Inch Cape Offshore Wind Farm

New Energy for Scotland

Offshore Environmental Statement:
VOLUME 2D
Appendix 12D: Biotope Mapping

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ENVISION MAPPING

Appendix 12D: Biotope Mapping

May / 2013

FINAL

Technical report for the data analysis and interpretation

Site

Inch Cape Offshore Wind Farm Development Area and Offshore Export Cable Corridor, Firth of Forth

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Glossary & Abbreviations

AGDS: Acoustic Ground Discrimination System. The characteristics of the echo from an acoustic (SONAR) sensor are analysed to extract information on the reflectance properties of the sea floor.

Biotope classification: The process of conversion of numerical data from a survey (species abundance records or particle size data) to a number of discrete classes. The local system may correspond to external national classification systems, such as the Marine Habitat Classification for Britain & Ireland (v04.05).

Classification/analysis: The analytical process of interpreting the geophysical data into biotopes or sediment classes through the use of training sites based on the ground truth samples.

Folks sediment classes: The modified Folks classification adopted by the British Geological Survey (BGS) is based on a triangular plot of gravel, sand and mud. It has been further adapted in this report to include sediment mixed with rock (cobble, boulders and bedrock).

Ground truth: Sample records that are used in statistical interpretation of remotely sensed images. In the context of this report, the ground truth points are tagged with habitat class and sediment class.

Training sites: Small areas of known habitat (or sediment) class superimposed on the geophysical images and used to extract data from the images for creating statistical signatures for a habitat class. In these analyses the training sites consisted of a small buffer zone around each sample point.

Executive Summary

1. Envision has undertaken a biological interpretation of the geophysical data from the Inch Cape Offshore Limited (ICOL) Development Area and Offshore Export Cable Corridor. The strategy for this interpretation was to integrate sample records and the geophysical remotely sensed images to produce distribution maps. This follows the strategy that has been established within the European Union (EU) through the Mapping European Seabed Habitats (MESH) program.

2. The geophysical data required processing and transformation in order to render the images suitable for integrated analysis.

3. Ground truth data (video and grabs) were provided for the Development Area with biotopes assigned to biotope classes (Marine Habitat Classification for Britain & Ireland (v04.05)) and Folks classification. The ground truth data for the Offshore Export Cable corridor were more sparse and were therefore were supplemented by data from neighbouring locations.

4. The analyses have been reported and biotope and sediment distribution maps have been presented. Any issues with map accuracy have been detailed and addressed.

5. The distribution of the biotopes has been discussed. The predominant biotope of the Development Area is the bivalve community SS.SMx.CMx.MysThyMx with other impoverished polychaete communities on the shallower sandbanks. The Offshore Export Cable corridor is largely muddy and the sea pen and burrowing megafauna biotope is the predominant biotope.

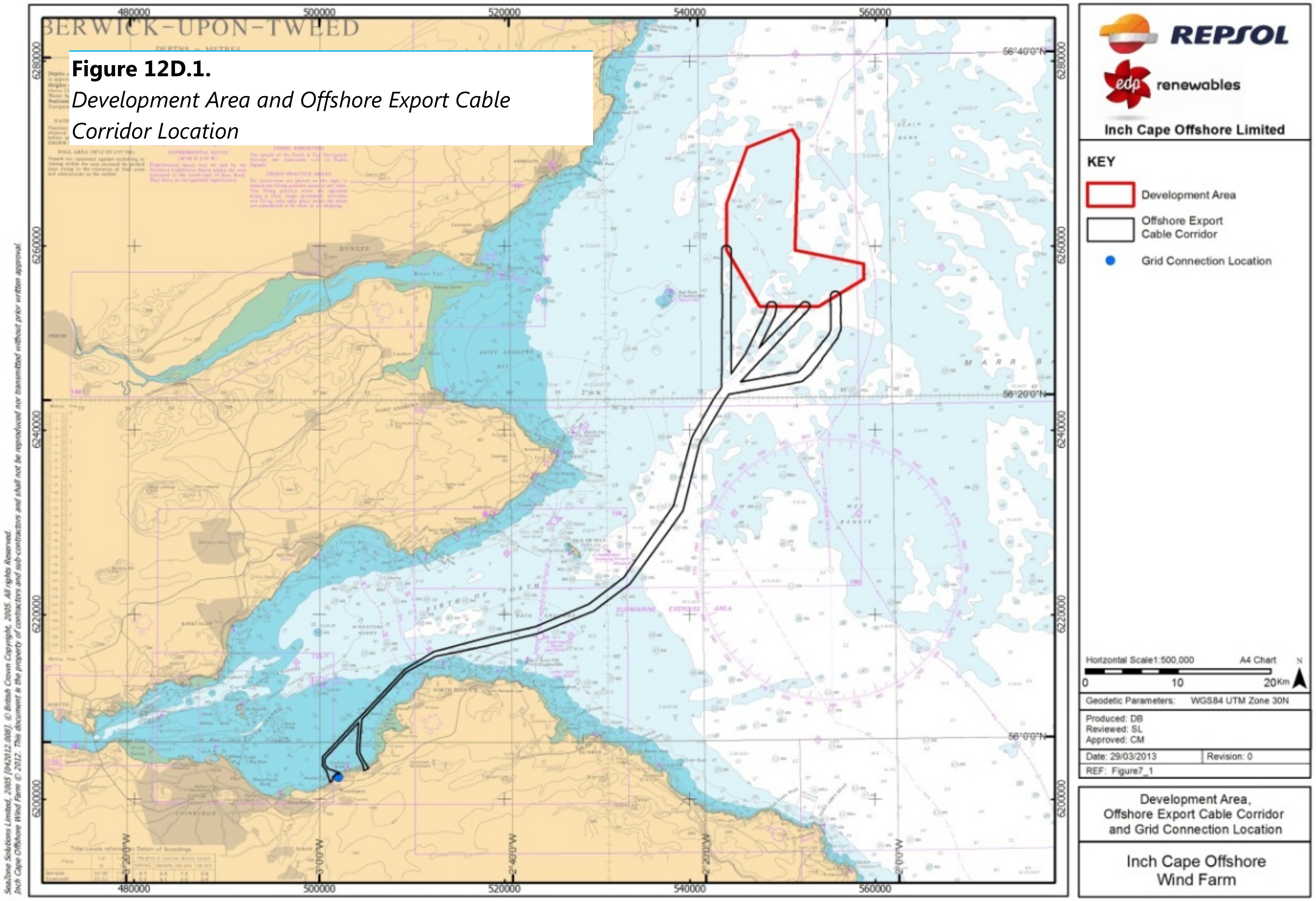
12D.1 Introduction

12D.1.1 Purpose of Analysis

The Inch Cape Offshore Wind Farm, situated in the offshore Firth of Tay area (Figure 12D.1.), is anticipated to consist of approximately 213 Wind Turbine Generators. The Offshore Export Cable Corridor connects the Development Area to the mainland in the Firth of Forth.

The purpose of the analysis undertaken for this report is to interpret the geophysical data using the available ground truth data (video and grab records) in order to produce distribution maps of biotopes and habitats for Development Area and Offshore Export Cable Corridors.

Figure 12D.1.
Development Area and Offshore Export Cable Corridor Location



12D.2 Methods for Analysis

12D.2.1 Available Data Used for Analysis

Analysis of the geophysical data was previously undertaken by Envision to help stratify an extensive benthic sampling campaign for the Development Area, which was undertaken over the spring and summer of 2012 (AMEC, 2012) and Appendix 12A: Benthic Ecology Baseline Development Area. Ground truth data for the Offshore Export Cable Corridor has relied more extensively on previously collected (seabed video and grab sample data gathered on behalf of ICOL) (EMU 2012, 2010) and Appendix 12C: Benthic Ecology Baseline Offshore Export Cable Corridor, but these samples did not all fall within the boundary of the finalised Offshore Export Cable corridor but were in the vicinity. All of these samples have been assigned to a biotope class according to the Marine Habitat Classification for Britain & Ireland (v04.05) (http://jncc.defra.gov.uk/page-1584) and also a sediment class based on the Folks classification adapted to accommodate rock.

The geophysical data available for analysis also varied between the areas: (1) the data for the Development Area survey (IXSurvey, 2011) included fine resolution bathymetry and a mosaic of the side scan data, (2) the Offshore Export Cable Corridor survey (Osiris Projects, 2012b) included measurements of 'roughness' and 'hardness' from a RoxAnn™ single beam acoustic ground discrimination system (AGDS) as well as bathymetry and side scan imagery, (3) the geophysical data for the Nearshore Offshore Export Cable Corridor (Osiris Projects, 2012a) consisted of bathymetry and side scan mosaics.

Because the three sections had different data sets (both geophysical and ground truth), it was considered appropriate to undertake three separate analyses, the Development Area and Offshore Export Cable corridor with a subsection analysis of the Nearshore Export Cable corridor, and then amalgamate the results to produce unified maps for the whole area.

12D.2.2 Data Preparation

12D.2.2.1 Ground Truth Datasets

The ground truth data for the Development Area was provided with an attribute table giving the allocated biotope codes from the analysis of the infaunal data and the video records. The attribute table also included sediment characteristics. There were a large number of records within the Development Area and no issues were considered likely to arise with the interpretation of the geophysical data sets.

Only three different biotopes were described for the Development Area (SS.SMx.CMx.MysThyMx; SS.SCS.CCS.MedLumVen; SS.SCS.OCS) and these were largely classified according to sediment type (circalittoral coarse sand and offshore coarse sand biotopes). There were six Folk classes in the attribute table. Two muddy sediment classes were represented by three records in total and these were amalgamated into one muddy class. The five resulting classes were:

- sand (S)

- sandy gravel (sG)
- gravelly sand (gS)
- slightly gravelly sand ((g)S)
- muddy gravelly sand/ muddy sand (mgS)

Using the ground truth data for the Offshore Export Cable Corridor was more complex as relatively few sites intersected the geophysical data directly. In order to increase the number of ground truth data available for analysis, points adjacent to the Offshore Export Cable Corridor were re-positioned within GIS to the nearest location within the Offshore Export Cable Corridor. This was done sparingly and with reference to the side scan images. This routine is, admittedly, somewhat circular and requires subjective expert judgement (e.g. an epifaunal, rocky biotope located near a 'hard' geophysical feature was re-positioned within this feature) to increase the number of valid ground truth records. The resulting maps must be viewed with this in mind as error and confidence assessment would be self-fulfilling and overestimate the results.

Many of the biotope records available for the Offshore Export Cable Corridor were single occurrences and, since these are difficult to incorporate into statistical analysis that relies on a minimum of duplication, singleton records were amalgamated into the closest biotope group. For both subsets of the Offshore Export Cable Corridors the biotopes were used for analyses were:

- SS.SCS.CCS.MedLumVen
- SS.SCS.OCS
- SS.SMu.CFiMu.SpnMeg
- SS.SMx.CMx
- SS.SMx.CMx.Pom
- SS.SMx.CMx.FluHyd/SS.SMX.CMx (*mixed biotopes*)
- SS.SMx.CMx.FluHyd/SS.SSa.CCS (*mixed biotopes*)
- SS.SMx.CMx.FluHyd/SS (*mixed biotopes*)
- SS.SMx.CMx.FluHyd/SS.SSa.CMuSa (*mixed biotopes*)
- SS.SMx.CMx.MysThyMx,
- SS.SSa.CMuSa

The ground truth data for the Development Area and the Offshore Export Cable Corridor are shown in Figure12D.2.to Figure 12D.5.

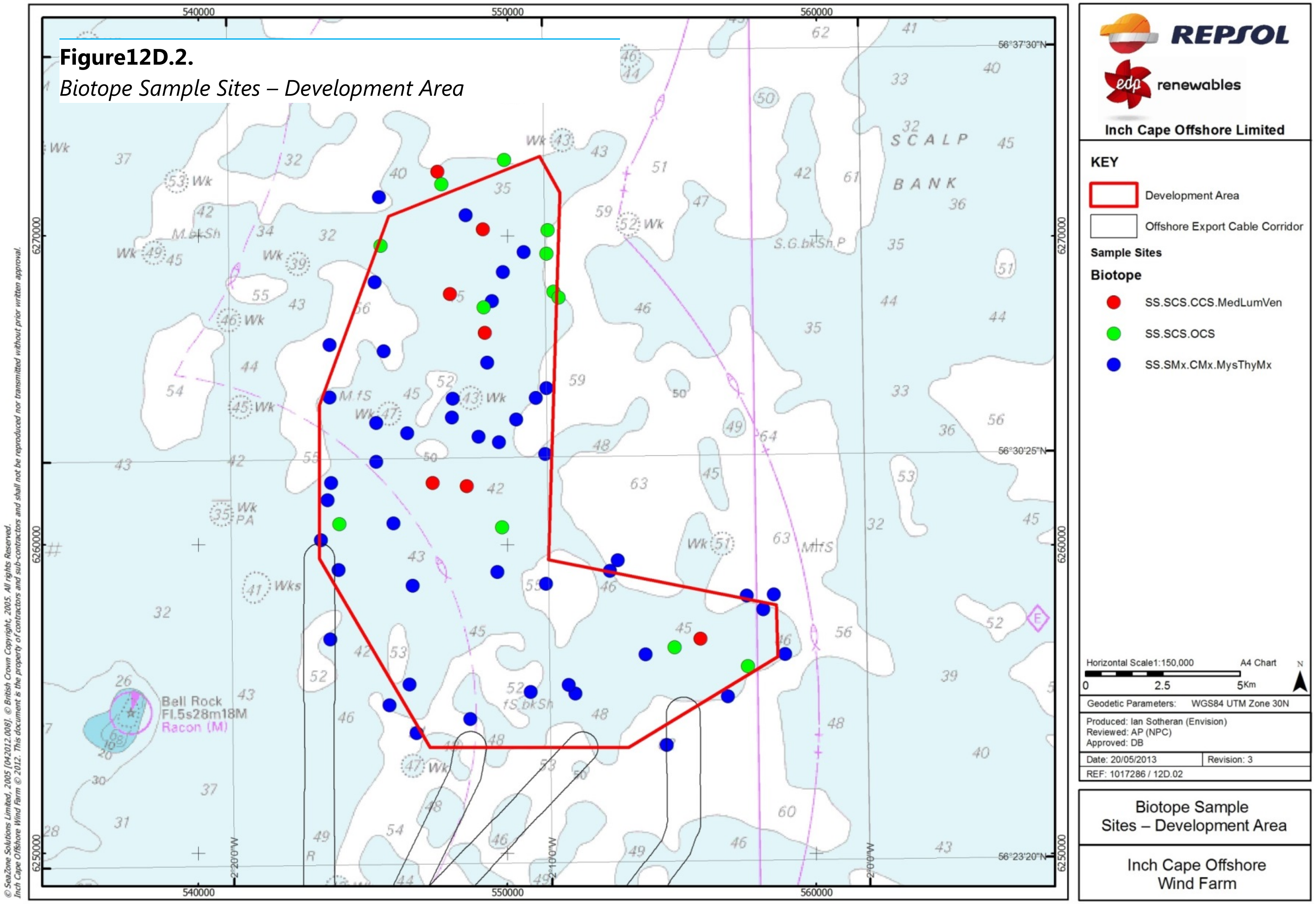


Figure12D.2.
Biotope Sample Sites – Development Area

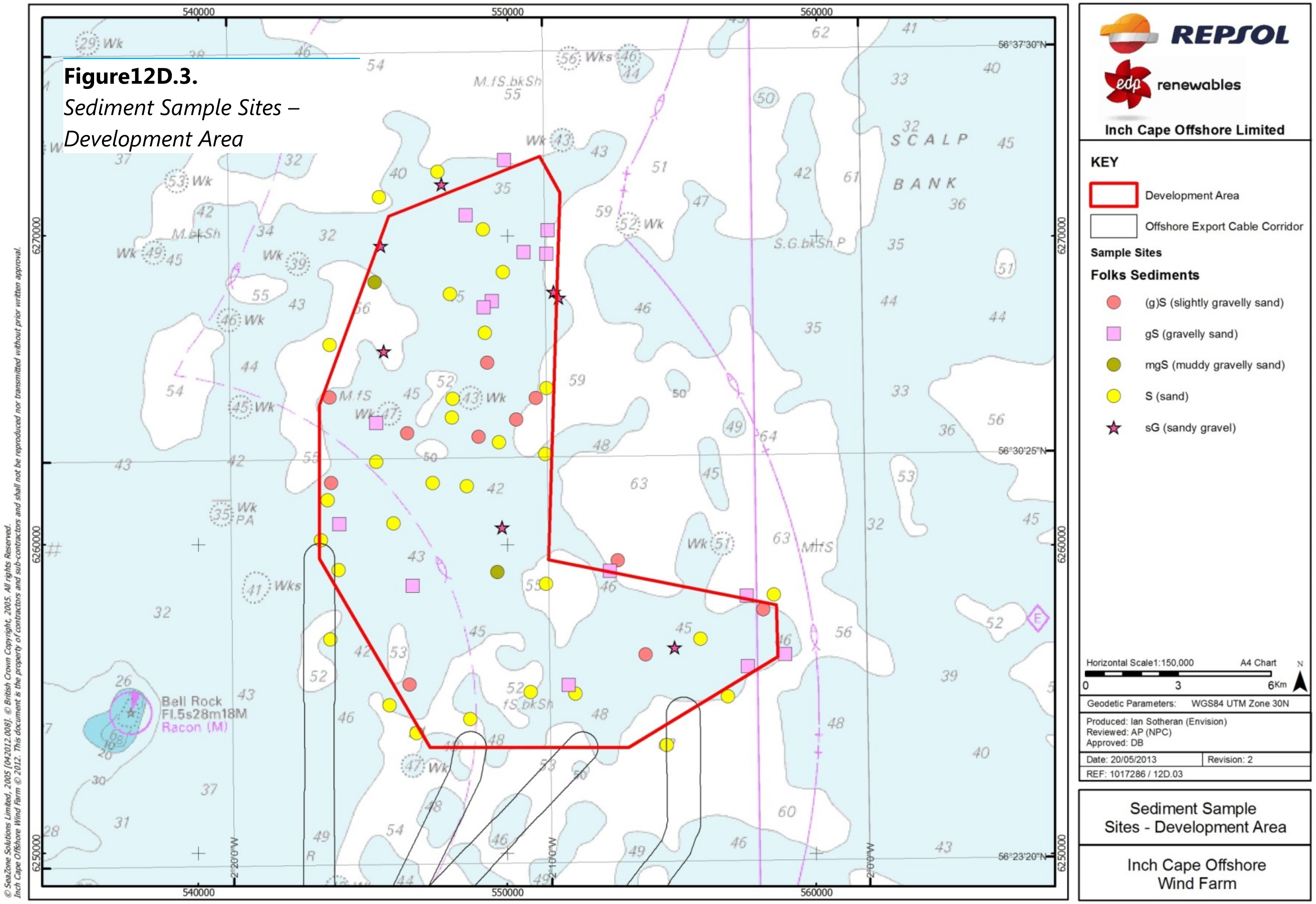


Figure12D.3.
Sediment Sample Sites – Development Area

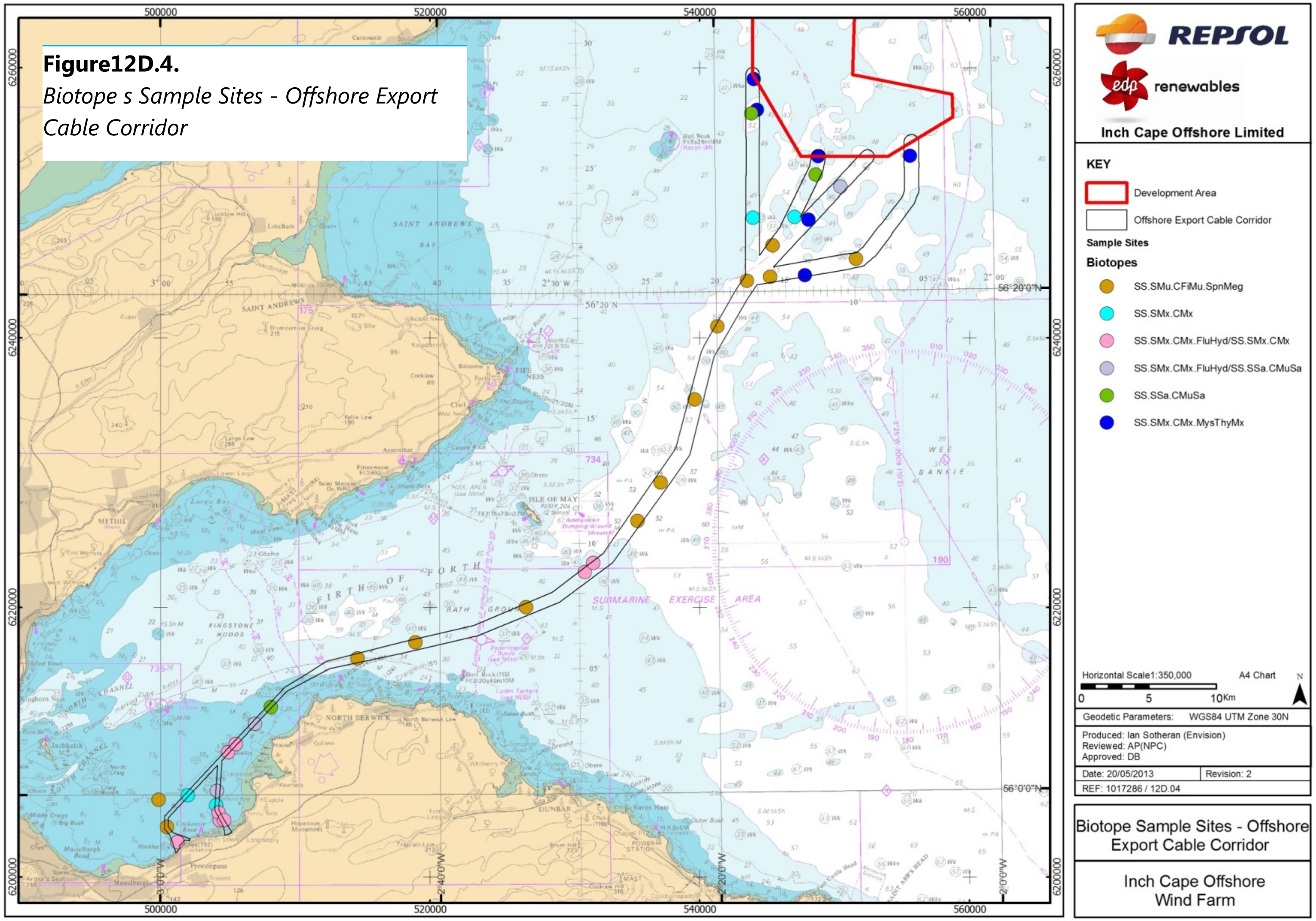


Figure12D.4.
Biotope s Sample Sites - Offshore Export Cable Corridor

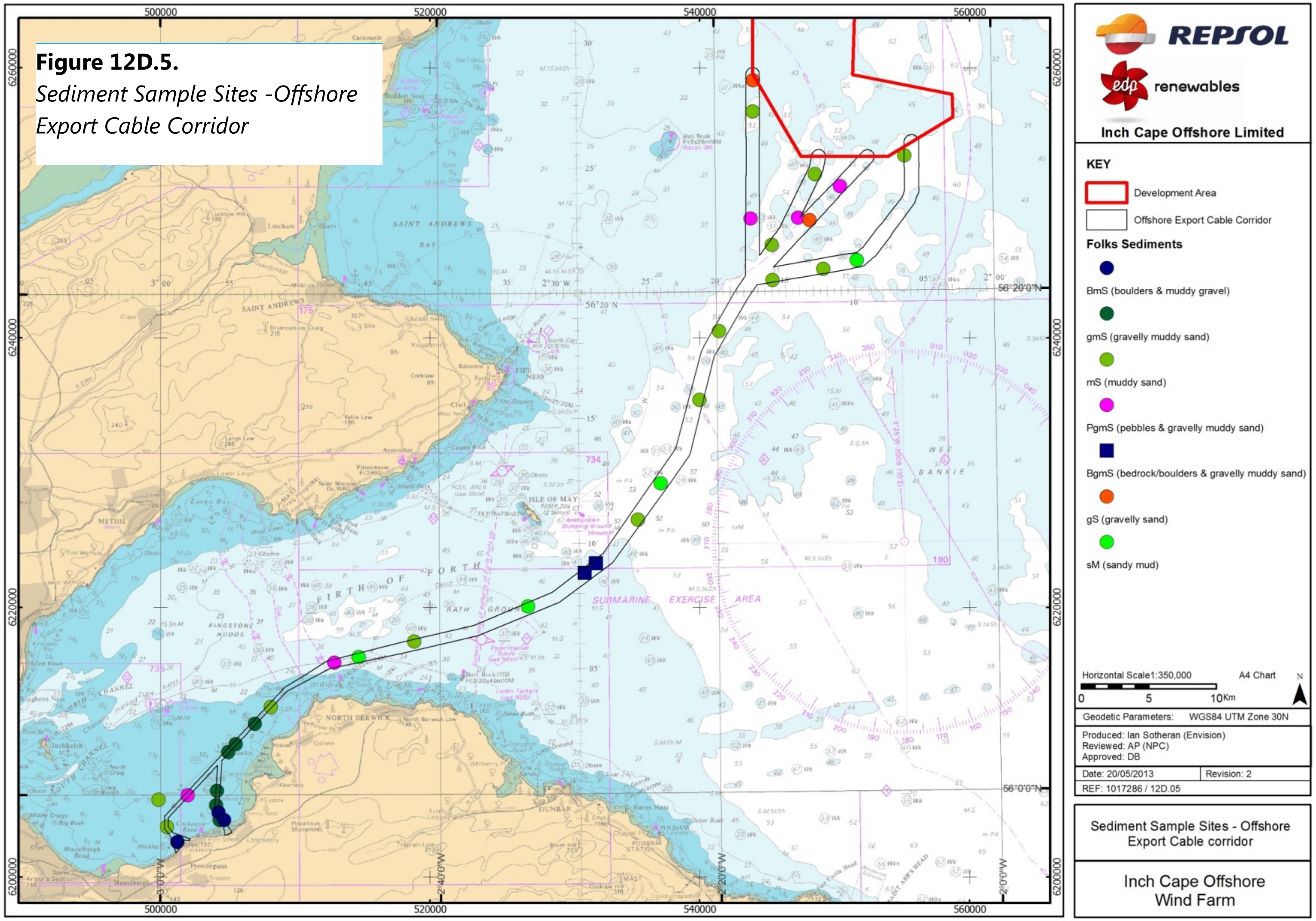


Figure 12D.5.
Sediment Sample Sites -Offshore Export Cable Corridor

12D.2.2.2 Geophysical Data

The purpose of processing the geophysical data was to provide raster images for each of the themes (bathymetry, side scan backscatter strength, AGDS 'roughness' and 'hardness') that were in exactly the same format and sharing the same resolution (numbers of rows and columns) and geographic bounds. This was necessary in order to perform raster-based analyses.

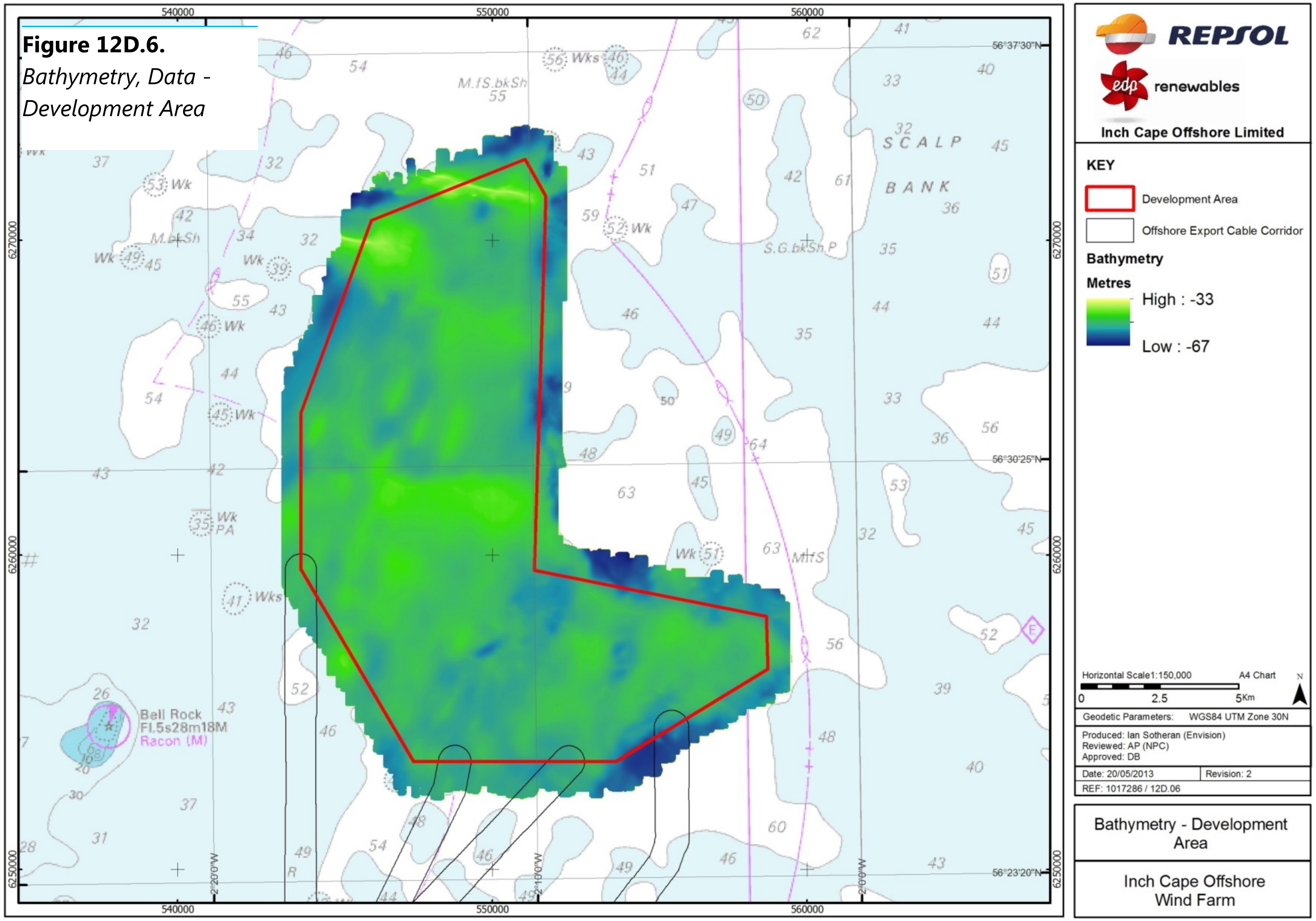
The bathymetry data were provided as XYZ points outputs from processing raw mulitbeam bathymetric data. The point data were imported into *Surfer*™ for interpolation and transformation of the data into a suitable grid format. Additionally, the bathymetric data were used to derive a slope image that could be used in the analyses.

The side scan mosaics were provided for all areas. The routines within specific software for the creation of these mosaics perform various transformations (such as removal of the water column from the original traces) and the grey-scale contrast of the raw images is often reduced in the mosaicked image. The images provided were generally markedly 'striped' (backscatter strength varied across the width of the traces irrespective of changes in ground type) and required contrast and adaptive filtering to mitigate these effects. The result was a smoothed, generalised image of backscatter strength that lost many of the detailed features of the original tracks. To compensate for this, the original mosaics were visually inspected for any features that might have had significance for biotope distribution.

Single beam AGDS data were available for the offshore section of the Offshore Export Cable Corridor. The data exhibited some variability between adjacent tracks that was unlikely to be due to changes in ground type and was probably due to changes in the configuration of the equipment set-up over time. The data required standardisation to overcome this variability. Smoothing the track data over 10 consecutive points to remove spikes and then standardising the smoothed point values by a moving spatial average based on a wide search radius. The resulting data were then interpolated to create a grid with the same dimensions as the other Offshore Export Cable Corridor images. The resulting images of 'roughness' and 'hardness' values, though not completely satisfactorily standardised, show smoothed local distribution patterns that add useful information about the acoustic ground types in the Offshore Export Cable Corridor.

The final images used for the three areas are summarised in Figure 12D.6 to Figure 12D.15.

Figure 12D.6.
Bathymetry, Data - Development Area



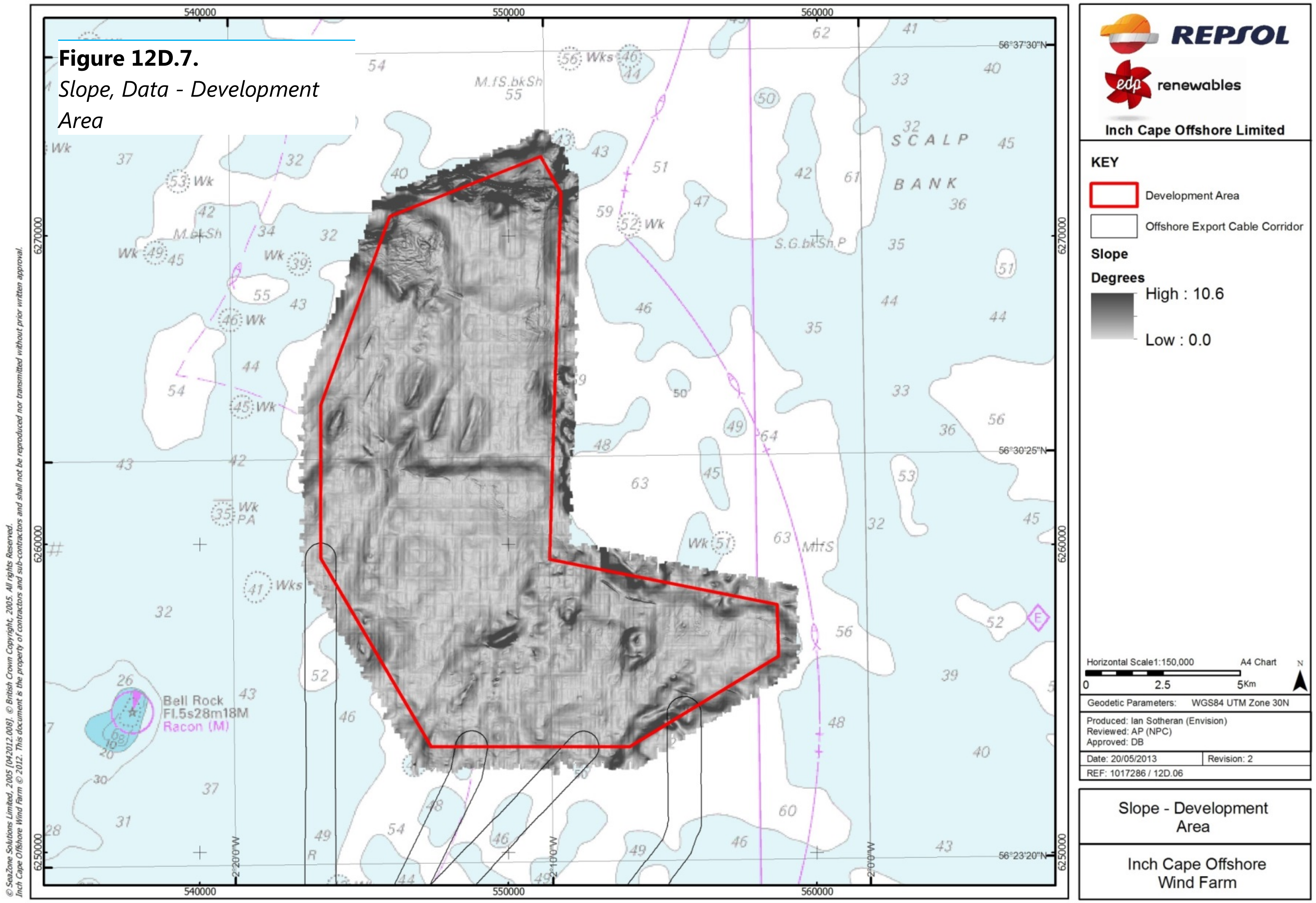


Figure 12D.7.
Slope, Data - Development Area

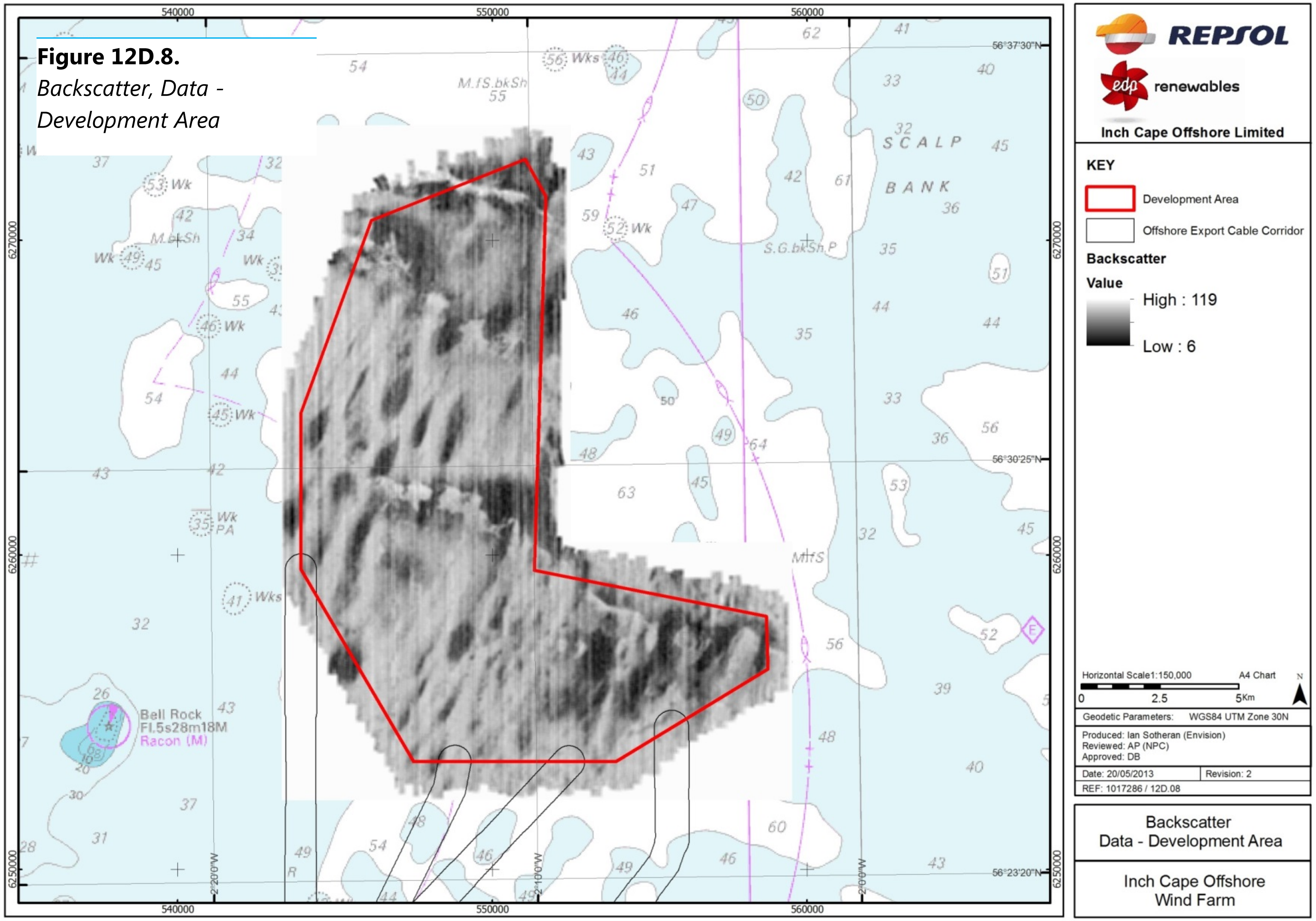


Figure 12D.8. *Backscatter, Data - Development Area*

Figure 12D.9.
Bathymetry - Offshore Export Cable Corridor

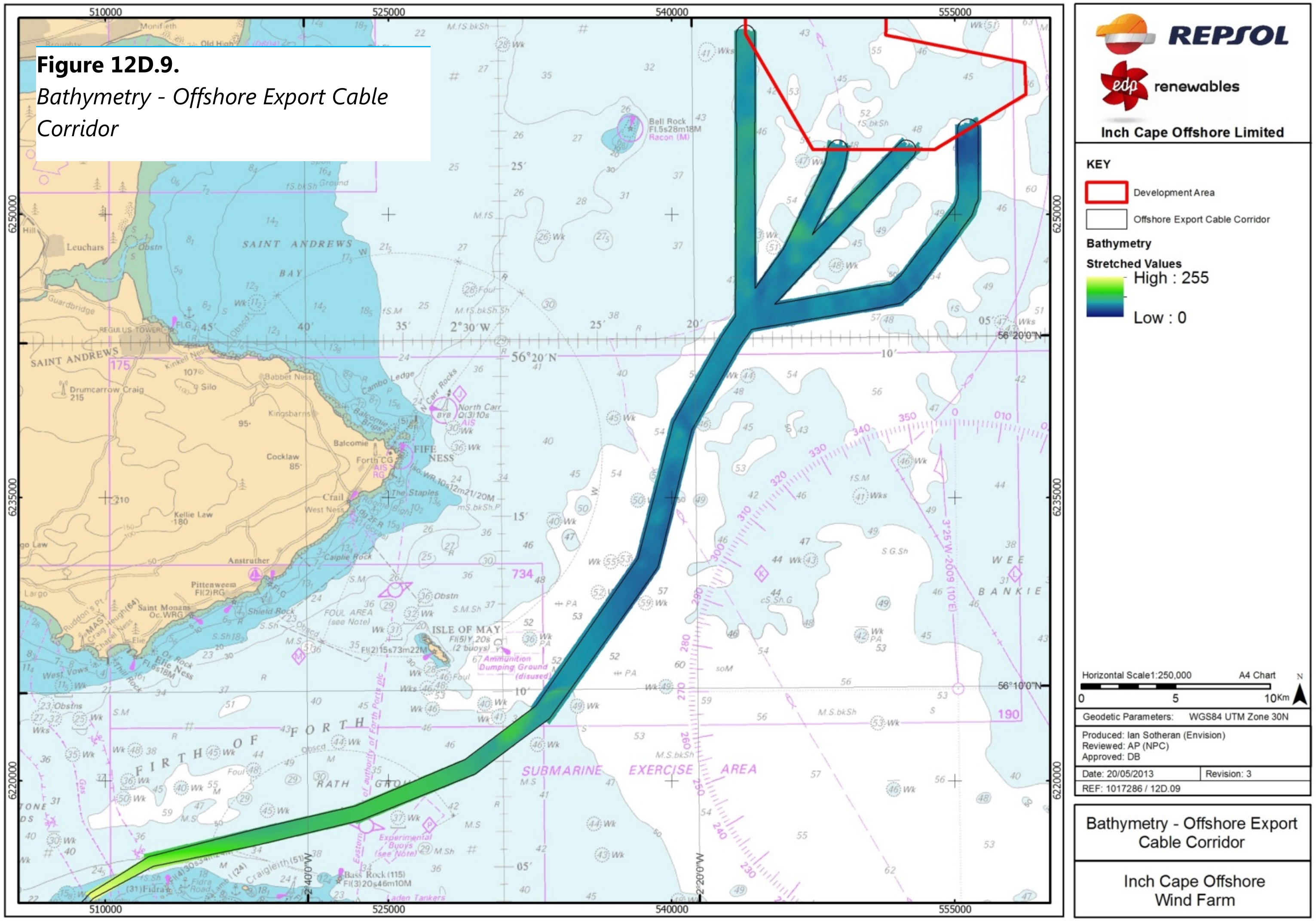


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Figure 12D.10.
Slope Data Offshore Export Cable Corridor

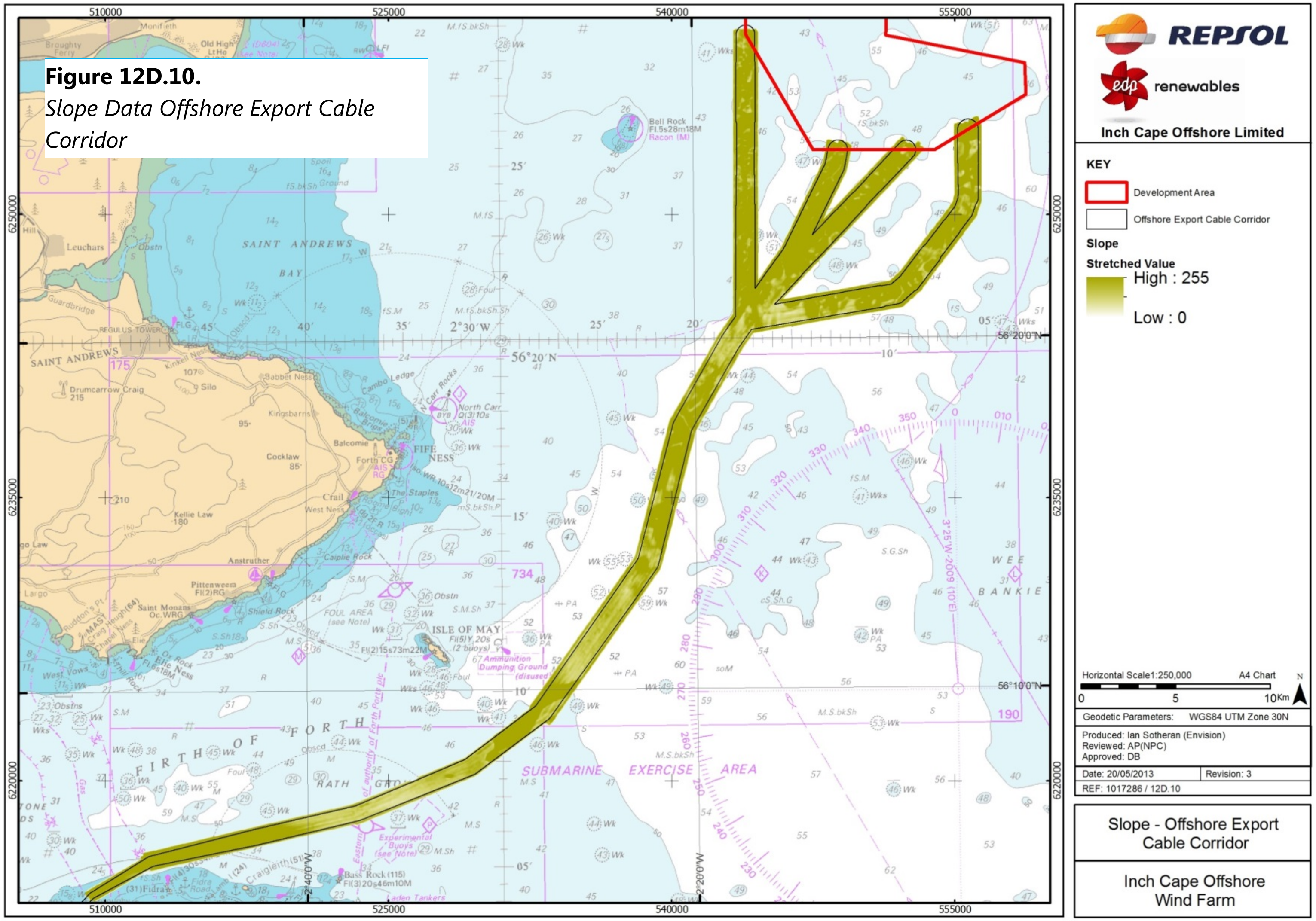
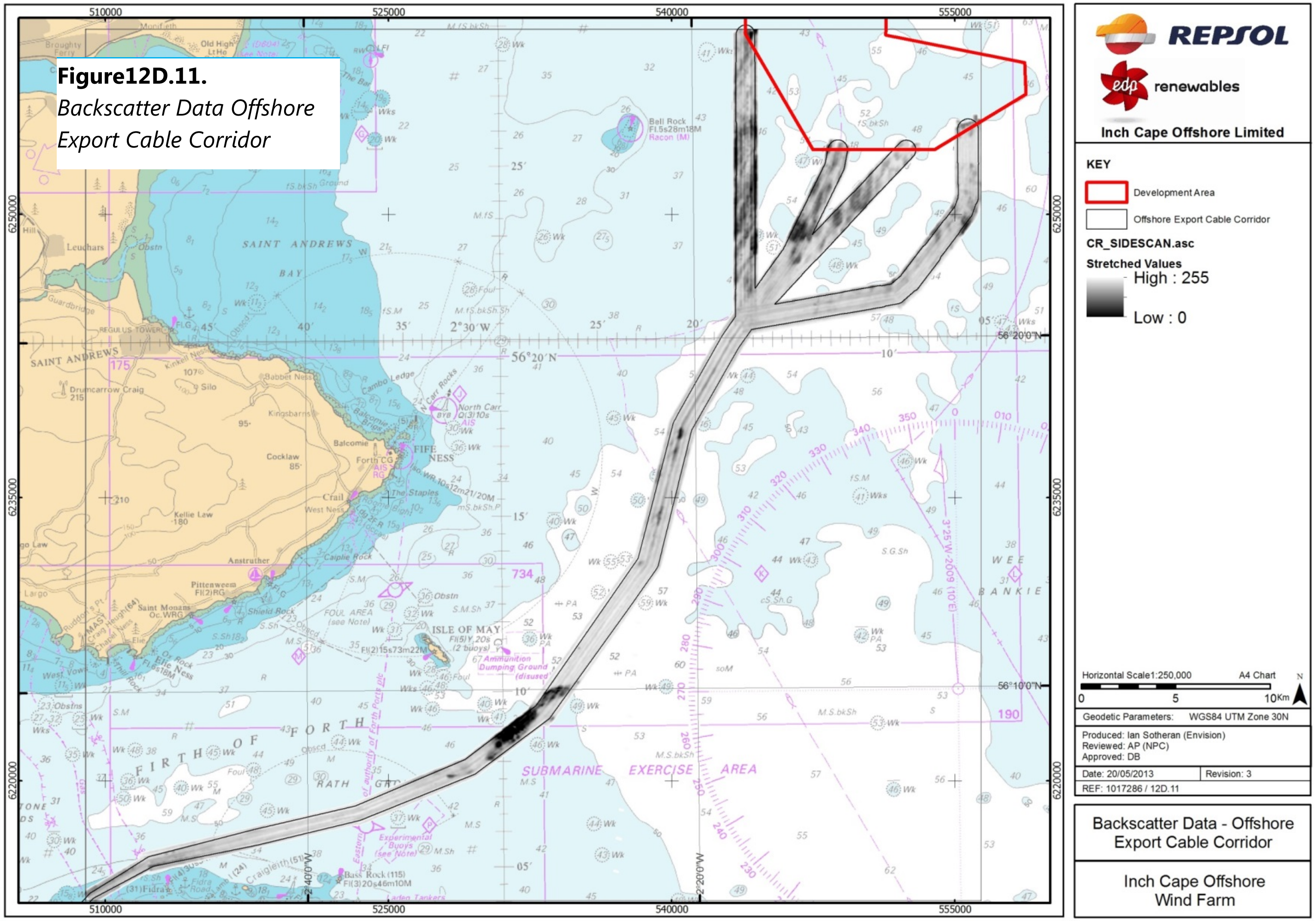


Figure12D.11.
Backscatter Data Offshore Export Cable Corridor



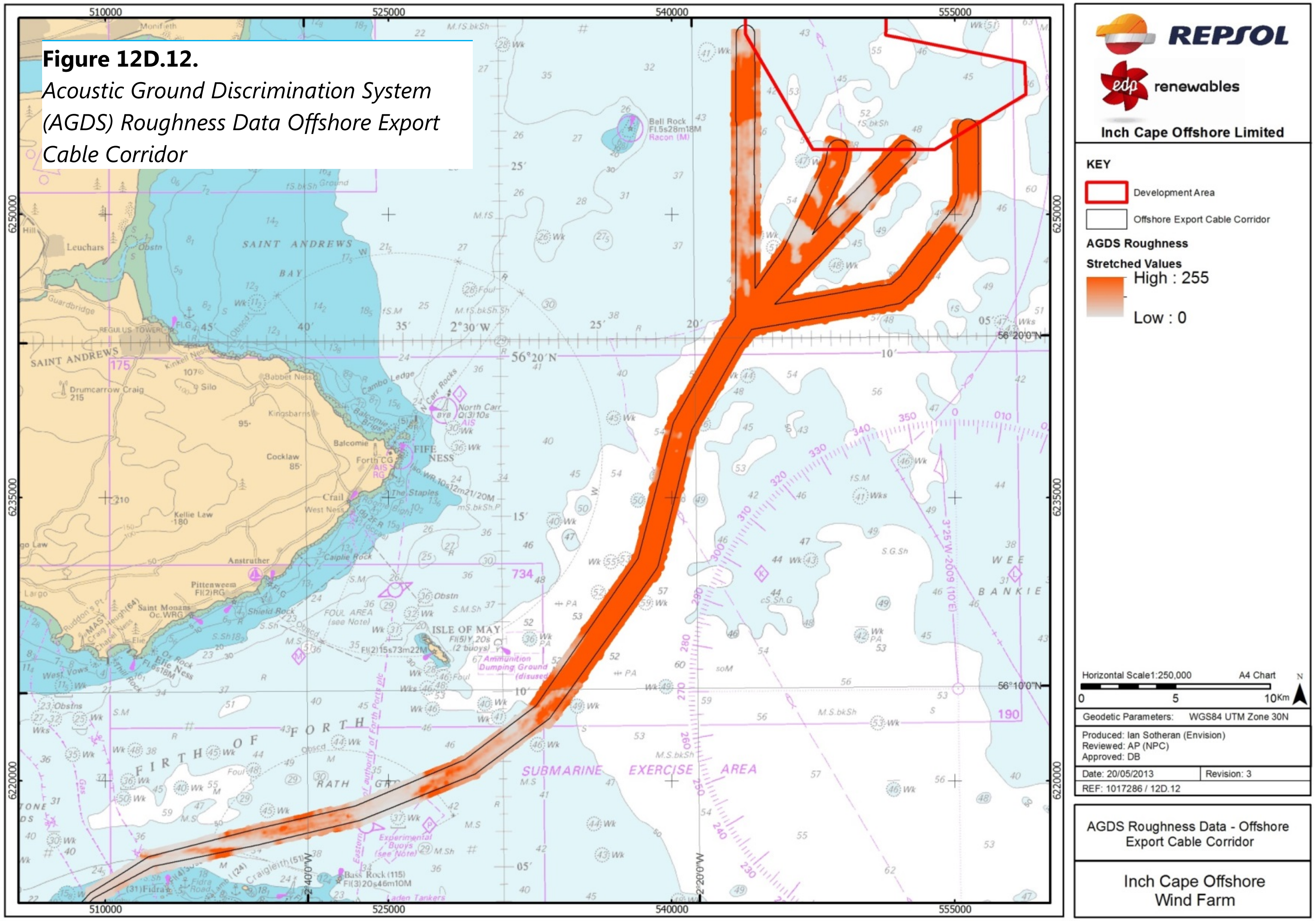


Figure 12D.12.
Acoustic Ground Discrimination System (AGDS) Roughness Data Offshore Export Cable Corridor

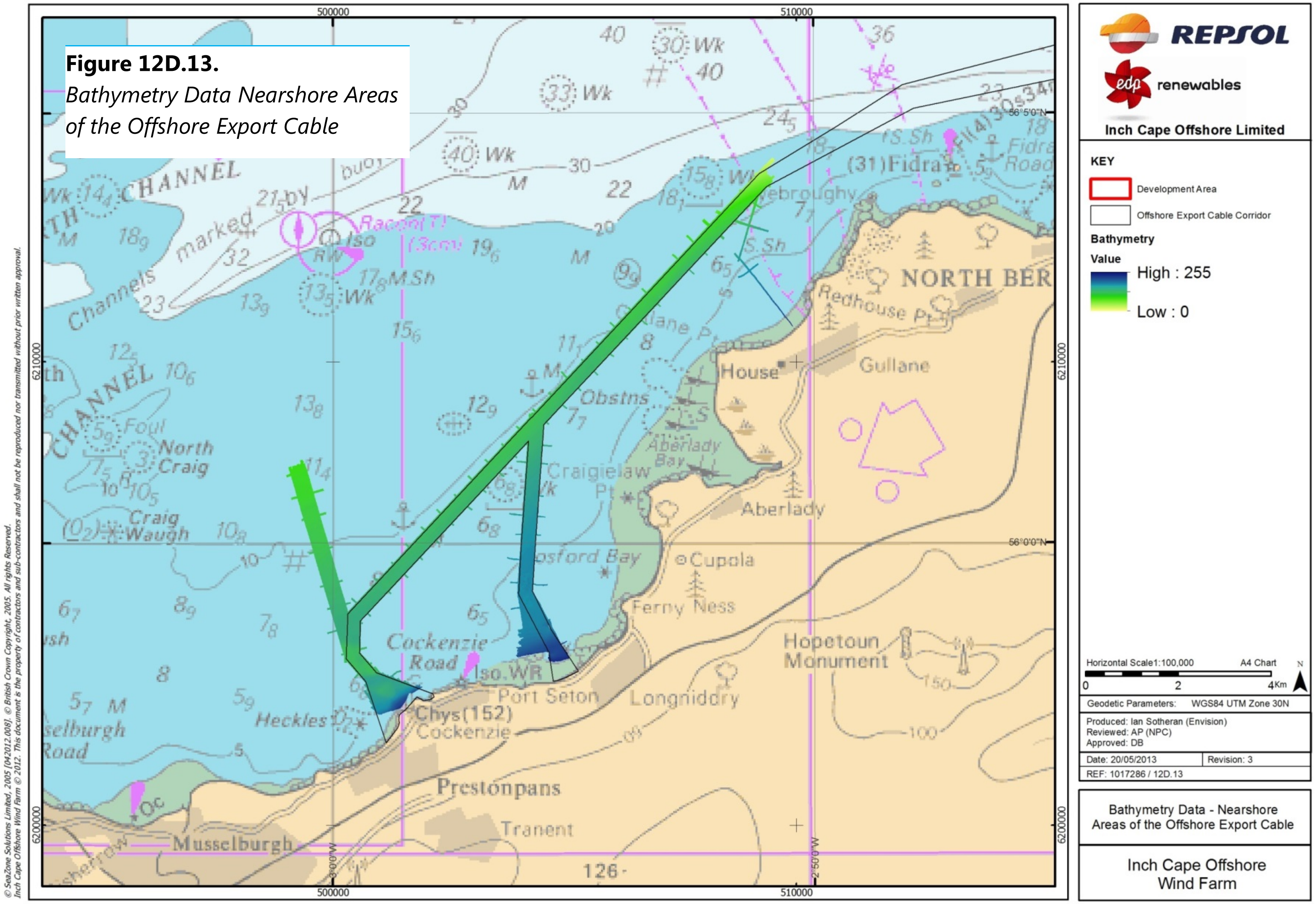


Figure 12D.13.
Bathymetry Data Nearshore Areas of the Offshore Export Cable

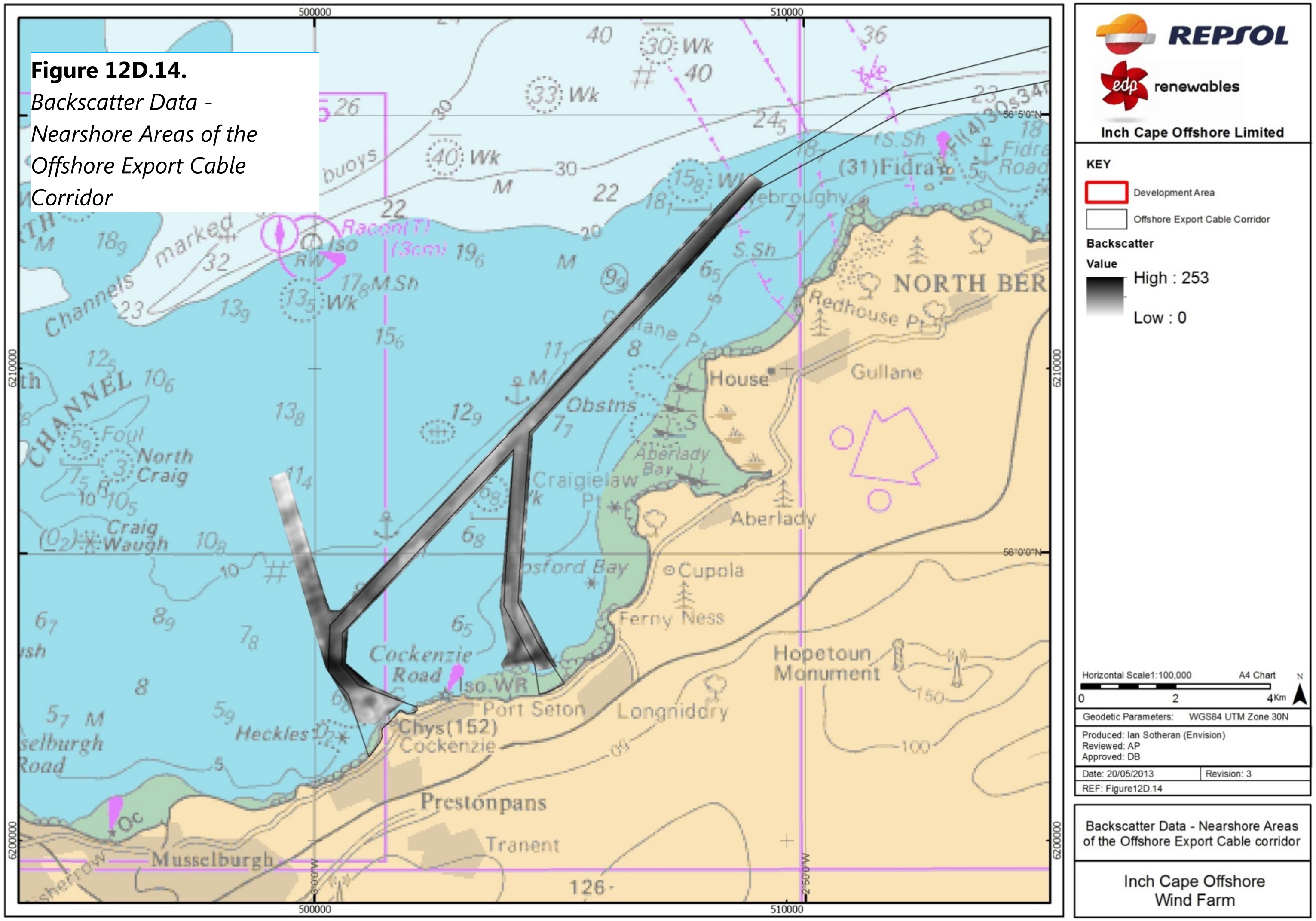


Figure 12D.14.
Backscatter Data - Nearshore Areas of the Offshore Export Cable Corridor

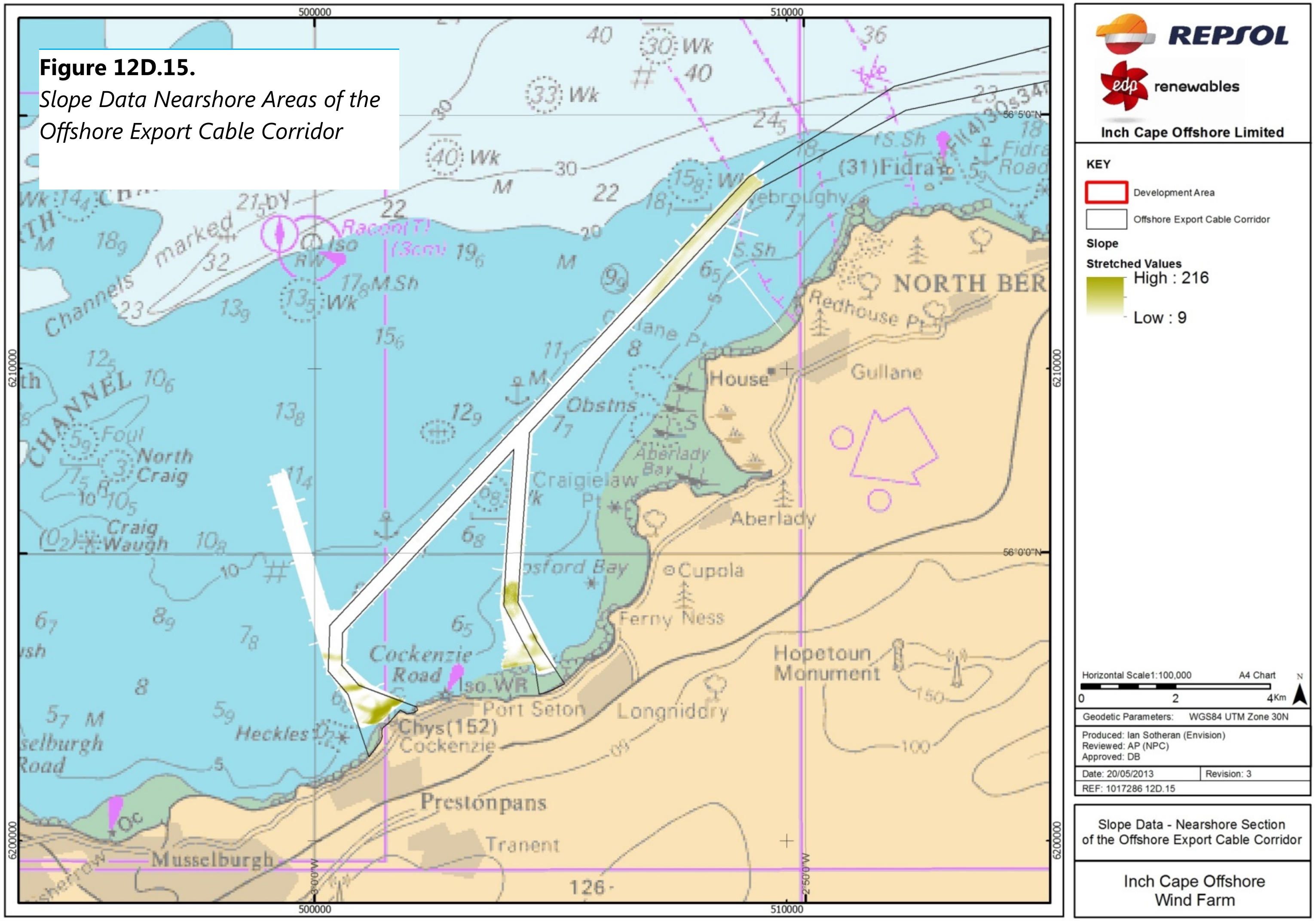


Figure 12D.15.
Slope Data Nearshore Areas of the Offshore Export Cable Corridor

12D.2.3 Analysis

The overarching strategy for the analysis and interpretation was to combine information from the point sample benthic data (shown in Figures 12D.2 to 12D5.) with the geophysical data (the raster input images shown in Figures 12D.6. to 12D.15) using image processing and statistical analysis. This process uses the benthic sample data to 'ground truth' the geophysical data, a strategy described in the MESH documentation (http://www.searchmesh.net/default.aspx?page=1661) from which Figure 12D.16 is taken.

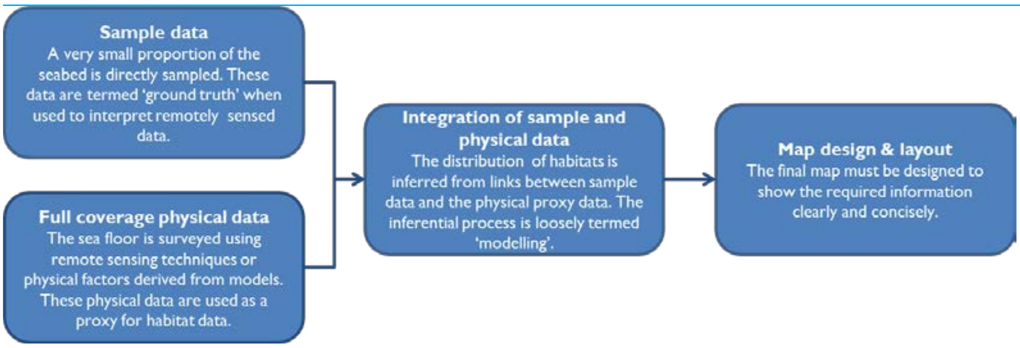


Figure 12D.16.
A Flow Chart of the Main Stages in Making a Habitat Map by Integrating Sample Data and Full Coverage Physical Data (MESH).

The ground truth point data were buffered to create a training area of 150 m radius around each point and these training areas labelled with the habitat class and/or sediment class (as appropriate) assigned to the point data.

The integration analysis was performed in the GIS and image processing software *Idrisi*™. The training areas were used to extract values from each of the geophysical layers that could be associated with the biological habitat classes (or sediment classes). These values were used to create a statistical 'signature' for each class.

These signatures were then applied to the whole geophysical data set. The simplest and most commonly used method for classifying images is using maximum likelihood whereby each grid cell is assigned to the class to which the grid cell has the highest probability of membership.

12D.2.4 Accuracy Assessment

The standard methods for assessing agreement between the ground truth data and the interpreted habitat class and sediment distributions involve calculation of an error matrix where the ground truth image is cross-tabulated against the map (predictive) image. Per cent agreement/match calculates the proportion of correctly predicted pixels over the total of shared pixels between the two images. The Kappa agreement index calculates the proportion of correct predictions over and above what would be expected by chance. These overall values do not give a true indication of predictive power of the maps but indicate the levels of agreement between the ground truth data and the interpreted distribution.

12D.3 Results

12D.3.1 The Development Area

12D.3.1.1 Biotope Classification

The majority of the ground truth data points within the Development Area were SS.SMx.CMx.MysThyMx (71 %) with far fewer SS.SCS.OCS (18 %) and SS.SCS.CCS.MedLumVen (11 %). The maximum likelihood classification allows the analyst to use a variety of prior probabilities for the various classes in the process. The default is to use equal probabilities and this was used in the classification in this analysis.

The resulting biotope distribution from classification analysis for the Development Area using equal prior probabilities (Figure 12D.17.) of the three biotopes gives a slight over-prediction of SS.SCS.CCS.MedLumVen and using prior probabilities based on frequencies of ground truth occurrence of the biotopes(Figure 12D.18.). The latter has a slight under-prediction of SS.SCS.CCS.MedLumVen.

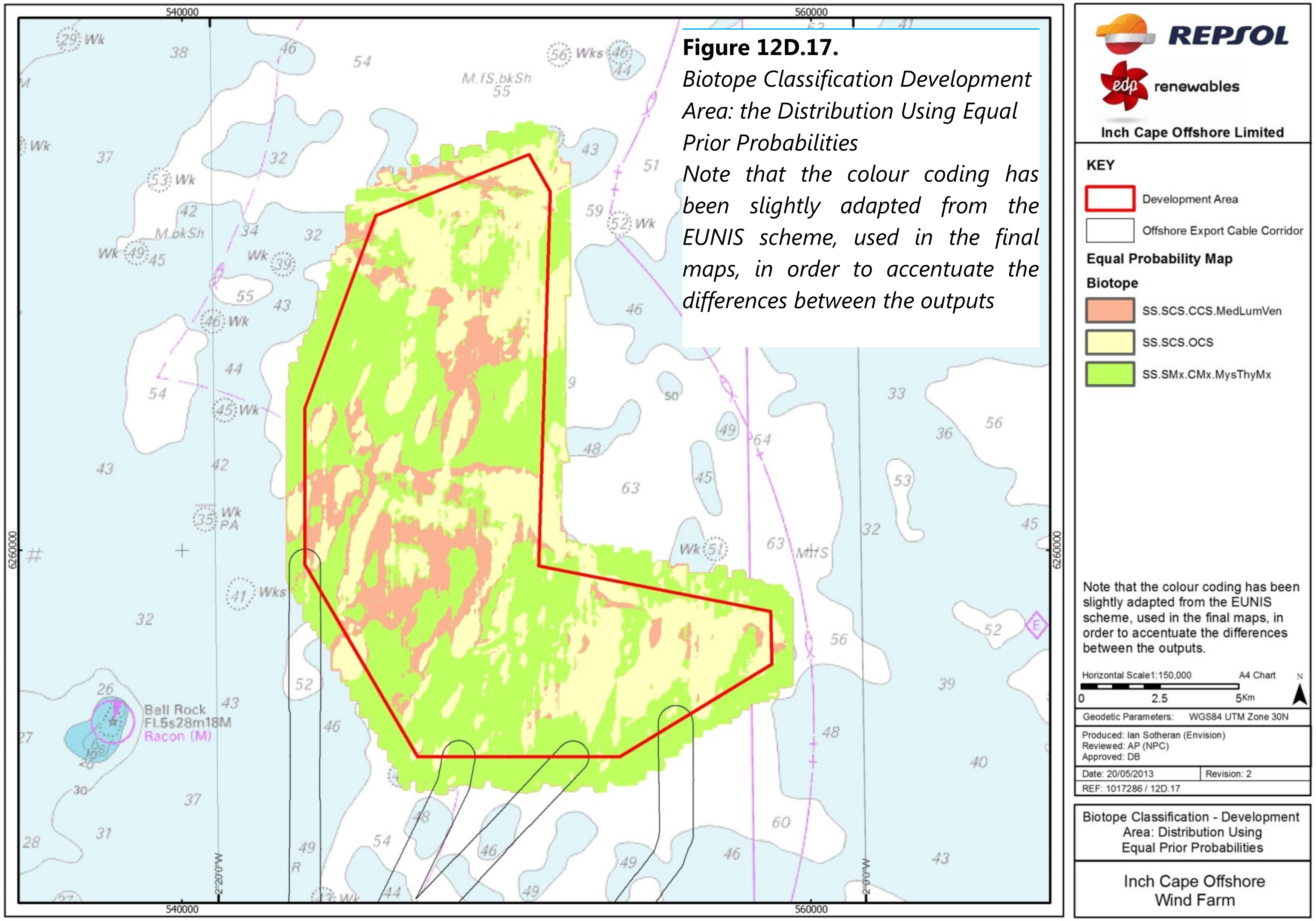


Figure 12D.17.
Biotope Classification Development Area: the Distribution Using Equal Prior Probabilities
Note that the colour coding has been slightly adapted from the EUNIS scheme, used in the final maps, in order to accentuate the differences between the outputs

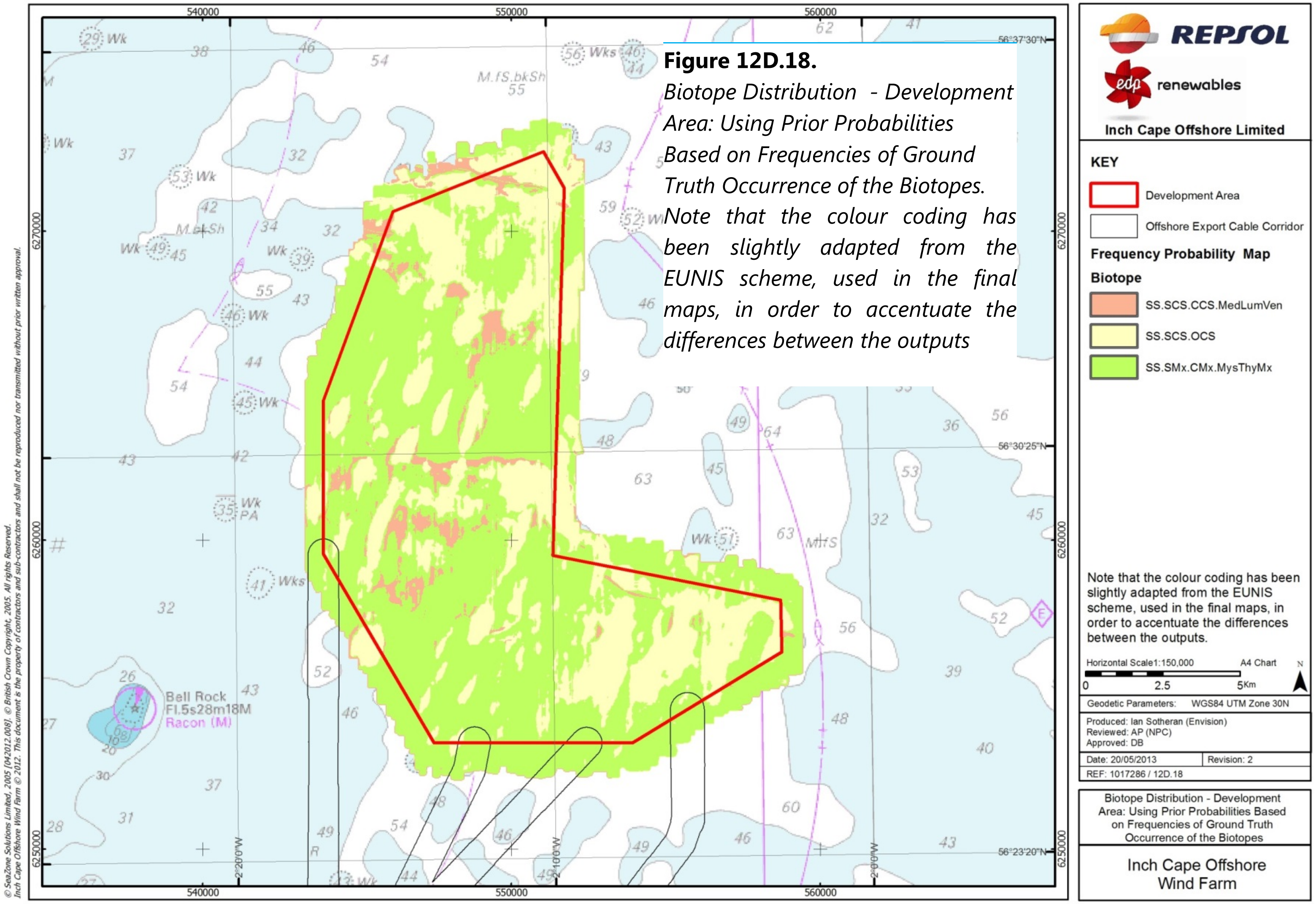


Figure 12D.18.

Biotope Distribution - Development Area: Using Prior Probabilities Based on Frequencies of Ground Truth Occurrence of the Biotopes. Note that the colour coding has been slightly adapted from the EUNIS scheme, used in the final maps, in order to accentuate the differences between the outputs

An error analysis has been performed on this analysis and the overall level of agreement (0.52) is fair rather than good (0.7 and above is considered a good level of agreement). In order to understand the nature of the error, it is necessary to examine the error matrix in detail (Table 12D.1).

The rows show the percentage of the three biotope classes predicted by the map that actually occurred within the ground truth training sites of each of the three classes. The first biotope (SS.SCS.CCS.MedLumVen) was 'over-predicted' and there was a high probability (Error of commission) that many of the predicted areas may, in fact, have been SS.SMx.CMx.MysThyMx. However, the probability that the first biotope was omitted was small (Error of omission). There was also a probability of over-prediction of the second biotope (SS.SCS.OCS) (Table 12D.1).

Table 12D.1.
Biotope Mapping Error Matrix

		1	2	3	Error Commission
SS.SCS.CCS.MedLumVen	**1**	8.1	0.1	15.0	0.7
SS.SCS.OCS	**2**	1.2	16.9	12.2	0.4
SS.SMx.CMx.MysThyMx	**3**	1.5	1.1	44.0	0.1
Error Omission		0.2	0.1	0.4	0.3

The prior probabilities can be changed for the classification analysis to reflect the overall differences in the occurrence of the three biotopes (0.14, 0.18 and 0.71 respectively). The result is shown in Figure 12D.8 and the distribution of SS.SCS.CCS.MedLumVen is more restricted to the benefit of SS.SMx.CMx.MysThyMx whilst SS.SCS.OCS is little changed. However, this analysis resulted in a much higher error of omission for SS.SCS.CCS.MedLumVen with some occurrences not reflected in the map at all.

It was decided to take forward the analysis using the equal prior probability with the assumption that the over-prediction of the less frequent biotopes at the expense of the most frequent was probably of lesser importance than under-prediction. However, it must be borne in mind that the actual distribution of SS.SCS.CCS.MedLumVen may be somewhere between that shown in these two images.

12D.3.1.2 Sediment Classification

The sediment ground truth records were predominantly of sand with smaller proportions of slightly gravelly sand, gravelly sand and sandy gravel with a very small number of muddy gravelly sand and muddy sand. The outputs from a preliminary classification indicated that this imbalance between the different Folks classes lead to errors of prediction with considerable overlap (often termed 'confusion') between similar sediment types. One way to overcome these issues is to amalgamate groups where confusion is greatest. On this basis the original sediment classes were grouped into three major sediment classes as follows: sand (muddy sand + sand), gravelly sand (gravelly muddy sand + slightly gravelly sand +

gravelly sand) and sandy gravel (original class not changed). Additionally, prior probabilities were set to reflect the general frequencies of occurrence of these classes. Two distribution maps (Figure 12D.9 and Figure 12D.20) were prepared using equal prior probabilities of the three sediment classes. Figure 12D.19. over-predicts sandy gravel whereas using prior probabilities based on frequencies of ground truth occurrence of the sediment classes. Figure 12D.20. has a slight under-prediction of sandy gravel. The later version was taken forward for the final sediment map.

The resulting distribution was examined using an error matrix, as completed for the biotope distribution map, and the overall Kappa agreement measure was 0.56 (fair). The error matrix indicated that there was probably over-prediction of gravelly sand and under-prediction of sandy gravel.

Table 12D.2.
Sediment Mapping Error Matrix

		1	2	3	Error Commission
Sand	**1**	**33.9**	**6.1**	**0.9**	**0.2**
Gravelly sand	**2**	12.4	35.5	4.8	0.3
Sandy gravel	**3**	0.9	0.6	4.9	0.2
Error Omission		0.3	0.2	0.5	

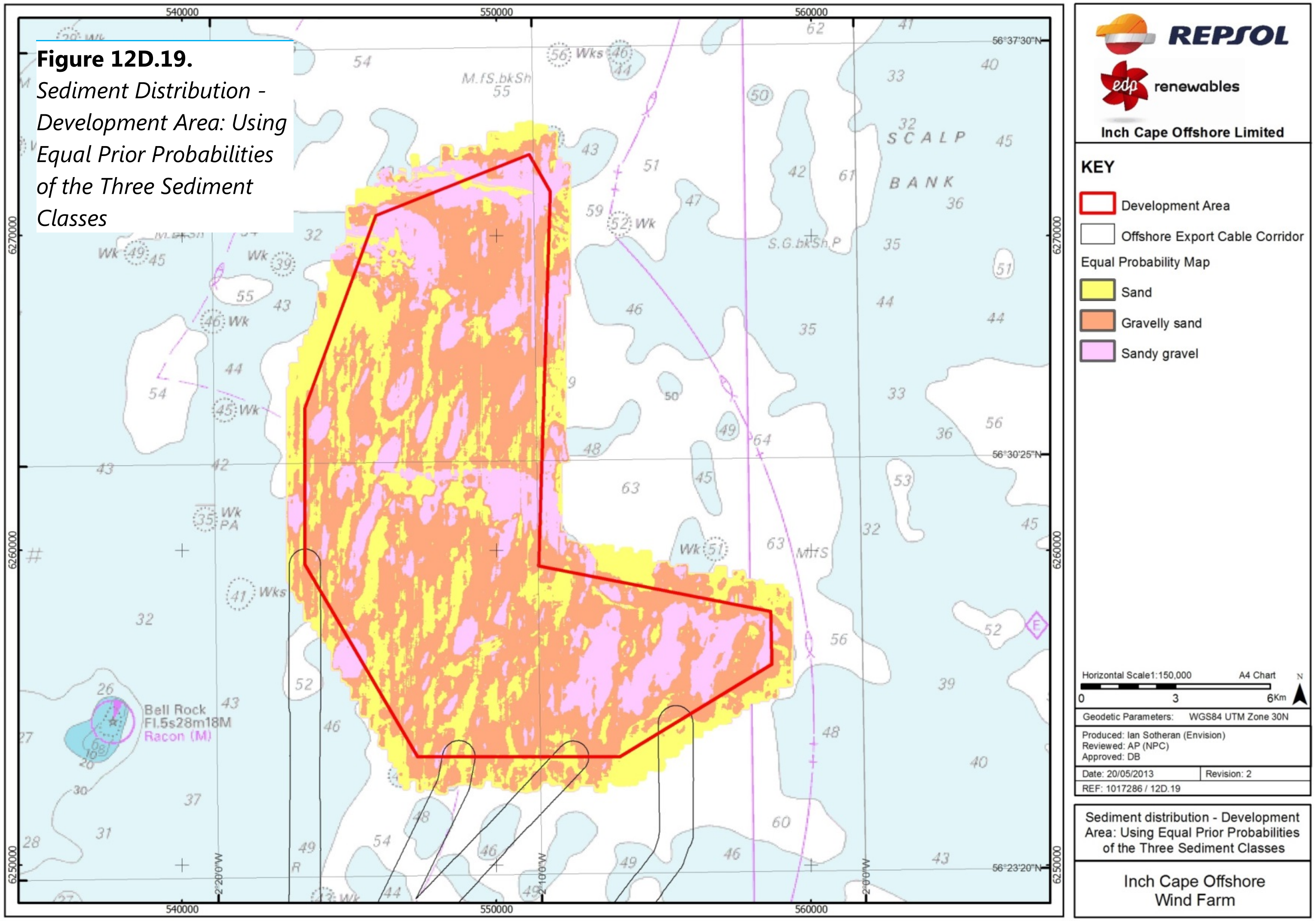


Figure 12D.19.
Sediment Distribution - Development Area: Using Equal Prior Probabilities of the Three Sediment Classes

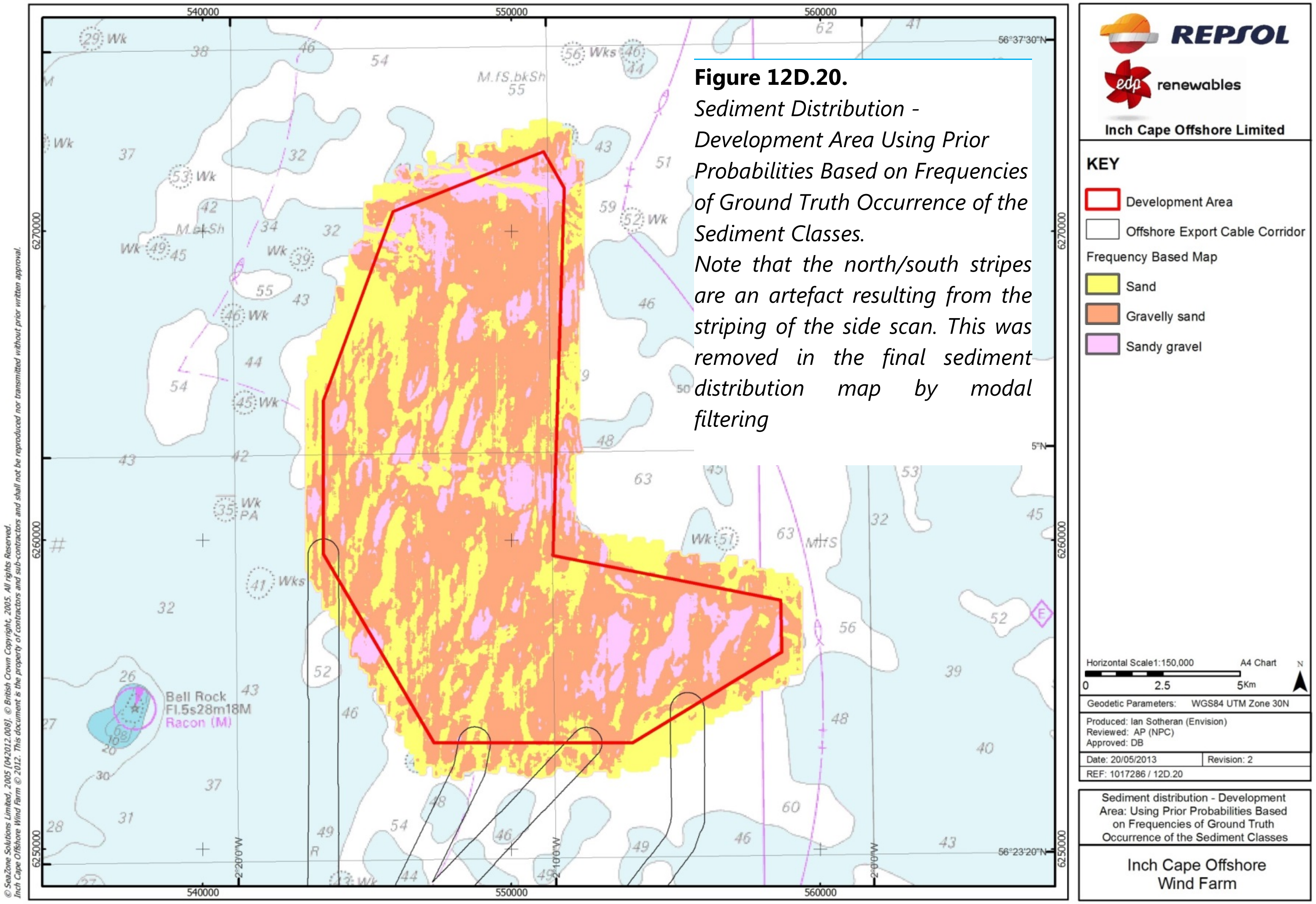


Figure 12D.20.
Sediment Distribution - Development Area Using Prior Probabilities Based on Frequencies of Ground Truth Occurrence of the Sediment Classes.
Note that the north/south stripes are an artefact resulting from the striping of the side scan. This was removed in the final sediment distribution map by modal filtering

12D.3.2 Offshore Export Cable Corridor

The analysis of the Offshore Export Cable Corridor geophysical data relied on relocating adjacent sample records onto the geophysical data in order to increase the ground truth data for certain some features which would have been underrepresented in the analysis. Where this is not an ideal solution it is the best available procedure given the data available and it does mean that statistical analysis of accuracy of the distributions of biotopes and sediments would be over calculated.

There were six biotope categories on the Offshore Export Cable Corridor with SS.SMu.CFiMu.SpnMeg the predominant biotope. One singleton biotope (in fact, a mixed biotope SS.SMx.FluHyd/ SS.SSa.CMuSa) was amalgamated into another mixed biotope group SS.SMx.FluHyd/ SS.SMx.CIloMxNem. The sediment records were predominantly muddy sand or sandy mud. The remainder were singleton records and were amalgamated to reduce the total number of sediment classes to five. There were sufficient ground truth data (24 points in total) to be able to analyse the geophysical data using the biotope and sediment classes as the training classes.

The small number of records for the nearshore portion of the Offshore Export Cable corridor (13 in total) spread over five biotope classes and four sediment classes created problems for the interpretation of the geophysical data in this section of the export cable route: small training sites result in poorly defined statistical signatures and the resulting classification is unsatisfactory. In order to overcome this, a signature was created for each individual record and the predicted distributions of similar biotopes or sediment records were subsequently amalgamated.

Alternative analyses were not performed on the Offshore Export Cable Corridor data and the outputs from analyses were incorporated into the final biotope and sediment distribution figures (See Figure Portfolio 12D.5).

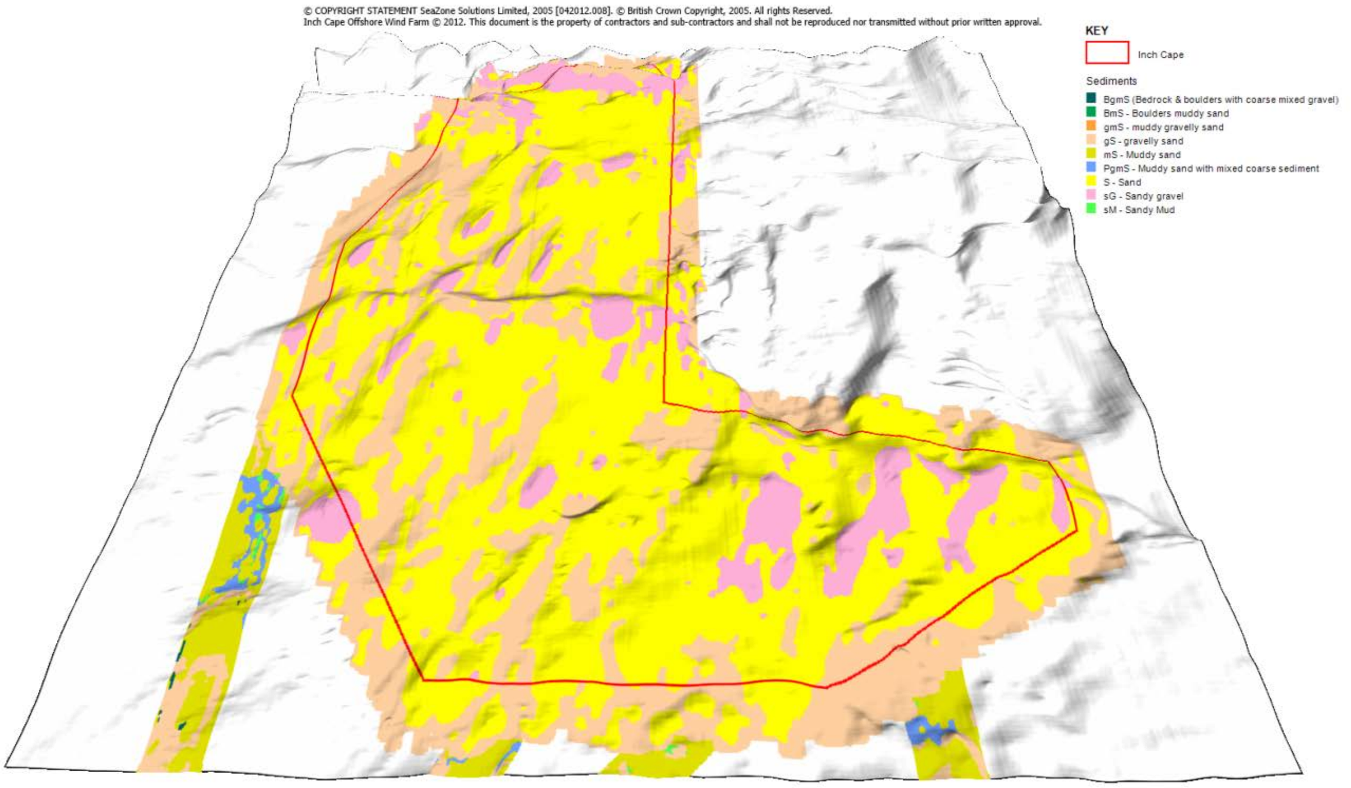
12D.4 Discussion

12D.4.1 Distribution of Biotopes and Sediment

The topography of the Development Area has two large ridges and troughs running irregularly east-west and numerous smaller sand banks aligned roughly north east/ south west (Figure 12D.9). The steeper, well-defined sand banks appear to be characterised by sandy gravel with the more irregular sand banks being largely sandy.

Figure 12D.21.

The Sediment Distribution is Draped over a Digital Terrain Model for the Development Area



The distributions of biotopes and sediments with depth in the Development Area are shown in Figure 12D.21. Although sand appears to be common on the raised sand banks and the gravelly sand in the lower lying troughs between, there is no clear depth cut-off between these two sediments. The biotopes SS.SCS.CCS.MedLumVen and SS.SCS.OCS are found at depths shallower than 50 m. Although the biotope SS.SMx.CMx.MysThyMx is the predominant biotope at depths below 50 m, it is found at all depths.

The Offshore Export Cable Corridor is predominantly muddy sand and sandy mud that supports the biotope "sea pens & burrowing megafuana" (SS.SMu.CFiMu.SpnMeg) with occasional outcrops of mixed sediment and cobble with the biotopes SS.SMx.CMx.MysThyMx or the epiufaunal SS.SMx.CMx.FluHyd.

The nearshore areas of the Offshore Export Cable Corridor is also largely muddy sand and SS.SMu.CFiMu.SpnMeg occurs close nearshore and in depths shallower than 30 m. Other habitats close nearshore are more mixed sediments with boulders.

12D.4.2 Annex 1 Features

Although there are morphological sand banks on the Development Area, these are at depths greater than 30 m and do not qualify as Annex 1 features.

In addition to sediment based biotopes there are also some cobble based areas (CMx.FluHyd) and it is possible that cobble features could qualify as a stony reef habitat under the EU Habitats Directive (Irving, 2009). An assessment of resemblance against criteria of an Annex 1 reef has been carried in Appendix 12C and is considered in *Chapter 12 Benthic Ecology Section 12.5.3*.

12D.4.3 Performance of the Analysis

The analysis of the Development Area has been accompanied by a discussion of the likely results of any error in the classification process. Error generally results in either an under-prediction or over-prediction of classes that leads to a contraction or expansion (respectively) of these classes on the distribution map. However, the general distribution remains much the same within the margin of error and the choice of output to use in the final maps has been made to best represent all the classes. Given the extent of sampling undertaken in the Development Area, a high level of confidence can be placed in the final maps being a true representation of the area.

As the Offshore Export Cable Corridor is less well supported by sample records the predicted distribution of biotopes and sediment classes along the route is the best possible given the constraints. As the sample records have been used to predict adjacent seabed types to no statistical analysis of the direction and scale of errors can be made, however a confidence assessment can be made using MESH standards.

The MESH confidence assessment tool was used to provide a confidence rating for the Offshore Export Cable Corridor and results in a confidence score of 70.

12D.5 Figures Portfolio

The following section contains a portfolio of maps showing the Benthic Biotopes, the Benthic Sediments at various scales.

- Figures 12D.22 – 12D.25: Benthic Biotopes, showing the Project, the Development Area, the Offshore Export Cable Corridor and the nearshore areas of the Offshore Export Cable Corridor
- Figures 12D.26 – 12D.29: Benthic Sediments, showing the Project, Development Area, the Offshore Export Cable Corridor and the nearshore areas of the Offshore Export Cable Corridor

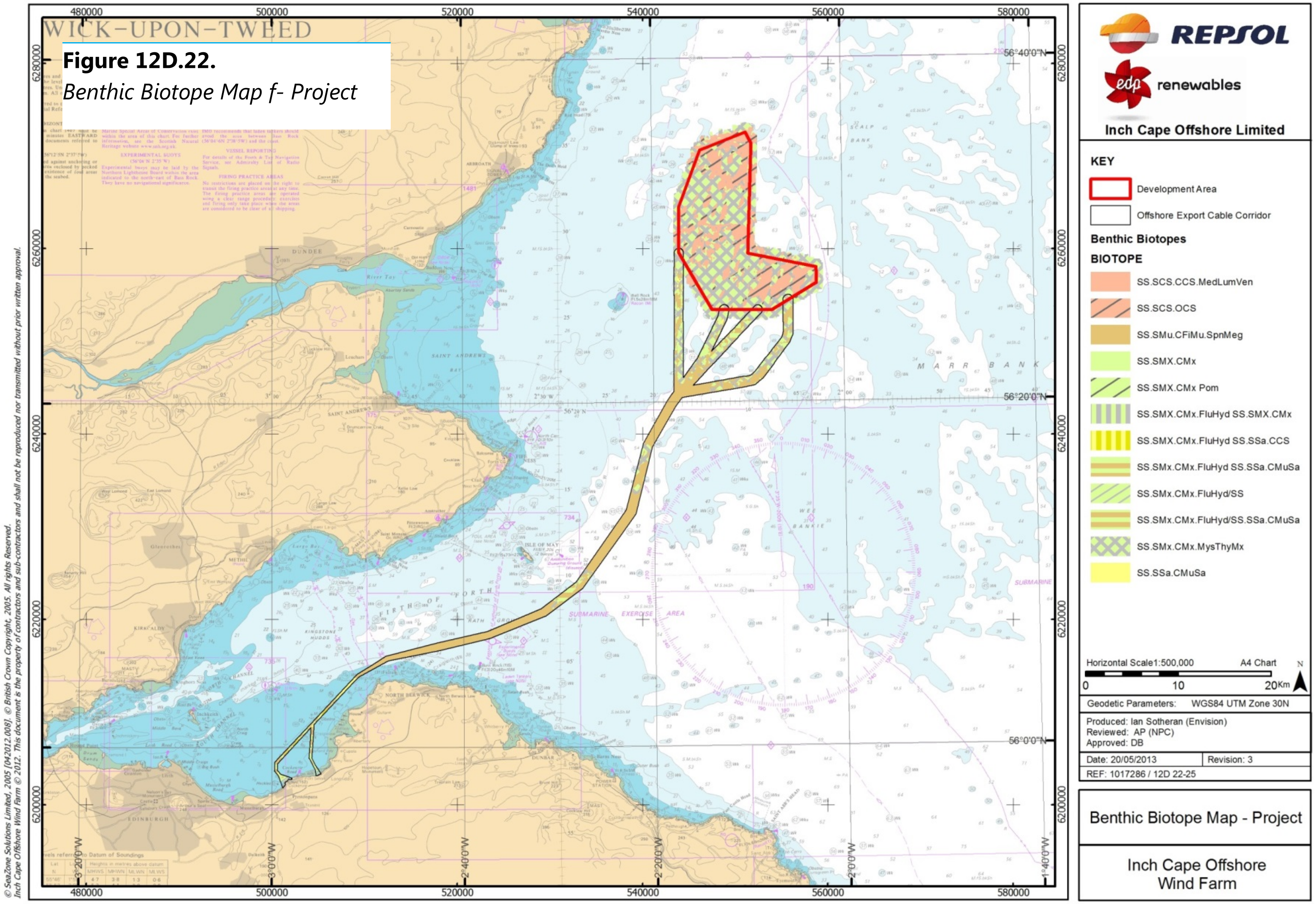


Figure 12D.22.
Benthic Biotope Map f- Project

Figure 12D.23.
Benthic Biotope Map - Development Area

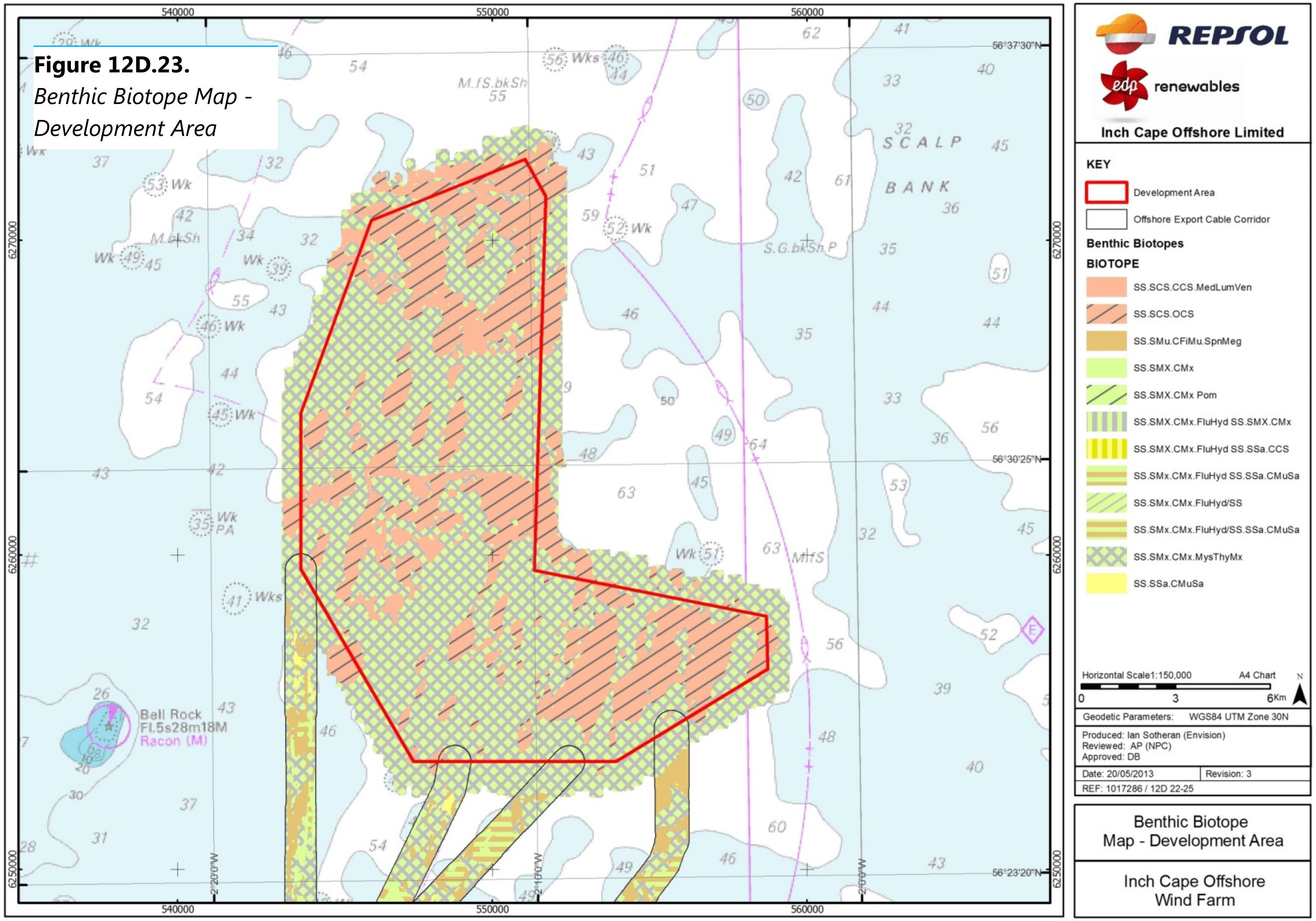
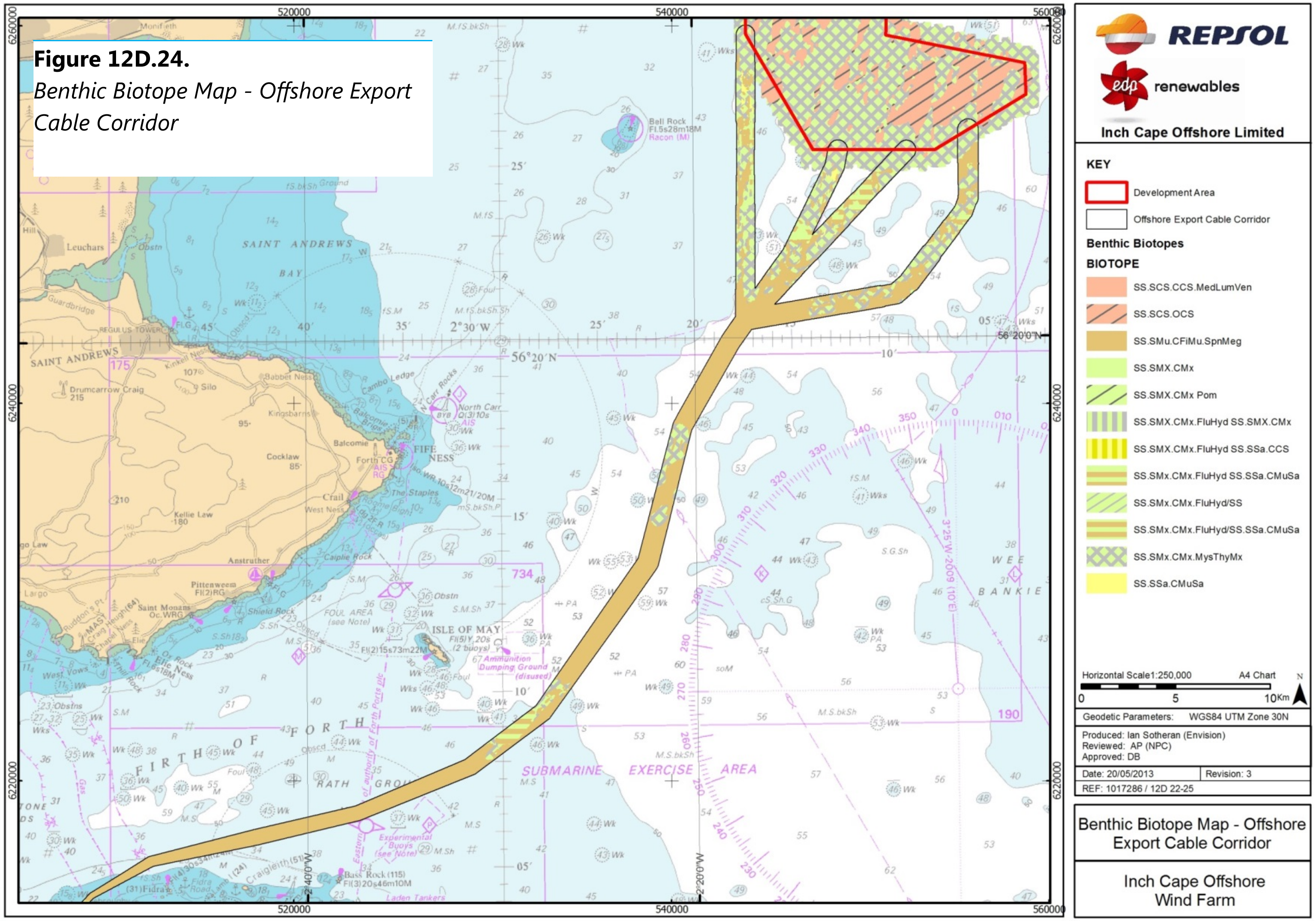


Figure 12D.24.
Benthic Biotope Map - Offshore Export Cable Corridor



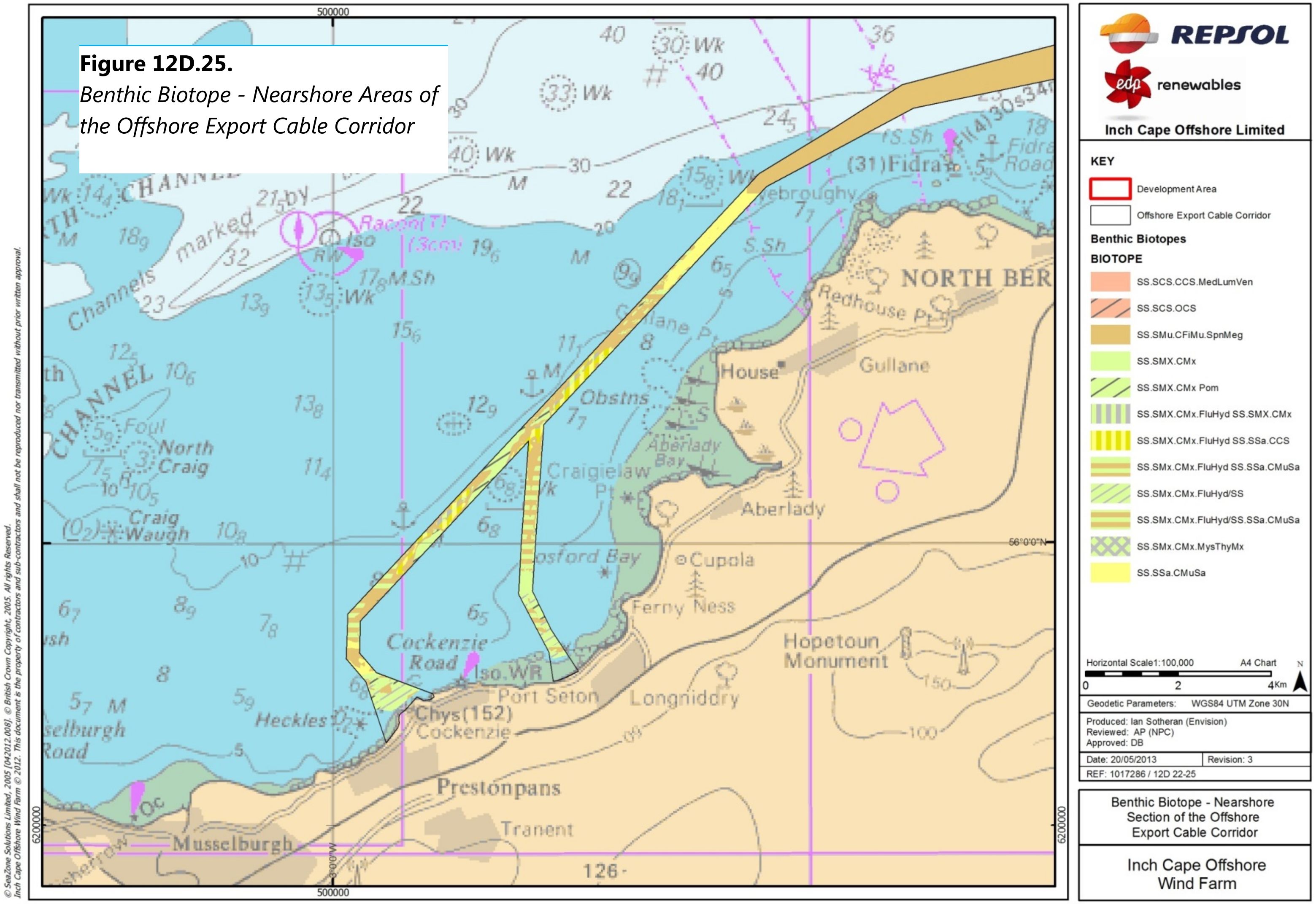


Figure 12D.25.
Benthic Biotope - Nearshore Areas of the Offshore Export Cable Corridor
REPSOL
renewables
Inch Cape Offshore Limited
KEY
Development Area
Offshore Export Cable Corridor
Benthic Biotopes
BIOTOPE
SS.SCS.CCS.MedLumVen
SS.SCS.OCS
SS.SMu.CFiMu.SpnMeg
SS.SMX.CMx
SS.SMX.CMx Pom
SS.SMX.CMx.FluHyd SS.SMX.CMx
SS.SMX.CMx.FluHyd SS.SSa.CCS
SS.SMx.CMx.FluHyd SS.SSa.CMuSa
SS.SMx.CMx.FluHyd/SS
SS.SMx.CMx.FluHyd/SS.SSa.CMuSa
SS.SMx.CMx.MysThyMx
SS.SSa.CMuSa
Horizontal Scale1:100,000 A4 Chart
0 2 4Km
Geodetic Parameters: WGS84 UTM Zone 30N
Produced: Ian Sotheran (Envision)
Reviewed: AP (NPC)
Approved: DB
Date: 20/05/2013 Revision: 3
REF: 1017286 / 12D 22-25
Benthic Biotope - Nearshore Section of the Offshore Export Cable Corridor
Inch Cape Offshore Wind Farm
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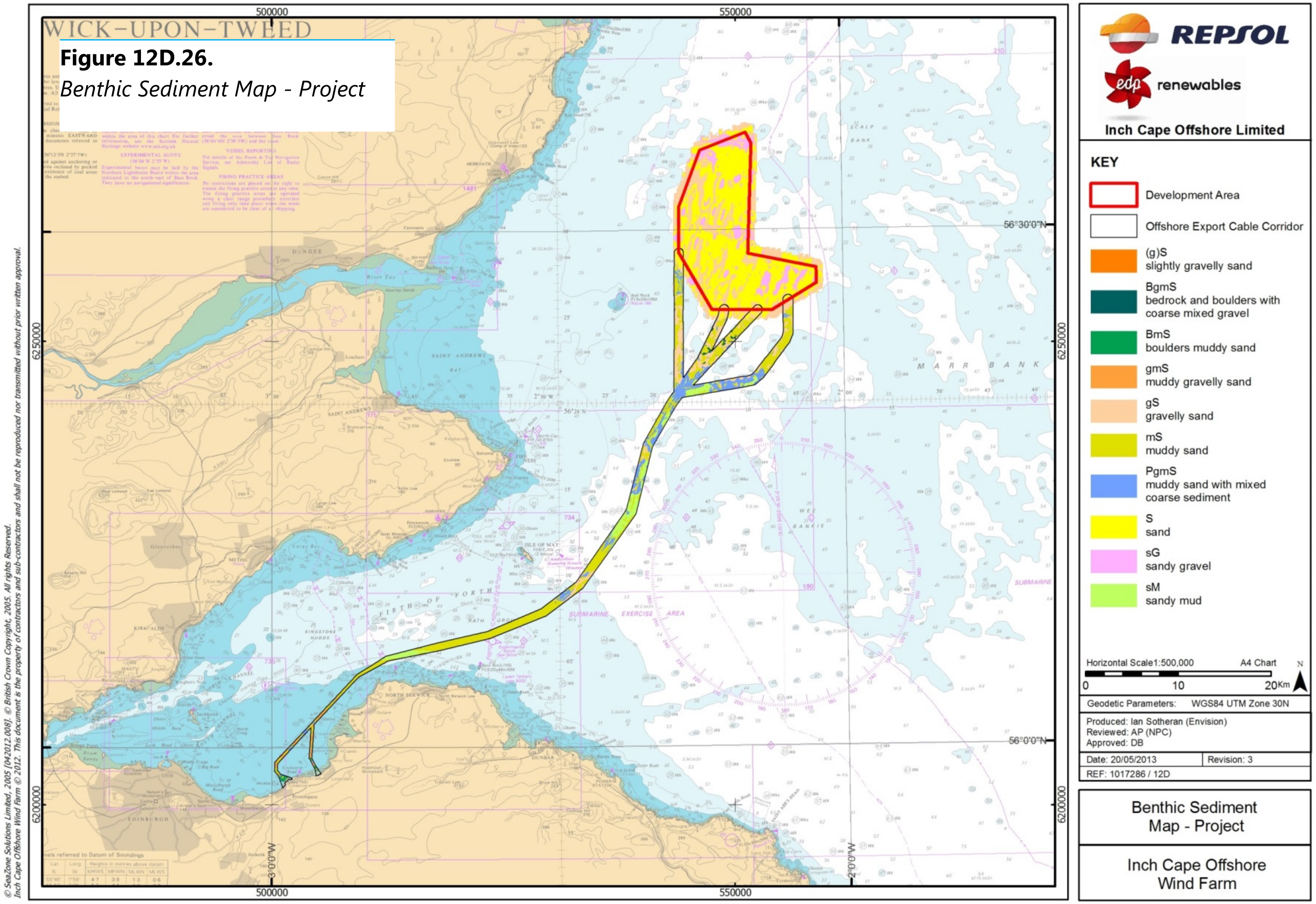

Figure 12D.26.
Benthic Sediment Map - Project

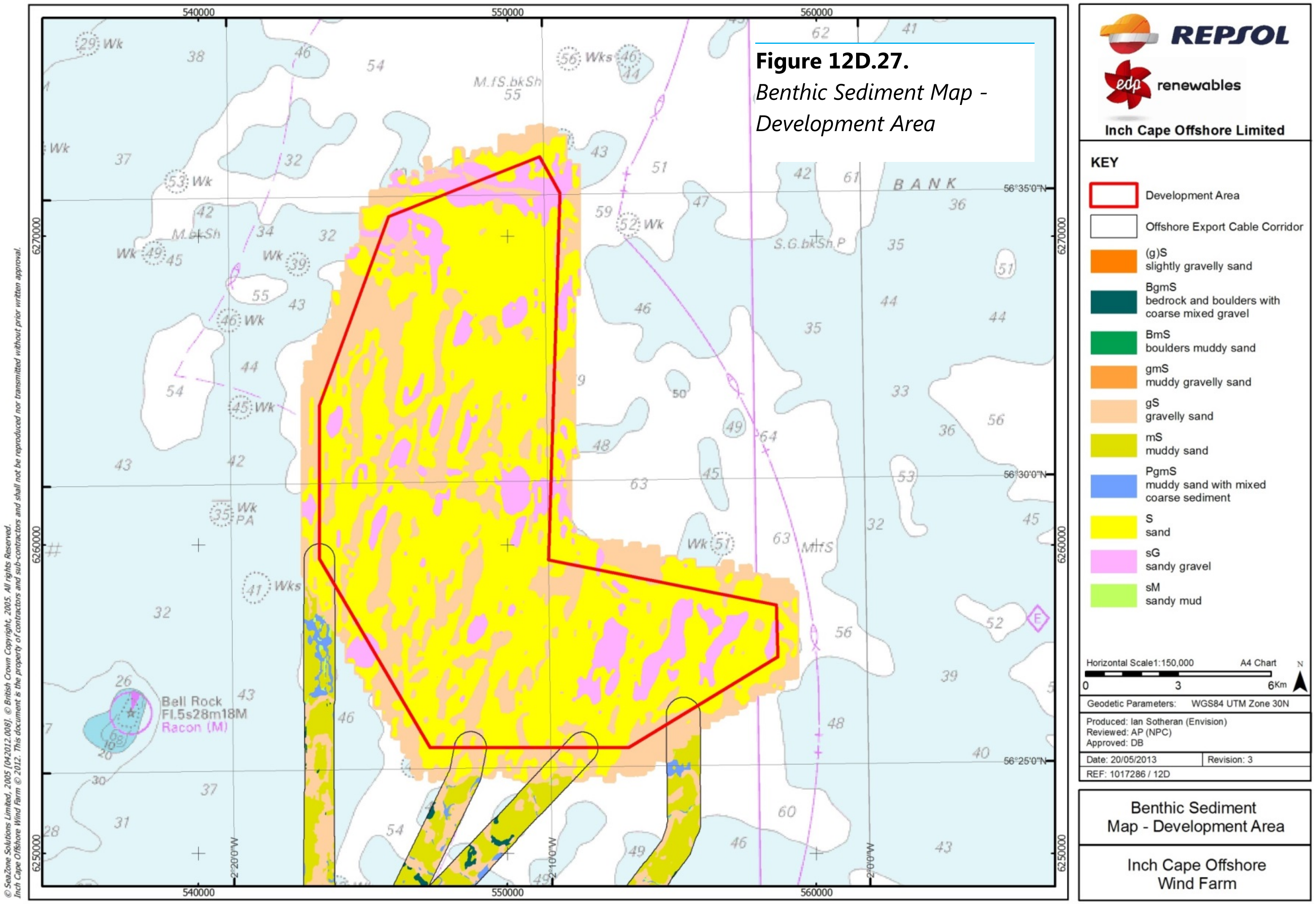

Figure 12D.27.
Benthic Sediment Map - Development Area
Inch Cape Offshore Limited
KEY
Development Area
Offshore Export Cable Corridor
(g)S slightly gravelly sand
BgmS bedrock and boulders with coarse mixed gravel
BmS boulders muddy sand
gmS muddy gravelly sand
gS gravelly sand
mS muddy sand
PgmS muddy sand with mixed coarse sediment
S sand
sG sandy gravel
sM sandy mud
Horizontal Scale1:150,000 A4 Chart
0 3 6Km
Geodetic Parameters: WGS84 UTM Zone 30N
Produced: Ian Sotheran (Envision)
Reviewed: AP (NPC)
Approved: DB
Date: 20/05/2013 Revision: 3
REF: 1017286 / 12D
Benthic Sediment Map - Development Area
Inch Cape Offshore Wind Farm
Bell Rock
Fl.5s28m18M
Racon (M)
BANK
540000
550000
560000
6270000
6260000
6250000
56°35'0"N
56°30'0"N
56°25'0"N
2°20'0"W
2°10'0"W
2°0'0"W
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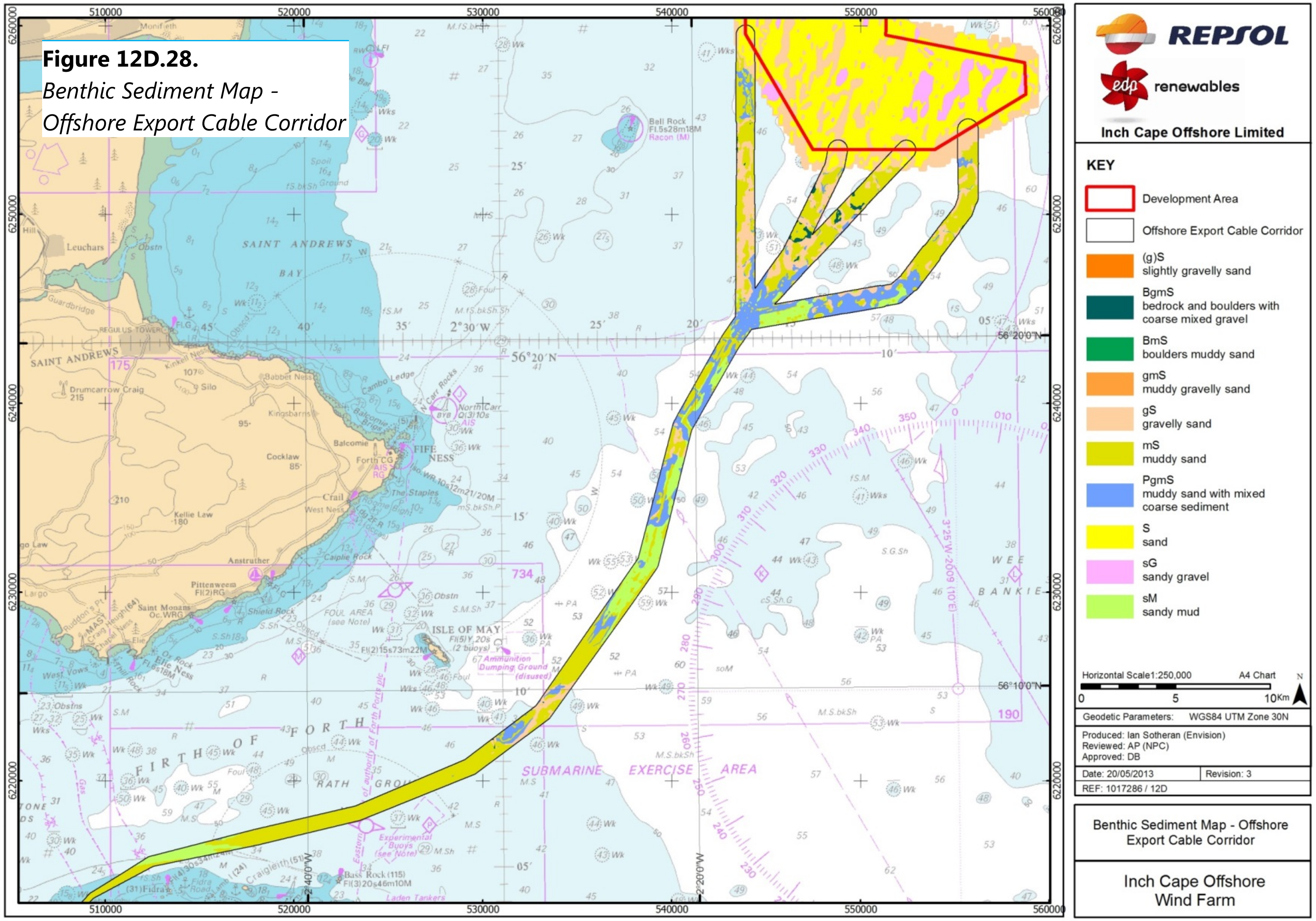

Figure 12D.28.
Benthic Sediment Map -
Offshore Export Cable Corridor
REPSOL
renewables
Inch Cape Offshore Limited
KEY
Development Area
Offshore Export Cable Corridor
(g)S
slightly gravelly sand
BgmS
bedrock and boulders with coarse mixed gravel
BmS
boulders muddy sand
gmS
muddy gravelly sand
gS
gravelly sand
mS
muddy sand
PgmS
muddy sand with mixed coarse sediment
S
sand
sG
sandy gravel
sM
sandy mud
Horizontal Scale1:250,000
A4 Chart
0
5
10Km
Geodetic Parameters: WGS84 UTM Zone 30N
Produced: Ian Sotheran (Envision)
Reviewed: AP (NPC)
Approved: DB
Date: 20/05/2013
Revision: 3
REF: 1017286 / 12D
Benthic Sediment Map - Offshore Export Cable Corridor
Inch Cape Offshore Wind Farm

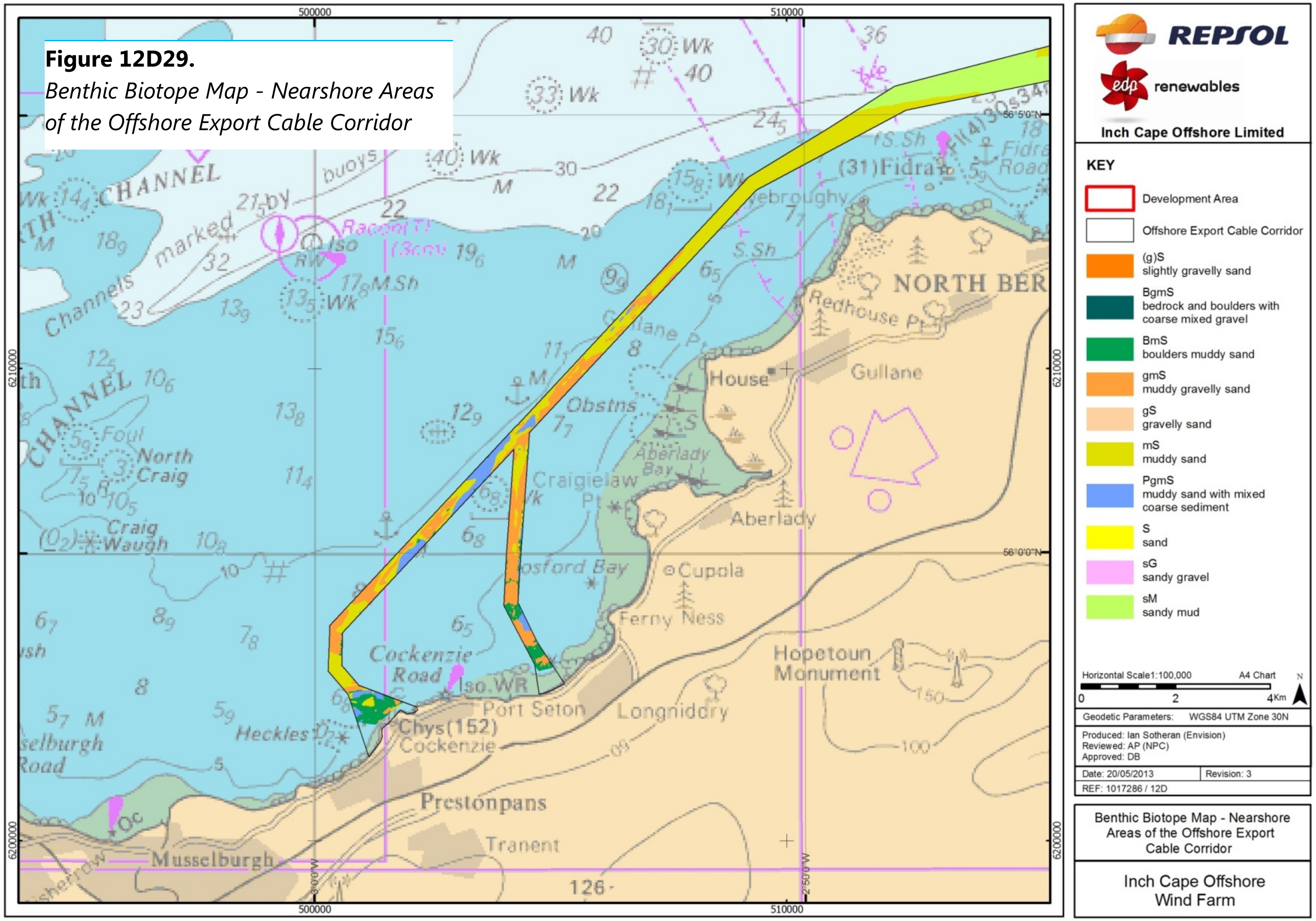

Figure 12D29.
Benthic Biotope Map - Nearshore Areas of the Offshore Export Cable Corridor

12D.6 References

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