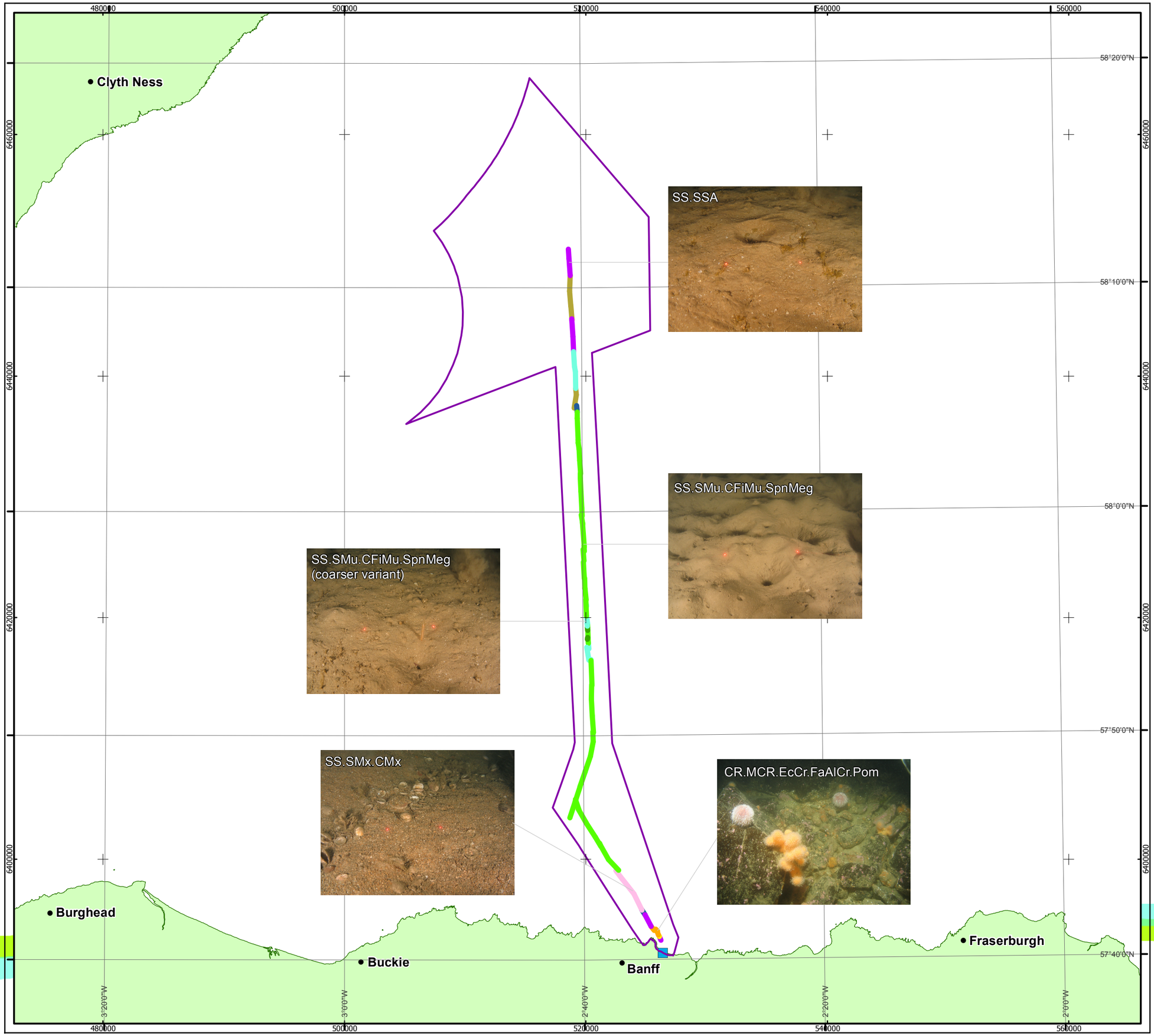
0 5,000 10,000 Metres

N

Geodetic Parameters:	WGS84 UTM Zone 30N
Produced: IMR Reviewed: ES Approved: CR	
Date: 13/06/2014	Revision: A
REF: 8460001-PSO0131-EMU-MAP-008	

Figure 2.1
Benthic Sampling Array

Moray Offshore Renewables Ltd



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REPSOL

Moray Offshore Renewables Ltd

KEY

- Modified OfTI
- Cable Route Landing Site

Biotopes

- CR.MCR.EcCr.FaAlCr.Pom
- CR.MCR.EcCr.FaAlCr.Pom (sheltered shore variant)
- SS.SMu.CFiMu.SpnMeg
- SS.SMu.CFiMu.SpnMeg (coarser variant)
- SS.SMu.CFiMu.SpnMeg with SS.SMx.CMx
- SS.SMx.CMx
- SS.SMx.CMx (with SSA)
- SS.SSA
- SS.SSA with areas of SS.SMx.CMx

Horizontal Scale: 1:300,000 A3 Chart

N

0 5,000 10,000 Metres

Geodetic Parameters: WGS84 UTM Zone 30N

Produced: IMR
Reviewed: ES
Approved: CR

Date: 13/06/2014 | Revision: A

REF: 8460001-PSO0131-EMU-MAP-009

Figure 3.1
Biotopes

Moray Offshore Renewables Ltd

480000 500000 520000 540000 560000

58°20'0"N
58°10'0"N
58°0'0"N
57°50'0"N
57°40'0"N

6460000
6440000
6420000
6400000

3°20'0"W 3°0'0"W 2°40'0"W 2°20'0"W 2°0'0"W

• Clyth Ness
• Burghead
• Buckie
• Banff
• Fraserburgh

KPA 50 and KPA 58

KPA 45

KPA 17, KPA 21, KPA 30, KPA 37, and KPB 12

KPA 12

KPB 7

(g)S
(g)S
gS
(g)mS
(g)mS
(g)mS
(g)mS
mS
(g)mS
msG

Moray Offshore Renewables Ltd

KEY

- Modified OfTI
- Cable Route Landing Site
- Video Transect

Principal Sediment Components (%)

- Gravel
- Sand
- Mud

Sediment Classification according to Folk, 1954.

Horizontal Scale: 1:300,000 A3 Chart

0 5,000 10,000 Metres

N

Geodetic Parameters:	WGS84 UTM Zone 30N
Produced: IMR Reviewed: ES Approved: CR	
Date: 13/06/2014	Revision: A
REF: 8460001-PSO0131-EMU-MAP-010	

Figure 3.3
Principal Sediment Components

Moray Offshore Renewables Ltd