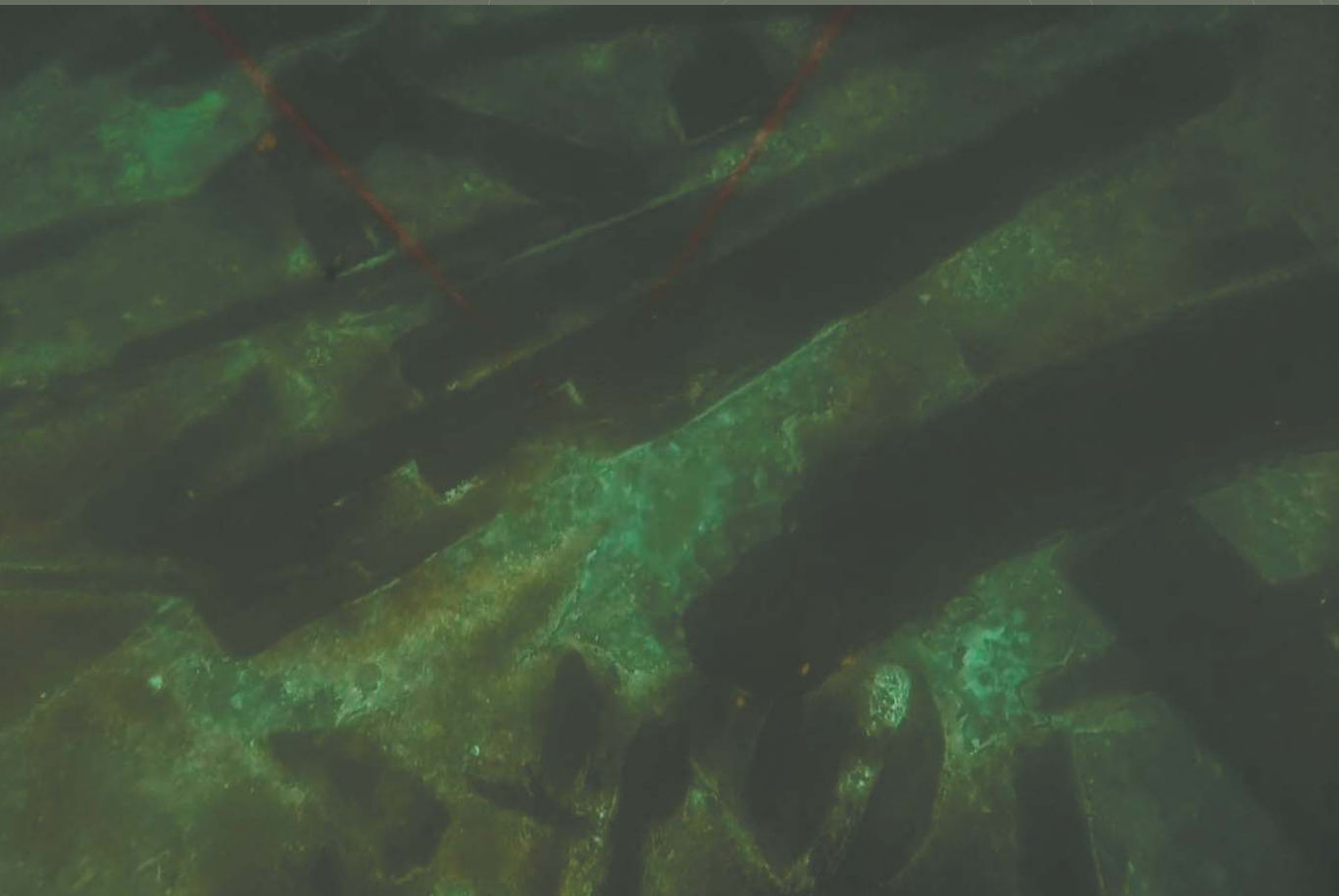


NORD STREAM 2 PIPELINE –  
SOUTH-EASTERN ROUTE  
Cultural heritage target assessment  
and exclusion zone recommendations

VIR 2740



Mikkel H. Thomsen



VIKINGESKIBS  
MUSEET

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***16/02648***

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August 2019

Cover illustration: wreck VIR 2912 © Nord Stream 2 AG/Marin Mätteknik AB

## Cultural heritage target assessment and exclusion zone recommendations

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### Appendix 1 – Targets

### **Abstract**

Nord Stream 2 AG has asked the Viking Ship Museum to identify potential cultural heritage objects potentially conflicting with the installation of new pipelines around Bornholm. This report covers a route south and east far off Bornholm, whereas the Base Case route closer to Bornholm and an alternative route north and west of Bornholm are covered in previous reports. Through an iterative process, the Viking Ship Museum has identified a number of objects on the seabed and assigned suggested exclusion zones to protect objects from damage during installation and operation of the pipeline. No objects have been recovered, and no further mitigation measures have been imposed.

### **Dansk resumé**

Nord Stream 2 AG har bedt Vikingeskibsmuseet udpege kulturhistoriske genstande, som potentielt berøres af et nyt sæt rørledninger ved Bornholm. Nærværende rapport behandler en rute syd og øst om Bornholm; den oprindelige rute nærmere Bornholm samt en alternativ rute nord og vest om Bornholm er behandlet i tidligere rapporter. Gennem en iterativ proces har Vikingeskibsmuseet udpeget et antal objekter på havbunden og tildelt foreslåede friholdelseszoner, som vil forhindre skade på objekterne under anlæg og drift af rørledningen. Ingen genstande er blevet bjærget, og der er ikke pålagt yderligere mitigerings tiltag.

## Background

In advance of finalising the route design for a set of new Baltic pipelines traversing the Danish EEZ around Bornholm, Nord Stream 2 AG (NS2) has asked the Viking Ship Museum (VIR) to identify and assess the cultural significance of objects potentially conflicting with the design, as well as to recommend possible mitigation measures.

The originally applied route east and south of Bornholm, now called the Base Case route, was reported in January 2018 (Thomsen & Hyttel 2018). Later the same year, NS2 asked VIR to perform a similar assessment of an alternative route north and west of Bornholm (called the North-Western Route). This was reported in June 2019 (Thomsen 2019). Immediately hereafter VIR began assessing data for a third route alternative further to the south and east of Bornholm. The present report covers this latter route alternative.



**Fig. 1. Nord Stream 2 Pipeline, Danish sector. Route design D6\_09, D6\_10, and D7\_05 South-east of Bornholm, DK. Drawing: Mikkel H. Thomsen © Vikingskibsmuseet. Base map: Styrelsen for Dataforsyning og Effektivisering (Skærmkort, dæmpet).**

**Table 1: Abbreviations.**

CHO	Cultural history object	Kulturhistorisk objekt
EEZ	Exclusive Economic Zone	Eksklusiv økonomisk zone
GIS	Geographical information system	Geografisk informationssystem
LF	Low frequency	Lavfrekvent
MAG	Magnetometer, magnetic	Magnetometer, magnetisk
MBES	Multibeam echo sounder	Flerstråleekkolod
MMO	Man-made object	Menneskeskabt objekt
MMT	Marin Mätteknik AB	
NS2	Nord Stream 2 AG	
ROV	Remotely operated vehicle	Fjernstyret undervandsfartøj
SBP	Sub-bottom profiler	Sedimentekkolod
SLKS	Agency for Culture and Palaces	Slots- og Kulturstyrelsen
SSS	Side scan sonar	Sideseende sonar
UCH	Underwater cultural heritage	Undersøisk kulturarv
VIR	Viking Ship Museum, Roskilde	Vikingskibsmuseet i Roskilde

### **Administrative data**

The desk-based assessments were completed at the Viking Ship Museum in Roskilde, Denmark, by maritime archaeologist Mikkel H. Thomsen.

The entire NS2 project archive is filed at VIR under file no. 2740.

### **Process overview**

Several route revisions and amendments/additions hereto, totalling more than 2500 survey line kilometres, have been surveyed by two different survey contractors between November 2018 and February 2019.

For a reconnaissance and detailed survey of the route sections *D6* and *D7 deviation* all data types (MBES, SSS, SBP and MAG) were collected by Marin Mätteknik AB using the MMT S-ROV, on board the *M/V Stril Explorer*.

For a detailed survey of sections *D4* and *D5*, MBES, SBP, and Gradiometer data were collected by Next Geosolutions Europe Ltd. using a work-class ROV from the *M/V Ievoli Ivory*.

The line spacing and range settings provide 300 % high frequency SSS coverage in the inner c. +/- 75 m and 200 % out to c. +/- 290 m. Using the low frequency data from the outer survey line brings the coverage up to 300% out to c. +/- 110 m and provides 100 % coverage out to +/- c. 360 m.

**Table 2: Summary of survey parameters**

<b>Campaign</b>	<b>Line spacing (nominal)</b>	<b>SSS range</b>	<b>SSS altitude</b>	<b>SSS coverage (nominal)</b>	<b>MBES resolution</b>
Stril Explorer High pass	100 m	120 m	18-23 m	300 % (LF) - +/- 110 m	0,5 m
Stril Explorer Prime low pass	33.5m	75 m	10-14 m	300 % (HF) - +/- 75 m	0,2 m
Ievoli Ivory	N/A	N/A	N/A	N/A	0,2 m

Data from these campaigns were forwarded to VIR for archaeological screening. Initially SSS data was screened. Later, targets picked during this screening phase, conflicting with the current route design, and having been subject to ROV-based visual inspection, were jointly assessed by VIR, NS2, and MMT at the latter's head office in Gothenburg using available inspection video footage as well as MBES, MAG and in one case SBP data. This assisted in identification of targets and adjustment of exclusion zone buffers.

## **Definitions**

### **Route revisions**

The South-Eastern route consists of three variants D6\_09, D6\_10, and D7\_05 (traversing and circumnavigating the munitions area east of Bornholm respectively) and was delivered to VIR as defined by the GIS files:

*Route D6\_09, D6\_10* (equivalent to W-EN-OFP-POF-DWG-804-D81012EN-02)

*Route D7\_05* (equivalent to W-EN-OFP-POF-DWG-804-D81255EN-02)

on which the confliction analysis was performed.

However, any future route revisions respecting the exclusion zones while still staying within the surveyed, and archeologically screened, area can be permitted on the same terms as routes D6\_09; D6\_10 and D7\_05.

### **Confliction**

A target is considered *outside* the affected area if its assigned exclusion zone does not intersect the lay corridor. It should be noted that other types of intervention works can be applied to segments of the route, necessitating a wider footprint on the seabed. These areas too must respect the exclusion zones. Objects outside the affected area have been assigned (usually circular) exclusion zones (see Appendix 1), and no other mitigation has been carried out.

Conversely, a target is said to be *conflicting* if its final exclusion zone intersects with design route centre line (Figure 2B).

A target is said to be *marginally conflicting* if the target exclusion zone intersects with the design pipelay corridor of +/- 8,25 m (or, eventually, intervention work areas), but does not intersect the design route centre line. Minor pipelay re-routing within the lay corridor is feasible so that the 'as-laid' position of the pipeline does not intersect with the exclusion zone (Figure 2A). In this case the pipelay contractor must manoeuvre away, maintaining a minimum of half the lay corridor from any target exclusion zone; the so-called *lay-avoid* procedure. If this should prove impossible (for example because of proximity of another object on the opposite side of the lay corridor), further mitigation may be required by the Danish Agency for Culture and Palaces (Slots- og Kulturstyrelsen, SLKS), e.g. further investigation, rerouting the pipeline, removing the object, or securing it *in situ*.

Contrary to the Base Case route methodology, no *outside* exclusion zones have been discarded during the process. Therefore future additional rerouting without renewed assessment is possible as long as only previously surveyed areas are used and exclusion zones respected.

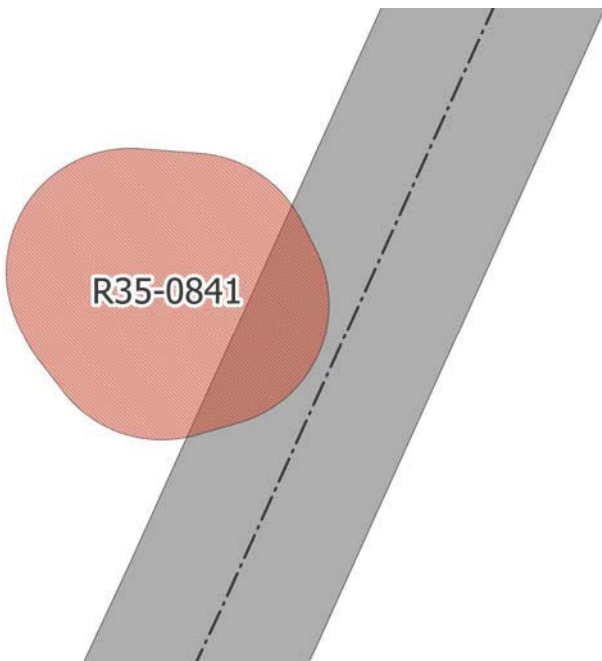


Fig. 2A. Marginally conflicting exclusion zone.

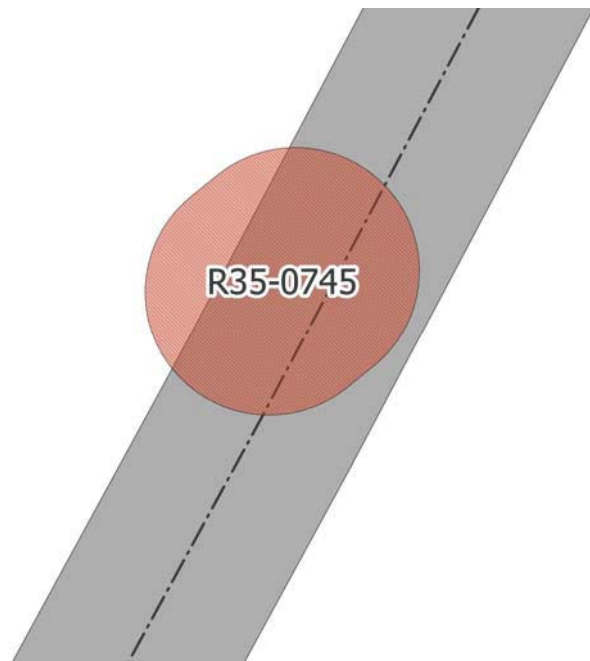


Fig. 2B. Conflicting exclusion zone.

Examples from Base Case route. Drawing: Frederik D. Hyttel © Vikingskibsmuseet.

### ***Desk-based assessment***

All side scan sonar data for the current route revision was screened and potential archaeological objects selected. Selected objects were assigned a first-generation, standard, exclusion zone defined as a circle centred on the target coordinates (single point) – usually 50 or 200 m radius was defined depending on the nature and size of the target.

Zones not intersecting the installation corridor were accepted without further scrutiny, whereas efforts were made to create smaller but better informed zones for objects where the circular first generation zone intersected the installation corridor. This was first based on screen digitising of observed object perimeters in side scan sonar imagery (allowing for the inevitable towed sonar navigation inaccuracies) and buffering this perimeter; usually by 10 m; occasionally more, depending on the nature of the object. If necessary (and where feasible) multibeam sonar imagery was used to eliminate the SSS position inaccuracy, usually resulting in a smaller object perimeter and buffer.

Many of the potentially conflicting cultural heritage objects were also of safety and engineering interest and had therefore been visually inspected by ROV. The screening of video data from conflicting objects not only led to better identification of a number of objects (and hence rejection of non-CHO) but the mapped video inspection coverage were also in some cases used to remove areas clear of CHO from an exclusion zone.

Following completion of the archaeological assessment, a meeting was held (12-08-2019) between NS2, VIR and SLKS, where *marginally conflicting* objects were assessed, resulting in further adjustment and approval of their exclusion zones. Mitigation measures for chance finds during pipelay were also discussed and approved.

## Results

Appendix 1 includes all 128 targets initially selected as potential cultural history objects (p-CHOs) based on SSS interpretation by VIR. The column *UCH status* (Yes, No, or Inconclusive) indicates whether, upon visual inspection wherever possible, the object is classed as protected or written off as modern MMO, geology, or not found. (When left empty, this indicates that a non-conflicting exclusion zone has been accepted as-is and the object is by definition *inconclusive*).

Of these, 108 have been assigned an exclusion zone (first generation circular zone or smaller, perimeter-based and/or adjusted as indicated in the column *Exclusion zone R (m)*). Upon final adjustment, only one of these (SD-DKS33-0153) remain *marginally conflicting* (as indicated in the column *Confliction*), requiring the abovementioned lay-avoid procedure to be observed. There are no *conflicting* objects left after the evaluation.

Five objects positively identified as CHOs are reported to the national sites & monuments register *Fund & Fortidsminder (F&F)*:

**Table 3: Cultural Heritage Object IDs.**

<b>Project-specific ID</b>	<b>VIR file no.</b>	<b>F&amp;F no.</b>	<b>Desc.</b>
SD-DKS33-0046	2909	401753-476	Wreck w. cargo or ballast of angular (cobble?)stones
SD-DKS33-0103	2910	401753-477	Modern iron wreck. Coaster (or similar). Almost completely buried. Exclusion zone voluntary
S-DKS35-0003	2911	401753-478	Iron wreck. Poss. barge or sailing ship
SD-DKS35-0060	2912	401753-479	Clinker-built wooden wreck w. iron elements.
SD-DKSD7S-0407	2913	401753-480	Man-made wooden object. Poss. an oar

## Further action

In conclusion to the continuous dialogue between Nord Stream 2 AG, the Viking Ship Museum and the Danish Agency for Culture and Palaces (Slots- og Kulturstyrelsen), the latter has evaluated the present target assessments. Pipelay according to route designs D6\_09, D6\_10 or D7\_05 can be carried out respecting exclusion zones as defined in the GIS files named:

[block no.] *VIR\_2gen\_zones\_region*  
identical to project-specific files named:  
[block no.] *Join\_Output\_final\_region*

In case of marginally conflicting objects, a so-called lay-avoid procedure can be followed, whereby the pipeline is micro-rerouted; staying within the proposed installation corridor but shifted sideways so as to maintain a distance of half the lay corridor width to *any* exclusion zone. The lay avoid procedure will be applied to the offshore construction contractor via amendments to the pipelay alignment drawings.

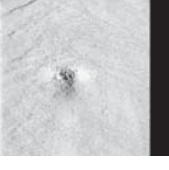

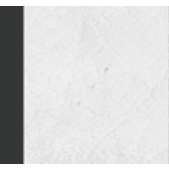


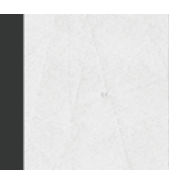
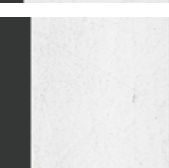
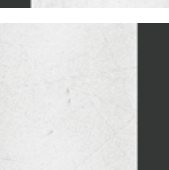
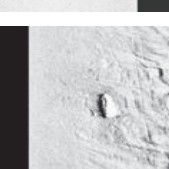
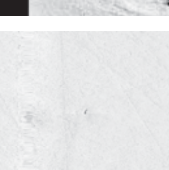
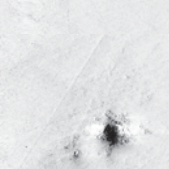

This assessment relates exclusively to route design rev. D6\_09, D6\_10 (W-EN-OFP-POF-DWG-804-D81012EN-02) and D7\_05 (W-EN-OFP-POF-DWG-804-D81255EN-02). However, within the surveyed area, the same methodology can be applied to all charted exclusion zones without necessitating renewed analysis.



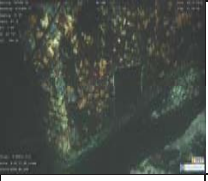
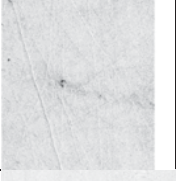
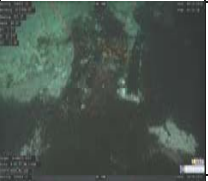

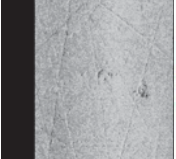
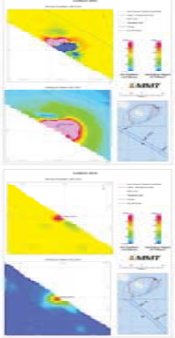

## **Litterature**

Thomsen, M.H. 2019: *Nord Stream 2 Pipeline – North-Western Route. Cultural heritage target assessment and exclusion zone recommendations*. Roskilde.

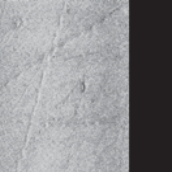




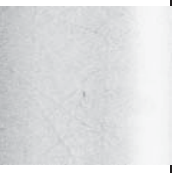






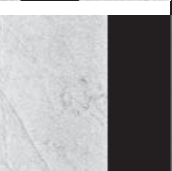
Thomsen, M.H. & Hyttel, F.D. 2018: *Nord Stream 2 Pipeline. Cultural heritage target assessment and exclusion zone recommendations*. Roskilde.

Geophysical Mode Target ID	SSS Easting, m	SSS Northing, m	SSS Latitude	SSS Longitude	SSS Line A KP	SSS Line A Offset, m	SSS Line B KP	SSS Line B Offset, m	Water Depth	Side scan sonar					Gradiometer			Visual					Exclusion Zone R (m)	Confliction			
										SSS Length, m	SSS Width, m	SSS Height, m	SSS Object Type	SSS Description	SSS Image	Magnetic data image	SSS/GRA Correlation, ID, m Offset	ROV object type	ROV Description	ROV (or DTM/SBP) Image	UCH (or UXO) interpretation	UCH status					
DKS33-VIRSS0001	559621,6	6130483,2								28,9	25,1	1,0	Mound	Poss. wreck											200		
DKS33-VIRSS0002	559597,4	6130716,3								37,9	2,9	0,1	Linear object	One or two linear objects; poss. semi-buried if connected												50	
DKS33-VIRSS0003	555676,1	6140323,3								24,9	0,2	0,1	Linear object	One (poss. semi-buried) or more linear objects			R-DKS33-3103				Unknown DK-PL cable. Visually observed at other location	N		0			
DKS33-VIRSS0004	545435,0	6151107,5								4,8	2,7	0,1	Unknown	Crossing lines											50		
DKS33-VIRSS0005	553163,1	6142614,2								2,0	2,5	0,1	Unknown												Perimeter-based		
DKS33-VIRSS0007	558350,1	6105762,5								4,4	0,5	0,1	Linear object	Same as S-DKS34-1172											50		
DKS33-VIRSS0008	555467,5	6140319,9								24,1	0,2	0,0	Linear object	One (semi-buried) or three linear objects											Perimeter-based		
DKS33-VIRSS0009	557444,6	6105076,5								26,1	11,5	2,0	Wreck	Wreck/ballast pile w. surrounding debris											200		
SD-DKS33-0035	551665,5	6143927,1	55° 26.328' N	015° 48.9970' E	13,305	-12,0	13,230	63,0	88,1	2,6	0,7	0,2	Other												50		
SD-DKS33-0046	549570,7	6145794,5	55° 27.3485' N	015° 47.0306' E	10,485	233,2	10,410	309,5	86,9	10,2	6,0	0,6	Debris	Debris pile				Wreck	Possible CHO item - Scattered pieces of wood and stones possibly related to wreck		Wreck. Loose planks nearby may be from this. Cargo or ballast of angular (cobble?)stones	I		200			

Nord Stream 2 Pipeline, SE alternative route

SD-DKS33-0049	559996,9	6129156,7								4,2	0,5	0,1	Linear Object	x2 linear objects, Correlates to NEXT historic target, R-DKS33-20010					Hose, modern	N	0					
SD-DKS33-0103	560052,0	6131871,3	55° 19.7724' N	015° 56.7938' E	28,780	-304,8	28,766	-229,0	91,7	38,6	9,6	2,0	Wreck	Centre of wreck				-	Wreck	Wreck		Iron wreck. Coaster (or similar) c. 72 m long w. 1 central mast and 4 crane booms. 2 hatches. Almost completely buried. Exclusion zone voluntary	N	200		
SD-DKS33-0105	554989,3	6141022,5	55° 24.7413' N	015° 52.1143' E	17,717	-98,6	17,643	-23,6	89,1	2,4	0,8	0,2	Debris					-						Perimeter-based		
SD-DKS33-0110	558523,8	6137696,4	55° 22.9237' N	015° 55.4218' E	22,574	-22,1	22,503	52,9	89,4	5,7	2,9	0,0	Debris	NMH				-				No data. Nearest object 21 m away	I	Perimeter-based, adjusted		
SD-DKS33-0112	545596,5	6150704,9	55° 30.0188' N	015° 43.3087' E	4,011	23,8	3,984	85,3	79,8	2,0	1,7	0,0	Debris	NMH										Perimeter-based, adjusted		
SD-DKS33-0114	548673,2	6146699,0	55° 27.8415' N	015° 46.1886' E	9,197	26,1	9,108	101,1	85,3	1,9	0,6	0,0	Linear Object	NMH										Perimeter-based		
SD-DKS33-0152	556279,2	6139673,3	55° 24.0051' N	015° 53.3203' E	19,583	24,0	19,503	99,1	89,2	4,4	6,2	0,0	Debris	NMH										Perimeter-based		
SD-DKS33-0153	558604,7	6137594,6	55° 22.8682' N	015° 55.4971' E	22,703	-10,2	22,634	64,8	89,7	2,4	1,0	0,1	Debris										Some linear features w. iron staining. Maybe some wood. Also some poss. Wire. Exclusion zone adjusted based on visual obs: nothing SW of observed object	I	Perimeter-based, adjusted	Marginally conflicting
SD-DKS33-0159	559893,5	6115383,0	55° 10.8849' N	015° 56.4336' E	45,270	-110,3	45,258	-35,3	88,7	1,6	1,0	0,0	Debris	NMH											Perimeter-based	
SD-DKS33-0227	556284,0	6139690,8	55° 24.0145' N	015° 53.3250' E	19,575	7,4	19,496	82,4	89,2	3,1	0,7	0,0	Debris	NMH			G-DKS33-3092, 1.77m	Wire	Partially buried wire. Additional wire detected ~19 m SE of target location, associated with SD-DKS33-0152 (not part of the inspection scope).		Wire/cable	N	0			



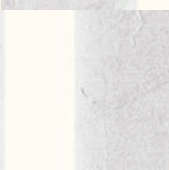

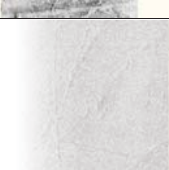
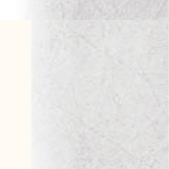
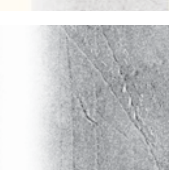
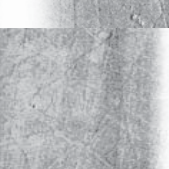
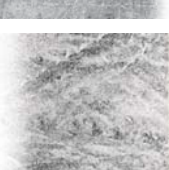

Nord Stream 2 Pipeline, SE alternative route

SD-DKS33-0231	550354,5	6145337,8	55° 27.0975' N	015° 47.7692' E	11,369	-39,4	11,307	35,6	87,0	2,6	0,5	0,3	Debris		-	Debris	Wooden debris				50			
SD-DKS33-0234	550349,8	6145299,0	55° 27.0766' N	015° 47.7642' E	11,397	-12,2	11,336	62,8	87,2	1,8	0,4	0,2	Debris		-	Debris	Wooden debris				50			
SD-DKS33-0288	550817,9	6145340,0								1,1	0,5	0,3	Debris						UXO. German KC-250 chemical bomb	N	0			
SD-DKS33-0300	552509,7	6143202,8								2,3	0,4	0,1	Linear Object									Perimeter-based		
S-DKS33-0130	559814,0	6133966,3	55° 20.9035' N	015° 56.5955' E	26,672	122,5	26,663	197,5	89,6	3,0	1,5	0,5	Debris		-							50		
S-DKS33-0241	550659,3	6145317,7	55° 27.0847' N	015° 48.0580' E	11,568	-270,4	11,507	-195,4	87,2	3,6	1,0	0,0	Debris	NMH		-	Debris	Tangled rope and wooden debris					Perimeter-based	
DKS34_VIRSS0003	554524,3	6101622,2								13,0	0,6	0,2	Linear object	Linear object									50	
DKS34_VIRSS0004	570194,1	6144978,5								1,7	0,6	0,3	Unknown	Unknown object in/across trawl scar									50	
DKS34_VIRSS0005	569503,5	6143604,5								2,9	1,7	0,6	Unknown	Unknown object									50	
DKS34_VIRSS0008	563418,2	6125700,7								14,7	12,9	0,3	Debris	Poss. wreck									200	



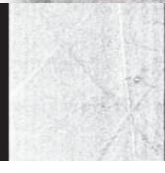
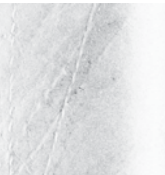
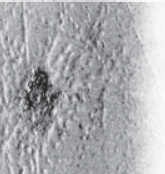
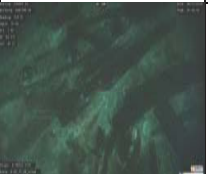

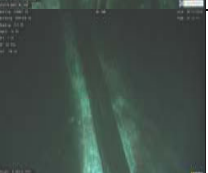


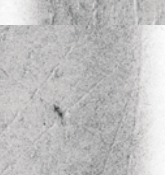

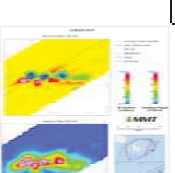

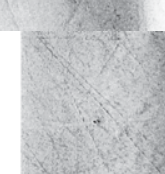
Nord Stream 2 Pipeline, SE alternative route

DKS34_VIRSS0009	564338,2	6129629,9											14,7	0,5	0,1	Linear angled	Linear object; semi-buried																	50			
DKS34_VIRSS0010	561062,0	6116419,5											11,5	0,2	0,0	Linear no height	Linear object NMH																		50		
S_DKS34_0172	558350,8	6105763,0											5,3	0,8	0,0	Debris																			50		
SD-DKS34-0034	560941,2	6115849,6	55° 11.1287' N	015° 57.4266' E	31,144	-19,6	31,136	55,4	88,7	8,2	0,6	0,3				Linear Object	Linear debris																		50		
SD-DKS34-0035	558592,6	6105912,1											3,3	0,3	0,1	Linear Object																			50		
SD-DKS34-0036	558248,0	6105114,4											3,4	0,3	0,3	Linear Object																			50		
SD-DKS34-0054	560838,4	6115300,7	55° 10.8336' N	015° 57.3227' E	31,702	-51,7	31,694	23,3	88,6	3,3	1,0	0,1				Debris																			50		
SD-DKS34-0062	561900,0	6119681,1	55° 13.1871' N	015° 58.3803' E	27,195	-29,5	27,186	45,5	88,9	2,0	0,3	0,1				Linear Object																				50	
SD-DKS34-0069	564255,0	6129175,0	55° 18.2870' N	016° 0.7310' E	17,413	-31,5	17,402	43,6	88,3	3,2	0,3	0,1				Linear Object																				50	
SD-DKS34-0074	565784,8	6135271,9	55° 21.5616' N	016° 2.2625' E	11,126	-53,7	11,117	21,3	86,1	2,4	0,5	0,2				Debris	Possibly fishing gear																			50	

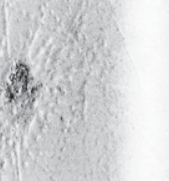





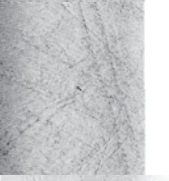

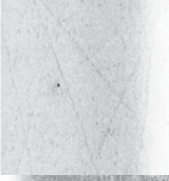





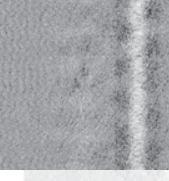



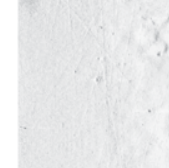
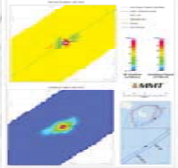

**Nord Stream 2 Pipeline, SE alternative route**

SD-DKS34-0079	566489,1	6137906,9	55° 22.9763' N	016° 2.9666' E	8,399	-104,1	8,390	-29,1	84,5	3,2	0,5	0,2	Linear Object											50		
SD-DKS34-0083	566700,8	6139023,2	55° 23.5763' N	016° 3.1830' E	7,264	-41,3	7,256	33,7	84,4	2,6	0,3	0,1	Linear Object												50	
SD-DKS34-0086	567877,3	6141536,1	55° 24.9213' N	016° 4.3339' E	4,439	-90,4	4,458	-15,4	83,0	6,1	0,3	0,4	Linear Object												50	
SD-DKS34-0088	569306,8	6143676,7	55° 26.0631' N	016° 5.7204' E	1,865	-39,3	1,885	35,7	81,5	11,5	0,5	0,2	Linear Object												50	
SD-DKS34-0104	562297,2	6121546,2	55° 14.1896' N	015° 58.7796' E	25,289	33,1	25,281	108,1	89,6	3,1	0,3	0,2	Linear Object												50	
SD-DKS34-0107	554008,9	6100760,2								4,5	0,9	0,2	Linear object												Perimeter-based	
SD-DKS34-0126	563674,3	6126911,1	55° 17.0711' N	016° 0.1515' E	19,750	-14,3	19,742	60,7	89,2	9,4	0,7	0,5	Linear Object												50	
SD-DKS34-0167	562999,0	6124486,1								4,5	1,0	0,0	Debris												50	
SD-DKS34-0176	569009,9	6143435,7	55° 25.9358' N	016° 5.4354' E	2,233	66,5	2,252	141,5	81,7	3,2	0,6	0,3	Linear Object												50	
SD-DKS34-0193	569239,8	6143240,8								3,8	1,8	0,3	Debris												50	

Nord Stream 2 Pipeline, SE alternative route




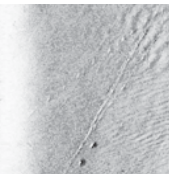
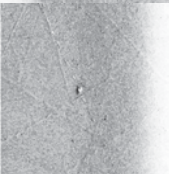
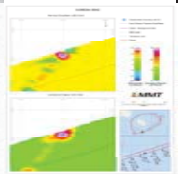

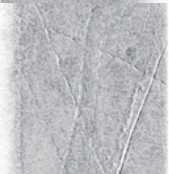

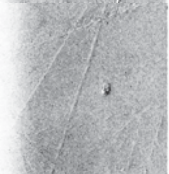

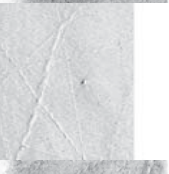
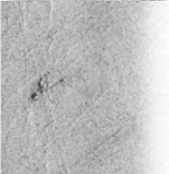
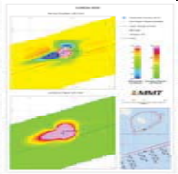

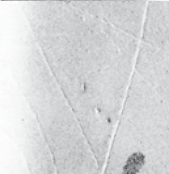


SD-DKS34-0200	567651,8	6141535,7									13,0	1,0	0,0	Linear Object	NMH												50					
SD-DKS34-0205	569581,9	6144229,8	55° 26.3589' N	016° 5.9895' E	1,259	64,5	1,284	139,8	81,0	2,4	0,5	0,1	Linear Object																50			
DKS35_VIRSS0003	526992,9	6079392,4									4,8	0,8	0,5	Linear Object	Linear object															Perimeter-based		
SD-DKS35-0049	530499,7	6082349,4	54° 53.2356' N	015° 28.5277' E	91,664	25,4	91,720	99,2	74,3	1,8	0,4	0,3	Linear Object																		Perimeter-based	
SD-DKS35-0060	536855,8	6087397,7	54° 55.9317' N	015° 34.5113' E	83,548	302,3	83,608	377,9	77,7	13,5	11,1	0,4	Debris	Pile of numerous debris targets			Wreck	Possible shipwreck likely CHO interest			Clinker-built wooden wreck. At least one section of articulated hull structure. Scattered planks and iron elements.	Y							100			
SD-DKS35-0061	536867,1	6087305,2	54° 55.8818' N	015° 34.5212' E	83,593	219,4	83,654	295,1	76,8	12,9	0,3	0,2	Linear Object				Debris	Possible mast related to R-DKS35-0060. Likely CHO interest.			Poss. mast from SD-DKS35-0060	I							50			
SD-DKS35-0062	536857,7	6087313,9	54° 55.8866' N	015° 34.5125' E	83,596	231,9	83,657	307,5	77,3	2,5	0,8	0,4	Linear Object				Debris	Possible wooden plank related to R-DKS35-0060. Likely CHO interest			Poss. mast from SD-DKS35-0060	I							50			
SD-DKS35-0066	538983,5	6089072,0	54° 56.8248' N	015° 36.5172' E	80,796	73,3	80,842	148,6	78,5	5,3	1,6	0,0	Debris	NMH																50		
SD-DKS35-0073	550966,2	6098562,4	55° 1.8766' N	015° 47.8421' E	65,509	-79,1	65,566	-3,2	85,1	15,7	0,4	0,0	Linear Object	NMH			Wire	G-DKS35-3019, 0.33m G-DKS35-3021, 4.14m	3cm thick wire coiled across route. Combined 3019. 3020. 3021. Total length and width is estimated from gradiometer data			Wire/cable	N							0		
SD-DKS35-0074	550897,9	6098407,8	55° 1.7936' N	015° 47.7763' E	65,662	-158,1	65,717	-82,2	84,7	5,4	0,2	0,0	Linear Object	NMH																	50	

Nord Stream 2 Pipeline, SE alternative route

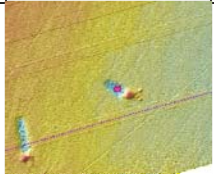
SD-DKS35-0188	536869,2	6087382,5	54° 55.9235' N	015° 34.5238' E	83,545	282,1	83,606	357,7	77,4	6,7	0,3	0,0	Linear Object	NMH				Nothing found	Nothing found				50	
SD-DKS35-0199	540219,8	6089928,7	54° 57.2808' N	015° 37.6824' E	79,302	-58,7	79,357	16,3	78,6	10,7	0,4	0,1	Debris								No data. Object - if any - seems to lie in depression. Exclusion zone adjusted based on MBES true perimeter	I	Perimeter-based, adjusted	
SD-DKS35-0201	531407,3	6083029,7	54° 53.5990' N	015° 29.3810' E	90,531	-5,0	90,587	70,0	74,2	3,5	0,8	0,4	Debris					Nothing found	Nothing found		Not magnetic. Pres. seabed depression. Poss ass. w. trawl scar	N	0	
SD-DKS35-1066	539010,5	6090793,3	54° 57.7527' N	015° 36.5566' E	79,714	1369,6	79,770	1444,6		3,1	1,0	0,3	Debris					Munition	Confirmed UXO		UXO	50		
SD-DKS35-1123	543722,9	6093157,7								1,8	0,7	0,0	Linear Object	NMH								Perimeter-based		
S-DKS35-0003	551072,4	6098346,2	55° 1.7593' N	015° 47.9394' E	65,559	-315,0	65,615	-239,2	84,5	28,0	5,1	2,0	Wreck					Wreck	Possibly of CHO interest		Iron wreck. No sign of propulsion (engine/boiler). Poss. barge or sailing ship ('clipper' stem)	I	200	
S-DKS35-0020	527069,8	6079777,7	54° 51.8608' N	015° 25.3052' E	95,952	134,2	96,006	209,2	72,3	2,5	0,6	0,2	Debris									50		
S-DKS35-0023	549742,2	6097705,5	55° 1.4220' N	015° 46.6843' E	67,004	132,3	67,056	207,5	84,5	5,0	0,4	0,2	Linear Object									50		
S-DKS35-0248	551196,5	6098445,2	55° 1.8119' N	015° 48.0570' E	65,390	-310,8	65,449	-235,0	84,9	5,3	0,9	0,0	Linear Object	NMH								50		
S-DKS35-0249	551206,6	6098370,5	55° 1.7716' N	015° 48.0656' E	65,429	-377,0	65,487	-301,2	85,1	2,0	1,3	0,3	Debris									50		




Nord Stream 2 Pipeline, SE alternative route

S-DKS35-1062	538120,0	6087752,0	54° 56.1171' N	015° 35.6978' E	82,327	-233,1	82,379	-158,1	77,7	3,2	0,5	0,0	Boulder	NMH				Munition	Confirmed UXO. Fully exposed		Russian MKD sensor magnetic influence mine. 850 kg explosives			50			
DKS36_VIRSS0001	510522,6	6068598,0								2,3	0,8	0,4	Unknown	Unknown, angular object; poss. large boulder												Perimeter-based	
SD-DKS36-0028	497274,2	6063277,7	54° 43.0074' N	014° 57.4612' E	130,357	-63,1	130,43	11,9	58,1	1,4	0,5	0,0	Debris	NMH							Wire. GRA shows it is connected to SD-DKS36-0029	N		0			
SD-DKS36-0029	497270,8	6063272,4	54° 43.0046' N	014° 57.4580' E	130,362	-66,7	130,435	8,3	58,0	2,4	1,2	0,0	Debris	Possible object in depression as seen in MBES			G-DKS36-3042, 1.25m	Wire	Wire rope. several exposed areas.		Wire	N		0			
SD-DKS36-0049	506789,6	6067201,3	54° 45.1208' N	015° 6.3294' E	120,054	-36,2	120,133	64,2	63,6	2,2	0,8	0,0	Debris	Possible object in depression as seen in MBES				Debris	Wire						Perimeter-based		
SD-DKS36-0062	520021,4	6073941,6	54° 48.7339' N	015° 18.6922' E	105,1	-72,6	105,154	2,4	69,1	3,5	2,3	0,1	Debris					Debris	Wooden sheet		Not magnetic. Pres. plywood sheet	N		0			
SD-DKS36-0068	522224,5	6075838,0	54° 49.7509' N	015° 20.7576' E	102,196	48,7	102,25	123,7	69,4	2,5	0,5	0,1	Linear Object													Perimeter-based	
SD-DKS36-0082	510109,0	6068516,7	54° 45.8267' N	015° 9.4265' E	116,486	-42	116,563	33,5	65,2	3,1	0,4	0,1	Linear Object	(incl. 0020/0081)										50			
SD-DKS36-0090	504358,4	6066254,1	54° 44.6116' N	015° 4.0621' E	122,67	27	122,742	102	62,1	2,6	0,8	0,0	Debris	NMH. Other objects in vicinity. Could be larger debris field				Debris	Wire						Perimeter-based		
SD-DKS36-0105	515970,3	6070835,2	54° 47.0677' N	015° 14.8998' E	110,189	-106,4	110,26	-31	67,6	1,9	0,6	0,4	Linear Object													Perimeter-based	



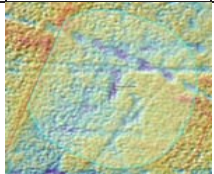
Nord Stream 2 Pipeline, SE alternative route

SD-DKS36-0116	517655,2	6072190,3	54° 47.7949' N	015° 16.4767' E	108,043	21,1	108,097	96,1	67,9	1,6	0,2	0,0	Linear Object								Perimeter-based
S-DKS36-0009	502032,9	6065044,2	54° 43.9601' N	015° 1.8942' E	125,279	-218,3	125,352	-143,3	60,5	3,6	0,7	0,3	Linear Object								50
S-DKS36-0100	496931,2	6063083,7	54° 42.9027' N	014° 57.1418' E	130,748	-113,7	130,821	-38,7	57,9	1,9	1,2	0,6	Debris								Perimeter-based
S-DKS36-0103	499722,6	6064463,5	54° 43.6473' N	014° 59.7416' E	127,638	113,6	127,696	238,7	59,6	17,1	9,5	0,7	Debris	Cluster of debris							100
DKS37_VIRSS0002	488463,7	6059553,2								5,9	1,8	0,0	Linear no height	Linear object NMH							50
DKS37_VIRSS0003	494551,0	6062118,3								2,9	0,8	0,0	Linear no height	Poss. linear object(s) NMH							50
DKS37_VIRSS0004	476517,6	6058752,0								1,2	0,0	0,0	Linear no height	Linear object NMH							Perimeter-based
DKS37_VIRSS0006	472385,9	6058285,7								14,7	5,4	0,0	Mound no height	Boat-shaped anomaly w. scour; NMH. Nearby points targets included					Nord Stream 1 anchor pull-out pit. Several similar in vicinity	N	0
DKS37_VIRSS0007	487793,9	6059533,9								4,2	2,3	0,0	Unknown	Unknown object NMH; w. scour							Perimeter-based
DKS37_VIRSS0008	479965,5	6059067,8								8,0	1,4	0,2	Linear angled	Linear object							50

**Nord Stream 2 Pipeline, SE alternative route**

SD-DKS37-0039	469668,5	6055970,2	54° 39.0128' N	014° 31.7950' E	159,727	-100,3	159,765	-45,4	39,9	1,5	0,8	0,1	Debris	Poss. part of group								Perimeter-based
SD-DKS37-0055	478205,5	6058831,0	54° 40.5819' N	014° 39.7205' E	150,163	-13,3	150,261	66,7	49,4	8,0	1,0	0,1	Linear Object	Corresponds to target B-DKS-50003 from previous survey								Perimeter-based, adjusted
SD-DKS37-0115	484737,8	6059202,3	54° 40.7965' N	014° 45.7974' E	143,616	-106,2	143,715	-49,7	51,9	1,9	0,8	0,3	Linear Object		UXO	Sweep obstructor		German rotary (paravane) "hammerbox" sweep obstructor. NIL explosive. Potential for explosive sweep cutters under or in the vicinity of the item				Perimeter-based
SD-DKS37-0132	491519,8	6060964,9	54° 41.7565' N	014° 52.1055' E	136,559	-39,1	136,633	35,9	55,0	2,4	0,5	0,3	Debris									Perimeter-based
SD-DKS37-0185	469287,6	6055703,4	54° 38.8676' N	014° 31.4425' E	160,170	40,0	160,208	94,9	38,4	1,8	0,5	0,1	Debris									Perimeter-based
SD-DKS37-0198	468815,8	6054782,0	54° 38.3690' N	014° 31.0097' E	161,189	-145,7	161,226	-90,8	34,8	8,3	0,4	0,1	Linear Object									50
SD-DKS37-0204	478975,6	6058923,1	54° 40.6335' N	014° 40.4366' E	149,390	35,1	149,493	112,0	49,8	5,9	0,6	0,2	Linear Object									Perimeter-based
DKSD7N_VIRSS0002	545513,6	6150372,7								5,8	3,3	0,0	Unknown	NMH								50
DKSD7N_VIRSS0004	546254,5	6146860,8								9,3	1,3	0,1	Linear Object	Linear object								50
SD-DKSD7N-0003	545551,2	6150748,5	55° 30.0426' N	015° 43.2661' E	3,966	58,5	3,942	119,1	79,6	1,9	1,1	0,0	Debris	NMH								50

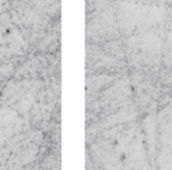

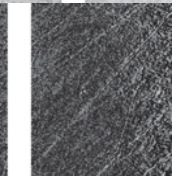
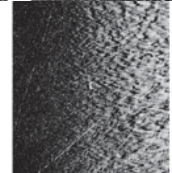
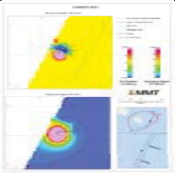

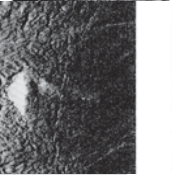
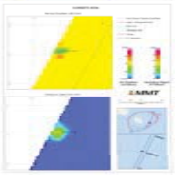



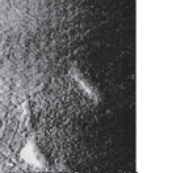
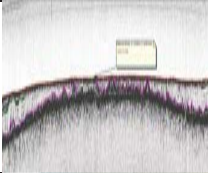
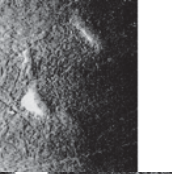
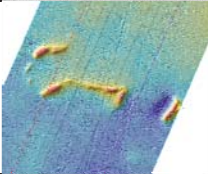
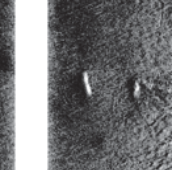

Nord Stream 2 Pipeline, SE alternative route

SD-DKSD7N-0005	545723,1	6149284,4	55° 29.2524' N	015° 43.4149' E	5,438	-10,2	5,415	51,5	81,3	3,9	0,4	0,0	Linear Object	NMH		G-DKSD7N-3005, 1,64m	Linear object	Linear metal debris		Modern metal debris w. handle	N	0	
SD-DKSD7N-0012	545949,7	6145501,5	55° 27.2117' N	015° 43.5925' E	9,228	29,3	9,204	94,0	85,0	3,3	0,3	0,3	Linear Object							I	Perimeter-based		
SD-DKSD7N-0014	546022,2	6144653,1	55° 26.7539' N	015° 43.6529' E	10,079	16,5	10,056	81,9	86,2	1,3	0,8	0,3	Debris							I	Perimeter-based, adjusted		
SD-DKSD7N-0026	546420,1	6138616,6	55° 23.4974' N	015° 43.9699' E	16,129	43,3	16,105	113,4	91,9	2,9	0,6	0,0	Linear Object	NMH			Wire	2 Wires - partly buried		Wire/fishing gear	N	0	
SD-DKSD7N-0033	544252,2	6125807,1	55° 16.6036' N	015° 41.7953' E	29,428	-16,2	29,439	58,9	95,6	3,1	1,7	0,4	Debris							I	Perimeter-based, adjusted		
SD-DKSD7N-0037	542297,9	6121123,9	55° 14.0891' N	015° 39.9075' E	34,502	43,3	34,513	118,4	94,8	5,4	0,9	0,6	Linear Object							I	Perimeter-based		
SD-DKSD7N-0039	540437,2	6116327,6	55° 11.5126' N	015° 38.1108' E	39,646	-26,2	39,657	48,9	93,2	2,5	0,2	0,1	Linear Object							I	Perimeter-based		
SD-DKSD7N-0045	543042,9	6122823,2	55° 15.0013' N	015° 40.6259' E	32,648	-11,6	32,658	63,5	95,3	3,9	0,1	0,0	Linear Object	NMH						No data. Exclusion zone adjusted based on MBES true perimeter	I	Perimeter-based, adjusted	
SD-DKSD7N-0051	546704,1	6135524,6	55° 21.8289' N	015° 44.2079' E	19,233	-22,9	19,209	49,6	93,7	1,4	0,4	0,2	Debris							I	Perimeter-based, adjusted		
SD-DKSD7N-0052	546867,4	6132749,9	55° 20.3321' N	015° 44.3347' E	22,007	-57,1	21,995	19,1	94,4	3,1	0,4	0,2	Linear Object							I	Perimeter-based, adjusted		

Nord Stream 2 Pipeline, SE alternative route

SD-DKSD7N-0054	545767,5	6129605,6	55° 18.6432' N	015° 43.2635' E	25.339	0.3	25.349	75.3	95.4	5.0	0.2	0.0	Cable	NMH			G-DKSD7N-3185, 0.64m G-DKSD7N-3186, 4.57m	Debris	Rope - partially buried, wrapped in possible plastic - 4cm diameter		Rope/fishing gear	N	0	
SD-DKSD7N-0067	546121,7	6144820,6	55° 26.8437' N	015° 43.7489' E	9,919	-94,5	9,896	-29,3	85,7	5,1	0,2	0,2	Linear Object								I	Perimeter-based		
SD-DKSD7N-0089	546165,1	6144164,4	55° 26.4897' N	015° 43.7835' E	10,577	-91,7	10,553	-26,0	86,6	13,7	0,4	0,0	Linear Object	NMH							I	Perimeter-based, adjusted		
SD-DKSD7N-0111	545909,5	6146965,0	55° 28.0009' N	015° 43.5689' E	7,765	-33,3	7,741	30,2	83,9	1,1	0,3	0,0	Linear Object	NMH							I	Perimeter-based		
S-DKSD7N-0126	545434,8	6151108,2	55° 30.2372' N	015° 43.1591' E	3,605	152,7	3,583	212,4	79,2	5,0	1,0	0,2	Debris					Debris	Metal frame partially buried				50	
S-DKSD7N-0145	545146,3	6127436,5	55° 17.4772' N	015° 42.6554' E	27,582	-235,5	27,593	-160,5	95,7	2,7	1,0	0,4	Debris					Wire	Wire/cable				50	
S-DKSD7N-0161	544531,0	6125978,7	55° 16.6946' N	015° 42.0603' E	29,165	-210,5	29,175	-135,5	95,4	29,8	3,7	0,0	Linear Object	NMH									50	
S-DKSD7N-0165	545928,6	6148075,9	55° 28.5997' N	015° 43.5981' E	6,659	-130,4	6,635	-67,8	82,8	2,4	0,3	0,1	Debris										50	
SD-DKSD7S-0088	537252,3	6108378,6	55° 7.2420' N	015° 35.0467' E	48,210	-47,8	48,220	27,3	76,2	1,8	1,4	0,0	Debris	NMH In depression Connected to SD-DKSD7S-0089				Nothing found	Nothing found		Pit from dragged boulder SD-DKSD7S-0089	N	0	
SD-DKSD7S-0197	530663,5	6092336,4	54° 58.6197' N	015° 28.7448' E	65,557	58,1	65,563	133,3	76,4	2,7	0,3	0,0	Linear Object	NMH										50, adjusted

Nord Stream 2 Pipeline, SE alternative route

SD-DKSD7S-0407	537276,9	6108582,3	55° 7.3516' N	015° 35.0714' E	48,012	5,6	48,022	80,7	76,3	2,7	0,5	0,0	Linear Object	NMH		Linear object	Metal pipe/bar		Not metallic. Pres. wooden MMO. Poss. an oar	I	Perimeter-based, adjusted
SD-DKSD7S-0430	536217,5	6105699,7	55° 5.8022' N	015° 34.0527' E	51,085	-90,9	51,092	-15,7	71,8	3,8	0,3	0,0	Linear Object	NMH					I	Perimeter-based, adjusted	
SD-DKSD7S-0432	535926,5	6105011,3	55° 5.4323' N	015° 33.7739' E	51,829	-78,6	51,839	-3,5	70,9	2,5	0,5	0,4	Debris		 	Boulder	2 Boulders (dimensions are of largest boulder)		Two boulders	N	0
SD-DKSD7S-0468	535207,6	6103276,0	55° 4.4998' N	015° 33.0853' E	53,707	-61,5	53,717	13,6	70,1	16,1	4,0	1,4	Other		 	Nothing found	Nothing found - 10x10m search grid shows scattered boulders up to 0.3m within area		Glacial till outcrop. One of a series w. SD-DKSD7S-0467, 0468, 0485 and 0486	N	0
SD-DKSD7S-0481	532469,7	6096634,1	55° 0.9300' N	015° 30.4672' E	60,891	-8,4	60,901	66,8	75,5	5,7	0,3	0,0	Debris	NMH		Nothing found	Nothing found		Pres. seabed scar	N	0
SD-DKSD7S-0485	535142,8	6103281,7	55° 4.5032' N	015° 33.0244' E	53,73	0,8	53,737	76,0	70,5	12,3	0,4	0,4	Other						Glacial till outcrop. One of a series w. SD-DKSD7S-0467, 0468, 0485 and 0486	N	0
SD-DKSD7S-0486	535132,0	6103309,5	55° 4.5182' N	015° 33.0145' E	53,708	21,2	53,715	96,4	71,0	29,0	2,6	1,1	Other						Glacial till outcrop. One of a series w. SD-DKSD7S-0467, 0468, 0485 and 0486	N	0
S-DKSD7S-0467	535251,6	6103259,0	55° 4.4905' N	015° 33.1265' E	53,706	-108,6	53,717	-33,4	70,3	17,6	6,1	1,1	Debris	Checked with MBES		Nothing found	Nothing found		Glacial till outcrop. One of a series w. SD-DKSD7S-0467, 0468, 0485 and 0486	N	0