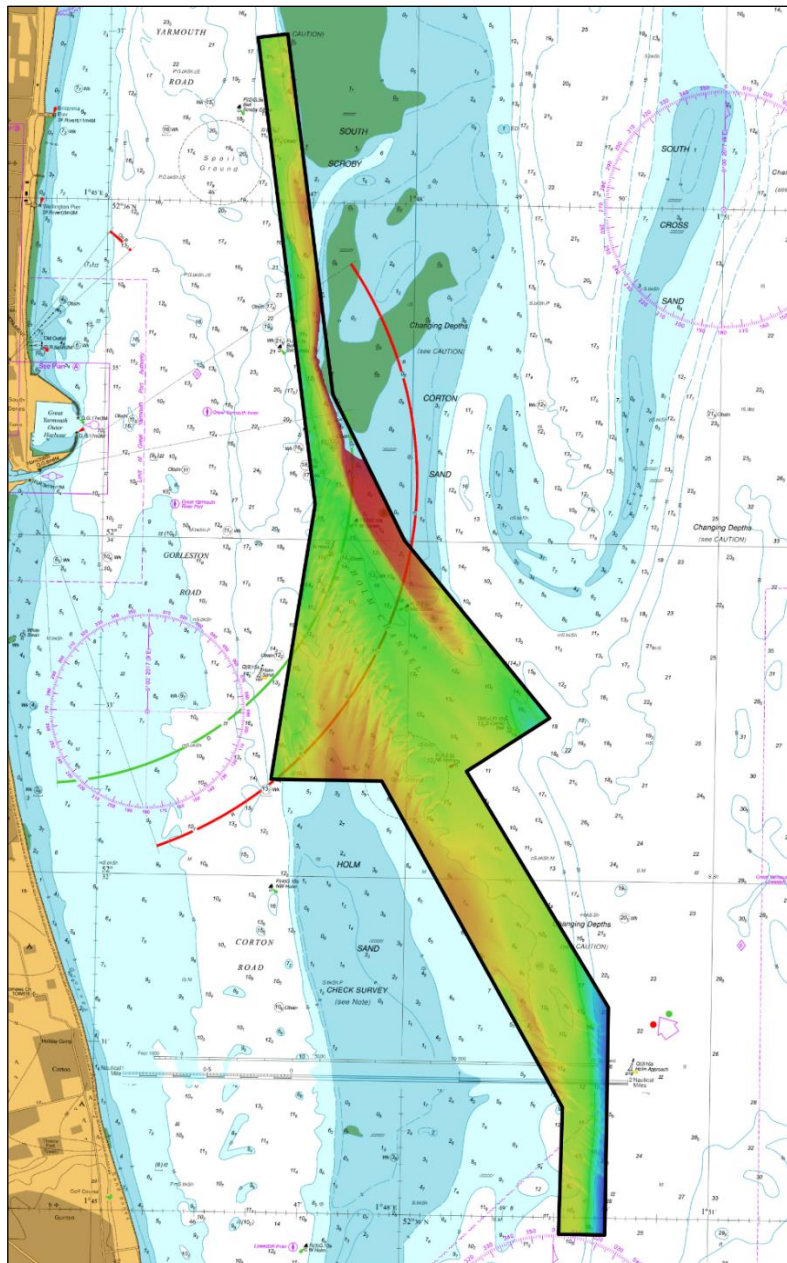




EAST ANGLIA HOLM CHANNEL (EA9) FOCUSED ASSESSMENT EA9/2016–V3

An assessment of the 2016 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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HOLM CHANNEL FOCUSED, EA9, 2016

1. EXECUTIVE SUMMARY

The Area and Recent Changes

- 1.1 This report covers the EA9 focused area and compares the 2016 survey against previous surveys. Focus area EA9 covers Holm Channel, which is the main approach to Great Yarmouth, and the banks that delimit it.
- 1.2 The southern end of Corton Sand continues to migrate westwards into Holm Channel. Depths have decreased in the south-east entrance to Holm channel, due to the continued migration of Holm Sand north-eastwards; and the southward migration of Corton Sand.
- 1.3 In the far north of focus area EA9, the west bank of South Scroby has continued to migrate eastwards, as observed in previous reporting periods.
- 1.4 The full area of EA9 is surveyed every three years, covering: The southern end of Corton Sand and South Cross Sand, to the east of Holm Channel; and the eastern extent of Holm Sand.

Reasons for Continuing to Resurvey the Area

- 1.5 The continued migration of Corton Sand into Holm Channel, with the resulting decrease in depths across the eastern entrance pose a risk to shipping in the area.

Recommendations

- 1.6 The annual focused survey should be maintained in EA9 to monitor the position of Corton Sand and Holm Sand in relation to Holm Channel. The focused area of EA9 should be re-designated EA9A to allow it to be distinguished from the full area survey limits EA9.
- 1.7 The south-east boundary of EA9 focused area should be extended eastwards to monitor depths around North east Holm and South Corton Bell which mark the entrance to Holm Channel.
- 1.8 The far north of EA9 focused area should be shifted eastwards to monitor the position of South Scroby's eastern bank and the full area survey limits of EA9 should also be shifted to accommodate this change.

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 all interested parties through the UKHO website and presented to the Civil Hydrography Working Group. When approved, the recommendations are incorporated into the Routine Resurvey Programme.
- 2.3 The Admiralty Chart extracts, other graphics and tables in this Report are included for illustrative purposes only and are NOT TO BE USED FOR NAVIGATION.
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3. AREA HISTORY

3.1 Summary of Surveys:

Year	Survey	Reference	Data	Year	Survey	Reference	Data
1995	M2469	HH090/662/01	s.t.d.	2006	M4527	HH091/163/01	m.
1996	M2612	HH090/687/01	s.d.	2007	M4633	HH091/220/01	m.
1997	M2801	HH090/733/01	s.d.	2008	M4788	HH091/260/01	m.
1998	M2996	HH090/766/01	s.d.	2009	HI1292	2009-29527	m. *
1999	M3207	HH090/848/01	s.t.d.	2010	HI1338	2010-213940	m. *
2000	M3339	HH090/883/01	s.d.	2011	HI1367	2011-106141	m.
2001	M3536	HH090/942/01	s.d.	2012	HI1397	2012-117402	m.*
2002	M3769	HH090/989/01	s.t.d.	2013	HI1432	2013-261940	m.*
2003	M3901	HH091/019/01	s.d.	2014	HI1458	2014-142852	m
2004	M4156	HH091/075/01	m	2015	HI1482	2015-83468	m.*
2005	M4267	HH091/111/01	m	2016	HI1521	2016-181422	m.*

Key: s = sonar sweep, t = seabed texture tracing, d = digital data, m = multibeam digital data, * = focused survey
Single-beam surveys (prior to 2004) conducted at 1:25,000 scale

3.2 Summary of historical recommendation enacted

Year	Remarks
1980	Area EA9 previously covered by routine resurvey areas D, E1 and E2. These were re-organized, creating the annual resurvey area B1.
1997	Area given the identifier EA9, but with unchanged limits and survey interval
2000	Area extended northwards to include a developing channel connecting Barley Picle to Holm Channel, previously surveyed every 12 years as part of EA7.
2002	Reduce extents to focus on Holm Channel.
2003	reduce eastern and western extents around Holm Channel
2004	Reduce eastern and western extents around Holm Channel
2010	Reduce eastern and western extends of the resurvey area.
2013	Adjust western limit to remove deeper areas from resurvey. Minor adjustment to eastern edge of area following the advancement of Corton sand. Applied in 2016 survey
2014	Revise limits along eastern edge of EA9 focussed area. Applied in 2016 survey

4. DESCRIPTION OF THE AREA

- 4.1 Focused area EA9 covers Holm Channel, which is the main approach to Great Yarmouth, and the banks that delimit it. The area extends south to cover the north and eastern banks of Holm Sand, and extends north to cover the southern and western banks of Corton Sand and South Scroby.
- 4.2 The focused area is sited within the limits of the full area EA9 which is surveyed every three years, covering: The southern end of Corton Sand and South Cross Sand, to the east of Holm Channel; and the eastern extent of Holm Sand.
- 4.3 Area covered during the focused survey: 3.55 NM² (12.2 km²) as shown in Figure 1 below.

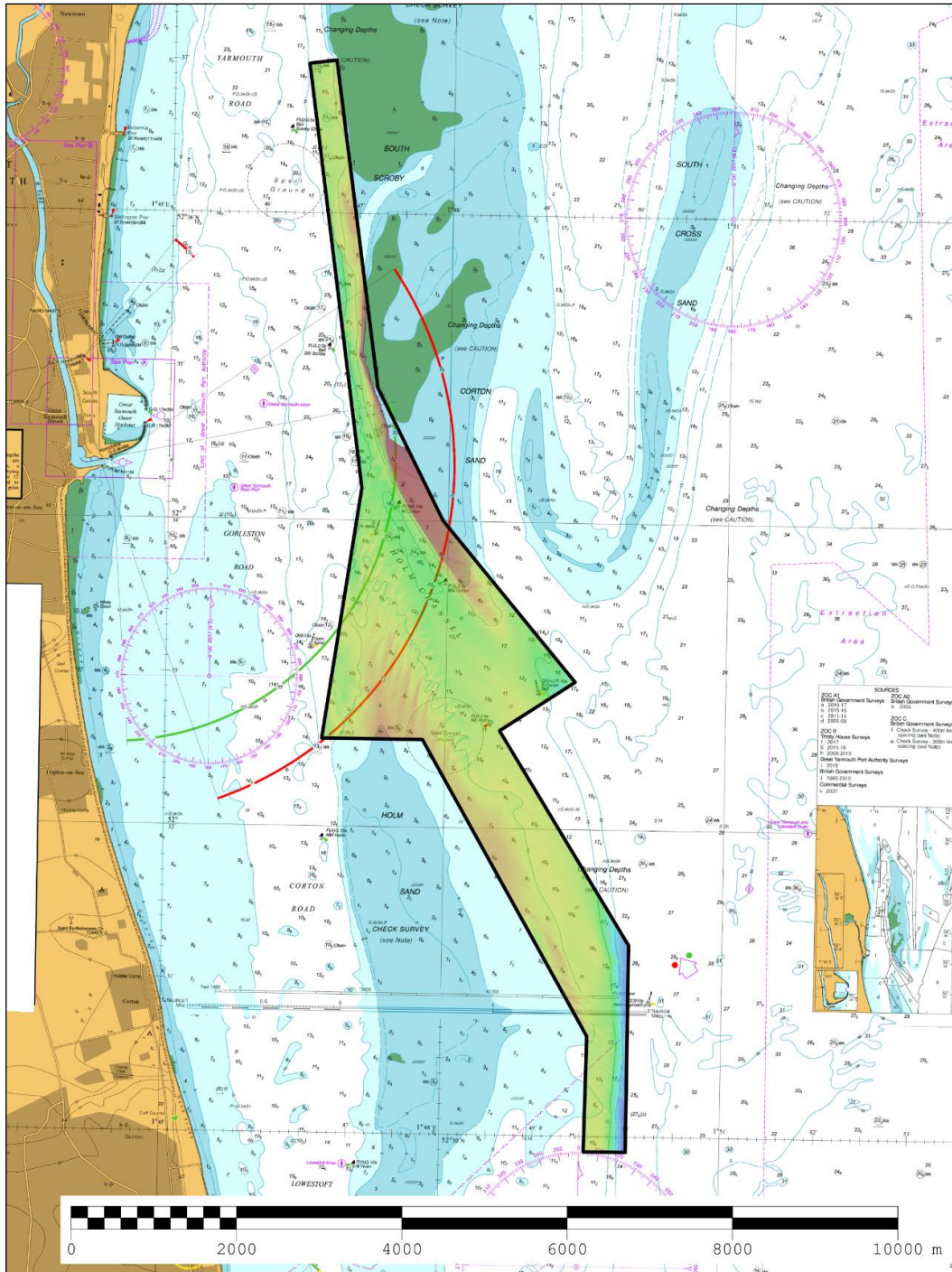


Figure 1 – 2016 survey data sun-illuminated view overlaid on BA Charts 1534 and 1535

4.4 The geographic limits at the time of resurvey are shown in the Table 1 below and coordinates are in Decimal Degrees referenced to WGS84:

Point	Latitude	Longitude
A	52.61629	1.77388
B	52.61667	1.77870
C	52.58108	1.78700
D	52.56675	1.79903
E	52.54940	1.82305
F	52.54400	1.80970
G	52.52086	1.83333
H	52.49833	1.83333
I	52.49833	1.82583
J	52.51090	1.82614
K	52.54290	1.79597
L	52.54290	1.77800
M	52.57018	1.78442

Table1 – Geographic limits of EA9 focused area

4.5 Survey interval at time of resurvey: EA9 focused area - 1 yr . EA9 full area - 3 yrs

4.6 Largest scale chart: BA1534, Great Yarmouth and Approaches (1:25,000) and BA1535, Lowestoft and Approaches (1:25,000)

5. SHIPPING IN THE AREA

5.1 Shipping data from satellite AIS data for 2016 of vessels larger than 2000GT shows the maximum registered draught of vessel to transit through Holm Channel the area was 10.8m.

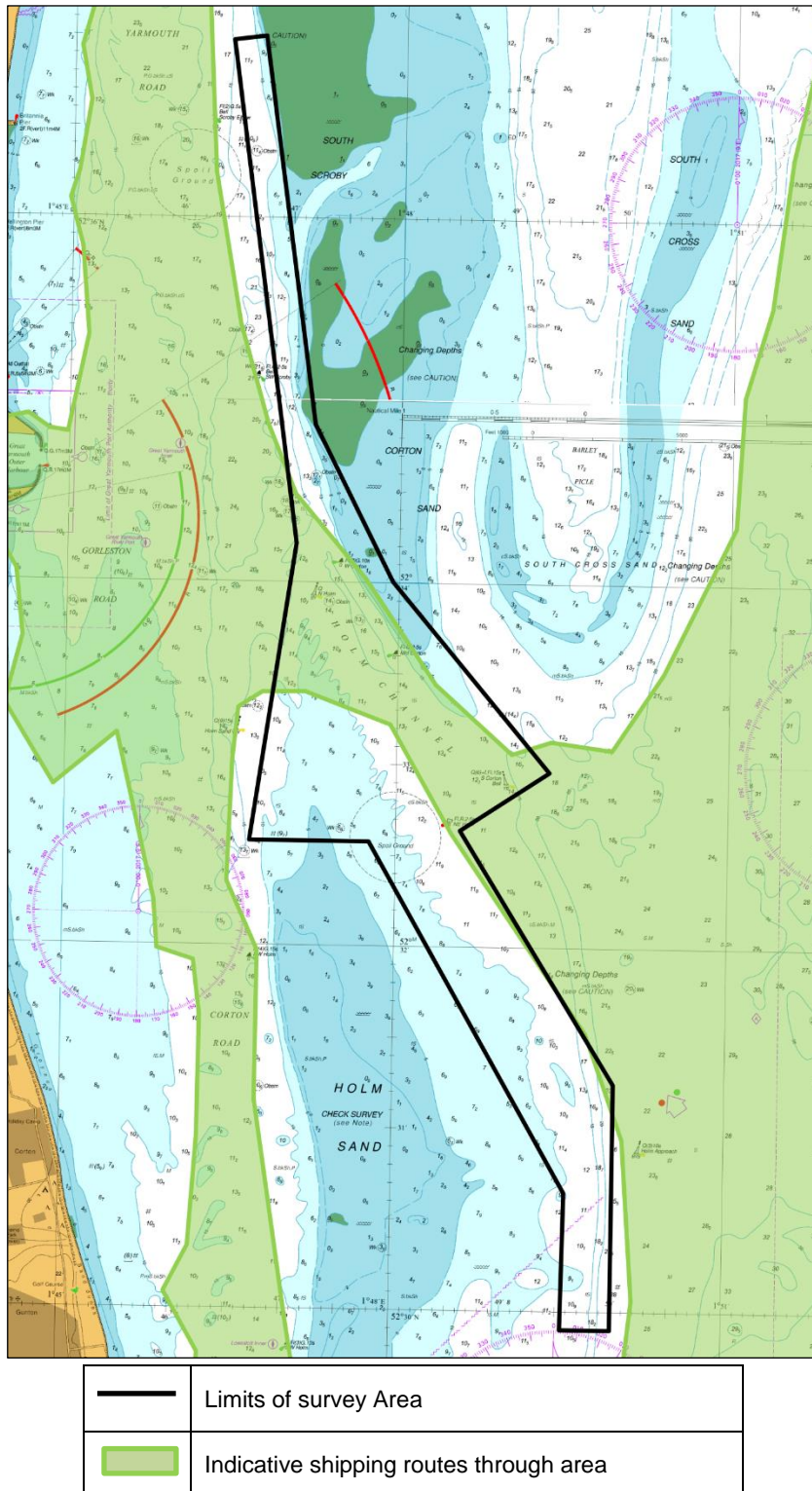


Figure 2 – Indicative shipping routes overlaid on BA Charts 1534 and 1535

6. REFERENCE SURVEY DETAIL

- 6.1 The last historical Routine Resurvey Programme survey to be undertaken was in 2015 under HI1482 and has been used as the reference to compile this assessment. The 2015 survey was partly conducted from the 4th October to the 10th October on board *FPV Morven*. Unfavourable weather caused a long period of down time until survey operations were continued from the 26th November to the 1st December on another survey vessel, *Wessex Explorer*. Sea states during the survey were reported as slight to moderate (3-4).
- 6.2 The survey data was acquired using multibeam echosounder system. The primary reference position system used GNSS and was supplemented by a dynamic GNSS Precise Point measuring system. The survey is referred to the International Terrestrial Reference Frame 2005 (ITRF 2005) datum.
- 6.3 Observations from GNSS 3D positioning were combined with the UKHO Vertical Offshore Reference Frame (VORF) to reduce depths to Chart Datum. The final deliverable was a 1m resolution CUBE (Combined Uncertainty and Bathymetry Estimator) surface.
- 6.4 The survey was validated by UKHO and met IHO S44 (5th Edition) Order 1a standards.
- 6.5 The Report of Survey for this surveys is available upon request from the UKHO and the validated bathymetric surfaces are available to download from INSPIRE portal and MEDIN Bathymetry Data Archive Centre.

7. COMPARISON SURVEY DETAIL

- 7.1 The latest survey undertaken as part of the CHP Routine Resurvey was in 2016 under HI1521. Survey operations on EA9 focused area were carried out on the 17th October 2016 under smooth to slight (2-3) sea state. Weather downtime was recorded from the 12th October to the 16th October.
- 7.2 The survey data was acquired using multibeam echosounder system. The primary reference position system used GNSS and was supplemented by a dynamic GNSS Precise Point measuring system. The survey is referred to the European Terrestrial Reference System 1989 (ETRS89) datum.
- 7.3 Observations from GNSS 3D positioning were combined with the UKHO Vertical Offshore Reference Frame (VORF) to reduce depths to Chart Datum. The final deliverable was a 1m resolution CUBE (Combined Uncertainty and Bathymetry Estimator) surface.
- 7.4 The survey was validated by UKHO and met IHO S44 (5th Edition) Order 1a standards.
- 7.5 The Report of Survey for this surveys is available upon request from the UKHO and the validated bathymetric surfaces are available to download from INSPIRE portal and MEDIN Bathymetry Data Archive Centre.

8. DESCRIPTION OF RECENT BATHYMETRIC CHANGE

8.1 Figure 3 shows a Variability Plot highlighted depth differences between 2015 and 2016, with arrows indicating the general direction of sediment movement and dashed lines showing the location of profile plots. The general trend shows a north to north-westward movement of sediment along the south-west bank of Corton Sand, compared with a south to south-easterly movement of sediment along the north-east bank of Holm Sand; as shown by arrows in Figure 3.

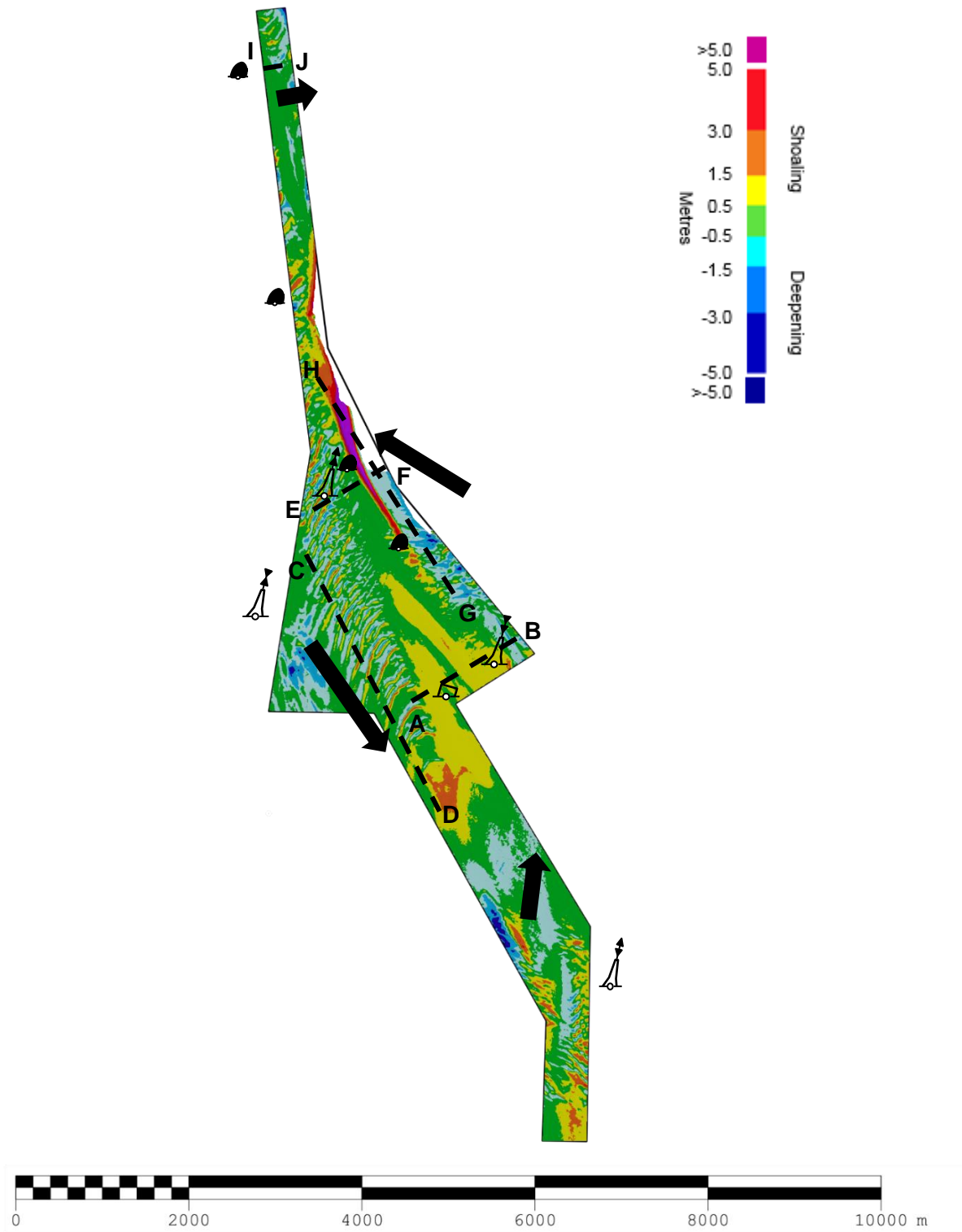
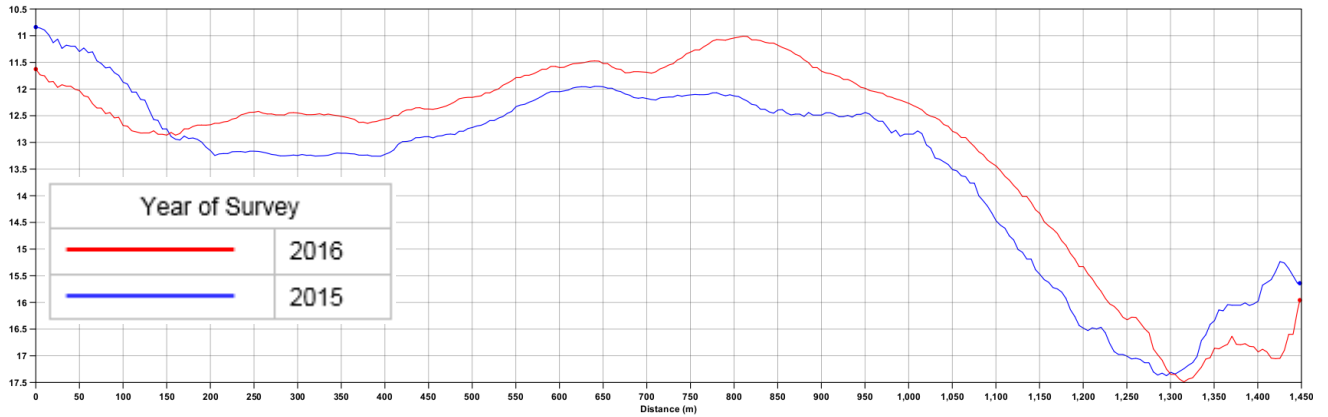


Figure 3 – Variability Plot showing Bathymetric Changes between the 2015 and 2016 Surveys

8.2 The eastern bank of Holm Sand has migrated east and north by up to 60m as part of larger anticlockwise rotation of both Corton and Holm Sand. This rotation is centred between Mid Corton and NE Holm Channel Buoys. In addition, there is a transfer of material along the eastern bank of Holm Sand north west in to Holm Channel as described in paragraph 8.6. Both are causing depths around the east entrance to Holm Channel between north East Holm Buoy and South Corton Bell to decrease by up to 1.8m, as shown in the above Variability Plot in Figure 3 and Profile Comparison A-B in Figure 4 below.



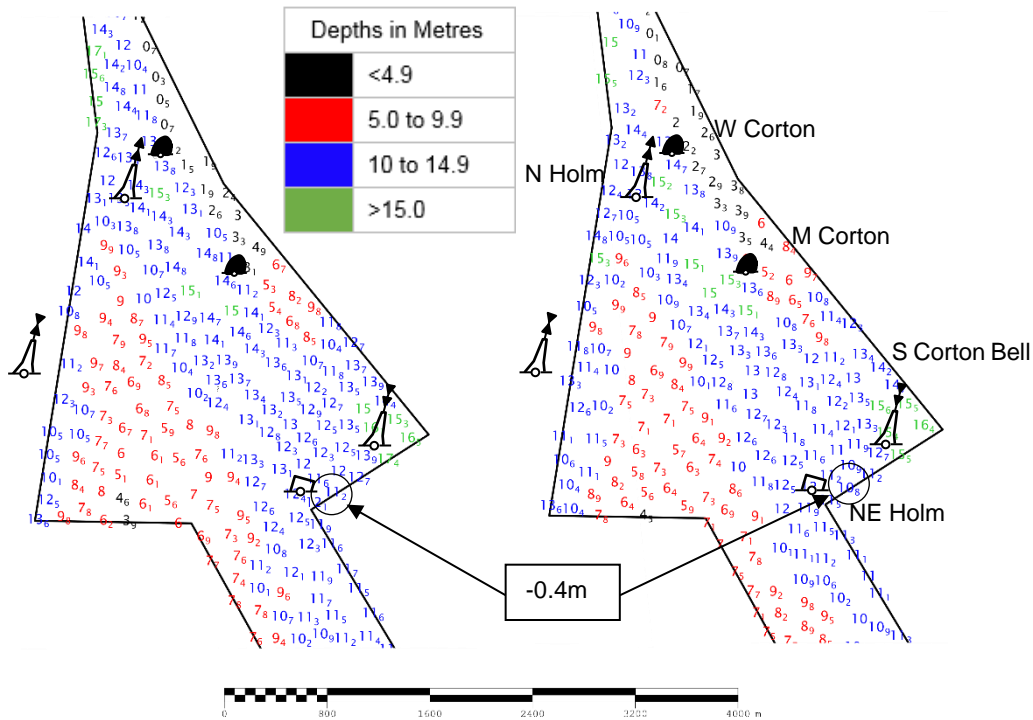
A

Figure 4 – Profile Comparison A-B

B

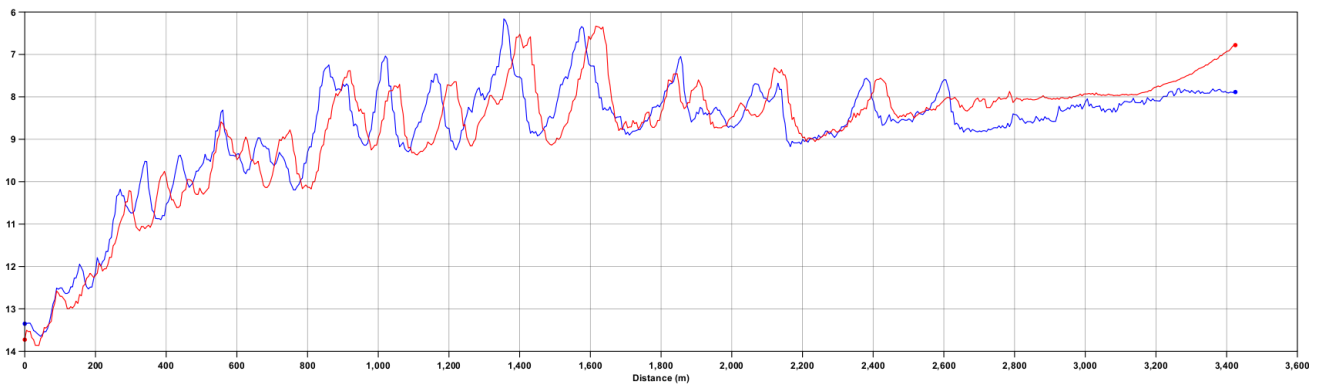
8.3 The Depth Plot focused on Holm Channel in Figure 5 below, highlights the controlling depth in the area just east of North East Holm Buoy, decreasing from 11.2m in 2015 to 10.8m in 2016.

Figure 5 – Depth Plot showing Sounding selection within Holm Channel, from 2015 (left) and 2016 (right) Surveys



Depth changes indicated above are from the closest corresponding 2015 sounding available. Hence depth differences will be from different positions from the 2016 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. Positive values (+) represent deepening. Negative values (-) represent seabed depths becoming shallower.

8.4 Sandwaves along the north-east bank of Holm sand continue to migrate in a south to south-easterly direction by approximately 50-100m.

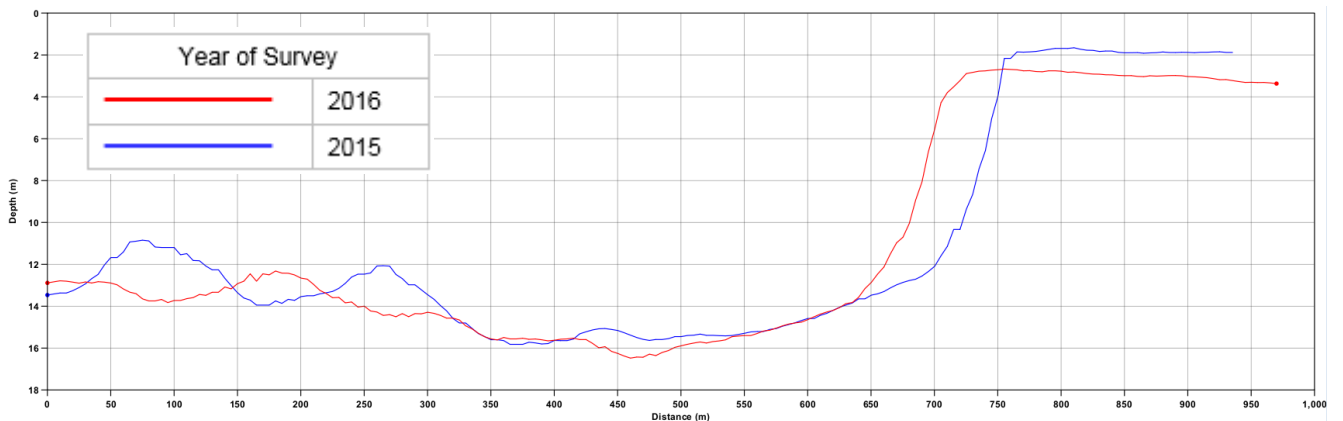


C

Figure 6 – Profile Comparison C-D

D

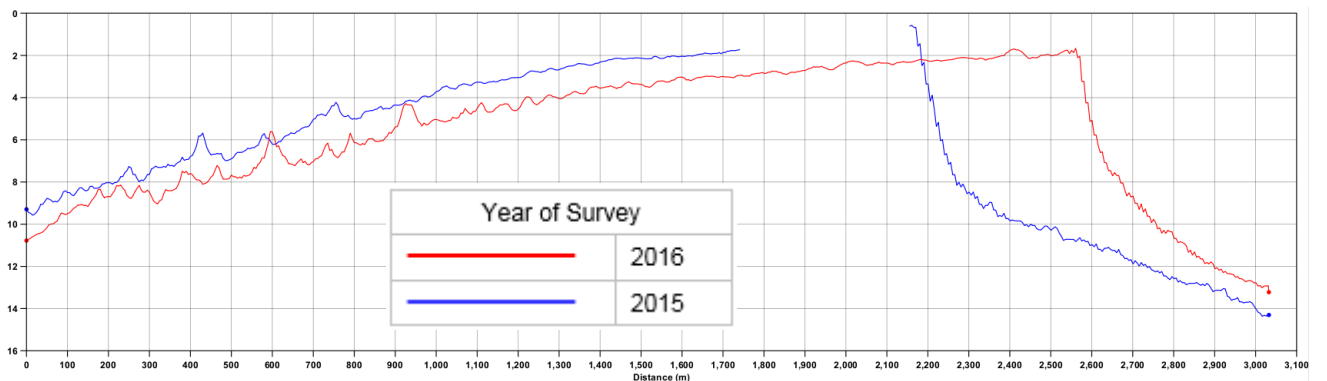
8.5 The Profile Comparison E-F in Figure 7 shows the south western bank of Corton Sand continues to expand approximately 30m into Holm Channel, with Profile G-H in Figure 8 additionally showing a northward expansion of the bank. AIS data indicates marine traffic through this area is concentrated between West Corton Buoy and North Holm Cardinal Buoy, with only isolated vessels moving south of north Holm Buoy.



E

Figure 7 – Profile Comparison E-F

F



G

Figure 8 – Profile Comparison G-H

H

8.6 The Changes to the 10m contour shown in Figure 9 shows a significant shift of up to 1050m along the eastern bank of Holm Sand due to a transfer of material north west in to Holm Channel. In the north of EA9, little change can be seen in the 10m contour.

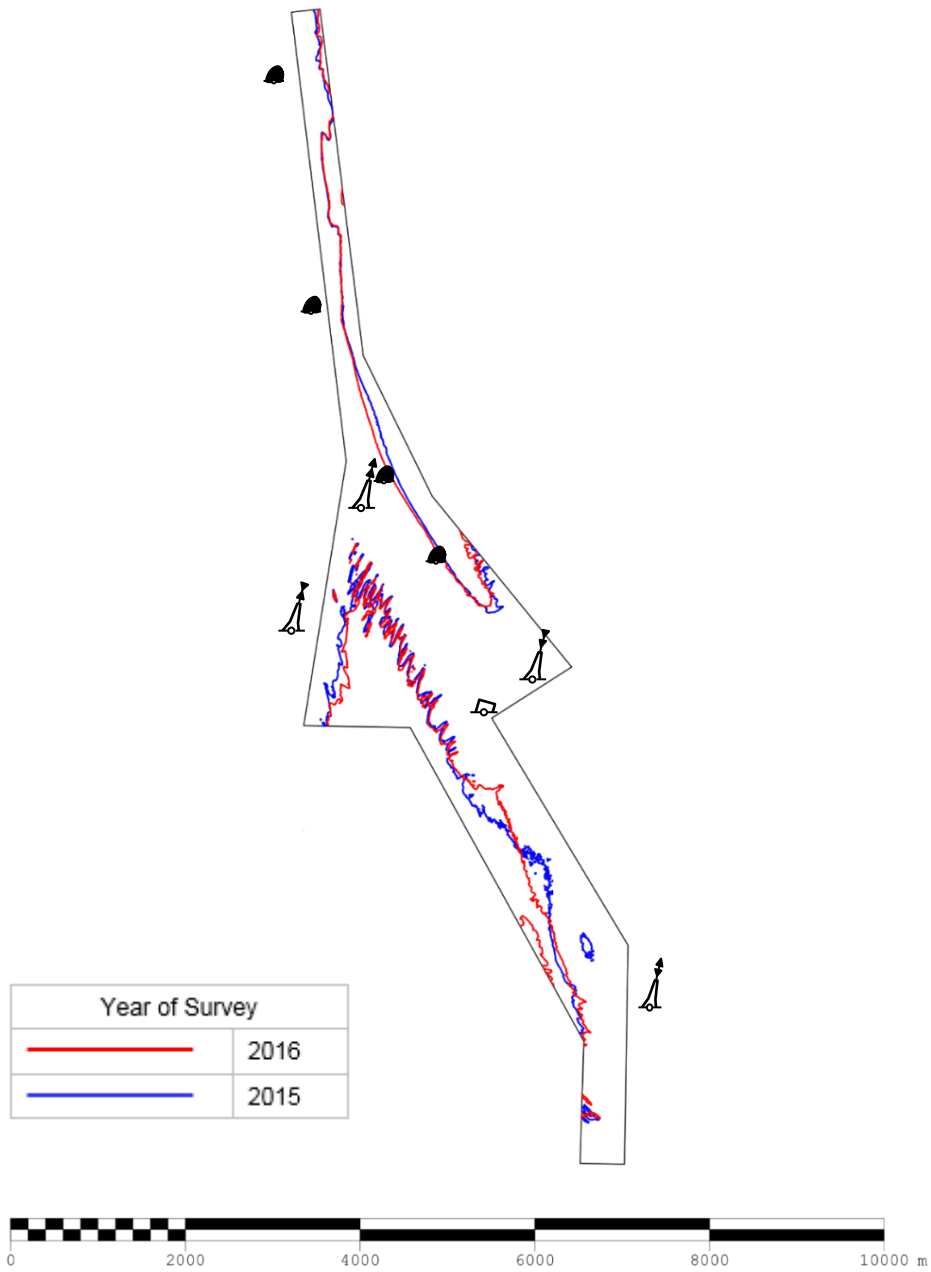


Figure 9 – Changes to 10m contour from the 2015 and 2016 Surveys

8.7 The western bank of South Scroby in the northern part of EA9 has continued to migrate eastwards. This continues the trend observed in the 2015 routine resurvey where the 10-metre contour migrated by 60m. The Profile Comparison I-J in Figure 10 includes the 2011 bathymetry to highlight the long-term migration.

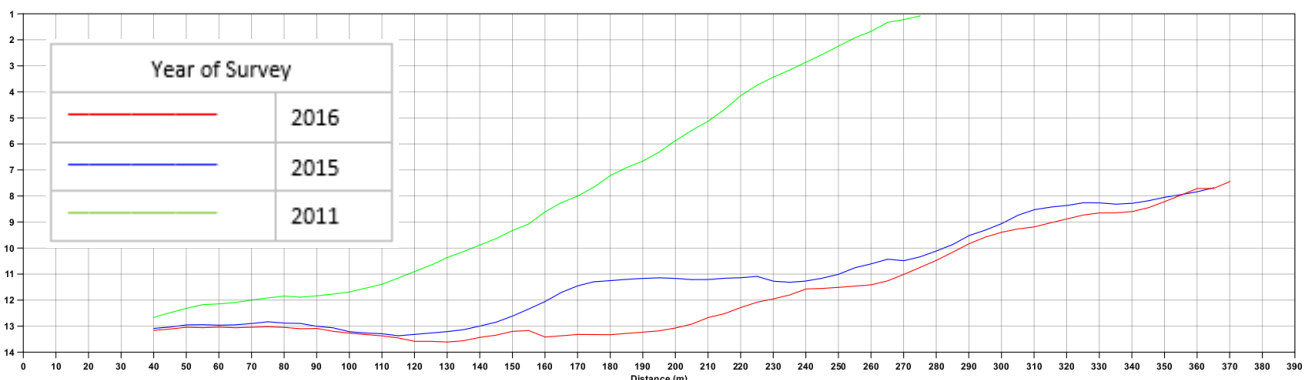


Figure 10 – Profile Comparison I-J

9. IMPLICATIONS FOR SHIPPING

- 9.1 Corton Sand continues to migrate westwards into Holm Channel, where shipping is focussed between West Corton and North Holm Buoys.
- 9.2 Shoaling has occurred to the south and west of South Corton Bell at the entrance to Holm Channel. Shipping traffic is currently directed between South Corton Bell and North-East Holm Buoys where the controlling depth is 10.8m along the east limit of the focus area. This poses a risk to the largest vessels recorded in the area (up to 10.8m registered draught) during 2016.

10. RECOMMENDATIONS FOR FUTURE SURVEYS

- 10.1 The focused area of EA9 should be re-designated EA9A to allow it to be distinguished from the full area survey limits EA9.
- 10.2 The south west bank of Corton Sand continues to migrate westwards into Holm Channel, supporting the continued annual resurvey of the focused area to ensure accurate depths around west Corton buoy. The annual resurvey interval should be maintained for the focused area.
- 10.3 Shoaling between North Holm and South Corton Bell due to the north and eastward migration of Holm Sand poses a risk to vessels entering Holm Channel. The eastern boundary of EA9 focussed area should be extended to monitor depths in this area and provide a comparison data set in 2018 following the full EA9 survey planned for 2017.
- 10.4 The eastern boundary in the north of EA9A should be shifted east up to the 2m contour to monitor the migration of South Scroby.
- 10.5 Move western limits of EA9A seaward towards Holm Channel to represent the gradual migration of the sandbanks in the area and remove areas shown to be deepening
- 10.6 Remove the area in the vicinity of Scroby Elbow in the north extent of the EA9A focused area
- 10.7 The proposed limits to the EA9 focused area is displayed in Figure 11 and coordinates given in Table 2 below with the changes decreasing the focused survey area by 0.19 NM² (0.64 km²) to give a total for the EA9 focused area 3.38 NM² (11.59 km²).

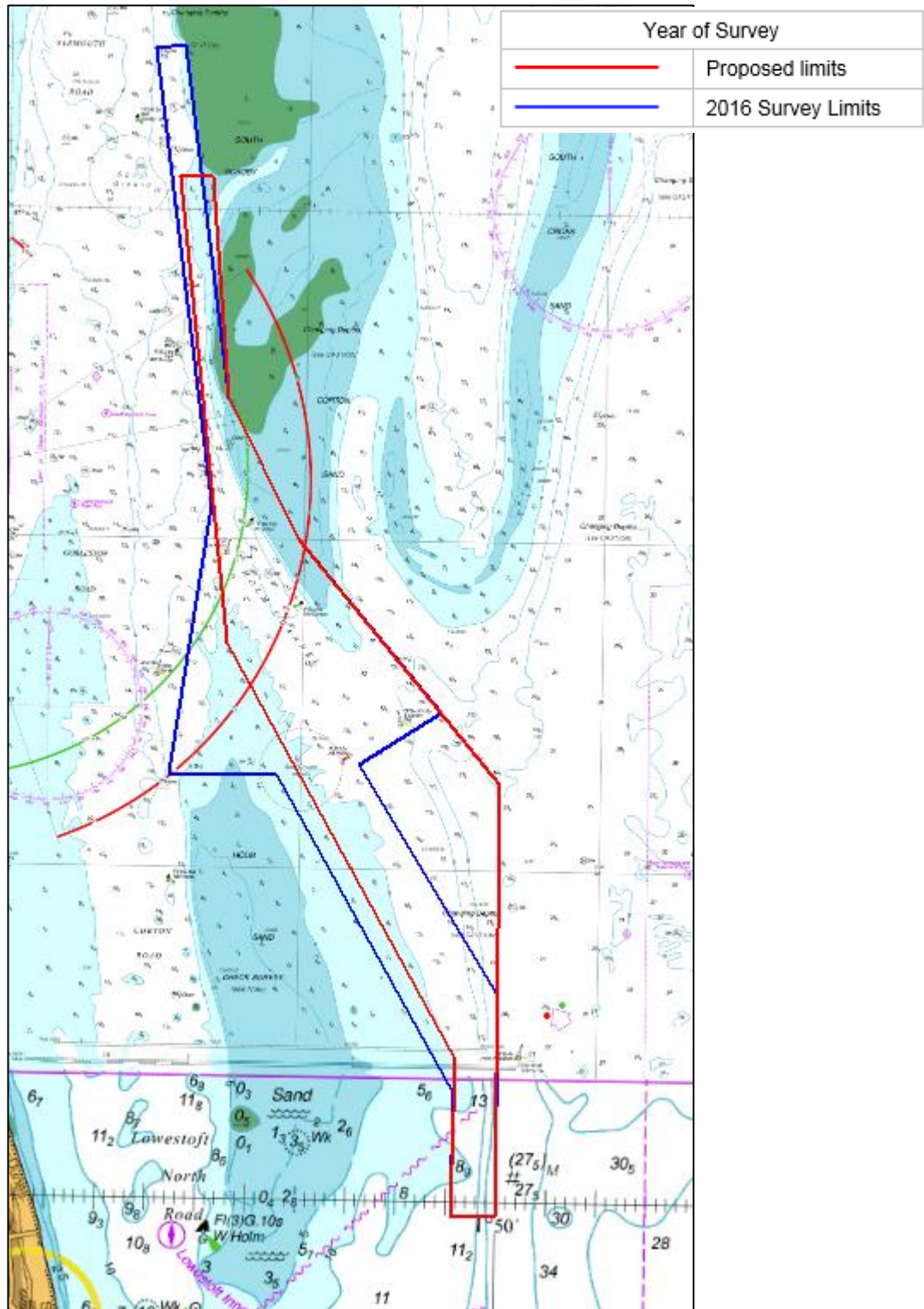


Figure 11 – Proposed change to the extent of EA9A - focus area

Point	Latitude (N)	Longitude (E)
A.	52-34.8648	001-47.2200
B.	52-34.0048	001-47.9417
C.	52-32.5320	001-49.9741
D.	52-29.8998	001-49.9998
E.	52-29.8998	001-49.5498
F.	52-30.8567	001-49.5748
G.	52-33.3701	001-47.2321
H.	52-36.1980	001-46.7004
I.	52-36.2061	001-47.0245

Table 2 – Proposed geographic limits of EA9 focused area

10.8 The proposed limits to the EA9 full survey area because of the changes to the EA9A focused area is shown in Figure 12 and in Table 3 below. The proposed changes increase the full survey area by 0.12 NM² (0.44 km²) to give a total for the EA9 full survey area 9.86 NM² (33.84 km²).

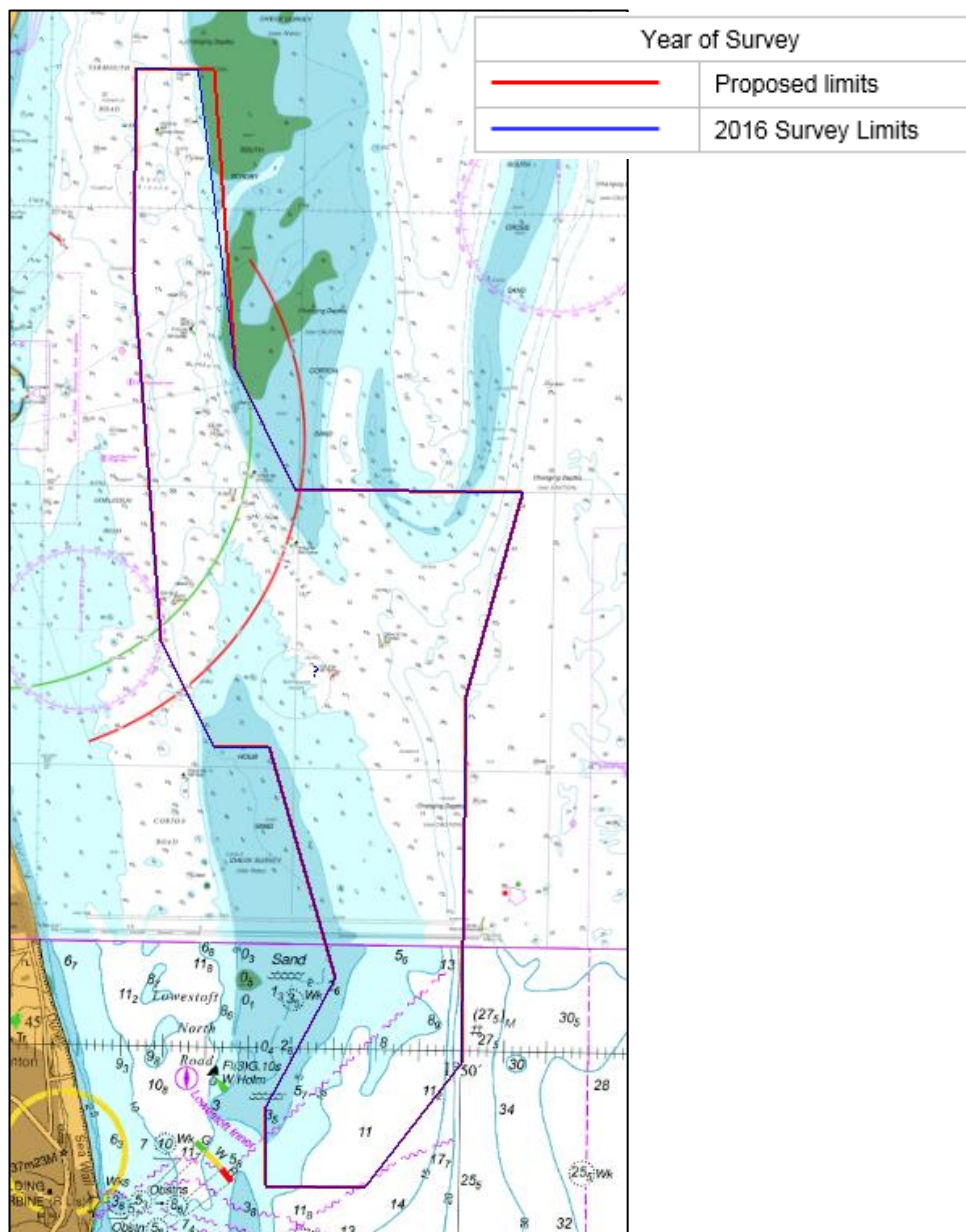


Figure 12 – Proposed change to the extent of EA9 - full area

Point	Latitude (N)	Longitude (E)
A.	52-37.0030	001-46.9078
B.	52-34.8648	001-47.2200
C.	52-34.0050	001-47.9415
D.	52-34.0050	001-50.6237
E.	52-32.5398	001-49.9998
F.	52-29.8998	001-49.9998
G.	52-28.9998	001-48.8898
H.	52-28.9998	001-47.7300
I.	52-29.5646	001-47.7300
J.	52-30.5002	001-48.5016
K.	52-32.1441	001-47.6932
L.	52-32.1432	001-47.0406
M.	52-32.8998	001-46.3998
N.	52-35.5302	001-46.0002
O.	52-37.0002	001-46.0002

Table 3 – Proposed geographic limits of EA9 area