

Nord Stream Project

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Table of Contents

1	Construction and Transboundary Monitoring Time Schedules	3
2	Transboundary Environmental Monitoring during Construction and Operation	6
2.1	Water Quality	6
2.2	Seabed Geochemistry	11
2.3	Benthic Invertebrate Communities	15
2.4	Impacts on Fish Shoals, Seabirds and Marine Mammals	18
3	Reporting of Monitoring Results	21
4	References	22
5	Revision Record	23

Appendix 1 Locations of transboundary monitoring stations

1 Construction and Transboundary Monitoring Time Schedules

The entire pipeline construction period is estimated to last for approximately 2.5 years (Figure 1). According to plans, the building of the first pipeline (North-West pipeline) will take place from April 2010 to October 2011 and the second pipeline (South-East pipeline) from May 2011 to October 2012, except for the pre-lay works that will be performed in 2010.

Before the construction started, munitions were cleared from the security corridor and partially from the anchor corridor. The clearance was carried out during the ice-free period in two campaigns and each campaign lasted for approximately two months (Figure 1). As shown in Figure 1 the first campaign was carried out during late autumn 2009 and the second campaign in spring 2010.

In order to ensure the integrity and stability of the pipelines, rock placement operations have to be carried out. Pre-lay rock placement operations before laying of the pipelines were carried out for both pipelines in 2010 and started in April 2010. Additional rock placement, so called post-lay works will be carried out in two phases after the pipelines have been laid. After their installation and prior to the commencement of operation the pipelines will be pressure-tested during the pre-commissioning phase including needed rock placements to secure on-bottom stability.

Laying of the first pipeline started in Finland in the end of June 2010. The anchored lay barge laid the first section from KP 498 at the Swedish EEZ border towards the East until KP 350. The dynamically positioning lay barge will enter the Finnish EEZ at KP 123 from the East in approximately the middle of October 2010 and lay the second section until KP 350. The first pipeline is planned to commence operation in 2011 and the second pipeline in 2012.

The current time schedule, based on a start of the construction in April 2010, for different construction activities in Finland is shown in Figure 1.

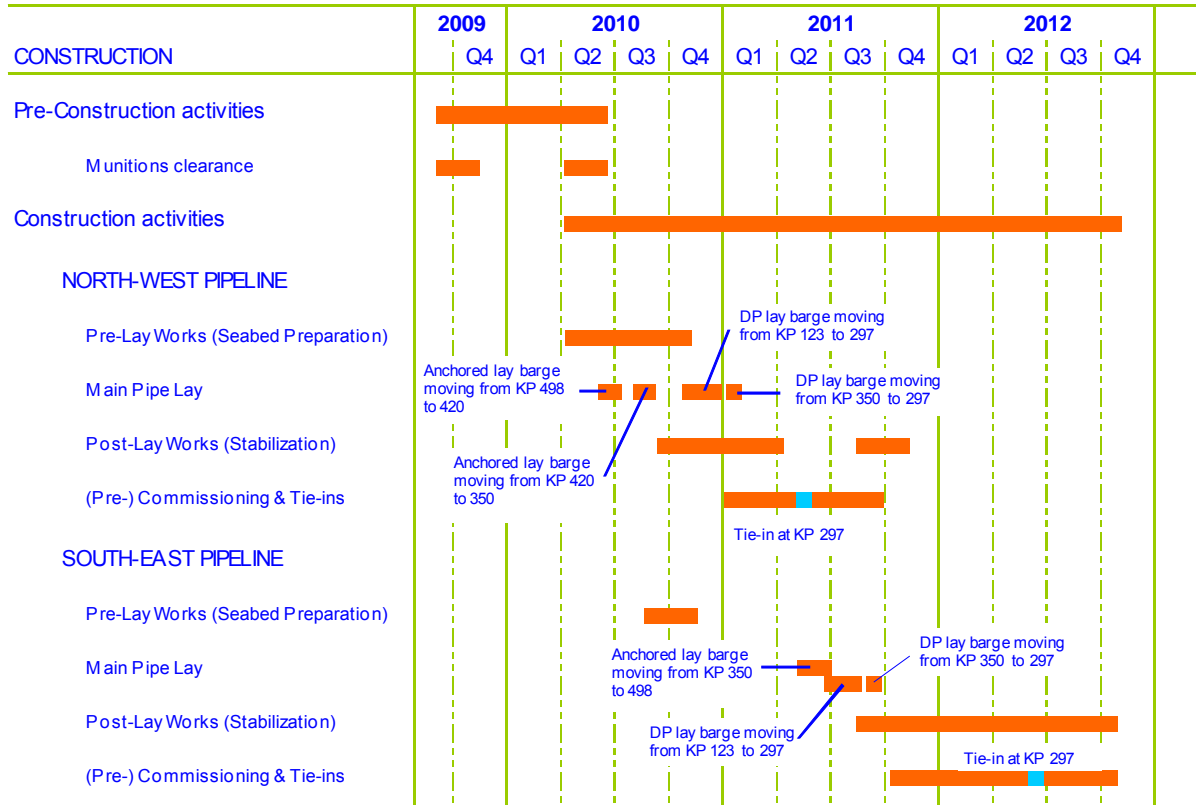


Figure 1. Nord Stream construction schedule in Finland (as of February 2010)

The predicted national and transboundary impacts from these activities on different receptors were assessed in /1/ and /2/. Based on the results of these impact assessments, transboundary environmental monitoring during construction and operation in the Finnish EEZ will include the activities presented in Chapter 2.

Timing of monitoring during construction follows the construction schedule and therefore the monitoring activities will not be a continuous process. The overview of the time schedule for different transboundary monitoring activities during construction and operation, based on the start of main construction activities in April 2010, is shown in Figure 2. More detailed information is provided in Chapter 2.

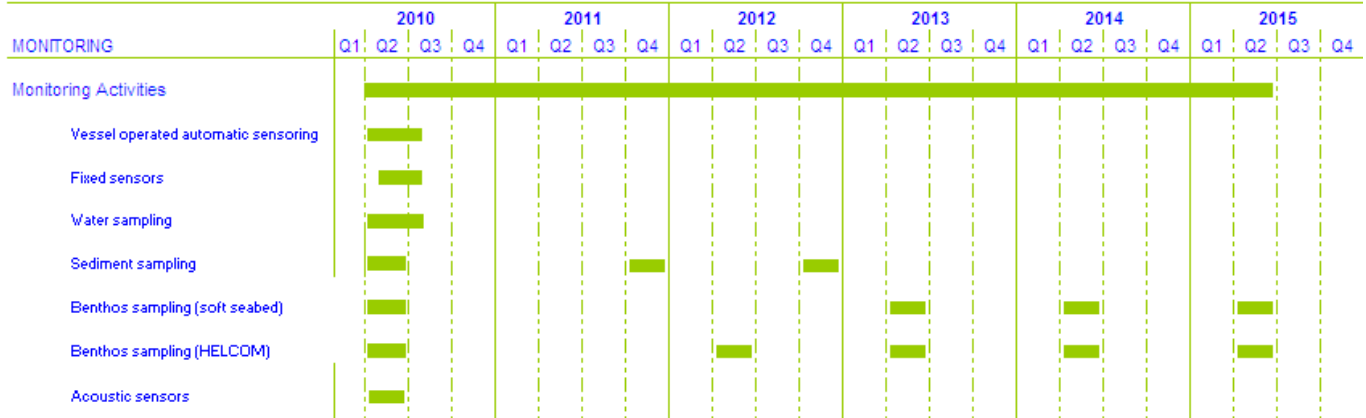


Figure 2. Approximate transboundary monitoring schedule of Nord Stream project during construction and operation in Finland (as of February 2010)

2 Transboundary Environmental Monitoring during Construction and Operation

The transboundary environmental monitoring is based on the approved monitoring programmes in Finland. The “Monitoring Programme for Munitions Clearance Finland” /3/ was approved with the decision No. 83/2009/2 by the Western Finland Environmental Permit Authority on 2 October 2009 and the “Baltic Sea Natural Gas Pipeline Environmental Monitoring Programme – Finland” /4/ was approved with the decision No. 4/2010/4 by the Regional State Administrative Agency for Southern Finland on 12 February 2010. Based on lessons learned during munitions clearance in 2009 and minor project changes after the decisions, a proposal for specifying the “Monitoring Programme for Munitions Clearance Finland” and “Baltic Sea Natural Gas Pipeline Environmental Monitoring Programme - Finland” was submitted to the Centres for Economic Development, Transport and the Environment of Uusimaa and Southwest Finland on 21 April 2010. Furthermore, notifications according to permit provisions including specifications to monitoring programmes were made to the Centres during the works in 2010. The Uusimaa Centre for Economic Development, Transport and the Environment has approved the proposed changes in letters dated on 4 June 2010 and 23 June 2010 (UUDELY/742/07.00/2010). The revision E of the “Baltic Sea Natural Gas Pipeline Environmental Monitoring Programme - Finland” /5/ and the revision G of the “Monitoring Programme for Munitions Clearance Finland” /6/ accommodate the approved changes.

With this “Transboundary Monitoring Programme Finland” the environmental monitoring as approved by the Finnish authorities is extended to assess potential transboundary impacts that may extend across the Estonian Exclusive Economic Zone (EEZ) border. The proposal for transboundary monitoring of the Estonian Ministry of Environment has been taken into account while developing the programme. The Estonian Ministry of Foreign Affairs granted a consent (No. 71) to Nord Stream to perform environmental monitoring as proposed in this programme on 7 of June 2010. The transboundary monitoring focuses on water quality, seabed geochemistry, benthic invertebrate communities, and impacts on fish shoals, seabirds and marine mammals.

2.1 Water Quality

The assessment of sediment re-suspension and spreading from the construction and operation of Nord Stream pipelines has been performed within the EIA (Chapter 8.1.1 Impacts on seabed and 8.1.2 Impacts on water quality) /1/. This assessment has been extended for munitions clearance on a munition by munition basis in /7/-/13/. Based on the assessment results, the transboundary monitoring of impacts on water quality will concentrate on the following construction activities:

- Munitions clearance
- Rock placement
- Pipe-laying and anchor handling

Sediment re-suspension and dispersion and impacts on water quality from these activities will be investigated through a combination of in situ measurements and water sampling to verify the assessment results with respect to:

- Total amount of re-suspended sediment
- Spatial range of sediment plume dispersion
- Duration of sediment plume dispersion

The quantification of the total amount of re-suspended sediment from munitions clearance will be based on a precise bathymetric survey of the seabed prior to the detonation and following the detonation to determine the resulting crater size.

The verification of the assessment results with respect to the spatial range and duration of sediment spreading (turbidity) for all activities will be conducted via in situ measurements. In situ monitoring will be performed in the immediate vicinity of selected construction sites. The monitoring procedure will include vertical profiling and horizontal transects with vessel operated automatic sensing and water sampling. In addition, for monitoring of rock placement and pipelay and anchor handling also fixed sensors will be used. The selected methods are described in detail below.

The following sensing of water quality will be performed during construction activities in the Finnish EEZ that aim at monitoring of potential transboundary impacts to Estonia:

- Vessel operated automatic sensing during munitions clearance (2 locations, VOM2-VOM3)
- Vessel operated automatic sensing and fixed sensors during rock placement (2 locations, VOFIXIW2-3)
- Vessel operated automatic sensing and fixed sensors during pipelay and anchor handling (1 location, LAY2)

The monitoring locations have been selected due to the close proximity of the construction activities to the Estonian EEZ border focusing mainly on sites with soft sediment. The proposal for transboundary monitoring of the Estonian Ministry of Environment and the geographical coverage of the monitoring have also been taken into account.

Vessel operated automatic sensing during munitions clearance will be carried out at two selected locations VOM2 and VOM3 (Appendix 1):

- VOM2 – Located at the clearance site of munition F22 with a charge size of 115 kg at KP 264. The seabed at the site consists of silt and fine sand, the depth is approximately 61 m and the distance to the Estonian EEZ border is 0.46 km.
- VOM3 – Located at the clearance site of munition F17 with a charge size of 350 kg at KP 243. The seabed at the site consists of very soft clay, the depth is approximately 71 m and the distance to the Estonian EEZ border is 2.44 km.

Vessel operated automatic sensing during rock placement will be performed at two selected locations VOFIXIW2 and VOFIXIW3 (Appendix 1):

- VOFIXIW2 – Located in the central Gulf of Finland close to KP 262, at the depth of approximately 63 m and 0.6 km from the Estonian EEZ border. Seabed is very soft clay and water column is not strongly stratified (neither strong halocline nor thermocline are expected to be present during monitoring). Approximately 7.400 m³ of rock will be placed to the seabed prior to the pipelay for the South-East pipeline. The works are planned to be done in the second quarter of 2010 and are estimated to last for approximately 3-4 days.
- VOFIXIW3 – Located in the eastern Gulf of Finland close to KP 164, at the depth of approximately 66 m and 2.2 km from the Estonian EEZ border. Seabed is dense sand. Approximately 3.700 m³ of rock will be placed to the seabed prior to the pipelay for the North-West pipeline. The works are planned to be done in the second quarter of 2010 and are estimated to last for approximately 2 days.

Vessel operated automatic sensing during pipelay of the first pipeline and anchor handling will be carried out at one selected location LAY2 (Appendix 1):

- LAY2 – Located at the section laid by an anchored lay barge near KP 495, as the barge will start pipelaying in the Finnish EEZ from KP 498 towards the East. The seabed in this area consists of soft sediments, the depth is approximately 181 m and the distance to the Estonian EEZ border is 1.3 km.

Vessel operated automatic sensing at these five locations will be carried out with multi parameter sonde that will measure vertical turbidity, temperature, conductivity and depth. The automatic sonde will be lowered from a monitoring vessel through the water column. Data will be gathered from surface to bottom with 20 to 50 cm intervals.

For munitions clearance the measurements at the selected sensing locations will be performed once prior to the detonation and two times after the detonation along two perpendicular transects. Also for rock placement the measurements at the sensing locations will be conducted once prior to and twice during the rock placement along two perpendicular transects. This enables the collection of sufficient data from the spreading and dilution of the sediment plume. The measurement grid (distance from one monitoring spot to another along a transect) depends on the size and form of the possible sediment plume arising from the activity and will be assigned prior to the measurement. The first measurement prior to a detonation and rock placement is a reference measurement and represents the natural background level of turbidity.

For pipelaying and anchor handling the measurements at the selected sensing location will be performed twice along two transects around the lay barge during the pipelay. At LAY2 station one transect will run behind the barge at a touchdown distance across the anchor corridor (+/- 800 m on either side of the pipeline route) and one transect along the outer edge of the anchor corridor at the distance of ca. 800 m from the barge. The locations of transects around the lay

barges will be confirmed well in advance of the performance of work by the pipelay contractor considering the safety issues related to monitoring.

Data from vessel operated automatic sensing will be shown as transect figures. Data is presented as a function of distance from a construction site, depth and turbidity. Results for each measurement round will show how the particulate matter in a plume behaves. Similar figures will be generated for salinity and temperature.

In addition to vessel operated sensing, 3 fixed sensors will be used at VOFIXIW2-3 stations to monitor sediment spreading from rock placement. The sensors are multiparameter sondes that measure vertical turbidity, temperature, conductivity and oxygen concentration. They will be anchored to ca. 1-2 m above the seabed and collect data every 60 minutes. At both stations also an ADCP will be installed next to the southern fixed sensor. The ADCP will be installed on the seabed and measure changes in underwater current field (current speed and direction) over the full water column. Data will be collected approximately every 1 to 2 metres from the seabed to the surface averaged over 30 to 60 minutes intervals. The sensors will be installed ca. two weeks before the start of rock placement and recovered ca. two weeks after the end of rock placement. They will be installed around the rock placement site at a distance of ca. 100 m. Exact locations around the rock placement sites will be defined in cooperation with the rock placement and monitoring contractors considering safety issues related to the monitoring work.

In addition to vessel operated sensing at LAY2 station, 2 fixed sensors will be used to monitor sediment spreading from pipelaying including anchor handling. Used sensors are multiparameter sondes that measure vertical turbidity, temperature, conductivity and oxygen concentration. Sensors are anchored to ca. 1-2 m above seabed and gather information every 60 minutes. The sensors will be installed ca. 1 week before the pipelay and recovered ca. 1 week after the pipelay. One sensor will be installed at a distance of ca. 50 m of the pipeline installation corridor and one sensor at a distance of ca. 800 m outside of the anchor corridor. The locations of the sensors will be confirmed in advance of the performance of work by the pipelay contractor considering safety issues related to the monitoring.

Water sampling from VOM2-3, VOFIXIW2-3 and LAY2 stations will be carried out in order to calibrate the results (turbidity, suspended solids and conductivity) of the vessel operated sensing. In addition the oxygen concentration, the concentration of phosphate (PO_4) and total phosphorus (P), the concentration of nitrate-nitrite ($\text{NO}_3 - \text{NO}_2$), ammonium (NH_4) and total nitrogen (N) as well as total metal concentrations (As, Cd, Cr, Co, Cu, Hg, Ni, Pb, Zn) will be analyzed from the water samples. These parameters will be analyzed with standards presented in Table 1 or similar with same accuracy and reliability by an accredited laboratory. The results for total metals will be combined with turbidity measurements to calculate their possible spreading with suspended sediments from construction activities.

At VOM2-3 and VOFIXIW2-3 stations water samples will be taken in intervals of ten meters and also from near surface and seabed (1 m from the surface and seabed). In addition, 4 to 6 samples will be taken according to the sensing data from sites that either represent the maximum turbidity concentration or at which elevated turbidity concentrations are no longer observed. At LAY2 station water samples will be taken at 3 to 4 spots along each transect from

3 to 4 depths. Depths of the water samples will be decided in the field according to the vessel operated automatic sensing data.

Results from water sampling will be presented as tables with locations and analyzed concentrations.

Table 1. Water samples will be analyzed according to the following standards or similar with same accuracy and reliability using an accredited laboratory and methods

Parameter	Accredited	Unit	Limit of quantification	Standard	Sample amount	uncertainty %
Turbidity	Yes	FTU	0.1	SFS-EN ISO 7027	100 ml	10
Oxygen concentration	Yes	mg/l	0.5	SFS-3040	100 ml	10
Phosphorus, total	Yes	µg/l	3	SFS 3036- MOD	100 ml	15
Phosphate phosphorus PO ₄ , 0.40 µm	Yes	µg/l	2	SFS 3036- MOD	100 ml	15
Nitrogen, total	Yes	µg/l	50	SFS-EN ISO 11905	100 ml	15
Nitrogen, NO ₃ +NO ₂ , 0.40 µm	Yes	µg/l	5	SFS-EN ISO 11905	100 ml	15
Nitrogen, NH ₄ , 0,40 µm	Yes	µg/l	5	SFS-EN ISO 11905	100 ml	15
Arsenic, As	Yes	µg/l	0.1	SFS-EN ISO 17294 :2005	100 ml *	20
Cadmium, Cd	Yes	µg/l	0.01	SFS-EN ISO 17294 :2005	100 ml *	15
Cobolt, Co	Yes	µg/l	0.05	SFS-EN ISO 17294 :2005	100 ml *	20
Chrome, Cr	Yes	µg/l	0.2	SFS-EN ISO 17294 :2005	100 ml *	20
Copper, Cu	Yes	µg/l	0.1	SFS-EN ISO 17294 :2005	100 ml *	20
Nickel, Ni	Yes	µg/l	0.2	SFS-EN ISO 17294 :2005	100 ml *	20
Led, Pb	Yes	µg/l	0.05	SFS-EN ISO 17294 :2005	100 ml *	20
Zinc, Zn	Yes	µg/l	0.5	SFS-EN ISO 17294 :2005	100 ml *	25
Mercury, Hg	Yes	µg/l	0.05	SFS-EN 1483:1997, modified	100 ml *	20

* = all metals from the same 100 ml sample

The transboundary monitoring programme for water quality is presented in Table 2.

Table 2. The transboundary monitoring programme for water quality

Water quality monitoring					
Project activity	Parameter	Unit	Method	Location	Timing / frequency
Munitions clearance	Sediment, nutrients and contaminant dispersion, conductivity, depth and temperature	NTU (turbidity), km (distance and height), h (duration), µs/cm (conductivity), °C (temperature), and m (depth)	Vessel operated automatic sensing	2 locations on silt and fine sand (VOM2) and on very soft clay (VOM3)	Once before and two times after the detonation
		NTU (turbidity), km (distance and height), h (duration), µs/cm (conductivity), °C (temperature), and m (depth)	Vessel operated automatic sensing	2 locations on very soft clay (VOFIXIW2) and on dense sand (VOFIXIW3)	Once before and two times during rock placement
Rock placement	Sediment, nutrients and contaminant dispersion, conductivity, depth and temperature	NTU (turbidity), µs/cm (conductivity), °C (temperature), and mg/l (oxygen)	ADCP and fixed sensors	1 ADCP and 3 turbidity sensors around rock placement sites (VOFIXIW2-3)	From ca. two weeks before rock placement until ca. two weeks after rock placement
		NTU (turbidity), km (distance and height), h (duration), µs/cm (conductivity), °C (temperature) and m (depth)	Vessel operated automatic sensing	1 location in an area with soft sediment (LAY2)	During pipe-laying and anchor handling
Pipe-laying by anchored lay barge	Sediment, nutrients and contaminant dispersion, conductivity, depth and temperature	NTU (turbidity), µs/cm (conductivity), °C (temperature), and mg/l (oxygen)	Fixed sensors	1 sensor outside the pipeline installation corridor and anchor corridor (LAY2)	From 1 week before pipelaying until 1 week after pipelaying
		Water samples for oxygen, nutrient and metal analysis and calibration of sensors	Water sampling for calibration and analysis	VOM2-3 VOFIXIW2-3 LAY2	Prior to and after munitions clearance, during rock placement and pipe-laying
Munitions clearance, rock placement and pipe-laying		mg/l and FTU (turbidity), mg/l (oxygen), µs/cm (conductivity) and µg/l (total and dissolved P and N, metals)			

2.2 Seabed Geochemistry

The assessment of sediment re-suspension and spreading from the construction and operation of Nord Stream pipelines has been performed within the EIA (Chapter 8.1.1 Impacts on seabed and 8.1.2 Impacts on water quality) /1/.

Monitoring of changes in seabed geochemistry has been discussed with the Finnish Meteorological Institute, Geological Survey of Finland, Finnish Environment Institute, Regional Environment Centres and Estonian Ministry of Environment. Based on these consultations transboundary monitoring of seabed geochemistry with focus on soft sediment will be performed at three stations SED3-SED5 (EST) (Figure 3):

- **SED3 (EST)** (relates to VOM3) – close to the munitions clearance site at KP 234 where the munition F17 will be detonated. The charge size of each munition is 350 kg. The munition is located 2.44 km from the Estonian EEZ border
- **SED4 (EST)** (relates to VOFIXIW2) – close to rock placement site at KP 262, where approximately 7.400 m³ of rock will be placed to the seabed prior to the pipelay for the South-East pipeline. The distance from the rock berm to the Estonian EEZ border will be approximately 0.6 km.
- **SED5 (EST)** (relates to VOFIXIW3) – close to rock placement site at KP 164, where approximately 3,700 m³ of rock will be placed to the seabed prior to the pipelay for the North-West pipeline. The distance from the rock berm to the Estonian EEZ border will be approximately 2.3 km.

The sediment sampling will be carried out once prior to and once after the munitions clearance and rock placement as well as once after the completion of the construction of the first and second pipeline. At all stations samples will be taken from three locations at approximately similar depths. At all locations surface sediment samples (0-2 cm) will be taken using a GEMAX-core sampler or similar.

The samples taken will be analyzed for dioxins, organic tin compounds, arsenic (As), cobalt (Co), chromium (Cr), nickel (Ni), zinc (Zn), copper (Cu), lead (Pb), cadmium (Cd), mercury (Hg) and total carbon (C_{tot}) according to the standards presented in Table 3 or similar with same accuracy and reliability. Also the grain size distribution / clay content and total organic carbon (TOC) required for the normalization of the results will be analyzed. Samples will be analyzed in an accredited laboratory.

The sediment analysis data from all sampling stations will be reported as actual concentrations and as normalized concentrations in tables and in graphs.

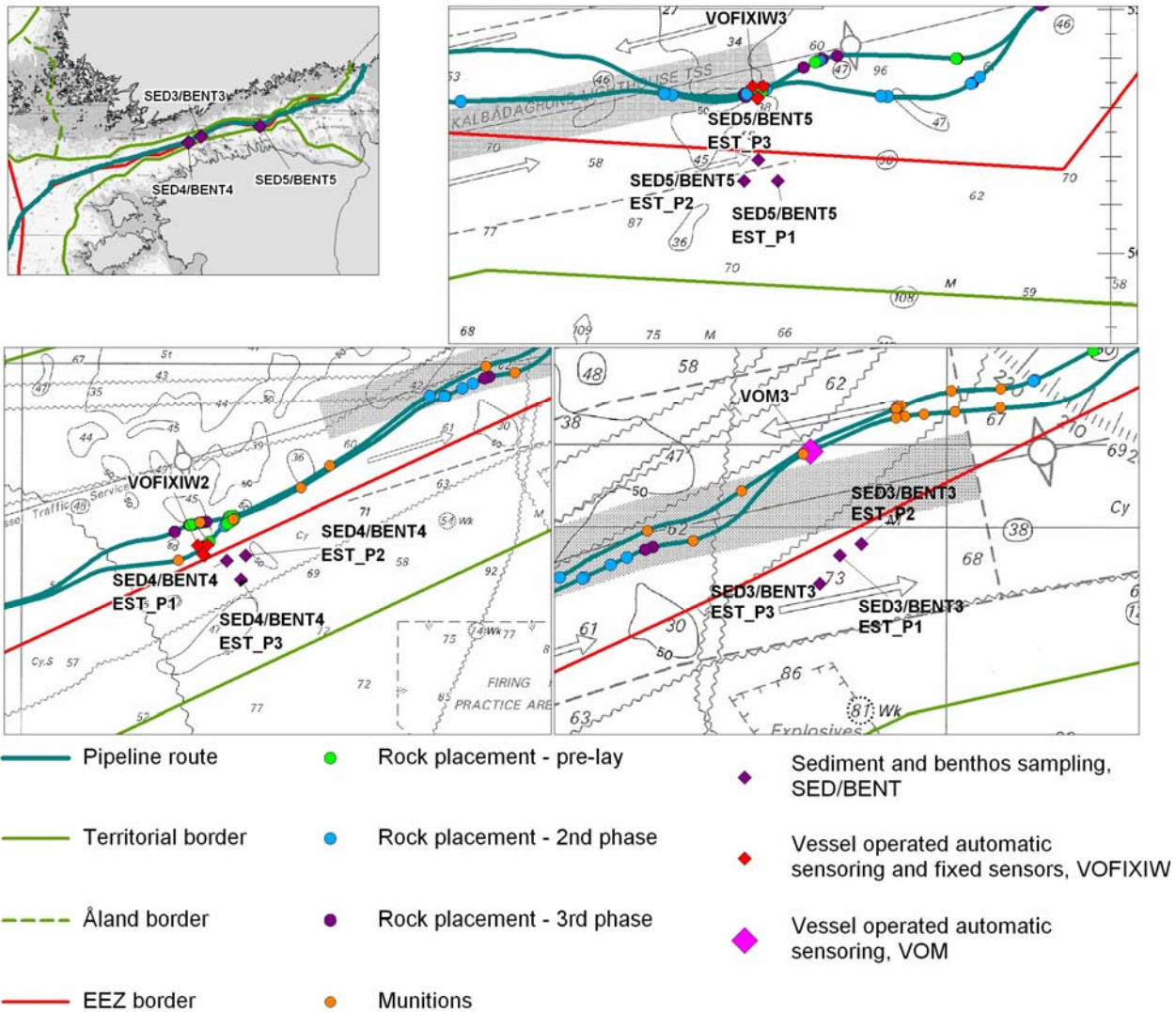


Figure 3. Sediment and benthos sampling stations SED3-5 (EST) and BENT3-5 (EST) for monitoring changes in seabed geochemistry and recovery of benthos.

Table 3. Sediment samples will be analysed according to these standards or similar with same accuracy and reliability

Parameters	Accredited	Unit	Limit of quantification	Description/ reference standards	Uncertainty +/- %
Grain size	yes			Sedigraph (micromeritic) X-ray method Measures grain size with a diameter of 300 to 0.10 µm (spherical)	10
Dry weight	yes			SFS 3008	
Loss of ignition, LOI	yes			SFS 3008	
Total organic carbon TOC	yes			ISO10694	
Arsenic, As	yes	mg/ kg	5.0	ISO 17294-2, EPA 3051A, ISO 11466	25
Mercury, Hg	yes	mg/ kg	0.1	ISO 17294-2, EPA 3051A, ISO 11466	35
Cadmium, Cd	yes	mg/ kg	0.4	ISO 17294-2, EPA 3051A, ISO 11466	20
Cobalt, Co	yes	mg/ kg	5.0	ISO 17294-2, EPA 3051A, ISO 11466	25
Chrome, Cr	yes	mg/ kg	5.0	ISO 17294-2, EPA 3051A, ISO 11466	25
Copper, Cu	yes	mg/ kg	5.0	ISO 17294-2, EPA 3051A, ISO 11466	25
Lead, Pb	yes	mg/ kg	10.0	ISO 17294-2, EPA 3051A, ISO 11466	25
Nickel, Ni	yes	mg/ kg	5.0	ISO 17294-2, EPA 3051A, ISO 11466	30
Zinc, Zn	yes	mg/ kg	5.0	ISO 17294-2, EPA 3051A, ISO 11466	30
Organotins	yes	µg/ kg	1	DIN ISO 23161	
Dioxins	yes	ng/ kg	0.455	EPA 16131, EPA 82902 and DIN 38414-243, all in combination with EN ISO 17025:2005	20-30
Pre-treatment (microwave)				EPA 3051A, ISO 11466	

The transboundary monitoring programme for seabed geochemistry during construction is presented in Table 4.

Table 4. The transboundary monitoring programme for seabed geochemistry

Seabed geochemistry monitoring					
Project activity	Parameter	Unit	Method	Location	Timing / frequency
Munitions clearance and rock placement	Dioxins, organotins, As, Co, Cr, Ni, Zn, Cu, Pb, Cd, Hg and C _{tot}	mg/kg, µg/g	GEMAX core sampler or similar	Three stations (SED3-5 (EST))	Once before and once after the clearance and rock placement. Once after the construction of the first pipeline and once after construction of the second pipeline (in total 4 times)

2.3 Benthic Invertebrate Communities

Soft seabed - Construction activities

An assessment of potential impacts on benthos from the construction and operation of Nord Stream pipelines has been performed within the EIA (Chapter 8.2.1 Impacts on benthic environment) /1/.

Monitoring of changes in and recovery of benthic invertebrate infauna has been discussed with the Finnish Environment Institute, Regional Environment Centres and Estonian Ministry of Environment. Based on these consultations transboundary benthos sampling from soft sediment will be performed at three stations (BENT3-5 (EST)), which are at the same locations as the sediment sampling stations SED3-5 (EST) (Figure 3):

- **BENT3 (EST)** – Close to the munitions clearance site at KP 243, where the munition F17 will be detonated. The charge size of the munition is 350 kg and the distance to the Estonian EEZ border is 2.44 km.
- **BENT4 (EST)** – Close to the rock placement site at KP 262, where approximately 7,400 m³ of rock will be placed to the seabed prior to the pipelay for the South-East pipeline. The distance from the rock berm to the Estonian EEZ border will be approximately 0.6 km.
- **BENT5 (EST)** – Close to rock placement site at KP 164, where approximately 3,700 m³ of rock will be placed to the seabed prior to the pipelay for the North-West pipeline. The distance from the rock berm to the Estonian EEZ border will be approximately 2.3 km.

Benthos will be sampled once prior to the monitored activity and once after the activity to gain accurate baseline data. In addition, the recovery of benthic invertebrate infauna will be monitored once a year during the first three years of operation. According to the current knowledge the duration of a normal recovery process of benthic invertebrate communities in the Baltic Sea is about three years. The samples will be taken by means of a Van Veen grab (0.1 m²) according to the HELCOM COMBINE guidelines (Annex C-8 Soft bottom macrozoobenthos¹). At each station three samples will be taken from three locations at approximately similar depths and each sample will be analysed individually. In the operational phase the benthos sampling will be performed during the same season as for HELCOM long-term monitoring, i.e. in May-June.

During the sampling procedure following notes will be taken:

- Coordinates
- Time and weather conditions
- Sampling depth and sediment description
- Type and specification of the sampler

¹ http://www.helcom.fi/groups/monas/CombineManual/AnnexesC/en_GB/annex8/

Samples will be sieved separately through a metal gauze (stainless steel, brass or bronze) having a mesh size of 0.5 and 1.0 mm. Monitoring results are presented as a number of species and individuals at monitored locations and as a list of species at specific locations.

Soft seabed – HELCOM stations

An assessment of potential impacts on HELCOM long-term monitoring stations and scientific heritage from the construction and operation of Nord Stream pipelines has been performed in /14/.

Monitoring of potential unexpected changes in benthos at HELCOM long term monitoring stations and minimizing risk to scientific heritage during operation has been planned based on discussions with the Finnish Meteorological Institute, Geological Survey of Finland and Finnish Environment Institute. Consequently HELCOM stations LL7 (1.2 km), LL5 (1.6 km) and LL6A (1.4 km) near the pipeline route will be monitored. Benthos will be sampled at each HELCOM station and two parallel stations (x and y). The parallel stations will be located at the similar depth and seabed type as the monitored station (LL7, LL5 and LL6A) but at a greater distance from the pipeline route. If the scientific heritage at any of these HELCOM stations would be jeopardized, the HELCOM station could be moved to one of the parallel stations (x or y). As shown in Figure 6 LL7 is located on the southern side of the South-East pipeline ca. 0.16 km from the Estonian EEZ border. Therefore the search for two suitable parallel stations to LL7 will be extended into the Estonian EEZ as necessary. The exact locations will be selected in co-operation with the Finnish Environment Institute. HELCOM stations will be monitored once before the installation of the first pipeline and annually after the construction of the first pipeline for five years.

The samples will be taken by means of a Van Veen grab according to the HELCOM COMBINE guidelines as described above and at the same time as for HELCOM long-term monitoring, i.e. in May-June.

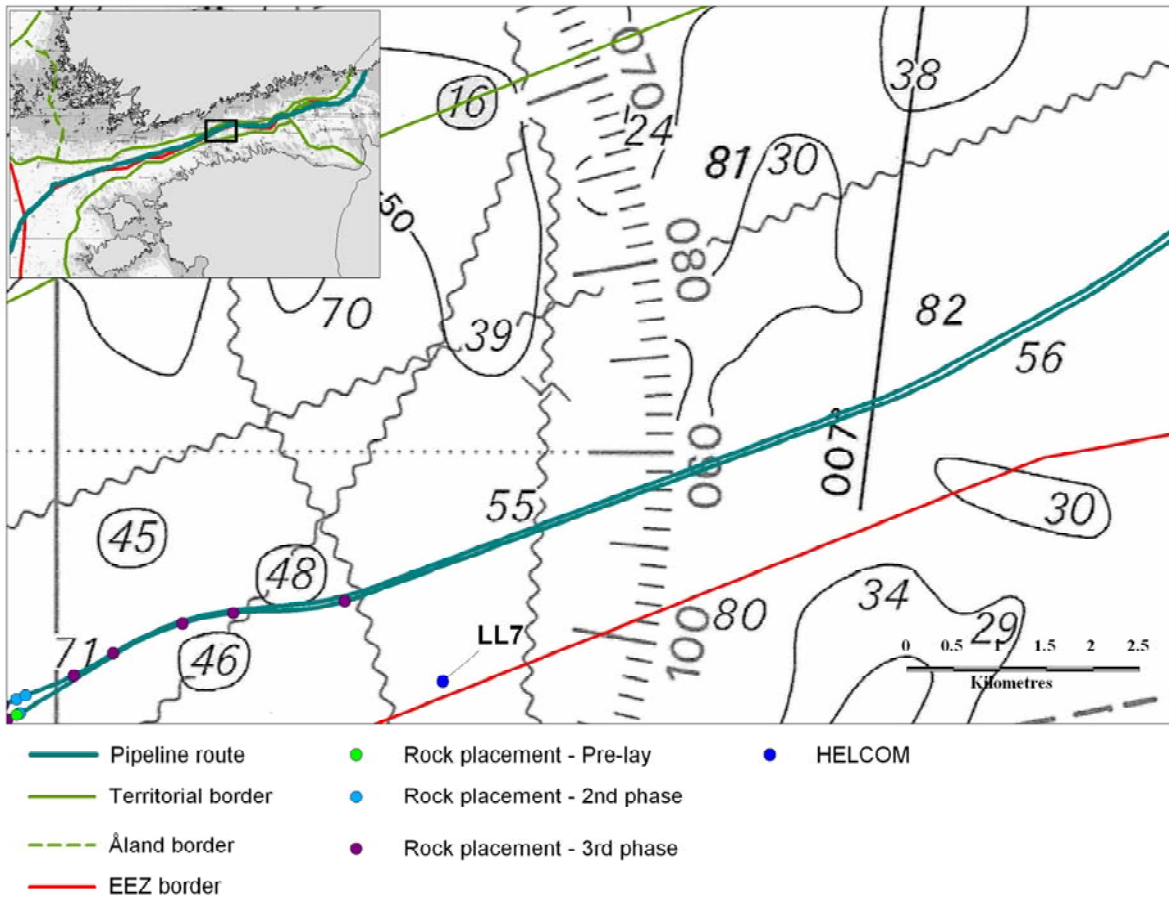


Figure 4. Location of the HELCOM station LL7 close to the Estonian EEZ border, for which two parallel stations x and y for benthos sampling will be selected.

The transboundary monitoring programme for benthos during construction and operation is presented in Table 5.

Table 5. The transboundary monitoring programme for benthos during construction and operation

Benthos monitoring					
Project activity	Parameter	Unit	Method	Location	Timing / frequency
Construction and Operation	Abundance of species and individuals - benthos, oxygen concentration	ind./m ² , species/m ² (abundance), mg/l (oxygen)	Van Veen grab	Three stations (BENT3-5 (EST))	Once before and once after the clearance and rock placement. Once annually after the construction of both pipelines for 3 years (in total 5 times)
	Abundance of species and individuals – benthos, oxygen concentration	ind./m ² , species/m ² (abundance), mg/l (oxygen)	Van Veen grab	Benthos sampling at HELCOM station LL7 and its two parallel stations x and y.	Once before installation of the first pipeline and annually after the construction of the first pipeline for 5 years

2.4 Impacts on Fish Shoals, Seabirds and Marine Mammals

An assessment of potential impacts on fish, marine mammals and seabirds caused by noise emissions and pressure waves resulting from munitions clearance has been performed within the EIA (Chapter 8.2.3 Impacts on fish and fish stocks, 8.2.4 Impacts on marine mammals and 8.2.5 Impacts on seabirds) /1/. This assessment has been extended on a munition by munition basis to consider the impact of the pressure wave resulting from the clearance of individual munitions on fish, marine mammals and seabirds /7/-/13/.

As defined in Nord Stream’s Munitions Construction Management Plan the primary approach to mitigate impacts on fish, seabirds and marine mammals during clearance works is to displace them from the safety zone prior to the detonation. The implementation of the mitigation approach will be designed separately to all munitions by the clearance Contractor in the munition specific clearance plans. The approach for all detonations involves the following measures:

1. Observations to determine, to the extent practicable, whether marine mammals, fish shoals or seabirds are in the injury/safety zone around the detonation location. Observations will commence at least 30 minutes prior to planned detonation. Observation methods will include:
 - **Visual observation** of the presence of marine mammals and seabirds by qualified Marine Mammal Observers (MMOs) from the survey vessel. To support effective observations they will be carried out in calm to slight sea conditions and daylight hours.
 - **Passive Acoustic Monitoring (PAM)** to detect vocalisations of marine mammals. The PAM buoy is equipped with a high sensitivity hydrophone (operating frequency up to 150 kHz). The PAM system will be deployed at the distance of about 300 m

from the munition prior to each detonation and the signals will be transmitted to the survey vessel by radio. The range of detection is determined by the frequency and source level of the animals' calls. The vocalizations are recorded in dB starting 1 hour prior to the detonation. The recorded results will be presented graphically or in audio format.

- **Active acoustic fish surveys** by sonar sweep to detect the presence of fish shoals. The sonar sweep is sensitive to frequencies of 50 kHz and 200 kHz and has a 50/200 kHz transducer. The recorded data is shown on a high resolution display. Acoustic fish survey will be carried out from the support vessel prior to each detonation.

If marine mammals, seabirds or fish shoals are identified in the injury/safety zone, the detonation will be delayed.

2. The displacement activities in the injury/safety zone of the detonation site will be undertaken after the observations. The methods will include:
 - **Acoustic deterrent devices** ("seal scrammer") to displace seals and harbour porpoises from the clearance site prior to the detonation. The scrammers produce high frequency sound with a maximum acoustic output of 189 dB. Their anticipated effective range for seals ca. 300 m. The number of planned scrammers is four: one next to the PAM 300 m from the munition, two anchored on the seabed 300 m from the munition and one from the support vessel. The standard layout of the environmental mitigation equipment prior to the detonation is shown in Figure 7.
 - **Acoustic fish scarers** comprising detonation of small explosive charges (50 to 500 g) to displace fish. They will be deployed from the support vessel at ca. 20 m below the surface and within 30 seconds of the detonation of each munition.
3. Marine mammals may be attracted to the munitions clearance area in case of dead or injured fish after the detonation. To minimise this effect the Contractor will recover any fish killed during the clearance activity by using a surface trawl from the support vessel.

Ecological supervision will be provided during the course of the clearance campaign to ensure that the displacement activities are properly implemented.

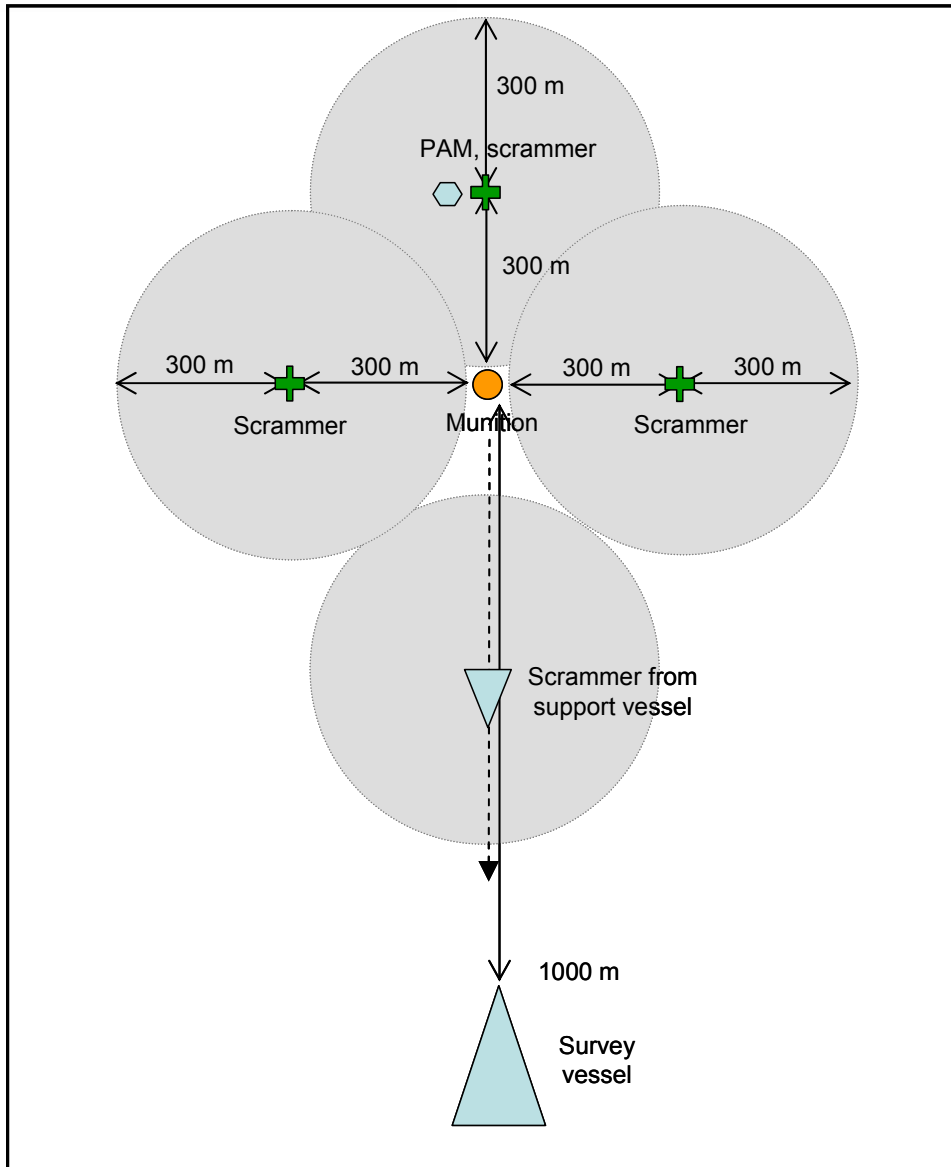


Figure 5. Standard layout of the environmental mitigation equipment prior to the detonation. View is from above.

As presented in /7/ the munition F22 (R-09-192) with a charge size of 115 kg charge is located at KP 264 ca. 0.46 km from Estonian EEZ border. Therefore Nord Stream intended to – subject to permission from Estonia - perform visual and acoustic observations and deploy acoustic deterrent devices around the munition also in the Estonian EEZ as necessary.

The transboundary monitoring programme for marine mammals, seabirds and fish shoals is presented in Table 6.

Table 6. The transboundary monitoring programme for marine mammals, seabirds and fish shoals during munitions clearance

Marine mammals, seabirds and fish monitoring					
Project activity	Parameter	Unit	Method	Location	Timing
Munitions clearance	Presence of marine mammals or seabirds	Present / absent, number and species	Visual observation by MMO, PAM	Munition F22 at KP 264	Prior to detonation
	Presence of fish shoals	Present / absent	Sonar sweep	Munition F22 at KP 264	Prior to detonation
	Injured marine mammals or seabirds	Yes / no, number and species	Visual observation	Munition F22 at KP 264	After detonation
	Mortality of fish	Yes / no, estimated amount and species	Visual observation and surface trawl	Munition F22 at KP 264	After detonation

Reporting of Observations

Qualified MMOs onboard will have daily log sheets which will record every sighting of marine mammals, seabirds and fish shoals prior to the detonation and also any incidents of injured seabirds or marine mammals and mortality of fish after the detonation. The clearance Contractor will report this data to Nord Stream within the daily reporting. The observation records will be provided to the authorities as a copy of the log book.

3 Reporting of Monitoring Results

Nord Stream is committed to report publicly on its monitoring programme on a regular basis. At national levels results will be shared with national authorities as agreed upon. The national monitoring results for Finland will be summarized in a report on yearly basis in Finnish, Swedish and English. The transboundary monitoring results from Estonian EEZ will be included as an appendix to this annual report. The transboundary results will be discussed in light of the water quality monitoring results gathered in Finland. The annual report will be delivered to the competent Finnish authorities within two months from the end of each year (by the end of February). The Finnish authorities will provide the report to the relevant Estonian authorities.

The annual monitoring report among others:

- summarizes the monitoring results from all monitored activities and parameters
- compares the results from sediment spreading to modeling results and
- examines the actual project impacts based on measured parameters and compares these with assessed impacts.

4 References

- /1/ Nord Stream and Ramboll, 2009, Environmental impact assessment report, Natural gas pipeline through the Baltic Sea, Environmental impact assessment in the exclusive economic zone of Finland.
- /2/ Nord Stream AG, 2009, Nord Stream Espoo Report.
- /3/ Nord Stream AG, 2009, Monitoring Programme for Munitions Clearance Finland, Rev. E
- /4/ Nord Stream AG, 2010, Baltic Sea Natural Gas Pipeline Environmental Monitoring Programme – Finland, Rev. C2
- /5/ Nord Stream AG, 2010, Monitoring Programme for Munitions Clearance Finland, Rev. G
- /6/ Nord Stream AG, 2010, Baltic Sea Natural Gas Pipeline Environmental Monitoring Programme – Finland, Rev. E
- /7/ Witteveen+Bos, 2010, Nord Stream Munitions clearance: Environmental impacts on munition by munition basis Finnish EEZ
- /8/ Witteveen+Bos, 2010, Nord Stream Munitions clearance in Finnish Exclusive Economic Zone: Sediment and contaminant spreading on munition by munition basis Gulf of Finland
- /9/ Witteveen+Bos and Nord Stream, 2010, Nord Stream munitions clearance in Finnish EEZ, Environmental impacts on munition by munition basis, Phase 2, G-PE-EIA-REP-000-MCLFP2EN-A
- /10/ Witteveen+Bos and Nord Stream, 2010, Nord Stream Munitions clearance in Finnish EEZ Environmental impacts of munitions F43-F46, G-PE-EIA-REP-000-MCLF4NEN-B
- /11/ Witteveen+Bos and Nord Stream, 2010, Nord Stream Munitions clearance in the Finnish EEZ, Environmental impacts of munitions F37-F38, G-PE-EIA-REP-000-MCLF3738-A
- /12/ Witteveen+Bos and Nord Stream, 2010, Nord Stream Munitions clearance in Finnish EEZ, Environmental impacts of munitions F38B-F38I, G-PE-EIA-REP-000-MCLF38BI-A
- /13/ Witteveen+Bos and Nord Stream, 2010, Nord Stream Munitions clearance in Finnish EEZ, Environmental impacts of munitions F38G-J-K, G-PE-EIA-REP-000-MCLF38GK-A
- /14/ Nord Stream and Ramboll, 2010, Background information on HELCOM and other long-term monitoring stations close to the Nord Stream Project area and assessment of the project's impacts on them - Finland

5 Revision Record

Rev.	Date	Description	Prepared	Checked	Approved		
			Nord Stream				
A	2010-08-30	Issue for use	TSA	MHA	SBO		
02	2010-03-10	Issue for consultation	TSA	MHA	SBO		
01	2010-02-18	Issue for consultation	TSA	MHA	SBO		

Appendix 1 Locations of transboundary monitoring stations