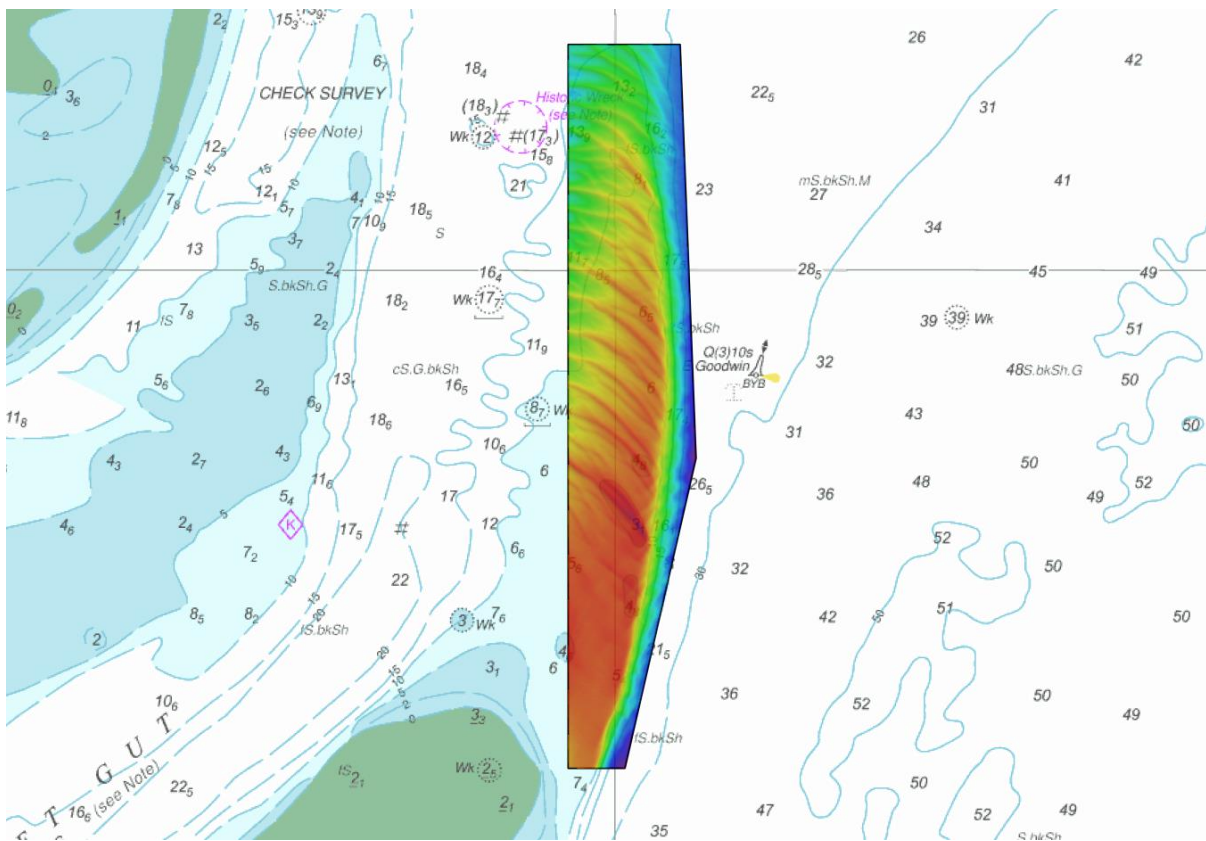




GOODWIN SANDS NORTHERN HEAD OF SOUTH CALLIPER

ASSESSMENT ON THE ANALYSIS OF ROUTINE RESURVEY AREA GS3
FROM THE 2015 SURVEY



ENGLAND - GOODWIN SANDS
NORTHERN HEAD OF SOUTH CALLIPER
Assessment GS3/2015

An assessment of the 2015 hydrographic survey of the area: to monitor recent seabed movement; to identify any implications for shipping; and to make recommendations for future surveys.

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NORTHERN HEAD OF SOUTH CALLIPER 2015

1. EXECUTIVE SUMMARY

The Area and Recent Changes

- 1.1. Area GS3 covers the Northern head of the South Calliper Shoal area to the east of Goodwin Sands and is currently surveyed every 6 years.
- 1.2. This area has undergone further change with the continued migration of sediment eastwards. Areas shoaler than 5 metres within the GS3 area have reduced in the last 6 years.
- 1.3. Whilst the western, shoal areas have increased in depth, the eastern edge of the area has become shoaler, in particular the southern part of the area due to the eastward migration of the bank.

Reasons for Continuing to Resurvey the Area

- 1.4. The continued migration of sediment and resulting shoaling of areas towards the Goodwin east cardinal buoy and the shipping traffic to the east of this buoy support the continued monitoring of this area.

Recommendations

- 1.5. The regularity of the routine resurvey of the northern part of area GS3 should be reduced from 6 to 12 years by incorporation into GS4 full area survey limits. This is deemed sufficient to ensure adequate future coverage of this area that is currently showing a lower sediment movement than the southern part.
- 1.6. It is advised for the southern part of GS3 that a check line survey is run every 6 years in lieu of the currently scheduled full seafloor coverage surveys.
- 1.7. The revised limits for GS3 can be found in Annexe I

2. INTRODUCTION

- 2.1. This Assessment is produced by the United Kingdom Hydrographic Office (UKHO) for the Maritime and Coastguard Agency (MCA).
- 2.2. Analysis of the Routine Resurvey Areas forms part of the Civil Hydrography Programme and the reports are made available to members of the Committee On Shipping Hydrography (COSH) through the UKHO website, before being presented to the Civil Hydrography Working Group. When approved, the recommendations are incorporated into the Routine Resurvey Programme. The report is governed by a Memorandum of Understanding between the DfT (including the MCA) and the MOD (including the UKHO).

3. HISTORY

- 3.1. The Goodwin Sands area has been surveyed numerous times since 1976. With the full area last being surveyed in 2009.
- 3.2. At the time of the 2009 survey, the GS3 area was significantly larger but as a result of the post survey assessment, the deepening, western part of the area was incorporated into area GS4.
- 3.3. Area specification and survey history shown at Annex A.

4. DESCRIPTION OF THE AREA

- 4.1. Goodwin Sands comprises of a complex and dynamic system of banks cut by relatively deep ebb and flood channels. Sandwaves overlies the banks, with notable sandwave fields at the northern ends of them.
- 4.2. Area GS3 is a small section of the eastern edge of the Goodwin Sands and incorporates a sand bank which is gradually migrating eastward leaving increasingly deeper water to the west. GS3 is at the northern edge of the large South Calliper sand bank and lies approximately 350 metres to the west of the Goodwin Sands eastern cardinal buoy.

5. SHIPPING IN THE AREA

- 5.1 The shoal and changing banks of the Goodwin Sands are generally avoided by shipping. Most pass well to the East but, where draught permits, some choose to use the inshore buoyed route of Gull Stream (Area GS2).
- 5.2 The sample shipping data available shows no vessels greater than 2000 Gross Tonnes passing within 100 metres of area GS3.
- 5.3 Overview of general shipping routes in relation to GS3 is shown at Annex B.

6. 2009 SURVEY DETAILS

- 6.1. The four Goodwin Sand areas were surveyed from 23rd July to 1st September under HI1294. Weather in the area was generally good throughout the survey period, with sea states ranging from 2 (Smooth) to 3 (Slight). Survey work was undertaken by two vessels, MV Triad and MV Seabeam.
- 6.2. The survey was conducted using Kongsberg Maritime EM3002D multibeam echosounders (MBES).
- 6.3. Positioning was by Applanix POS/MV, combining GPS and inertial Measurement Unit data to produce the navigation solution. The survey is referred to the International Terrestrial Reference Frame (ITRF) 2000 Datum.
- 6.4. Depths were reduced to Chart Datum using GPS heights, with ellipsoidal height to chart datum separation values taken from the UKHO Vertical Offshore Reference Framework (VORF).
- 6.5. The final dataset was supplied as a 1 metre gridded Combined Uncertainty & Bathymetry Estimated (CUBE) surface and obtained 100% seafloor cover up to the 2 metre contour. The survey was validated by the UKHO and achieved IHO S44 Order 1a standard (5th Edition).

7. 2015 SURVEY DETAILS

- 7.1. The survey HI1523 of the area of Northern Head of south Calliper was conducted on 2nd and 3rd of September 2015.
- 7.2. Data acquisition was conducted on board FPV Morven using a Dual Head Kongsberg EM2040C MBES.
- 7.3. The primary horizontal reference was provided by a V5 Applanix POS MV system together with GPS data from C&C Technologies C-Nav 3050 system and referred to the International Terrestrial Reference Frame 2005 (ITRF05).

- 7.4. Vertical reference positions were obtained using post processed GPS derived heights together with the UKHO Vertical Offshore Reference Frame (VORF) to reduce heights to Chart Datum (CD).
- 7.5. The final dataset was supplied as a 1metre gridded Combined Uncertainty & Bathymetry Estimated (CUBE) surface. The survey was validated by the UKHO and achieved IHO S44 order 1a standard (5th edition).

8. DESCRIPTION OF RECENT BATHYMETRIC CHANGE

- 8.1. The variability plot at Annex G shows the changes in depth that have occurred since the 2012 survey. This plot shows the continued eastward migration of the sand bank although with generally smaller change in the north of the area.
- 8.2. The survey areas for GS3 in 2009 and 2015 differ slightly. This shows in the variability plot as a narrow white area to the north east within the boundary of the GS3 area. This has occurred due to the change of survey areas. The whole GS3 area was covered in 2015 but not in 2009. The most recent previous survey to completely cover the area of missing data was run in 1997. Due to the relatively small size of the missing data and the nature of the movement in the rest of the area this was not considered a concern for the purposes of this report.
- 8.3. Depth plots of the 2009 and 2015 surveys are shown in Annexes E and F respectively and allow a comparison of selected depth values. The minimum seabed depth in the 2015 survey within the area limits is 3.1 metres towards the south east of the area, 3.1 metres shoaler than in the same point in the 2012 survey. The selected depth plots indicate a general deepening in the west and shoaling in the east. With a greater rate of shoaling over the 6 years shown in the south of the survey area of up to 5 metres compared with up to 2 metres in the north of the survey area.
- 8.4. The changes noted above are supported by the cross section profiles in Annex D and contour plots in Annexes H1-3 which are summarised below:
 - a) The deeper northern part of the sand bank does not feature on the 5 and 10 metre contour plots. The 15 meter contour plot (Annex H-3) and the profile A-B (Annex D) show a south eastward movement of the sand bank of up to 50m in 6 years.
 - b) Approximately 1km from the northern boundary of the GS3 area, the 10m contour plot (Annex H-2) and the profile C-D (Annex D) also show the sand bank migrating in a south eastern movement since the 2009 survey of up to 160m.
 - c) In the centre of the survey area, the direction of migration changes from south east to due east. Profile E-F (Annex D) and the 10m and 15 metre contour plots (Annexes H-2 and H-3) show a migration of up to 70m to the east over the 6 year period.
 - d) At the southern end of the GS3 area boundary, the sediment migration continues due eastward. Profile G-H (Annex D) and the 10m and 15 metre contour plots (Annexes H-2 and H-3) show a 6 year migration of up to 90m to the east.
 - e) All four profiles (Annex D) show a steepening of the eastern slope of the ridge. The steepening is less pronounced at the northernmost profile (A-B).

9. IMPLICATIONS FOR SHIPPING

- 9.1. It is considered that there is no immediate impact on shipping. The average 70m movement over the 6 years still leaves a distance of some 350m to the cardinal buoy. Despite this however, it is considered that the continued shoaling towards the east does warrant monitoring.

10. RECOMMENDATIONS FOR FUTURE SURVEYS

- 10.1. The northern part of the area GS3 should be incorporated into GS4 with a 12 yearly survey interval (Next complete area GS4 Survey due 2021).
- 10.2. The revised coordinates to GS4 Goodwin Sands are shown in Assessment GS4/2015.
- 10.3. Whilst not a direct risk to vessels, the continued eastward movement and shoaling from the mid to southern parts of GS3 suggest monitoring should continue. However it is proposed that this should now be a 6 yearly check line survey.
- 10.4. The revised coordinates and limits with respect to GS3 are found at Annex I.

AREA SPECIFICATIONS

(Including Survey History)

REGION: Goodwin Sands
GS3**NAME:** Northern Head of South Calliper**AREA:**

LIMITS:

a)	51° 16.69'N	001° 34.77'E
b)	51° 16.69'N	001° 35.32'E
c)	51° 15.41'N	001° 35.40'E
d)	51° 14.45'N	001° 35.05'E
e)	51° 14.45'N	001° 34.77'E

AREA SIZE: 0.757 SQ NM (2.6 SQ KM)**SURVEY INTERVAL:** 6 yrs**PREVIOUS SURVEYS:** (conducted at 1:25,000 scale (not applicable to multibeam surveys))

Year	Survey	File Ref	Data
1980	K8552	H1938/78	
1986	K9866	H2333/85	s.t.
1991	M1777	HH090/511/01	s.d.t
1997	M2866	HH090/741/01	s.d.c
1998	M3054	HH090/820/01	s.d.t
2003	M3935	HH090/1029/01	s.d.t
2009	HI1294	200929529	m

KEY: s = sonar sweep, t = seabed texture tracing, d = digital data, c = check lines, m = multibeam digital data.

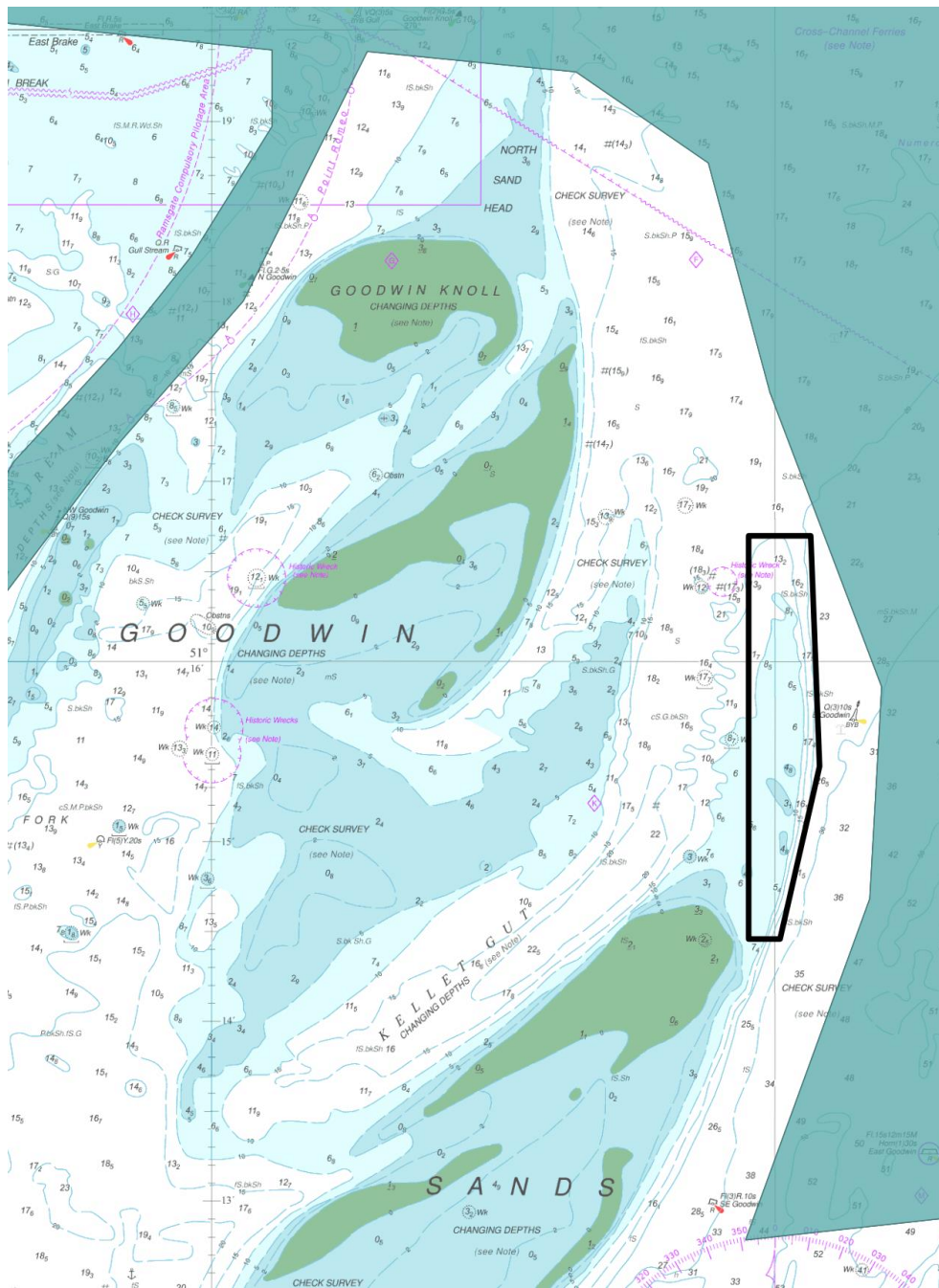
REPORTS: 1986 Latest survey included K8552 (H0423/86)
1999 Latest survey included M3054 (HA145/010/019/01)

ASSESSMENTS: none

REMARKS: 1980 Area C3 established. Part of old area C (H3913/80).
1999 Report changed area limits and identifier from C3 to GS3.
2009 Area Revised see report 2009 GSI 1-2-3-4 Goodwin Sands RRS.

LARGEST SCALE CHART: BA 1828 (1:37,500)

SHIPPING ROUTES

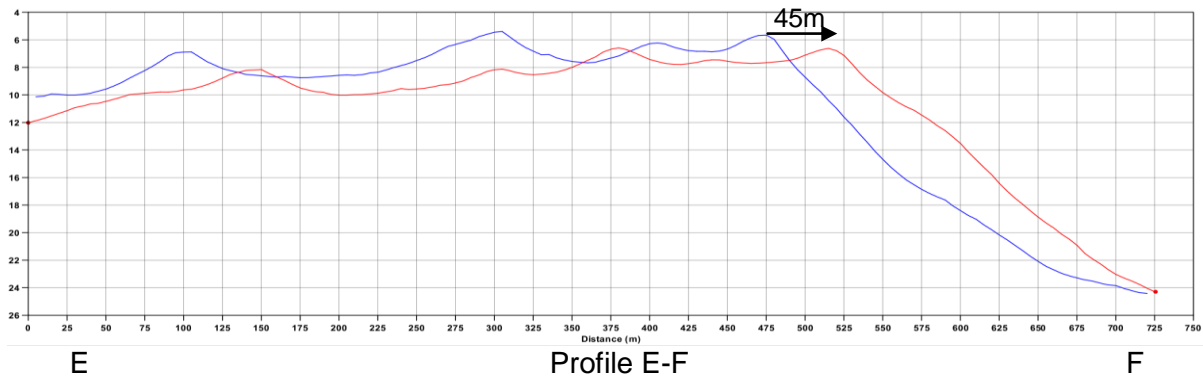
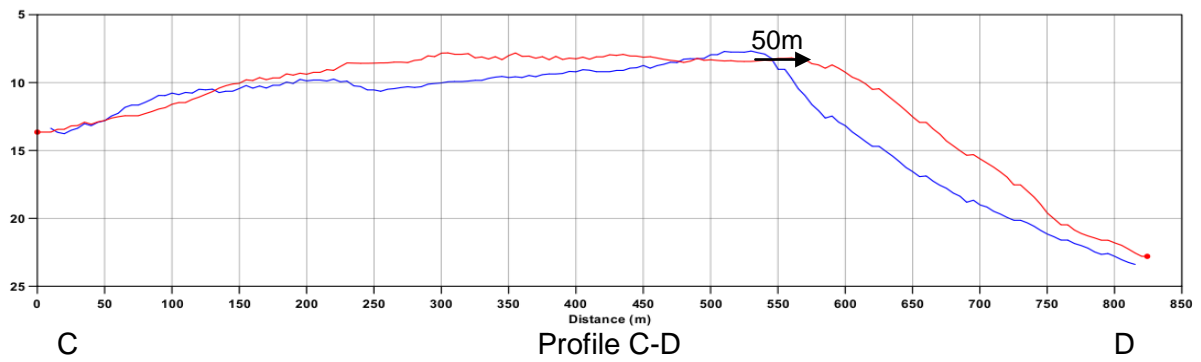
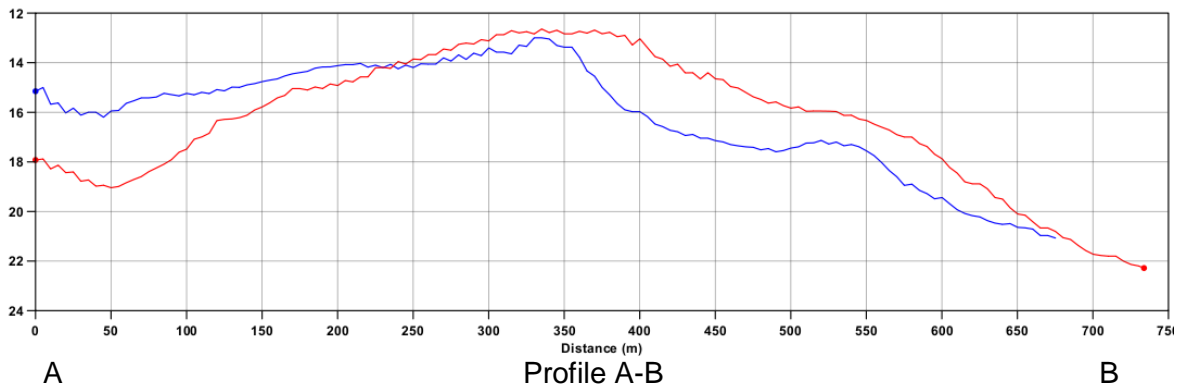


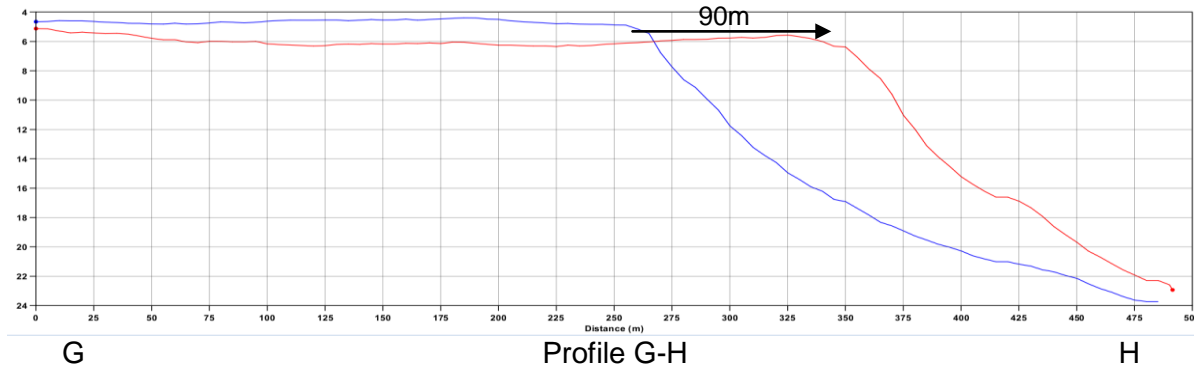
- Indicative shipping routes around area GS3
- Limits of GS3 survey area

Note: Data from satellite AIS data for FY2015/2016 of vessels larger then 2000GT

CROSS SECTION COMPARISONS

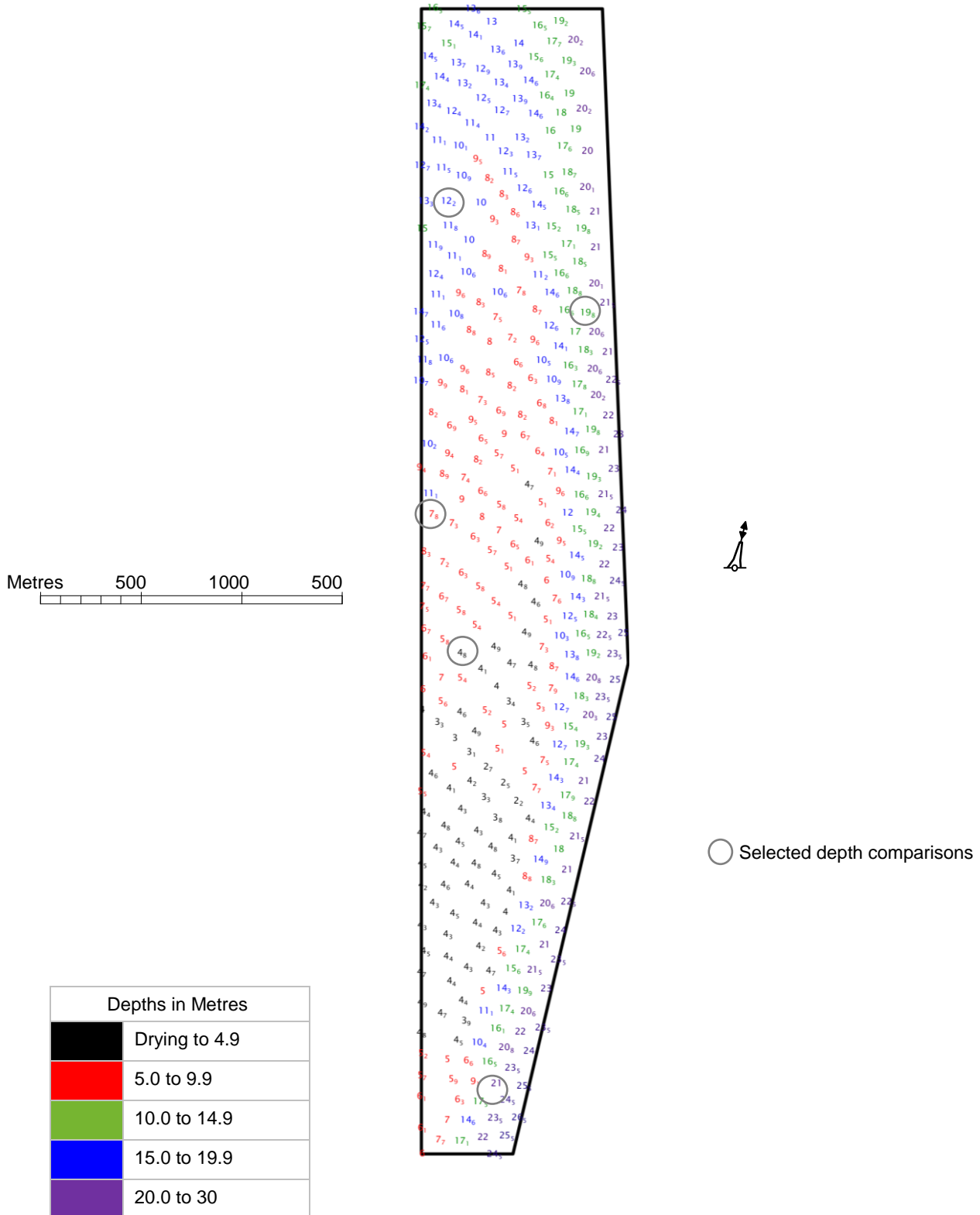
(See Annex C for Locations)





Year of Survey	
—	2015
—	2009

COLOUR BANDED DEPTH PLOT
 FROM THE 2009 SURVEY
 SHOWING SELECTED DEPTHS
 SCALE 1:20:000



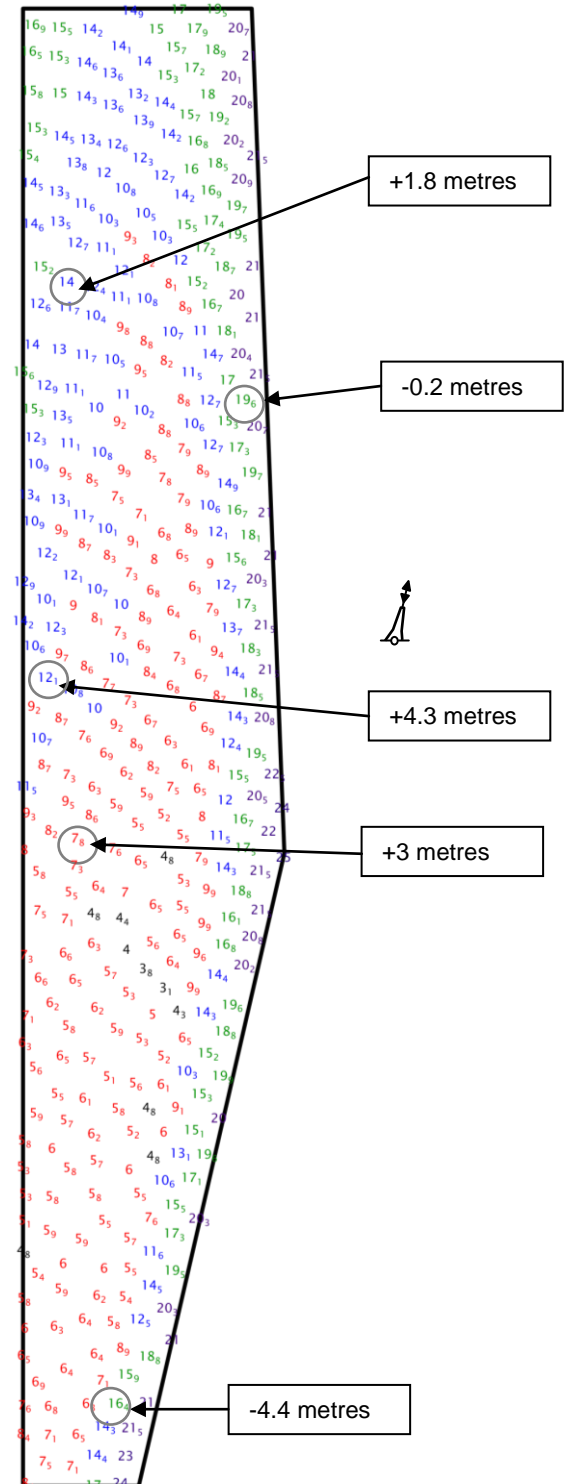
COLOUR BANDED DEPTH PLOT
 FROM THE 2015 SURVEY
 SHOWING SELECTED DEPTHS
 SCALE 1:20,000

Note: Depth changes indicated above are from the closest corresponding 2009 sounding available. Hence depth differences will be from different positions from the 2015 sounding selection as an automatic shoal bias sounding selection tool has been utilised which produces a representation of the shoal values in a data set.

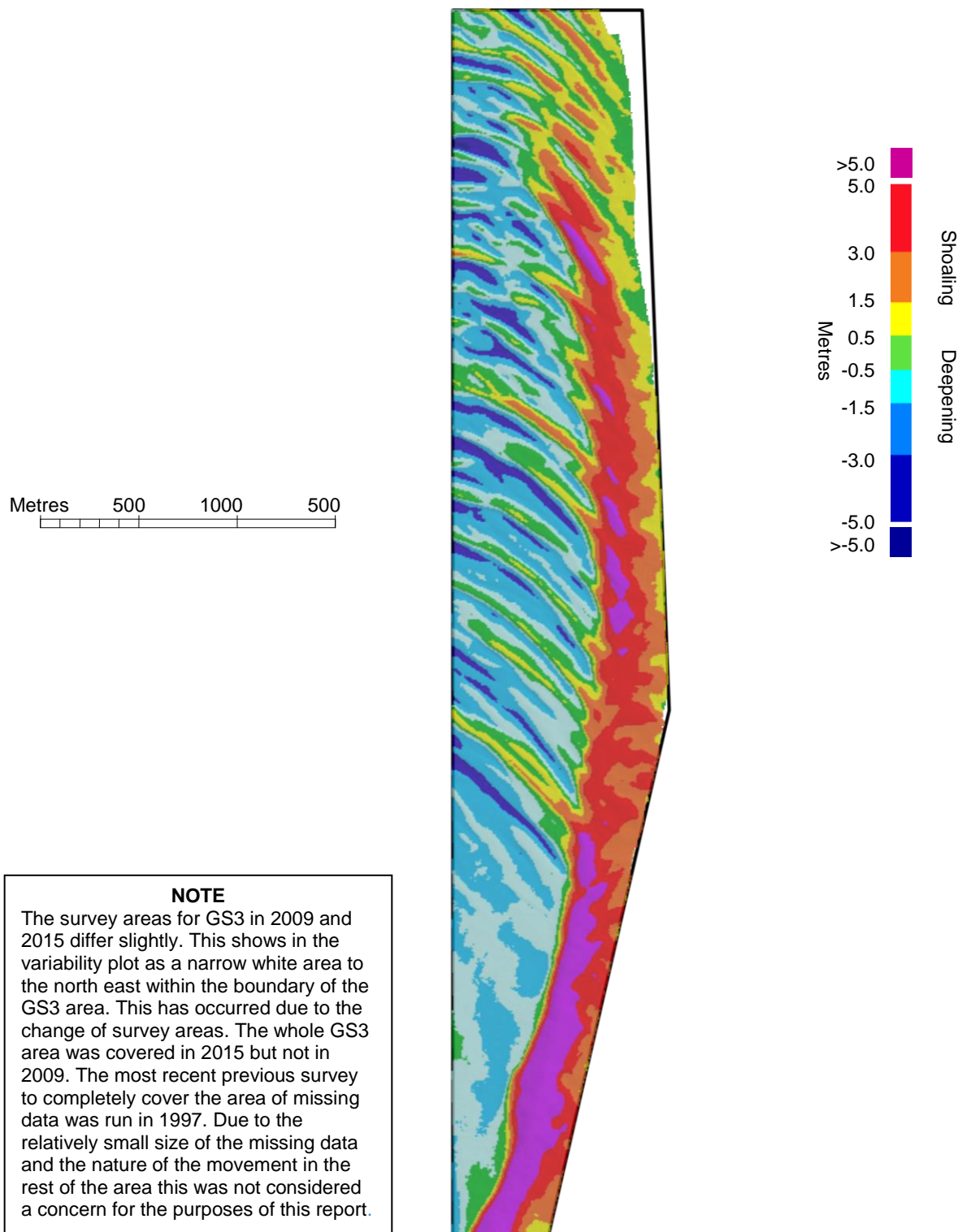
Depths in Metres	
	Drying to 4.9
	5.0 to 9.9
	10.0 to 14.9
	15.0 to 20
	20 to 30

Deepening + Positive value / Shoaling - negative value

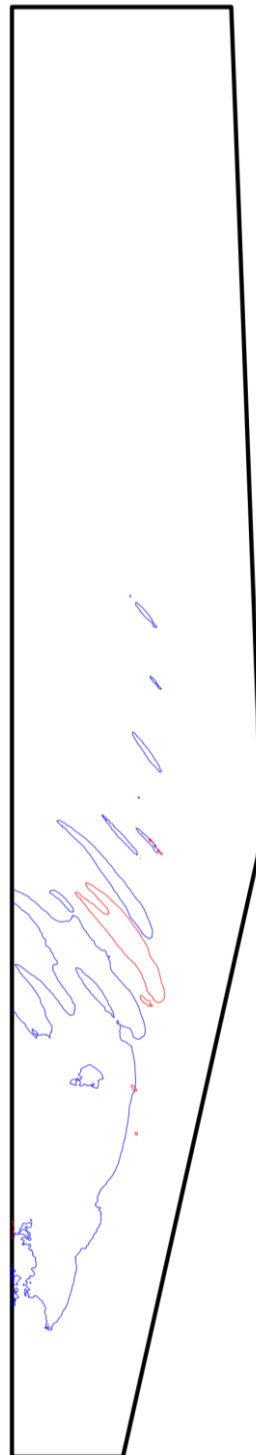
○ Selected depth comparisons





VARIABILITY PLOT SHOWING
 BATHYMETRIC CHANGES BETWEEN THE 2009 AND 2015 SURVEYS
 AND CHARTED CONTOURS FROM THE 2015 SURVEY
 SCALE 1:20,000

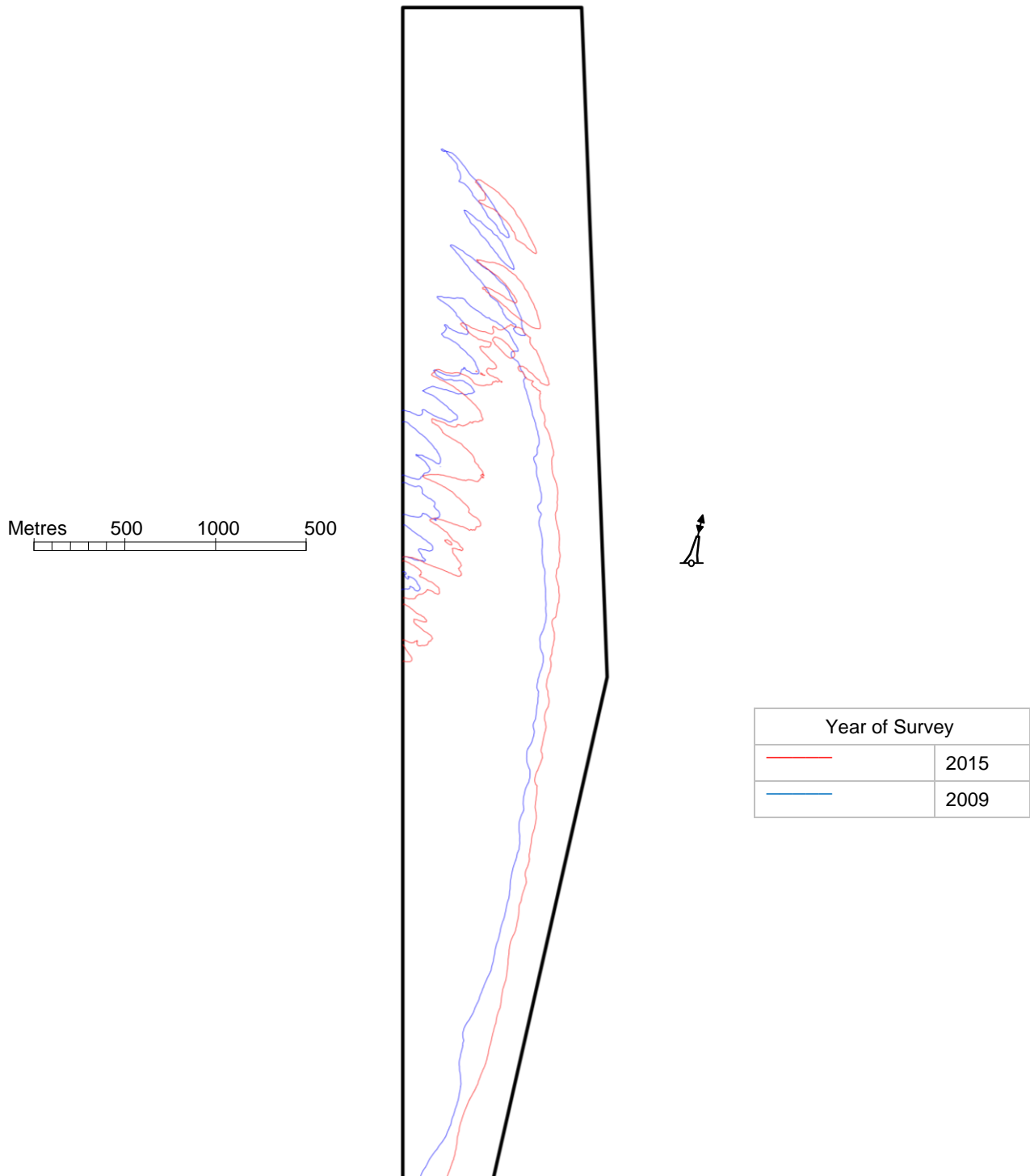


COMPOSITE DIAGRAM OF THE
5 METRE CONTOUR FROM THE 2009 AND 2015 SURVEYS
SCALE 1:20,000

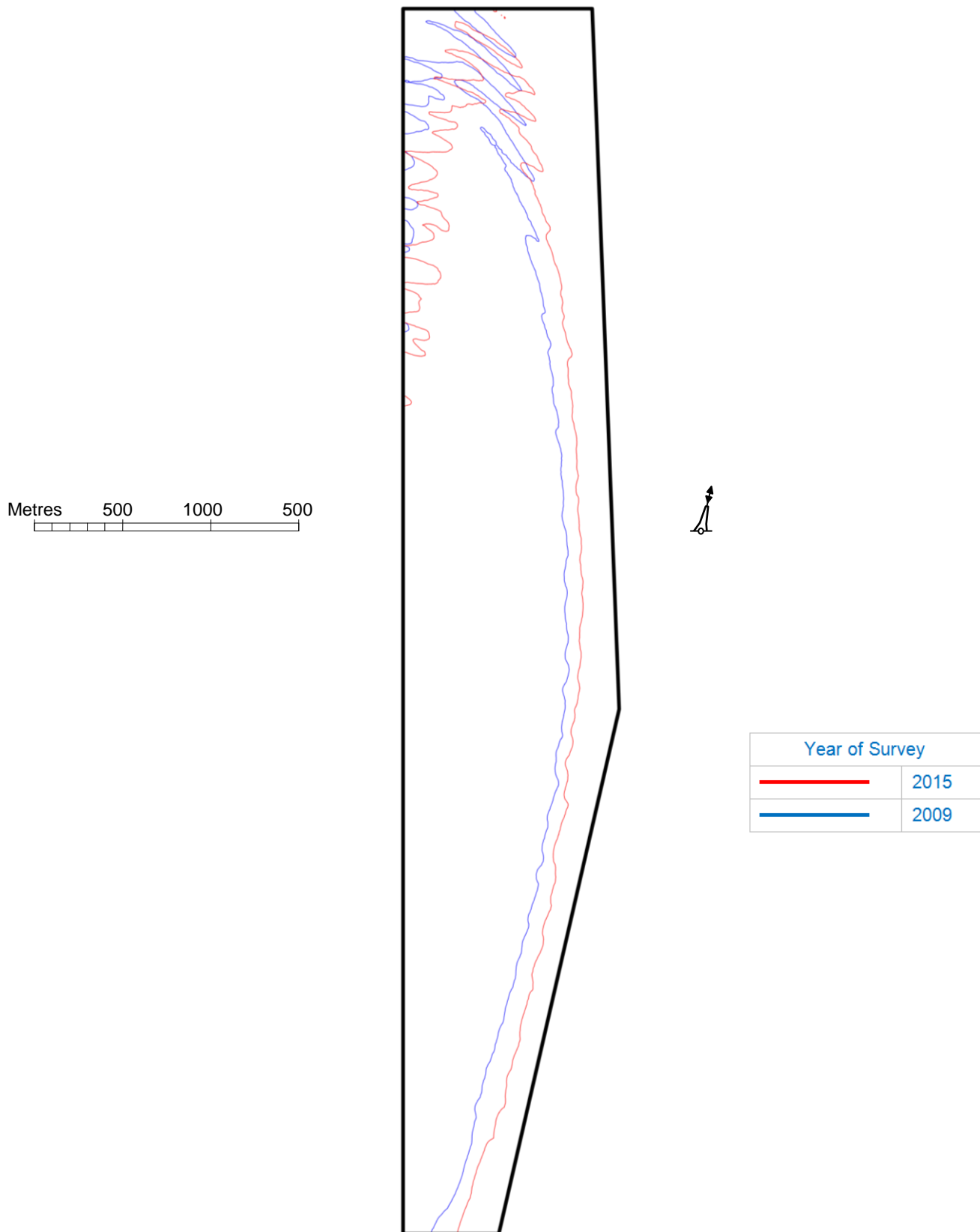


Year of Survey	
	2015
	2009

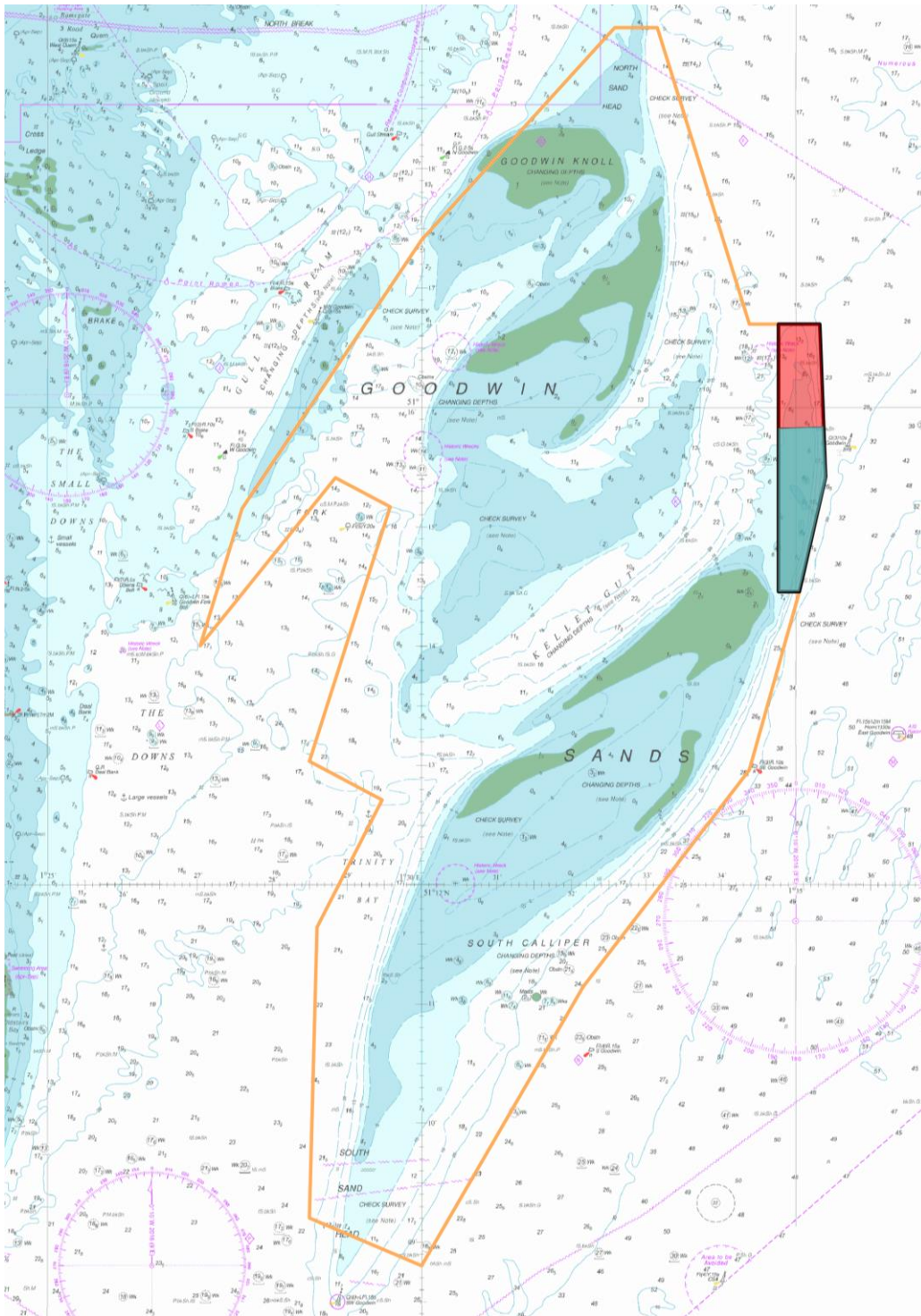
COMPOSITE DIAGRAM OF THE
10 METRE CONTOUR FROM THE 2009 AND 2015 SURVEYS
SCALE 1:20,000

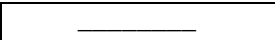





COMPOSITE DIAGRAM OF THE
15 METRE CONTOUR FROM THE 2009 AND 2015 SURVEYS
SCALE 1:20,000



PROPOSED REVISED LIMITS



	Existing GS3 area survey limits
	Existing GS4 12 year resurvey area limits
	Area for proposed incorporation into area GS4
	Remaining GS3 area for change to 6 yearly checkline survey

The coordinates for the area to be removed from GS3 and added to GS4 are shown below and describe a total area of 1.06km² (0.31 NM²)

	Latitude	Longitude
a	51° 16.69'N	001° 34.77'E
b	51° 16.69'N	001° 35.32'E
c	51° 15.83'N	001° 35.37'E
d	51° 15.83'N	001° 34.77'E

The coordinates for the area to be revised from full survey to a check line survey undertaken at the same survey frequency as current (6 year) are shown below and describe a total area of 1.50km² (0.44NM²).

	Latitude	Longitude
a	51° 15.83'N	001° 34.77'E
b	51° 15.83'N	001° 35.37'E
c	51° 15.41'N	001° 35.40'E
d	51° 14.45'N	001° 35.05'E
e	51° 14.45'N	001° 34.77'E