RHYL FLATS
OFFSHORE WIND FARM
DEVELOPMENT

SEABED COMPARISON

2001 (Fugro Data) – August 2005 – March 2006

FINAL
REPORT

C6005c

June 2006

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RHYL FLATS
OFFSHORE WIND FARM DEVELOPMENT

SEABED COMPARISON
2001 (Fugro Data) – August 2005 – March 2006

REPORT

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For the attention of: -

Julian Garnsey

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1. INTRODUCTION

On the instructions of Npower Renewables, Osiris Projects were commissioned to carry out hydrographic survey works within the proposed turbine area of the Rhyl Flats offshore wind farm development site in Liverpool Bay. The overall primary objective of the surveys was to map bathymetry, sub-bottom profiling and seabed features, including any magnetic anomalies and sonar contacts.

The purposes of this report were to directly compare both the bathymetry and side scan sonar data sets from two surveys carried out in 2005 and 2006, in order to evaluate the general movement of mobile sediments across the site. This scope was extended when bathymetric data from the 2001 survey, carried out by Fugro Ltd, was also made available for comparison.

Osiris Projects carried out the first of their surveys during August 2005, with data collected at a survey line spacing of 50m. Data acquisition for the 2006 survey was carried out during the period 14th March to 5th April 2006. This survey involved running a series of additional lines, run parallel to, but offset 10m south from, the 2005 survey lines. All processed and interpreted data from the 2006 survey is separately presented in Osiris Projects Report No C6005b.

Data acquisition for the 2005 and 2006 surveys was undertaken using MV 'Barinthus', a purpose built survey vessel owned and operated by Ocean Marine Services Limited.

All positions are expressed in UTM Zone 30N, 3°W coordinates, throughout this report.

2. RESULTS AND INTERPRETATION

All charts can be found in Appendix 1 to this report.

2.1 Existing Bathymetry (2006)

Drawing no C6005-C-01a presents the bathymetry for the turbine area for both August 2005 and March/April 2006, contoured at a vertical interval of 1.0m, relative to Chart Datum (CD), which is approximately (Lowest Astronomical Tide (LAT). The accuracy of the seabed levels for each of the surveys is quoted as ± 0.1m.

Seabed levels across the development area range from below -3.5mCD, at the extreme south easterly limits of the site, to below -13.5mCD at the north and north westerly limits of the development area, which covers the eastern edge of Constable Bank.

Bed levels vary rapidly across a large expanse of sand waves, which lies over much of the southern section of the development area. In the eastern section of this area of sand waves, individual sand wave crests lie between -3.3mCD and -6.5mCD, with their corresponding troughs falling to below -9.0mCD. Whereas, in the western section, the individual sand waves are much smaller, with their crests lying at approximately -9.5mCD and their corresponding troughs at -10.5mCD. Maximum seabed gradients of up to 1 in 5 can be found on several of the steepest sided sand waves.

The general dip of the seabed across this area of sand waves is from south east to north west, with the sand waves gradually disappearing offshore of a line drawn through 454025mE, 5915900mN to 459500mE, 5914700mN. Offshore of this line, seabed levels dip towards the north.

2.2 Bathymetry Comparison: 2001 - 2005 - 2006

For direct visual comparisons, the 2005 and 2006 data sets are presented side by side on drawing no C6005-C-01a, at a scale of 1:10000, with drawing no C6005-C-02a indicating the actual differences in seabed levels between the two surveys, presented at a scale of 1:5000. Similarly, the 2001 and 2006 data sets are presented side by side on drawing no C6005-C-01b, at a scale of 1:10000, with drawing no C6005-C-02b indicating the actual differences in seabed levels between those two surveys, also presented at a scale of 1:5000. Finally, drawing nos C6005-C-03a and -03b present a contoured, pseudo-colour image of the 2006 bathymetry data set, overlain with the 2005 and 2001 contours (in red) respectively.

By comparing the bathymetry data from each of the data sets, it has been possible to identify localised areas of erosion (where seabed levels have deepened) and areas of deposition (where seabed levels have risen).

Raw multi-beam echo sounder data sets from the 2005 and 2006 surveys were contoured using the same commercial software package (Surfer v.8) and identical gridding parameters to ensure compatibility. The 2001 single beam echo sounder data set was collected by Fugro Ltd and provided to Osiris Projects as raw XYZ data.

Drawing no C6005-C-02a indicates any variations in seabed levels across the turbine area between the 2005 and 2006 surveys, with coloured areas indicating either a shallowing or deepening of the seabed respectively. The data shows that seabed levels have risen by up to 0.4m over much of the turbine area, although most of this occurs along the edges of the numerous bed forms in the southern part of the site. Drawing no C6005-C-03b shows the 2001 contours (in red) overlain onto the pseudo-colour contoured 2006 data image. This chart shows very little differences in the positions on individual contours between the two surveys.

A comparison of the two data sets indicates that there has been a relatively minor net movement of sediment into the survey area between the August 2005 and March/April 2006 surveys. The net effect of this has produced only minor changes in the shapes of individual sand waves, with the actual sand wave crest positions almost identical to those from the 2005 survey.

Drawing no C6005-C-02b indicates variations in seabed levels between the 2001 and 2006 surveys. This shows that highly localised seabed level changes of up to 2.5m occur along the crests and troughs of many of the numerous bed forms, although between these individual features, variations in seabed levels average less than 0.5m. Drawing no C6005-C-03b shows the 2001 contours (in red) overlain onto the pseudo-colour contoured 2006 data image. This chart indicates that a lateral shift in the seabed contours has taken place across the southerly sand wave area, over the period between the two surveys. This lateral shift averages between 25m and 40m from west to east and results in highly localised seabed level changes of up to 2.5m, caused by the movement of sediments across the area.

The table below shows the reduced seabed levels from the individual surveys, at each of the turbine locations:

Turbine No.	2001	2005	2006	Turbine No.	2001	2005	2006	Turbine No.	2001	2005	2006
1	11.4	11.7	11.6	**11**	10.7	10.8	10.8	**21**	9.7	9.6	9.6
2	11.0	11.2	11.0	**12**	10.2	9.6	9.6	**22**	9.2	9.1	9.0
3	11.1	11.3	11.1	**13**	9.8	9.7	9.5	**23**	8.8	8.4	8.4
4	10.9	11.1	10.9	**14**	8.8	8.5	8.7	**24**	8.0	7.8	7.7
5	10.7	10.9	10.8	**15**	8.4	8.6	8.6	**25**	7.8	7.6	7.5
6	10.2	10.3	10.2	**16**	8.4	8.0	7.8	**26**	6.7	6.7	6.6
7	9.1	9.3	9.2	**17**	7.9	7.9	8.0	**27**	6.2	6.5	6.4
8	12.5	12.6	12.5	**18**	6.1	6.3	6.3	**28**	6.0	5.7	5.9
9	11.9	11.7	11.6	**19**	11.0	11.0	10.8	**29**	7.3	6.8	6.9
10	11.4	11.3	11.2	**20**	10.3	10.4	10.3	**30**	4.3	4.1	4.1

2.3 Existing Seabed Features (2006)

The results of the side scan sonar survey can be found on drawing no C6005-C-05, the Seabed Features with Contacts chart. This chart is presented at a scale of 1:5000.

The sonar data indicate that granular sediments are present at seabed level across the whole survey area. These deposits range from mobile finer-grained sands over much of the southern section of the development area, to less mobile coarser grained gravelly sands/sandy gravels, together with cobbles and occasional boulders.

A large area of sand waves is present to the south of a line drawn through 454025mE, 5915900mN to 459500mE, 5914700mN. The sand waves stand up to 4.0m high, with wavelengths of between 100m and 300m and they are generally orientated NNW – SSE, with the exception of the extreme SE corner of the development area, where the orientation is NW –SE. Smaller, megaripple bed forms are present between individual sand waves. The megaripples are orientated similar to the sand waves, but with average wavelengths of between 5.0 and 12.0m and heights generally less than 0.5m. To the north of the sand wave area, the seabed sediments consist of coarser granular materials, comprising mainly sandy gravels and cobbles, with occasional boulders. These granular deposits are covered by a general veneer of finer grained sands in an irregular WNW – ESE orientated strip, which traverses the northern part of the survey area.

Many of the boulders can be clearly seen on the sonar data, together with other relevant seabed contacts. The sonar targets have been cross-correlated with the magnetic anomaly data, where relevant. No charted wrecks are present within the limits of the survey area.

A total of 70 seabed targets were noted on the sonar data set and these are outlined on the relevant listings in Appendix 2 to this report.

2.4 Seabed Features Comparison (2005 – 2006)

Seabed character boundaries across the development area appear to have remained almost constant in the period between the two respective surveys, with the crests of any major bedforms in almost identical positions. A total of 70 seabed targets were noted on the sonar data set, compared with a total of 54 targets identified during the 2005 survey. This may be due to several factors, including survey line position and minor sediment movement. Many of the targets correspond to those identified during the 2005 survey and these are outlined on the relevant listings in Appendix 2 to this report.

2.5 Existing Magnetometer (2006)

The results of the magnetometer survey can be found on the Seabed Features with Contacts Chart, drawing no C6005-C-05. A total of 33 magnetic anomalies are indicated within the survey area, with the positions of their respective maximum deflections along individual survey lines plotted. These points do not necessarily indicate the actual positions of the features causing the individual anomalies.

With the exceptions of the two large anomalies related to the existing meteorological mast, the anomalies vary in size between 0.5nT and 26.7nT.

2.6 Magnetometer Comparison (2005 – 2006)

When comparing the 2005 and 2006 data sets, many of the 2006 magnetic anomalies are seen to roughly coincide with earlier features, in both position and amplitude. However, anomaly MR20, which appears to relate to the 2005 anomaly M43, has increased in amplitude from 2.8nT to 26.7nT, indicating that the buried feature causing both anomalies lies closer to the position of MR20.

Similarly, anomaly MR30 (amplitude 7.7nT) appears to relate to the 2005 anomaly M80 (amplitude 3.5nT). This indicates that the buried feature causing both anomalies lies closer to the position of MR30.

Once again, when comparing the 2005 and 2006 data sets, it is also obvious that significantly more anomalies were flagged during the earlier survey. With the possible exception of M71 (amplitude 9.4nT), from the 2005 data set, most other magnetic anomalies not seen (or identified) during the 2006 survey, appear to be localised features. These may also not have been seen, as the 2006 survey lines were offset to the north by 10m from the corresponding 2005 lines. Details of all anomalies can be found on the relevant listings in Appendix 2 to this report.

3. DISCUSSION

As expected, the data comparison has indicated seabed level variations over parts of the development area.

The relatively small timescale between the 2005 and 2006 surveys gives only a limited indication of the general movement of sediments across the site. However, when comparing the 2001 and 2006 data sets, the data shows a marked lateral, west to east shift in the contours on the large southerly area of sand waves. This shift has resulted in highly localised seabed level changes, particularly along the crests and troughs of the large sand waves, which is caused by the gradual movement of these large bed forms from west to east, across the area.

APPENDICES

APPENDIX 1 - CHARTING

C6005-C-01a - Bathymetry Differences Overview 2005 – 2006

C6005-C-01b - Bathymetry Differences Overview 2001 – 2006

C6005-C-02a - Bathymetry Differences 2005 – 2006 Data

C6005-C-02b - Bathymetry Differences 2001 – 2006 Data

C6005-C-03a - 2006 Bathymetry Chart with 2005 Contours Overlain

C6005-C-03b - 2006 Bathymetry Chart with 2001 Contours Overlain

C6005-C-04 - Seabed Features Overview 2005 - 2006

C6005-C-05 - Seabed Features 2006

APPENDIX 2 - LISTINGS

SIDE SCAN SONAR CONTACT LISTING (2005)

SIDE SCAN SONAR CONTACT LISTING (2006)

MAGNETIC ANOMALY LISTING (2005)

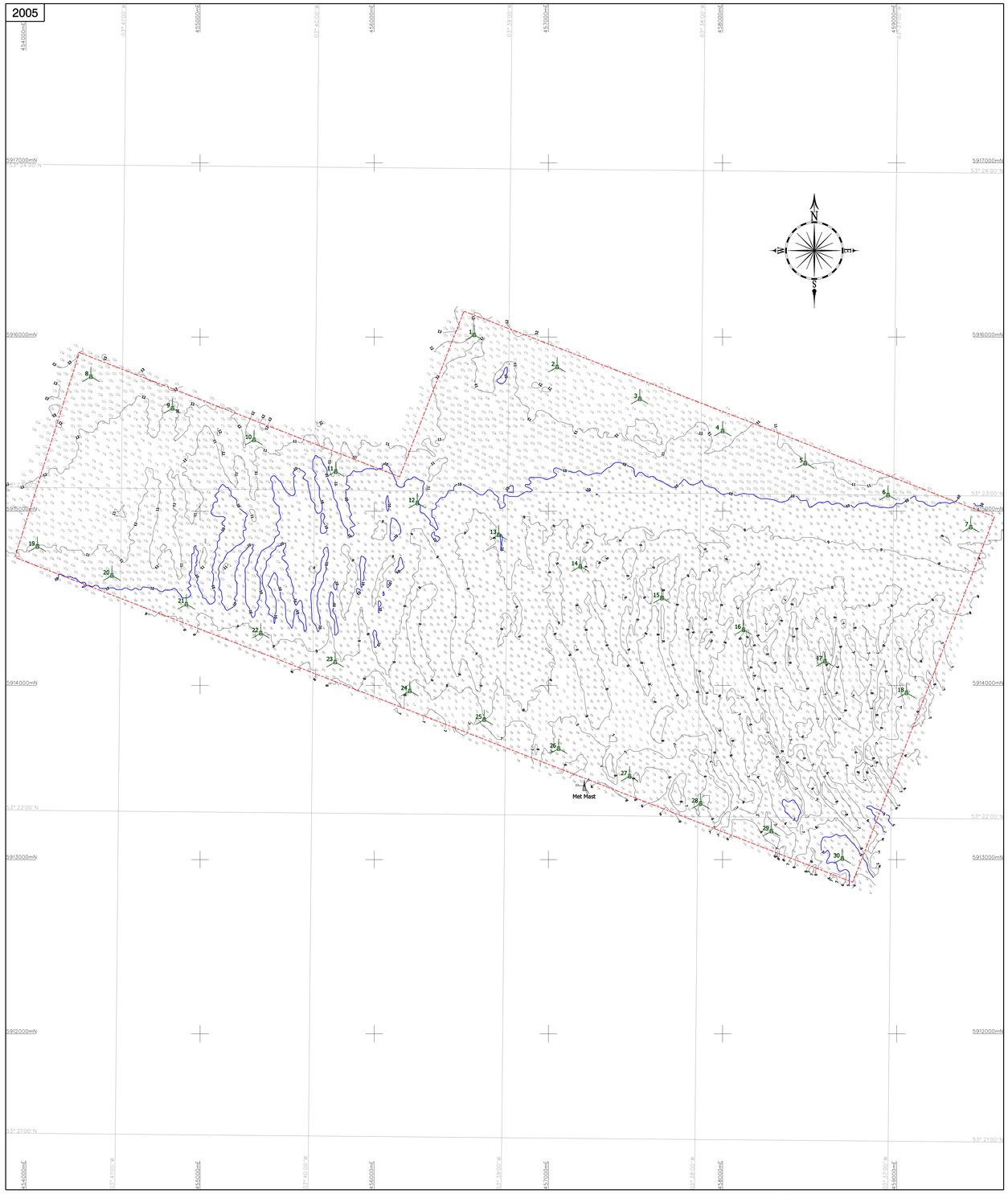
MAGNETIC ANOMALY LISTING (2006)

APPENDIX 1

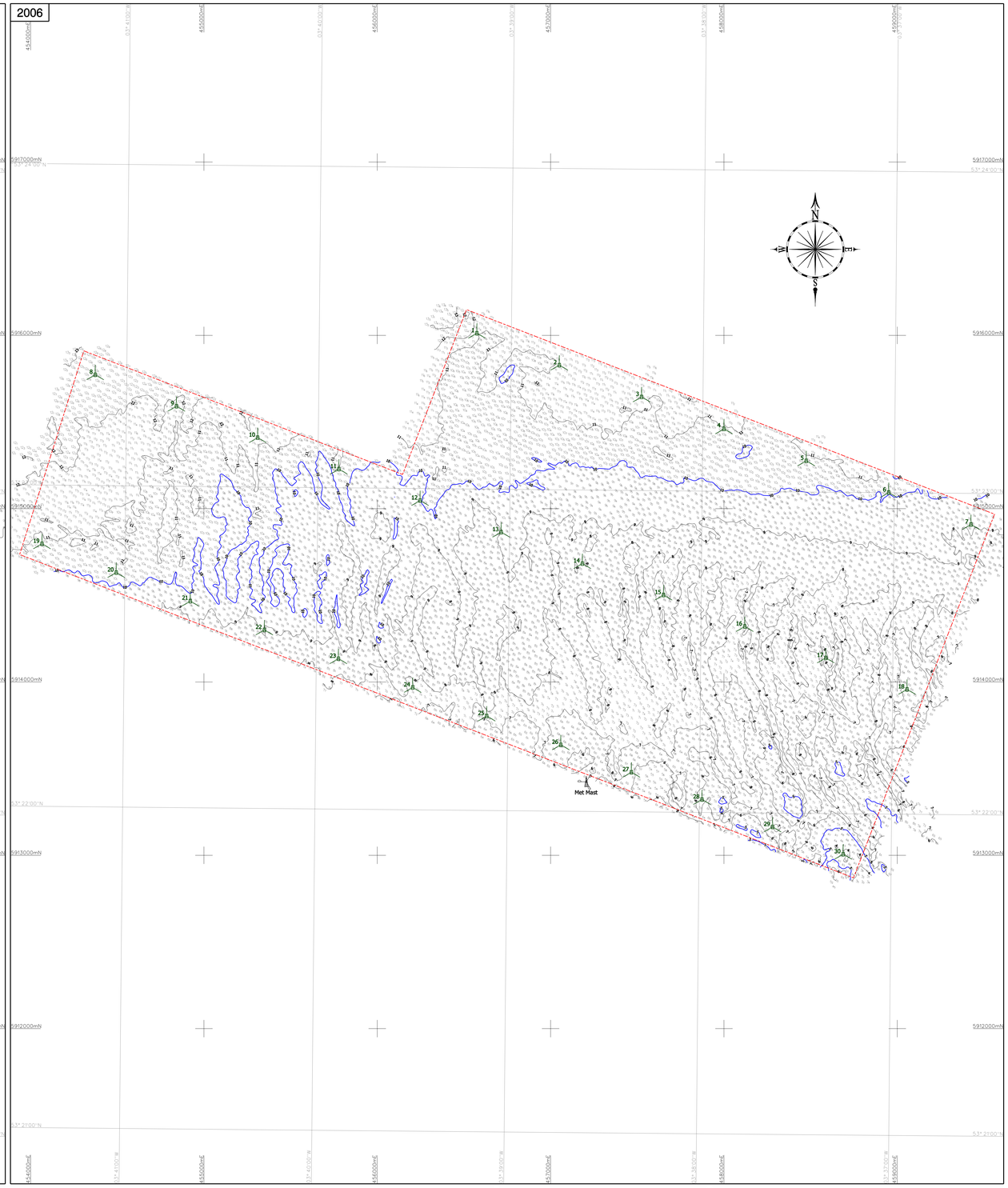
CHARTING

C6005-C-01a	-	Bathymetry Differences Overview 2005 – 2006
C6005-C-01b	-	Bathymetry Differences Overview 2001 – 2006
C6005-C-02a	-	Bathymetry Differences 2005 – 2006 Data
C6005-C-02b	-	Bathymetry Differences 2001 – 2006 Data
C6005-C-03a	-	2006 Bathymetry Chart with 2005 Contours Overlain
C6005-C-03b	-	2006 Bathymetry Chart with 2001 Contours Overlain
C6005-C-04	-	Seabed Features Overview 2005 - 2006
C6005-C-05	-	Seabed Features 2006

2005



2006



Legend:

5 — Major bathymetry contours at 5m intervals below Chart Datum.

1 — Minor bathymetry contours at 1m intervals below Chart Datum.

Soundings in metres and decimetres relative to Chart Datum.

Legend General:

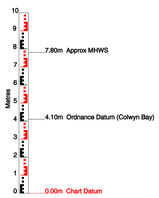
Survey Area.

Turbine position with identifier.

Meteorological Mast.

Vertical Datum:

All depths are in metres and are reduced to Chart Datum (CD).



Notes:

1. Survey conducted by Osiris Projects aboard MV 'Barinthus' during the period 14th March to 5th April 2006.

Geodetic Parameters:

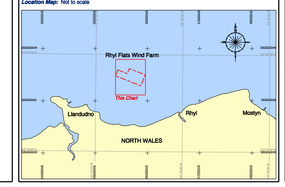
Projection	: UTM, Zone 30
Latitude of Origin	: 0° North
Longitude of Origin	: 3° West
False Easting	: 500000 metres
False Northing	: 0 metres
Scale Factor	: 0.9996
Ellipsoid	: WGS '84
Geodetic Datum	: WGS '84

Horizontal Scale:

Scale 1:10000 — Distance in metres — Original Plot Size A0

0 200 400 600 800 1000

Location Map: Not to scale



Client:

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Contractor:

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D				Drawn.	NLM & HS	May '06
C				Checked.		
B				Approved.		
A	Final	NLM	June '06	Scale Horiz: 1:10000		Contract No:
REVISION: A		By.	Date.	Vert: N/A		C6005

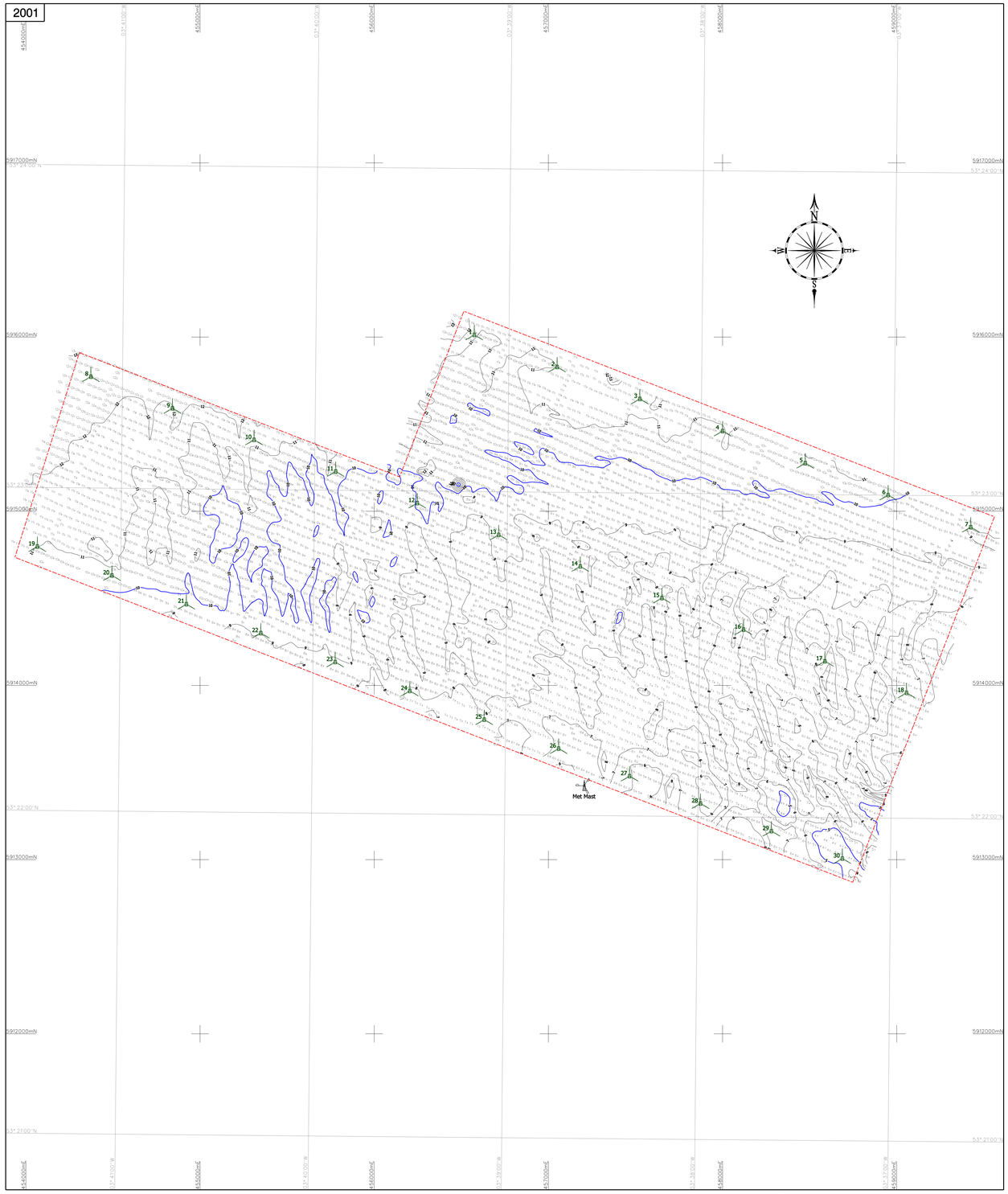
Contract:

RHYL FLATS
OFFSHORE WIND FARM DEVELOPMENT
SEABED COMPARISON 2001, 2005 & 2006

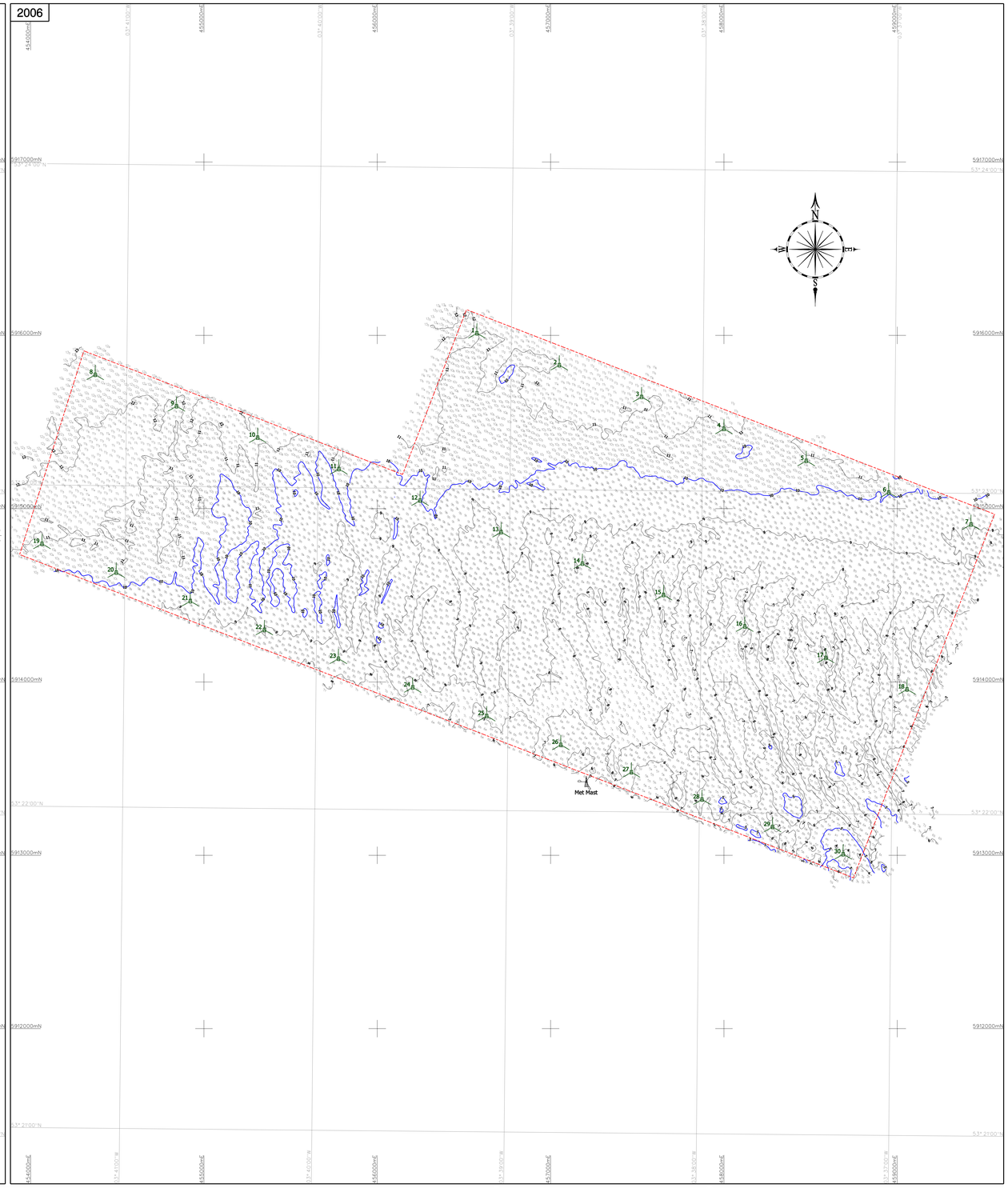
Chart Number:	Appendix:	Chart Title:
C6005-C-01a	-	BATHYMETRY DIFFERENCE OVERVIEW 2005 & 2006

...\Drawings\C6005-C-01a-V8.dgn 20/06/2006 08:28:30

2001



2006



Legend:

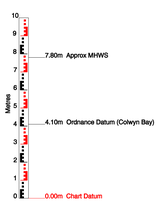
- 5 — Major bathymetry contours at 5m intervals below Chart Datum.
- 1 — Minor bathymetry contours at 1m intervals below Chart Datum.
- Soundings in metres and decimetres relative to Chart Datum.

Legend General:

- Survey Area.
- Turbine position with identifier.
- Meteorological Mast.

Vertical Datum:

All depths are in metres and are reduced to Chart Datum (CD).



Notes:

1. Survey conducted by Osiris Projects aboard M/V 'Barinthus' during the period 14th March to 5th April 2006.
2. Representation of 2001 single beam bathymetry data supplied by Client, surveyed by Fugro Survey Limited.

Geodetic Parameters:

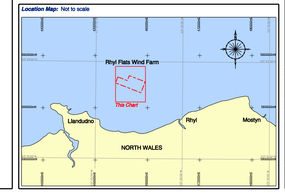
Projection	: UTM, Zone 30
Latitude of Origin	: 0° North
Longitude of Origin	: 3° West
False Easting	: 500000 metres
False Northing	: 0 metres
Scale Factor	: 0.9996
Ellipsoid	: WGS '84
Geodetic Datum	: WGS '84

Horizontal Scale:

Scale 1:10000 — Distance in metres — Original Plot Size A0

0 200 400 600 800 1000

Location Map: Not to scale



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Contractor:

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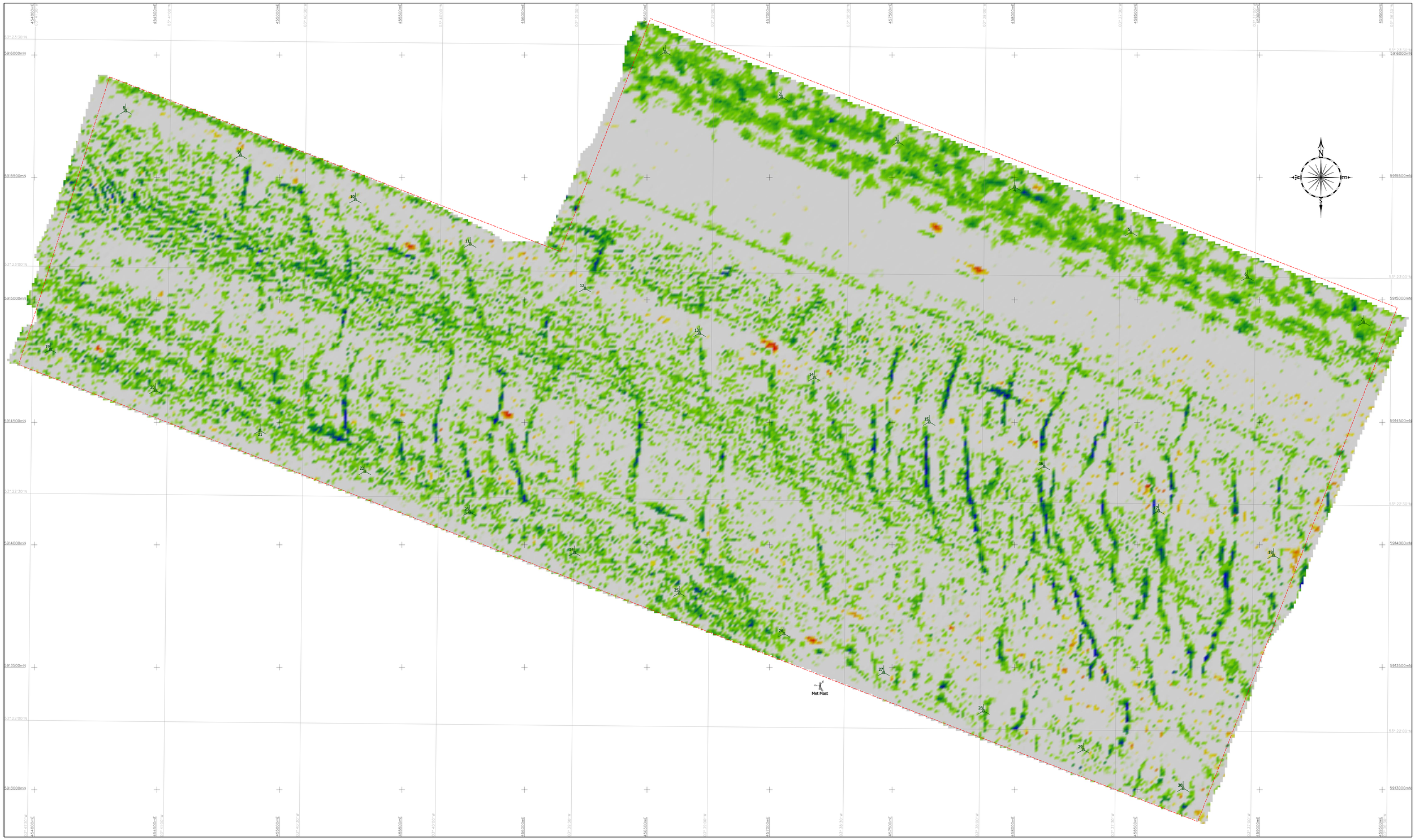
C				Checked.		
B				Approved.		
A	Final	NLM	June '06	Scale Horiz: 1:10000		Contract No:
REVISION: A		By.	Date.	Vert: N/A		C6005c

Contract:

RHYL FLATS
OFFSHORE WIND FARM DEVELOPMENT
SEABED COMPARISON 2001, 2005 & 2006

Chart Number:	Appendix:	Chart Title:
C6005-C-01b	-	BATHYMETRY DIFFERENCE OVERVIEW 2001 & 2006

..\Drawings\C6005-C-01b-V8.dgn 20/06/2006 10:11:38



Legend:

Change in seabed levels between the 2005 and 2006 survey data.

Shallower in 2006

Deeper in 2006

Seabed level change in metres: 0.9, 0.8, 0.7, 0.6, 0.5, 0.4, 0.3, 0.2, 0.1, 0.0, -0.1, -0.2, -0.3, -0.4, -0.5, -0.6, -0.7

Legend General:

Survey Area.

Turbine Position with Identifier.

Meteorological Mast.

Vertical Datum:

All depths are in metres and are reduced to Chart Datum (CD).

Metres: 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0

7.80m Approx MHWS

4.10m Ordnance Datum (Colwyn Bay)

0.00m Chart Datum

Notes:

1. Survey conducted by Osiris Projects aboard MV 'Barinthus' during the period 14th March to 5th April 2006.
2. Due to the subtle differences represented on the chart approximately 6 minor artefacts from the 2006 data have been highlighted.

represents the minor 2006 artifact.

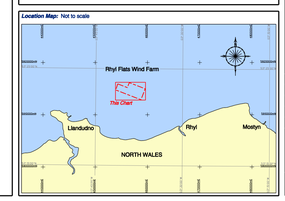
Geodetic Parameters:

Projection	: UTM, Zone 30
Latitude of Origin	: 0° North
Longitude of Origin	: 3° West
False Easting	: 500000 metres
False Northing	: 0 metres
Scale Factor	: 0.9996
Ellipsoid	: WGS '84
Geodetic Datum	: WGS '84

Horizontal Scale:

Scale 1:5000 — Distance in metres: 0, 100, 200, 300, 400, 500 — Original Plot Size A0

Location Map: Not to scale



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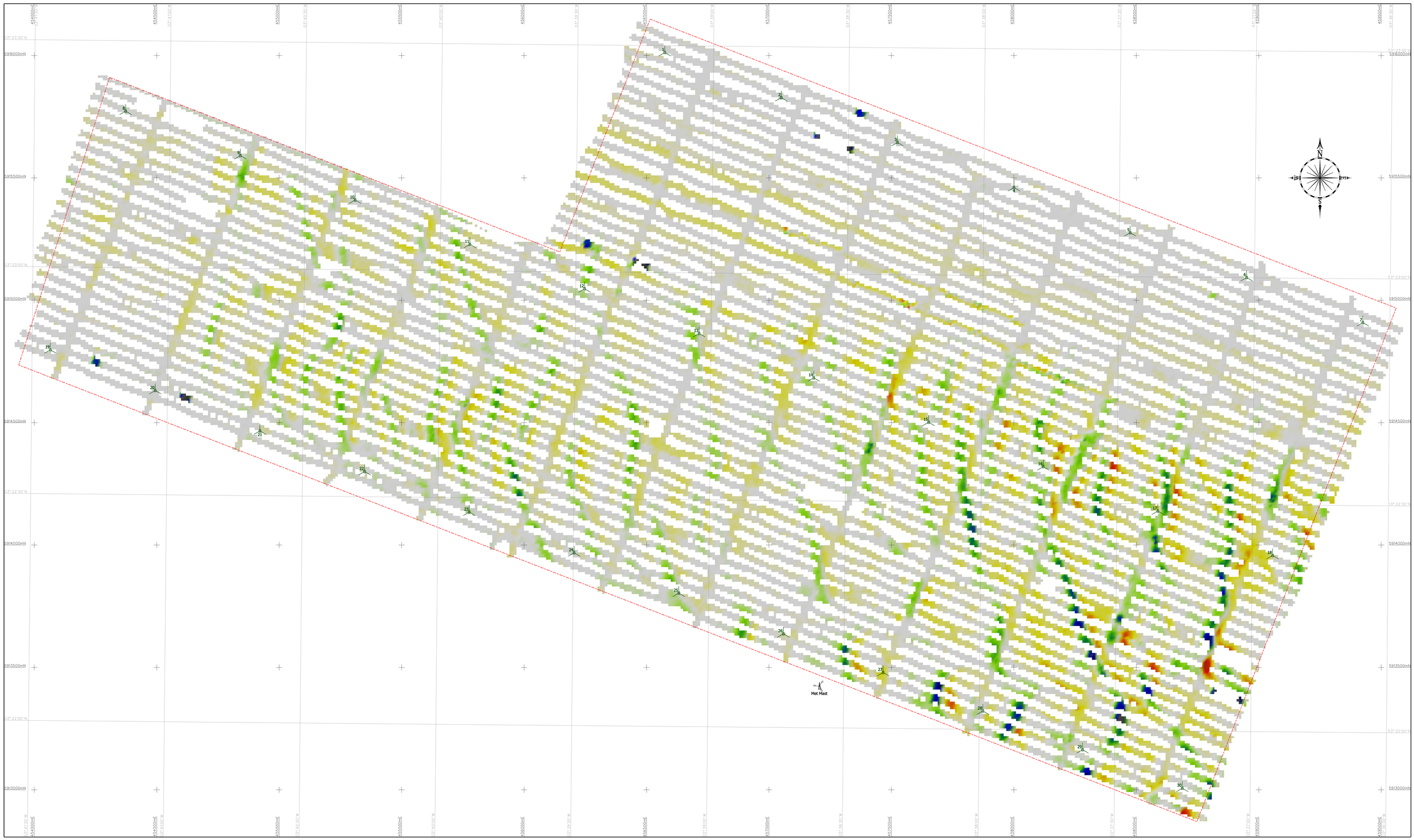
C				Checked.		
B				Approved.		
A	Final	NLM	June '06	Scale Horiz: 1:5000	Contract No:
REVISION: A		By.	Date.	Vert: N/A	C6005c

Contract:

RHYL FLATS
OFFSHORE WIND FARM DEVELOPMENT
SEABED COMPARISON 2001, 2005 & 2006

Chart Number: C6005-C-02a | **Appendix:** - | **Chart Title:** BATHYMETRY DIFFERENCES 2005 - 2006 DATA

...\Drawings\C6005-C-02a-V8.dgn 20/06/2006 08:32:04



Legend:

Change in seabed levels between the 2001 and 2006 survey data.

Seabed level change in metres: 7.5, 7.0, 6.5, 6.0, 5.5, 5.0, 4.5, 4.0, 3.5, 3.0, 2.5, 2.0, 1.5, 1.0, 0.5, 0.0, -0.5, -1.0, -1.5, -2.0, -2.5

Differences related to erroneous values in 2001 data set.

Shallower in 2006

Deeper in 2006

Legend General:

- Survey Area.
- Turbine Position with Identifier.
- Meteorological Mast.

Vertical Datum:

All depths are in metres and are reduced to Chart Datum (CD).

Metres: 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0

7.80m Approx MHWS

4.10m Ordnance Datum (Colwyn Bay)

0.00m Chart Datum

Notes:

1. Survey conducted by Osiris Projects aboard M/V 'Barinthus' during the period 14th March to 5th April 2006.
2. Representation of 2001 single beam bathymetry data supplied by Client, surveyed by Fugro Survey Limited.
3. On interpretation of supplied Fugro, 2001, single beam data it was noted a number of significant artefacts (spikes) were present.

represents the manifestation of these artefacts in terms of the difference chart.

Geodetic Parameters:

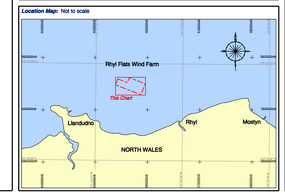
Projection	: UTM, Zone 30
Latitude of Origin	: 0° North
Longitude of Origin	: 3° West
False Easting	: 500000 metres
False Northing	: 0 metres
Scale Factor	: 0.9996
Ellipsoid	: WGS '84
Geodetic Datum	: WGS '84

Horizontal Scale:

Scale 1:5000 — Distance in metres — Original Plot Size A0

0 100 200 300 400 500

Location Map: Not to scale



Client:

npower renewables
RWE Group
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Contractor:

Osiris Projects
Seabed & Sub-Seabed Mapping
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Eastham
Wirral
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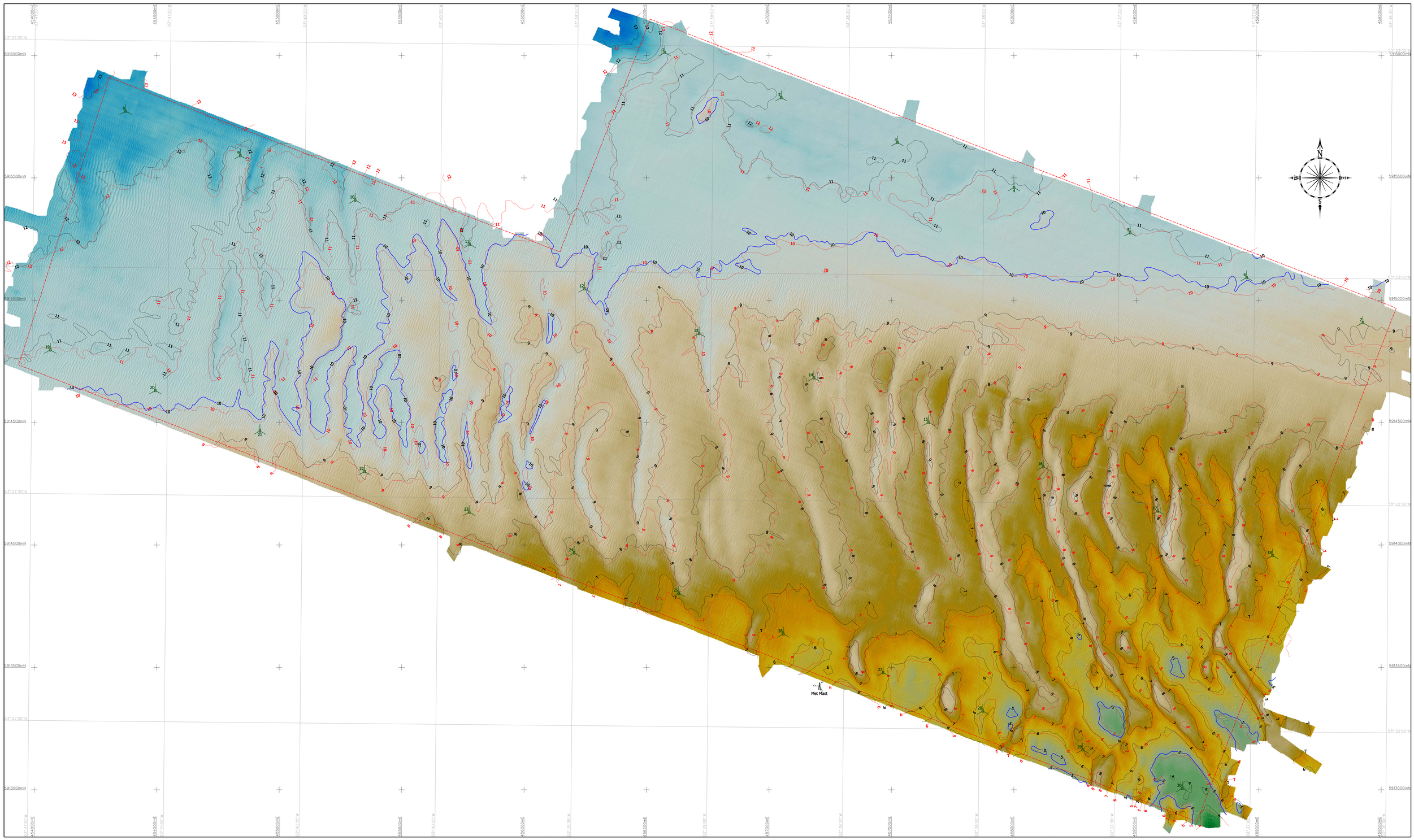
D				Drawn.	NLM & HS	May '06
C				Checked.		
B				Approved.		
A	Final	NLM	June '06	Scale Horiz: 1:5000	Contract No:
REVISION: A		By.	Date.	Vert: N/A	C6005c

Contract:

RHYL FLATS
OFFSHORE WIND FARM DEVELOPMENT
SEABED COMPARISON 2001, 2005 & 2006

Chart Number:	Appendix:	Chart Title:
C6005-C-02b	-	BATHYMETRY DIFFERENCES 2001 - 2006 DATA

...\Drawings\C6005-C-02b-V8.dgn 20/06/2006 10:57:01



Legend:

5 — Major bathymetry contours at 5m intervals below Chart Datum (2006 Survey).

1 — Minor bathymetry contours at 1m intervals below Chart Datum (2006 Survey).

5 — Major bathymetry contours at 5m intervals below Chart Datum (2005 Survey).

1 — Minor bathymetry contours at 1m intervals below Chart Datum (2005 Survey).

Swathe bathymetry image scale bar. Image is displayed with no vertical exaggeration.

Metres below Chart Datum: 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0, 10.5, 11.0, 11.5, 12.0, 12.5, 13.0, 13.5, 14.0

Legend General:

Survey Area.

22 — Turbine Position with Identifier.

Meteorological Mast.

Vertical Datum:

All depths are in metres and are reduced to Chart Datum (CD).

Metres: 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0

7.80m Approx MHWS

4.10m Ordnance Datum (Colwyn Bay)

0.00m Chart Datum

Notes:

1. Survey conducted by Osiris Projects aboard MV 'Barinthus' during the period 14th March to 5th April 2006.

Geodetic Parameters:

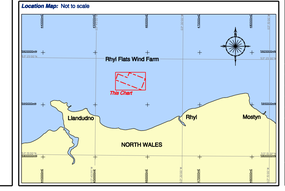
Projection	: UTM, Zone 30
Latitude of Origin	: 0° North
Longitude of Origin	: 3° West
False Easting	: 500000 metres
False Northing	: 0 metres
Scale Factor	: 0.9996
Ellipsoid	: WGS '84
Geodetic Datum	: WGS '84

Horizontal Scale:

Scale 1:5000 — Distance in metres — Original Plot Size A0

0 100 200 300 400 500

Location Map: Not to scale



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Contractor:

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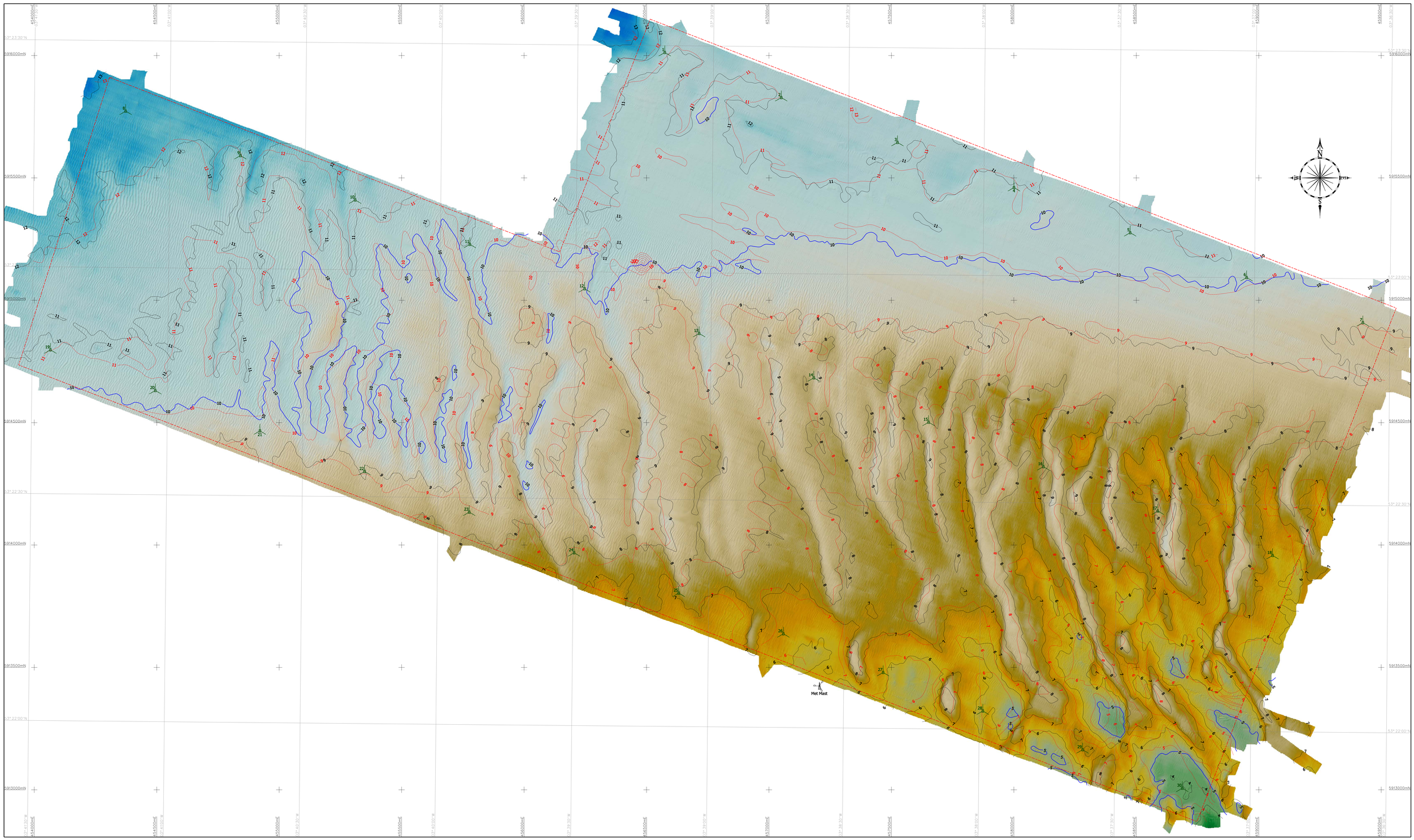
				Drawn.	NLM & HS	May '06
				Checked.		
				Approved.		
A	Final	NLM	June '06	Scale Horiz: 1:5000		Contract No:
REVISION: A		By.	Date.	Vert: N/A		C6005c

Contract:

RHYL FLATS
OFFSHORE WIND FARM DEVELOPMENT
SEABED COMPARISON 2001, 2005 & 2006

Chart Number:	Appendix:	Chart Title:
C6005-C-03a	-	2006 BATHYMETRY CHART WITH 2005 CONTOURS OVERLAIN

..\Drawings\C6005-C-03a-V8.dgn 20/06/2006 08:35:42



Legend:

5 Major bathymetry contours at 5m intervals below Chart Datum (2006 Survey).

1 Minor bathymetry contours at 1m intervals below Chart Datum (2006 Survey).

Swathe bathymetry image scale bar. Image is displayed with no vertical exaggeration.

Metres below Chart Datum: 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0, 10.5, 11.0, 11.5, 12.0, 12.5, 13.0, 13.5, 14.0

5 Major bathymetry contours at 5m intervals below Chart Datum (2001 Survey).

1 Minor bathymetry contours at 1m intervals below Chart Datum (2001 Survey).

Legend General:

Survey Area.

22 Turbine Position with Identifier.

Meteorological Mast.

Vertical Datum:

All depths are in metres and are reduced to Chart Datum (CD).

Metres: 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0

7.80m Approx MHWS

4.10m Ordnance Datum (Colwyn Bay)

0.00m Chart Datum

Notes:

1. Survey conducted by Osiris Projects aboard MV 'Barinthus' during the period 14th March to 5th April 2006.
2. Representation of 2001 single beam bathymetry data supplied by Client, surveyed by Fugro Survey Limited.

Geodetic Parameters:

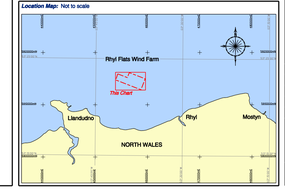
Projection	: UTM, Zone 30
Latitude of Origin	: 0° North
Longitude of Origin	: 3° West
False Easting	: 500000 metres
False Northing	: 0 metres
Scale Factor	: 0.9996
Ellipsoid	: WGS '84
Geodetic Datum	: WGS '84

Horizontal Scale:

Scale 1:5000 — Distance in metres — Original Plot Size A0

0 100 200 300 400 500

Location Map: Not to scale



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Contractor:

Osiris Projects
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D				Drawn.	NLM & HS	May '06
C				Checked.		
B				Approved.		
A	Final	NLM	June '06	Scale Horiz: 1:5000	Contract No:
REVISION: A		By.	Date.	Vert: N/A	C6005c

Contract:

RHYL FLATS
OFFSHORE WIND FARM DEVELOPMENT
SEABED COMPARISON 2001, 2005 & 2006

Chart Number:	Appendix:	Chart Title:
C6005-C-03b	-	2006 BATHYMETRY CHART WITH 2001 CONTOURS OVERLAIN

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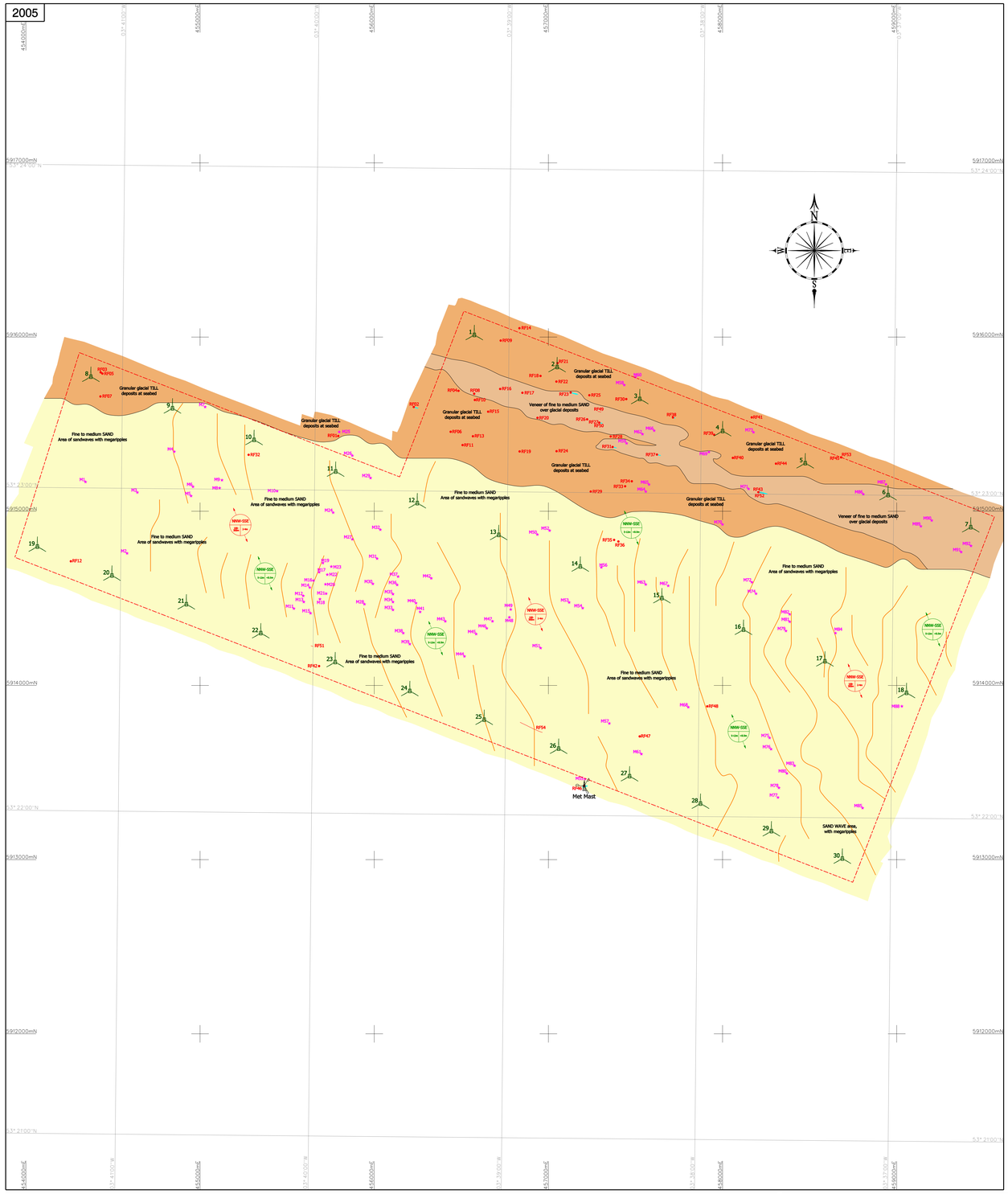
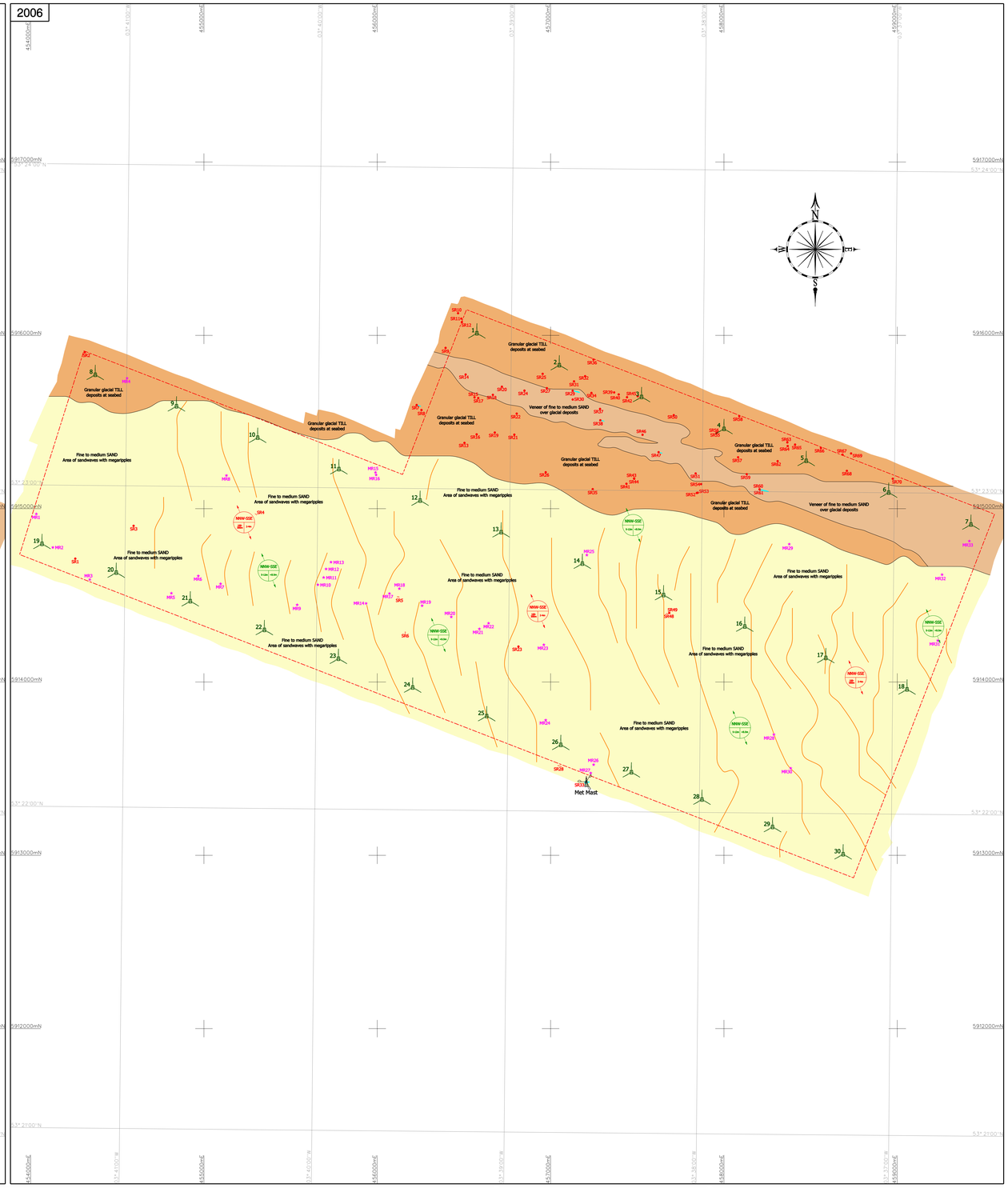
2005



2006



Legend:

- Fine to medium SAND, area of sandwaves with megaripples.
- Veneer of fine to medium SAND over glacial deposits.
- Granular glacial TILL deposits at seabed.
- Denotes seabed character boundaries.
- SR42 — Side scan sonar target with identifier (see listing in Volume 1, Appendix 2).
- SRS1 — Linear side scan sonar target with identifier (see listing in Volume 1, Appendix 2).
- MR15 — Magnetic contacts with identifier (see listing in Volume 1, Appendix 2).
- Scour.
- Sand wave crests.

Along Crest Orientation: NNW-SSE — Megaripples — 0.12m +0.5m — Wavelength / Height

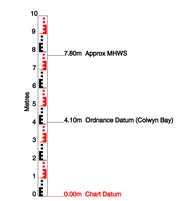
Along Crest Orientation: NNW-SSE — Sand Waves — 20m 2-4m — Wavelength / Height

Legend General:

- Survey Area.
- 22 — Turbine position with identifier.
- Meteorological Mast.

Vertical Datum:

All depths are in metres and are reduced to Chart Datum (CD).



Notes:

1. Survey conducted by Osiris Projects aboard MV 'Bairinthus' during the period 14th March to 5th April 2006.
2. Magnetic anomalies are plotted at the point(s) of maximum deflection along individual survey lines. These points do not necessarily indicate the actual positions of the features causing the individual anomalies.

Geodetic Parameters:

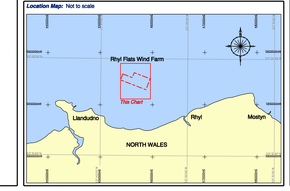
Projection	: UTM, Zone 30
Latitude of Origin	: 0° North
Longitude of Origin	: 3° West
False Easting	: 500000 metres
False Northing	: 0 metres
Scale Factor	: 0.9996
Ellipsoid	: WGS '84
Geodetic Datum	: WGS '84

Horizontal Scale:

Scale 1:10000 — Distance in metres — Original Plot Size A0

0 200 400 600 800 1000

Location Map: Not to scale



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D				Drawn.	May '06
C				Checked.	
B				Approved.	
A	Final	NLM	June '06	Scale Horiz: 1:10000	Contract No:
REVISION: A		By.	Date.	Vert: N/A	C6005

Contract:

RHYL FLATS
OFFSHORE WIND FARM DEVELOPMENT
SEABED COMPARISON 2001, 2005 & 2006

Chart Number:	Appendix:	Chart Title:
C6005-C-04	-	CONTACTS WITH SEABED FEATURES OVERVIEW 2005 - 2006

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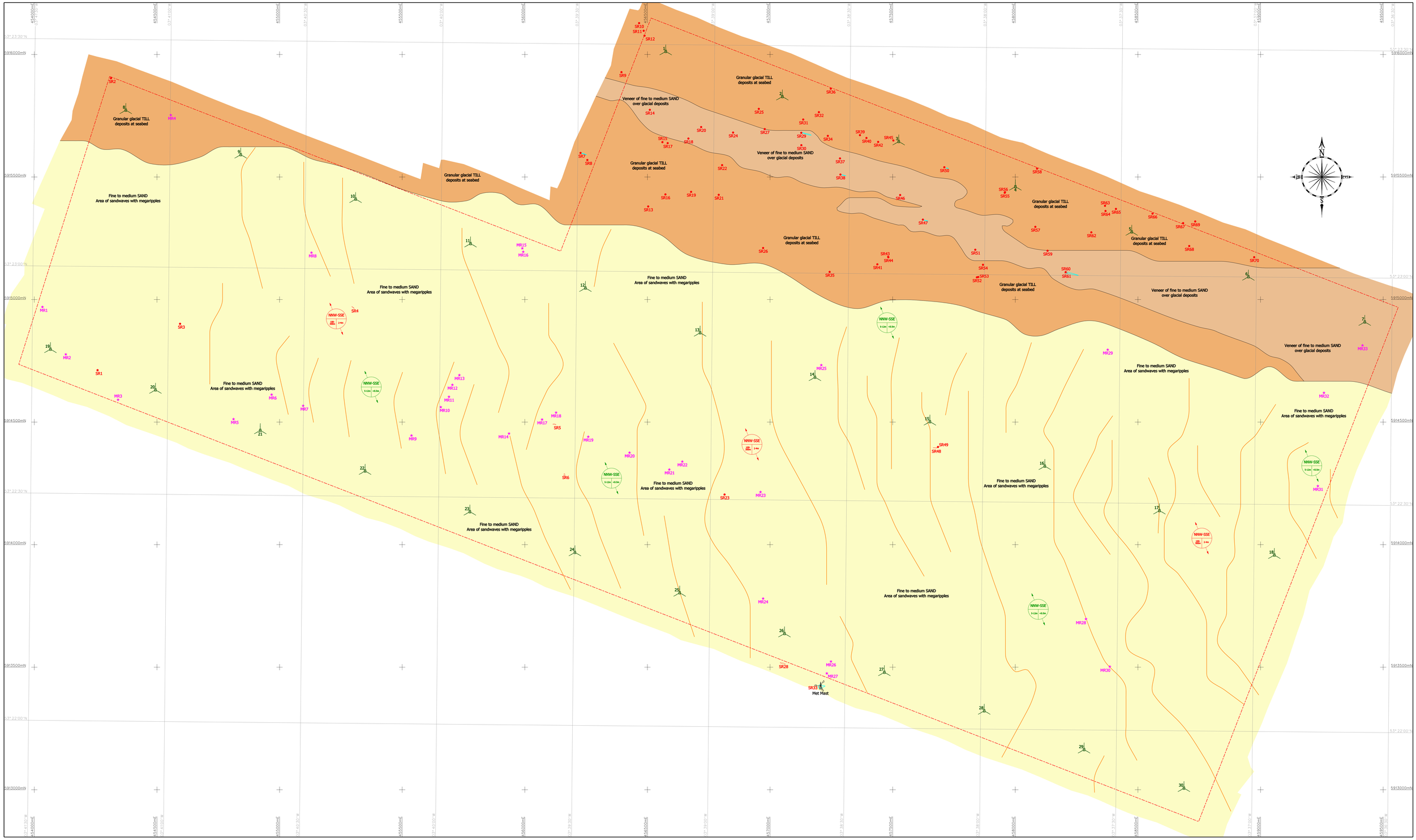


Legend:

- Fine to medium SAND, area of sandwaves with megaripples.
- Veneer of fine to medium SAND over glacial deposits.
- Granular glacial TILL deposits at seabed.
- Denotes seabed character boundaries.
- SR42 — Side scan sonar target with identifier (see listing in Volume 1, Appendix 2).
- SRS1 — Linear side scan sonar target with identifier (see listing in Volume 1, Appendix 2).
- MR15 — Magnetic contacts with identifier (see listing in Volume 1, Appendix 2).
- Scour.
- Sand wave crests.

Megaripples: Along Crest Orientation NNW-SSE; 5-12m; <0.5m; Wavelength; Height

Sand Waves: Along Crest Orientation NNW-SSE; 5-12m; 2-4m; Wavelength; Height

Legend General:

- Survey Area.
- 22 — Turbine Position with Identifier.
- Meteorological Mast.

Vertical Datum:

All depths are in metres and are reduced to Chart Datum (CD).

Metres: 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0

- 7.80m Approx MHWS
- 4.10m Ordnance Datum (Colwyn Bay)
- 0.00m Chart Datum

Notes:

1. Survey conducted by Osiris Projects aboard MV 'Barinthus' during the period 14th March to 5th April 2006.
2. Magnetic anomalies are plotted at the point(s) of maximum deflection along individual survey lines. These points do not necessarily indicate the actual positions of the features causing the individual anomalies.

Geodetic Parameters:

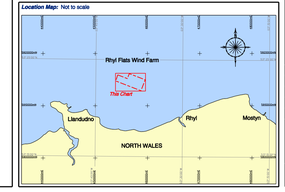
Projection	: UTM, Zone 30
Latitude of Origin	: 0° North
Longitude of Origin	: 3° West
False Easting	: 500000 metres
False Northing	: 0 metres
Scale Factor	: 0.9996
Ellipsoid	: WGS '84
Geodetic Datum	: WGS '84

Horizontal Scale:

Scale 1:5000 — Distance in metres — Original Plot Size A0

0 100 200 300 400 500

Location Map: Not to scale



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Contractor:

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D				Drawn. NLM & HS	May '06
C				Checked.	
B				Approved.	
A	Final	NLM	June '06	Scale Horiz: 1:5000	Contract No:
REVISION: A		By.	Date.	Vert: N/A	C6005c

Contract:

RHYL FLATS
OFFSHORE WIND FARM DEVELOPMENT
SEABED COMPARISON 2001, 2005 & 2006

Chart Number:	Appendix:	Chart Title:
C6005-C-05	-	SEABED FEATURES 2006

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APPENDIX 2

LISTINGS

SIDE SCAN SONAR CONTACT LISTING (2005)

SIDE SCAN SONAR CONTACT LISTING (2006)

MAGNETIC ANOMALY LISTING (2005)

MAGNETIC ANOMALY LISTING (2006)

SIDE SCAN SONAR CONTACT LISTING (2005)

Anomaly No.	Eastings (m)	Northings (m)	Length (m)	Height (m)	Width (m)	Description
RF01	455793.23	5915432.05	5.8	0.7	1.5	Object with shadow - related to M25
RF02	456227.02	5915598.62	2.4	0.4	0.9	Object with scour
RF03	454429.08	5915797.47	3.4	0.2	0.7	Object low relief
RF04	456483.7	5915691.3	2.1	0.3	1.4	Object with shadow
RF05	454439.32	5915790.47	3.2	0.2	0.6	Object low relief
RF06	456438.69	5915456.31	2.2	0.3	1.5	Object with scour
RF07	454427.95	5915658.94	2.9	0.2	0.9	Object with shadow
RF08	456573.77	5915674.72	1.7	0.2	0.9	Object with shadow
RF09	456726.19	5915979.98	3.9	0.6	1.8	Object with shadow
RF10	456577.64	5915638.86	4.1	0.8	1.5	Object low relief - surrounded by smaller objects
RF11	456507.35	5915380	3.4	0.2	0.9	Object with shadow
RF12	454258.09	5914712.78	2.3	0.2	1.2	Object with shadow
RF13	456566.73	5915430.54	1.7	-0.2	0.8	Object low relief
RF14	456833.72	5916050.91	2.7	0.4	0.9	Object with shadow
RF15	456654.21	5915571.66	3.2	0.5	1.7	Object with shadow
RF16	456723.06	5915702.23	4.7	0.4	0.6	Object with shadow
RF17	456850.89	5915680.21	2.7	0.6	1.2	Object with shadow
RF18	456954.66	5915776.83	4.5	0.3	1.1	Object with shadow
RF19	456834.79	5915343.43	2.9	-0.1	0.9	Object low relief
RF20	456937.43	5915536.47	3.7	0.4	1.3	Object with scour
RF21	457052.33	5915850.42	3.7	0.3	1.4	Object with shadow
RF22	457045.97	5915744.54	1.9	0.5	1.1	Object with scour
RF23	457127.93	5915681.52	1.5	0.6	1.6	Object with scour
RF24	457046.91	5915344.72	3.1	0.2	1.1	Object low relief
RF25	457235.09	5915666.14	3.1	0.8	1.6	Object with scour
RF26	457222.52	5915527.76	2.5	0.2	1.1	Object with shadow
RF27	457291.74	5915508.99	0.8	0.4	1.5	Object with shadow
RF28	457357.76	5915429.46	2.7	0	0.9	Object low relief
RF29	457243.04	5915112.93	3.7	0.1	1	Object low relief
RF30	457447.2	5915644	2.7	0.5	1.4	Object with shadow
RF31	457368.8	5915369.09	2.7	0.3	0.8	Object with scour
RF32	455278.95	5915324.05	2.6	0	0.8	Object low relief
RF33	457440.46	5915143.47	2.8	0.1	1	Object low relief
RF34	457478.93	5915172.08	2.4	0	1	Object low relief
RF35	457377.31	5914835.45	3.4	0.5	1.1	Object with shadow
RF36	457401.83	5914826.52	1.2	0.4	1	Object with shadow
RF37	457623.19	5915325.56	1.4	0.3	1.2	Object with scour
RF38	457715.31	5915538.43	2.7	0.4	1.2	Object with scour
RF39	457951.79	5915439.03	2.1	0.2	4.2	Object with scour
RF40	458058.95	5915306.44	1.7	0	1.4	Object with shadow
RF41	458167.69	5915538.93	0.1	0.5	0.9	Object with scour
RF42	455683.27	5914111.06	2.9	0	1.7	Object low relief
RF43	458205.58	5915109.88	4.7	1.9	3	Large Object with scour - mag anomaly M71
RF44	458306.7	5915273.31	2.9	0.3	1.3	Object with shadow
RF45	458680.19	5915310.74	5.2	0	1.6	Object low relief
RF46	457203.95	5913422.61	4.2	0	2.1	Met Mast

Anomaly No.	Eastings (m)	Northings (m)	Length (m)	Height (m)	Width (m)	Description
RF47	457524.12	5913707.43	3.2	0	1.5	Object low relief
RF48	457912.12	5913879.96	2.4	0	1.5	Object low relief
RF49	457288.11	5915572.3	19.8	0	0	Linear object
RF50	457298.92	5915507.12	14.4	0	0	Linear target
RF51	455642.02	5914225.83	13.7	0	0	Faint linear target
RF52	458225.65	5915105.37	34.4	0	0	Linear Target - mag anomaly M71
RF53	458680.49	5915309.58	13.9	0	0	Linear Target
RF54	456890.71	5913761.89	141.6	0	0	Very faint linear target

SIDE SCAN SONAR CONTACT LISTING (2006)

Anomaly No.	Easting (m)	Northing (m)	Length (m)	Width (m)	Height (m)	Description	Related to 2005 Target No.
SR01	454257.9	5914711.8	5.6	0.5	0.1	Possible pipe	RF12
SR02	454312.6	5915903.3	2.2	0.7	0.4	Object	
SR03	454594.3	5914901.1	2.8	0.1	0.1	Possible pipe	
SR04	455302.2	5914967.0	2.9	0.9	0.2	Object	
SR05	456127.2	5914490.4	13.0	2.2	nmh	Possible fishing debris	
SR06	456161.6	5914287.2	10.5	3.7	nmh	Possible fishing debris	
SR07	456227.3	5915598.2	5.0	2.1	nmh	Irregular seabed	RF02
SR08	456255.0	5915569.3	7.1	1.3	nmh	Irregular seabed	
SR09	456394.1	5915927.8	7.2	1.3	0.7	Object	
SR10	456466.0	5916127.9	0.8	0.6	0.6	Object	
SR11	456484.7	5916096.7	3.0	0.9	0.5	Object	
SR12	456488.2	5916076.8	3.2	0.5	0.3	Object	
SR13	456503.1	5915379.7	8.4	1.0	nmh	Irregular seabed	RF11
SR14	456509.8	5915774.1	3.1	1.3	0.8	Object	
SR15	456561.1	5915642.2	1.7	0.5	0.3	Object	
SR16	456573.3	5915429.0	6.6	1.4	nmh	Irregular seabed	RF13
SR17	456582.6	5915638.2	4.1	2.0	0.6	Object	RF10
SR18	456667.0	5915656.9	1.5	1.4	0.7	Object	
SR19	456678.1	5915439.4	7.3	2.7	nmh	Irregular seabed	
SR20	456719.1	5915703.8	3.2	1.1	0.9	Object	RF16
SR21	456790.7	5915427.3	3.9	0.3	0.1	Object	
SR22	456804.6	5915548.5	1.2	0.6	0.3	Object	
SR23	456814.4	5914204.5	2.3	0.8	0.2	Object	
SR24	456849.2	5915681.4	4.3	1.1	0.8	Object	RF17
SR25	456954.1	5915778.0	3.2	1.2	0.2	Object	RF18
SR26	456971.7	5915210.6	4.1	2.1	nmh	Irregular seabed	
SR27	456978.2	5915695.5	2.7	1.0	0.4	Object	
SR28	457054.4	5913515.7	22.5	4.7	nmh	Possible cable or fishing debris	
SR29	457127.3	5915680.2	1.4	1.0	0.9	Object	RF23
SR30	457127.6	5915629.8	4.2	0.5	0.3	Object	
SR31	457135.1	5915734.6	3.0	0.3	0.2	Object	
SR32	457199.1	5915764.7	0.7	0.8	0.5	Object	
SR33	457202.8	5913421.4	7.0	6.0	nmh	Base of Met Mast (Mag. anomalies MR26 & 27)	
SR34	457235.6	5915667.8	1.7	1.6	0.9	Object	RF25
SR35	457242.9	5915112.7	4.1	2.6	nmh	Irregular seabed	RF29
SR36	457247.5	5915860.3	3.0	0.8	0.3	Object	
SR37	457285.1	5915575.8	4.9	0.8	0.3	Object	RF49
SR38	457287.0	5915510.1	2.4	1.5	0.6	Object	RF27
SR39	457366.5	5915670.8	1.6	0.8	0.3	Object	
SR40	457393.0	5915659.3	4.2	0.8	0.3	Object	
SR41	457437.5	5915143.8	7.3	1.8	nmh	Irregular seabed	
SR42	457440.8	5915643.2	3.8	0.8	0.6	Object	RF30

Anomaly No.	Easting (m)	Northing (m)	Length (m)	Width (m)	Height (m)	Description	Related to 2005 Target No.
SR43	457481.5	5915174.2	4.6	2.8	nmh	Irregular seabed	RF34
SR44	457482.4	5915172.5	1.1	0.5	0.2	Object	RF34
SR45	457502.8	5915649.1	3.1	1.3	0.4	Object	RF34
SR46	457530.5	5915426.5	8.7	3.2	0.3	Object	
SR47	457623.2	5915326.1	4.3	0.8	0.5	Object	RF37
SR48	457677.5	5914394.3	22.3	0.1	0.1	Possible cable or rope	
SR49	457684.7	5914398.5	1.0	0.9	0.0	Object	
SR50	457710.6	5915539.7	2.4	0.9	0.2	Object	RF38
SR51	457836.8	5915203.2	2.3	0.6	0.1	Object	
SR52	457843.3	5915090.6	4.2	2.3	nmh	Irregular seabed	
SR53	457849.0	5915091.9	1.3	1.1	0.1	Object	
SR54	457868.3	5915141.8	3.9	1.4	nmh	Irregular seabed	
SR55	457956.8	5915435.6	8.5	0.8	0.2	Object	RF39
SR56	457958.2	5915437.8	7.0	5.4	-0.5	Depression	RF39
SR57	458081.7	5915296.7	3.0	0.6	0.4	Object	RF40
SR58	458088.4	5915534.6	1.2	0.7	0.2	Object	
SR59	458131.5	5915199.1	2.3	0.8	0.4	Object	
SR60	458205.4	5915111.9	6.2	2.4	1.8	Prominent object	RF43
SR61	458207.4	5915108.7	11.5	8.0	nmh	Irregular seabed	RF52
SR62	458310.0	5915274.2	2.0	0.6	0.5	Object	RF44
SR63	458365.8	5915382.5	0.8	0.6	0.1	Object	
SR64	458367.8	5915361.3	1.2	0.6	0.4	Object	
SR65	458410.4	5915369.9	1.2	0.4	0.1	Object	
SR66	458559.5	5915350.7	0.9	0.6	0.2	Object	
SR67	458684.3	5915311.8	4.3	1.1	0.9	Object	RF45, RF53
SR68	458709.1	5915218.4	4.4	0.7	0.3	Object	
SR69	458733.6	5915318.7	3.8	0.7	0.2	Object	
SR70	458974.0	5915172.8	1.4	0.7	0.5	Object	

*nmh = no measured height

MAGNETIC ANOMALY LISTING (2005)

Anomaly no.	Amplitude (nT)	Width (m)	Description
M1	1.2	41.2	Dipole-related to target RF01
M2	1.8	174	Broad positive monopole
M3	1.3	44.5	Negative dipole
M4	2.1	63.9	Complex dipole
M5	1.9	114.8	Complex dipole
M6	1.7	110.1	Broad positive monopole
M7	1.5	66.8	Broad positive monopole
M8	1.4	61.1	Complex dipole
M9	2.3	65.1	Complex dipole
M10	1.1	43.9	Complex dipole
M11	2.5	55.6	Positive monopole - related to M12,M13, M14, M16, M17 & M19
M12	2.3	57	Complex dipole- related to M11,M13, M14, M16, M17 & M19
M13	2.3	103.3	Broad positive monopole- related to M11,M12, M14, M16, M17 & M19
M14	2.1	83.1	Broad positive monopole - related to M11,M12, M13, M16, M17 & M19
M15	0.9	46.9	Positive monopole
M16	2.4	66.2	Broad positive monopole - related to M11,M12, M13, M14, M17 & M19
M17	2.1	67.3	Complex dipole - related to M11,M12, M13, M14, M16 & M19
M18	1	32.1	Complex dipole - related to M20,M21, M22 & M23
M19	3.2	50.8	Complex dipole- related to M11,M12, M13, M14, M16 & M17
M20	0.8	37.3	Positive monopole - related to M18,M21, M22 & M23
M21	1.6	71.9	Broad negative monopole - related to M18,M20, M22 & M23
M22	2.4	43.6	Complex dipole - related to M18,M20, M21 & M23
M23	3.5	60	Complex dipole - related to M18,M20, M21 & M22
M24	1.6	56	Dipole
M25	2	52.9	Negative monopole
M26	3.6	32.3	Complex dipole
M27	1.3	40	Positive monopole
M28	2.6	48	Positive monopole
M29	2	47.5	Dipole
M30	0.9	30	Positive monopole
M31	2.3	92	Positive monopole
M32	1	91.5	Broad dipole
M33	1.4	42	Positive monopole - related to M34, M35, M36 & M37
M34	1.1	68.2	Complex dipole - related to M33, M35, M36 & M37
M35	1.7	75.4	Complex dipole - related to M33, M34, M36 & M37
M36	1.2	43.3	Complex dipole - related to M33, M34, M35 & M37
M37	1.1	33.8	Complex dipole - related to M33, M34, M35 & M36
M38	1.5	76.6	Complex dipole
M39	2.7	106.2	Broad positive monopole
M40	0.7	37.6	Positive monopole
M41	1.2	50.3	Complex dipole
M42	1.7	73.3	Broad positive monopole
M43	2.8	39.7	Dipole
M44	2.1	80.8	Complex dipole
M45	2.3	62.3	Positive monopole - related to M46 & M47
M46	1.4	65.6	Broad positive monopole - related to M45 & M47

Anomaly no.	Amplitude (nT)	Width (m)	Description
M47	1.6	100	Broad positive monopole - related to M45 & M46
M48	1.7	47.1	Complex dipole
M49	1.8	47.5	Complex dipole
M50	1.5	24.2	Complex dipole
M51	1.6	19.1	Positive monopole
M52	0.9	30.2	Positive monopole
M53	2	78.3	Broad positive monopole
M54	1.2	76.1	Complex dipole
M55	158	344	Broad negative monopole-Metmast(target RF46)
M56	1.3	71.5	Broad negative monopole
M57	1.8	92	Complex dipole
M58	1.9	54	Complex dipole
M59	1.8	78.7	Complex dipole
M60	1.9	44.6	Complex dipole
M61	1.3	16	Dipole
M62	1.8	80.8	Broad positive monopole
M63	1.7	69.4	Complex dipole
M64	1.1	41.4	Dipole
M65	0.9	35.4	Positive monopole
M66	1.6	90.6	Positive monopole
M67	1.9	61.3	Complex dipole
M68	1.4	71.7	Broad positive monopole
M69	1.7	56.5	Positive monopole
M70	1.4	57.2	Complex dipole
M71	9.4	545	Complex dipole - related to targets RF43 & RF52
M72	1.6	59.1	Positive monopole
M73	1.3	28.3	Positive monopole
M74	1.9	75.6	Positive monopole
M75	1.7	41.5	Positive monopole
M76	1.5	59.5	Positive monopole
M77	1.7	46.5	Positive monopole - related to M78,M80 & M83
M78	1.7	35.8	Positive monopole - related to M77,M80 & M83
M79	1.7	67.3	Positive monopole - related to M81 & M82
M80	3.5	68.5	Dipole - related to M77,M78 & M83
M81	1.7	83.4	Positive monopole - related to M79 & M82
M82	1.2	55.9	Complex dipole - related to M81 & M82
M83	2.1	104.1	Broad negative monopole - related to M77,M78 & M80
M84	1.8	22.3	Negative monopole
M85	2.8	72.8	Positive monopole
M86	1.4	30	Dipole
M87	1.3	29.4	Complex dipole
M88	1.4	24.5	Positive monopole
M89	2	163	Broad positive monopole
M90	4.8	173.4	Broad complex dipole
M91	1	23.2	Positive monopole
M92	0.9	28.9	Positive monopole

MAGNETIC ANOMALY LISTING (2006)

Anomaly No.	Amplitude (nT)	Width (m)	Comments	Related to 2005 Anomaly No.
MR01	0.9	6.1		
MR02	0.6	6.6		
MR03	0.6	7.1		
MR04	0.7	8.3		
MR05	0.6	8.1		
MR06	0.6	10.0		
MR07	0.8	7.8		
MR08	2.9	76.6		M9
MR09	2.7	72.8		M11
MR10	3.7	149.4	Linear group of anomalies MR10,11,12, 13	
MR11	4.1	160.2	Linear group of anomalies MR10,11,12, 13	
MR12	4.0	176.7	Linear group of anomalies MR10,11,12, 13	M17
MR13	3.0	173.5	Linear group of anomalies MR10,11,12, 13	
MR14	2.8	65.3		M28
MR15	1.6	19.3		M29
MR16	1.6	54.3		
MR17	2.4	217.1		
MR18	2.8	146.2		
MR19	2.5	53.9		M41
MR20	26.7	48.9		
MR21	3.6	73.5		M45
MR22	2.3	127.2		M46
MR23	1.6	19.9		M51
MR24	0.5	5.4		
MR25	0.7	6.7		
MR26	14.6	549.1	100m from Met Mast (Sonar Contact SR33)	M55
MR27	89.6	701.1	70m from Met Mast (Sonar Contact SR33)	M55
MR28	1.6	68.1		M75
MR29	0.9	35.4		
MR30	7.7	86.0		M80
MR31	1.6	29.3		
MR32	1.7	33.3		
MR33	0.9	22.7		M92