United Kingdom
Hydrographic Office

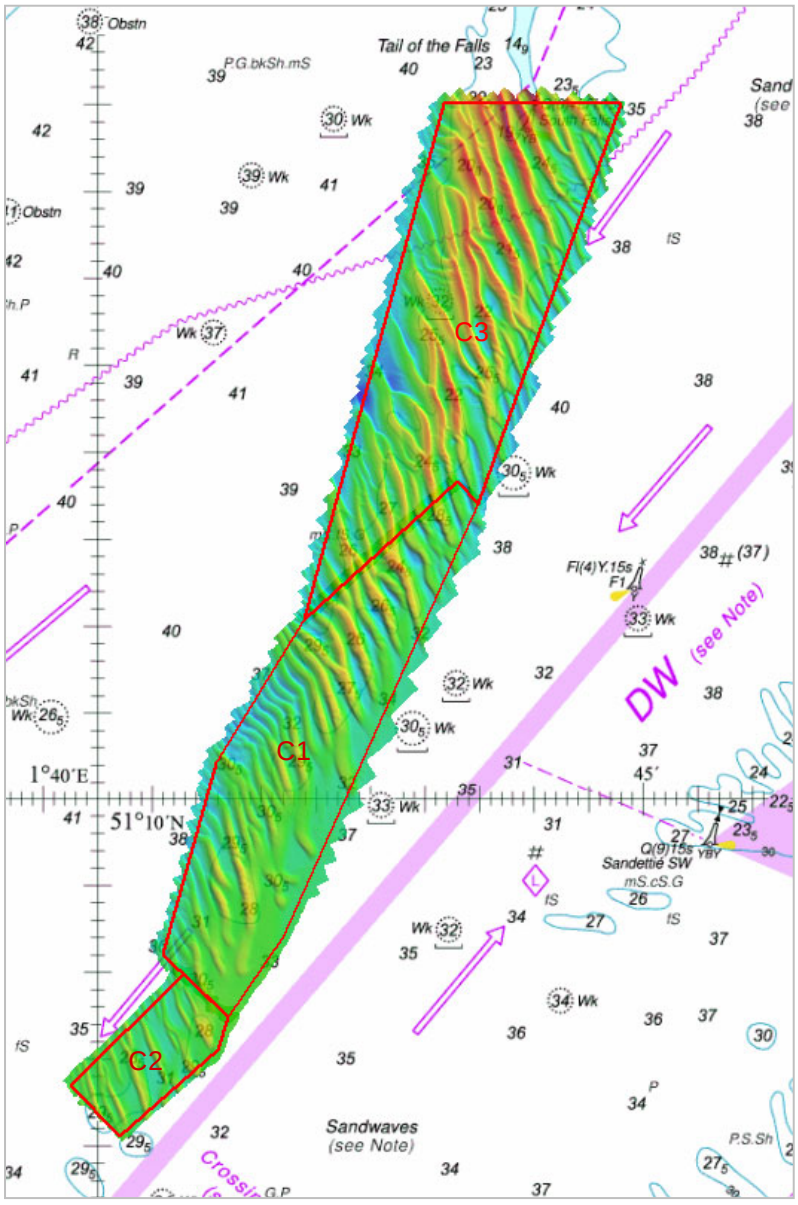
DOVER STRAIT

TAIL OF THE FALLS

ASSESSMENT ON THE ANALYSIS OF ROUTINE RESURVEY AREAS

DWR C1, C2 & C3

FROM THE 2012 SURVEY



August 2013

DOVER STRAIT

TAIL OF THE FALLS

AREAS DWR C1, DWR C2 & DWR C3

Assessment DWR C1, C2 & C3/2012

An assessment of the 2012 hydrographic survey of the areas: to monitor recent seabed movement; to identify any implications for shipping; and to make recommendations for future surveys.

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.

CONTENTS

ANNEXES

TAIL OF THE FALLS, 2012

1. EXECUTIVE SUMMARY

The Area and Recent Changes

1.1 Areas DWR C1, C2 and C3 lie in the southwest bound lane of the Dover Strait Traffic Separation Scheme (TSS) and cover the sandwave field which extends south-westwards from Tail of the Falls. DWR C1 covers part of a deep draught route, which is described in the Dover Strait Pilot but has no formal standing. Area C1 is surveyed annually, area C2 every 6 years and C3 every 3 years.

1.2 Although a very busy area, changes in depths are only of concern to very deep draught ships. Ships drawing up to 22.5 metres are known to use the southwest bound traffic lane, with the Tail of the Falls area forming a critical stage of their passage.

1.3 Within DWR C1, the controlling depth of 24.5 metres in the 2012 survey is the shallowest depth in the last 23 surveys examined.

Reasons for Continuing to Resurvey the Area

1.4 Sandwaves extending south-westwards from Tail of the Falls provide potentially critical depths to deep draught vessels using the southwest bound lane of the TSS and in particular the deep draught route. In this area, sandwave migration has been shown to occur slowly over many years, but potentially significant changes in sandwave heights occur over much shorter periods.

Recommendations

1.5 The current re-survey periods and limits of DWR C1, C2 and C3 are appropriate and should remain unchanged.

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 Area C was established in 1984, when an Understanding between the Hydrographers of the Netherlands, Belgium, France and the United Kingdom was reached on national responsibilities for hydrographic surveying in the southern North Sea and Dover Strait. In effect, the Understanding modified the surveying limits that would be delineated by official territorial waters / continental shelf boundaries in order to ensure that efficient and coherent surveys are conducted.

3.2 A report in 1986 split Area C into four areas (C, C1, C2 and C3), with the areas being surveyed at 1, 3 or 12 year intervals.

3.3 A report in 1991 further rationalised the areas into three new areas, DWR C1, C2 and C3. Area C1 was to be resurveyed annually with C2 and C3 resurveyed every 3 years. Following the Assessment of the 2003 survey, the limits of DWR C1 were reduced to better focus on the sandwave area.

3.4 Area specifications, including survey history, are at Annex A.

4. DESCRIPTION OF THE AREA

4.1 Areas DWR C1, C2 and C3 lie in the southwest bound lane of the Dover Strait Traffic Separation Scheme (TSS) and cover 4.6 sq NM (15.8 sq km). The limits and an image of the 2012 survey overlaid on chart 323 are shown at Annex C.

4.2 The areas cover part of a sandwave field which extends in a southwest direction from Tail of the Falls. These sandwaves dominate the area, with their maximum height ranging from 16 metres in the north, to 7 metres in the south. The net sediment transport regime within the area is influenced by the local topography, including South Falls. On the eastern side, southwest facing, strongly asymmetric, sandwaves exist. On the western side, sandwaves are symmetrical or asymmetrical and northeast facing.

4.3 The sun-illuminated view at Annex D shows clear bifurcation of sandwaves, where the broad asymmetrical sandwaves on the eastern side of the area divide into smaller, more numerous, sandwaves on the western side. Although at any one time sandwaves can have continuous crest lines crossing the opposing transport, these crests break and reattach as the sandwaves migrate in opposite directions.

4.4 Down the central axis of the sandwave field, between opposing directions of migration, the sandwaves are subject to much less change.

5. SHIPPING IN THE AREA

5.1 The survey area is situated in one of the busiest locations in the separation scheme, with heavy traffic converging and tracking southwest around the southern tip of South Falls. In addition, shipping passes across the TSS within the vicinity of the resurvey areas.

5.2 DWR C1 covers part of a suggested route for deep draught vessels. The route runs from Sullom Voe to the English Channel, via Noord Hinder Junction and includes a 0.5 nautical mile safety margin either side, forming a one nautical mile corridor. The route has no formal standing and is not endorsed in every detail by the British authorities. However, details of the route and under-keel allowances recommended by the UK Department for Transport are contained in the Dover Strait Pilot and the Routeing Guide for the English Channel and Southern North Sea. The route was originally published in a guide for masters of VLCCs owned by an Exxon affiliate or on charter to Exxon.

5.3 DWR C1 covers part of the route leg that joins waypoints 22 and 23. The Department for Transport's recommended under-keel allowance for deep draught vessels using this part of the route and travelling at 12 knots is 5.3 metres when under the influence of storm waves and swell. Under-keel allowances include a combined element to allow for vessel draught uncertainties and uncertainties in seabed level due to sandwaves, tidal reduction of surveys and survey instrumentation / interpretation inaccuracies.

5.4 It is understood from deep sea Pilots that the area south of South Falls buoy forms a critical stage of passage and where possible the area is transited at about 2-3 hours before high water at Dover. However, some ships are known to transit the area close to low water.

Depths of less than 27.8 metres would be of concern to a 22.5 metre draught vessel if it were to transit at Chart Datum using the under-keel allowance of 5.3 metres.

Shipping

5.5 The southwest bound traffic lane has a high volume of shipping, but only a small number of these ships are very deep draught and would be concerned about depths in the area. Sample data indicates that approximately 60 ships a year transit the area with a draught of more than 20 metres. A sample of 15 transits shows the deepest draught ship drawing 22.5 metres. However, only four of these exceed 20 metres below Chart Datum when taking into account the effect of tide, with the deepest draught in relation to Chart Datum being 21.0 metres.

5.6 The generalised routes taken by ships drawing 20 metres or more is shown at Annex B.

5.7 Ships drawing up to 17 metres have been observed passing through the centre of DWR C3.

6. 2009 SURVEY DETAILS

6.1 The survey was conducted on 23, 25 and 26 July, with two infill lines run on 31 August. Weather conditions during the survey were good with sea state 2-3 and wave heights generally less than 0.5 metres. Weather for the preceding month was also good, with wave heights generally less than 1.5 metres at the Sandettié buoy close to the east. The survey was referred to the ITRF2000 Datum.

7. 2011 SURVEY DETAILS

7.1 The survey was conducted on 29 July, with Sea State 3 experienced during the survey.

7.2 The survey is referred to the ETRF89 reference frame.

8. 2012 SURVEY DETAILS

8.1 The survey was conducted on 19, 21 and 26 December, with intervening days spent alongside due to bad weather. Sea states 2 to 3 were experienced during data gathering, but with sea state 4 and wave heights of around 2 metres recorded while alongside at Dover.

8.2 The survey is referred to the ETRF89 reference frame.

8.3 The survey overlaid on chart 323 is at Annex C.

8.4 Surveys achieved IHO Order 1a, with full seafloor cover across the area. Depths from the 2009, 2011 and 2012 survey were reduced to Chart Datum using GPS heights, with ellipsoidal height to Chart Datum taken from the Vertical Offshore Reference Framework (VORF).

8.5 The survey deliverable for both the 2011 and 2012 surveys was in the form of a 1 metre resolution CUBE (Combined Uncertainty & Bathymetric Estimator) surface. All these surveys achieved full seafloor cover with multibeam echosounders.

9. DESCRIPTION OF RECENT BATHYMETRIC CHANGE

9.1 Colour banded depth plots of the 2009 and 2012 surveys covering C1, C2 and C3, are at Annexes E and F respectively. Selected shoal depths have also been identified in the Annexes. A variability plot, at Annex G, shows the changes in depths between the 2009 and 2012 surveys. Most, but not all of the changes reflect the horizontal movement of sandwaves that has occurred. The inferred residual sediment transport direction, based on the variability plot and asymmetry of the sandwaves, is shown in Annex D. Comparisons of the 28 and 30 metre contours are at Annexes H and I respectively.

9.2 Colour banded depth plots of the 2011 and 2012 surveys covering C1 are at Annexes J and K respectively. A variability plot, at Annex L, shows the changes in depths between the 2011 and 2012 surveys. Most, but not all of the changes reflect the horizontal movement of sandwaves that has occurred. Comparisons of the 28 and 30 metre contours are at Annexes M and N respectively.

DWR C1

9.3 Minimum depths are found over the large sandwaves in the north of the area. In the 2012 survey, the minimum depth is 24.5 metres, as shown in Figure 9.1. This is the shallowest depth surveyed when examining surveys back to 1989 and is 1.4 metres shallower than that found in the 2011 survey.

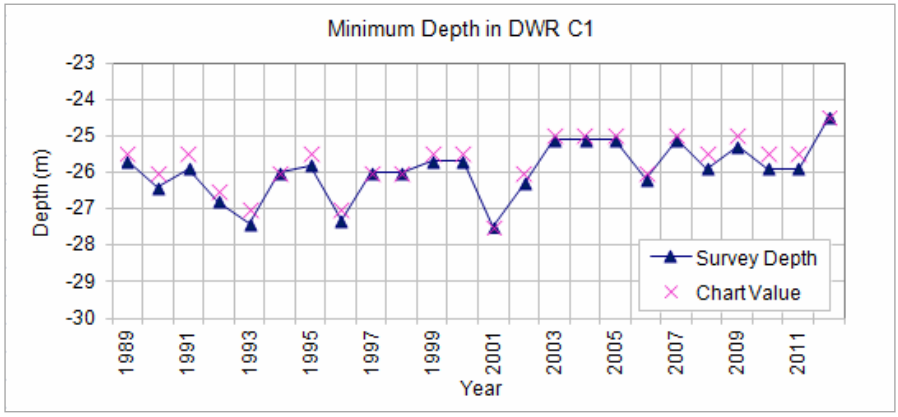


Figure 9.1

9.4 Minimum depths over two sandwaves in the north of the area, over which minimum depths within the deep draught route corridor have been found in recent surveys, have been examined and depths are shown in figure 9.2. Depths over both sandwaves have deepened slightly in the last 3 surveys.

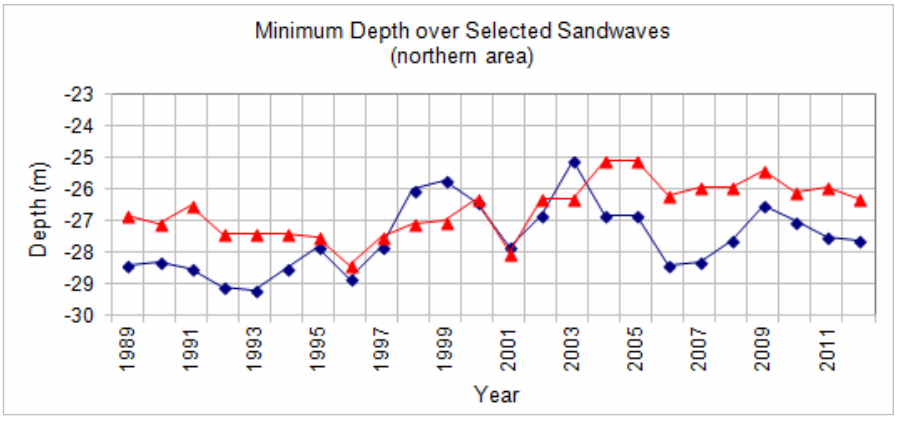


Figure 9.2

9.5 In the southern part of the area, minimum depths have been found over the same sandwave in 18 of the last 22 surveys (see figure 9.3). The current charted depth is 28 metres, depths have remained relatively stable, but with slight shoaling, in the last eight surveys.

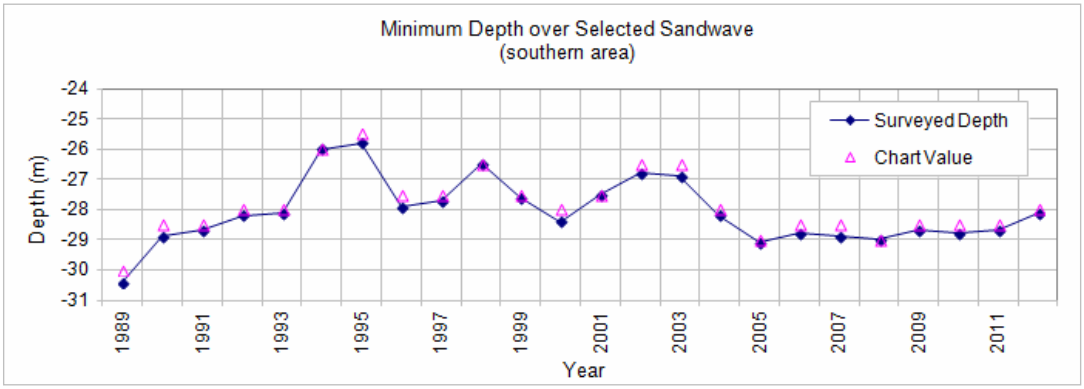


Figure 9.3

DWR C2

9.6 The minimum depth of 28.3 metres in the 2012 survey is similar to that found in the previous two surveys (see figure 9.4). These depths lie outside the suggested route corridor for deep draught vessels, with depths of more than 30 metres within the corridor.

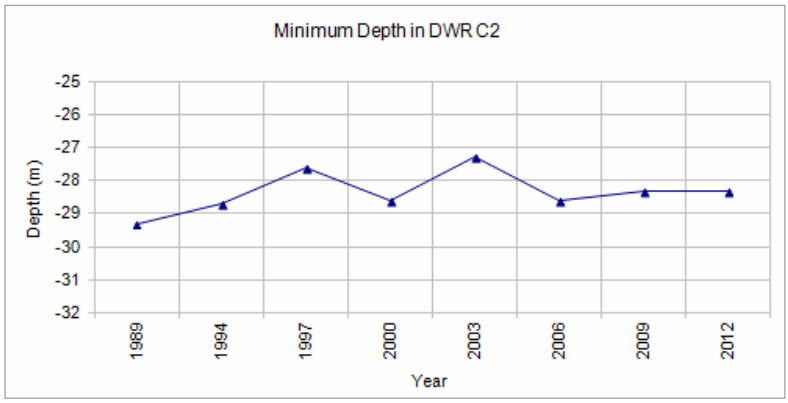


Figure 9.4

DWR C3

9.7 Area DWR C3, being closest to Tail of the Falls, contains the shallowest depths of the three areas. In the south of the area, the minimum depth in the 2012 survey is 22.3 metres, deepening from 21.4 metres in 2009. Depths in this area range from 20.6 to 22.6 metres in the last six surveys, as shown in figure 9.4.

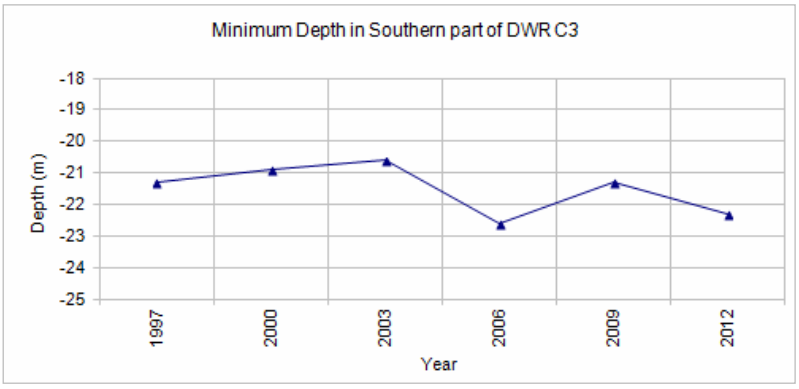


Figure 9.4

9.8 In the north, minimum depths from two general areas have been extracted (figure 9.5) and show that minimum depths in the north range from 18.0 to 19.9 metres over the last six surveys.

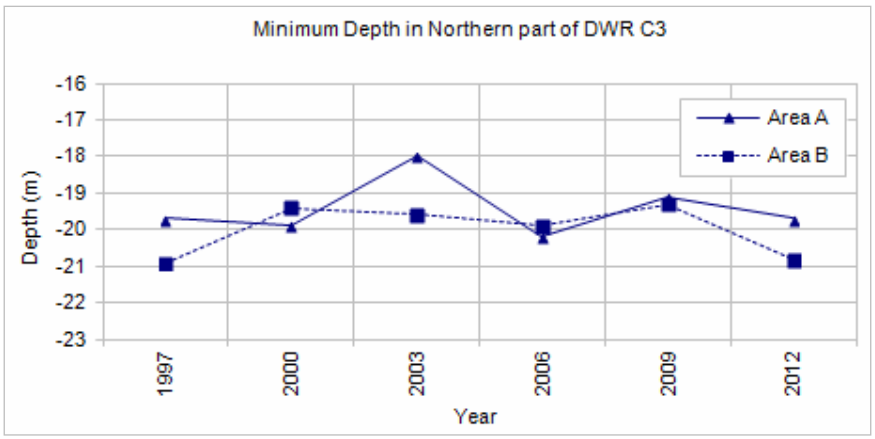


Figure 9.5

10. IMPLICATIONS FOR SHIPPING

10.1 The minimum depth within DWR C1 has shoaled to 24.5 metres, the shallowest observed in surveys going back to 1989, and needs to be taken into account by the deepest draught ships when transiting the area close to low water.

10.2 The minimum depths within DWR C2 and C3 are similar or deeper than in the previous survey.

11. RECOMMENDATIONS FOR FUTURE SURVEYS

DWR C1

11.1 The minimum depth of 24.5 metres found in the 2012 survey is shallower than the last 23 surveys examined. Although most very deep draught ships using the area keep to the south of the shallowest depths, the area is critical to very deep draught ships and change to depths over individual sandwaves supports retaining area DWR C1 as an annual survey.

DWR C2

11.2 Depths are deeper than in area DWR C1 and sandwaves smaller, with all depths less than 30 metres lying outside the deep draught route corridor. It is recommended that the existing 6 year re-survey frequency and limits are retained.

DWR C3

11.3 DWR C2 lies outside of the deep draught route corridor, but much of the area is less than 23 metres and a small number of very deep draught ships transit the southern part of the area, with ships drawing up to 17 metres transiting the shallower northern part of the area. The resurvey interval of 3 years and current limits should be retained.

AREA SPECIFICATIONS DWR C1
(Including Survey History)

REGION: Deep Water Route **NAME:** Tail of the Falls **AREA:** DWR C1

LIMITS:

a)	51º.19717N	1º.72150E
b)	51º.19500N	1º.72483E
c)	51º.15333N	1º.69500E
d)	51º.14567N	1º.68667E
e)	51º.15167N	1º.67667E
f)	51º.17016N	1º.68480E
g)	51º.18383N	1º.69817E

Area co-ordinates are referred to WGS84 Datum

AREA SIZE: 1.9 SQ NM (6.57 SQ KM) **SURVEY INTERVAL:** 1 yr

SURVEYS:

Year	Survey	File Ref.	Data	Year	Survey	File Ref.	Data
1988	M1239	H6345/87	s.t.d	2001	M3584	HH090/933/01	s.d
1989	M1436	H3937/88	s.d	2002	M3747	HH090/991/01	s.d
1990	M1607	HH090/491/01	s.d	2003	M3925	HH091/024/01	s.t.d
1991	M1779	HH090/518/01	s.d	2004	M4172	HH091/079/01	s.d
1992	M1925	HH090/551/01	s.t.d	2005	M4278	HH091/120/01	m
1993	M2150	HH090/577/01	s.d	2006	M4628	HH091/159/01	m.t
1994	M2295	HH090/632/01	s.d	2007	M4647	HH091/226/01	m
1995	M2511	HH090/648/01	s.d	2008	M4647	HH091/226/01	m
1996	M2672	HH090/691/01	s.d	2008	HI1270	200826415	m
1997	M2839	HH090/745/01	s.t.d	2009	HI1294	200929529	m
1998	M3051	HH090/772/01	s.t.d	2010	HI1339	201018827	m
1999	M3251	HH090/853/01	s.d	2011	HI1368	2011112084	m
2000	M3411	HH090/889/01	s.d	2012	HI1399	2012131314	m

KEY: s = sonar sweep, t = seabed texture tracing, d = digital data available, m = multibeam digital data
Singlebeam surveys (prior to 2004) conducted at 1:25,000 scale

REPORTS:

1986	HH0423/86
1991	Latest survey included M1436 (HA145/02/03/01 - E3)
1998	Latest survey included M3051 (HA145/002/001/02)
1999	Combined report on C1, C2 and C3 (91, 94 and 97 surveys)

ASSESSMENTS:

1995	M2511 (HA145/02/03/05 - E11)
1996	M2672 (HA145/010/006/01 - E3)
1999	M3251 (HA145/010/006/01 - E8)
2000	M3411 (HA145/010/006/01 - E10)
2001	M3584 (HA145/010/066/01 – E8)
2002	M3747 (HA145/010/083/01 – E5)
2003	M3925 (HA145/010/092/01 – E5)
2004	M4172 (HA145/010/104/01 – E1)
2005	M4278
2007	M4268 & M4647

REMARKS:

1984	Area C established (H6026/82-E53).
1986	Report divides area C into new areas C, C1, C2 and C3 (H0423/86).
1991	Report on areas C, C1, C2 and C3 removes area C and limits and survey intervals of areas C1, C2 and C3 amended (HA145/02/03/01-E3).
1997	Sandwave Analysis Report (HA107/042/003/02) (parts of C1 & C3) – examining 5 surveys conducted over a 1 month period.
2004	Area limits reduced following assessment of the 2003 survey (M3925).

LARGEST SCALE CHART: BA 323 (1:75,000)

AREA SPECIFICATIONS DWR C2
(Including Survey History)

REGION: Deep Water Route **NAME:** Tail of the Falls **AREA:** DWR C2

LIMITS:
a) 51º.14983N 01º.67973E
b) 51º.14567N 01º.68667E
c) 51º.14250N 01º.68500E
d) 51º.13417N 01º.67000E
e) 51º.13917N 01º.66250E

Area co-ordinates are referred to ETRS89 Datum

AREA SIZE: 0.40 SQ NM (1.36 SQ KM) **SURVEY INTERVAL:** 6 yr

SURVEYS:

Year	Survey	File Ref.	Data
1987	M1120	H4028/86	s.t.
1988	M1239	H6345/87	s.t.d
1989	M1436	H3937/88	s.d
1990	M1607	HH090/491/01	s.d
1991	M1779	HH090/518/01	s.d
1994	M2295	HH090/632/01	s.d
1997	M2839	HH090/745/01	s.t.d
2000	M3411	HH090/889/01	s.d
2003	M3925	HH090/1024/01	s.t.d
2006	M4628	HH091/159/01	s.t.d
2009	HI1294	200929529	m
2012	HI1399	2012131314	m

KEY: s = sonar sweep, t = seabed texture tracing, d = digital data available, m = multibeam digital data
Singlebeam surveys (prior to 2004) conducted at 1:25,000 scale

REPORTS:
1986 HH0423/86
1991 Latest survey included M1436 (HA145/02/03/01 – E3)
1998 Latest survey included M2839 (HA145/010/06/01 – E3)

ASSESSMENTS:
2001 M3411 (HA145/010/013/01 – E2)

REMARKS:
1984 Area C established (H6026/82-E53).
1986 Report divides area C into new areas C, C1, C2 and C3 (H0423/86).
1992 Report on areas C, C1, C2 and C3 removes area C and limits and survey intervals of areas C1, C2 and C3 amended (HA145/02/03/01-E3).
2009 Survey frequency extended to 6 years

LARGEST SCALE CHART: BA 323 (1:75,000)

AREA SPECIFICATIONS DWR C3
(Including Survey History)

REGION: Deep Water Route **NAME:** Tail of the Falls **AREA:** DWR C3

LIMITS:
a) 51º.23333N 01º.71950E
b) 51º.23333N 01º.74667E
c) 51º.19500N 01º.72483E
d) 51º.19717N 01º.72150E
e) 51º.18383N 01º.69817E

AREA SIZE: 2.3 SQ NM (7.88 SQ KM) **SURVEY INTERVAL:** 3 yr

SURVEYS:

Year	Survey	File Ref.	Data
1988	M1239	H6345/87	s.t.d
1991	M1779	HH090/518/01	s.d
1994	M2295	HH090/632/01	s.d
1997	M2839	HH090/745/01	s.t.d
2000	M3411	HH090/889/01	s.d
2003	M3925	HH090/1024/01	s.t.d
2006	M4628	HH091/159/01	s.t.d
2009	HI1294	200929529	m
2012	HI1399	2012131314	m

KEY: s = sonar sweep, t = seabed texture tracing, d = digital data available, m = multibeam digital data
Singlebeam surveys (prior to 2004) conducted at 1:25,000 scale

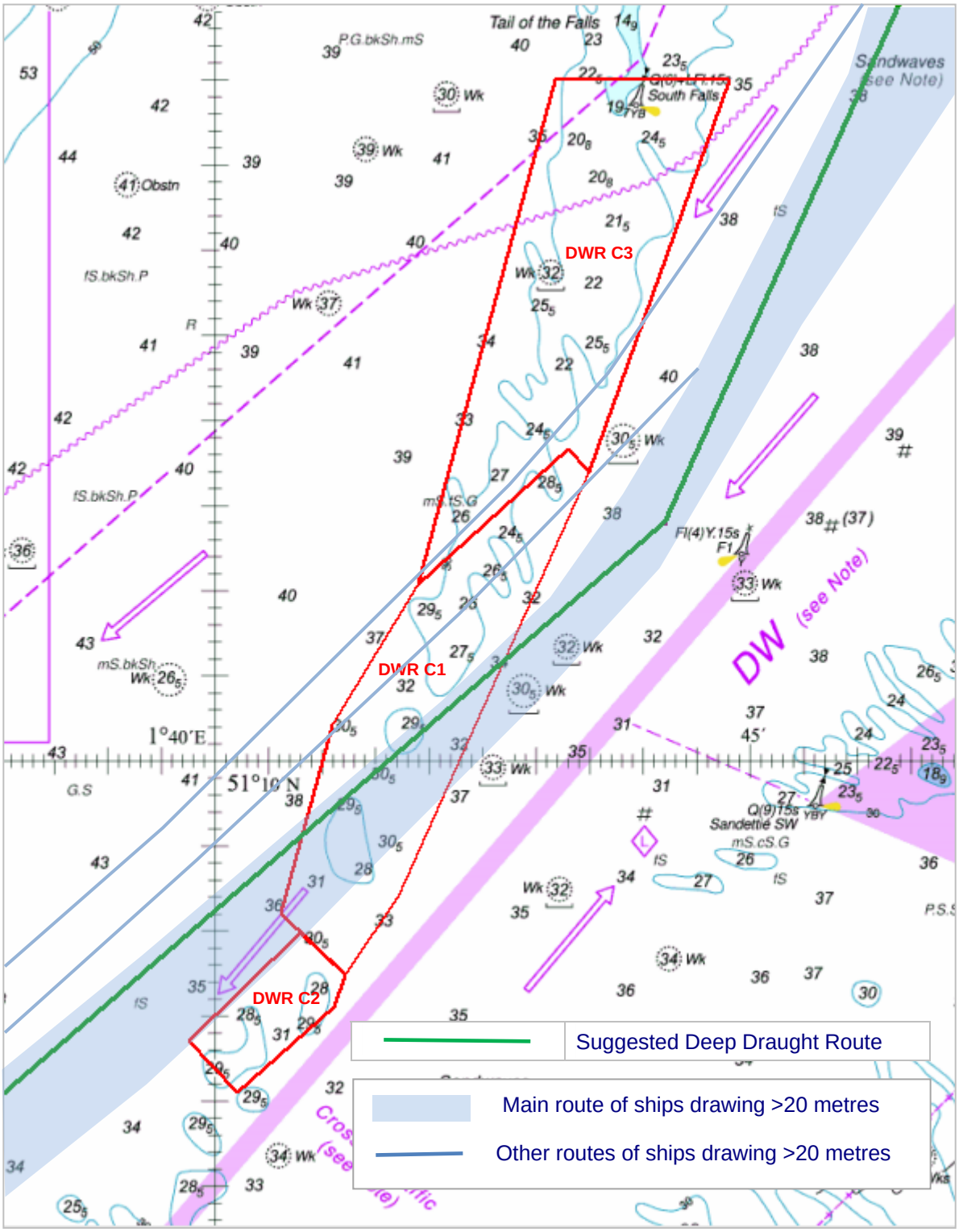
REPORTS:
1986 HH0423/86
1991 Latest survey included M1239 (HA145/02/03/01 - E3)
1998 Latest survey included M2839 (HA145/010/06/01)
1999 Combined report on C1, C2 and C3 (91, 94 and 97 surveys)

ASSESSMENTS: 2001 M3411 (HA145/010/012/01 – E3)

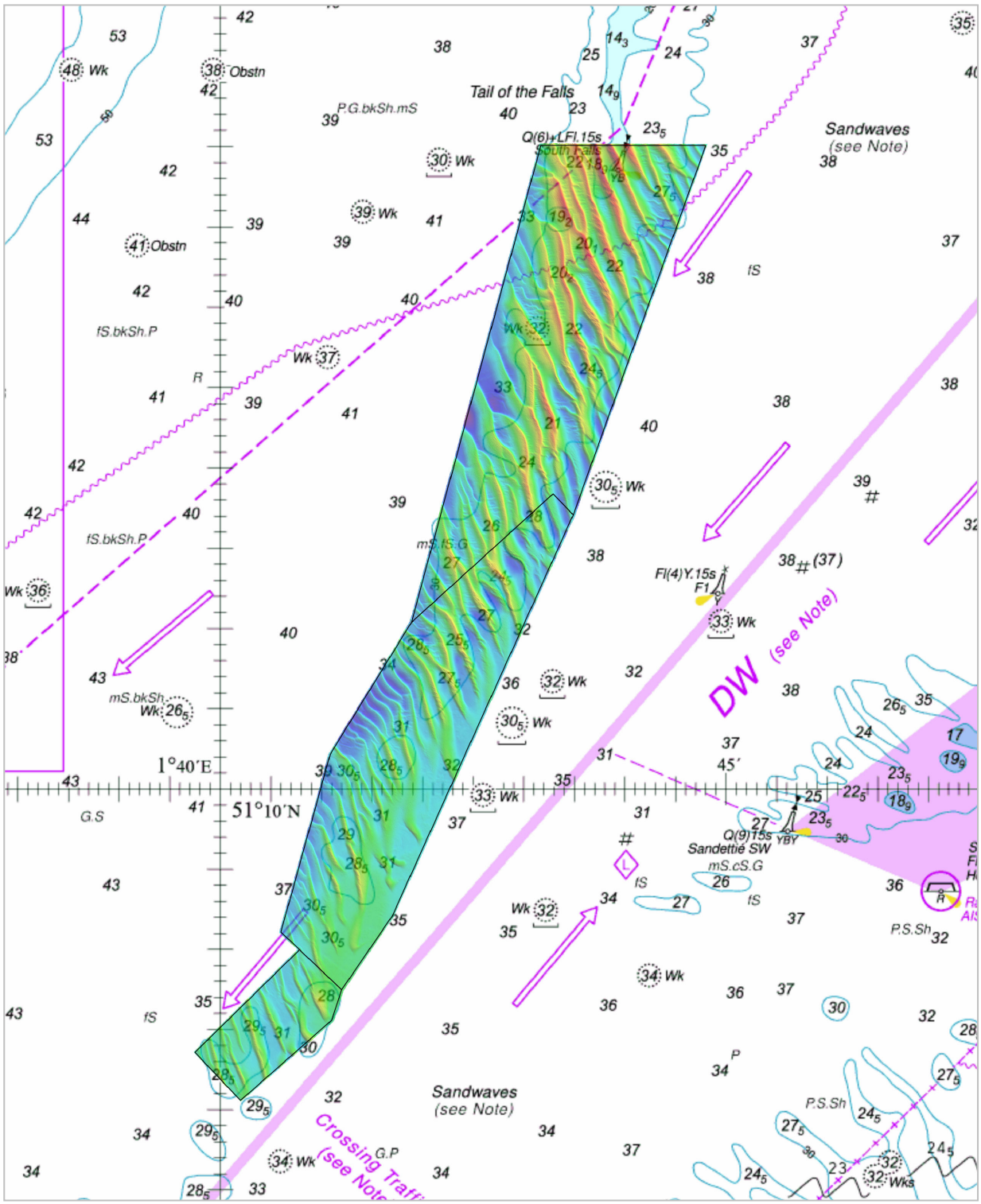
REMARKS:
1984 Area C established (H6026/82-E53).
1986 Report divides area C into new areas C, C1, C2 and C3 (H0423/86).
1993 Report on areas C, C1, C2 and C3 removes area C and limits and survey intervals of areas C1, C2 and C3 amended (HA145/02/03/01-E3).
1997 Sandwave Analysis Report (HA107/042/003/02) (parts of C1 & C3) – examining five surveys conducted over a 1 month period.
1999 Limits change. See Report RRA C1, C2, C3, March 99

LARGEST SCALE CHART: BA 323 (1:75,000)

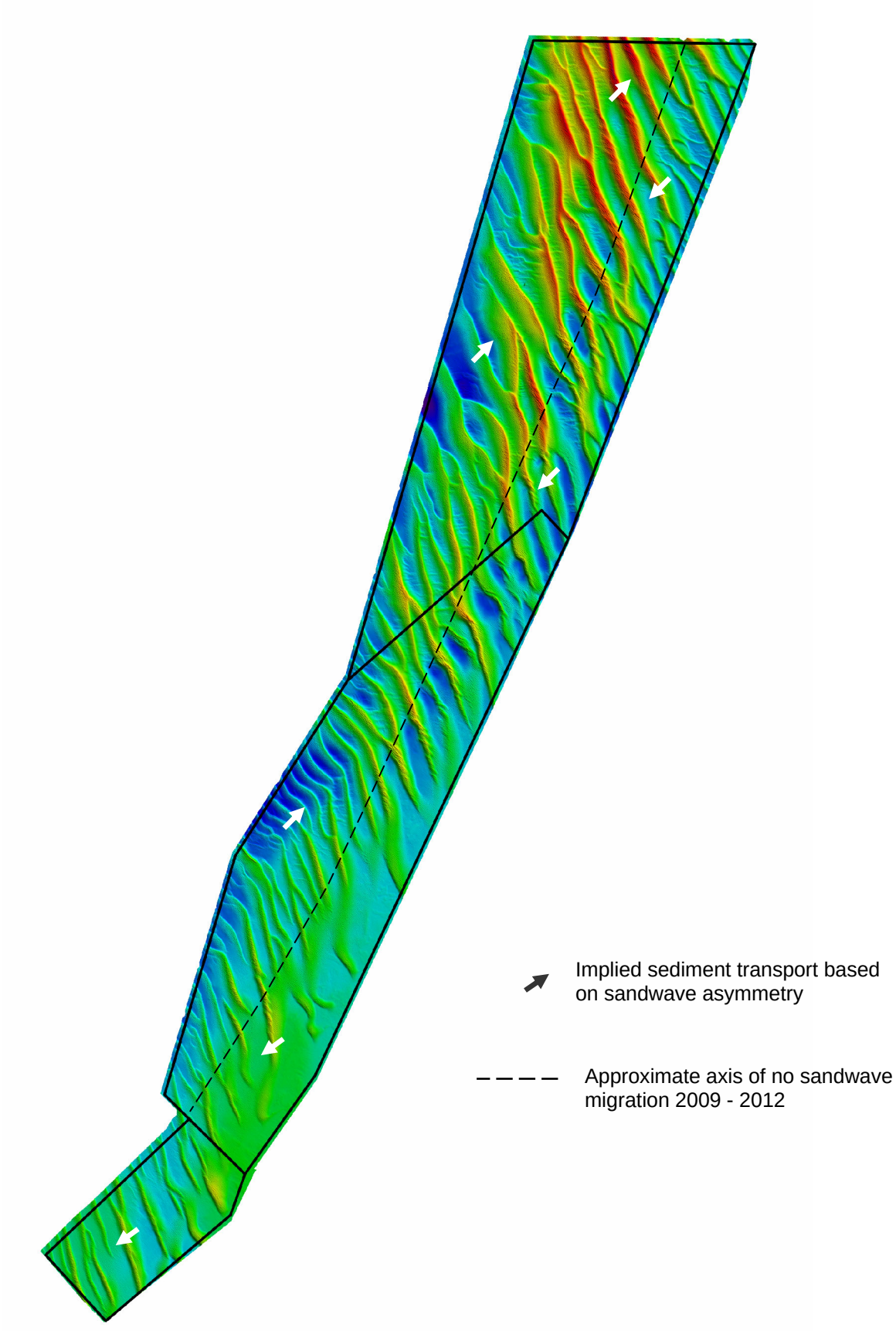
DEEP DRAUGHT SHIPPING ROUTE



2012 SURVEY OVERLAID ON CHART 323

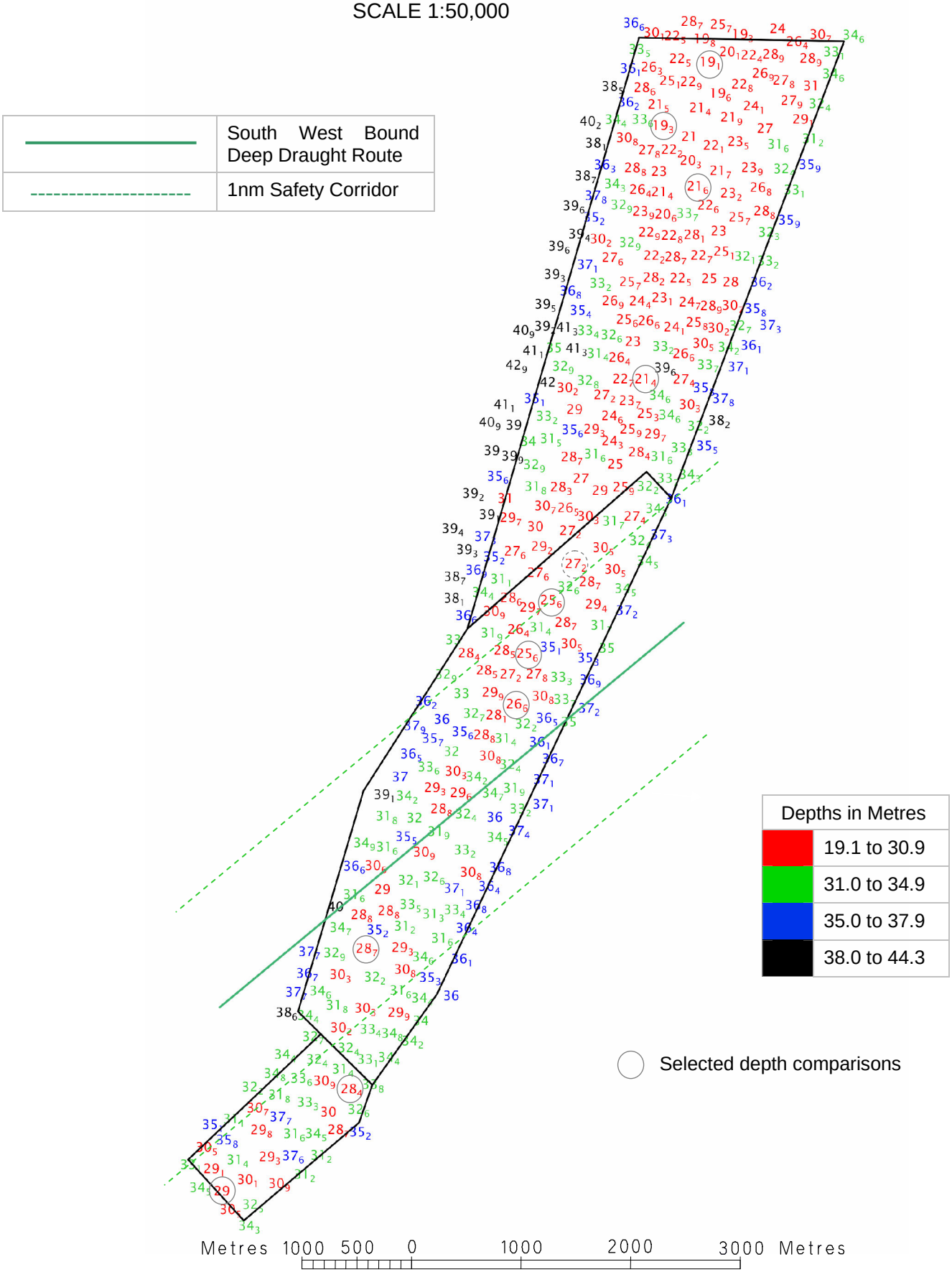


SUN-ILLUMINATED VIEW OF THE 2012 SURVEY



COLOUR BANDED DEPTH PLOT FROM THE 2009 SURVEY SHOWING SELECTED DEPTHS

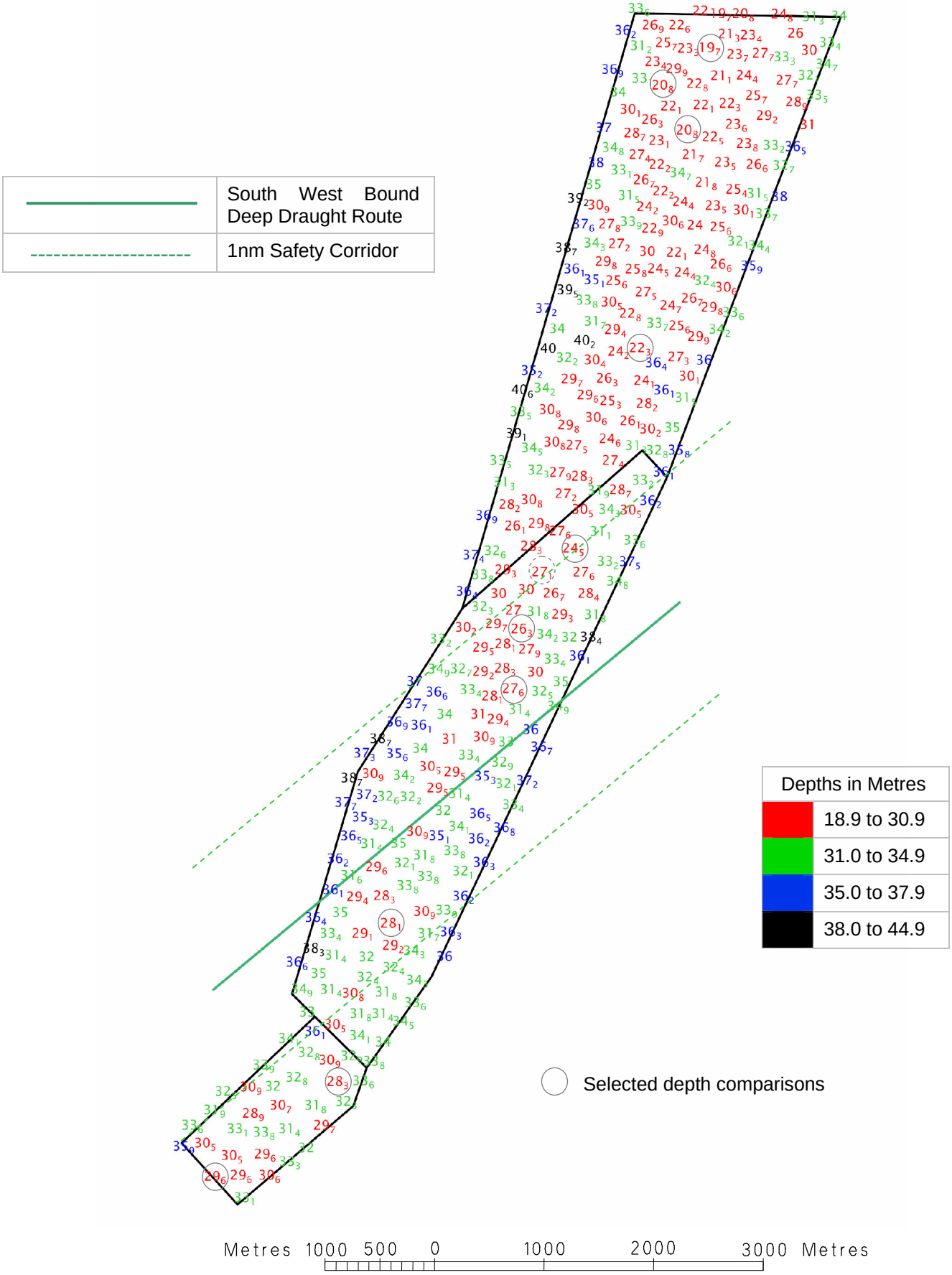
SCALE 1:50,000



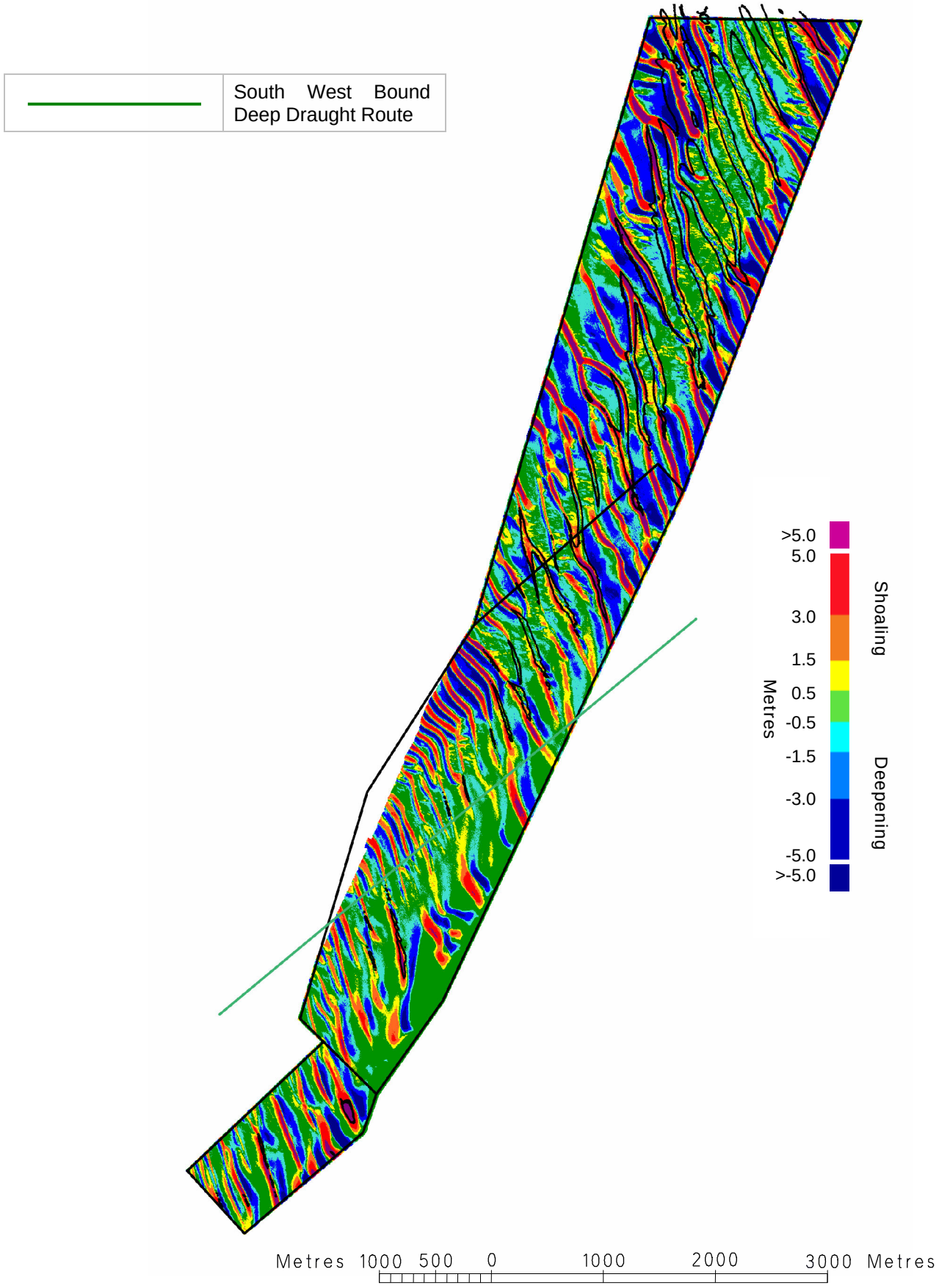
COLOUR BANDED DEPTH PLOT FROM THE 2012 SURVEY

SHOWING SELECTED DEPTHS

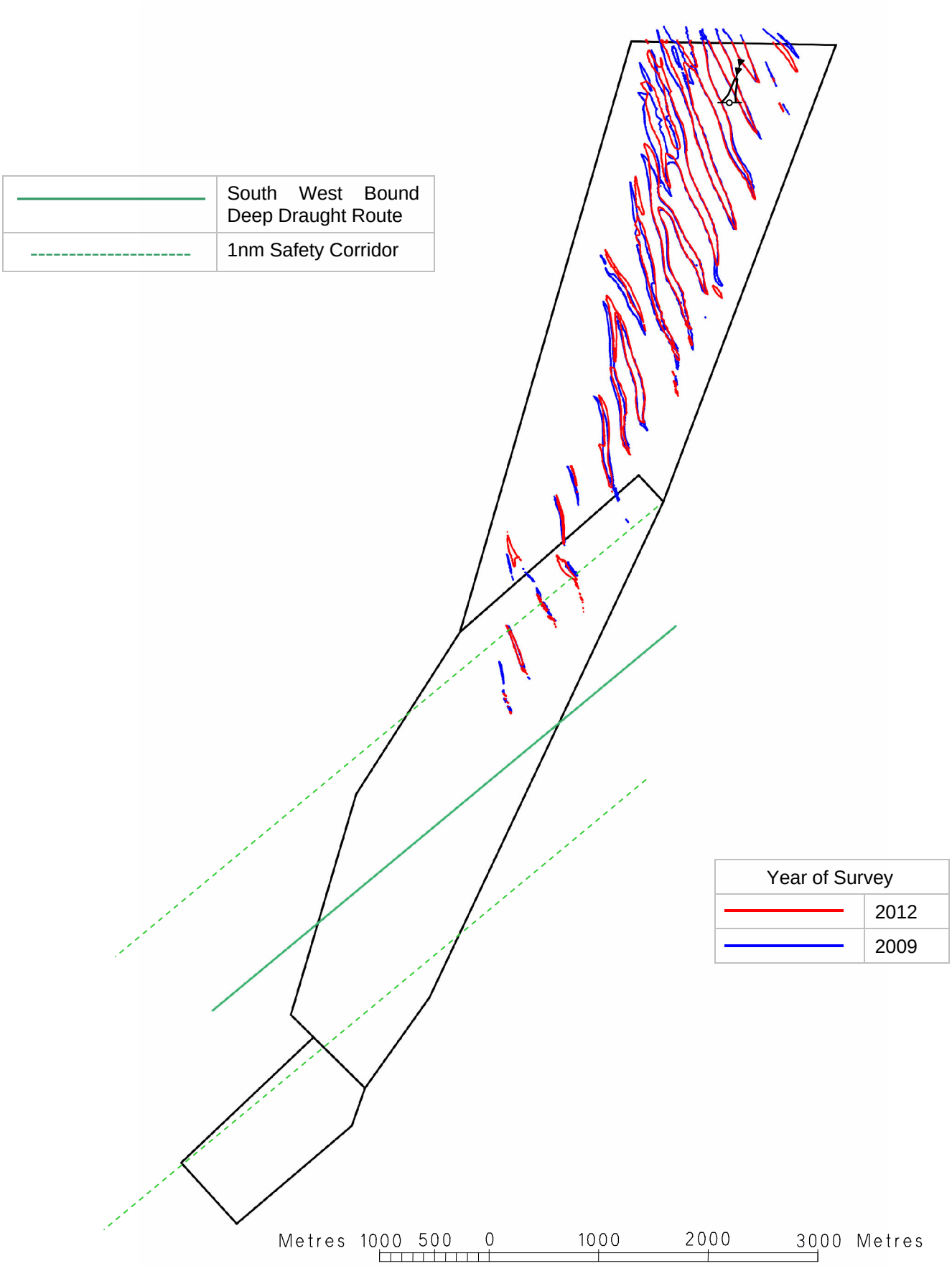
SCALE 1:50,000



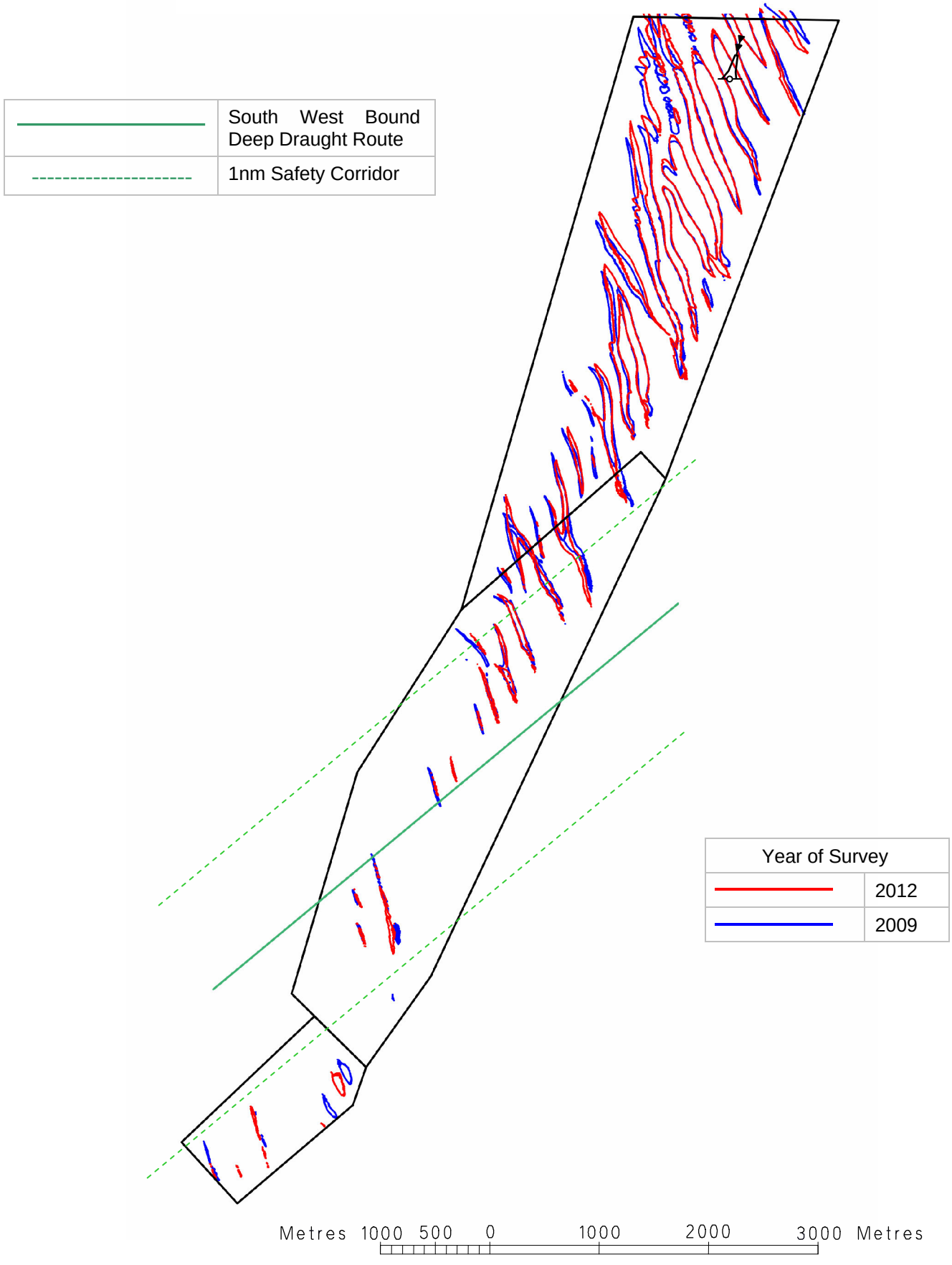
VARIABILITY PLOT SHOWING BATHYMETRIC CHANGES
BETWEEN THE 2009 AND 2012 SURVEYS
AND THE 30 METRE CONTOUR FROM THE 2012 SURVEY
SCALE 1:50,000



COMPOSITE DIAGRAM OF THE 28 METRE CONTOUR
FROM THE 2009 AND 2012 SURVEYS
SCALE 1:50,000



COMPOSITE DIAGRAM OF THE 30 METRE CONTOUR
FROM THE 2009 AND 2012 SURVEYS
SCALE 1:50,000

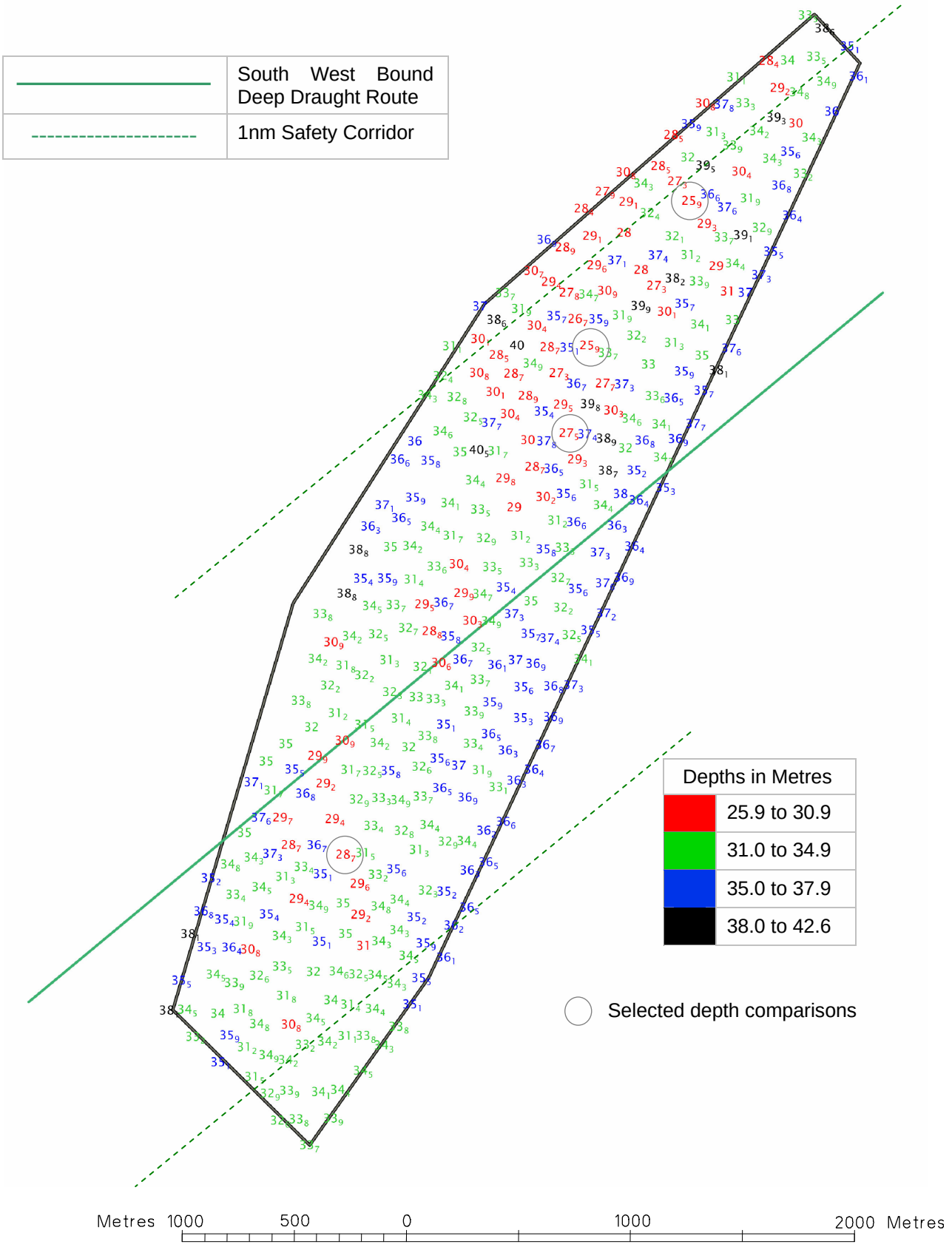


DWR C1

COLOUR BANDED DEPTH PLOT FROM THE 2011 SURVEY

SHOWING SELECTED DEPTHS

SCALE 1:25,000

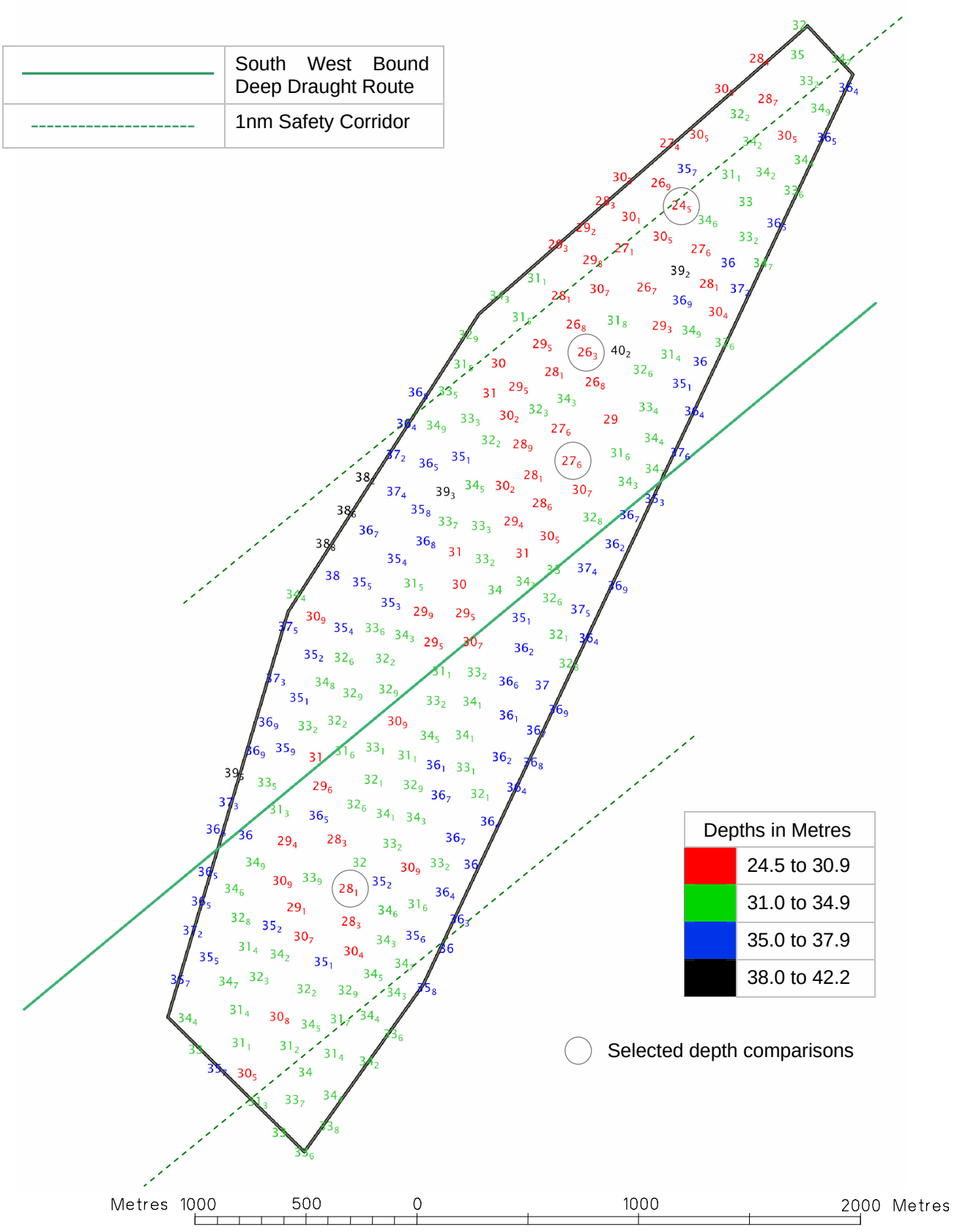


DWR C1

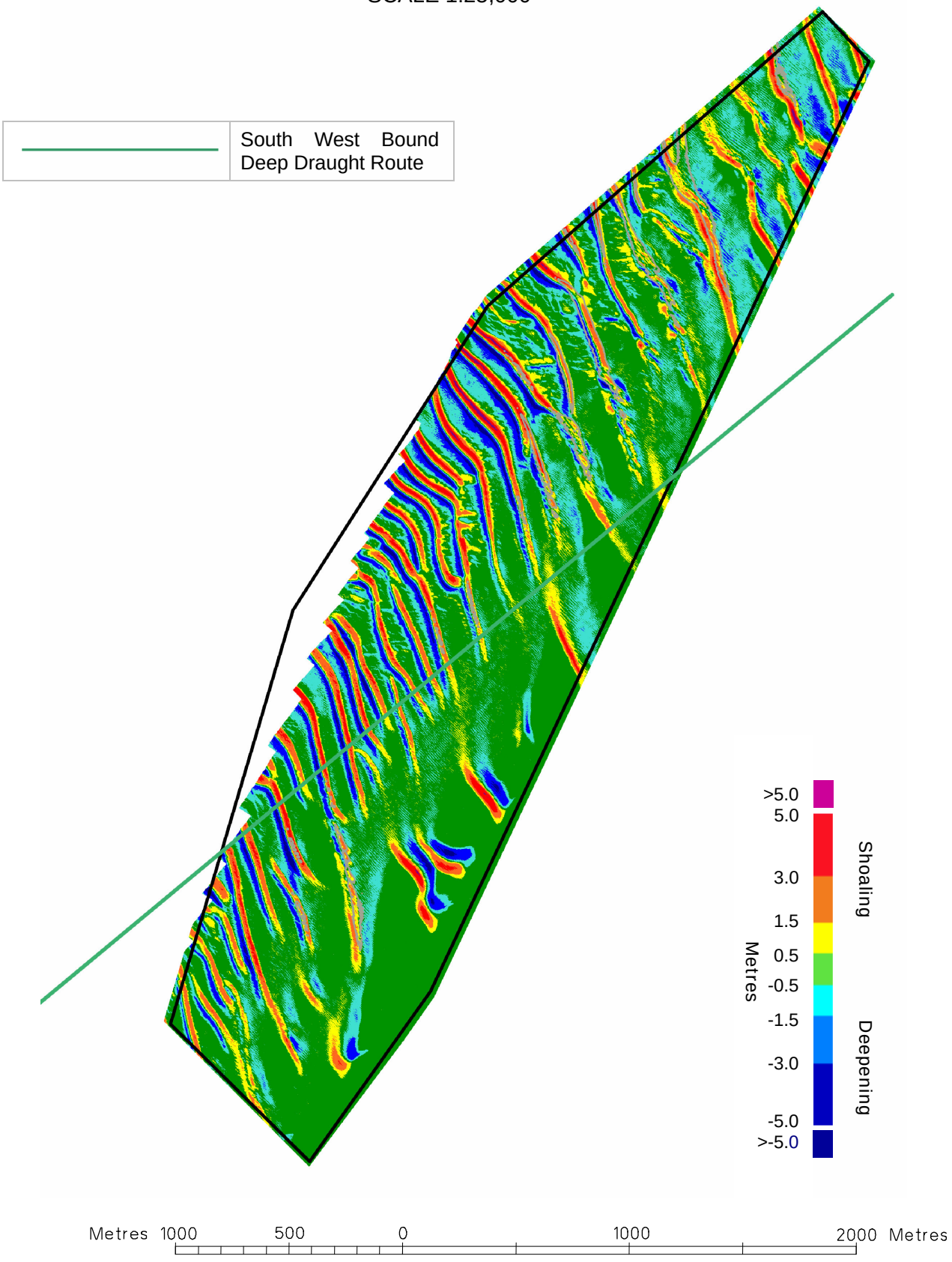
COLOUR BANDED DEPTH PLOT FROM THE 2012 SURVEY

SHOWING SELECTED DEPTHS

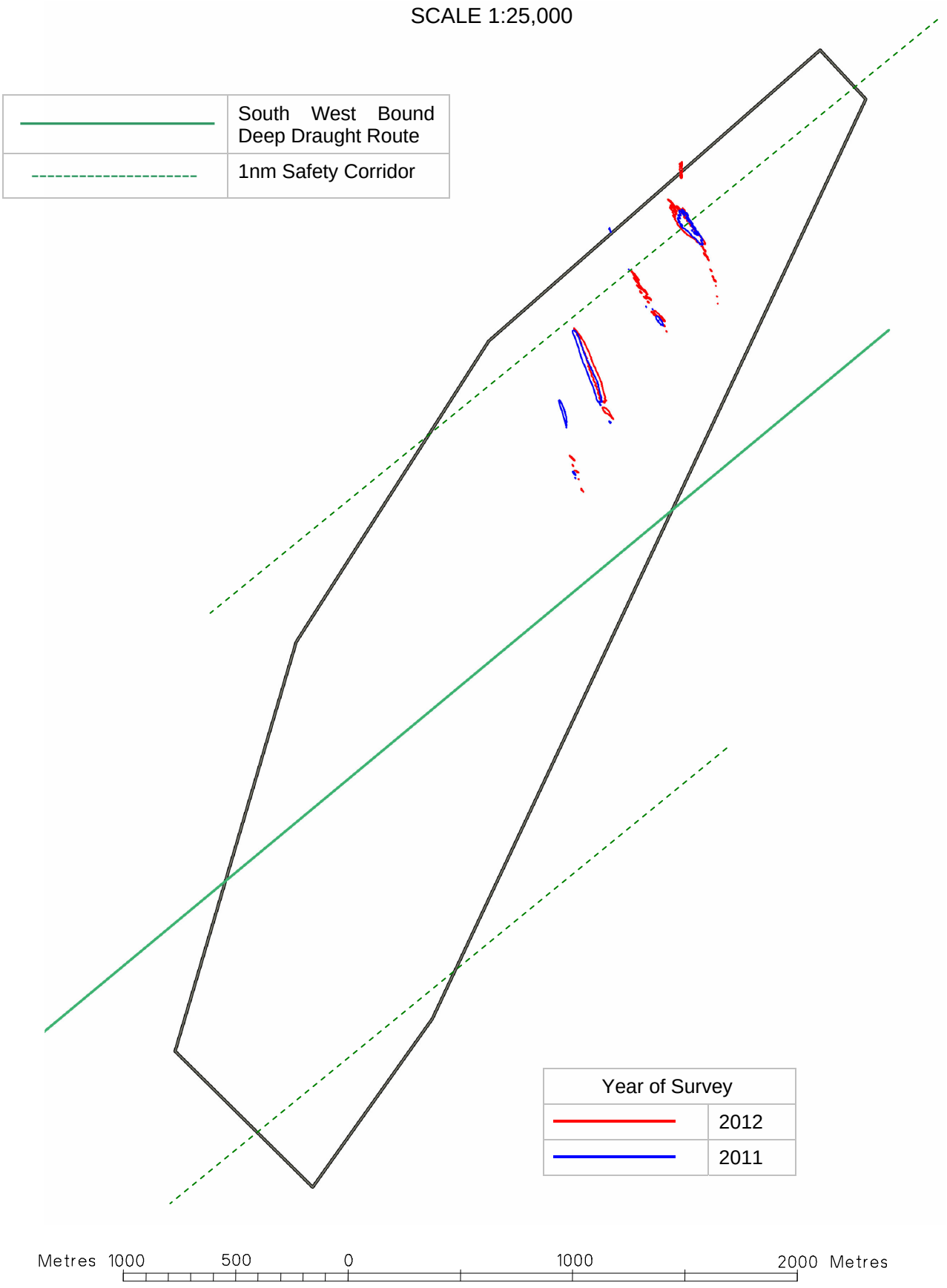
SCALE 1:25,000



DWR C1
VARIABILITY PLOT SHOWING BATHYMETRIC CHANGES
BETWEEN THE 2011 AND 2012 SURVEYS
AND THE 30 METRE CONTOUR FROM THE 2012 SURVEY
SCALE 1:25,000



DWR C1
COMPOSITE DIAGRAM OF THE 28 METRE CONTOUR FROM THE 2011 AND 2012 SURVEYS
SCALE 1:25,000



DWR C1
COMPOSITE DIAGRAM OF THE 30 METRE CONTOUR FROM THE 2011 AND 2012 SURVEYS
SCALE 1:25,000