Nord Stream 2 Natural Gas Pipeline construction and operation in the Finnish EEZ Environmental and Technical Monitoring Quarterly Report Q2 2018

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Summary

The report presents results and preliminary findings of the environmental and technical monitoring for construction activities of Nord Stream 2 Gas Pipeline in the Finnish EEZ for the second quarter 2018. Monitoring is based on the report Natural Gas Pipeline Route through the Baltic Sea – Environmental Monitoring Programme, Finland by Nord Stream 2 (W-PE-EMS-PFI-REP-805-032300EN-11). The programme has been approved on 12.4.2018 within the water permit decision (Nro 53/2018/2, Dnro ESAVI/9101/2017).

Sitowise Oy prepared this report based on data and reports provided by Nord Stream 2 AG and monitoring contractors. All findings are preliminary and final conclusions will be reported in annual report for 2018 to be published in May 2019.

The construction activities during the second quarter were munitions clearance, the first campaign of rock placement and pre-installation surveys for mattress installation.

The munitions clearance was successfully completed in the second quarter. The charge of munitions was either comparable to the charge presented in the permit application or smaller.

The area where the permanent threshold shift (PTS) level (risk of permanent hearing damage) of marine mammals was reached was significantly smaller than was assessed to in the permit application in all 3 vessel based munitions clearances. The PTS level was not reached within any of the adjacent Natura 2000 areas.

NSP2 has decided to conduct sampling of sediment contaminants and explosive residuals for 2 munition clearances. The sediment toxicity analysis at munition clearance locations showed no residuals of explosives exceeding the laboratory detection limits.

The first water quality analysis will be carried out during Q3.

A wreck inspection survey for the monitoring object S-R05-7978 and an anti-submarine net verification survey for monitoring object S-R09-09806 were performed in early May 2018.

Content

Annexes

Annex 1 Luode Consulting Oy 2018. Interim report of underwater noise monitoring during munition clearance in the Finnish EEZ. W-GE-EMO-PFI-REP-812-UWNIREEN-05

Annex 2 Nord Stream 2 construction activities during Q2/2018

1 Introduction

The report presents results and preliminary findings of the environmental and technical monitoring for the construction activities of Nord Stream 2 Gas Pipeline in the Finnish EEZ for the second quarter (Q2) of 2018.

Nord Stream 2 AG has started construction activities for a new two-pipeline offshore natural gas system from Russia to Germany through the Baltic Sea (Figure 1). The length of the corridor is approximately 1,200 km. Parallel pipelines pass through the territorial waters and/or Exclusive Economic Zones (EEZ) of Russia, Finland, Sweden, Denmark and Germany. In the Finnish EEZ the route follows the existing Nord Stream pipeline route. The length of the route in the Finnish sector is approximately 374 km. Pipelay of Line A started on the 5th of September 2018 and Pipelay of Line B is scheduled to start in 2019. Both lines are planned to be ready by the end of 2019, after which the pipelines are planned to be taken into operation.

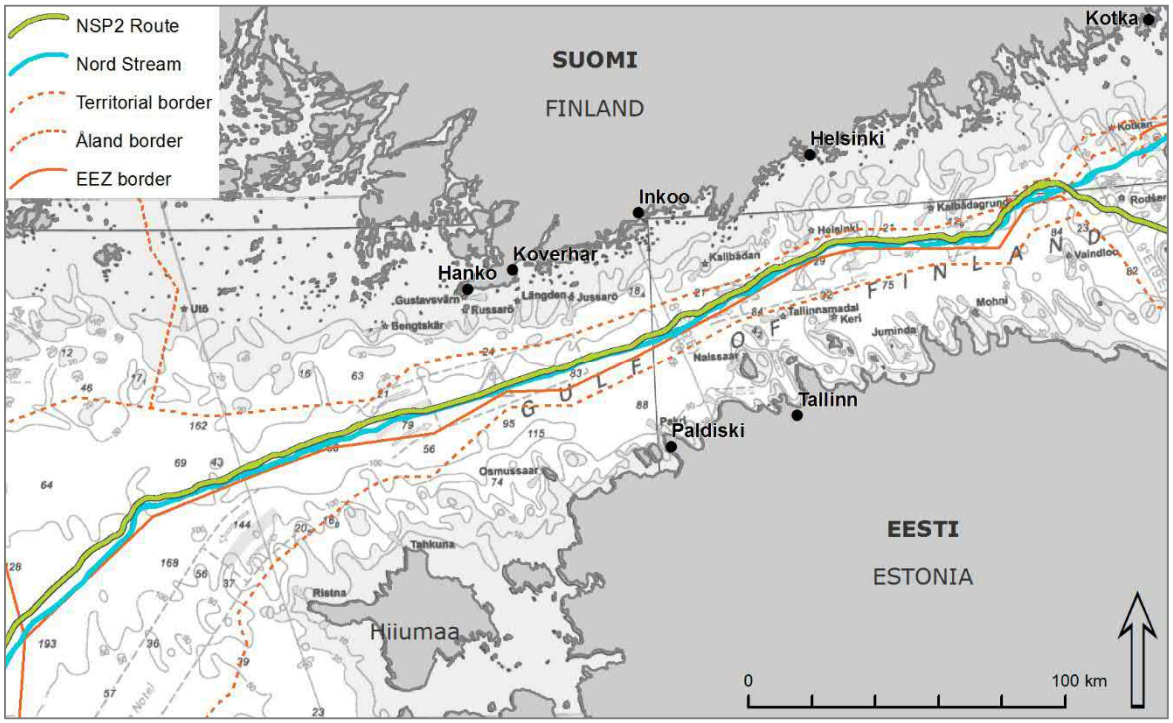


Figure 1. Nord Stream 2 route passes through the Finnish EEZ.

Nord Stream 2 AG is responsible for environmental monitoring and reporting during construction and operation of the pipelines. The content of monitoring is presented in the report Natural Gas Pipeline Route through the Baltic Sea – Environmental Monitoring Programme, Finland (W-PE-EMS-PFI-REP-805-032300EN-11, Ramboll 1.2.2018). The programme has been approved within the water permit decision 12.4.2018 (N:o 53/2018/2, Dnro ESAVI/9101/2017).

Monitoring is most intensive during the construction phase (Table 1).

Table 1. General schedule for monitoring activities 2018–2023 in the Finnish EEZ (based on Ramboll 2018, modified).

Monitoring target	Construction		Operation			
	2018	2019	2020	2021	2022	2023
Underwater noise	X					
Water quality and currents	X	X				
Commercial fishery					X	
Cultural heritage	X		X			

The supervising authorities for monitoring of underwater noise, turbidity and water quality are the regional ELY-Centres (The Centres for Economic Development, Transport and the Environment). For fishery monitoring, the supervising authority is Southwest Finland ELY-Centre. For cultural heritage, the supervising authority is National Board of Antiquities.

Quarterly reports will be provided three months after the end of the quarter during the construction period, and annual reports by the end of May the following year during construction and during operation.

Quarterly reporting aims at presenting the main results from technical and environmental monitoring to authorities. For this reason, they are concise and focused on results. Annual reports will include further data analysis, comparisons to the impact assessments presented in the EIA Report and the permit application and more thorough discussion on the observed impacts.

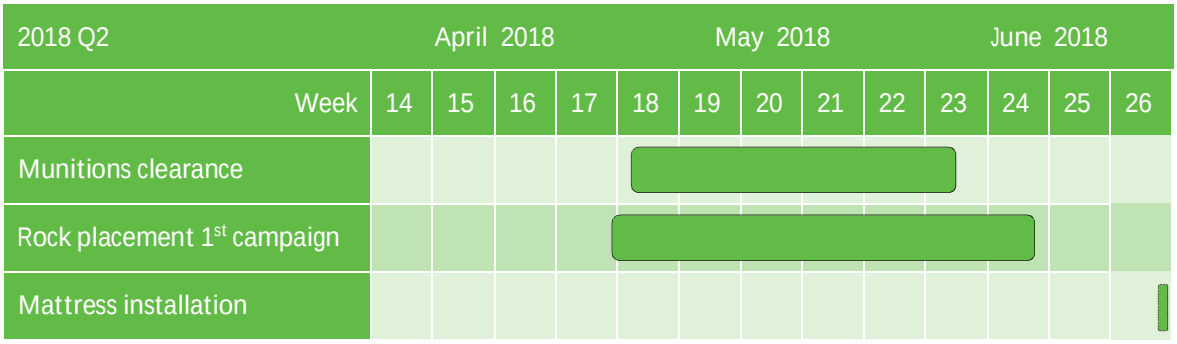
2 Construction activities during the second quarter

2.1 Schedule

The construction activities during the second quarter were munitions clearance, the first campaign of rock placement and pre-survey for mattress installation (Table 2). Munitions clearance started in the beginning of May and was completed in early June (3.5–6.6.2018). First rock placement campaign started in Finland 29.4 and ended 15.6.2018. The mattress installation at pipeline and cable crossings started 30.6.2018 with pre-installation surveys. The actual installation of mattresses started on the 1.7.2018 and will be reported in the Q3 report.

The second rock placement campaign is planned to start in August 2018. The pipelay (Line A) started on 5.9.2018. Line B is planned to be laid in 2019. Both lines are planned to be ready by the end of 2019, after which the pipelines are planned to be taken into operation.

Table 2. Construction activities during Q2 2018.



2.2 Activities during the period

Munition clearance

The scope of work included clearance and/or disposal of unexploded ordnance (UXO) at the locations identified by Nord Stream 2 and for any further "chance finds" located during the work and which could endanger the safe construction and operation of the pipelines. The results of the clearance works are presented in the contractor reports (MMT Sweden AB 2018 - W-SU-UXO-PFI-REP-808-EODSUREN-01, and N-Sea/BODAC - W-SU-UXO-PFI-REP-831-GEOFRREN-01). The removal of the unexploded ordnance was scheduled to ensure that areas are cleared prior to commencing rock placement and pipelay.

The work was divided between two companies MMT/Ramora and N-Sea/Bodac. Out of 87 planned clearance targets 15 were found not to be munitions. Additionally, 2 chance finds were cleared making the total number of detonated unexploded ordnance 74 (Table 3).

Bubble curtains were used to reduce or attenuate the acoustic noise from the detonation to mitigate noise levels based on the following criteria:

- if the total net explosive quantity (NEQ)* of target was >22 kg,

- within a sensitive marine environment (i.e. east of GKP 174)
- or requested by a cable owner with a cable within 500 m security corridor

During munition clearance the contractors were responsible for the implementation of mitigation measures in line with Great Britain's Joint Nature Conservation Committee (JNCC) guidelines.

To minimise the risk of injury to marine mammals from the explosives, a mitigation zone was established, where deployment of Acoustic Deterrent Devices (ADD), Passive Acoustic Monitoring (PAM) and Marine Mammal Observer (MMO) observations were conducted. ADD's were deployed around the UXO in a cardinal point configuration.

MMO was observing for minimum of one hour at 1 to 2 km radius from the detonation site. According to the guidelines, explosion would take place only if no marine mammals was observed during the last 20 minutes of the minimum of one-hour watch. No visual or other record of marine mammals in the mitigation zone were made.

Detonation was taking place only if no bird flocks or fish schools were detected/seen at the detonation site.

The charge of the munitions was either comparable to the charge presented in the permit application or smaller (Table 3). The duration of the munition clearance campaign was shorter than planned because objects were reassessed as not munitions and therefore did not require clearance. In addition, the weather conditions were favourable allowing uninterrupted operation, including clearance of more than one munition object a day on several occasions.

Table 3. Munition clearance campaign 3.5.-6.6.2018 including the work of MMT/Ramora and N-Sea/Bodac.

	Planned	Actual	Difference between planned and actual
Munitions clearances	87 No.	74 No.	15 objects were found not to be munitions*, 2 chance finds added
Bubble curtain use	80 No.	58 No.	26 munitions had total NEQ** smaller than 22 kg and of these, 16 were cleared without bubble curtain. In addition15 were not munitions and therefore did not require clearance.
Donor charge	15 kg	2,5 – 10 kg	The donor charges were 10, 5 or 2,5 kg, out of which 5 kg was most commonly used.
Charge	2 – 795 kg	0,5 – 300 kg	The total NEQ of all munitions was either smaller or equal to the estimated values. Small increases in munition sizes (max of 4 kg) were compensated by the use of smaller donor charge.

* 1 object was not found, 1 was left in situ, 13 were recovered to the deck
** the total net explosive quantity NEQ (munition charge plus donor charge)

During the munitions clearance campaign two chance finds were added to the scope. These were identified through additional inspections of previously identified targets. One was identified as Russian depth charge of 25 kg charge, and the other as a Russian fish mine of a 10 kg charge. Both were previously interpreted as boulders in July 2016 survey. Rerouting of the pipelines was not feasible because of uneven sea bottom.

The sediment displacement through the detonations exceeded 5 m^3 at 10 targets, the biggest displacement being 30,8 m^3 (R-R09-7495). The Environmental impact assessment on Munition by Munition basis (updated April 2018, W-PE-EIA-PFI-REP-999-MBYM00EN-08) indirectly indicated bigger effect for this object. The sediment release was assessed to be 190,3 tonnes equal to 127 m^3 (10% clay, 90% hard sediment). The largest sediment displacement mass was estimated to be 368,6 t with the munition item R-R12-10082. The actual displacement volume was significantly less, 12 m^3.

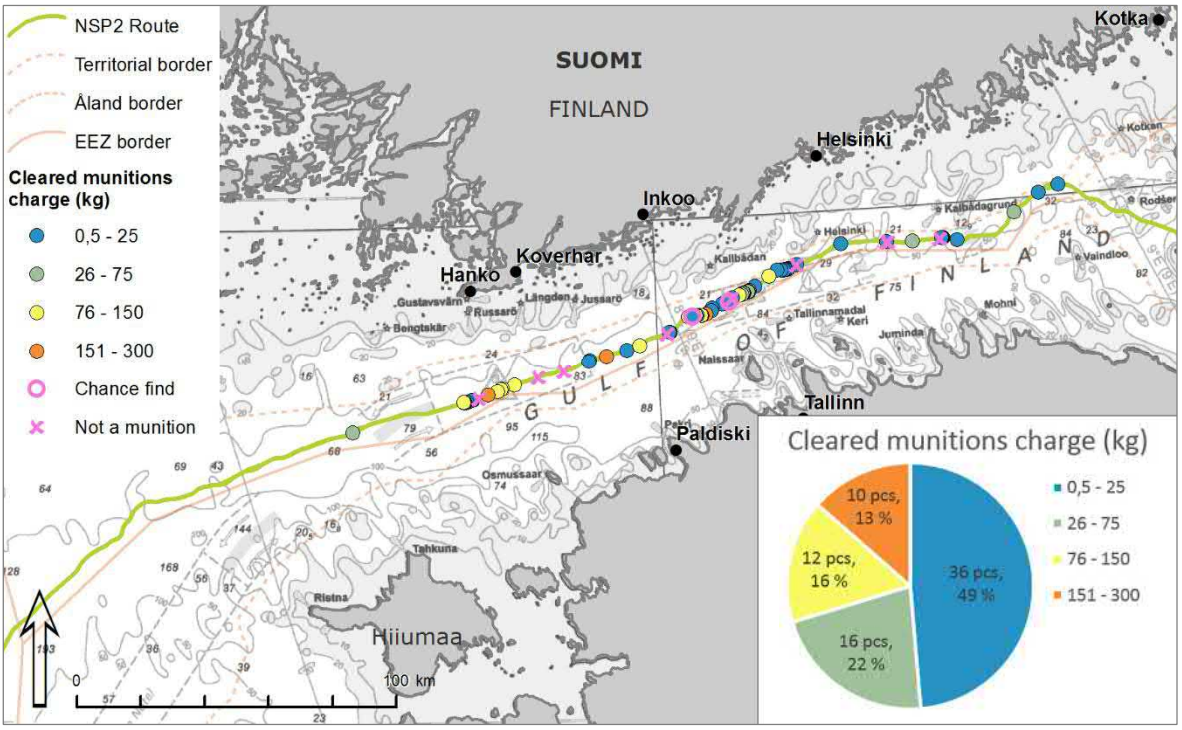


Figure 2. Total number of cleared munitions was 74. During the clearance 15 expected munition objects were found not to be munitions. Also 2 chance finds were discovered.

Rock placement

The first rock placement campaign took place from 29.4 to 15.6 between Inkoo and Russian border (GKP 122–237) (Figure 3). Rock placement was done for both Line A and Line B. NSP2 has accepted and approved certificates of all 44 installed berms.

The total mass of rock placement in the first campaign was 313 842 tonnes, which is equivalent to 200 847 m^3.

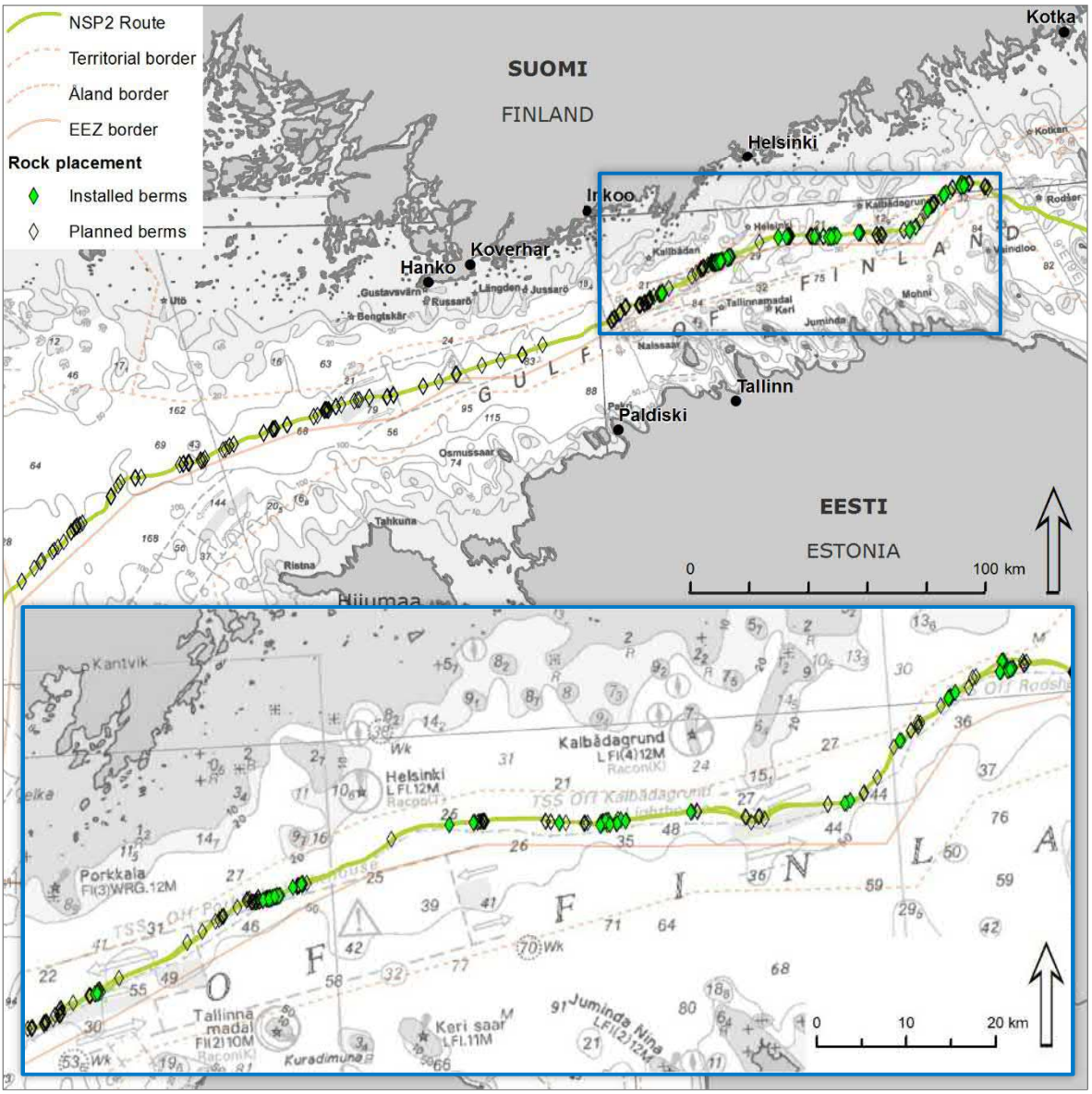


Figure 3. The first rock placement campaign. The lower map shows the area marked with the blue frame in more detail.

Mattress installation

Mattresses installation started in Finland on the 30.6 with the pre-installation surveys. The actual installation of mattresses started on the 1.7 and will be reported in Q3 report 2018.

3 Underwater noise

3.1 Monitoring activities

Underwater noise measurements were carried out according to the Environmental Monitoring Programme Finland, by Luode Consulting Oy. The monitoring consisted of 8 fixed long-term monitoring stations covering practically the whole Gulf of Finland, and vessel based on-site monitoring of 3 selected munitions clearance operations (Table 4).

Table 4. Munitions monitored with vessel based campaigns.

ID	Classification	Nationality	Predicted in permit application [TNT kg]	Clearance contractor re-evaluation [TNT kg]
R-R05-7058	Grenade	Russian	40	7
R-R06-20716	Depth Charge	Unknown	180	40
R-R09ALT1-20117	EMC-1	German	300	300

The long-term stations were installed between 17–24.4.2018 and serviced between 15.-26.5.2018 when the data was downloaded for further analysis. The available data covers approximately the first month of the munitions clearance operation. The final report of underwater noise monitoring will be finished during Q3.

Two main indicators were calculated based on the records:

- Peak Sound Pressure Level (SPL) is the maximum sound pressure level that is measured during the noise event. It is in units of dB.
- Permanent Threshold Shift (PTS) describes the sound pressure level that causes an increased risk of onset of permanent damage for hearing. For marine mammals this level is 179 dB. PTS is often presented as the area where the 179 dB level is exceeded. It can also be presented as the maximum distance from the sound source where the 179 dB level is still reached.

Calculation of PTS requires measurements also in the vicinity of the sound source. These measurements were available for the 3 vessel based monitored munitions clearance sites. In addition, the clearance operators carried out their own on-site measurements around other clearance sites. These measurements will be available for further assessment during Q3.

3.2 Results

In the data collected at the long-term monitoring stations, 24 munitions clearance events were detected and analysed. Because the same clearance event was measured on several stations, altogether 84 separate peak SPLs were detected. When compared to the modelled values in the permit application, 83 out of 84 measured peak SPLs were at or

below the modelled range (Figure 4). Only one measured peak (R-R09ALT1-20117 at 500 meters) was 5 dB higher than the modelled value. This took place well within the estimated influence area of the ADD's. The probability for the occurrence of marine mammals increases with increasing distance from the munition. However, all the measured SPLs were clearly below the modelled values within the 5–120 km range.

There is increasing variation in the measured peak SPLs with increasing distance which was not found in the model results. Bottom topography was estimated to be the main reason for this. Islands and shallow areas effectively break the SPLs. Thus the Finnish shallow archipelago was sheltered more effectively than the deeper Estonian coastline which typically has no islands.

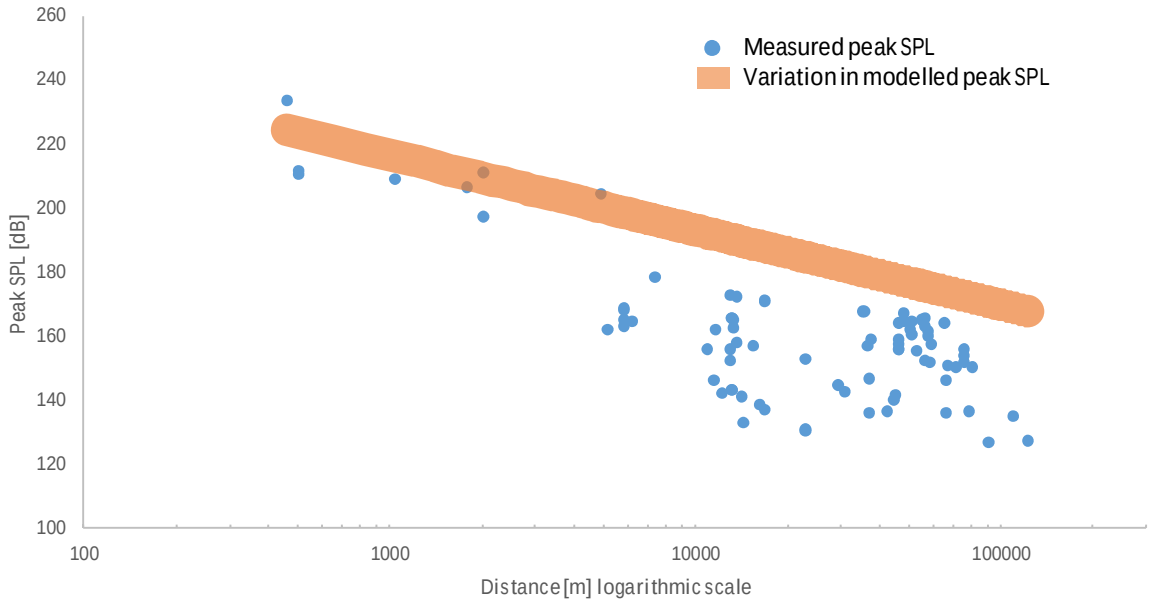


Figure 4. Peak sound pressure levels (SPL) from munitions clearance measured both by long term measurement stations and by vessel based stations. The SPL levels used in the permit application are based on modelling. They are presented as an area which covers the variation in the model results.

The area where the risk of onset of PTS level for marine mammals was reached was significantly smaller than it was assessed to be in the permit application in all 3 vessel based monitored munition clearances (Figure 5). The PTS level was not reached within any of the adjacent Natura 2000 areas.

In the case of the two smaller vessel based monitored munitions, the munition appeared to be of a smaller charge size than predicted (Table 4). The size of the largest munition (300 TNT kg) was not changed in the clearance contractor re-evaluation. However, even in the case of the largest munition, there was a significant decrease in the PTS area compared to the permit application. It is possible that the use of a bubble curtain around the cleared

munition was more effective than predicted in the modelling. In addition, munitions were old and may have had a low order detonation rather the assessed high order detonation.

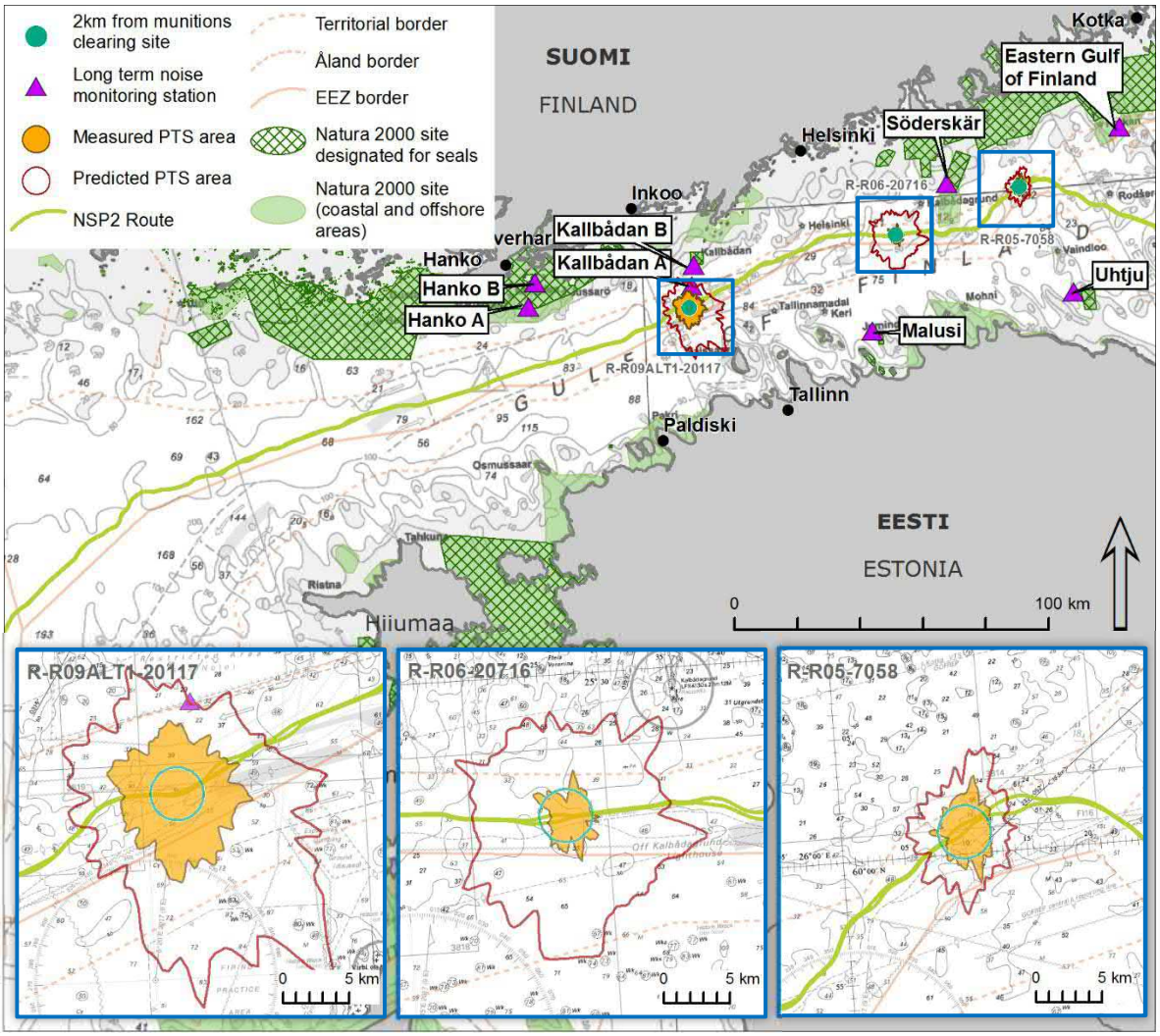


Figure 5. The map shows both the areas where the PTS levels for marine mammals was assessed to be reached in the permit application (predicted PTS area), and the actual measured areas (measured PTS area). The data for measurements was collected at 3 vessel based monitored munition clearance sites on 6– 8.5.2018.

4 Water quality and currents

4.1 Monitoring activities

Water quality and current velocity was monitored according to the approved Environmental Monitoring Programme Finland, at 6 sites by Luode Consulting (Table 5 and Figure 6). The sites were equipped with profiling current meters measuring flow speeds and directions in separate depth layers covering the whole depth range from the bottom to the surface. Water quality monitoring includes turbidity, dissolved oxygen, salinity and temperature measurements at three depth layers near bottom.

During Q2, two of the sites were located at munition clearance sites, one on a pre-lay rock placement site and one in the Sandkallan protected area relatively close to the munition clearance and rock placement sites. In addition, two control stations were set up in the Western and Eastern Gulf of Finland. The same control locations were used during the Nord Stream pipeline construction. First data analysis will be available during Q3. One additional monitoring site will be installed during Q3 to observe rock placement activities.

Table 5. Water quality and current velocity monitoring sites.

	Installed	Recovered
Munitions clearance 1 (R-R09ALT1-20467)	9.5.2018	
Munitions clearance 2 (R-R12-10513)	23.5.2018	21.6.2018
Sandkallan protected area	18.4.2018	
Rock placement 1 (FI-A1001)	18.4.2018	
Control 1	17.4.2014	
Control 2	18.4.2014	

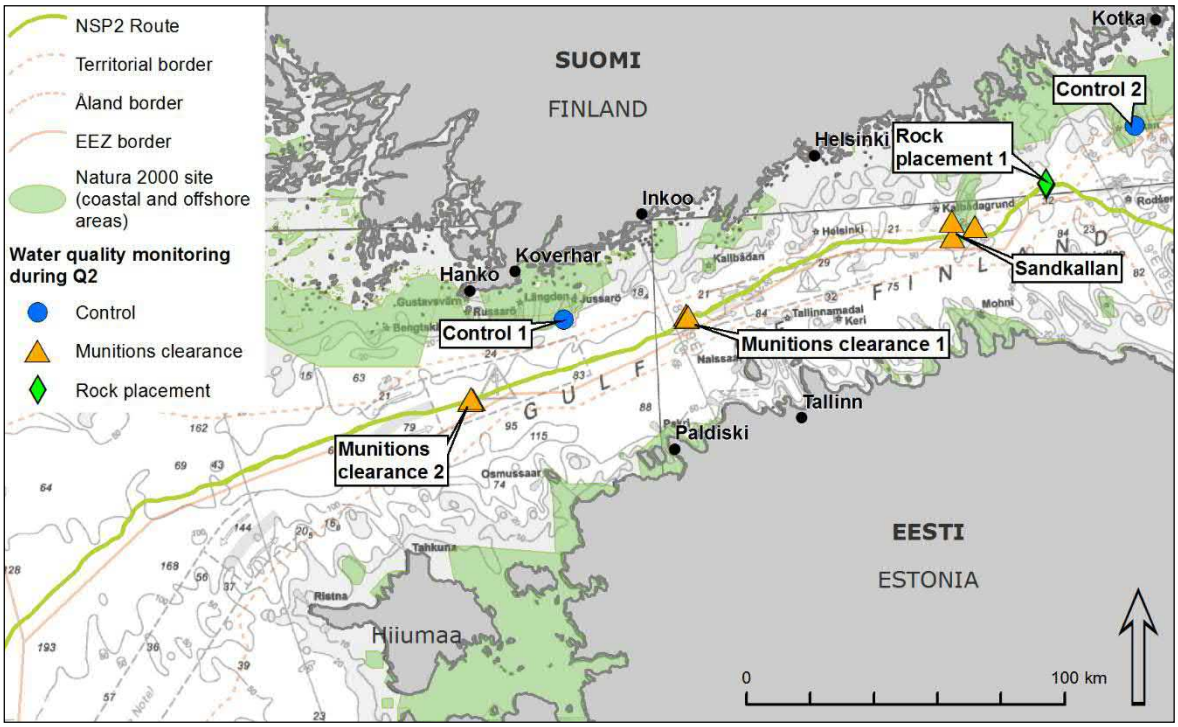


Figure 6. Water quality and current monitoring sites during Q2.

4.2 Results

First water quality and current data analysis will be available during Q3.

5 Sediment toxicity analysis

In order to study potential toxic material release to seabed due to munitions clearance, 17 sediment samples were collected to provide reference data of potential explosive residual and heavy metal spreading in clearance site surroundings of targets R-R08-5261 and R-R09-7495. Target R-R08-5261 was an old Russian depth charge BM-1 with NEQ 30 kg, and target R-R09-7495 a German EMC-1 mine with NEQ 310 kg. No residues of explosives exceeding the laboratory detection limits were found. Heavy metal concentrations were typical to those seen in earlier studies in the Gulf of Finland (W-PE-EMS-PFI-REP-812-SEDTOXSEN-01).

The study methodology and results will be presented in more detail in the Q3 report and in the 2018 annual report.

6 Cultural heritage

To verify any changes in the two monitored marine archaeological objects, surveys were performed before the start of construction.

Wreck S-R05-7978

The wreck inspection using Remotely Operated Vehicle (ROV) survey for the monitoring object S-R05-7978 was performed from the MV Stril Explorer on 6.5.2018. The cannon barge wreck site is regarded as an important archaeological site.

Figure 7. Wreck midship, cannons, cannon balls and debris. Picture from 2016 inspection W-SU-DET-POF-REP-808-CHO001EN-01.

The object is located approximately 59 meters from the nearest planned pipeline.

Distance to the nearest planned rock placement area is more than 500 meters, and to the nearest munition clearance 6,9 km.

Anti-submarine net S-R09-09806

The inspection of existence and condition of the historical anti-submarine net S-R09-09806 was performed by the MV Geosund on 2.5.2018.

A Multibeam Echo Sounder (MBES) sweep was performed from north to south, across the installation corridor for both cable routes, A and B. The Remotely Operated Vehicle (ROV) then proceeded to visually trace the line of floats and cables of the anti-submarine warfare net. Various, predefined targets defined by NSP2 were then each inspected, and their condition recorded for future reference.

Figure 8. Buoy attached to submarine net/wires (SD-Alt1-3372-J) from 2016 inspection, W-SU-DET-POF-REP-808-WRK014EN-03.

The seabed in this area is dominated by exposed rock outcrops. The eastern margin of this outcrop forms a steep scarp face (33 % gradient). The anti-submarine net seems to have been laid along this rock outcrop.

Only the associated floats / buoys and the cable were seen during the survey. No munitions or other debris items were visible.

7 Notifications to ELY-Centres during the second quarter

NSP2 delivered the following notifications to Uusimaa, Southeast and Southwest ELY-Centres during the monitoring period:

- 18/04: Nord Stream 2 notification on commencement of works in Finland – WP condition 44
- 23/04: Change in the monitoring programme (2 munitions for UW noise monitoring) – Water Permit (WP) provision 41
- 11/05: Change in the use of bubble curtains – WP provision 18
- 14/05: Preliminary results of UW noise (as per monitoring programme)
- 15/05: Summary table and map of munitions (interim version) –WP provision 18
- 24/05: Interim technical UW noise report (as per monitoring programme)
- 25/05: Munition chance finds –WP provision 24
- 31/05: Non-conformity notification regarding use of bubble curtains
- 29/06: Summary table and map of munitions (final version) –WP provision 18

The content of the notifications will be presented in the 2018 annual report.

8 Conclusions

The preliminary construction works have been proceeding as planned and environmental and technical monitoring has been carried out according to the monitoring programme.

The preliminary results indicate that environmental impacts of underwater noise have been as assessed or smaller.

The results in this report are preliminary. The final results will be presented in the annual report.

9 List of sources

Literature

Great Britain's Joint Nature Conservation Committee 2017. JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys

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Maps and GIS data

Background admiralty charts, 2018. Charts are not to be used for navigation.
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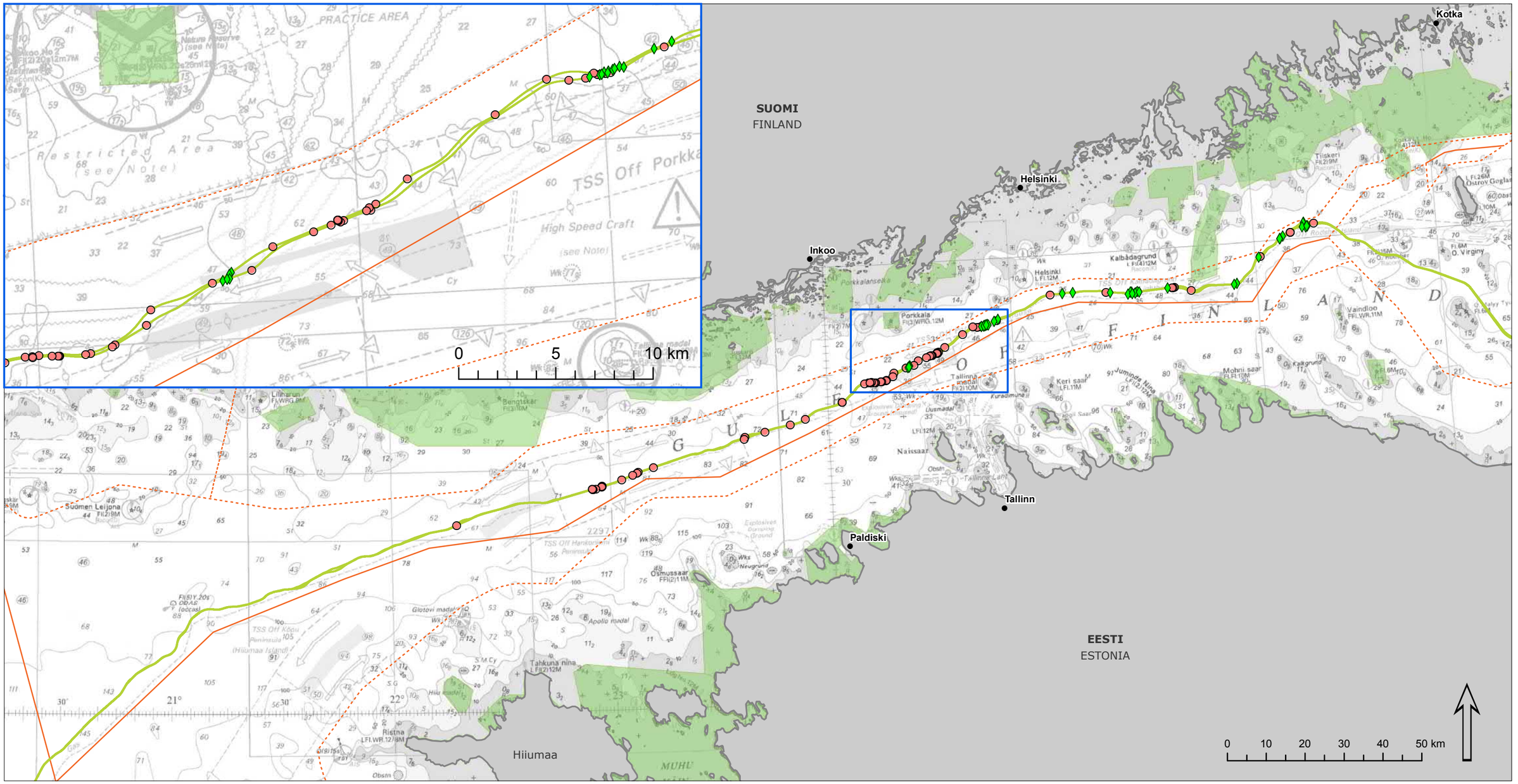
International Boundaries Research Unit (IBRU) 2010. Borders of Exclusive Economic Zones and Territorial Waters



Nord Stream 2 Construction activities during Q2/2018

- Cleared munitions (74 munition objects)
- Installed berms
- NSP2 Route
- Natura 2000 site (coastal and offshore areas)
- Territorial border
- Åland border
- EEZ border

References:
- Limits of Exclusive Economic Zones and Territorial Waters: IBRU May 2010
- Background sea charts are "Not to be used for navigation"
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Appendix 2

Version: Q2 report EN ver6
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Date: 24.9.2018
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Construction activities during Q2/2018

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