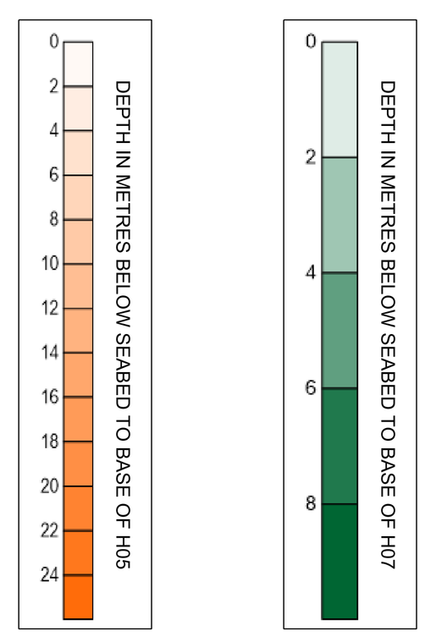
LEGEND

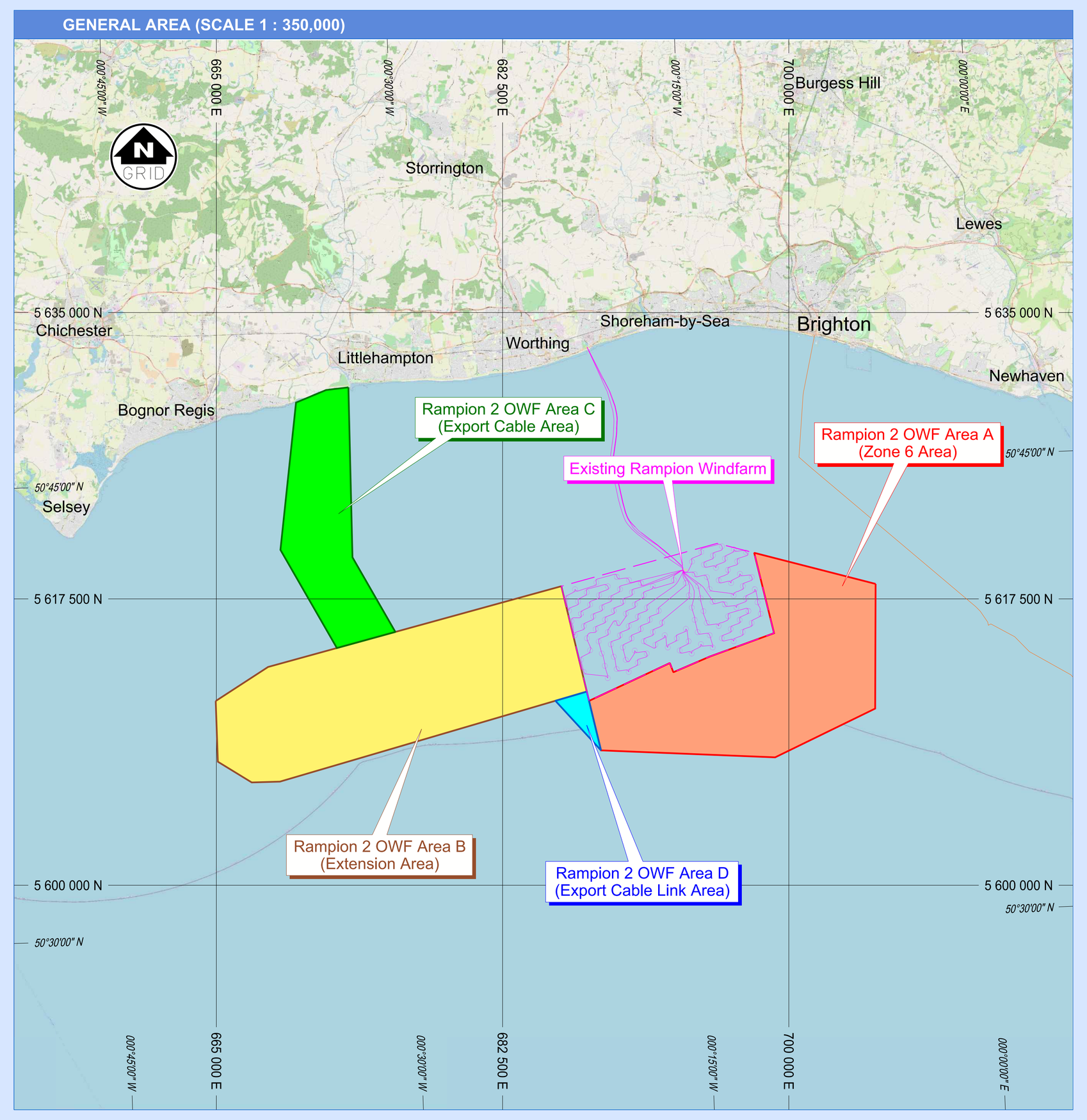
- PROPOSED RAMPION 2 OWF AREA A (ZONE 6 AREA)
- PROPOSED RAMPION 2 OWF AREA B (EXTENSION AREA)
- PROPOSED RAMPION 2 OWF AREA C (EXPORT CABLE AREA)
- PROPOSED RAMPION 2 OWF AREA D (EXPORT CABLE LINK AREA)
- PROPOSED RAMPION 2 WIND TURBINE GENERATOR LAYOUT (SOURCE: CLIENT PROVIDED)
- EXISTING RAMPION WIND TURBINE GENERATOR LAYOUT (SOURCE: CLIENT PROVIDED)
- EXISTING RAMPION WIND FARM CABLE (SOURCE: CLIENT PROVIDED)
- EXISTING RAMPION SURVEY AREA (SOURCE: CLIENT PROVIDED)
- DEPTH IN METRES BELOW SEABED TO BASE OF H05, CONTOURED AT 2 METRE INTERVALS
- LIMIT OF BASE OF H05
- DEPTH IN METRES BELOW SEABED TO BASE OF H07, CONTOURED AT 2 METRE INTERVALS
- LIMIT OF BASE OF H07



NOTES

1. ASSUMED SEISMIC VELOCITY = 1700m/s
2. H05 = YOUNGER HOLOCENE DEPOSITS COMPRISING UNCONSOLIDATED SEDIMENTS, LARGELY SAND AND GRAVEL. POTENTIALLY MOBILE IN PLACES
3. H07 = QUATERNARY DEPOSITS COMPRISING CONSOLIDATED SEDIMENTS, LARGELY SAND AND GRAVEL

GENERAL AREA (SCALE 1 : 350,000)



GEODETIC REFERENCE SYSTEM

GEODETIC DATUM:	WGS84
ELLIPSOID:	WGS84
PROJECTION:	UTM ZONE 30 N (CENTRAL MERIDIAN 3° W)

SURVEY INFORMATION

SURVEY VESSEL:	M.V. VIGILANT	M.V. TITAN DISCOVERY	M.V. OCEAN OBSERVER
SURVEY DATE:	30-JUN-2020 TO 01-AUG-2020	01-JUL-2020 TO 12-AUG-2020	16-SEP-2020 TO 13-OCT-2020
POSITIONING SYSTEM:	OCEANERRING C-NAV DGNSS SONARDYNE RANGER USBL	APPLANIX POS MV WAVEMASTER SONARDYNE RANGER USBL	FUGRO STARFIX DGNSS SONARDYNE RANGER USBL
NAVIGATION SYSTEM:	VOYAGER 5	VOYAGER 5	VOYAGER 5
ECHO SOUNDER (MULTI-BEAM SYSTEM):	SIMRAD EM2040D	RESON T20-P DUAL HEAD	SIMRAD EM2040
ECHO SOUNDER (SINGLE-BEAM SYSTEM):	SIMRAD EA400	ODOM ECHOTRAC MKIII	SIMRAD EA400
SIDE SCAN SONAR:	EDGETECH 4200FS	EDGETECH 4200FS	EDGETECH 4200FS
MAGNETOMETER:	GEOMETRICS G882	GEOMETRICS G882	GEOMETRICS G882
SUB-BOTTOM PROFILER:	GEOACOUSTICS PINGER	SURFACE TOW BOOMER	GEOACOUSTICS PINGER
ULTRA HIGH RESOLUTION SEISMIC (UHRS):			1 x 10 cu.in. T.I. SLEEVE GUN 75m TELEDYNE STREAMER

SCALE (A0 ORIGINAL)

1 : 25 000 (Horizontal)

250 0 1250 2500

METRES

TITLE

SURVEY CONTRACTOR

GARDLINE LIMITED
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CLIENT

RWE The energy to lead

PROJECT TITLE

RAMPION 2 OFFSHORE WINDFARM DEVELOPMENT GEOPHYSICAL SITE SURVEY FOR AREAS B & D

DRAWING TITLE

SHALLOW SOILS (BASE OF H05 & H07)

CHART 11

REVISION

REV.	DATE	TITLE	DESCRIPTION	AUTHOR	DRAWN	CHECKED	APPROVED
0	16-DEC-2020	DRAFT	FIRST ISSUE FOR CLIENT REVIEW, PDF ONLY	CB	JS	MK	DIG

CLIENT REFERENCE | REPORT REFERENCE 11521.3 | DRAWING NUMBER 11521.3.11

LEGEND

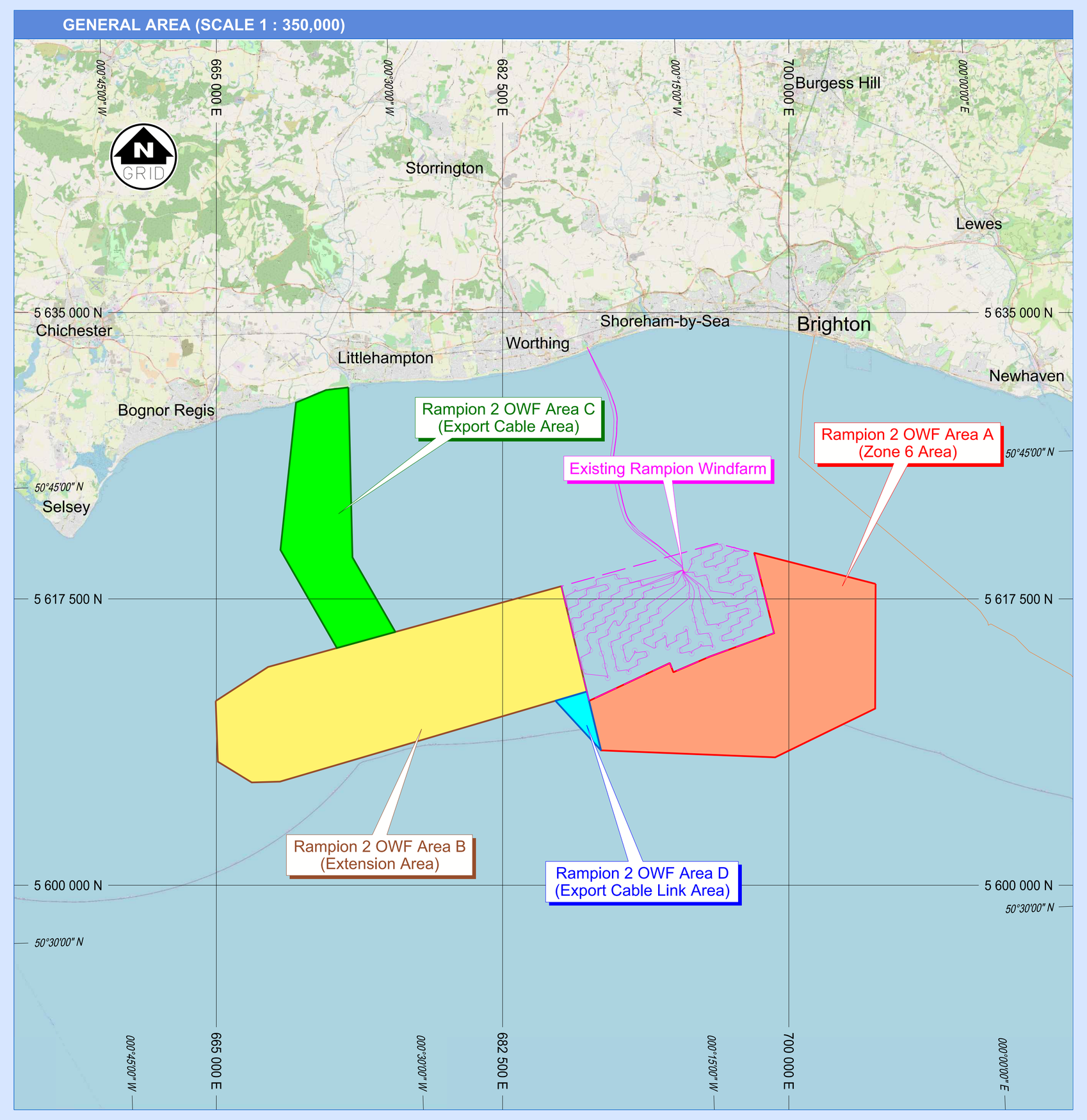
- PROPOSED RAMPION 2 OWF AREA A (ZONE 6 AREA)
- PROPOSED RAMPION 2 OWF AREA B (EXTENSION AREA)
- PROPOSED RAMPION 2 OWF AREA C (EXPORT CABLE AREA)
- PROPOSED RAMPION 2 OWF AREA D (EXPORT CABLE LINK AREA)
- PROPOSED RAMPION 2 WIND TURBINE GENERATOR LAYOUT (SOURCE: CLIENT PROVIDED)
- EXISTING RAMPION WIND TURBINE GENERATOR LAYOUT (SOURCE: CLIENT PROVIDED)
- EXISTING RAMPION WIND FARM CABLE (SOURCE: CLIENT PROVIDED)
- EXISTING RAMPION SURVEY AREA (SOURCE: CLIENT PROVIDED)
- 2 — DEPTH IN METRES BELOW SEABED TO BASE OF H10 - PALAEOCHANNEL, CONTOURED AT 2 METRE INTERVALS
- LIMIT OF BASE OF H10
- 11.4 — AREA OF BLANKING WITH SPOT DEPTHS IN METRES BELOW SEABED

DEPTH IN METRES BELOW SEABED TO BASE OF H10: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32

NOTES

1. ASSUMED SEISMIC VELOCITY = 1700m/s
2. H10 = PALAEOCHANNELS ARE SEEN CUTTING THROUGH THE BEDROCK. THESE CHANNELS ARE INTERPRETED TO COMPRISE INTERBEDDED CLAY, SANDS AND GRAVELS, WITH PEAT LAYERS AND BASAL GRAVELS AND ARE ASSOCIATED WITH GLACIAL ADVANCES AND THE ASSOCIATED FALLS IN SEA LEVEL

GENERAL AREA (SCALE 1 : 350,000)



GEODETIC REFERENCE SYSTEM

GEODETIC DATUM:	WGS84
ELLIPSOID:	WGS84
PROJECTION:	UTM ZONE 30 N (CENTRAL MERIDIAN 3° W)

SURVEY INFORMATION

SURVEY VESSEL:	M.V. VIGILANT	M.V. TITAN DISCOVERY	M.V. OCEAN OBSERVER
SURVEY DATE:	30-JUN-2020 TO 01-AUG-2020	01-JUL-2020 TO 12-AUG-2020	16-SEP-2020 TO 13-OCT-2020
POSITIONING SYSTEM:	OCEANERRING C-NAV DGNSS SONARDYNE RANGER USBL	APPLANIX POS MV WAVEMASTER SONARDYNE RANGER USBL	FUGRO STARFIX DGNSS SONARDYNE RANGER USBL
NAVIGATION SYSTEM:	VOYAGER 5	VOYAGER 5	VOYAGER 5
ECHO SOUNDER (MULTI-BEAM SYSTEM):	SIMRAD EM2040D	RESON T20-P DUAL HEAD	SIMRAD EM2040
ECHO SOUNDER (SINGLE-BEAM SYSTEM):	SIMRAD EA400	ODOM ECHOTRAC MKIII	SIMRAD EA400
SIDE SCAN SONAR:	EDGETECH 4200FS	EDGETECH 4200FS	EDGETECH 4200FS
MAGNETOMETER:	GEOMETRICS G882	GEOMETRICS G882	GEOMETRICS G882
SUB-BOTTOM PROFILER:	GEOACOUSTICS PINGER	SURFACE TOW BOOMER	GEOACOUSTICS PINGER
ULTRA HIGH RESOLUTION SEISMIC (UHRS):			1 x 10 cu.in. T.I. SLEEVE GUN 75m TELEDYNE STREAMER

SCALE (A0 ORIGINAL)

1 : 25 000 (Horizontal)

250 0 1250 2500

METRES

TITLE

SURVEY CONTRACTOR

Gardline

GARDLINE LIMITED
ENDEAVOUR HOUSE, ADMIRALTY ROAD, GREAT YARMOUTH, NORFOLK NR30 3NG. ENGLAND
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CLIENT

RWE The energy to lead

PROJECT TITLE

RAMPION 2 OFFSHORE WINDFARM DEVELOPMENT
GEOPHYSICAL SITE SURVEY FOR AREAS B & D

DRAWING TITLE

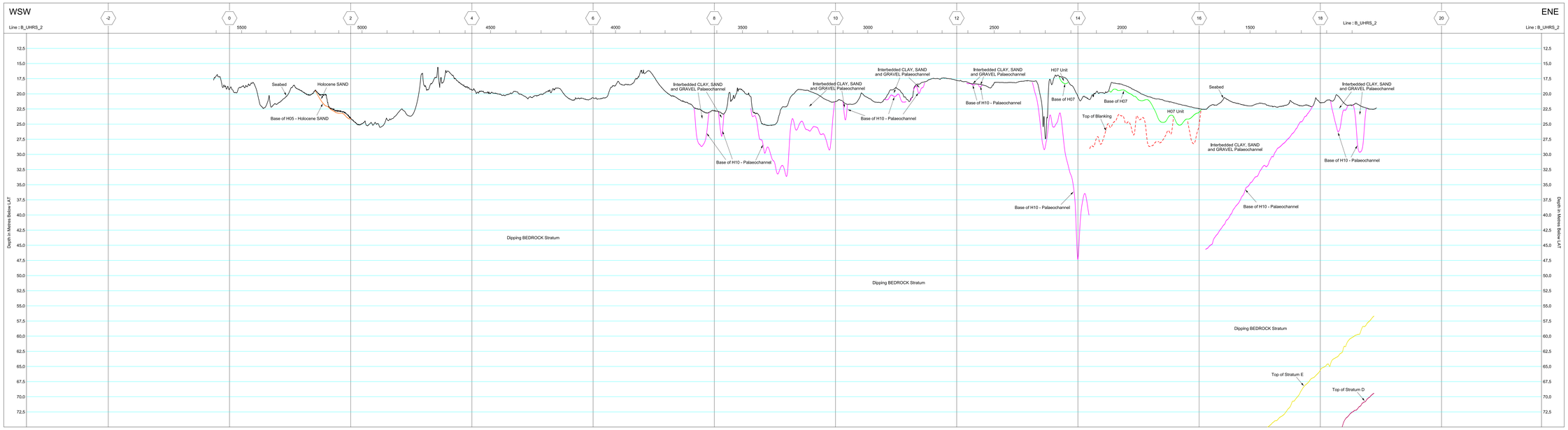
SHALLOW SOILS
(BASE OF H10)

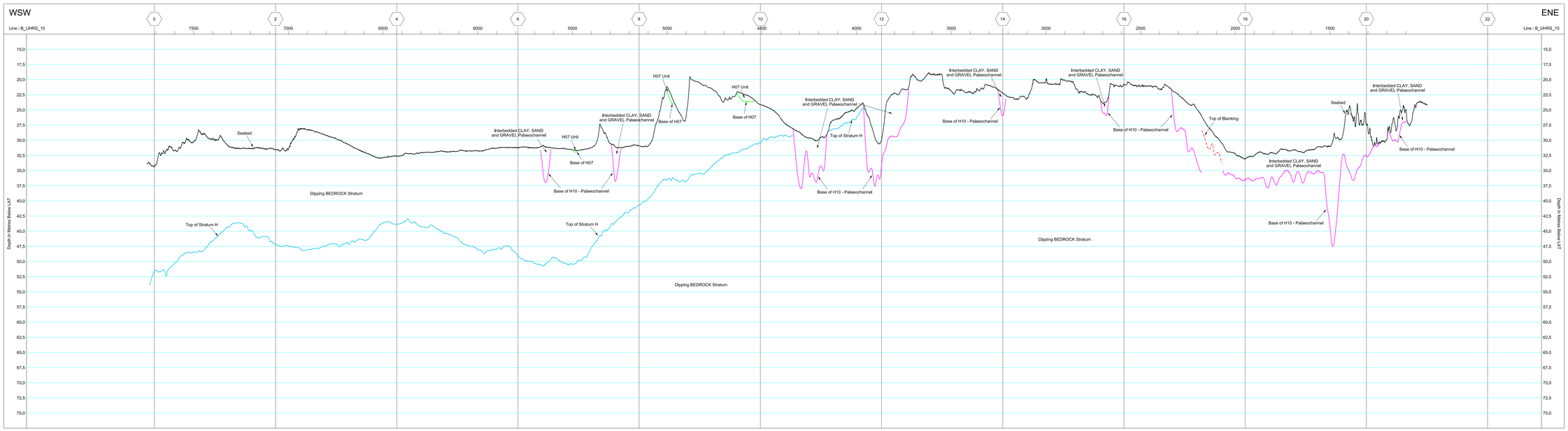
CHART 12

REVISION

REV.	DATE	TITLE	DESCRIPTION	AUTHOR	DRAWN	CHECKED	APPROVED
0	16-DEC-2020	DRAFT	FIRST ISSUE FOR CLIENT REVIEW, PDF ONLY	CB	JS	MK	DIG

CLIENT REFERENCE | REPORT REFERENCE 11521.3 | DRAWING NUMBER 11521.3.12





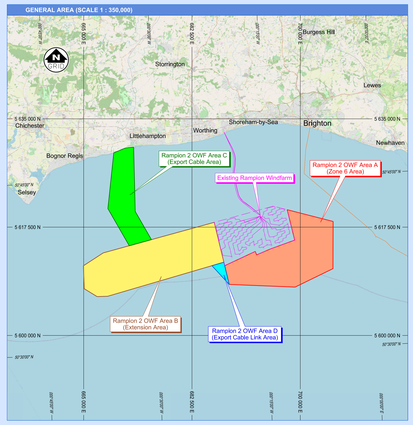
LEGEND

- SEABED
- BASE OF H05 - HOLOCENE SAND
- BASE OF H07 - UNIT 7
- BASE OF H10 - PALAEOCHANNEL
- TOP OF BLANKING
- TOP OF STRATUM D
- TOP OF STRATUM E
- TOP OF STRATUM H

NOTES

1. ASSUMED SEISMIC VELOCITY = 1700m/s
2. VERTICAL SCALE = 1 : 250
3. VERTICAL EXAGGERATION = 100 : 1

GENERAL AREA (SCALE 1 : 350,000)



GEODETIC REFERENCE SYSTEM

GEODETIC DATUM:	WGS84
ELLIPSOID:	WGS84
PROJECTION:	UTM ZONE 30 N (CENTRAL MERIDIAN 3° W)

SURVEY INFORMATION

	M.V. VIGILANT	M.V. TITAN DISCOVERY	M.V. OCEAN OBSERVER
SURVEY VESSEL:	M.V. VIGILANT	M.V. TITAN DISCOVERY	M.V. OCEAN OBSERVER
SURVEY DATE:	30-JUN-2020 TO 01-AUG-2020	01-JUL-2020 TO 12-AUG-2020	16-SEP-2020 TO 13-OCT-2020
POSITIONING SYSTEM:	OCEANEERING C-NAV DGNSS	APPLANIX POS MV WAVEMASTER	FUGRO STARFIX DGNSS
	SONARDYNE RANGER USBL	SONARDYNE RANGER USBL	SONARDYNE RANGER USBL
NAVIGATION SYSTEM:	VOYAGER S	VOYAGER S	VOYAGER S
ECHO SOUNDER (MULTI-BEAM SYSTEM):	SIMRAD EM2040D	RESON T20-P DUAL HEAD	SIMRAD EM2040
ECHO SOUNDER (SINGLE-BEAM SYSTEM):	SIMRAD EA400	ODOM ECHOTRAC MK8	SIMRAD EA400
SIDE SCAN SONAR:	EDGETECH 4200FS	EDGETECH 4200FS	EDGETECH 4200FS
MAGNETOMETER:	GEOMETRICS G882	GEOMETRICS G882	GEOMETRICS G882
SUB-BOTTOM PROFILER:	GEOACOUSTICS PINGER	SURFACE TOW BOOMER	GEOACOUSTICS PINGER
ULTRA HIGH RESOLUTION SEISMIC (UHRS):			1 x 10 cu.in. T.I. SLEEVE GUN
			75m TELEDYNE STREAMER

SCALE (A0 ORIGINAL)

1 : 25 000 (Horizontal)

250 0 1250 2500

METRES

TITLE

SURVEY CONTRACTOR

Gardline

GARDLINE LIMITED
ENDEAVOUR HOUSE, ADMIRALTY ROAD, GREAT YARMOUTH, NORFOLK NR30 3NG, ENGLAND
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CLIENT

RWE
The energy to lead

PROJECT TITLE

RAMPION 2 OFFSHORE WINDFARM DEVELOPMENT
GEOPHYSICAL SITE SURVEY FOR AREAS B & D

DRAWING TITLE

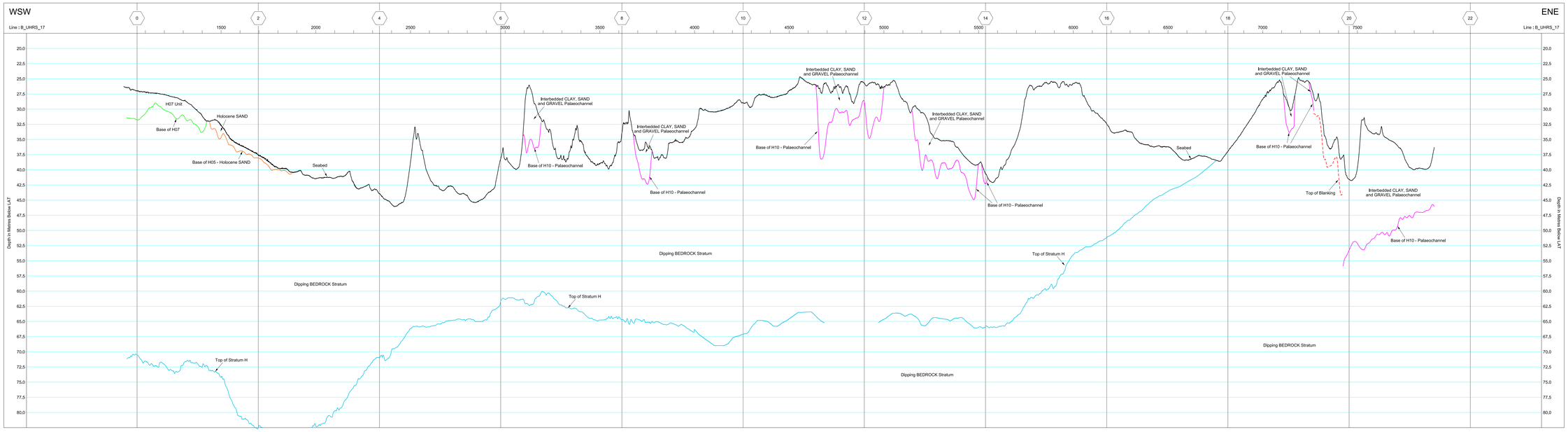
GEOLOGICAL PROFILES - 2D UHRS
(LINES B_UHRS_2 AND B_UHRS_10)

CHART 13

REVISION

REV.	DATE	TITLE	DESCRIPTION	AUTHOR	DRAWN	CHECKED	APPROVED
0	16-DEC-2020	DRAFT	FIRST ISSUE FOR CLIENT REVIEW, PDF ONLY	CB	JS	MK	DIG

CLIENT REFERENCE	REPORT REFERENCE 11521.3	DRAWING NUMBER 11521.3.13



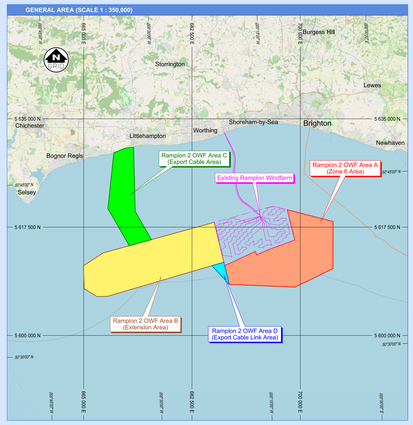
LEGEND

- SEABED
- BASE OF H05 - HOLOCENE SAND
- BASE OF H07 - UNIT 7
- BASE OF H10 - PALAEOCHANNEL
- TOP OF BLANKING
- TOP OF STRATUM D
- TOP OF STRATUM E
- TOP OF STRATUM F
- TOP OF STRATUM H

NOTES

1. ASSUMED SEISMIC VELOCITY = 1700m/s
2. VERTICAL SCALE = 1 : 250
3. VERTICAL EXAGGERATION = 100 : 1

GENERAL AREA (SCALE 1 : 350,000)



GEODETIC REFERENCE SYSTEM

GEODETIC DATUM:	WGS84
ELLIPSOID:	WGS84
PROJECTION:	UTM ZONE 30 N (CENTRAL MERIDIAN 3° W)

SURVEY INFORMATION

	M.V. VIGILANT	M.V. TITAN DISCOVERY	M.V. OCEAN OBSERVER
SURVEY VESSEL:	M.V. VIGILANT	M.V. TITAN DISCOVERY	M.V. OCEAN OBSERVER
SURVEY DATE:	30-JUN-2020 TO 01-AUG-2020	01-JUL-2020 TO 12-AUG-2020	16-SEP-2020 TO 15-OCT-2020
POSITIONING SYSTEM:	OCEANEERING C-NAV DGNSS	APPLANIX POS MV WAVEMASTER	FUGRO STARFIX DGNSS
	SONARDYNE RANGER USBL	SONARDYNE RANGER USBL	SONARDYNE RANGER USBL
NAVIGATION SYSTEM:	VOYAGER S	VOYAGER S	VOYAGER S
ECHO SOUNDER (MULTI-BEAM SYSTEM):	SIMRAD EM2040S	RESON T20-P DUAL HEAD	SIMRAD EM2040
ECHO SOUNDER (SINGLE-BEAM SYSTEM):	SIMRAD EA400	ODOM ECHOTRAC MKII	SIMRAD EA400
SIDE SCAN SONAR:	EDGETECH 4200FS	EDGETECH 4200FS	EDGETECH 4200FS
MAGNETOMETER:	GEOMETRICS G882	GEOMETRICS G882	GEOMETRICS G882
SUB-BOTTOM PROFILER:	GEOACOUSTICS PINGER	SURFACE TOW BOOMER	GEOACOUSTICS PINGER
ULTRA HIGH RESOLUTION SEISMIC (UHRS):			1 x 10 cu.in. T.I. SLEEVE GUN
			75m TELEDYNE STREAMER

SCALE (A0 ORIGINAL)

1 : 25 000 (Horizontal)

250 0 1250 2500

METRES

TITLE

SURVEY CONTRACTOR

GARDLINE LIMITED
ENDEAVOUR HOUSE, ADMIRALTY ROAD, GREAT YARMOUTH, NORFOLK NR30 3NG. ENGLAND
TELEPHONE +44 (0) 1493 845600 FAX +44 (0) 1493 852106 WEBSITE WWW.GARDLINE.COM

CLIENT

PROJECT TITLE

RAMPION 2 OFFSHORE WINDFARM DEVELOPMENT GEOPHYSICAL SITE SURVEY FOR AREAS B & D

DRAWING TITLE

GEOLOGICAL PROFILES - 2D UHRS (LINES B_UHRS_17 AND B_UHRS_39)

CHART 14

REVISION

REV.	DATE	TITLE	DESCRIPTION	AUTHOR	DRAWN	CHECKED	APPROVED
0	16-DEC-2020	DRAFT	FIRST ISSUE FOR CLIENT REVIEW, PDF ONLY	CB	JS	MK	DIG

CLIENT REFERENCE		REPORT REFERENCE 11521.3	DRAWING NUMBER 11521.3.14

Survey Report for
RWE Renewables UK Ltd

Project:
Rampion 2 Offshore Windfarm Development

Description:
Area C Geophysical Survey

Survey Date:
March to May 2020

Project Number:
11521.4

Report Status:
Draft

REPORT AUTHORISATION AND DISTRIBUTION

Compilation	Geophysics	C Buckmaster / C Thacker / M Naulls
	Surveying	T Stynes
Authorisation	Checked	M Kingston
	Approved	D I Gordon

Revision	Date	Title	Description
0	03-Nov-2020	Draft	Draft Report PDF only

Distribution

1 copy

RWE Renewables UK Ltd
Greenwood House
Westwood Way
Westwood Business Park
Coventry
CV4 8TT

For attention of
Naren Mistry

SURVEY OVERVIEW

Gardline Limited was contracted by RWE Renewables UK Ltd to acquire shallow geophysical and UHRS data across areas being considered for development at the Rampion 2 Offshore Windfarm and associated export cable route corridor.

The offshore portion of the survey was undertaken predominantly by M.V. Vigilant, mobilising in Hull on 30-Jun-2020 and demobilising in Hull on 19-Aug-2020 after completion of the shallow geophysical data acquisition. The M.V. Ocean Observer carried out the UHRS portion of the survey including acquiring SBP and magnetometer data infilling the planned gaps in the geophysical survey including all crosslines. It mobilised in Lowestoft on 21-Sept-2020 and demobilised in Great Yarmouth on 13-Oct-2020. The M.V. Titan Discovery and Titan owned Unmanned Aerial Vehicle carried out the nearshore acquisition, mobilising on 01-Jul-2020 and demobilising 12-Aug-2020.

Report volumes are as follows:

Report	Report No.
Operations Report	11521.1
Rampion 2 OWF Area A Survey Report	11521.2
Rampion 2 OWF Area B Survey Report	11521.3
Rampion 2OWF Area C Survey Report	11521.4

This report is the Rampion 2 OWF Area C survey report.

USE OF THIS REPORT

This report has been prepared with due care and diligence and with the skill reasonably expected of a reputable contractor experienced in the types of work carried out under the contract and as such the findings in this report are based on an interpretation of data which is a matter of opinion on which professionals may differ and unless clearly stated is not a recommendation of any course of action.

Gardline Limited has prepared this report for the client(s) identified on the front cover in fulfilment of its contractual obligations under the contract and the only liabilities Gardline Limited accept are those contained therein.

Please be aware that further distribution of this report, in whole or part, or the use of the data for a purpose not expressly stated within the contractual work scope is at the client's sole risk and Gardline Limited recommends that this disclaimer be included in any such distribution.

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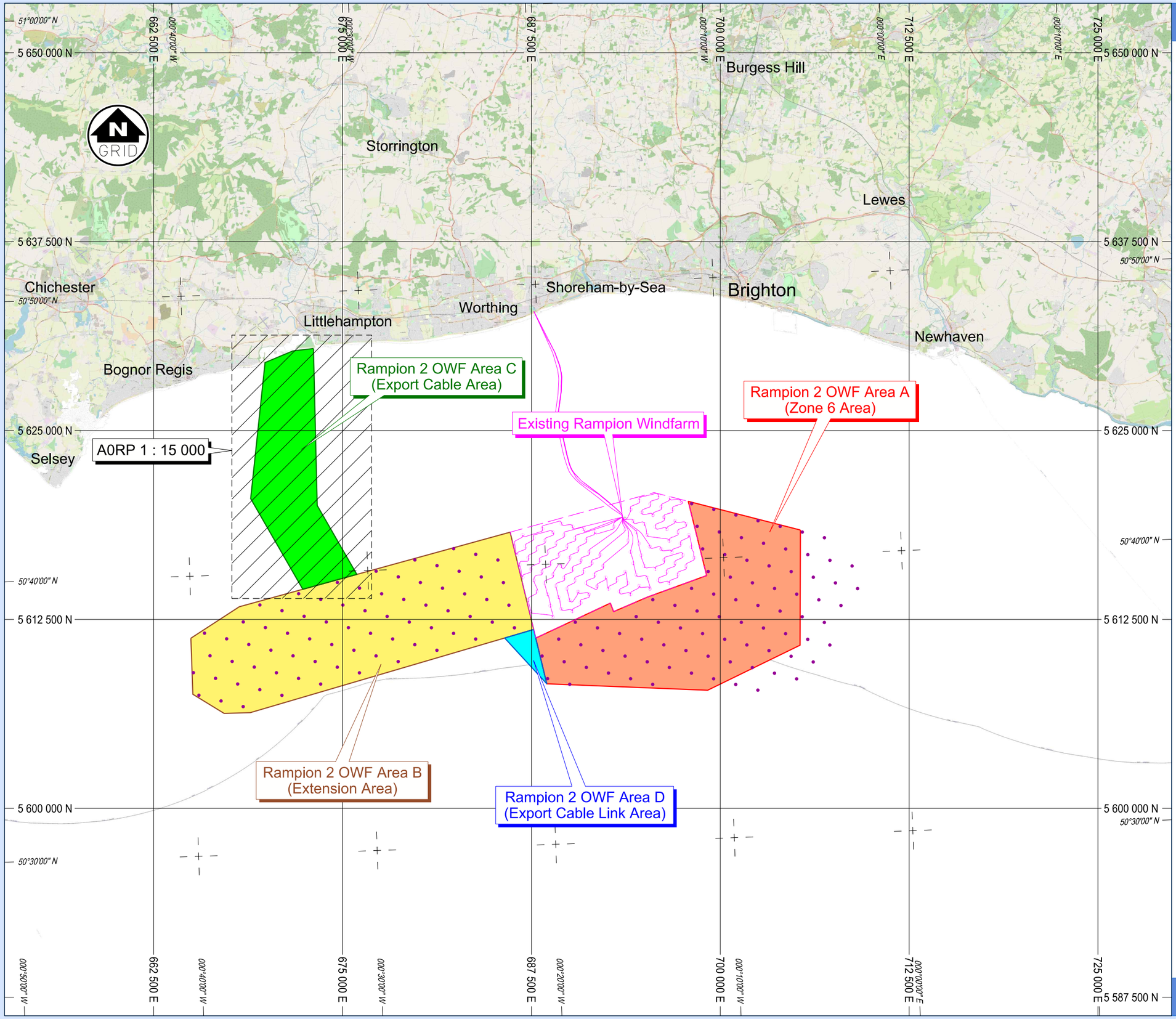
www.gardline.com



LOCATION MAP
RAMPION 2 OFFSHORE WINDFARM DEVELOPMENT

- PROPOSED RAMPION 2 OWF AREA A (ZONE 6 AREA)
- PROPOSED RAMPION 2 OWF AREA B (EXTENSION AREA)
- PROPOSED RAMPION 2 OWF AREA C (EXPORT CABLE AREA)
- PROPOSED RAMPION 2 OWF AREA D (EXPORT CABLE LINK AREA)
- PROPOSED RAMPION 2 WIND TURBINE GENERATOR LAYOUT (SOURCE: CLIENT PROVIDED)
- EXISTING RAMPION WIND TURBINE GENERATOR LAYOUT (SOURCE: CLIENT PROVIDED)
- EXISTING RAMPION WIND FARM CABLE (SOURCE: CLIENT PROVIDED)
- EXISTING RAMPION SURVEY AREA (SOURCE: CLIENT PROVIDED)

Scale 1 : 250 000
WGS84/UTM Zone 30N (3°W)

Job No. 11521.4

TABLE OF CONTENTS

LIST OF CHARTS

Charts are enclosed at a scale of 1:15,000:

LIST OF FIGURES

LIST OF TABLES

GLOSSARY OF ABBREVIATIONS

AVO	Amplitude Versus Offset
BASE	Bathymetry Associated with Statistical Error
BGS	British Geological Survey
BS	British Standards
BSB	Below Seabed
cm	Centimetre(s)
CMP	Common Mid Point
CoG	Centre of Gravity
CPT(U)	Cone Penetrometer Testing (Unit)
cu. in.	Cubic Inch(es)
d	Delta
dB	Decibel(s)
deg	Degree(s)
(D)GNSS	(Differential) Global Navigation Satellite System
EBS	Environmental Baseline Survey
EC	European Commission
EGNOS	European Geostationary Navigation Overlay Service
EPSG	European Petroleum Survey Group
f	Focal Length
ft	Foot/Feet
h	Hours (times expressed hh:mmh e.g. 12:45h)
H	Height
HDOP	Horizontal Dilution of Precision
ISO	International Organisation for Standardisation
J	Joule(s)
(k)Hz	(Kilo)Hertz
kg	Kilogram(s)
km	Kilometre(s)
kN	Kilonewton(s)
kPa	Kilopascal(s)
kW	Kilowatt(s)
L	Length
LAT	Lowest Astronomical Tide
m	Metre(s)
M	Megapixels
MBES	Multi-Beam Echo Sounder
MDAC	Methane Derived Authigenic Carbonates
MHWI	Mean High Water Interval
ml	Millilitre(s)
mm	Millimetre(s)
MPa	Megapascals
MRU	Motion Reference Unit
ms	Millisecond(s)
m/s	Metres per Second
MSL	Mean Sea Level
MSR	Mean Spring Range
M.V.	Motor Vessel
N,E,S,W	North, East, South, West
nT	NanoTesla
oct	Octave
OGP	International Association of Oil and Gas Producers
OSPAR	Oslo and Paris Commissions
PC	Piston Core
PDOP	Positional Dilution of Precision
ppm	Parts Per Million
QC	Quality Control
QPRO	Quality Procedure
r	Rotation
RMS	Root Mean Square
RPL	Route Positioning List
Rx	Receive
S	Second(s)
SBES	Single Beam Echo Sounder
sd	Standard Deviation
SEGY	Society of Exploration Geophysicists storage format
SNR	Signal to Noise Ratio
SP	Shot Point
SRME	Surface Related Multiple Elimination
SV	Sound Velocity
SWNA	Surface Wave Noise Attenuation
TWT	Two Way Time
Tx	Transmit
UHRS	Ultra High Resolution Seismic
UKCS	United Kingdom Continental Shelf
USBL	Ultra Short Base Line
(U)TM	(Universal) Transverse Mercator
VC	Vibrocore
(V)GPS	(Voyager) Global Positioning System
VORF	Vertical Offshore Reference Frames
WGS84	World Geodetic System 1984

1. PROJECT SUMMARY

1.1 Scope of Work

Gardline Limited carried out a shallow geophysical and UHRS survey for RWE Renewables UK Ltd off the coast of Brighton, Sussex. The objective was to investigate three areas being considered for development using multi-beam echo sounder, side scan sonar, magnetometer, sub-bottom profiler and UHRS equipment.

The three extension areas were designated:

- Area A: “Zone 6 Area” to the south-east of the existing Rampion offshore wind farm. Part of this area was previously surveyed during the original development and there was no requirement for re-surveying at this stage of the development.
- Area B: “Extension Area” to the west of the existing Rampion offshore windfarm.
- Area C: “Export Cable Area” to the north of Area B, with landfall between Littlehampton and Bognor Regis. No UHRS acquisition was required for Area C.

The purpose of the survey was to:

- To provide accurate bathymetry of the site regions and cable routes region
- To identity natural seabed features and any obstructions, man-made objects, debris, or wrecks
- To produce isopach charts to show sediment thickness of the upper, loose, and any mobile material, and of any other significant reflector levels which might impact on the engineering design to 50m below seabed for Areas A and B, and to 10m below seabed for Area C
- To locate any structural complexities or geohazards within the shallow geological succession such as faulting, accumulations of shallow gas, buried channels etc to 50m below seabed for Areas A and B, and to 10m below seabed for Area C
- Locate and identify sites of near surface soft material pertinent to jack-up operations
- To provide detailed geological interpretation to show strata variations and structural feature changes via appropriate maps and sections
- To provide interpretation to assist design of the offshore foundations / structures and cable routing and burial
- To identity items through correlation of magnetic anomalies and sonar contacts that may require further physical survey, for example UXO and wrecks

The offshore work scope was carried out by the Gardline vessel M.V. Vigilant, with additional work undertaken by M.V. Ocean Observer. The M.V. Vigilant acquired full coverage with MBES and SSS of Areas A, B and the offshore part of Area C. In addition, it acquired SBP and magnetometer data on all of the offshore part of Area C with a line spacing of 60m, and 4 out of every 5 main lines in Areas A and B, with a line spacing of 77m.

The M.V. Ocean Observer acquired UHRS, SBP and magnetometer data on Areas A and B at a line spacing of 385m, and on each of the cross lines in Areas A and B at a line spacing of 1336m. Both the main and cross lines are orientated and positioned so as to acquire UHRS data through the proposed locations of the turbines in Areas A and B.

The nearshore work scope was covered by the M.V. Titan Discovery and a Titan owned Unmanned Aerial Vehicle (UAV). Details of operational activities is included in the Operations Report, 11521.1.

All coordinates quoted in the report are with respect to **World Geodetic System 1984 (WGS84), UTM Grid Zone 30N (3° West)**. All water depths are reduced to **Lowest Astronomical Tide (LAT).** Full details of the geodetics used during the project are contained in Appendix A.

The grid of survey lines as acquired for Rampion Area C is illustrated on Charts 1, Chart 2 and Chart 3.

This report is the Rampion Area C Survey Report.

1.2 Equipment Summary

Table 1.1 Survey Equipment – M.V. Vigilant

System	Make/Model
Positioning system	Oceaneering C-Nav DGNSS
	Sonardyne Ranger USBL
Navigation System	Voyager5
Echo Sounder (MBES system)	Simrad EM2040D
Echo Sounder (SBES system)	Simrad EA400
Side Scan Sonar	EdgeTech 4200FS
Magnetometer	Geometrics G882
Sub-Bottom Profiler	GeoAcoustics Pinger

Table 1.2 Survey Equipment – Titan Discovery

System	Make/Model
Positioning Systems	Applanix POS MV WaveMaster
	Trimble SPS855 GNSS Receiver
	Sonardyne Mini Ranger 2
Navigation System	QPS QINSy 9
Echo Sounder (SBES system)	Odom Echotrac MK III
Echo Sounder (MBES system)	Reson T20-P Dual Head
Side Scan Sonar	Edgetech 4200FS
Magnetometer	Geometrics G882
Sub-Bottom Profiler	Applied Acoustics CSP300 Bang Box Applied Acoustics 20 Element Hydrophone
UAV	Sensefly eBee

2. ACCURACY AND TERMS FOR SEISMIC INTERPRETATION

2.1 Resolution and Limitations for Site Survey Data

2.1.1 Bathymetry

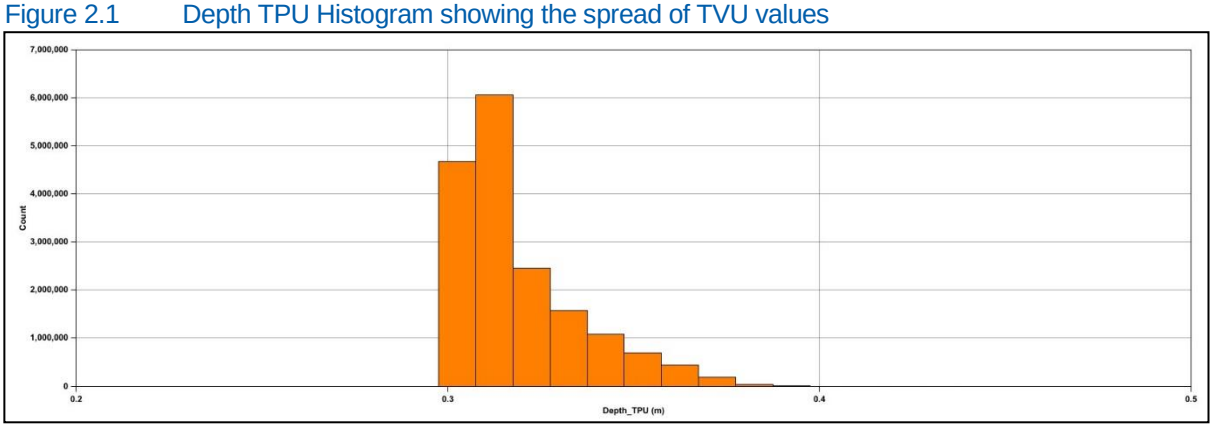
Several factors influence the accuracy of the bathymetric data:

- Variations in sound velocity
- Instrument accuracy (typically 0.2-0.5% of depth depending on beam angle)
- Weather effects/vessel movement
- Morphology of seabed

The uncertainty requirement of the survey to achieve International Hydrographic Organisation's (IHO) Order 1. In the guidelines produced by the IHO, a formula is outlined to derive an accuracy level depending on the depth of water the survey is being carried out in. This Total Vertical Uncertainty (TVU) value is used to ensure the data collected meets the standard required to meet Order 1a. Using water depths of 15m and 60m as the rough range within which Gardline acquired data, the MBES TVU must be better than +/- 0.537m and +/- 0.926m, respectively.

The data were analysed using the Total Propagated Uncertainty (TPU) engine in CARIS. A depth TPU surface created within CARIS to identify the TVU range. The figure below shows that the TVU values meet the minimum level required to me the IHO Order1.

Figure 2.1 Depth TPU Histogram showing the spread of TVU values



In addition to standard processing flow of the data, post processing was carried out on the raw GNSS records to produce a more accurate tidal profile to be applied to the data.

Multi-beam echo sounder data have been processed with a 1m bin size. As such, localised gradients of features with a smaller lateral extent will be underestimated.

2.1.2 Seabed Features

Side scan sonar data were collected for the purpose of mapping and imaging features and hazards on the seabed. Collected data from the Vigilant have frequencies of 122kHz and 410kHz and a range of 100m per channel. Collected data from the Titan Discovery have frequencies of 122kHz and 550kHz and a range of 75m per channel.

From corrections made to the sonar mosaic, and comparing the sonar data with the swathe data, USBL positioning accuracy is expected to be in the order of ±2m, and horizontal resolution between adjacent objects is expected to be approximately 0.5m. Vertical protrusions above the seabed of 0.1m

should be detectable (and flat-lying objects above 0.1m diameter) depending on range, and measurable to the nearest 0.1m.

2.1.3 Magnetic Survey

Magnetometer data were inspected for potential anomalies with the results being presented on the enclosed Seabed Features chart.

Records were of average quality with background noise apparent due to the relative close proximity of the survey vessel to the magnetometer due to the shallow water depths on site, as well as induced noise from the underlying geology.

Positioning of ferrous bodies from magnetic anomalies is problematical. Errors are introduced from uncertainties on raw navigation data and on offset errors, as well as from the inherent ambiguity of determining body shape from magnetic anomalies. Where possible magnetic anomalies are cross referenced against other datasets (e.g. bathymetry, side scan sonar, sub-bottom profiler, database records etc), in order to assign a likely centre of the magnetic deviation. Where this is not possible the positioning accuracy will be largely dependent on the acquired line spacing.

2.1.4 Sub-Seabed Data

Boomer and Pinger data were of good quality and exhibit an average penetration of 10m and 15m respectively and depending on the local geological conditions. An assumed seismic velocity of 1650m/s was used for time/depth conversion in the shallow sediments. Maximum vertical resolution may be determined theoretically by one quarter of the wavelength, which would give a maximum vertical resolution of the Boomer and Pinger data is approximately 0.1m and 0.3m respectively, assuming a dominant frequency of approximately 1300Hz and 3500Hz. Theoretical minimum detectable layer, estimated at 1/30th the dominant wavelength, is calculated to be approximately 0.016m and 0.043m respectively at seabed.

2.2 Criteria for Horizon Picking

Interpretation of the sub-seabed data has been aided using BGS records and previous reports which are detailed in Section 4.

Horizons were picked where they separated distinct seismo-stratigraphic units. Generally, they were picked on the peak, but where the horizons represented a velocity inversion, they were picked on the trough.

3. GEOPHYSICAL SURVEY RESULTS

3.1 Bathymetry

Rampion Area C bathymetry is illustrated on Chart 4 as a colour shaded relief image with contours at 1m intervals. An overview of the bathymetry is presented as Figure 3.1.

A shaded relief image of the bathymetry is illustrated on Chart 5. An overview of the shaded relief is presented as Figure 3.2.

Seabed Gradient is illustrated on Chart 6. An overview presented as Figure 3.3.

Within the survey area, the shallowest depth is -18.9m LAT (observed above sea level) to the north of the site where the Titan UAV (Sensefly Ebee) surveyed the dryline. Water depths reach 28.2m LAT within a possible dredging extraction area to the south of the site. Seabed gradients across the survey area are generally <1°, dipping towards the south. Localised gradients reach up to 10° within the depression caused by possible dredging extraction.

Megaripples are present towards the southern end of the site with heights of 0.2m and wavelengths reaching 7m. The seabed undulates across much of the site, influenced by the underlying geology. The dipping strata in the bedrock frequently approach seabed and are orientated from northwest to southeast. Occasional rocky outcrops are observed across the centre and north of Area C, with seabed gradients reaching 10°.

A significant seabed depression is present in the far south of Area C. This measures approximately 285m across and 11m deep, with gradients reaching 20° on its flanks. This has been interpreted as a possible dredging extraction area.

The difference between LAT and MSL within the survey area is approximately 3.3m.

BATHYMETRY OVERVIEW FOR RAMPION 2 OWF AREA C

PROPOSED RAMPION 2 OWF AREA C (EXPORT CABLE AREA)

PROPOSED RAMPION 2 OWF AREA B (EXTENSION AREA)

PROPOSED RAMPION 2 WIND TURBINE GENERATOR LAYOUT (SOURCE: CLIENT PROVIDED)

15 BATHYMETRIC CONTOURS SHOWN AT 5 METRE INTERVALS LAT

DEPTH IN METRES BELOW LAT
-20
-10
0
10
20
30
36

Littlehampton

Bognor Regis

5 632 500 N
5 628 750 N
5 625 000 N
5 621 250 N
5 617 500 N
5 613 750 N

663 750 E
667 500 E
671 250 E
675 000 E
678 750 E
682 500 E

50°48'00" N
50°45'00" N
50°42'00" N
50°39'00" N

000°42'00" W
000°38'00" W
000°33'00" W
000°30'00" W
000°27'00" W
000°24'00" W

Scale 1 : 75 000
WGS84/UTM Zone 30N (3°W)

Figure 3.1

Job No. 11521.4

SEABED SHADED RELIEF OVERVIEW FOR RAMPION 2 OWF AREA C

PROPOSED RAMPION 2 OWF AREA C
(EXPORT CABLE AREA)

PROPOSED RAMPION 2 OWF AREA B
(EXTENSION AREA)

PROPOSED RAMPION 2
WIND TURBINE GENERATOR LAYOUT
(SOURCE: CLIENT PROVIDED)

DEPTH IN METRES BELOW LAT
-20
-10
0
10
20
30
36

Littlehampton

Bognor Regis

5 632 500 N
5 628 750 N
5 625 000 N
5 621 250 N
5 617 500 N
5 613 750 N

663 750 E
667 500 E
671 250 E
675 000 E
678 750 E
682 500 E

50°48'00" N
50°45'00" N
50°42'00" N
50°39'00" N

000°42'00" W
000°39'00" W
000°36'00" W
000°33'00" W
000°30'00" W
000°27'00" W
000°24'00" W

Scale 1 : 75 000
WGS84/UTM Zone 30N (3°W)

Figure 3.2

Job No. 11521.4

SEABED GRADIENT OVERVIEW FOR RAMPION 2 OWF AREA C

PROPOSED RAMPION 2 OWF AREA C
(EXPORT CABLE AREA)

PROPOSED RAMPION 2 OWF AREA B
(EXTENSION AREA)

PROPOSED RAMPION 2
WIND TURBINE GENERATOR LAYOUT
(SOURCE: CLIENT PROVIDED)

GRADIENT IN DEGREES
>10
7.5
5.0
2.5
0.0

Littlehampton

Bognor Regis

5 632 500 N
5 628 750 N
5 625 000 N
5 621 250 N
5 617 500 N
5 613 750 N

50°48'00" N
50°45'00" N
50°42'00" N
50°39'00" N

663 750 E
667 500 E
671 250 E
675 000 E
678 750 E
682 500 E

000°42'00" W
000°38'00" W
000°33'00" W
000°30'00" W
000°27'00" W
000°24'00" W

Scale 1 : 75 000
WGS84/UTM Zone 30N (3°W)

Figure 3.3

Job No. 11521.4

3.2 Seabed Features

Seabed features are illustrated on Chart 7, with an overview provided as Figure 3.4. A side scan sonar mosaic is presented on Chart 8, with an overview provided as Figure 3.5.

Seabed sediments are expected to comprise predominately gravel and sand. with sandy gravel primarily to the north and gravelly sand primarily to the south, with occasional outcrops of rock located in the centre of the site, trending northwest to southeast.

Megaripples are prevalent over much of the south of the site, and are trending northwest to southeast. The crests extend up to 0.2m in height relative to the surrounding seabed. Localised gradients up to 5° are present on the flanks of the megaripples. A side scan sonar data example of the megaripples is illustrated on Figure 3.6.

5434 contacts exceeding 0.5m in any dimension are interpreted across Area C, the majority of which are interpreted as boulders. The largest measures 1.7m in height, and is located in the south of the survey area. 21 contacts are interpreted as debris with largest measuring 2.6m in height, located to the south of the site. 23 contacts are interpreted as fishing pots and are associated with fishing gear across the site.

Areas of numerous boulders cover much of the site with the majority being associated with rock outcrops, and have been categorised as boulder fields. These can be observed in Figure 3.7, Figure 3.8 and Figure 3.9. Boulders found within boulder fields have not been individually picked.

Linear debris is observed sporadically across the site. 14 items of linear debris measuring >1m are interpreted within the site limits. The largest item of linear debris is 378m in length, located in the south of the survey area, illustrated in Figure 3.10. Five linear contacts are interpreted as fishing gear; an example of these can be seen in Figure 3.11, Figure 3.12 and Figure 3.13. The largest item of potential fishing gear is 382m in length, located in the northwest of the survey area.

One possible pipeline/cable has been observed in the centre of the site, with an associated magnetometer anomaly, seen in Figure 3.14. This feature is observed on both side scan sonar and bathymetry data, however no background information is available to positively identify this.

Three wrecks occur within Area C, predominantly located in the southern section of the survey area, and all of which are identified on the geophysical data. These are all located on admiralty charts. All of the observed wrecks are located to the south of the site. All have been observed on side scan sonar, magnetometer and bathymetric records. The largest wreck, illustrated on Figure 3.15, has a length of 120m, width of 32m and a height of 2.3m. The two remaining wrecks are illustrated on Figure 3.16 and Figure 3.17.

54 magnetometer contacts are observed across the site. Magnetometer contacts generally do not correlate with any object identified at seabed. Due to the relative distance to underlying geology, most of the smaller anomalies may be associated with geological features. Seven magnetometer contacts are associated with the observed wrecks.

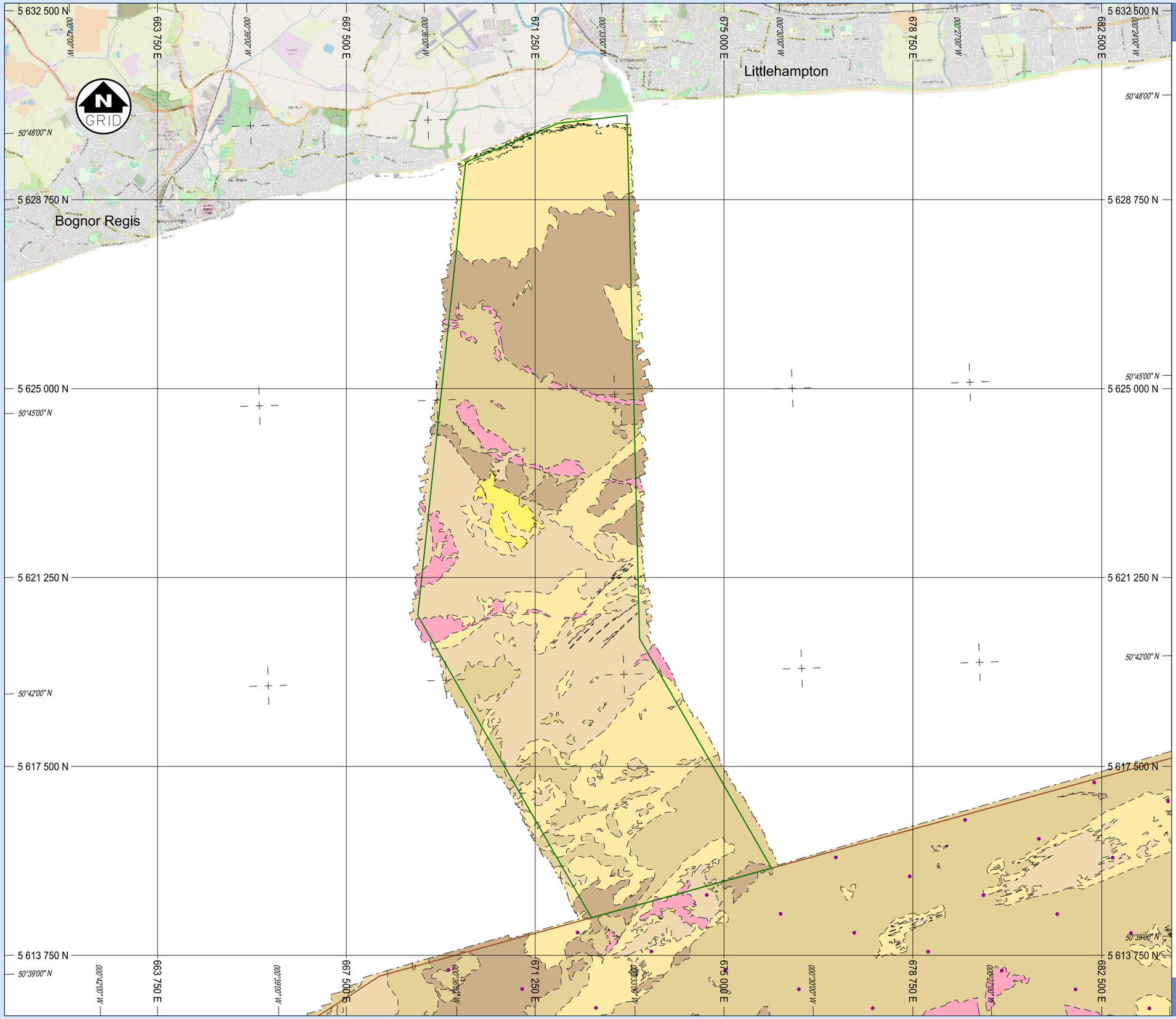
Several areas of the seabed appear as patchy areas of raised sonar reflectivity with shallow depressions measuring approximately 0.5m in diameter, to the north of the site. Such a texture on side scan sonar data is often indicative of *Biogenic Structures,* illustrated on Figure 3.18 . The extents of these areas have been delineated on Chart 6 as *possible black bream nest aggregations*. Ground truthing is required to confirm the presence of these nesting areas.

Table 3.1 Table of Wrecks

Name	Easting	Northing	Length (m)	Width (m)	Height (m)
Wreck 1	672 748	5 619 009	13.6	3.5	3.1
Wreck 2 A	670 696	5 617 303	4.2	2.3	4.0
Wreck 2 B	670 703	5 617 298	3.4	2.1	3.7
Wreck 3	672 045	5 616 545	119.7	31.9	2.3

MBES and side scan sonar montages of Wreck 2 and Wreck 3 are illustrated on Figure 3.19 and Figure 3.20, respectively.

SEABED SEDIMENTS OVERVIEW FOR RAMPION 2 OWF AREA C



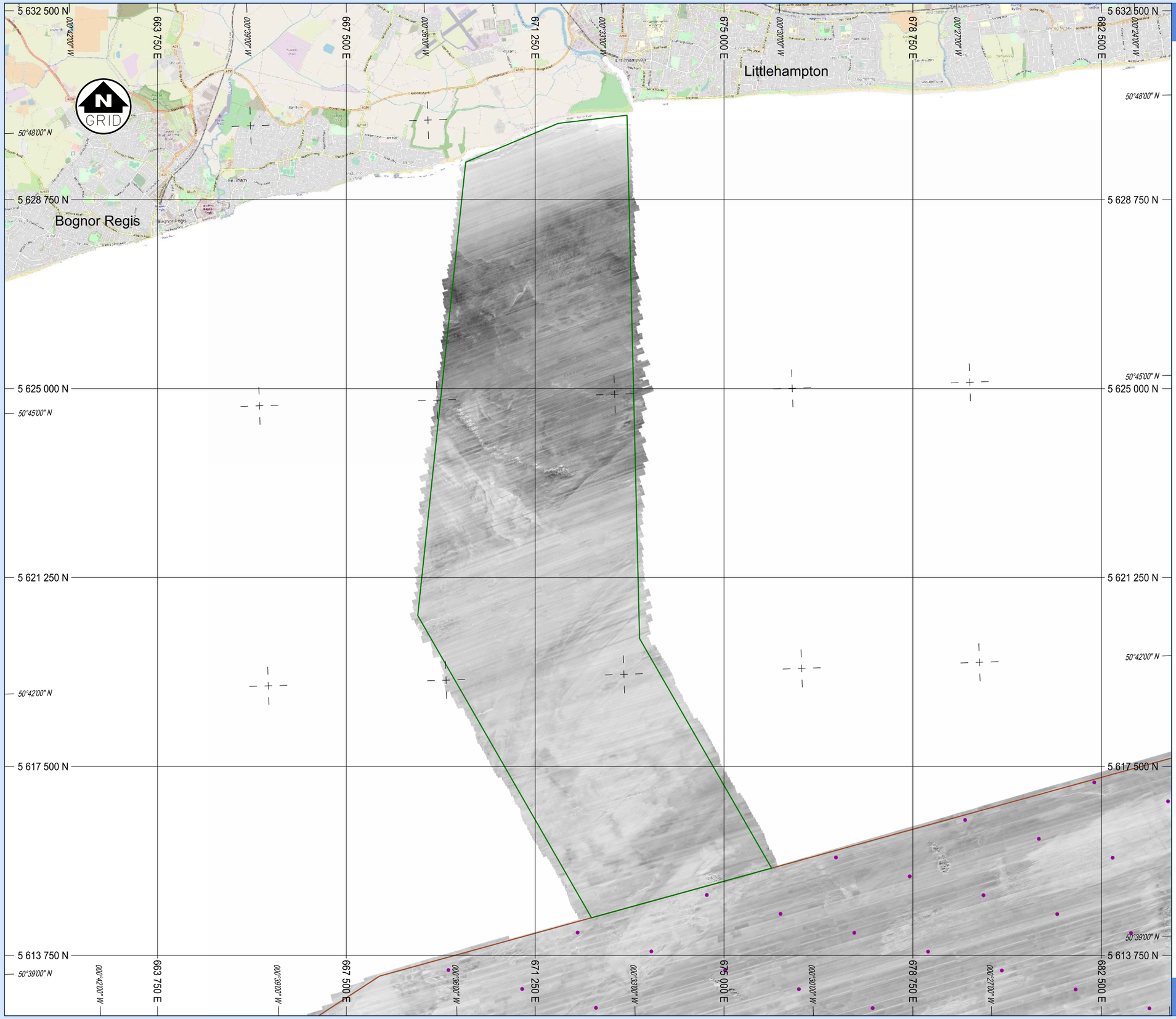
- PROPOSED RAMPION 2 OWF AREA C (EXPORT CABLE AREA)
- PROPOSED RAMPION 2 OWF AREA B (EXTENSION AREA)
- PROPOSED RAMPION 2 WIND TURBINE GENERATOR LAYOUT (SOURCE: CLIENT PROVIDED)
- SAND (NO BEDFORMS)
- SAND (MEGARIPPLED)
- SLIGHTLY GRAVELLY SAND (NO BEDFORMS)
- SLIGHTLY GRAVELLY SAND (MEGARIPPLED)
- SANDY GRAVEL (NO BEDFORMS)
- SANDY GRAVEL (MEGARIPPLED)
- SANDY GRAVEL (OUTCROP)
- ROCK (OUTCROP)
- LIMIT OF SIDE SCAN SONAR COVERAGE

Scale 1 : 75 000
WGS84/UTM Zone 30N (3°W)

Figure 3.4

Job No. 11521.4

SIDE SCAN SONAR MOSAIC OVERVIEW FOR RAMPION 2 OWF AREA C



PROPOSED RAMPION 2 OWF AREA C
(EXPORT CABLE AREA)

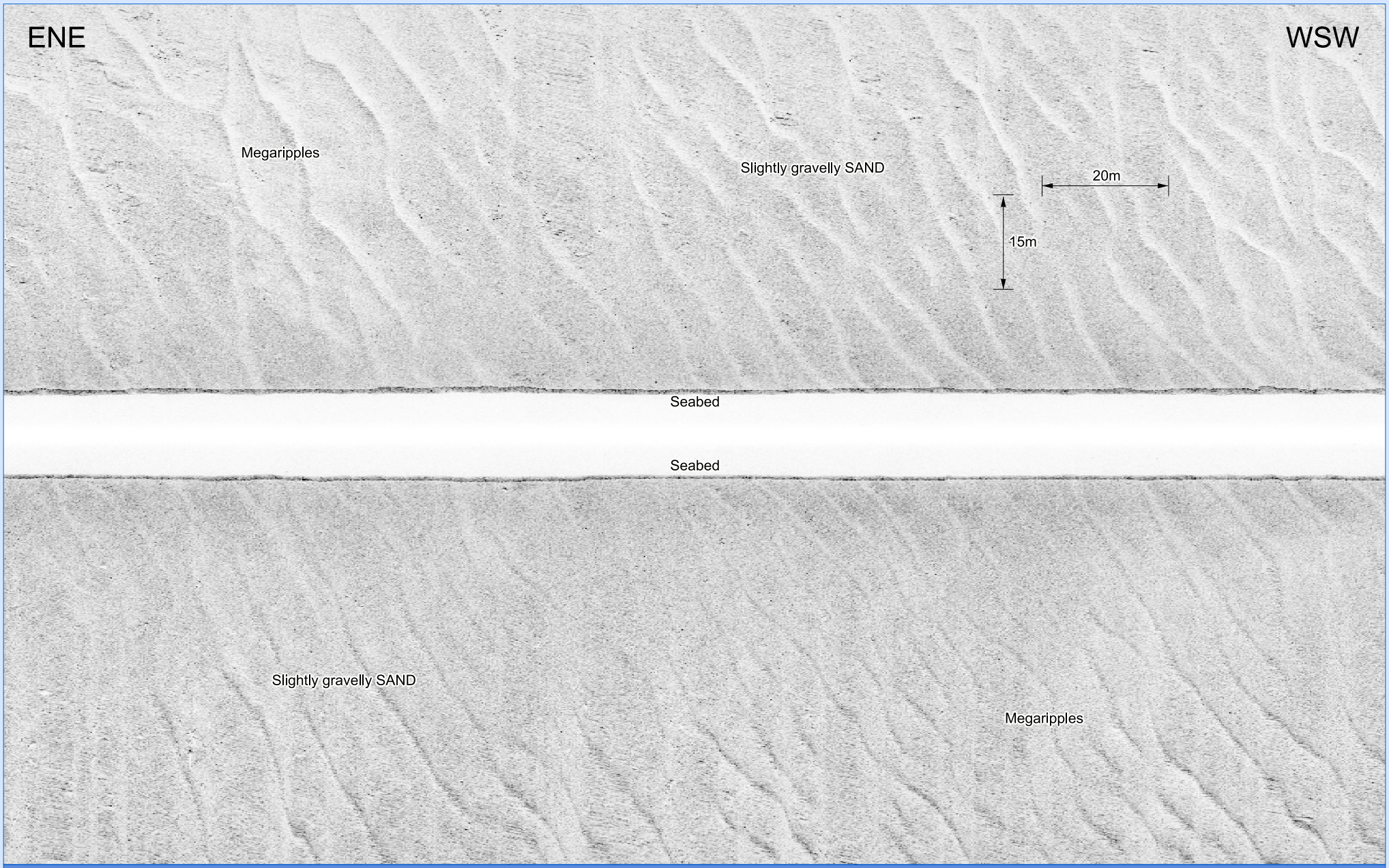
PROPOSED RAMPION 2 OWF AREA B
(EXTENSION AREA)

PROPOSED RAMPION 2
WIND TURBINE GENERATOR LAYOUT
(SOURCE: CLIENT PROVIDED)

Scale 1 : 75 000
WGS84/UTM Zone 30N (3°W)

Figure 3.5

Job No. 11521.4

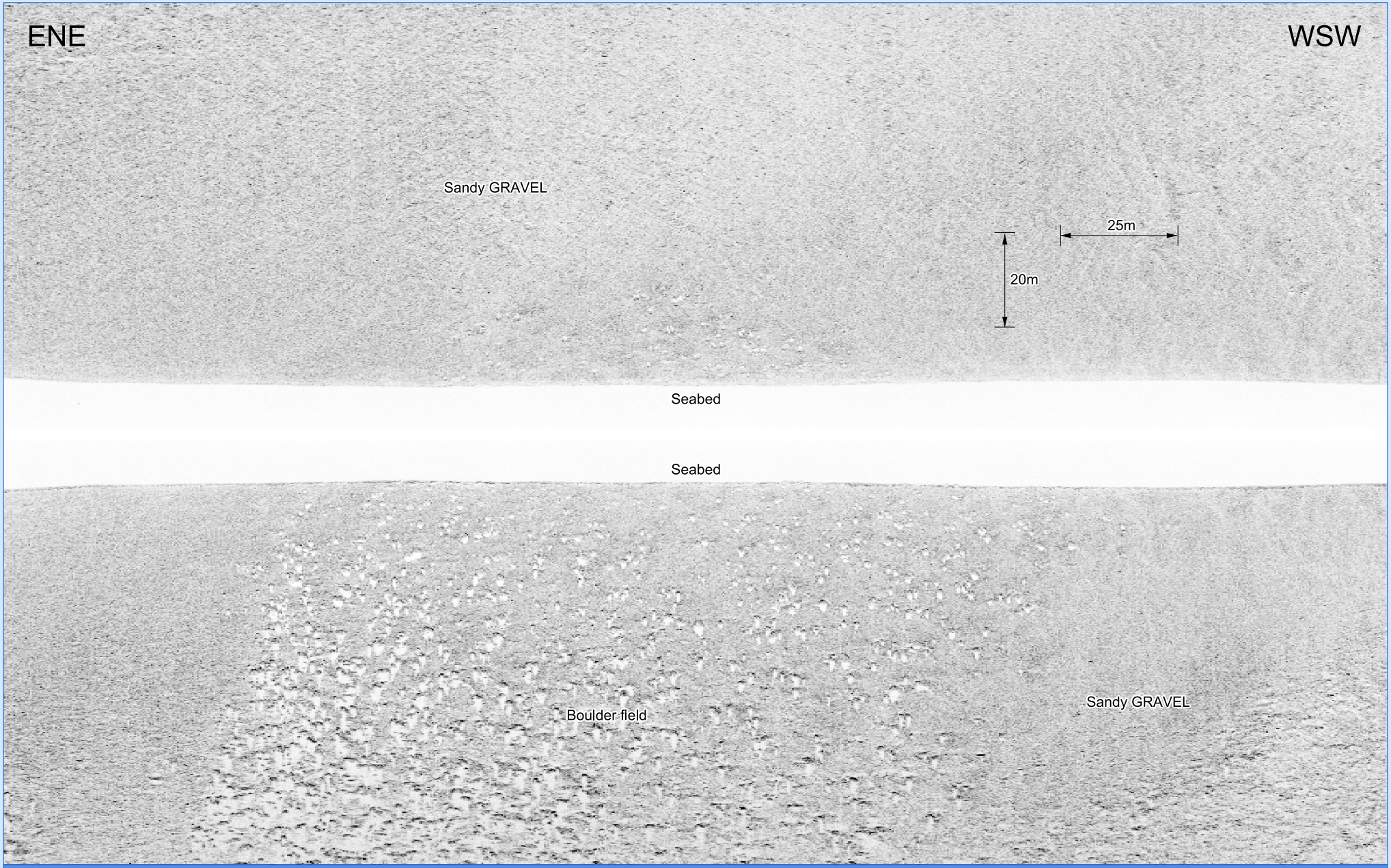


Line M39

SIDE SCAN SONAR
Illustrating megaripples

Figure 3.6

Job No. 11521.4

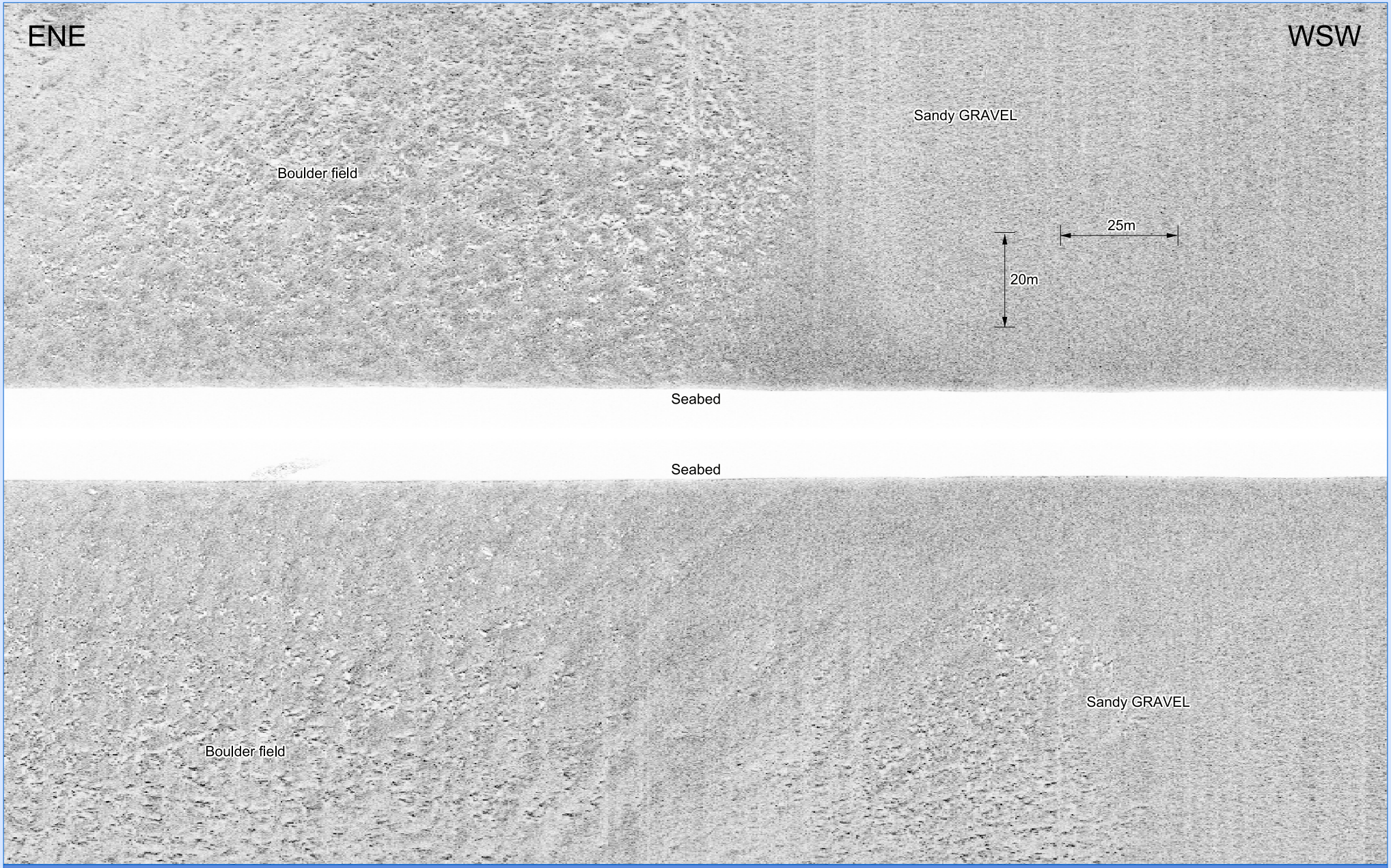


Line C_M-60

SIDE SCAN SONAR
Illustrating boulder field area

Figure 3.7

Job No. 11521.4

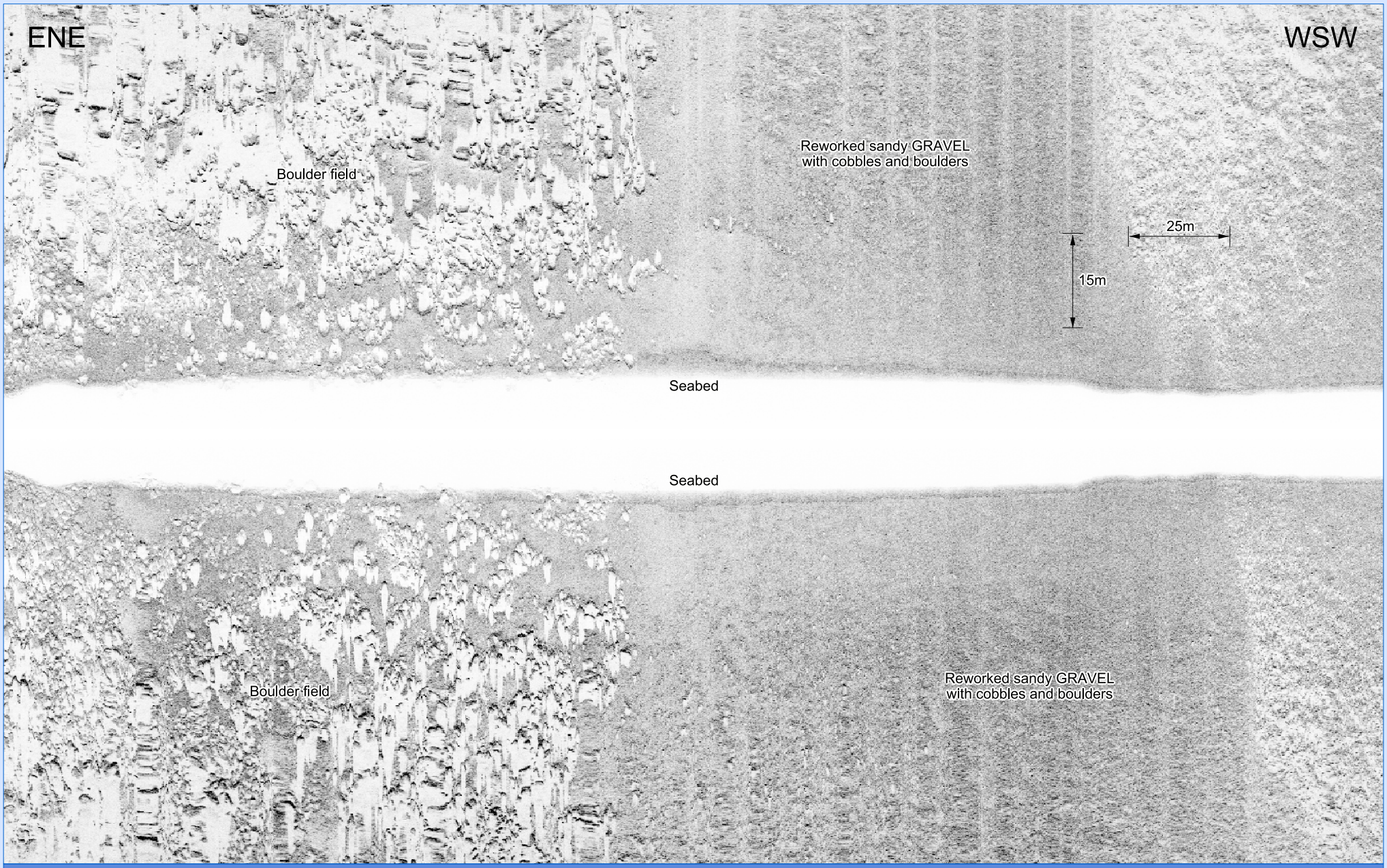


Line C_M-37

SIDE SCAN SONAR
Illustrating boulder field area

Figure 3.8

Job No. 11521.4

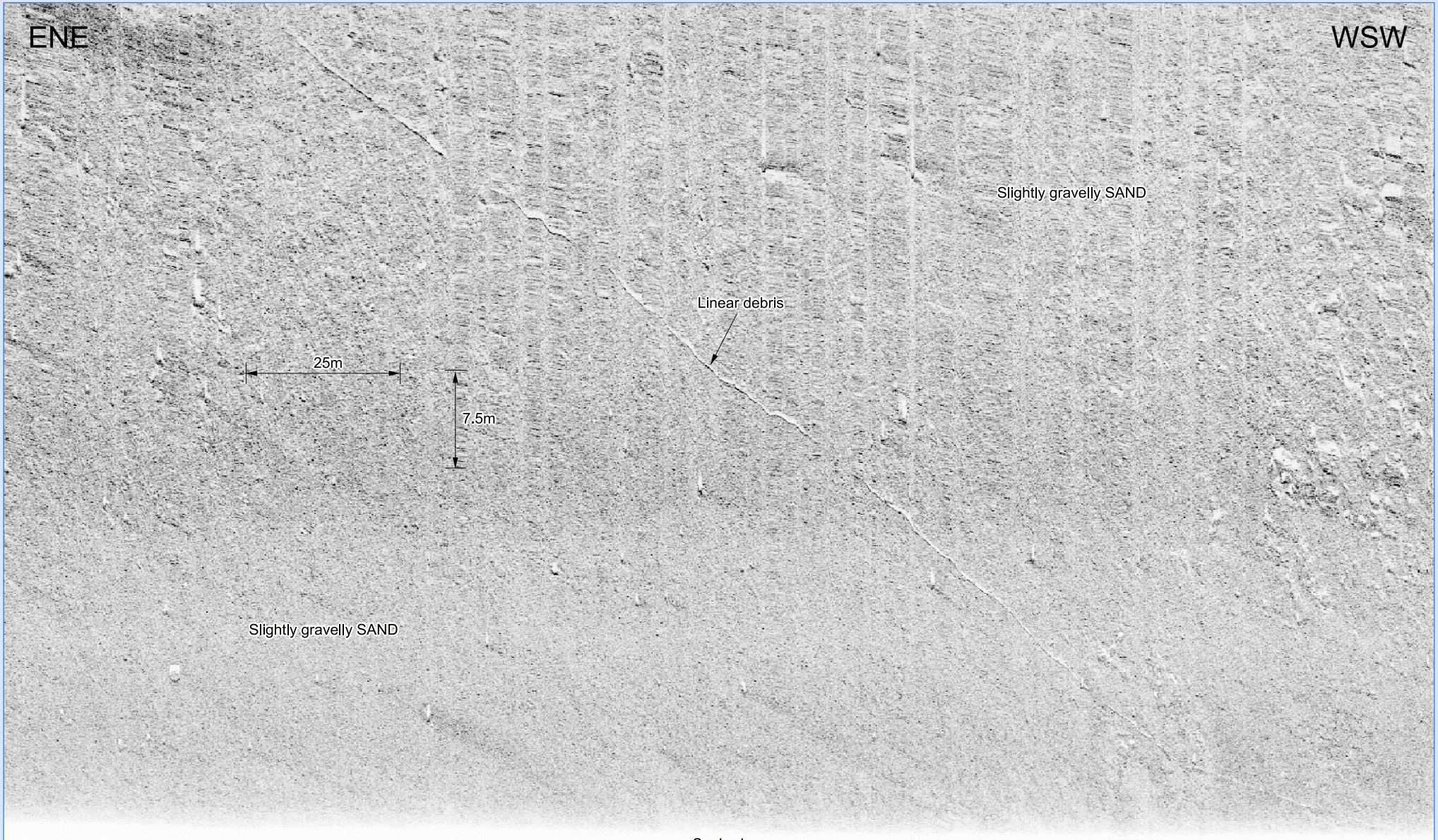


Line M91

SIDE SCAN SONAR
Illustrating boulder field area

Figure 3.9

Job No. 11521.4

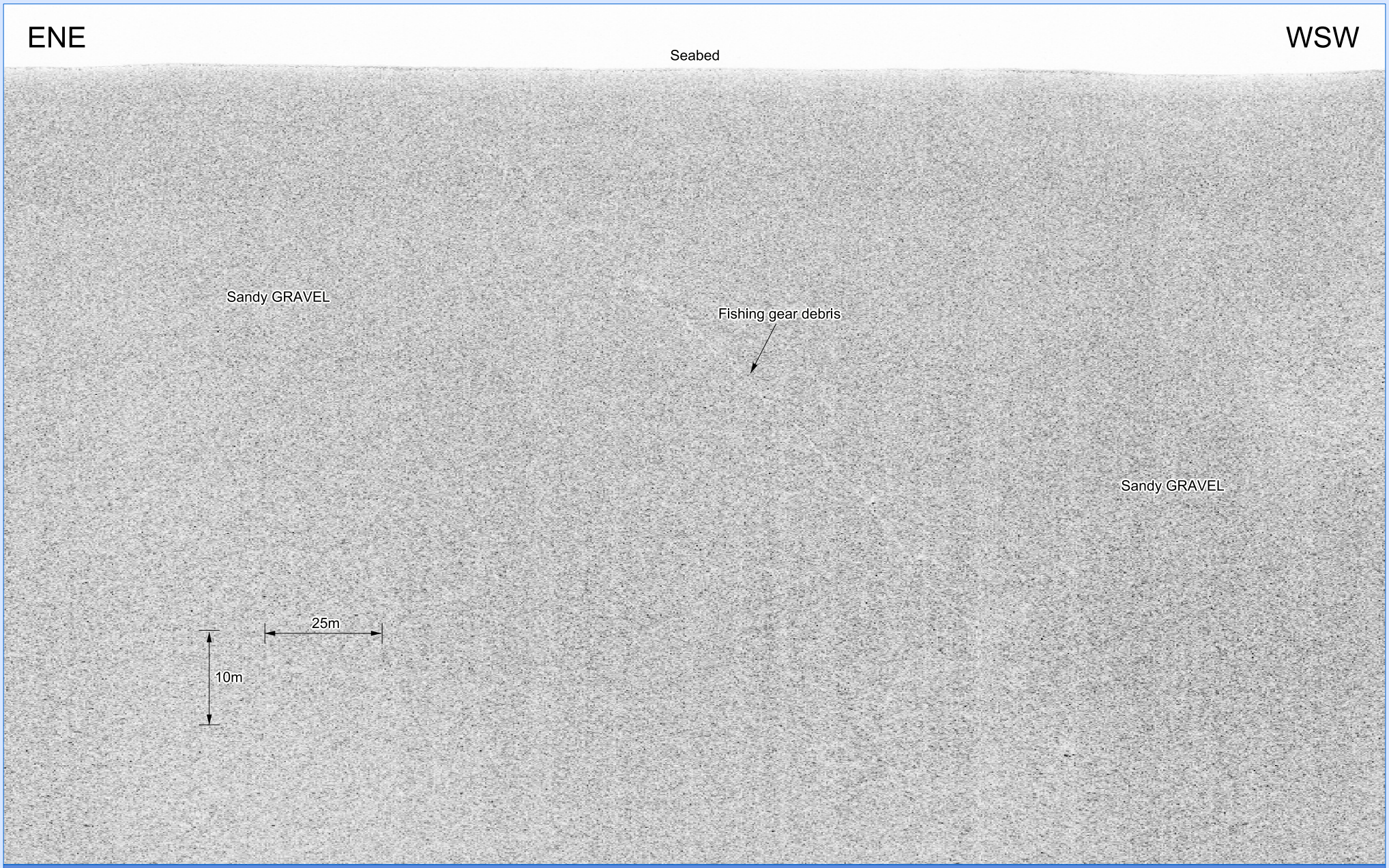


Line M24

SIDE SCAN SONAR
Illustrating linear debris

Figure 3.10

Job No. 11521.4



Line C_M-77

SIDE SCAN SONAR
Illustrating fishing gear debris

Figure 3.11

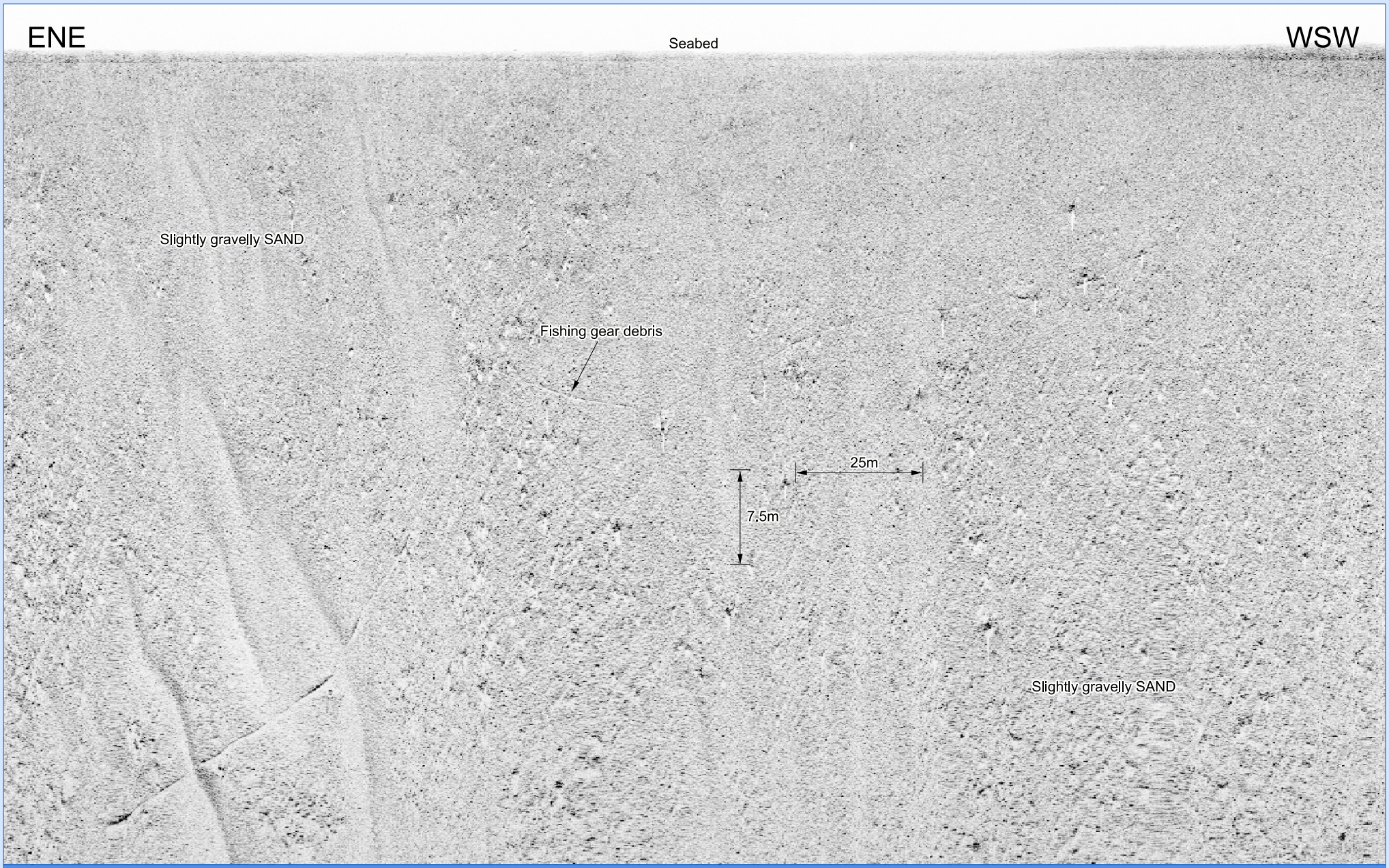
Job No. 11521.4

Line C_M-42

SIDE SCAN SONAR
Illustrating fishing gear debris

Figure 3.12

Job No. 11521.4

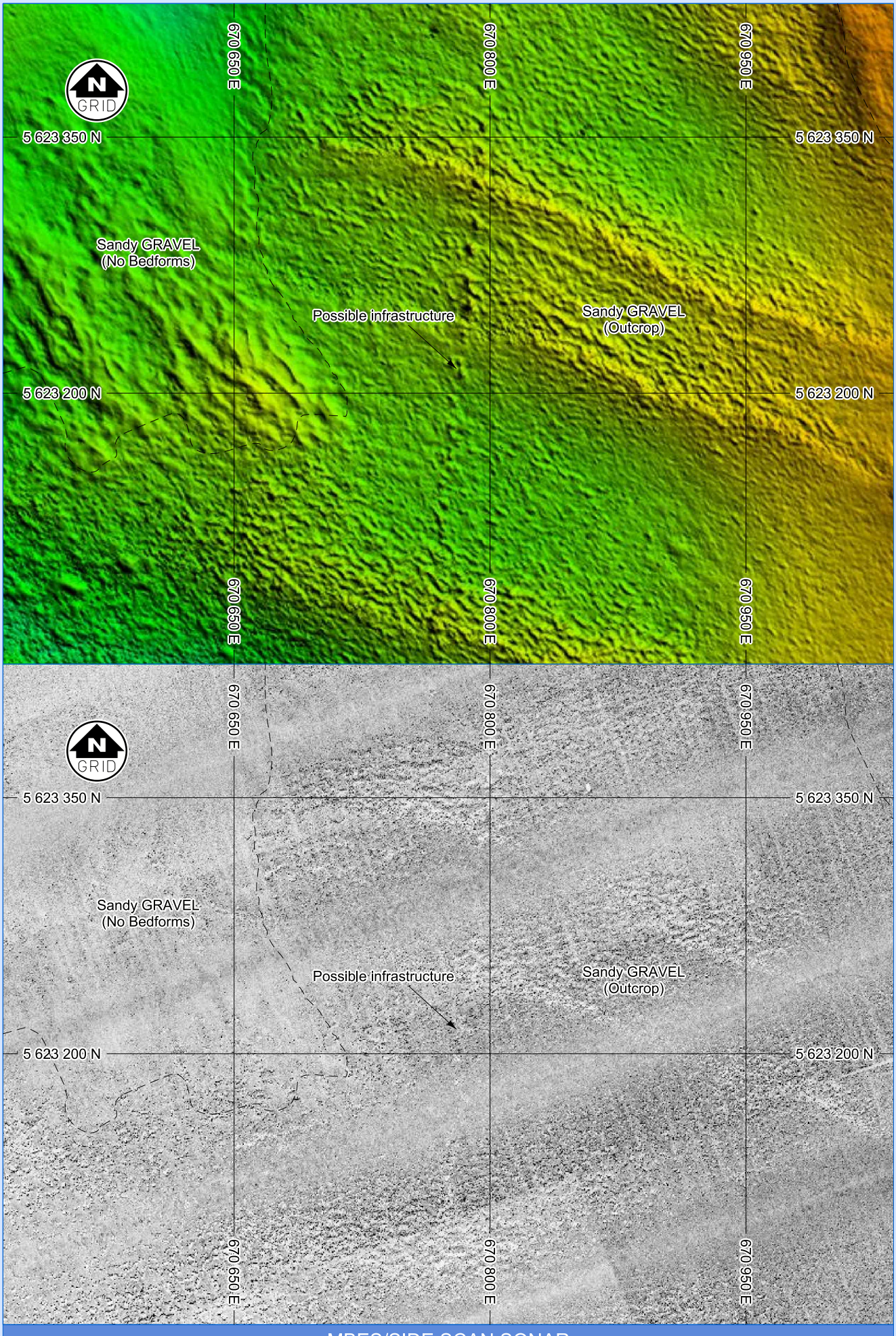


Line M69

SIDE SCAN SONAR
Illustrating fishing gear debris

Figure 3.13

Job No. 11521.4

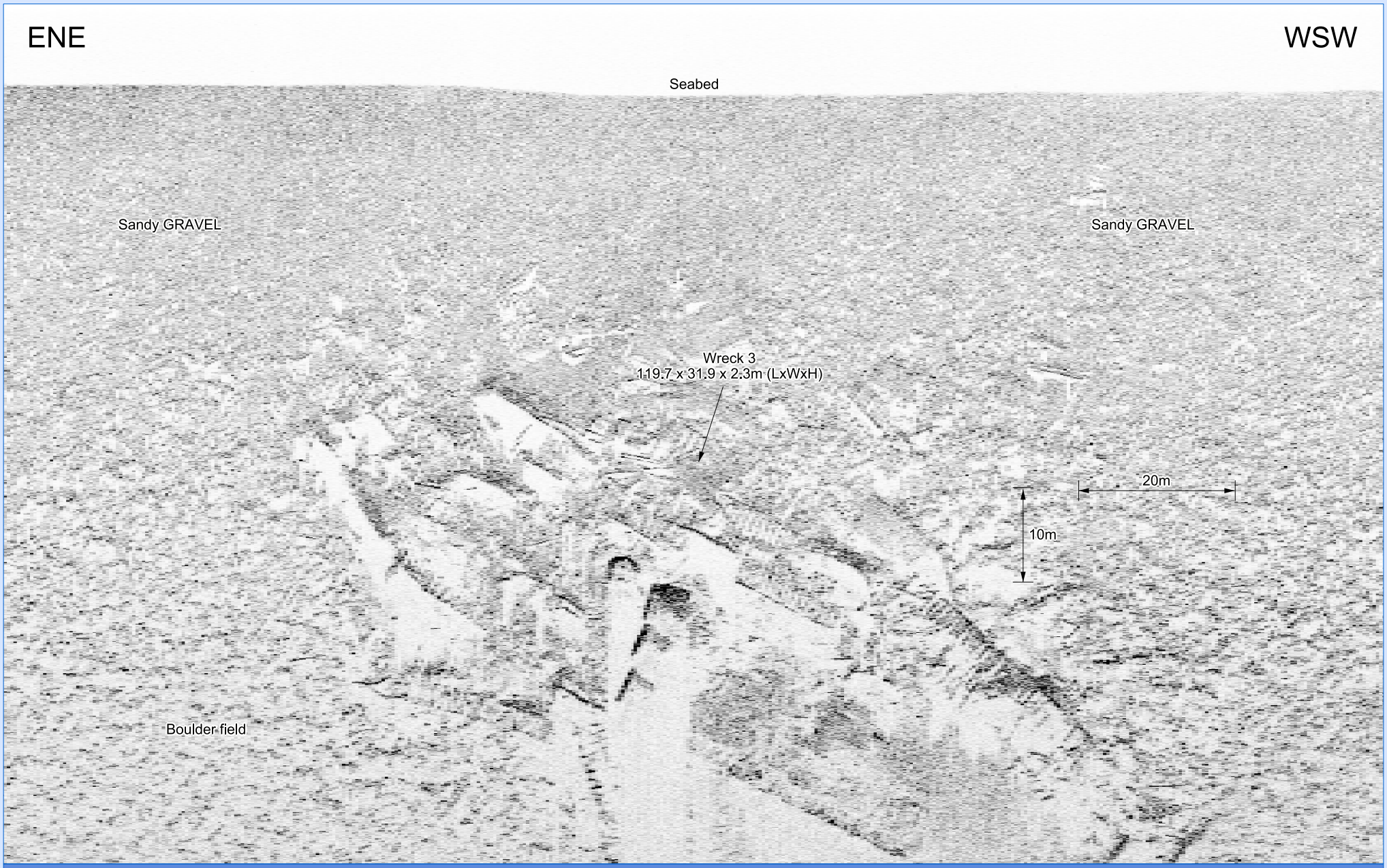


Scale 1 : 3 000
WGS84/UTM Zone 30N (3°W)

MBES/SIDE SCAN SONAR
Illustrating possible infrastructure

Figure 3.14

Job No. 11521.4

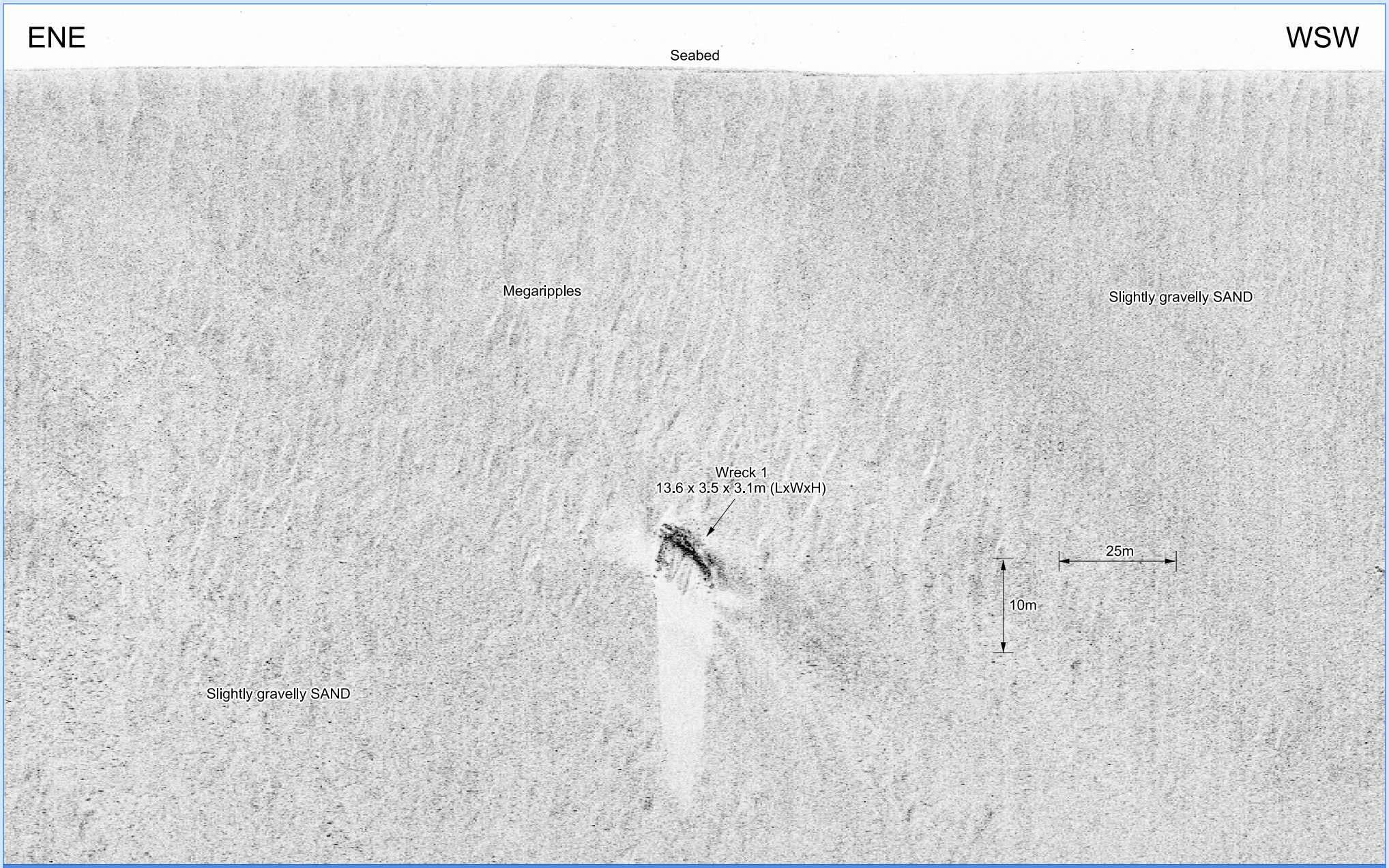


Line C_M-55

SIDE SCAN SONAR
Illustrating Wreck 3

Figure 3.15

Job No. 11521.4



Line C_M-21

SIDE SCAN SONAR
Illustrating Wreck 1

Figure 3.16

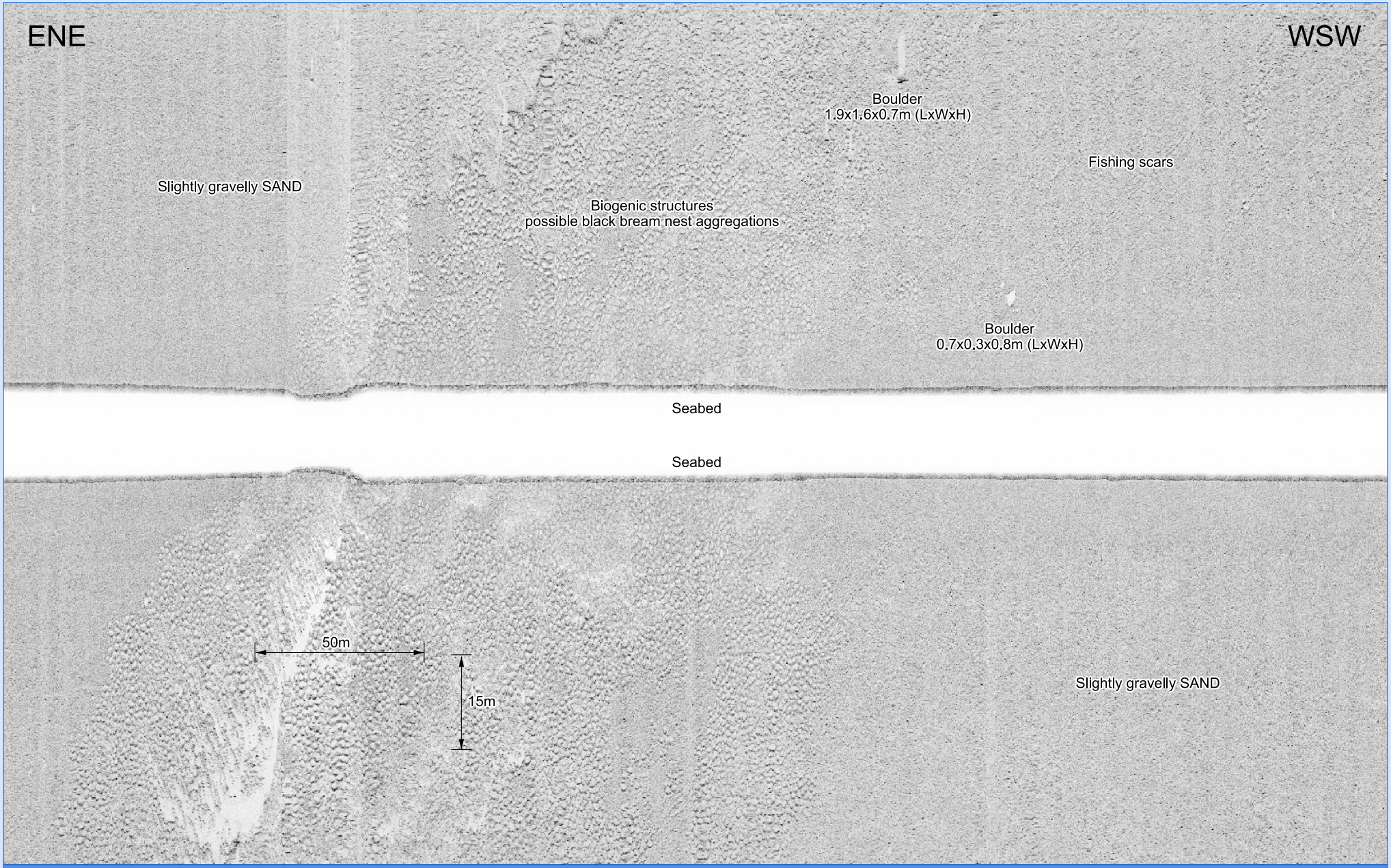
Job No. 11521.4

Line C_M-37

SIDE SCAN SONAR
Illustrating Wreck 2

Figure 3.17

Job No. 11521.4



Line M102

SIDE SCAN SONAR
Illustrating biogenic structures - possible black bream nest aggregations

Figure 3.18

Job No. 11521.4