



# **Nord Stream 2 Natural Gas Pipeline construction and operation in the Finnish EEZ Environmental and Technical Monitoring Quarterly Report Q3 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 third 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 third quarter were rock placement, mattress installation, and pipelay of Line A.

The underwater noise monitoring consisted of 8 fixed long-term monitoring stations covering the entire Gulf of Finland, vessel based on-site monitoring of munitions clearance operations and on-site measurements carried out by clearance operators. The long-term stations were installed between 17.–24.4.2018, serviced between 15.–26.5.2018 and recovered between 9.–17.7.2018.

The measured risk area for permanent hearing damage for marine mammals was significantly smaller than assessed in the permit applications being only 11 % of the modelled area. The PTS level was not reached within any of the adjacent Natura 2000 areas with marine mammals as conservation object.

Water quality and current direction and magnitude were measured at seven monitoring sites during munition clearance and rock placement activities. Analysed results were available for two Munition clearance sites (1 and 2), two Rock Placement sites (1 and 2) and the control stations Sandkallan, Control 1 and Control 2. Neither munition clearance site showed elevated levels of turbidity during or after the clearance. The effect of rock placement on turbidity was clearly detected at the site Rock Placement 1, although the measured values were mostly below the modelled values presented in the permit application. At the Rock Placement site 2 neither of the modelled turbidity levels were exceeded. All the turbidity measurements at the control stations Sandkallan, Control 1 and Control 2 stayed at the background level.

NSP2 has conducted sampling of sediment contaminants and explosive residuals for two munition clearance events. The sediment contaminant study at munition clearance locations showed no residuals of explosives exceeding the laboratory detection limits.

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# 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 third quarter (Q3) 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 gas pipe route. The length of the route in the Finnish sector is approximately 374 km. Pipelay of Line A started on September 5, 2018 and Pipelay of Line B is scheduled to start in 2019. Both lines are planned to be finished by the end of 2019, after which the pipelines are planned to be taken into operation.

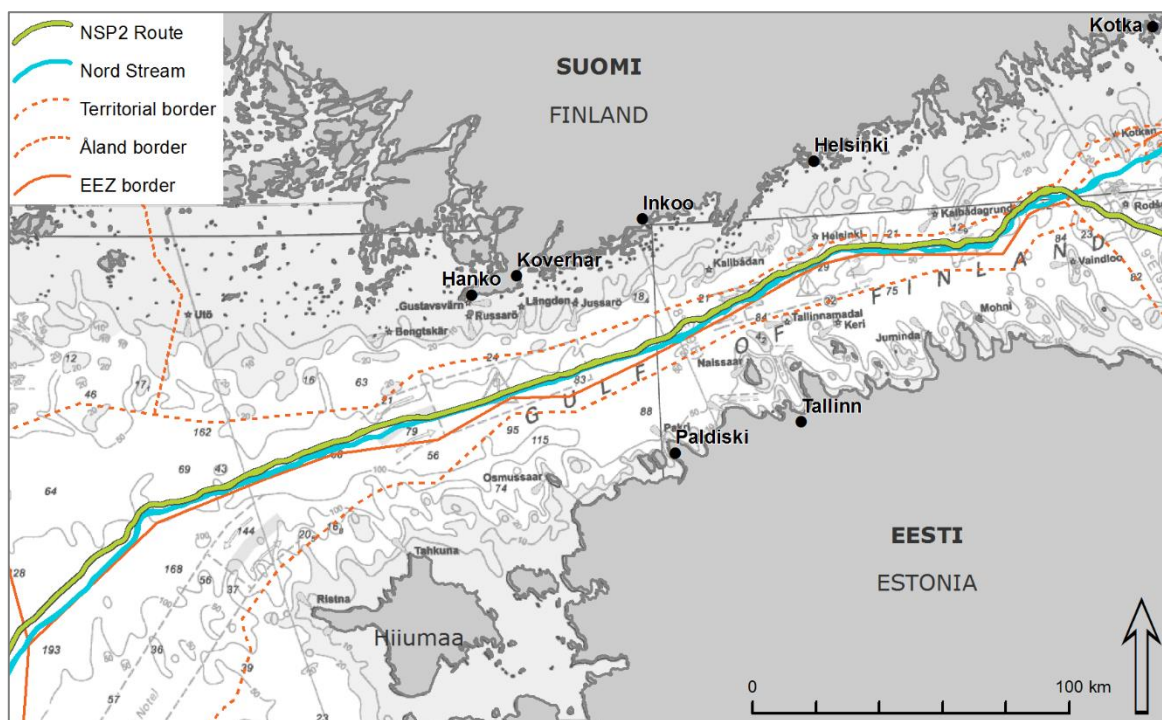


Figure 1. Nord Stream 2 route passes through the Finnish EEZ.

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, currents 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 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 Environmental conditions during the third quarter

In July, average mean temperature of 19.6 degrees was the highest ever measured in the entire climate observation history of Finland. In addition, August was warmer than average. September was exceptionally warm in whole Finland and the average temperature was 14 degrees on the south coast of Finland. In most parts of Finland, rainfall was below average during the summer months.

In the other half of September low pressures created strong winds causing delays to the ferry traffic at the Åland Sea and some damages to power transmission lines in western parts of Finland. In September pipelay was interrupted three times due to weather conditions not suitable for pipelay.

According to the Finnish Meteorological Institute's open data, during 1.7.–30.9.2018, wave height varied between 0.1 and 4.1 m (Figure 2). The observation data was collected from an open seas wave buoy located in the Gulf of Finland (59°58' N 25°14' E) approximately six kilometres north of GKP 185.

According to the long-term monitoring results by Luode Consulting Oy, the stratification structure of water column was clearly seen in salinity and oxygen concentrations as well as in temperature during 18.4.–10.7.2018. Stratification conditions will be discussed in more detail in the annual report 2018.

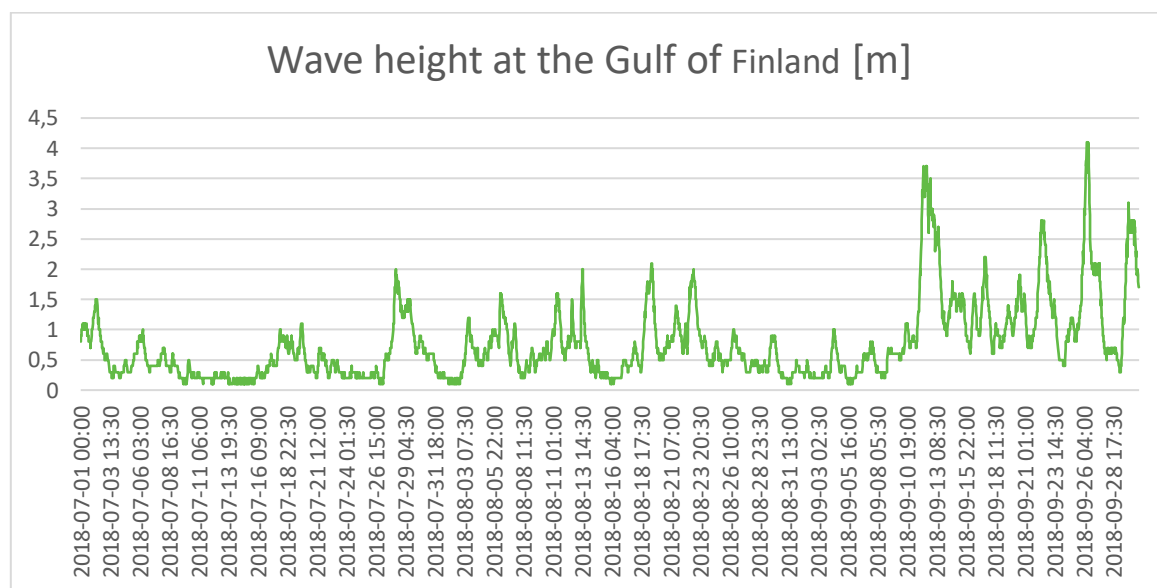


Figure 2. Wave height at the Gulf of Finland during period 1.7.–30.9.2018. The data consists of measurements conducted every half an hour.

### 3 Construction activities during the third quarter

#### 3.1 Schedule

Construction activities during the third quarter included rock placement, mattress installation and pipelay of line A (Table 2). Mattress installation at pipeline and cable crossings started on June 30, 2018 with pre-installation surveys. The actual installation of mattresses started on July 1, 2018. Rock placement campaign started again on August 24, 2018 and continued through the rest of the Q3.

The pipelay (Line A) started on September 5, 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 taken into operation.

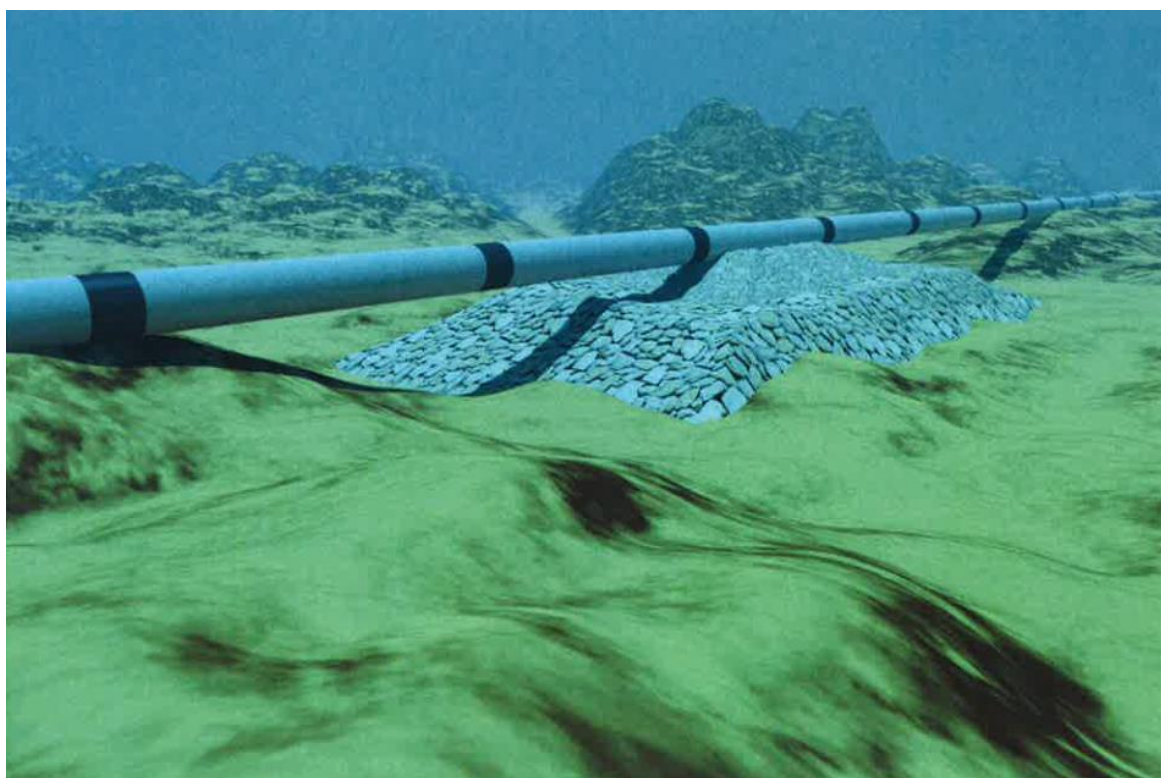
Table 2. Construction activities during Q3 2018.

2018 Q3		July 2018					August 2018					September 2018			
	Week	27	28	29	30	31	32	33	34	35	36	37	38	39	
Mattress installation		cont.													
Pre-lay rock placement										cont.					
Post-lay rock placement													cont.		
Pipelay Line A											cont.				

### 3.2 Activities during the monitoring period

#### Rock placement

Rock placement started again after a summer pause on August 24, 2018 with pre-lay rock placement (Figure 3). Post-lay placement was initiated September 15, 2018 and will be completed after finishing the pipe-lay. Rock placement activities during Q3 took place between south of Inkoo and south of Hanko (GKP 210–256) as well as in the entrance to the Gulf of Finland (GKP 382–429) (Figure 4). Additionally, pre-lay rock placement was conducted for Nord Stream gas pipe crossings close to the Russian border. Rock placement was done for both Line A and Line B.



*Figure 3. Visualization of a typical pre-lay rock berm, which is constructed to support the pipeline.*

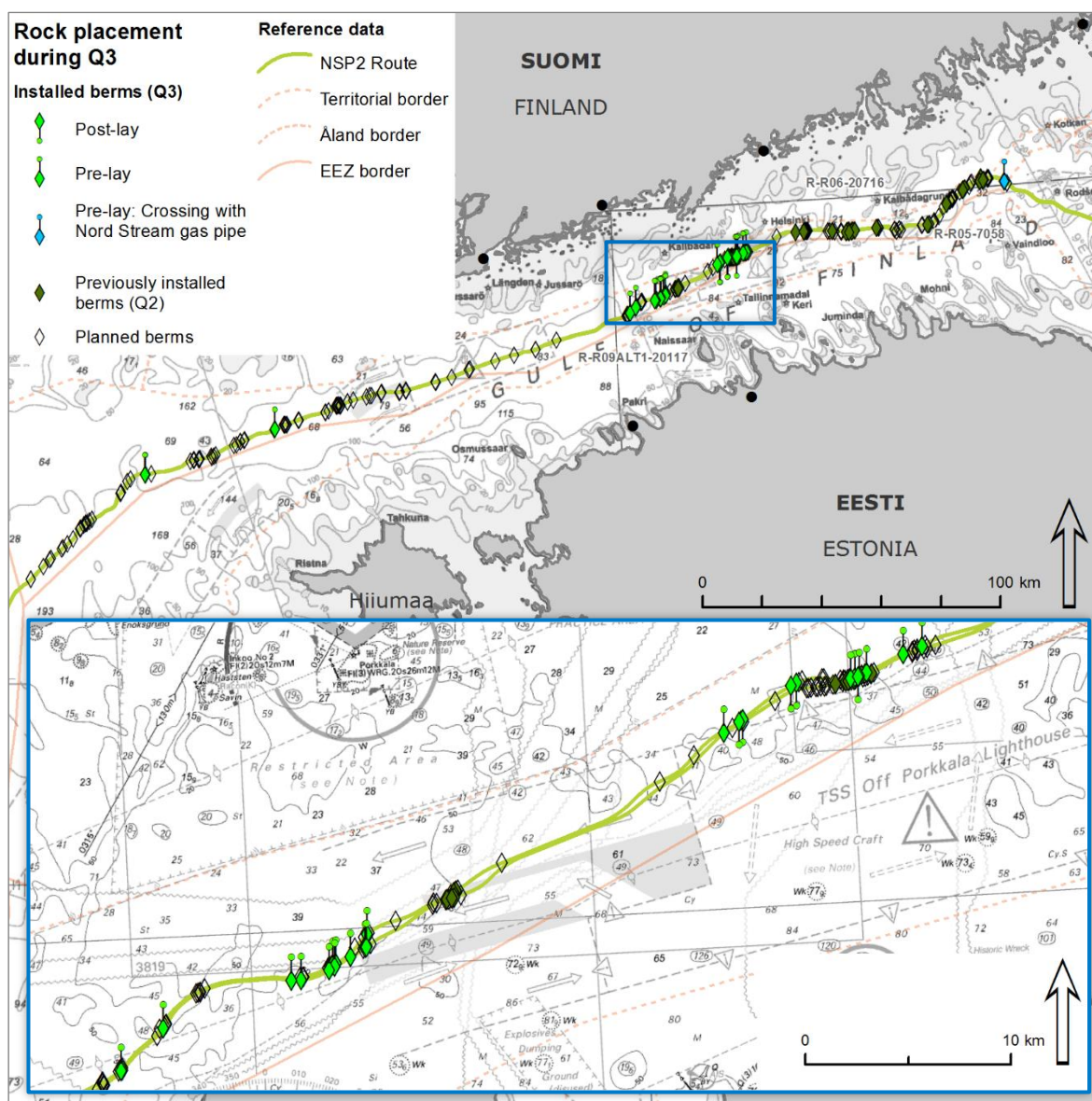


Figure 4. Rock placement activities during Q3. The lower map shows the area marked with the blue frame in more detail.

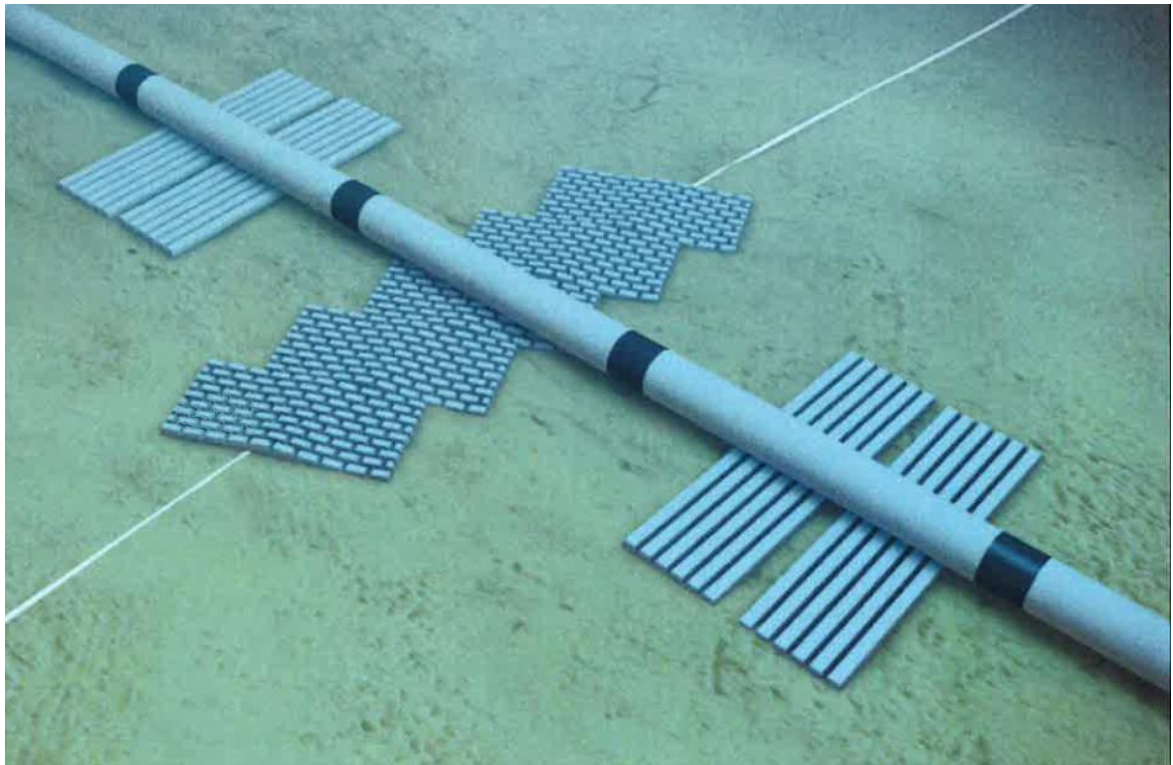
The total rock placement volume during Q3 was 105 470 m<sup>3</sup>. Of this 79 % was pre-lay placement and 21 % post-lay.

During the third quarter 29 berms were finished. The total volume of berms installed during Q2 and Q3 was 306 317 m<sup>3</sup> and the number of finished berms 67 out of planned total 373.

The berm construction plans were updated during Q3. Three berms were deemed not necessary and one new berm was added because of redesign.

## Mattress installation

Mattress installation started in Finland on June 30, 2018 with pre-installation surveys. Actual Installation work began on July 1, 2018 and will end in late October 2018. During Q3, 466 mattresses (out of 492) were installed for cable crossings and all 12 for crossings with the Nord Stream gas pipe. (Figures 5 and 6.)



*Figure 5. Visualization of a typical cable crossing. Biflex mattresses are placed between the cable and pipeline, and rigid mattresses support the pipeline below on both sides of the crossing.*

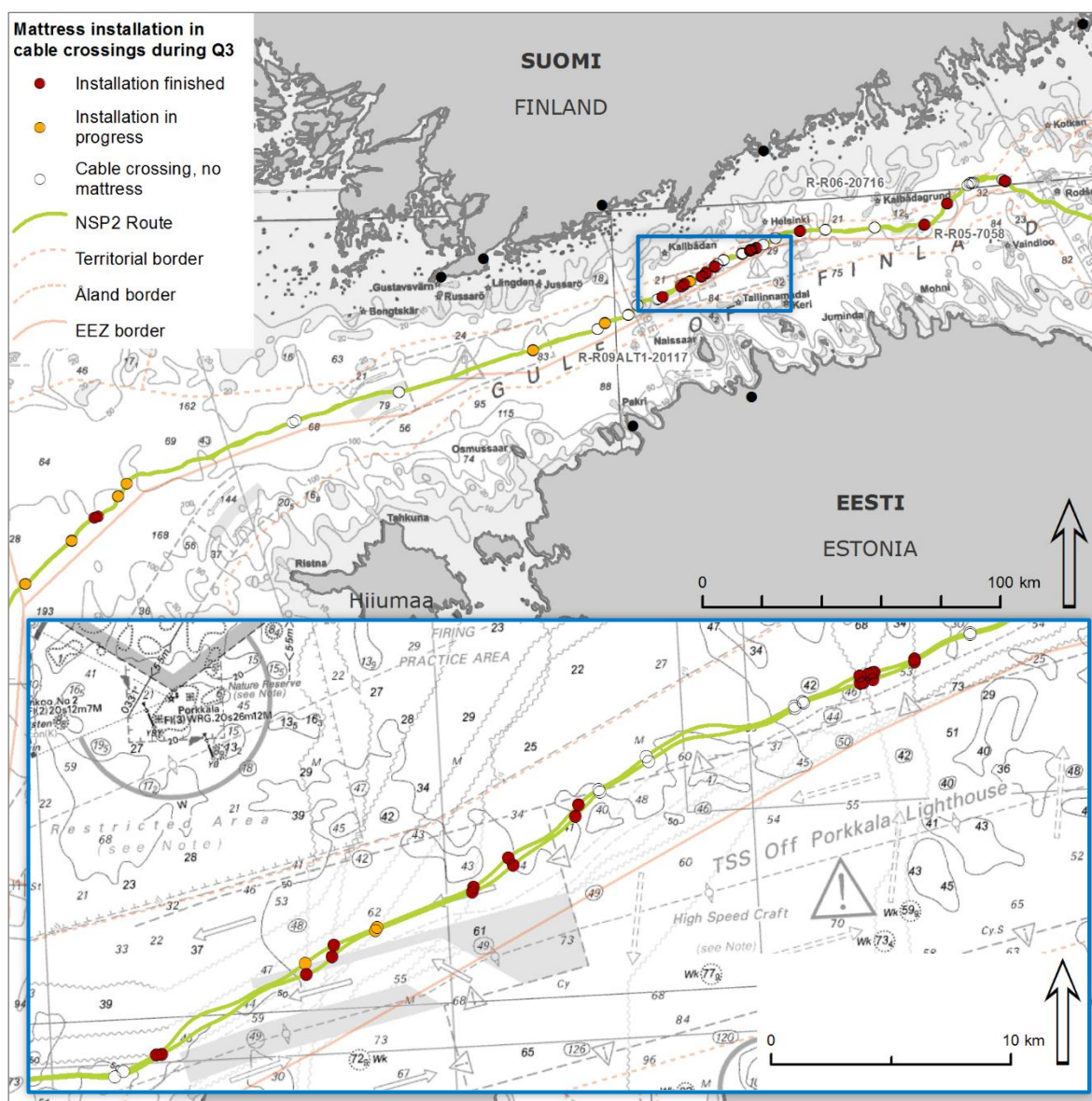


Figure 6. Mattress installation in cable crossings during the third quarter of 2018. The lower map shows the area marked with blue frame in more detail.

Specifications on mattress amount and design were finalized in the beginning of Q3 as a result of final detailed design and tests of mattresses. The number of biflex mattresses was reduced for crossings with one cable (NSP2\_R15\_Unknown\_01). The number of mattresses for the mentioned crossing reduced the total amount of mattresses for the crossing with line A by ten, and for line B by five.

In the permit applications filed to the authorities in September 19, 2018, the number of mattresses was 364 biflex and 114 rigid mattresses. On July 3, 2018, the ELY-centres were notified of an increase in biflex mattress number and dimensions. Crossing design was further developed after the notification to the authorities, and according to the final design, the final number of mattresses for cable crossings is 378 for biflex and 114 for rigid (Table 3).

Table 3. Specifications of amount and dimensions of planned mattresses are emphasised with bold font. All numbers are excluding crossings with Nord Stream gas pipe.

	Water permit application 19.9.2018	Changes notified 3.7.2018	Final design
No. of biflex mattresses	app. 364	<b>393</b>	<b>378</b>
Dimensions of biflex mattresses	6 m x 2,5 m x 0,3 m	6 m x <b>3 m</b> x 0,3 m	6 m x 3 m x 0,3 m
No. of rigid mattresses	app. 114	114	114
Dimensions of rigid mattresses	10 m x 3 m x 0,3 m	10 m x 3 m x 0,3 m	10 m x 3 m x 0,3 m
Total no. of mattresses	478	<b>507</b>	<b>492</b>

## Pipelay

The pipelay vessel Solitaire commenced pipelay (Line A) on September 5, 2018 south of Porkkala (GKP 231) and continued towards east reaching the position GKP 184 at the end of September (Figure 7). Pipelay was interrupted three times due to weather conditions unsuitable for pipelay.

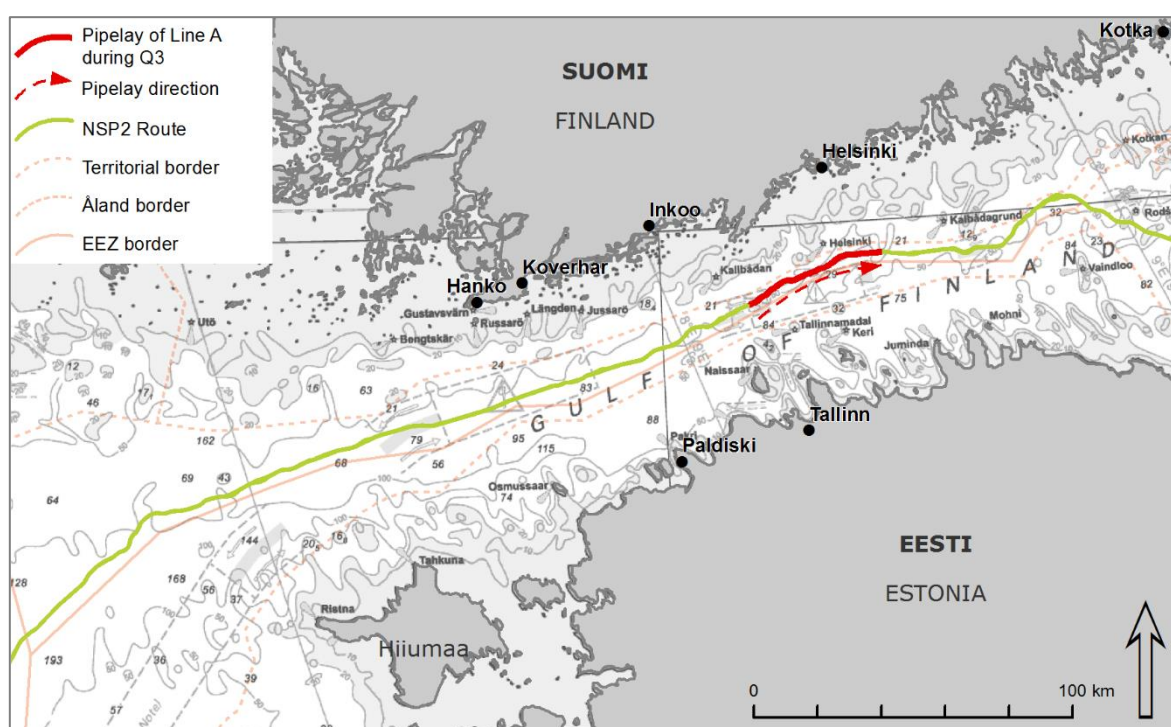


Figure 7. Pipelay of Line A proceeded from GKP 231 to GKP 184 during Q3.

When it is necessary to interrupt pipelay due to weather conditions unsuitable for pipelay, the abandonment and recovery (A&R) standard procedure is followed. A decision to abandon and recovery will be made by the Superintendent and/or Master of the vessel.

When the abandonment procedure is initiated, pipelay is interrupted and a special pipeline head is welded to the pipeline. A cable is connected to the head after which the pipeline is laid on the seabed and the pipeline can be abandoned.

Once weather conditions have improved, the vessel can recover the pipeline and continue normal pipelay. First the vessel moves to the correct stand-off position as specified in the A&R installation engineering analysis and recovers the pipeline back into the vessel. Then the cable is disconnected, and the head is removed.

Efficiency of pipelay during Q3 is presented below:

- approximately 47 kilometers of pipelay
- 19 days of effective pipelay
- pipelay at 8 cable crossings
- highest average speed of pipelay in September 3 km/day

## 4 Underwater noise

### 4.1 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 the entire Gulf of Finland, vessel based on-site monitoring of munitions clearance operations and on-site measurements carried out by clearance operators (Annex 2. Luode Consulting Oy 2018. Underwater noise monitoring during munition clearance in the Finnish EEZ. W-PE-EMS-PFI-REP-812-UWNFIREN-04). The long-term stations were installed between 17.–24.4.2018, serviced between 15.–26.5.2018 and recovered between 9.–17.7.2018. 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 expressed in dB.
- **Permanent Threshold Shift (PTS)** describes the sound pressure level which is the onset for the risk of a 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.

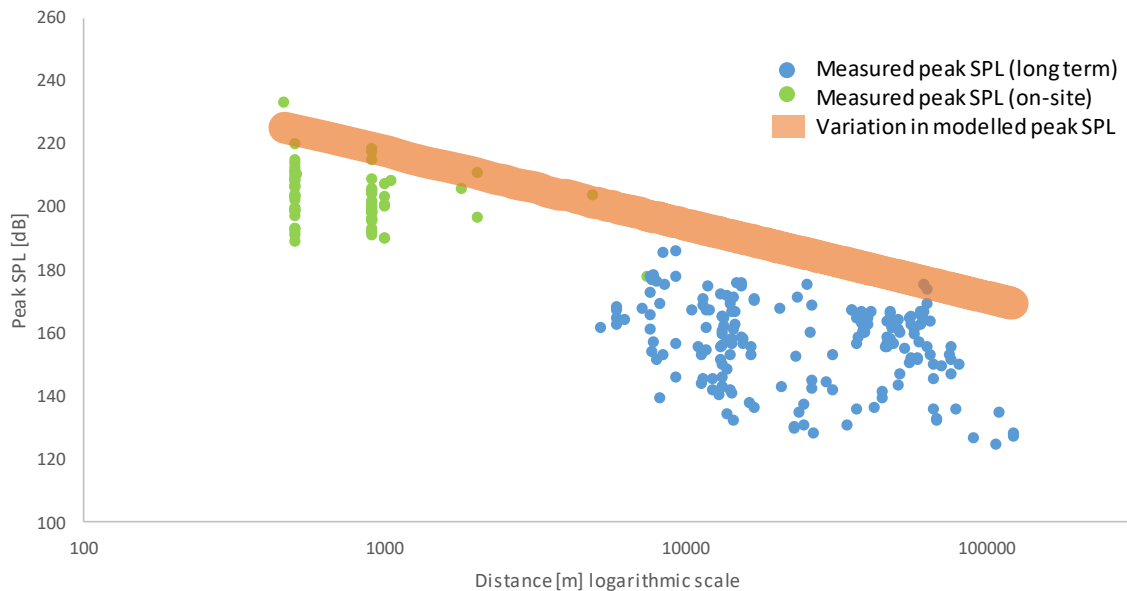
### 4.2 Results

The preliminary results for underwater noise monitoring are already discussed in Q2 report. In the data collected at the long-term monitoring stations, 76 munitions clearance events were detected and analysed. In total 71 munitions were cleared, so some munitions needed more than one attempt to be cleared. Data was not available for three cleared munitions as they were not detected by the monitoring network. Because the same clearance event was measured on several stations, altogether 254 separate peak SPLs were detected.

When compared to the modelled values in the permit application, 253 out of 254 measured peak SPLs were at the same level or below the modelled range (Figure 8). 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.

In several cases the munition appeared to be of a smaller charge size than predicted. It is also 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 their explosive did not discharge completely. This is supported by the result that there was no correlation with the munitions charge weight and the measured sound peak pressure level.

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. The Finnish shallow archipelago was sheltered more effectively than the deeper Estonian coastline which practically has no islands.



*Figure 8. Peak sound pressure levels (SPL) from munitions clearance events. 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.*

Calculation of PTS area requires measurements from both the fixed long-term monitoring stations and from the vicinity of the sound source (mobile monitoring and vessel measurements). These measurements were available for 67 out of the total of 76 detected munition clearance events. The measured risk area for permanent hearing damage for marine mammals was significantly smaller than assessed in the permit applications being only 11 % of the modelled area (Figure 9). The PTS level was not reached within any of the adjacent Natura 2000 areas. Only in 6 munition clearance events out of total of 67 analyzed the PTS range exceeded the 2 km effective range of ADD's (Acoustic Deterrent Devices).

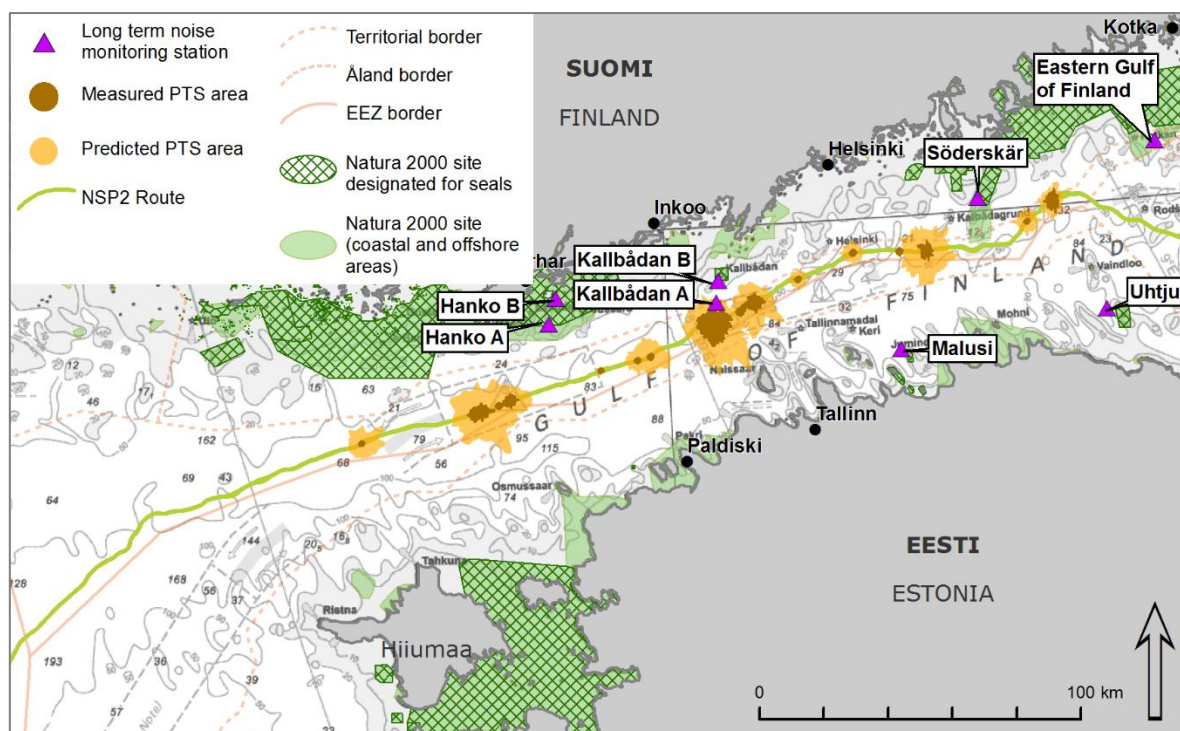


Figure 9. The map shows both predicted and measured PTS-areas for marine mammals. (PTS-area: the onset for the risk of a permanent damage).

## 5 Water quality and currents

### 5.1 Monitoring activities

Water quality and current velocity was monitored according to the approved Environmental Monitoring Programme Finland, at 7 sites by Luode Consulting (Table 4 and Figure 10). 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.

Table 4. Water quality and current velocity monitoring sites.

	Installed	Last service	Recovered
Munitions clearance 1 (R-R09ALT1-20467)	9.5.2018		9.7.2018
Munitions clearance 2 (R-R12-10513)	23.5.2018		21.6.2018
Sandkallan	18.4.2018	10.7.2018	
Rock placement 1 (FI-A1001)	18.4.2018		10.7.2018
Rock placement 2 (FI-B1031)	14.8.2018		2.10.2018
Control 1	17.4.2014	2.10.2018	
Control 2	18.4.2014	3.10.2018	

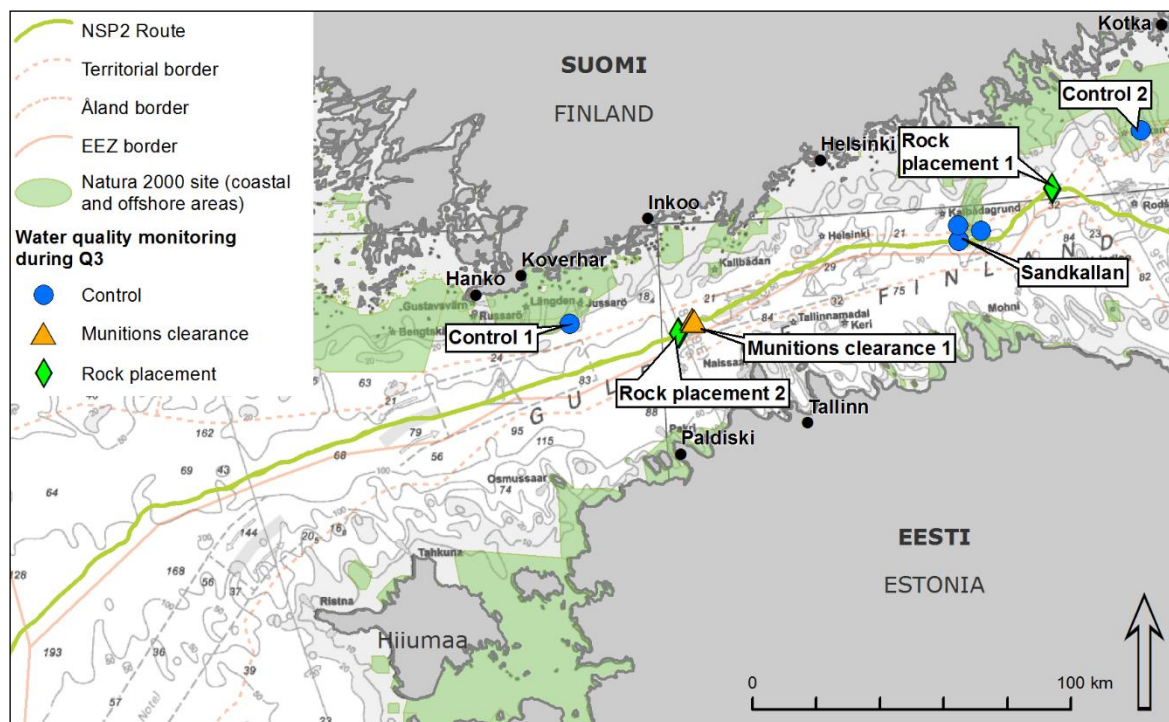


Figure 10. Water quality and current monitoring sites during Q3.

During Q3, one monitoring site was still located at a munition clearance site, two on rock placement sites and one in the Sandkallan protected area relatively close to the munition clearance and rock placement sites. In addition, two control stations continued to measure in the Western and Eastern Gulf of Finland. The same control locations were used during the Nord Stream gas pipe construction.

## 5.2 Results

Analysed results were available for both Munition clearance sites (1 and 2), Rock Placement sites (1 and 2) and the control stations Sandkallan, Control 1 and Control 2 (W-PE-EMS-PFI-REP-812-WQCR01EN-04).

### 5.2.1 Munition clearance 1 and 2

The cleared munitions are described in Table 5. Two attempts were needed to complete the clearance on the site 1 (R-R09ALT1-20467). In the post clearance survey, both sites showed distinct craters with sediment displacement of 3.0–7.2 m<sup>3</sup>.

Neither munition clearance site showed elevated levels of turbidity during or after the clearance. Most probable explanation for missing signal is that the effect of clearance on turbidity was limited and the currents carried the compact turbidity cloud between the turbidity sensors. The particle tracking calculations based on current measurements support this hypothesis.

*Table 5. Description of the monitored munition clearances and the sediment displacement.*

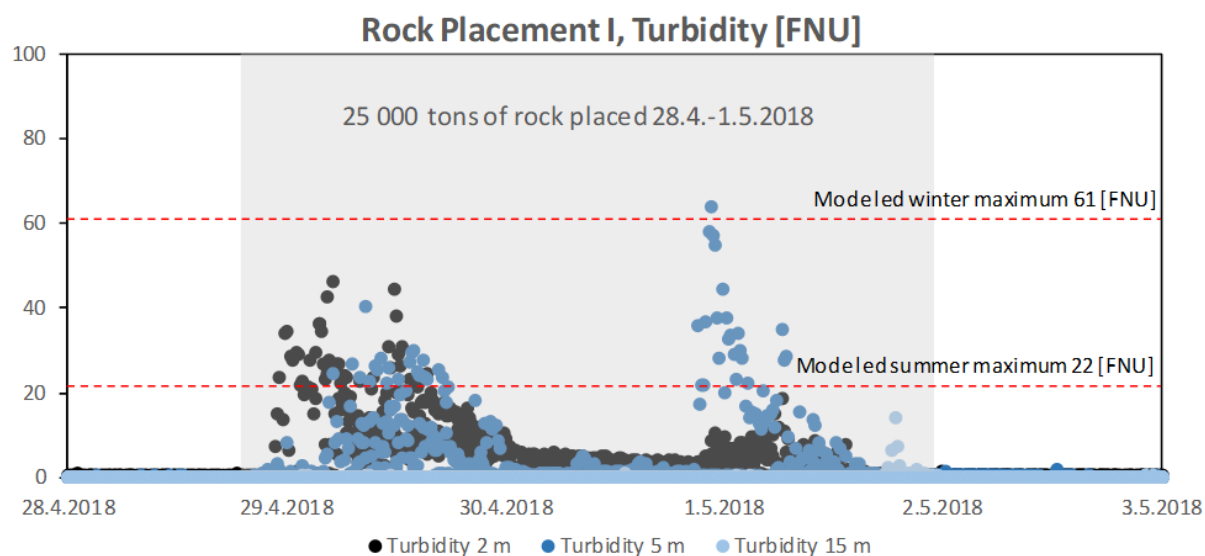
	Type	Total charge NEQ [kg]	Displaced Sediment [m <sup>3</sup> ]
Munitions clearance 1 (R-R09ALT1-20467)	Russian M-8	120	3.0
Munitions clearance 2 (R-R12-10513)	German EMF	245	7.2

### 5.2.2 Rock placement 1

Altogether 25 000 tons of rock was placed close to the monitoring site “Rock placement 1” within 4 days. The constructed rock berm is one of the largest berms. Only the berm needed for the crossing of Nord Stream gas pipe is larger. Another reason for the selection of this berm for monitoring was its location on soft sediment.

The effect of rock placement on turbidity was clearly detected by the network of turbidity sensors (Figure 11). The model results in the permit application indicated that the maximum turbidity level for winter conditions would be 61 FNU (turbidity measurement unit) and for summer conditions 22 FNU.

Only one measurement out of 3456 measurements (0.03 %) recorded during the 4 days of rock placement exceeded the winter maximum level of 61 FNU. The summer maximum was exceeded in 82 measurements (2.4 %). All the high values were measured close by the bottom at distances of 2 and 5 meters.

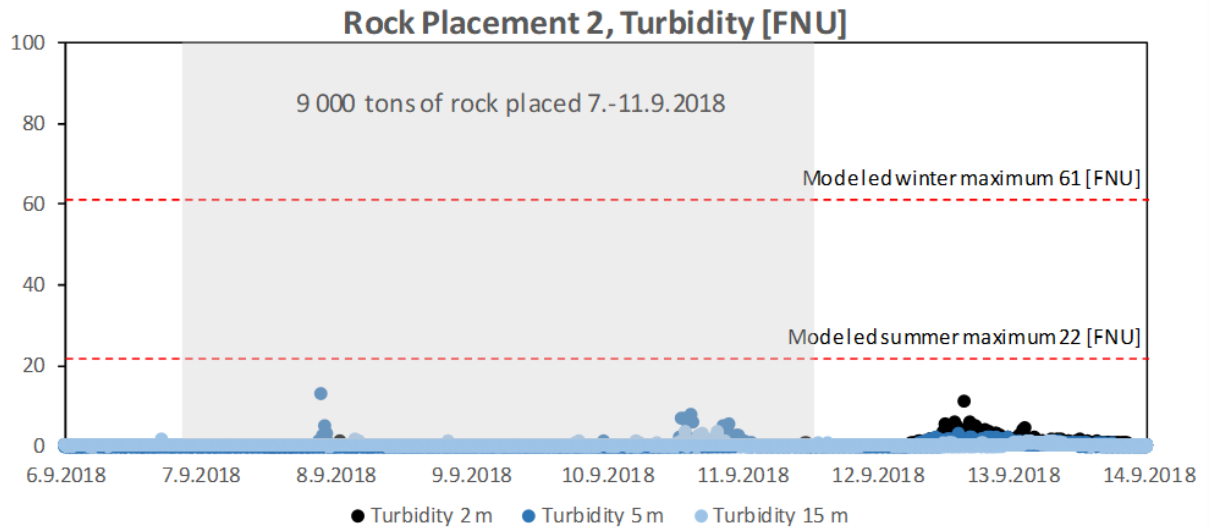


*Figure 11. Turbidity measurements at Rock Placement 1. Placement of 25 000 tons took place between 28.4 and 1.5.2018. The turbidity sensors were located at three distances from the bottom: 2 m, 5 m and 15 m.*

## 5.2.3 Rock placement 2

Altogether 9 000 tons of rock was placed close to the monitoring site “Rock placement 2” in 7.–11.9.2018.

The effect of rock placement on turbidity was detected by the network of turbidity sensors (Figure 12). Neither of the modelled turbidity levels were exceeded. The highest single measured value was 13 FNU. All other measurements stayed below 10 FNU. Only 2 days after the rock placement was completed, a natural high current speed episode (>30 cm/s) rose the background turbidity to the same level measured during the operation.



*Figure 12. Turbidity measurements at Rock Placement 2. Placement of 9 000 tons took place between 7. and 11.9.2018. The turbidity sensors were located at three distances from the bottom: 2 m, 5 m and 15 m.*

#### 5.2.4 Control stations

All the turbidity measurements at the control stations Sandkallan, Control 1 and Control 2 stayed at the background level.

## 6 Sediment contaminant study

NSP2 has conducted sampling of sediment contaminants and explosive residuals for munition clearances in order to study potential toxic material release to seabed due to munitions clearance (W-PE-EMS-PFI-REP-812-SEDTOXSEN-03).

During the 5-6th of June 2018, clearance operator N-Sea conducted sediment sampling onboard "MV Geosund" with a ROV (Remotely Operated Vehicle) (NSea/Bodac. Clearance report-R-R08-5261. W-SU-UXO-PFI-REP-831-DSP089EN-01). Six sediment samples were taken from target R-R08-5261 which was cleared during the 6th of June. The munition object was relocated for its detonation. Sediment sampling took place at the original location and at the relocation site before and after detonation (Figure 13).

On 11th of July 2018 Luode Consulting Oy took additional 11 sediment samples from the surroundings of target RR09-7495 which was cleared on 13th of May 2018. Samples were taken from vessel "Monitor" with a Gemax gravity corer. The delay between clearance and sampling time has no impact on results due to persistent characteristics of compounds to be analysed.

Target R-R08-5261 was an old Russian depth charge BM-1 with total NEQ 30 kg, and target R-R09-7495 a German EMC-1 mine with total NEQ 310 kg.

All 17 sediment samples were analysed for explosive residuals and concentrations of aluminium oxide and mercury. In addition, more extensive screening for other heavy metals was done for 11 samples taken from R-R09-7495.

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.

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

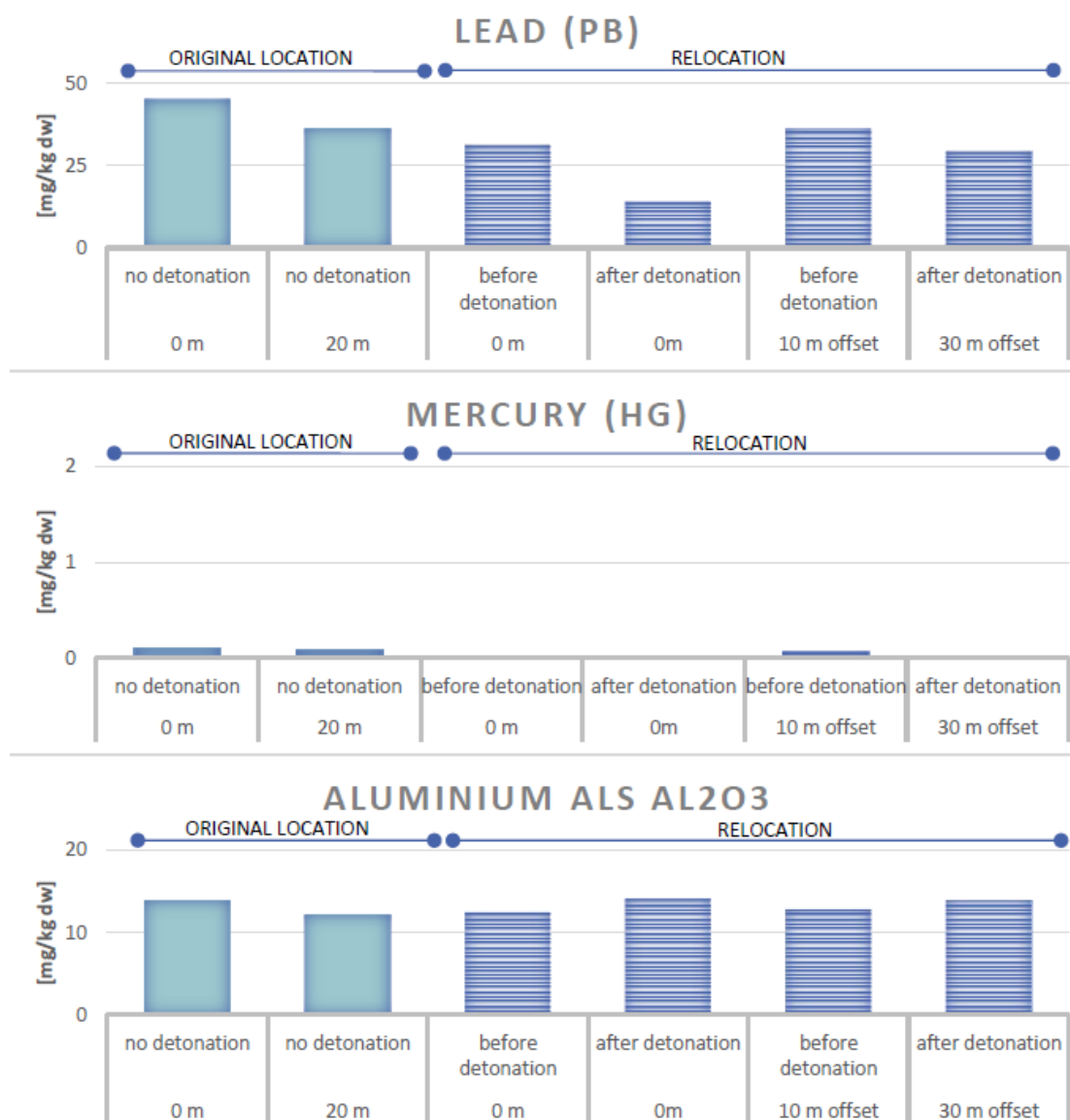


Figure 13. Analysed sediment metal concentrations from target R-R08-5261. Samples from the original location are marked with different colour than those taken from relocation detonation place.

## 7 Cultural heritage

To verify any changes in the two monitored marine archaeological objects, Wreck S-R05-7978 and Anti-submarine net S-R09-09806 were surveyed before the construction. The results of the pre-surveys were presented in the 2018 Q2 report and will be presented in the annual report for the year 2018 in more detail.

## 8 Notifications to ELY-Centres during the third quarter 2018

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

- 9.7.2018: Notification on munitions not requiring clearance.
- 12.7.2018: Incident Report - minor oil leak. A small oil leak (release of 4 litres of biodegradable oil) occurred with the ROV of Oceanic.
- 16.9.2018: Notification on small oil leak. A small amount of biodegradable oil (< 2 litres) was leaked into the water from the ROV of Olympic Triton.

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

## 9 Conclusions

Construction in Q3 consisted of pre- and post-lay rock placement, mattress installation and pipelay of line A. Due to unsuitable weather conditions, pipelay was interrupted three times during the third quarter. In addition, the amount and dimensions of mattresses and rock berms have been specified during the third quarter.

Munitions clearance was completed already during the second quarter. The results including all data show that environmental impacts of underwater noise have been as assessed or smaller.

In Q3 water quality and current velocity were monitored at munition clearance and rock placements sites. Neither munition clearance site showed elevated levels of turbidity during or after the clearance. Most probably the effect of clearance on turbidity was limited and the currents carried the compact turbidity cloud between the turbidity sensors.

The effect of rock placement on turbidity was clearly detected at Rock Placement site 1, although the measured values were mostly below the modelled values presented in the permit application. Only one measurement out of 3456 measured turbidity values (0.03 %) exceeded the winter maximum level of 61 FNU (Formazine Nephelometric Unit) presented in the permit application. The modelled summer maximum of 22 FNU was exceeded in 82 measurements (2.4 %). At the Rock Placement site 2 neither of the modelled turbidity levels were exceeded. All measurements stayed under 10 FNU except for one measurement, where measured turbidity level was 13 FNU.

The sediment toxicity analysis at monitored munition clearance locations showed no residuals of explosives exceeding the laboratory detection limits and heavy metal concentrations were typical to those seen in earlier studies in the Gulf of Finland.

Environmental and technical monitoring has been carried out according to the monitoring programme. The results in this report are preliminary. Final results will be presented in the annual report of 2018.

## 10 List of sources

### Literature

Luode Consulting Oy, 2018. Results of sediment toxicity analysis for targets R-R08-5261 and R-R09-7495. W-PE-EMS-PFI-REP-812-SEDTOXSEN-03.

Luode Consulting Oy 2018. Underwater noise monitoring during munition clearance in the Finnish EEZ. W-GE-EMO-PFI-REP-812-UWNFIREN-04.

Luode Consulting Oy, 2018. Water quality and current monitoring in the Gulf of Finland April – July 2018. W-PE-EMS-PFI-REP-812-WQCR01EN-04.

NSea/Bodac. Clearance report-R-R08-5261. W-SU-UXO-PFI-REP-831-DSP089EN-01

Ramboll, 2018. Nord Stream 2. Natural gas pipeline route through the Baltic Sea – Environmental monitoring programme, Finland. 1.2.2018. W-PE-EMS-PFI-REP-805-032300EN-11.

### Maps and GIS data

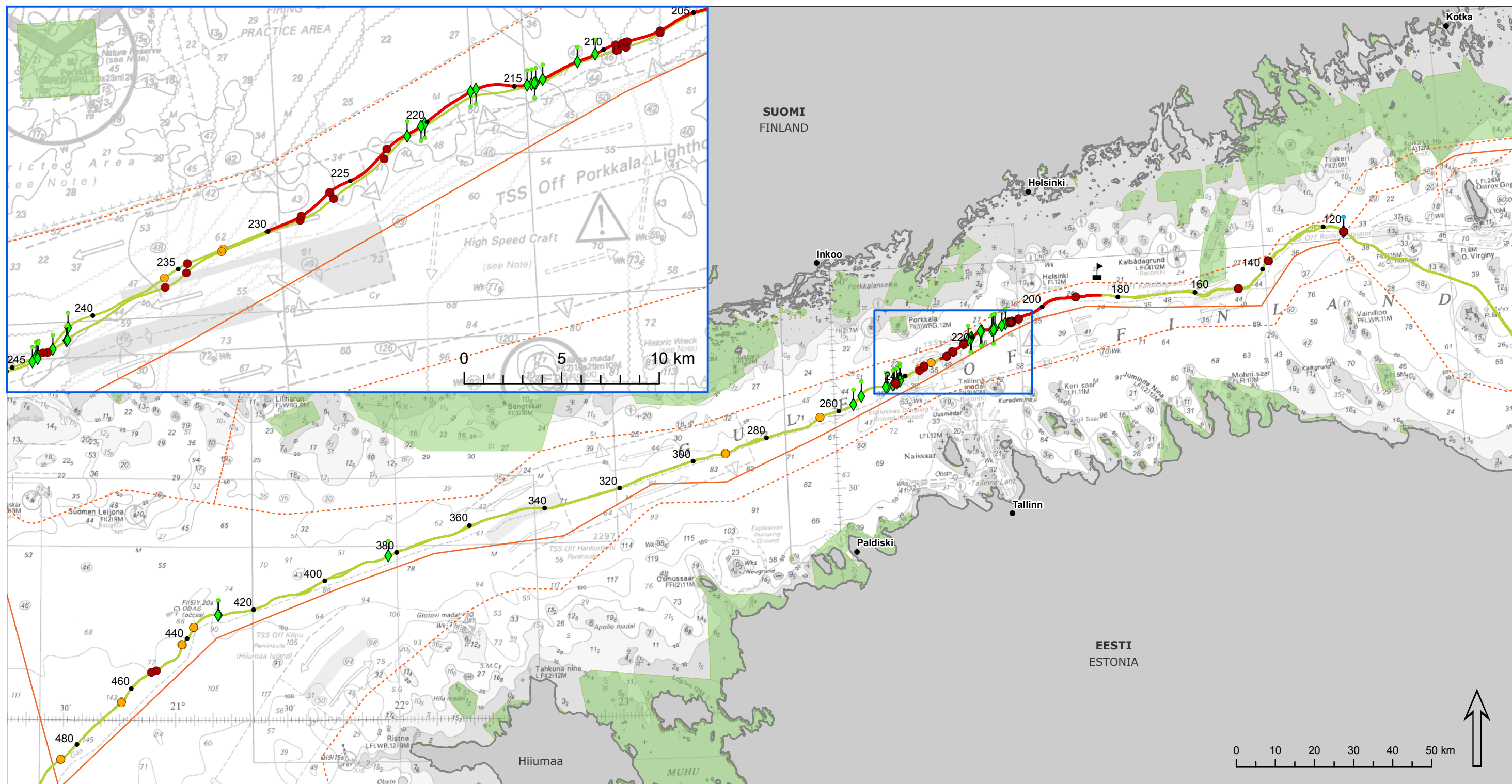
Background admiralty charts, 2018. Charts are not to be used for navigation.

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European Environmental Agency (EEA) 2018. Natura 2000 sites. © Directorate-General for the Environment (DG ENV).

Finnish Environmental Institute (SYKE) 2018. Natura 2000 sites.

International Boundaries Research Unit (IBRU) 2010. Borders of Exclusive Economic Zones and Territorial Waters.



## Nord Stream 2 Construction activities during Q3/2018

### Pipelay

— Pipelay of Line A

### Mattress installation

- Installation finished
- Installation in progress

### Installed berms

- ◆ Post-lay
- ◆ Pre-lay
- ◆ Pre-lay: Crossing with Nord Stream 1

### Reference data

- NSP2 Route
- Global Kilometre Point (GKP)
- 🚧 Open seas wave buoy
- 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"
- Background sea chart; © Crown Copyright and/or database rights. Unauthorized copying prohibited. See further copyright description in the report.
- Natura 2000 sites. EEA and SYKE 2018.

### Appendix 1

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### Construction activities during Q3/2018

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