Nord Stream Project

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List of Abbreviations

AIS	Automatic Identification System
AUV	Automated underwater vehicle
bcm	billion cubic metres
CIP	Contractor Implementation Plan
CMP	Construction Management Plan
DP lay barge	Dynamically positioning lay barge
EEZ	Exclusive economic zone
EIA	Environmental impact assessment
ESMS	Environmental and Social Management System
ESMP	Environmental and Social Management Plan
FIMR	Finnish Institute for Marine Research, merged to Finnish Environment Institute and Finnish Meteorological Institute
FNBA	Finnish National Board of Antiquities
GOFREP	Gulf of Finland Reporting System
GTK	Geological Survey of Finland
HSES MS	Health, Safety, Environment and Social Management System
IMR	Inspection, maintenance and repair
KP	Kilometre point
ROV	Remotely Operated Vehicle
S	Salinity
SYKE	Finnish Environment Institute
T	Temperature
Tot-N	Total nitrogen
Tot-P	Total phosphorous
TW	Territorial waters

List of Abbreviations of Monitoring Stations

BENT	Benthos monitoring station
CONTROL	Long term water quality monitoring station
FIX	Fixed water quality monitoring station during specific construction activity
LAY	Water quality monitoring station during pipelay
SED	Sediment monitoring site
VOFIXIW	Water quality monitoring station during rock placement. Vessel operated and fixed monitoring.
VOHE	Water quality monitoring station close to HELCOM station. Vessel operated monitoring.

1 Introduction

Nord Stream AG is installing and plans to operate an offshore natural gas pipeline from Russia to Germany. The Nord Stream Pipeline will connect the large natural gas resources of Russia with the European natural gas pipeline network. At full capacity, it will provide 55 billion cubic metres (bcm) of natural gas per year to European consumers.

The length of the entire two-pipeline system ('the Nord Stream Pipeline') will be approximately 1,220 km. The pipeline crosses the exclusive economic zones (EEZ) of Russia, Finland, Sweden, Denmark and Germany, and territorial waters (TW) of Russia, Denmark and Germany.

The pipeline construction works commenced in 2010 and the second pipeline is planned to be completed in 2012. The Nord Stream Pipeline is designed to operate for 50 years. This document provides the approved environmental monitoring programme for the main pipeline construction activities and the pipeline operation within the Finnish EEZ. The monitoring programme has been developed in cooperation with the Finnish Environment Institute (SYKE), Geological Survey of Finland (GTK), Finnish Meteorological Institute, Employment and Economic Development Centre for Uusimaa, Employment and Economic Development Centre for Southeastern Finland, Uusimaa Regional Environment Centre, Southwest Finland Regional Environment Centre, Southeast Finland Regional Environment Centre[1] and the Finnish Border Guard.

To ensure the safe installation and long-term integrity of the pipeline, some clearance of conventional munitions was required prior to the commencement of main construction activities. The monitoring programme for munitions clearance in phase 1 in the Finnish EEZ is presented in a separate "Monitoring Programme for Munitions Clearance Finland" that was approved by the decision No. 83/2009/2 of the Western Finland Environmental Permit Authority on 2 October 2009.The monitoring programme for munitions clearance in phase 2 in the Finnish EEZ is attached to this programme as an Appendix 4. Monitoring of the recovery of the benthic environment during pipeline operation that also relates to potential impacts from munitions clearance is included in Ch. 6.4 of this Baltic Sea Natural Gas Pipeline Environmental Monitoring Programme - Finland.

The revision C2 of the "Baltic Sea Natural Gas Pipeline Environmental Monitoring Programme - Finland" (dated on 8 February 2010) was approved by the decision No. 4/2010/4 of the Southern Finland Regional State Administrative Agency on 12 February 2010. Based on lessons learned during munitions clearance in 2009 and minor project changes after the decision 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 implications to monitoring programmes have been 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 a letter dated on 4 June 2010 (UUDELY/742/07.00/2010) and a letter dated on 23 June 2010 (UUDELY/742/07.00/2010). This revision E of the "Baltic Sea Natural Gas Pipeline

[1] As a result of the restructuring of the administration, the regional Employment and Economic Development Centres and Environment Centres were integrated and since 1 January 2010 the names of these authorities were changed to: Uusimaa Centre for Economic Development, Transport and the Environment, Centre for Economic Development, Transport and the Environment of Southwest Finland and Centre for Economic Development, Transport and the Environment of Southeast Finland.

Environmental Monitoring Programme - Finland" and the revision G of the "Monitoring Programme for Munitions Clearance Finland" accommodate the approved changes.

2 General Approach

According to Nord Stream's general monitoring approach environmental monitoring will be directed at those areas of environmental sensitivity that are predicted to experience significant (moderate significance or more) impacts from the Project. Additionally it is important to direct monitoring effort where there may be uncertainty as to the accuracy of the impact assessment. In such cases the outcome of monitoring has the potential to influence the work introducing or modifying mitigations that will reduce the significance of the impact.

In the context of this Project, the opportunities to apply lessons learned from monitoring are threefold: at or near to the monitoring site, in subsequent sections of the construction activities along the route and for the second pipeline.

Nord Stream's overall project environmental monitoring during construction and operation will vary in spatial range, temporal frequency, duration and monitored parameters from place to place in accordance with the potential adverse impacts predicted and in relation to potential receptors. The monitoring activities will also address particular reporting requirements at national levels. The programme presented in this document will concentrate on the monitoring activities that will be carried out in the Finnish EEZ. The purpose of the monitoring programme is to define how Nord Stream will monitor the impacts of the main construction works in the Finnish EEZ, as regards to statutory monitoring pursuant to the Water Act. The programme has been developed with the following objectives:

- To monitor that the pipeline is installed in accordance with the national permit conditions
- To confirm that the pipeline construction does not cause impacts not previously identified or greater impacts than predicted
- To provide a basis for corrective action, where required
- To document the recovery of the environment after construction
- To monitor that significant environmental effects will not be caused during operation
- To verify the findings of the EIA and the modelling results used to predict environmental impacts

Environmental and social monitoring together with a specific Environmental and Social Management Plan (ESMP) (Construction) will be an integral part of the overall Nord Stream Health, Safety, Environment and Social Management System (HSES MS) consistent with ISO 14001 and OHSAS 18001.

The environmental monitoring for pipeline construction activities comprises three major phases:

- baseline investigation (planning/permitting phase)
- monitoring during construction
- monitoring during operation (after construction)

Although these steps require different actions, they are seen as part of a single overall approach.

In order to measure the effectiveness of mitigation measures and potential actual Project-related impact the receptors/indicators identified within the monitoring programme should have/be:

- Low natural variability and broad applicability
- Measurable
- Supported by a sound historic data series
- Appropriate to the scale of impact, the impact mechanism and temporal and spatial dynamics.

Further key principles guiding the development and implementation of the national environmental monitoring programmes for the Nord Stream Project are as follows /1/:

Consistency: It will be desirable to the extent practicable to have a harmonised approach in terms of sampling and analysis protocols along the length of the route. For some parameters there may be prescriptive requirements at the national level but where this is not the case a harmonised approach across national boundaries will be used. This will deliver data that are more readily comparable and will allow for improved environmental management and performance. Monitoring will, where possible, be congruent with HELCOM guidelines.

Synergy: In addition to the environmental surveys the Project undertakes engineering inspection and maintenance led surveys. These include seabed investigations to understand seabed conditions, shallow geology, presence of obstacles and cultural heritage, and the condition of pipelines and their support structures. The results of the surveys will be complied in integrated survey reports. This approach will be adopted to maximise the synergy between the various monitoring activities (environmental and engineering) with different initial objectives.

Reporting and Data Sharing: It will be important for the Project to have access to ongoing data acquisition programmes by third parties and government institutions to be able to fully interpret the data it collects. By the same token, subject to any constraints on disclosure placed by a national authority, the Project is committed to share its data with relevant stakeholders and make arrangements to facilitate this process. At a Project-wide level, Nord Stream is committed to report publically on its monitoring programme on a regular basis. At a national level, results will be shared with national authorities at a frequency to be agreed with the relevant national authority.

Seasonal and Inter-annual Variability: It is important to consider the inherent natural variability that is typical of many of the parameters used in marine monitoring programmes to avoid incorrect conclusions about its presumed impacts. Similarly, it is important that reference sites are used to account for the spatial variability that may occur in the marine environment. Whereby, data are acquired from within the impact area (as predefined in the EIA) and at reference areas located sufficiently far away to ensure that they will be unaffected by the Project and where natural environmental conditions will be preserved. Where possible the co-use of 3rd party (HELCOM etc) long term monitoring stations will be considered.

Review and Close Out: Monitoring is not an open-ended process. It is important to regularly review monitoring results, not just from the perspective of corrective action if required, for specific impacts but also to establish whether there is any need for a particular element of the monitoring programme to continue, or to continue in its current form. Once a designated purpose has been served some elements of monitoring will cease. Others may be enhanced or become more frequent in response to lessons learnt. Overall it is important that the programme remains fit-for-purpose and delivers the main monitoring objectives throughout the Project lifetime. Expert review will therefore be conducted on a regular basis to ensure these objectives still hold true.

3 Environmental Management Framework

Nord Stream has an Environmental and Social Management System (ESMS) and an Environmental and Social Management Plan (ESMP) (Construction) which will be implemented during the construction phase for the Project. The ESMS will be extended to include an ESMP (Operation) for the operation phase.

The purpose of the ESMS is as follows:

- Establish a framework for implementing mitigation and management measures and for monitoring the effectiveness of those measures;
- Provide assurance to authorities and other stakeholders that their requirements with respect to environmental and social performance will be met;
- Provide for the implementation of corrective measures where required; and
- Establish a framework for performance monitoring that will enable Nord Stream to ensure that its commitments and policies with respect to environmental and social performance are being met.

The content of the ESMP is guided by the findings and recommendations of the National Environmental Impact Assessments (EIAs) and the Espoo Report, EU EIA Directive requirements, Lenders requirements and the requirements of the relevant authorities. Most of these requirements will feature in the permits issued in each country.

Key elements within the ESMS and ESMP (Construction) include:

- Projects Standards Document
- Commitments Register
- Management of Change Document
- Compliance Assurance Document
- A suite of topic specific Construction Management Plans (CMP)

Each CMP addresses the environmental and social management, mitigation and monitoring commitments for Nord Stream. Nord Stream's pre-permit CMPs address the following topics:

- Munitions
- Seabed Intervention
- Offshore Pipelay
- German Landfall
- Russian Landfall
- Pollution Prevention
- Hazardous Materials
- Waste
- Emergency Preparedness
- Vessels and Marine Transport
- Pre-Commissioning
- Fisheries
- Employment and Training

- Cultural Heritage
- Stakeholder Engagement
- Compensation
- Third-party Health, Safety and Security
- Operations management
- Biodiversity.

The pre-permit CMPs are available on request at the Nord Stream website. The construction management plans will be finalised following the receipt of all permits and referred to as post-permit CMPs.

The Project contractors are required to comply with the standards set in the CMPs. Based on the stated requirements, the contractors will produce Contractor Implementation Plans (CIPs) that document how the management, mitigation and monitoring actions that are contractor responsibilities will be implemented and monitored. Procedural documentation particularly relevant to environmental monitoring during construction activities comprise Emergency Response, Environmental Management and Ship traffic management plans. Such plans will be developed by the Project contractors prior to the commencement of works.

The objective of Nord Stream's compliance assurance is to ensure that the Project contractors properly implement their CIPs. The contractor's compliance with the defined procedures will be monitored through offshore inspections and reporting, for example compliance assurance during:

- Vessel safety audits by a marine warranty surveyor prior to mobilisation.
- Rock placement by a Nord Stream technical representatives (engineering and survey), who will stay on-board the contractor's vessel during operations.
- Pipe-laying by Nord Stream technical representatives (engineering, welding and periodically survey) who will stay on-board the contractor's vessel during operations. In addition third party inspection will be performed by the certifying authority.
- Survey services by a Nord Stream survey representative who will stay on-board the survey vessel during all survey operations
- Periodical on-site environmental and safety inspections during rock placement and pipe-laying by an environment, health and safety representative.

During operations the contractors are required to prepare daily progress reports that provide a concise description of daily operations. The contractors are also requested to deliver field reports on the construction works on an on-going basis. They will include the results related to the implementation of the Environmental Management Plan.

Moreover, Nord Stream will maintain regular notification and liaison with the relevant local and national authorities and associations as well as the cable operators throughout the works.
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4 Baseline Investigations

The Nord Stream EIA report for the pipeline section in Finland 'Environmental impact assessment in the exclusive economic zone of Finland' /2/, presents in chapter 5 'Present situation in the project area' the baseline conditions in the project area. This addresses the following:

- Physical and chemical environment
- Biological environment
- Protected areas
- Socio-economic environment

Baseline field investigations have been performed during the EIA phase in 2005-2008. After the submission of the Finnish EIA report (March 2009) Nord Stream has decided to strengthen the baseline along the exact pipeline route regarding sediment quality, nutrients and contaminants with particular emphasis on selected munitions clearance and rock placement sites in sedimentation areas.

In June and July 2009, a sampling and analysis programme was performed to sample sediments in the main rock placement areas and in the vicinity of selected munitions clearance sites. The sediment samples were analyzed for nutrients, organic contaminants and heavy metals according to the same programme as conducted by FIMR in 2007 and 2008. Dioxins were included as an additional parameter into the analysis. Additional near surface and near bottom water samples were taken at these stations. Some further sediment samples were taken along the pipeline route for mainly dioxin analysis making the total number of sampled locations to 33.

5 Environmental Monitoring during Construction

5.1 Scope and Schedule

Environmental monitoring programme for the whole Nord Stream project during construction will vary in spatial range, frequency and duration in accordance with the potential adverse impacts and in relation to potential receptors. The programme presented in this chapter will concentrate on the monitoring activities that will be carried out during construction in the Finnish EEZ.

Based on the results of performed environmental impact assessments environmental monitoring during construction in the Finnish EEZ will address the impacts that may result from the following construction activities:

- **Rock placement** (pre-lay and post-lay)
- **Pipe-laying** (Figure 1)
  - Thrusters wash (for dynamically positioned (DP) lay barge between KP 123 - KP 350. Between KP 467 - KP 491 either with anchored or DP lay barge)
  - Anchor handling (for anchored lay barge between KP 350 - KP 498, except between KP 467 – KP 491 where either anchored or DP lay barge)
  - Pipe-laying (both pipe lay barges between KP 123 - KP 498)
- **Pre-commissioning**[2]

[2] A programme to monitor the potential environmental impacts from pre-commissioning will be established. The programme in Finland will focus on the impacts on commercial ship traffic at KP 297. The environmental monitoring activities related to dewatering in Russia (e.g. measurement of turbidity, pH and oxygen) will be included in the Russian environmental monitoring programme.

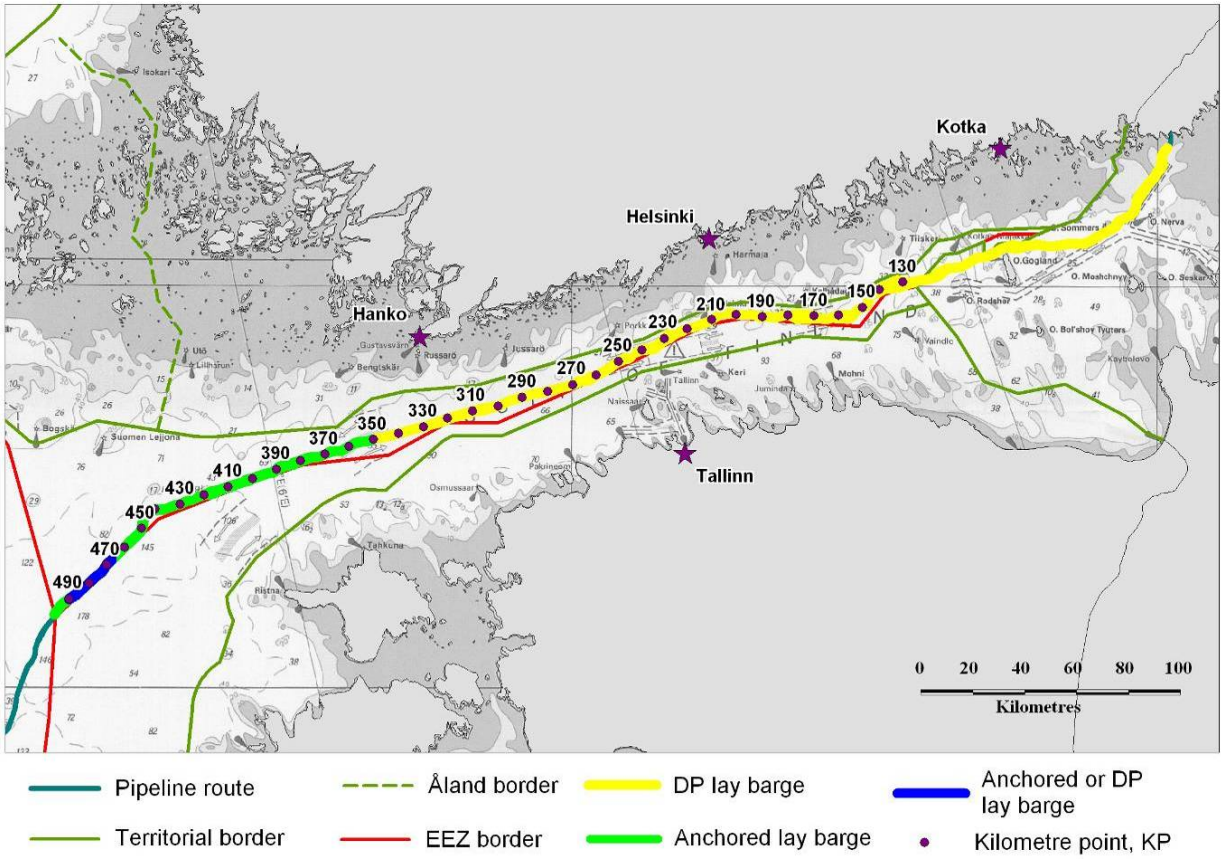

Figure 1. For pipe-laying of both pipelines between KP 7 - KP 350 (yellow line) a DP lay barge will be used and between KP 350 - KP 467 and KP 491 - KP 498 an anchored lay barge (green line). Between KP 467 – KP 491 either DP or anchored lay barge will be used.

The pipeline construction period is estimated to last for approximately 2.5 years (Figure 2). According to plans, the building of the first pipeline (North-West pipeline) will take place from ca. 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 done for both pipelines in 2010.

Before the construction can start, munitions have to be cleared from the security corridor and partially from the anchor corridor. The clearance will be carried out during the ice-free period in two phases and each phase will last for approximately two months (Figure 2). As shown in Figure 2 the phase 1 clearance started during late autumn 2009 and will continue in the second quarter of 2010. Also the phase 2 clearance starts in the second quarter of 2010. As described in Ch. 1 monitoring during munitions clearance in phase 1 is presented in a separate monitoring programme that was already approved on 2 October 2009. The monitoring programme for munitions clearance in phase 2 is a separate Appendix 4 to this overall programme.

In order to ensure the integrity and stability of the pipelines, rock placement operations have to be carried out. First rock placement operations, so called pre-lay works, will start approximately 2 months before the laying of the first pipeline will start. The pre-lay works for both pipelines are planned to be carried out in 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.

The current construction time schedule, based on a start of the main construction activities in April 2010, for different construction activities in Finland is shown in Figure 2.

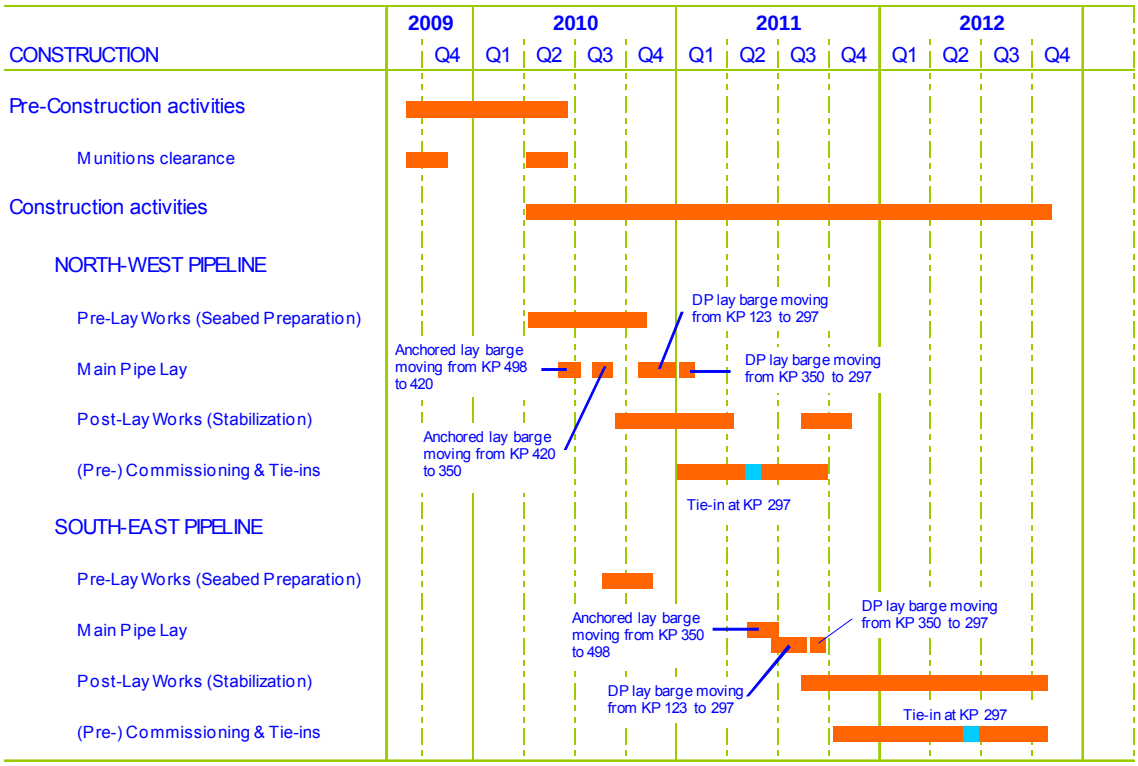

Figure 2. Nord Stream construction schedule in Finland (as of January 2010). Pipelay between KP 467 – KP 491 will be done either with anchored or DP lay barge.

The predicted impacts from these activities on different impact targets were assessed in /2/ and /3/. Based on the results of these impact assessments, environmental monitoring during construction in the Finnish EEZ will include the activities presented in sections 5.2-5.6.

Timing of monitoring during construction follows the construction schedule and therefore the monitoring activities will in many cases not be a continuous process. The overview of the time schedule for different monitoring activities in Finland, based on a start of the main construction activities in April 2010, is shown in Figure 3. More detailed information is provided in chapters 5 and 6 as well as in Appendix 4.

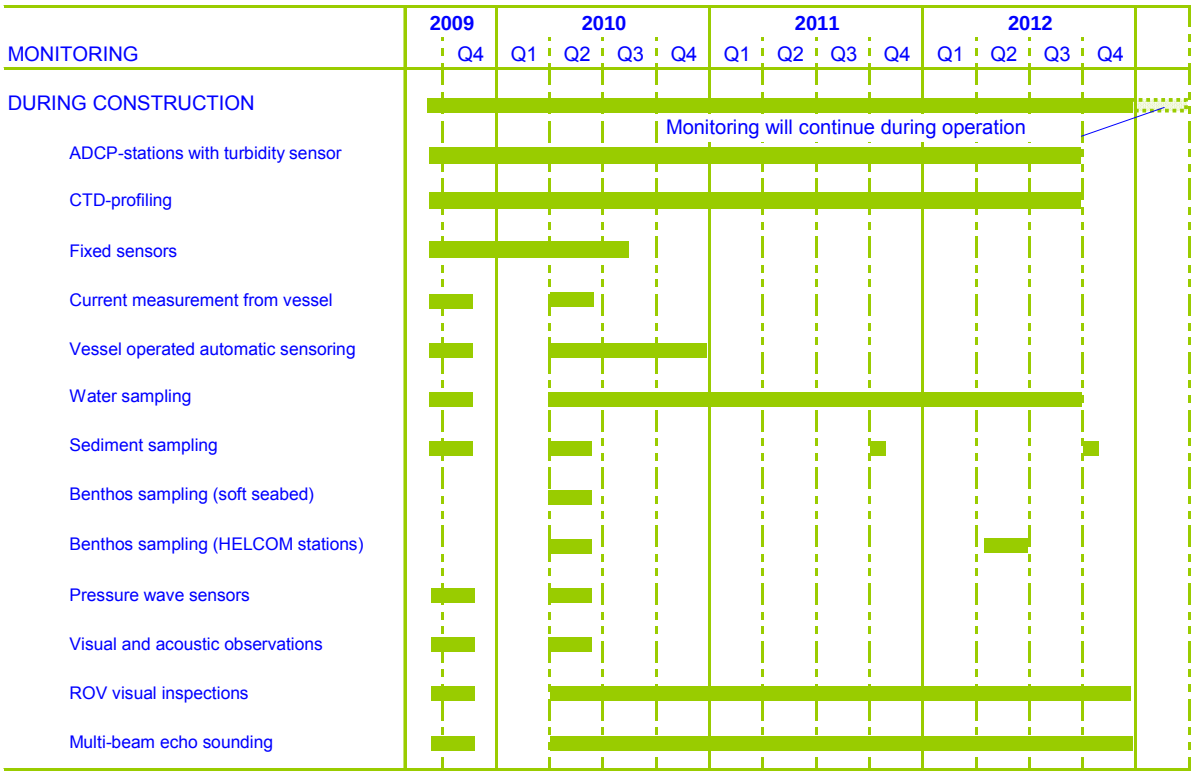

Figure 3. Approximate monitoring schedule of Nord Stream project during construction in Finland (as of February 2010)

5.2 Seabed Morphology

The assessment of the changes in the seabed morphology resulting from construction activities has been performed within the EIA procedure /2/ (Ch. 8.1.1). This assessment has been extended for pipe-laying by a dynamically positioned (DP) lay barge in an additional environmental impact assessment /3/. Based on the assessment results and Nord Stream construction requirements the monitoring of impacts on this impact target will concentrate on the following construction activities:

- Rock placement
- Pipe-laying

Rock placement and pipe-laying

To verify the existing seabed morphology before the pre-lay rock placement, the seabed bathymetry and presence of obstacles on the directly affected seabed will be surveyed by means of an ROV instrumented with multi-beam echo sounder or similar, sonar and video cameras. During and after

the pre-lay rock placement the condition of the rock berms will be established using the same devices.

Prior to pipe-laying the existing seabed conditions including the seabed bathymetry and presence of obstacles on the directly affected seabed will be surveyed by means of an ROV instrumented with multi-beam echo sounder or similar, sonar and video cameras. Also the condition of the pre-lay rock berms per design will be established as part of the pre-lay survey. After pipe-laying as-laid surveys of the pipelines will be performed, and the position and condition of the pipelines will be documented using the same devices.

After pipe-laying follows post-lay rock placement. During and after the post-lay rock placement the condition of the rock berms and the pipelines will be established by means of an ROV instrumented with multi-beam echo sounder or similar, sonar and video cameras.

An as-built survey will be performed after the construction of the pipelines has been completed, i.e. in the Finnish EEZ after the post-lay rock placement. The as-built survey documents the extent of rock berms (for both pre- and post-lay rock placement) and that the integrity of the pipelines has been maintained throughout the construction process. The as-built survey is an external inspection conducted by means of an ROV instrumented with multi-beam echo sounder or similar, sonar and video cameras and side-scan sonar.

All rock placement sites along the pipeline route are shown in Figure 4. The monitoring programme for seabed morphology during rock placement and pipe-laying is presented in Table 1.

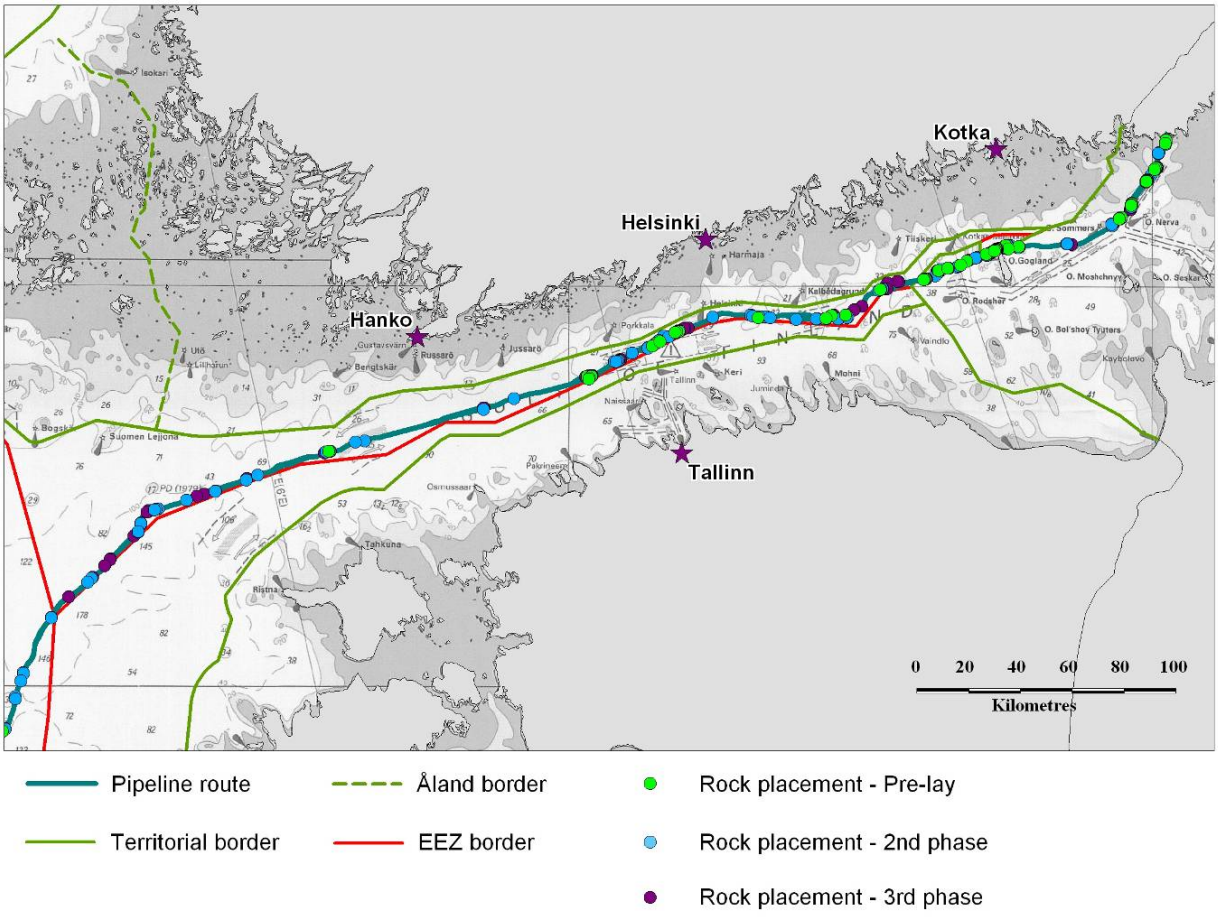

Figure 4. Rock placement locations where ROV-inspections will be carried out.

Table 1. The monitoring programme for seabed morphology during construction

Seabed morphology monitoring					
Project activity	**Parameter**	**Unit**	**Method**	**Location**	**Timing / frequency**
Pre-lay rock placement	Obstacles	Yes / no, location (E,N)	Instrumented ROV with multi-beam echo sounder, sonar and video cameras	All pre-lay rock placement locations	Prior to pre-lay rock placement
	Seabed bathymetry	m (depth)			
	Condition of rock berms	m^3 (volume), m (height)			Monitoring berm during placement
					After pre-lay rock placement
Pipe-laying	Obstacles	Yes / no, location (E,N)	Instrumented ROV with multi-beam echo sounder, sonar and video cameras	Full length of installation corridor	Prior to pipe-laying (pre-lay survey)
	Seabed bathymetry	m (depth)			
	Rock berm – per design	m (height)			
	Pipe position	m (E, N, depth)		Intermittent	During pipe-laying
	Pipe position	m (E, N, depth)		Full length of pipeline	After pipe-laying (as-laid survey)
	Pipe condition	intact / damage			
Post-lay rock placement	Condition of rock berm and pipeline	m^3 (volume), m (height), Intact / damage,	Instrumented ROV with multi-beam echo sounder, sonar and video cameras	All post-lay rock placement locations	Monitoring berm during placement
					After post-lay rock placement
After construction	Pipeline integrity, extent of rock berms and seabed conditions	Intact / damage, m^3 (volume), m (height), m (free spans length and height)	Instrumented ROV with multi-beam echo sounder, sonar and video cameras, Side scan sonar	Sections where post lay interventions have been performed	After post-lay rock placement or other intervention (as-built survey)

Reporting of Results

The results of the pre-lay and as-laid surveys together with the as-built survey of any post-lay intervention works will be compiled. The compiled report will provide the as-built information, which will include a series of alignment sheets and pipeline events lists that define the as-built pipeline position, condition and configuration.

The gathered information will be available electronically and as a hard copy. Electronic data will be issued in standard formats such as:

- Microsoft Word (.doc) files
- Microsoft Excel (.xls) files
- Adobe Acrobat (.pdf) files
- AutoCAD 2008 (.dwg) files
- Arc GIS database
- Bathymetry in ASCII x,y,z

The results of visual inspections will be reported as 'digital video reports' in standard formats such as MPEG-2 SD and MPEG-4. Video data will be "tagged" so that there is a search functionality and the possibility to integrate with ArcGIS. Video data will have an overlay with information such as survey task, position, date, depth, kilometre point etc.

5.3 Water Quality

The assessment of sediment dispersion and consequent impacts on water quality resulting from construction activities has been performed within the EIA procedure /2/ (Ch. 8.1.2). This assessment has been extended for impacts caused by a DP lay barge /3/. Based on the assessment results, the monitoring of water quality will concentrate on the following construction activities:

- Rock placement
- Pipe-laying:
    - Thrusters wash (DP lay barge between KP 123 - KP 350. Between KP 467 - KP 491 either with anchored or DP lay barge))
    - Anchor handling (anchored lay barge between KP 350 - KP 498, except between KP 467 – KP 491 where either anchored or DP lay barge)

Sediment re-suspension, 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 adequacy of the assessment results with respect to:

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

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 sensoring and water sampling. In addition to vessel operated automatic sensoring in some monitoring locations also fixed sensors will be used. The monitoring locations will be assigned according to the type of activity and the predicted impact intensity. The selected methods are described in detail below. The following sensoring for monitoring of water quality will be performed during construction activities in the Finnish EEZ:

- Vessel operated automatic sensoring and fixed sensors during rock placement (3 locations, VOFIXIW1, VOFIXIW2 and VOFIXIW3)
- Vessel operated automatic sensoring for HELCOM / FIMR stations during rock placement (1 location VOHE3[3])
- Vessel operated automatic sensoring and fixed sensors during pipe lay (2 locations, LAY1 and LAY2)

[3] VOHE1 and VOHE2 will be monitored during munitions clearance. VOHE3 will be monitored only if rock placement will be done in phase 2 within 3.5 km from the HELCOM station JML.

If deemed necessary, part of the in situ measurements during the pipe-laying activity will be repeated during the laying of the second pipeline.

In addition to these measurements at construction sites, the following station will be established for two months in the Eastern Gulf of Finland to monitor potential transboundary impacts of sediment dispersion from dredging in the Russian landfall:

- Fixed sensor (1 location, FIX3[4])

Furthermore, two long term monitoring stations that measure time series of temperature, conductivity, turbidity, and current velocity by automatic sensors will be installed for the entire construction period in the vicinity of the Natura 2000 sites as follows:

- Long term monitoring with ADCP station (2 locations, CONTROL1 and CONTROL2)

The locations of the CONTROL stations are the same as during the phase 1 munitions clearance in the Finnish EEZ.

Summary of selected stations where water quality monitoring is done during construction is presented in Table 2 and Figure 5. Summary of all monitoring stations during construction and operation is presented in Appendix 2. The monitoring results will be reported as presented in Chapter 8. The water quality results will be analysed also with respect to fishery.

Table 2. Monitoring stations during construction

Monitoring stations during construction		
Monitoring	**Code**	**Construction activity**
Vessel operated automatic sensoring and fixed sensors	VOFIXIW1	Rock placement
	VOFIXIW2	Rock placement
	VOFIXIW3	Rock placement
Vessel operated automatic sensoring, HELCOM / FIMR	VOHE3**	Rock placement
Vessel operated automatic sensoring and fixed sensors	LAY1	Pipe lay, DP lay barge
	LAY2	Pipe lay, anchored lay barge
Transboundary impacts, Dredging in Russia	FIX3	Dredging in Russia
Long term monitoring	CONTROL1	Whole construction period
	CONTROL2	Whole construction period
Sediment sampling*	SED2	Rock placement
	SED3	Munitions clearance

* Discussed in chapter 6.3

** VOHE3 will be monitored only if phase 2 rock placement is done within 3.5 km from HELCOM station JML

[4] FIX1 and FIX2 have been installed to monitor potential transboundary impacts from munitions clearance in Russia.

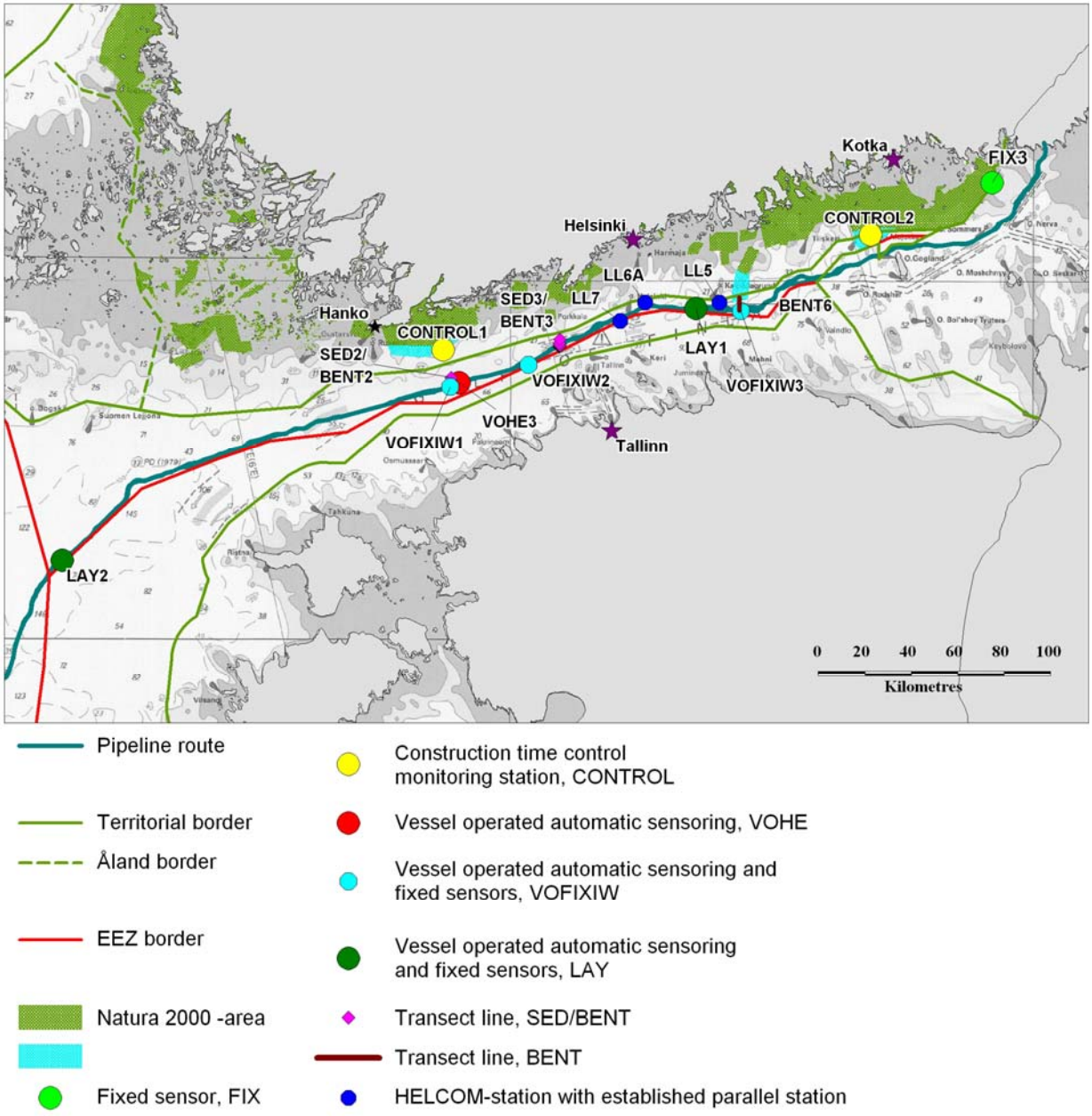

Figure 5. Monitoring stations for water quality and benthos during construction and operation

Rock placement

Monitoring of re-suspension and dispersion of sediment from rock placement will be carried out at 3-4 selected locations as presented in following.

Vessel operated automatic sensoring and fixed sensors: 3 locations VOFIXIW1, VOFIXIW2 and VOFIXIW3 (Figure 6) have been selected for monitoring on the basis of soft seabed sediment, amount of rock placement and timing and duration of activity. VOFIXIW2 is also situated close to Estonian EEZ border and VOFIXIW3 relates to transboundary monitoring in Estonia.

- VOFIXIW1 – Located in the central Gulf of Finland close to KP 297, at the depth of approximately 79 m and 5.9 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). Rock placement will be done for tie-in for both pipelines at the same time totalling approximately 92,000 m^3. Placement work is planned to be done in the second quarter of 2010 and it is estimated to last for approximately 49 days.

- 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 m^3 of rock (berm E2011) will be placed before pipe lay for the second pipeline. Placement work is planned to be done in the second quarter of 2010 and it is estimated to last for approximately 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 m^3 of rock (berm WK005) will be placed before pipe lay for the first pipeline. Placement work is planned to be done in the second quarter of 2010 and it is estimated to last for approximately 2 days.

Vessel operated automatic sensoring: 1 location VOHE3 (Figure 6) has been selected for monitoring considering HELCOM and FIMR long term monitoring station that may be impacted by turbidity caused by rock placement. Post-lay rock placement for north-west pipeline has been planned to be done in the proximity of VOHE3 station. Station has been selected based on guidance obtained in discussions with the Meteorological Institute of Finland, Geological Survey of Finland and Finnish Environment Institute (Table 3 and Figure 7).

- VOHE3 – Located at the distance of 3.1 km from HELCOM / FIMR station JML. Water depth in the area is ca. 80 m and seabed is very soft clay. Planned volume for rock placement is ca. 2 600 m^3 and the duration of rock placement is ca. 1-2 days. As the exact amounts and locations of post lay rock placement will be determined later, monitoring of VOHE3 station will only be done if rock placement takes place closer than 3.5 km from the HELCOM station JML.

Vessel operated automatic sensoring at these three locations will be carried out with multi parameter sonde that will measure turbidity, temperature, conductivity and depth. This automatic sonde is lowered from a support vessel through the water column. Data will be gathered from surface to bottom with 20 to 50 cm intervals. Research line grid (distance from one research spot to another along the line) depends on the size of the rock placement and the size and formation of the possible sediment plume and will be assigned prior to the measurement. The amount of lines during each measurement is two. For rock placement the measurements at one sensoring location will be done once prior and twice after the rock placement in order to receive sufficient data from the spreading

and dilution of the sediment plume. The first measurement prior to rock placement at each location is a reference measurement and represents natural background level of turbidity.

Data from vessel operated automatic sensoring will be shown as transect figures. Data is presented as a function of distance from a rock placement site, in relation to depth and turbidity. Results will be shown for both two perpendiculars transects for each measurement round to present how the solid material in a plume behaves. Similar figures will be generated for salinity and temperature.

In addition to vessel operated sensoring at VOFIXIW1-3 stations, 3 fixed sensors will be used to monitor sediment spreading from rock placement. Used sensors are multiparameter sondes that measure vertical turbidity, temperature, conductivity and oxygen concentration. Sensors are anchored to ca. 1-2 m above the seabed. Sensors gather information every 60 minutes. At all 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.

Data from fixed sensoring and the ADCP will be presented as time series figures. In addition, the current data will be analyzed and shown as distribution figures for current magnitude and direction.

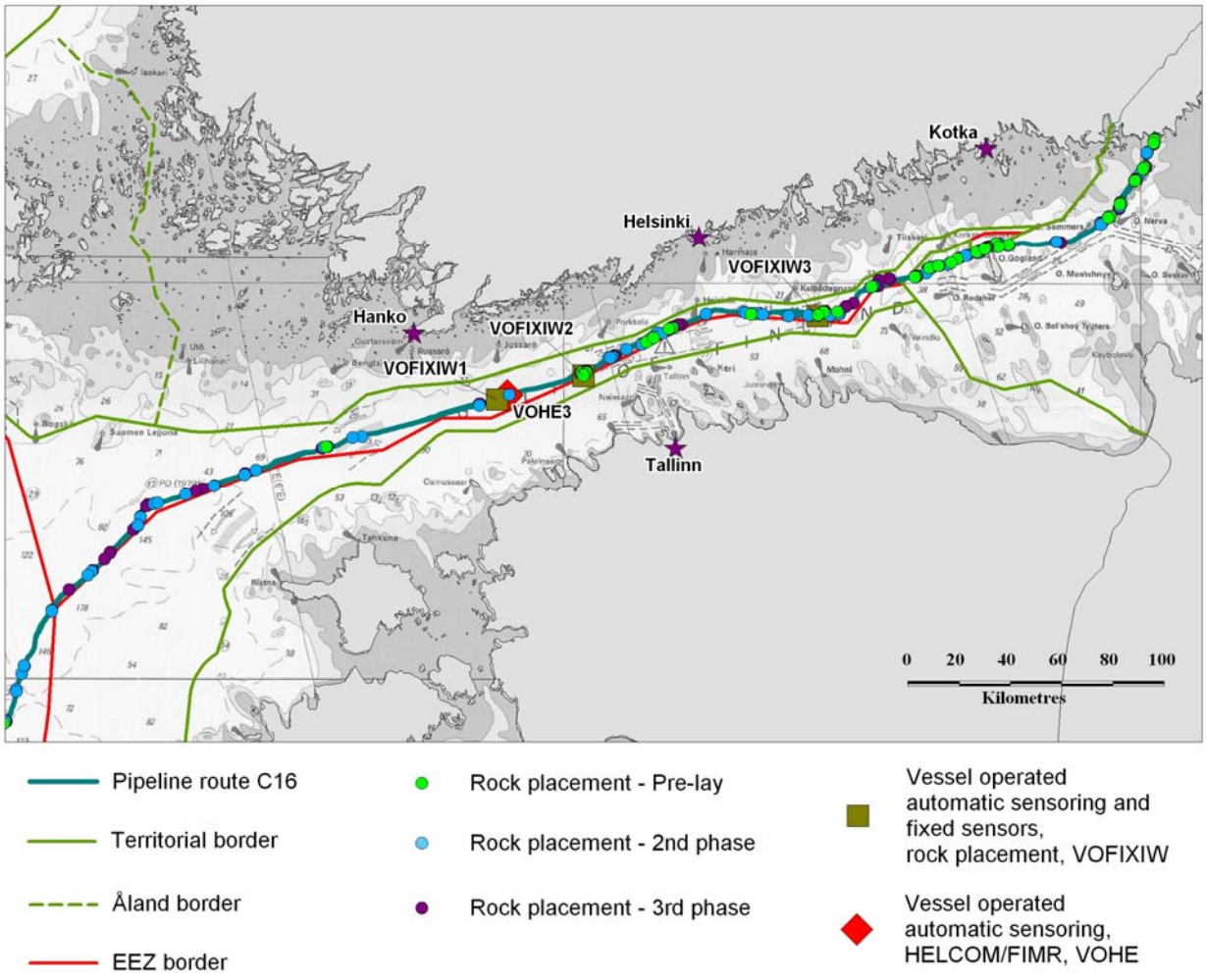

Figure 6. Locations where water quality measurements with vessel operated automatic sensoring will be carried out during rock placement. The VOHE1-2 will be monitored during munitions clearance.

Table 3. Closest distances from HELCOM / FIMR stations to the rock placement sites in the Finnish project area. The selected station to be monitored is highlighted in yellow. Monitoring will be done by vessel operated sensoring. Monitoring of impacts to HELCOM / FIMR stations and selection of stations have been discussed with Geological Survey of Finland, Finnish Meteorological Institute and Finnish Environmental Institute. A list showing the distances from different pipeline construction activities to monitoring stations is shown in Appendix 1. The stations are so far from the construction activities that the only potential impact on them is a temporary increase in water turbidity. Monitoring of HELCOM during operation is discussed in chapter 6.4.

Long-term monitoring station			Rock placement			
Station code	**Station type**	**Monitored parameter: (W)ater (S)ediment (B)enthos**	**Closest distance [km]**	**Pipeline: North-West (NW) South-East (SE)**	**Phase[1]**	**Sensoring site**
LL3A	HELCOM	W S B	7.6	NW	3	
LL4A	HELCOM	W B	4.3	SE	2, 3	
GF2	FIMR/ HELCOM	W S B	5.3	SE	2, 3	
14	HELCOM (Estonia)	W	6.5	SE	2, 3	
LL5	FIMR	W B	4.1	SE	2, 3	
LL6A	FIMR	W B	3.8	SE	2, 3	
LL7/ F3	HELCOM	W S B	1.4	SE	3	
GF1	FIMR	W S B	11.6	NW	1, 2, 3	
LL9	FIMR	W B	5.2	NW	3	
JML	FIMR/ HELCOM	W S B	3.1	NW	2, 3	VOHE3
LL11A	HELCOM	W B	7.3	NW	3	
LL11/ BMPF5	HELCOM	W B	6.8	NW	3	
22	HELCOM	W B	22.0	NW	3	
LL12/ H1	HELCOM	W B	16.8	SE	2, 3	
LL13	FIMR	W B	8.4	SE	2	
AS7	FIMR	W S	14.5	NW	2, 3	
25	HELCOM (Estonia)	W	5.5	NW	2, 3	
LL15	FIMR	W B	14.7	SE	2, 3	
BY27	HELCOM (Sweden)	W	1.55	SE	2, 3	
LL17/ H2	HELCOM	W B	10.9	NW	3	
NCB	FIMR	W S	5.4	SE	2, 3	
BY29	HELCOM (Sweden)	W	9.7	SE	2, 3	

[1] Phase 1: Pre-lay rock placement
Phase 2: Post-lay rock placement after the pipelay but before the pipeline pressure-testing
Phase 3: Post-lay rock placement after the pipeline pressure-testing

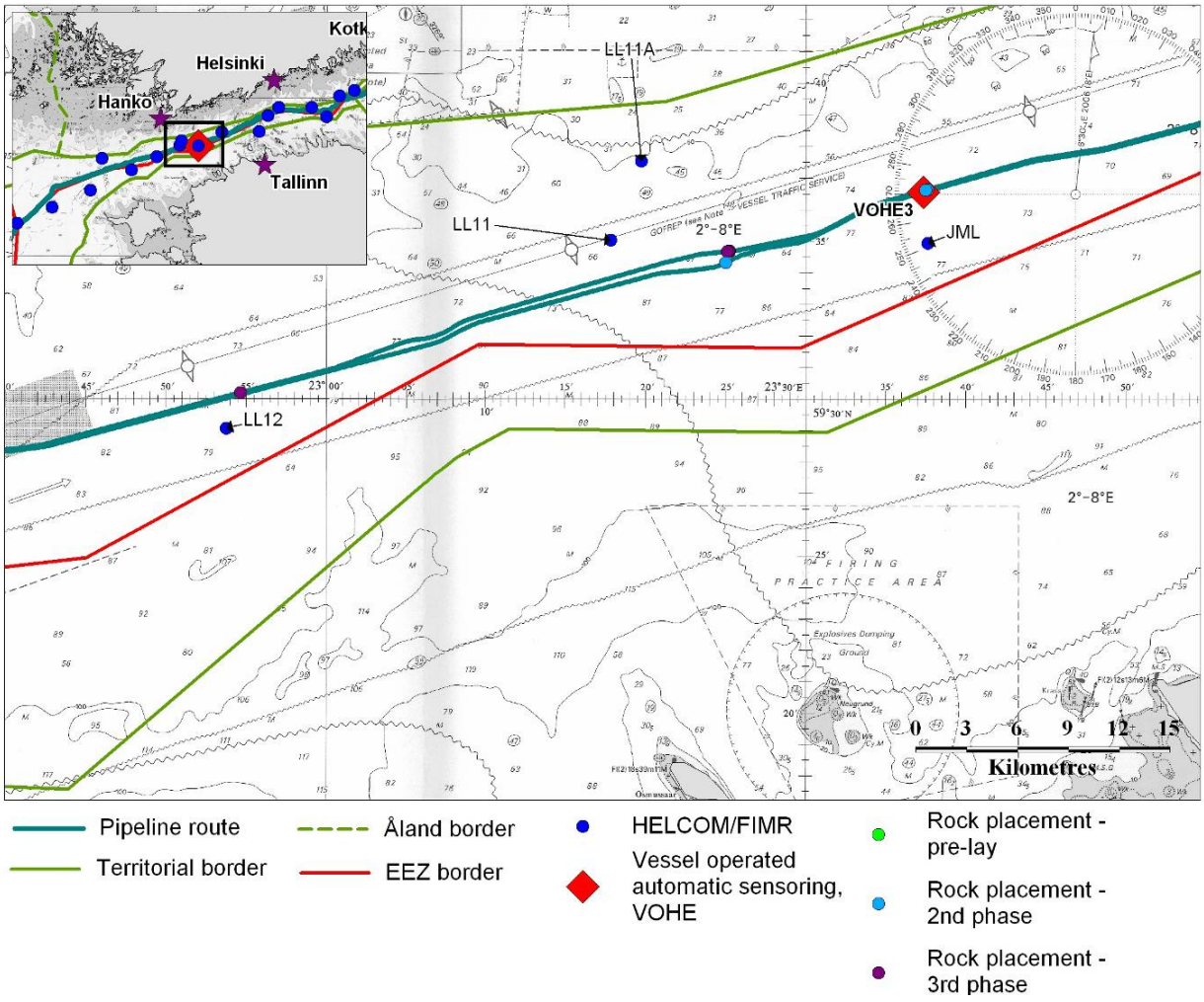

Figure 7. Location for monitoring turbidity spreading to HELCOM / FIMR station. Monitoring is done with vessel operated automatic sensoring. Monitoring at VOHE3 station will only be done if rock placement in phase 2 is carried out within 3.5 km from the HELCOM station JML. The VOHE1-2 stations will be monitored during munitions clearance.

Water sampling from VOFIXIW and VOHE stations will be carried out in order to calibrate the results (turbidity, suspended solids and conductivity) of the automatic sensoring. In addition oxygen concentration, dissolved phosphate phosphorus (PO_4) and nitrate-nitrite (NO_3 - NO_2) and ammonium (NH_4) nitrogen as well as total phosphorus (P) and nitrogen (N) will be analyzed. Also total metal concentrations (As, Cd, Cr, Co, Cu, Hg, Ni, Pb, Zn) will be analysed from the water samples. These parameters will be analyzed with standards presented in Table 4 or similar with same accuracy and

reliability. The results will be combined with turbidity measurements to calculate the possible spreading of metals with suspended sediments from rock placement.

At each sampling site (VOFIXIW1-3 and VOHE3) water samples will be taken after rock placement 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 sensoring data from the sites that either represent the maximum turbidity concentration or at which elevated turbidity concentrations are no longer observed. Depths of the water samples will be decided in the field according to the vessel operated automatic sensoring data. All samples will be analyzed by an accredited laboratory with normal laboratory methods used for analysis of brackish water. The monitoring programme for water quality is presented in Table 5.

The water sampling results are presented as tables with the sampling locations and analyzed concentrations.

Table 4. Water samples will be analysed in line with the following standards or similar with same accuracy and reliability using an accredited laboratory and methods

Parameter	Accre-dited	Unit	Limit of quantifi-cation	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	5	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	7	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
Lead, 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

Pipe-laying by using a DP lay barge or an anchored lay barge

Monitoring during the pipe-laying aims at the quantification of the overall dispersion of sediment from the pipe-laying activity, including anchor handling or thrusters wash. The measurements will be carried out at 2 selected locations as presented below.

Vessel operated automatic sensoring and fixed stations (LAY): two locations LAY1 and LAY2 (Figure 8) have been selected for monitoring during laying of the first pipeline:

- LAY1 – Monitoring location will be selected at the section where the DP-barge is used between KP 181 and KP 185 according to weather etc. conditions. The seabed is of hard-bottom complex, the depth is approximately 50-62 m, which is one of the shallowest areas in Finnish project area and the distance to the Estonian EEZ border 1.7 km. In addition to the shallowness of the area, the location has been selected because of its close proximity to the proposed Sandkallan Natura 2000 area (Figure 9).

- LAY2 – Monitoring location will be selected from the section where the anchored lay barge is used near KP 495, because the barge will start pipe laying in the Finnish EEZ from KP 498 towards the East. The seabed in this area consists of soft sediment, the depth is approximately 181 m and the distance to the Estonian EEZ border 1.3 km.

Vessel operated automatic sensoring at these two locations will be carried out with multi parameter sonde that will measure vertical turbidity, temperature, conductivity and depth. The measurements will be done during pipe-laying and the automatic sonde will be lowered from a support vessel through the water column. Data will be gathered from surface to bottom with 20 to 50 cm intervals. The form of the measurement grid (distance from one research spot to another along the line) depends on the size and form of the possible sediment plume arising from the pipelay. The measurements at one sensoring location will be done twice along the transects around the lay barge during the pipelay. At LAY1 station the transect will run behind the barge at a touchdown distance across the security corridor. At LAY2 station one transect will run behind the barge at a touchdown distance across the anchor corridor (+/-800 m on either side or the pipeline route) and one transect along the outer edge of the anchor corridor at the distance of ca. 800 m from the barge for ca. 3 km. 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 sensoring will be shown as transect figures. Data is presented as a function of distance from the pipelay barge, in relation to depth and turbidity. Results for each measurement round will show how the material in plume behaves. Similar figures will be generated for salinity and temperature.

In addition to vessel operated sensoring at LAY1-2 stations, 2 fixed sensors will be used to monitor sediment spreading from pipelaying including anchor handling or thrusters wash. 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 passing of the pipelay barge and recovered ca. 1 week after the passing of the pipelay barge. At LAY1 station one sensor will be installed at a distance of ca. 50 m on each side of the pipeline installation corridor. At LAY2 station 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 near the pipeline installation corridor will be confirmed well in advance of the performance of work by the pipelay contractor considering safety issues related to the monitoring.

Data from fixed sensoring will be presented as time series figures.

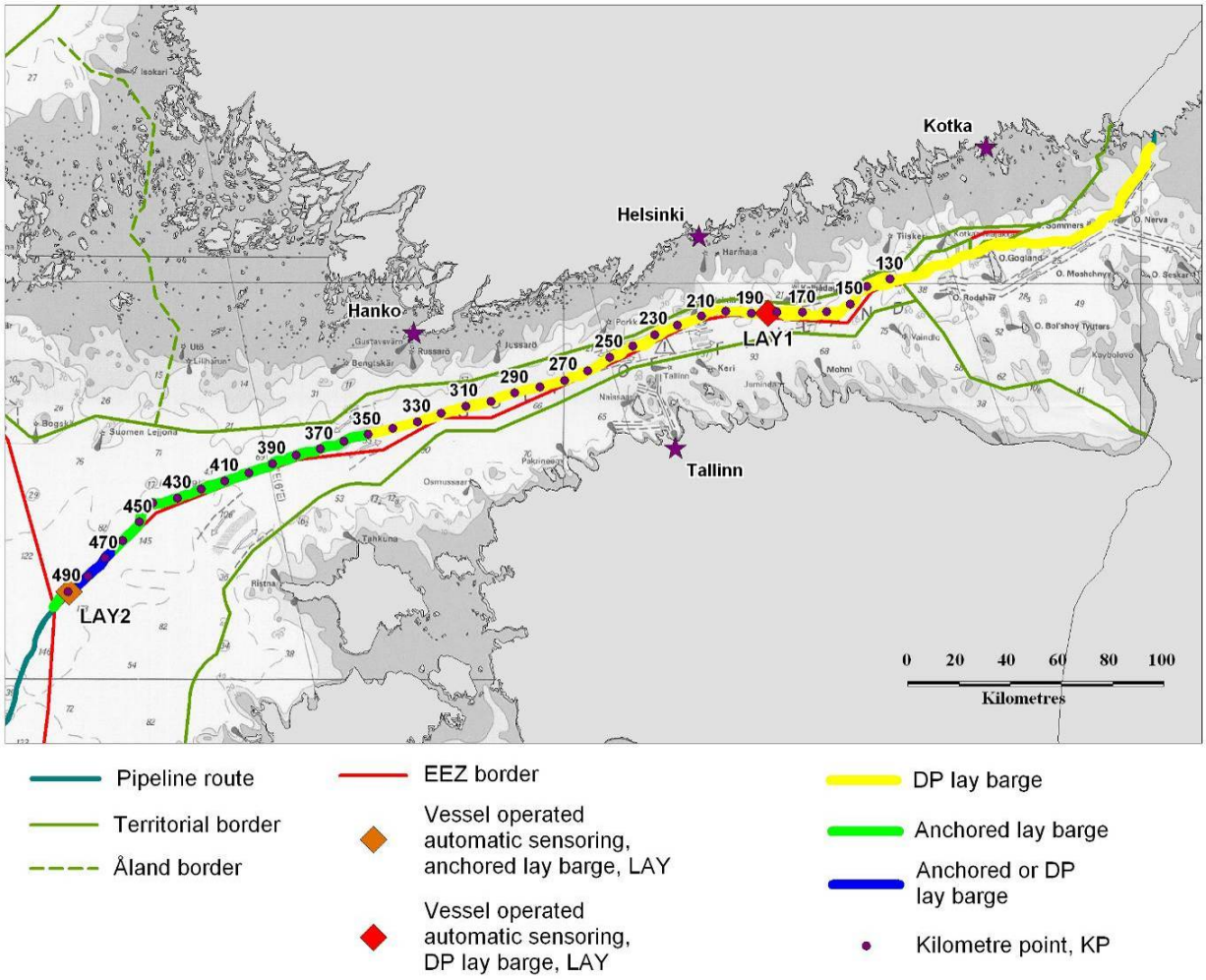

Figure 8. LAY1-2 locations for turbidity measurements with vessel operated automatic sensors during pipe lay.

Water sampling from LAY stations will be carried out in order to calibrate the results (turbidity, suspended solids and conductivity and) of the automatic sensoring. In addition the oxygen concentration, the concentration of both dissolved phosphate phosphorus (PO_4), nitrate-nitrite (NO_3 - NO_2) and ammonium (NH_4) nitrogen as well as total phosphorus (P) and nitrogen (N) will be analyzed from water samples. Also 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 4 or similar with same accuracy and reliability. The results will be combined with turbidity measurements to calculate the possible spreading of metals with suspended sediments from pipelay.

At each sampling location (LAY1 and LAY2) water samples will be taken at both ends and middle point of each transect from 3 to 4 depths. Depths of the water samples will be decided in the field

according to the vessel operated automatic sensoring data. All samples will be analyzed by an accredited laboratory with normal laboratory methods used for quantification from brackish water. The monitoring programme for water quality is presented in Table 5.

The water sampling results are presented as tables with the sampling locations and analyzed concentrations.

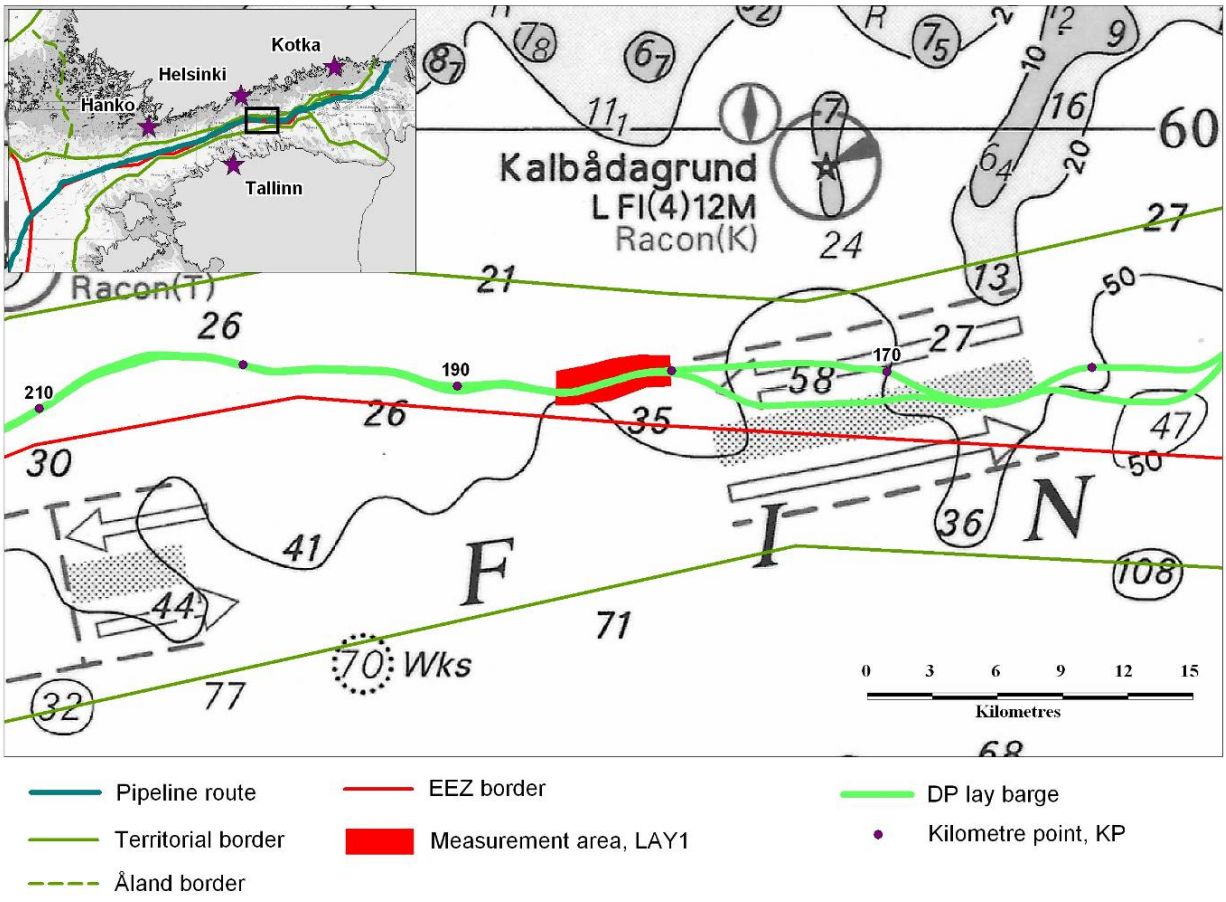

Figure 9. LAY1 monitoring location will be selected more precisely according weather etc. circumstances from the marked (red) area.

Transboundary impacts from dredging in Russian landfall area

A fixed sensor (FIX) will be used at one location in order to monitor possible sediment dispersion from ca. 1.8 km long section of dredging in the Russian landfall to Finland. The measurements will be done with a multi parameter sonde that will measure vertical turbidity, temperature, conductivity and oxygen concentration. The sensor will be anchored to the seabed and installed approximately 1 to 2 meters from the seabed. The sensor will collect data every 30 to 60 minutes for ca. two months (June and July 2010) from two weeks before the dredging has started until two weeks after the

dredging has ended. The location of FIX3 station has been selected close to the Russian border, 2 km southeast of the long term water quality monitoring station Kyvy-8A. Kyvy-8A is monitored by the Southeast Finland Regional Environment Centre (Figure 10). Authority monitoring results from Kyvy-8A can be used for comparison if needed.

- FIX3 – In the Eastern Gulf of Finland Archipelago and Waters Natura 2000 area, 0.8 km from the Russian EEZ border at a depth of approximately 40 m. The shortest distance from FIX3 station to the Russian dredging section is approximately 26 km.

In order to obtain background information of temperature and salinity stratification, CTD-profiling will be conducted during service visits to upload data from the stations. At the same time the vertical distribution of turbidity will also be determined. The measurements will be performed using an automatic sonde that is lowered from a support vessel through the water column. The data will be gathered from the surface to the bottom with 20 to 50 cm intervals.

Fixed sensoring data will be presented as time series figures together with the CTD profiling data from the same period. CTD data will be shown as a function of depth on each site.

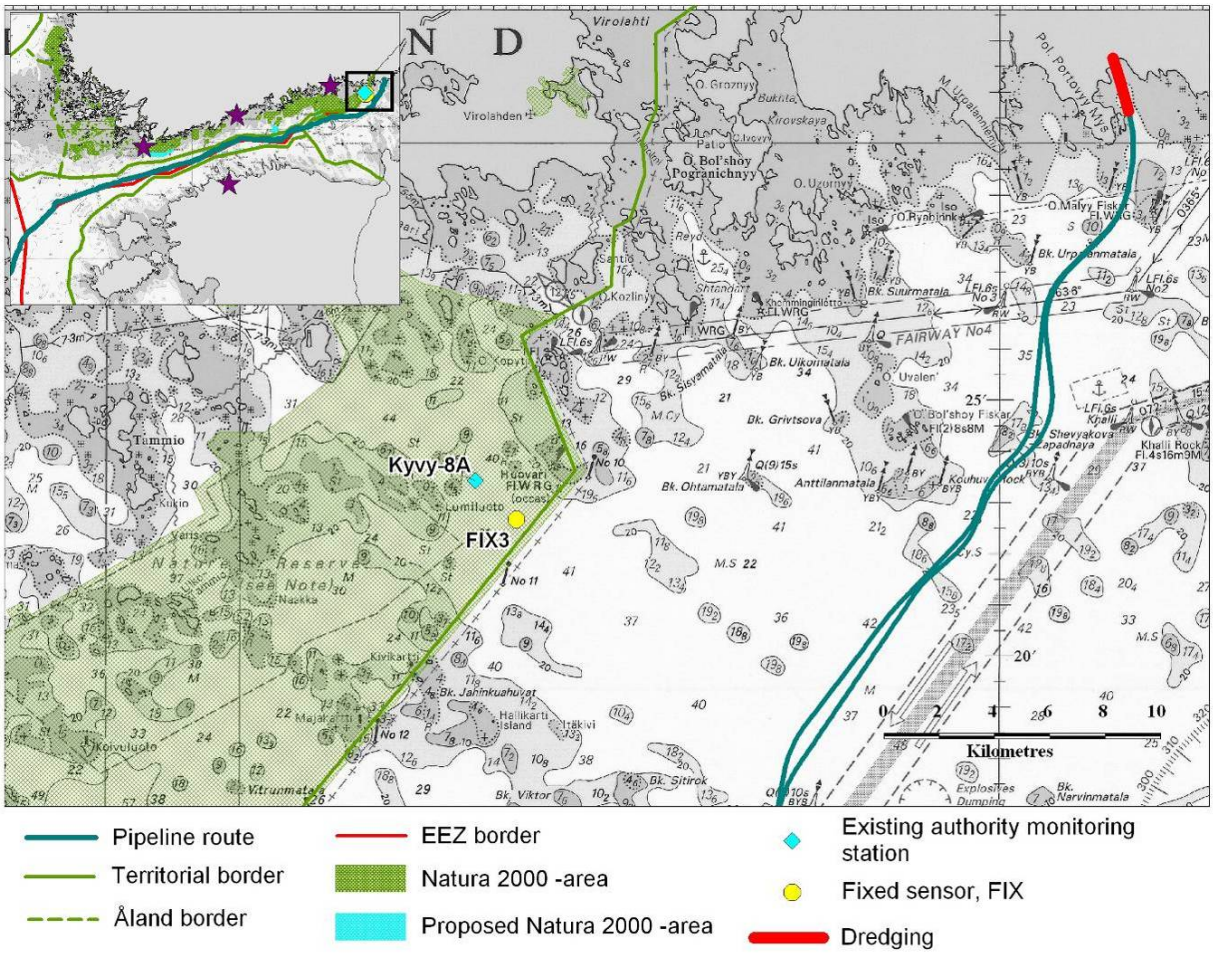

Figure 10. Locations of FIX3 and Kyvy-8A monitoring stations and dredging section at Russian landfall

Long term monitoring during construction

Long term monitoring with Acoustic Doppler Current Profiler (ADCP) stations (CONTROL) with a turbidity sensor will be carried out at two selected locations. These locations include (Figure 11):

- CONTROL1 - close to Natura 2000 area in Tammisaari archipelago, at the depth of approximately 22 m
- CONTROL 2 - close to Natura 2000 areas in the Eastern Gulf of Finland at the depth of approximately 37 m

ADCP will measure changes in underwater current field (current speed and direction) throughout the whole water column. The station will be instrumented also with an automatic turbidity sensor. The

turbidity sensor will be installed near the seabed and will monitor the turbidity, conductivity, temperature and oxygen concentration. The ADCP will be placed near the seabed ca. two weeks before the construction works start. Data will be collected approximately every 1 to 2 metres from the seabed to the surface averaged over 30 to 60 minutes intervals. Data from the station will be used as a comparison for results obtained from other locations and to study the natural variability and seasonal changes. Monitoring will continue for ca. two weeks after the completion of the construction works.

In order to obtain background information of temperature and salinity stratification, CTD-profiling will be conducted during service visits to upload data from the stations. At the same time the vertical distribution of turbidity will also be determined. The measurements will be performed using an automatic sonde that is lowered from a support vessel through the water column. The data will be gathered from the surface to the bottom with 20 to 50 cm intervals.

ADCP data will be presented as time series figures together with CTD profiling data from same period. In addition, current data will be analyzed and shown as distribution figures for current magnitude and direction. CTD profiling data will be shown as a function of depth on each site.

Water sampling from FIX3 and CONTROL1-2 stations will be carried out during data upload visits in order to calibrate the results (turbidity, suspended solids, conductivity and oxygen concentration) of the automatic sensoring and to analyze the concentration of both dissolved phosphate phosphorus (PO_4), nitrate-nitrite (NO_3 - NO_2) and ammonium (NH_4) nitrogen as well as total phosphorus (P) and nitrogen (N). These parameters will be analysed with standards presented in Table 4 or similar with same accuracy and reliability.

At each FIX and CONTROL station one water sample will be taken from the same depth as the actual sensor is located. Samples will be analyzed by an accredited laboratory. The monitoring programme for water quality is presented in Table 5.

The water sampling results will be presented as tables with the sampling locations and analyzed concentrations.

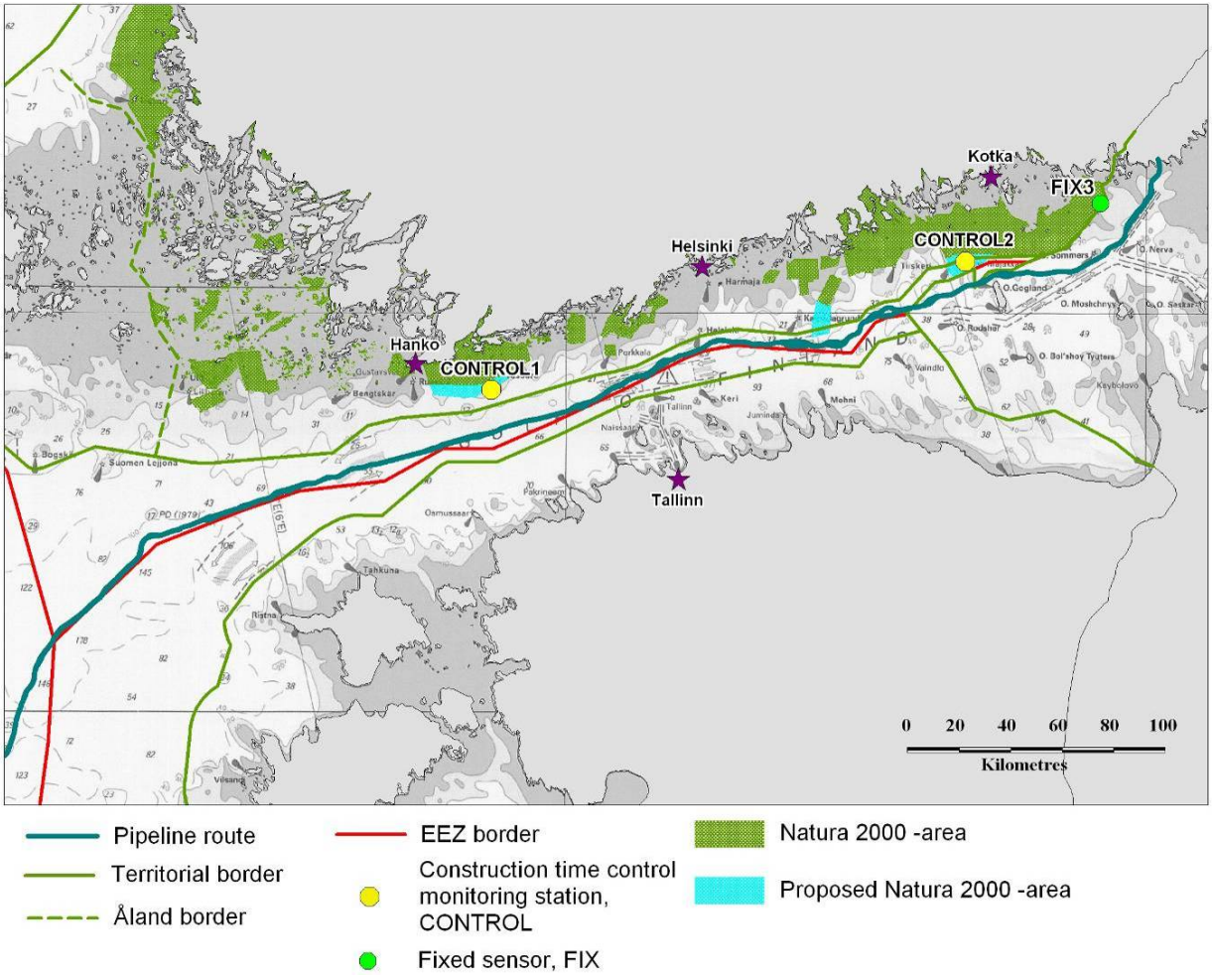

Figure 11. Locations of the fixed station FIX3 and long term monitoring stations CONTROL1-2 during construction

Table 5. The monitoring programme for water quality during construction

Water quality monitoring					
Project activity	**Parameter**	**Unit**	**Method**	**Location**	**Timing / frequency**
Long term monitoring during construction	Current speed and direction, turbidity, conductivity, temperature and oxygen concentration	m/s (current speed), degrees (direction), NTU (turbidity), µs/cm (conductivity, ˚C (temperature) and mg/l (oxygen)	ADCP with a turbidity sensor and CTD profile	2 stations: one in Eastern Gulf of Finland (CONTROL2) and one close to Natura 2000 area in Tammisaari archipelago. (CONTROL1)	Throughout the whole construction period. CTD-profile when uploading data
	Water samples for calibration of sensors and nutrient analysis	mg/l and FTU (turbidity), mg/l (oxygen), µs/cm (conductivity) and µg/l (total and dissolved P and N)	Water sampling for calibration and analysis	CONTROL1-2	From two weeks before until two weeks after the construction works when uploading data
Monitoring during dredging in Russia	Sediment dispersion, conductivity, temperature and oxygen concentration	NTU (turbidity), µs/cm (conductivity), ˚C (temperature) and mg/l (oxygen)	Fixed sensoring and CTD-profile	1 station in the Eastern Gulf of Finland (FIX3)	Starts ca. 2 weeks before the dredging and continues ca. two weeks after the dredging, CTD-profile when uploading data
	Water samples for calibration of sensors and nutrient analysis	mg/l and FTU (turbidity), mg/l (oxygen), µs/cm (conductivity) and µg/l (total and dissolved P and N)	Water sampling for calibration and analysis	FIX3	From two weeks before until two weeks after the dredging when uploading data
Rock placement	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 sensoring	3 locations on soft sediment (VOFIXIW1-3). VOFIXIW2 is close to Estonian EEZ border and VOFIXIW3 relates to transboundary monitoring in Estonia	Once before and two times after rock placement
		m/s (current speed), degrees (direction), 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 (VOFIXIW1-3)	From two weeks before rock placement until approximately two weeks after the rock placement has ended
		NTU (turbidity), km (distance and height), h (duration), µs/cm (conductivity), ˚C (temperature) and m (depth)	Vessel operated automatic sensoring for HELCOM stations	1 HELCOM/ FIMR monitoring station in the vicinity of a rock placement site (VOHE3).Station will be monitored if rock placement will be done within 3.5 km radius from HELCOM station JML	Once before and two times after rock placement
Pipe-laying by DP lay barge	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 sensoring	1 location at relatively shallow area close to the Estonian EEZ border (LAY1)	During pipe-laying
		NTU (turbidity), µs/cm (conductivity), ˚C (temperature), and mg/l (oxygen)	Fixed sensors	2 sensors on either side of the pipeline installation corridor (LAY1)	From 1 week before pipelaying until 1 week after pipelaying

Pipe-laying by anchored lay barge	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 sensoring	1 location in an area with soft sediment and close to the Estonian EEZ border (LAY2)	During pipe-laying
		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
Rock placement and pipe-laying	Water samples for oxygen, nutrient and metal analysis and calibration of sensors	mg/l and FTU (turbidity), mg/l (oxygen), µs/cm (conductivity) and µg/l (total and dissolved P and N, metals)	Water sampling for calibration and analysis	VOFIXIW1-3 VOHE3 LAY1-2	After rock placement and during pipe-laying

5.4 Cultural Heritage, Debris and Existing Infrastructure

An assessment of the potential impacts from the construction activities on cultural heritage sites and existing infrastructure has been performed within the EIA procedure /2/ (Ch. 8.4.4 and Ch. 8.4.5). Nord Stream's mitigation measures to reduce risk to cultural heritage sites as small as possible are presented in detail in the Cultural heritage CMP for the project. Based on the assessment results, the monitoring of impacts on cultural heritage, debris (munitions or barrels) and existing infrastructure will concentrate on the following construction activities:

- Rock placement
- Pipe-laying
- Anchor handling

Rock placement

Prior to the rock placement the area of directly affected seabed will be surveyed to verify the seabed conditions, i.e. that there are no new objects (e.g. barrels or munitions). This survey will be conducted prior rock placement and will be carried out by means of a visual inspection via ROV.

Based on the made surveys the closest cultural heritage site (S-09-3025/2_9) to the pre-lay rock placement sites is at a distance of 480 m and the closest cultural heritage sites (S-09-3025/2_9, S-W8A-10289) to the post-lay rock placement sites at the distance of 470 m. Thus, there are no cultural heritage sites located within 50 m from the rock placement sites and therefore they will not be monitored during rock placement.

Based on the made surveys the closest barrel (S-E6E-10505) to the pre-lay rock placement sites is at a distance of 930 m and the closest barrel (R-12-5179) to the post-lay rock placement sites at the distance of 80 m. Thus, there are no barrels located within 50 m from the rock placement sites, and therefore they will not be monitored during rock placement.

There are also no cables located within 50 m from the rock placement sites and therefore they will not be monitored during rock placement.

Pipe-laying

Prior to the pipe-laying the area of directly affected seabed will be surveyed to verify the seabed conditions, i.e. that there are no new objects (e.g. barrels or munitions). This pre-lay survey will be carried out by means of a visual inspection via ROV in the installation corridor along the entire pipeline length.

A controlled lay procedure has been discussed with the Finnish National Board of Antiquities regarding areas where archaeologically significant wreck sites are closer than 50 m to the pipeline route. Based on the consultation four wrecks within or close vicinity of the security corridor have been selected to be included into the monitoring programme during pipe-laying. These wrecks include S-07-2736, S-08-2939, S-08-10289 and S-10-3237 and their locations are shown in Figure 12. The pipeline will be laid pass these wrecks maintaining a minimum offset that has been agreed with the Finnish National Board of Antiquities. In the vicinity of these wrecks the pipe-laying will be followed closely by means of touch-down monitoring i.e. an instrumented ROV located close to the point where the pipeline touches down on the seabed. The position and integrity of these wrecks will be monitored prior to the pipelay and after the pipelay by means of a visual inspection via ROV (plus cable tracker) to confirm that there has been no adverse impact.

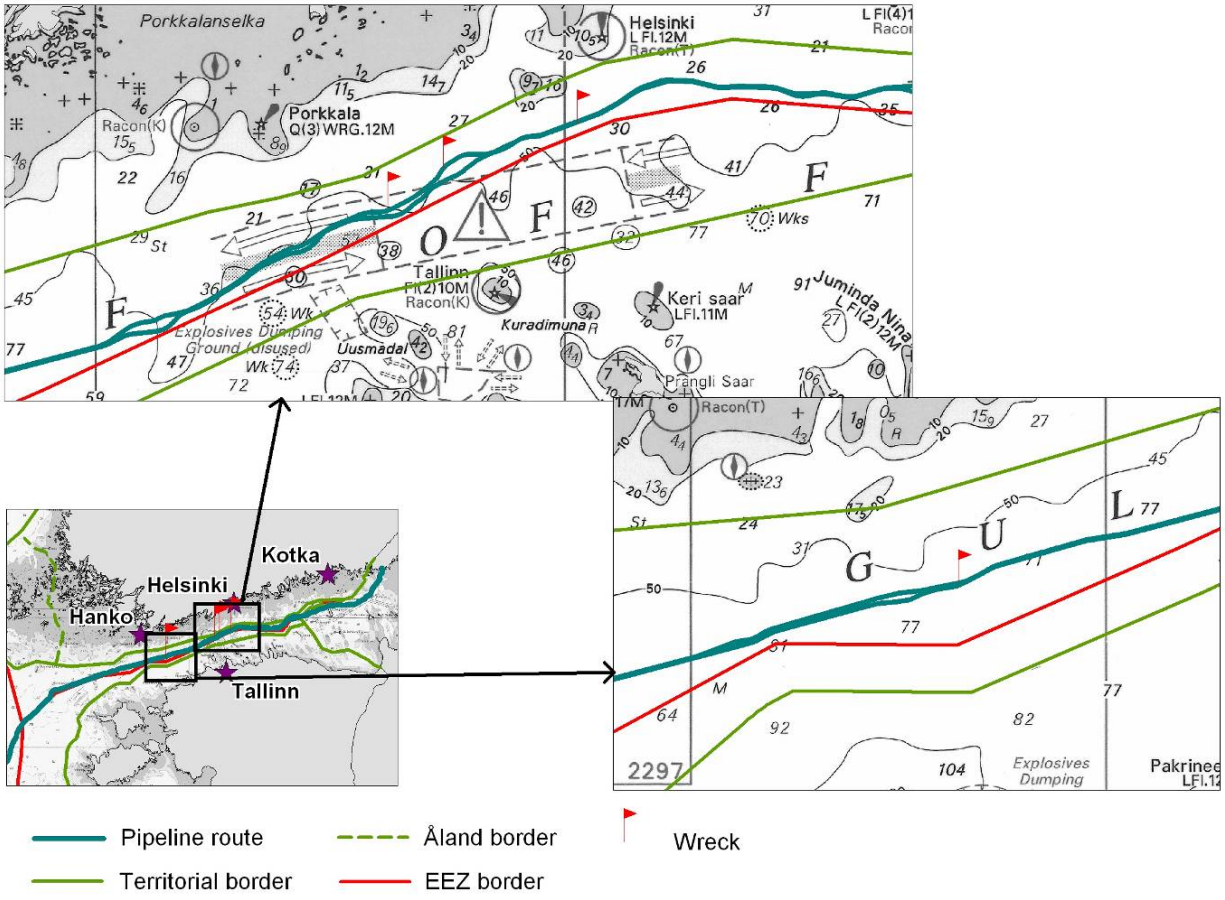

Figure 12. Identified cultural heritage sites (wrecks) that will be monitored by an ROV visual inspection before and after pipe-laying

The barrels located within the installation corridors (+/- 7.5 m each side of the pipeline) of the pipelines and there distance from the pipeline route are presented in Table 6. Pipelines will be laid pass these barrels maintaining a minimum offset and using a controlled lay procedure, during which the pipeline touchdown will be monitored by means of an instrumented ROV. The position and integrity of these barrels will be monitored prior to the pipelay and after the pipelay by a visual inspection via ROV to confirm that there has been no adverse impact on them. Locations of the barrels that will be monitored during pipe-laying are presented in Figure 13.

Table 6. Barrels within the pipeline installation corridor in the Finnish EEZ

Barrel	Offset, m	Environmental Risk Class*
R-09-23	2.2 NW	0
R-10-3277	4.5 NW	0
R-10-130066	4.2 NW	0
11-S-88	2.7 NW	0
R-E6E-10505	1.1 SE	N/A
R-06-20629	3.0 SE	1
R-08-5108	4.5 SE	0
R-E8C-10177	4.4 SE	0
R-09-5139	4.7 SE	0
R-11AG-WE-011	5.4 SE	1
12-S-46	2.7 SE	1
R-12-130145	3.7 SE	0
R-13-3546	3.5 SE	0
R-W13CG-EE-004-A	6.6 SE	1

* Classification of the environmental risk class of barrels according to the condition and exposure of the content to the sea water:

- Class 0: barrels in which the content is and has been fully exposed to sea water
- Class 1: barrels which have holes, ruptures or punctures, and in which the content has been at least partly exposed to sea water
- Class 2: barrels which most likely have holes, ruptures or punctures, and in which the content has propably been partly exposed to sea water
- Class 3: barrels with no observed openings, and most likely contain the very same substances as they did at dropping or drop moment

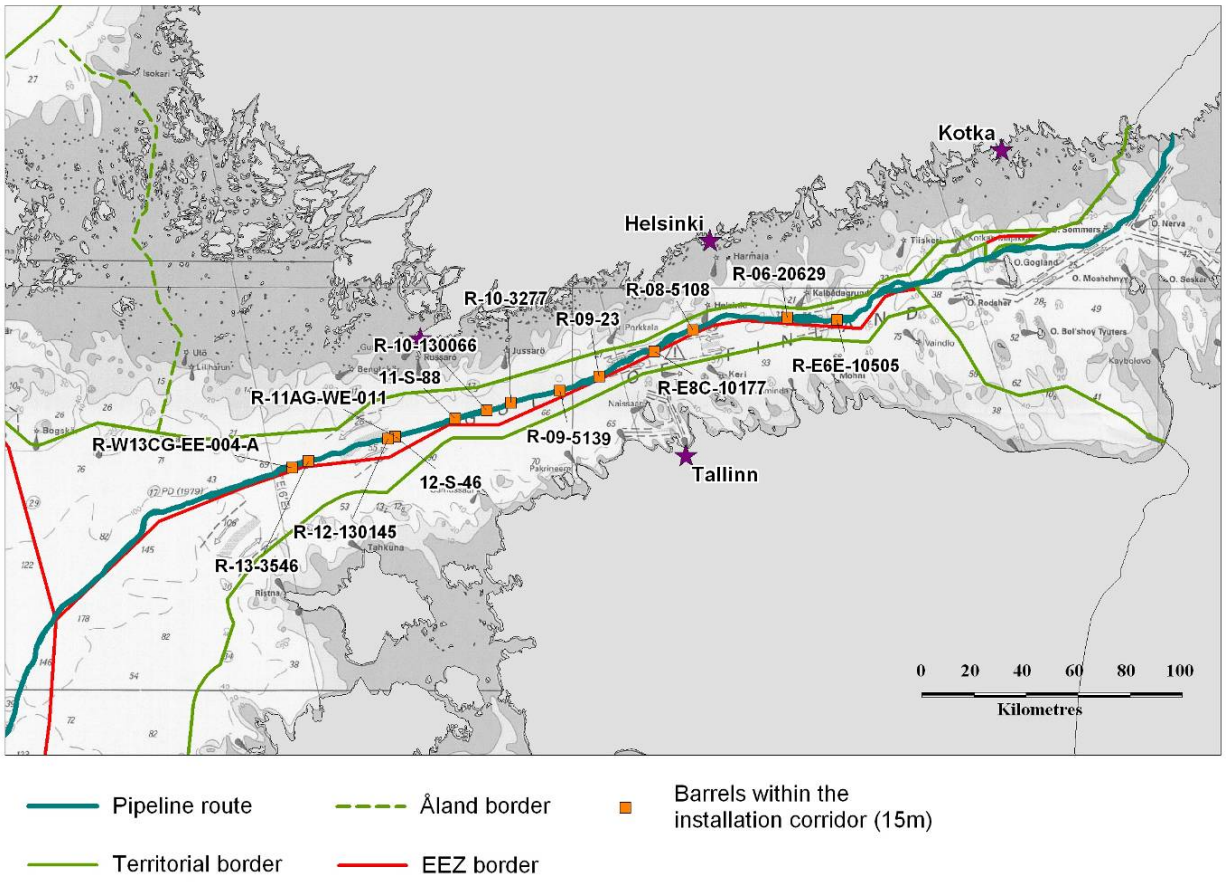

Figure 13. Identified barrels located within the installation corridors that will be monitored by an instrumented ROV prior to and after pipe-laying

The Nord Stream pipelines will cross cables that are in use 18 times in the Finnish EEZ. There will be 9 crossings per pipeline: EE-S1 at KP 448, EE-SF2 at KP 218, EE-SF3 at KP 238, FEC 1 at KP 245, FEC 2 at KP 216, Estlink at KP 244, unknown cable at KP 234.8 as well as Pangea Seg 3 at KP 219 and KP 442. In addition, the pipelines cross the UCCBF cable 6 times. Nord Stream has agreed with the owner of the UCCBF cable that the cable can be crossed without crossing structures. This is why the pipeline crossings with UCCBF cable will not be monitored. Locations of the planned cable crossings are presented in Figure 14. Prior to the installation of a crossing the position of the cable will be verified and after the installation an as built survey of the crossing will be performed. Both surveys are conducted by means of a visual inspection via ROV. The cable owners will be notified prior to and after the crossing installation.

The pipeline will be laid on the crossings using a controlled lay procedure, during which the pipe-laying is closely followed by means of an instrumented ROV. The condition of the crossing will be monitored prior to the pipeline installation during the pre-lay survey and after installation during the as-laid survey. Surveys will be performed by a visual inspection via ROV. Cable owners will be notified prior to and after the pipe-laying.

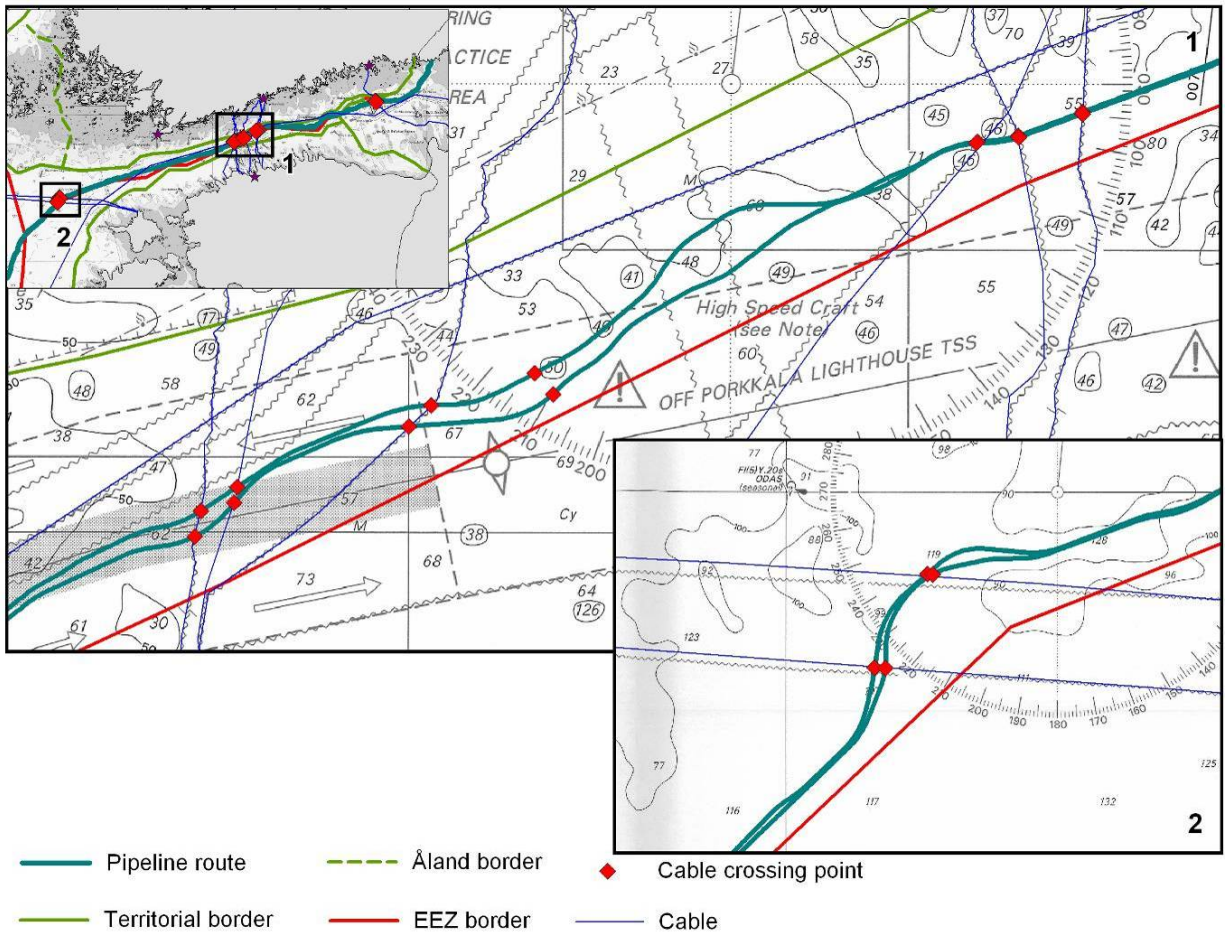

Figure 14. Cable crossings along the pipeline route that will be monitored by an instrumented ROV prior to and after pipe-laying

Anchor handling

In order to prevent damage to cultural heritage sites and minimise the risk of unplanned contact with munitions during the pipelay by an anchored lay barge, a detailed anchor corridor survey has been performed from KP 300 to KP 498 (surveys were completed in the third quarter of 2009). The survey was mainly conducted in a 1 km wide corridor to each side of the pipeline routes. In shallower waters (below 100 m) the survey corridor was 800 m either side of the route. The anchor corridor survey consisted of a geophysical phase, visual inspection and an expert evaluation of findings. The Finnish National Board of Antiquities has assessed the cultural heritage value of wrecks and munitions have been evaluated by a marine warfare expert.

In critical sections (in the vicinity of cultural heritage sites, munitions, barrels or existing cables) defined based on the anchor corridor survey results, anchor patterns will be developed and submitted to the appropriate authorities. While developing the anchor patterns the pipelay contractor will take into account all identified wrecks demanded by FNBA (S-13-31313, S-13-34523, S-15-35565 and S-16-36567), barrels of environmental risk class 3 and 2, munitions and existing cables in order to establish clearance zones around the objects and thus to minimise the risk of impacts to these objects.

Similar to general pipe-laying pre-lay surveys on wrecks of cultural value will be performed during anchor handling prior to the passing of the pipelay barge and post-lay surveys after the installation of the section. These pre- and post-lay surveys will be conducted by a visual inspection via ROV. Based on the assessment of the Finnish National Board of Antiquities four wrecks within the anchor corridor have been selected to be included into the monitoring programme during anchor handling. These wrecks include S-13-31313, S-13-34523, S-15-35565 and S-16-36567 and their locations are shown in Figure 15.

The remote possibility of finding unexpected munitions or items of cultural value during the actual construction works will be dealt with within the ‘chance finds’ procedure referred to in the Munitions and Cultural Heritage Management Plans. The procedure provides guidelines for actions to be taken in dealing with accidental finds and their documentation and reporting.

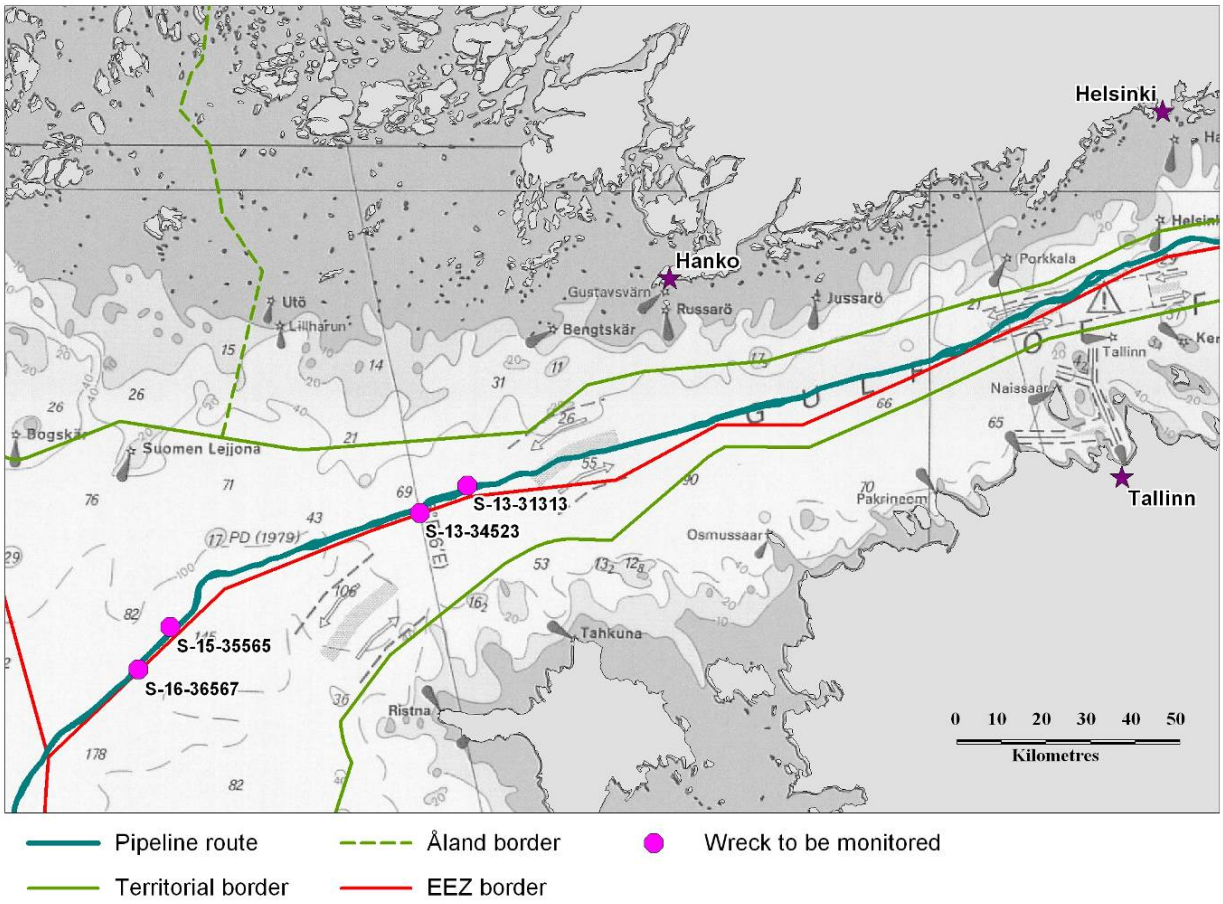

Figure 15. Cultural heritage sites (wrecks) located in the anchor corridor that will be monitored by an ROV visual inspection before and after pipe-laying

The monitoring programme for cultural heritage and existing infrastructure during construction is presented in Table 7.

Table 7. The monitoring programme for cultural heritage and existing infrastructure during construction

Cultural Heritage and Existing Infrastructure monitoring					
Project activity	**Parameter**	**Unit**	**Method**	**Location**	**Timing / frequency**
Rock placement	Presence of new unknown objects	Yes no, location (E,N)	Visual inspection via ROV	All rock placement locations	Prior to rock placement
Pipe-laying	Presence of new unknown objects	Yes no, location (E,N)	Visual inspection via ROV	Installation corridor along the entire pipeline length	Prior to pipe-laying
	Position and integrity of cultural heritage	coordinates, Intact / damage	Visual inspection via ROV	4 cultural heritage sites within security corridor or close proximity to it	Pre-lay, pipeline touchdown and post-lay
	Position and integrity of barrels	coordinates, Intact / damage	Visual inspection via ROV	All barrels within the installation corridor (+/- 7.5 m)	Pre-lay, pipeline touchdown and post-lay
	Position and condition of crossings	coordinates, Intact / damage	Visual inspection via ROV (plus cable tracker)	18 cable crossings	Pre-lay, pipeline touchdown and post-lay
Anchor handling	Integrity of cultural heritage	Intact / damage	Visual inspection via ROV	4 cultural heritage sites in the anchor corridor	Prior to and after pipe-laying by an anchored lay barge

Reporting of Results

ROV inspections will be reported in the form of a catalogue of all features inspected. These catalogues will present feature type, description, coordinates and images and link to associated video files.

The ROV inspections for different objects will entail the following:

- **Cultural heritage:** general overview highlighting sensitive objects
- **Barrels:** 360 degree visual inspection
- **Cables:** longitudinal traverse – visual inspection and bathymetry

Direct comparison between pre-lay and post-lay survey will be presented, together with indications of condition of cultural heritage sites, barrels and cables.

Reports shall be submitted in both hard copy and digital format. The digital report will include:

- CD-ROM based reports
- Charts in AutoCad 2000 compatible format
- All acquired processed data in commonly accepted digital data formats.

5.5 Commercial Shipping – Mitigation and Monitoring Measures

All movements of vessels of 300 GT or more are monitored by the GOFREP (Gulf of Finland Reporting system in international waters of the Gulf of Finland). GOFREP is a mandatory ship reporting system and adopted by the International Maritime Organization. GOFREP was established to improve maritime safety, to protect the maritime environment and to monitor compliance with the International Regulations for Preventing Collisions at Sea. The sea areas in the Gulf of Finland are monitored by Finland, Estonia and the Russian Federation.

An assessment of the potential impacts resulting from the construction activities on commercial shipping has been performed within the EIA (Ch. 8.4.1). To reduce the frequency of potential collision between the commercial ship traffic and the vessels performing pipeline construction activities mitigation measures will be detailed in a ship traffic management plan. The construction vessels when performing pipelay or under water operations are restricted in their ability to manoeuvre and are therefore exempt of complying to Rule 10 of COLREGs which provides guidance in determining safe speed, the risk of collision and the conduct of vessels operating in or near traffic separation schemes.

The ship traffic management will interface with GOFREP and address the following construction activities:

- Rock placement (pre-lay and post-lay);
- Pipe-laying;
- Pre-commissioning and hyperbaric tie-in.

In order to notify minor vessels outside of GOFREP, all fishing organizations and maritime organizations will be informed prior to the commencement of construction works.

Pipe-laying

During the pipe-laying activities the movements of the vessels within the pipe-lay spread and third party shipping will be monitored in accordance with a ship traffic management plan. The plan will define a safety zone around the pipe-lay barge. The planned radius of the safety zone around anchored pipe lay barge is 3 km and 2 km around DP lay barge. The ship traffic management plan will be developed by the pipe-lay contractor in close consultation with the Finnish Maritime Institute. The plan will interface with GOFREP to ensure maritime safety for third party ship traffic.

The Finnish Maritime Administration will be notified of the installation schedule well in advance of the commencement of work. Daily and weekly based reporting will be provided to the relevant GOFREP Vessel Traffic Service (VTS) centres whilst the activities are on-going.

A marine captain and in heavy traffic areas possibly a vessel traffic operator (from VTS Helsinki) will be onboard the pipe-laying vessel to monitor all third party shipping activity.

The vessels use the Automatic Identification System (AIS) for the identification and locating of vessels. Any unexpected vessels entering a closest point of approach radius will be monitored closely and the support vessels of the spread can be used to alert them.

Rock placement, pre-commissioning and hyperbaric tie-in

During the rock placement, pre-commissioning and hyperbaric tie-in activities vessel movements will be monitored in accordance with a ship traffic management plan. The plan will define a safety zone around construction vessels. The planned radius of the safety zone is between 500 m – 1 km. The ship traffic management plan will be developed by the rock placement contractor in close consultation with the Finnish Maritime Administration. The plan will interface with GOFREP, ensuring the safety of third party shipping.

The Finnish Maritime Administration will be notified of the rock placement schedule well in advance of the commencement of work. Daily and weekly basis reporting will be submitted to the relevant GOFREP Vessel Traffic Service (VTS) centres whilst the activities are on-going.

To avoid adverse impacts on the commercial shipping a safety zone will be established around the rock placement activities in consultation with the Finnish Maritime Administration.

5.6 Commercial Fishing

An assessment of the potential impacts resulting from the construction activities on commercial fishing has been performed within the EIA (Ch. 8.4.2).

As described in section 5.5, to minimise the risk of vessel collision safety zones with a varying radius will be established around the construction sites. The negative impact of this mitigation measure is that potential fishing activities are excluded from the safety zone during the construction works. However, the affect is temporary and of short duration as the pipe-laying operation is a progressive, moving activity (approx 2.5 to 3 km per day) and the duration of rock placement activities at different sites is short-term.

Prior to the commencement of construction activities Nord Stream will consult with the fishing associations regarding the planned activities and exclusion zones of different construction works. Throughout the construction period regular information will be provided addressing construction vessels, work scopes, progress and potential safety concerns, including how to handle the interaction between fishing gear and the pipeline. Following installation of the pipelines the as built configuration will be provided to the fishing community.

After construction of the pipeline Nord Stream will apply to the relevant authority to have the pipeline shown on nautical charts together with a cautionary note highlighting that the pipeline may be in free span and this may cause a potential hazard to trawling.

6 Environmental Monitoring during Operation

6.1 Scope and Schedule

Environmental monitoring of the whole Nord Stream project during operation will vary in spatial range, frequency and duration in accordance with the potential adverse impacts predicted and in relation to potential receptors. The programme presented in this chapter concentrates on the monitoring activities that will be carried out during operation in the Finnish EEZ.

Based on the results of performed environmental assessments environmental monitoring during operation in the Finnish EEZ will concentrate on the following:

- Seabed morphology
- Sediment geochemistry
- Recovery of and changed in benthic communities and
- Social impacts and impacts on fishery

Summary of the selected monitoring stations for monitoring seabed geochemistry and benthos during operation is presented in Table 8. Summary of all monitoring stations during construction and operation is presented in Appendix 2.

Table 8. Monitoring stations during operation

Monitoring stations during operation		
Sensoring	**Code**	**Monitoring of long term impacts also from these activities**
Sediment and benthos sampling (soft seabed)	SED2 / BENT2	Rock placement
	SED3 / BENT3	Munitions clearance
Benthos transect (Sandkallan)	BENT6	All activities
Parallel monitoring of HELCOM stations	LL5, LL6A, LL7, and x and y from all of these (e.g. LL5x)	All activities and pipelines on seabed

Monitoring during operation will be carried on until it can be assured that there are no unexpected impacts on the selected impact targets. Technical pipeline inspections will be carried on during the whole operational lifetime (Figure 16).

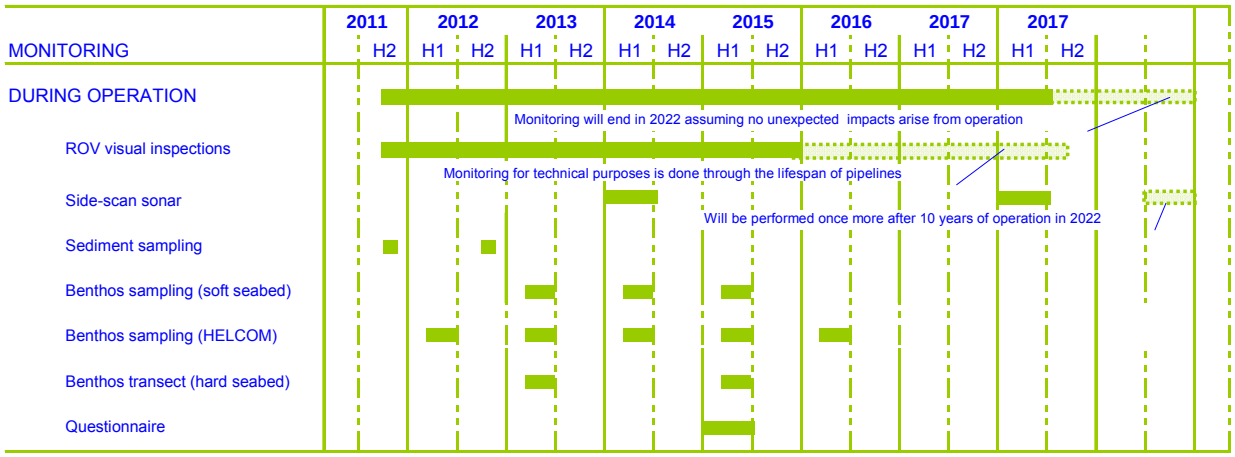

Figure 16. Approximate schedule for monitoring of Nord Stream project during operation in Finland (as of February 2010)

6.2 Seabed Morphology

The seabed conditions surrounding the pipelines will be inspected regularly during the external inspections in the operation phase. Simultaneously, any potential foreign objects in the vicinity of the pipelines will be detected. Inspections will be carried out by means of a ROV instrumented with multi-beam echo sounder or similar, sonar and video cameras. The aim of inspections is to ensure the long term pipeline integrity. The monitoring results will be provided to the authorities in the same format as the results for seabed morphology monitoring during construction. However, the focus will be in comparing the prevailing conditions first with the as-built pipeline position, condition and configuration and later on with the results of the previous inspection.

Monitoring of changes in bottom close currents has been discussed with the Finnish Meteorological Institute, Geological Survey of Finland and Finnish Environment Institute. Based on these consultations monitoring of bottom close currents will be performed by side scan sonar. Monitoring will be done three times: 1) once 1-2 years after the finalization of the construction of both pipelines, 2) once after 5 years of operation and 3) once after 10 years of operation to assess if there have been any changes in sedimentation and erosion.

The side scan sonar survey with dual frequency (300/600 kHz) will cover a 150 m wide corridor centred on the as-laid pipeline alignment of each pipeline. Surveys will be performed along two lines offset 25 m either side of the pipeline.

The monitoring results will be provided to the authorities as side scan sonar mosaics in a digital format and interpreted as side scan survey in map format that indicates areas of scour and sedimentation based on sonar back scatter. The need for further side scan sonar surveys will be assessed based on the monitoring results.

The monitoring programme for seabed morphology during operation is presented in Table 9.

Table 9. The monitoring programme for seabed morphology during operation

Seabed morphology monitoring					
Project activity	**Parameter**	**Unit**	**Method**	**Location**	**Timing / frequency**
Operation	Pipeline position, condition and adjacent seabed	Location, intact / damaged, seabed profile	ROV instrumented with multi-beam echo sounder, sonar and video cameras	Entire pipeline length in the Finnish EEZ	During whole lifespan
	Bottom close current conditions	Changes in erosion/ sedimentation patterns	Side scan sonar	Entire pipeline length in the Finnish EEZ	Once 1-2 years after construction of both pipelines, once after 5 and 10 years of operation

6.3 Seabed Geochemistry

Monitoring of seabed geochemistry has been discussed with the Finnish Meteorological Institute, Geological Survey of Finland, Finnish Environment Institute and regional environment centres. Based on these consultations seabed geochemistry will be analysed from sediment transects at two locations (SED2 and SED3) with focus on soft sediment. Samples will be taken once before construction activities and once after the activities as well as once after completion of the construction of the first and once after completion of the construction of the second pipeline. The samples will be taken along the transects at seven locations: 50 m, 100 m, 200 m, 400 m, 800 m, 1600 m and 3200 m to the North of the pipeline route (a-g). The sampling locations are presented in Figure 17 and Figure 18. The increasing distance of sampling locations from the pipeline will enable the use of the furthest locations as control sampling stations. At all locations surface sediment samples (0-2 cm) will be taken and at a distance of 50 m and 100 m from the pipeline route also samples from 2-10 cm depth will be taken. The seabed geochemistry prior to construction at the station SED3 will be assessed prior to munitions clearance phase 1 (see Document G-PE-PER-REP-000-EMPFINMU-G) and at station SED2 prior to rock placement. SED3 sampling station is the same as VOM3 and SED2 is the same as VOFIXIW1.

The samples taken will be analyzed for dioxins, organic tin compounds (TBT, TPhT and their degradation products), 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 10 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 analysed. Samples will be taken with a GEMAX-core sampler or similar and analysed in an accredited laboratory.

The sediment analysis data from all sampling stations will be reported as actual concentrations and as normalized concentrations. These results are presented in tables and in graphs as concentrations in relation to the distance from the pipeline.

The monitoring programme for seabed geochemistry during operation is presented in Table 11 and standards for sediment analyses in Table 10.

Table 10. 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
Organic tin compounds	yes	µg/ kg	1	DIN ISO 23161	
Dioxins	yes	ŋg/ 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	

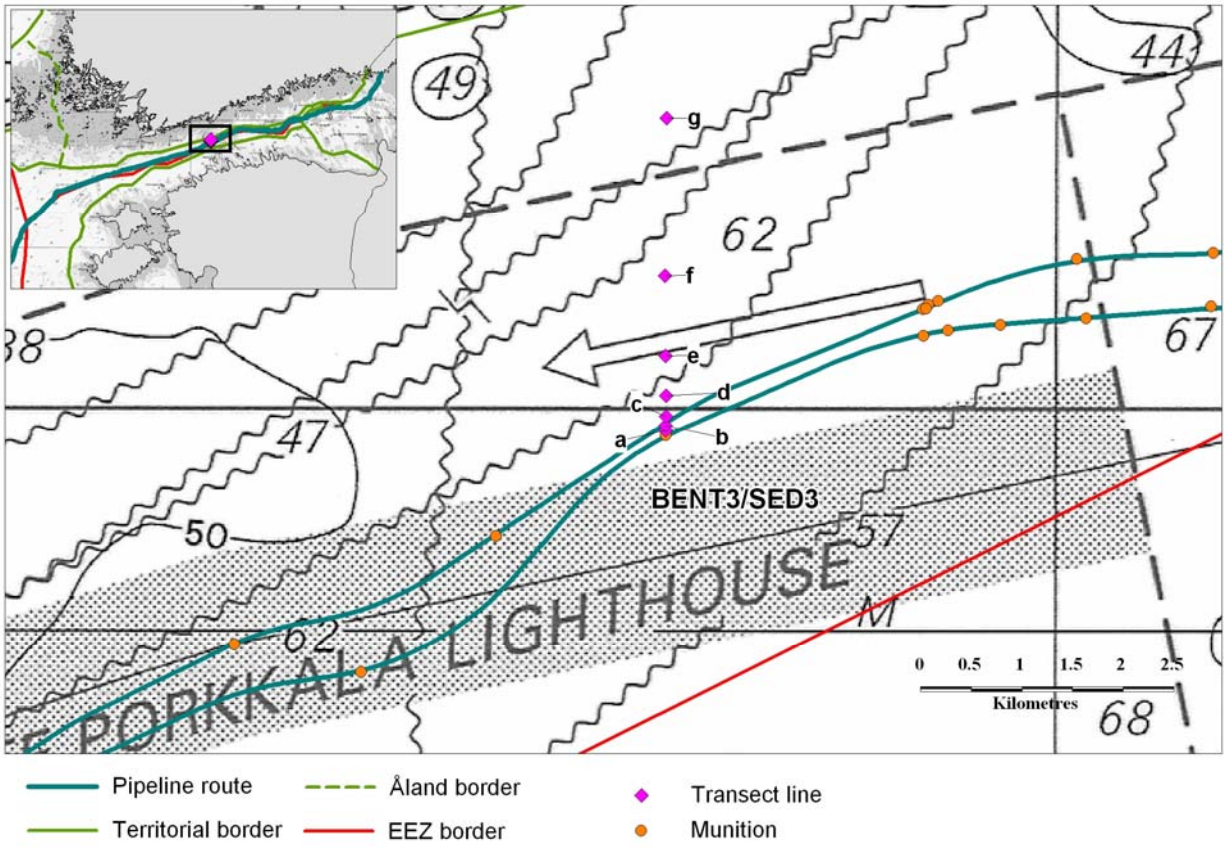

Figure 17. Sediment and benthos sampling transect SED3 and BENT3 for monitoring changes in seabed geochemistry and benthos.

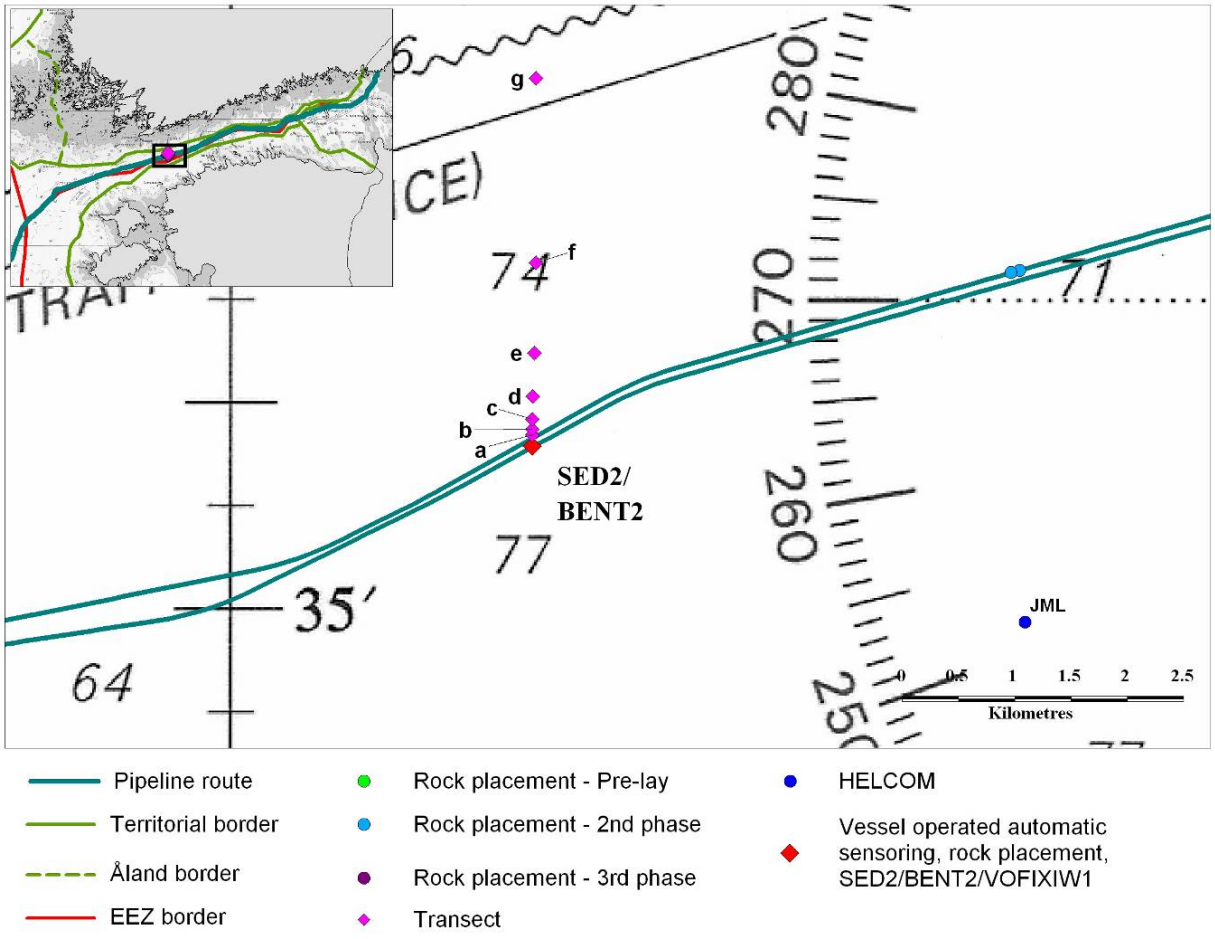

Figure 18. Sediment and benthos sampling transect SED2 and BENT2 for monitoring changes in seabed geochemistry and benthos.

Table 11. The monitoring programme for seabed geochemistry

Seabed geochemistry monitoring					
Project activity	**Parameter**	**Unit**	**Method**	**Location**	**Timing / frequency**
Operation	Dioxins, organic tin compounds, As, Co, Cr, Ni, Zn, Cu, Pb, Cd, Hg and C_{tot}	mg/kg, µg/g	Sediment sampling in transect	Two transects (SED3-munitions clearance and SED2 – rock placement)	Once before activity, once after activity, once after the completion of construction of the first pipeline and once after the completion of construction of the second pipeline (in total 4 times)

6.4 Recovery of and Changes in Benthic Invertebrate Communities

Soft seabed

The recovery of benthic invertebrate infauna will be monitored once a year during the first three years of operation. According to present knowledge three years is a normal recovery time for benthic invertebrate communities in the Baltic Sea. In addition benthos samples will be taken before and immediately after the monitored construction activity to receive baseline data. Samples will be taken by Van Veen grab (0.1 m^2) or similar according to the HELCOM COMBINE guidelines (Annex C-8 Soft bottom macrozoobenthos[5]). Three samples will be collected and each sample will be analysed individually. The used methods will correspond to ones used in HELCOM long term monitoring. Benthos surveys during the operation will be scheduled according to the HELCOM long term monitoring, i.e. in May-June.

The spatial design of the sampling grid will consider the spatial distribution of construction activities causing considerable seabed interventions and the results of the monitoring during construction on the spatial range of sediment dispersion.

Benthos sampling from soft sediment will be done at two stations BENT2-3 (Figures 17 and 18). BENT2 is in the same location as SED2 / VOFIXIW1 and BENT3[6] in the some location as SED3/ VOM3. BENT3 station represents a site where the recovery of benthic environment after munitions clearance is being monitored and BENT2 is a site where the recovery of benthic environment is being monitored after rock placement.

- BENT2 – Close to rock placement site (approximately 92 000 m^3) at KP 297.
  BENT3 – Close to clearance site near KP 243 where munition F17 (R-08-2805) will be detonated in munitions clearance phase 1. The munition has a charge size of 350 kg.

During the benthos sampling following notes will be taken:

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

Samples are sieved separately through a metal gauze (stainless steel, brass or bronze) having mesh sizes of 0.5 mm and 1.0 mm. Monitoring results are presented as a number of species and individuals and as a list of species. Details of sample analyses will be agreed with SYKE in order to have results comparable with those of HELCOM long term monitoring.

Soft seabed – HELCOM

Monitoring of potential unexpected changes in benthos at HELCOM long term monitoring station and minimizing risk to scientific heritage during operation has been planned after discussions with the Finnish Meteorological Institute, Geological Survey of Finland and Finnish Environment Institute.

[5] http://www.helcom.fi/groups/monas/CombineManual/AnnexesC/en_GB/annex8/
[6] BENT3 (EST) is located in the Estonian waters and part of the transboundary monitoring programme.

Consequently HELCOM stations LL7 (1.2 km), LL5 (1.6 km) and LL6A (1.4 km) near the pipeline will be monitored (Figure 20 and Appendix 1). Benthos will be sampled from each station and also parallel each station with two locations (x and y) with similar depth and seabed type as the monitored station (LL7, LL5 and LL6A) but with increasing distance to pipeline. If scientific heritage at any of these HELCOM stations would be jeopardized, it could be moved and one of these monitored locations (x, y) would be used as "new" HELCOM station. Figure 19 shows the location of LL7 and exemplary locations for LL7x and LL7y. The exact locations, sampling methods, timing of sampling and methods for sample analysis will be agreed with SYKE. For sampling and sample analysis the HELCOM long term monitoring methods will be applied. Agreed monitoring sites and methods will be delivered to relevant authorities before the first sampling. HELCOM stations will be monitored once before the installation of the first pipeline and annually during the 5 first years after construction of the first pipeline. Monitoring results will be added also to monitoring reports.

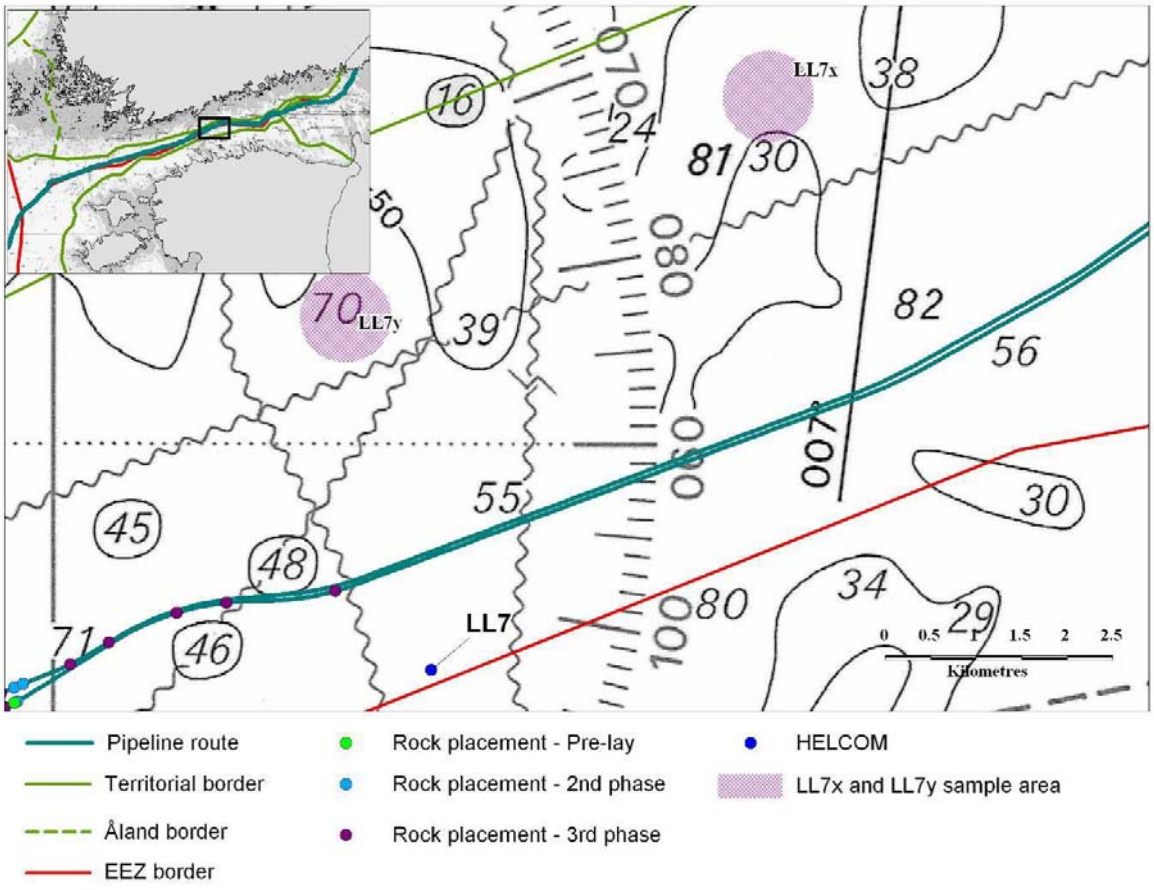

Figure 19. Example of monitoring locations for HELCOM long term monitoring stations. Red circles represent locations of the two parallel sampling sites LL7x and LL7y for monitoring the HELCOM long term monitoring station LL7 (Chapter 6.4). Similar stations will be established also for HELCOM stations LL5 and LL6A. The exact monitoring locations will be decided in co-operation with Finnish Environment Institute.

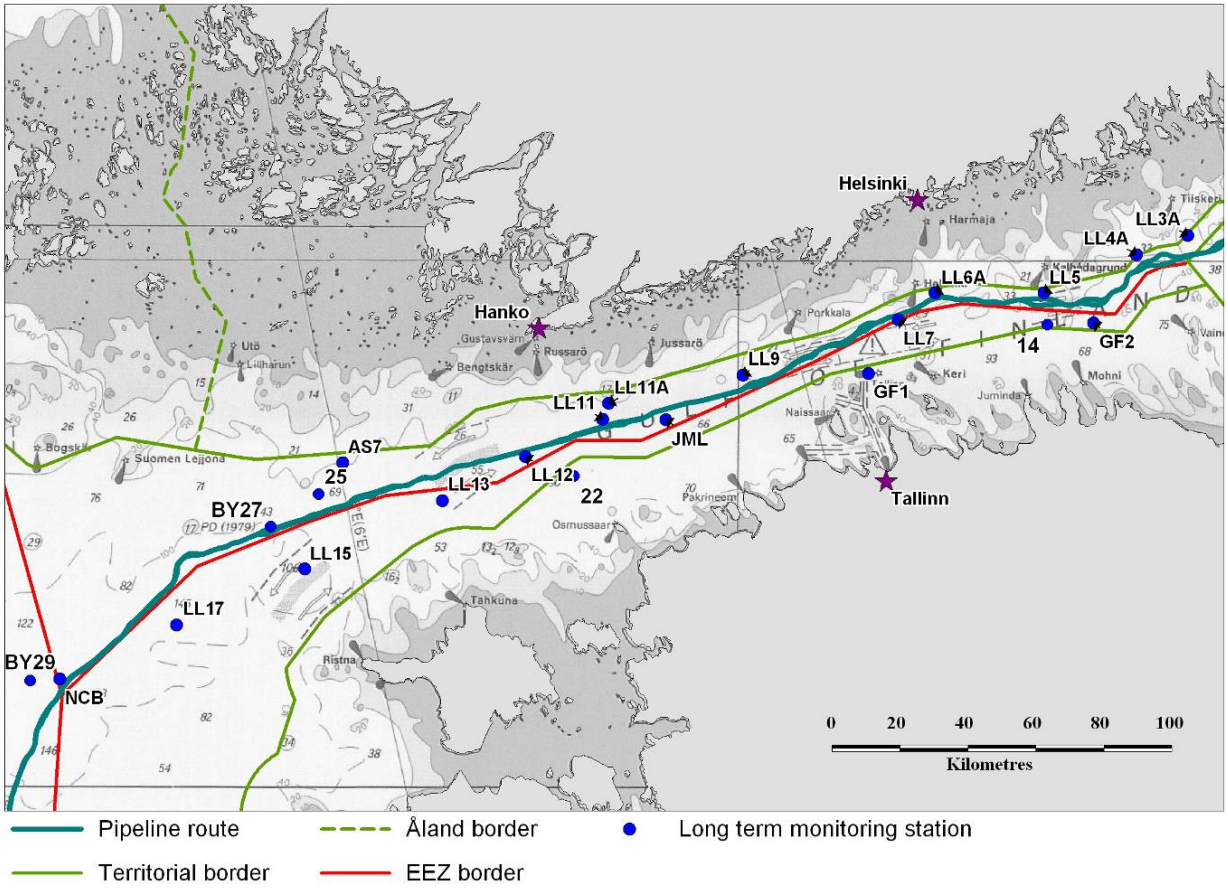

Figure 20. HELCOM stations close to the Nord Stream pipeline.

Hard seabed

The nearest proposed new Natura 2000 area to the pipeline route is Sandkallan Southern Marine Area. It has been proposed to be protected due to the nature value of its reef habitat. The Sandkallan area is located 2.9 km from the pipeline route, in the section where the DP lay barge is used, and 3.2- 3.9 km from the nearest rock placement sites. The potential changes in the benthic invertebrate epifauna in this area will be documented from a ca. 5 km transect (BENT6[7]) by means of a visual inspection via ROV. This transect will be established from the pipeline route to the direction of Sandkallan area (FI0100106) (Figure 22). The southern end of transect is in 430104 E, 6639387N and the northern end is in 430104 E, 6645000 N. The water depth is between 32 - 66 m.

The monitoring of potential changes in invertebrate epifauna at the Sandkallan area will be performed once immediately after the construction of the second pipeline and once after two years

[7] BENT4 (EST) and BENT5 (EST) are located in the Estonian waters and part of the transboundary monitoring programme.

of operation. At the chosen transect, a combined ROV video recording and photo camera survey will be performed. This is an appropriate method for the identification of seabed habitats/biotopes as well as epibenthic flora and fauna. The video shows an overview that can be used for identifying habitats/biotopes and their changes. The photo images will be taken every 50 meters and used for identifying epibenthic biota and counting species density/m^2 in the photographed area. Results are presented as a number of species and individuals at monitored locations and as a list of species at specific locations. Earlier benthos study in this transect took place in 2008 and the collected data can be used as a reference.

The pipeline itself functions also as a substrate to invertebrate epifauna. The pipeline epifauna will be documented (at sections with water depth < 50 m) by means of a visual inspection via ROV during the external technical inspections.

The monitoring programme for benthos during operation is presented in Table 12.

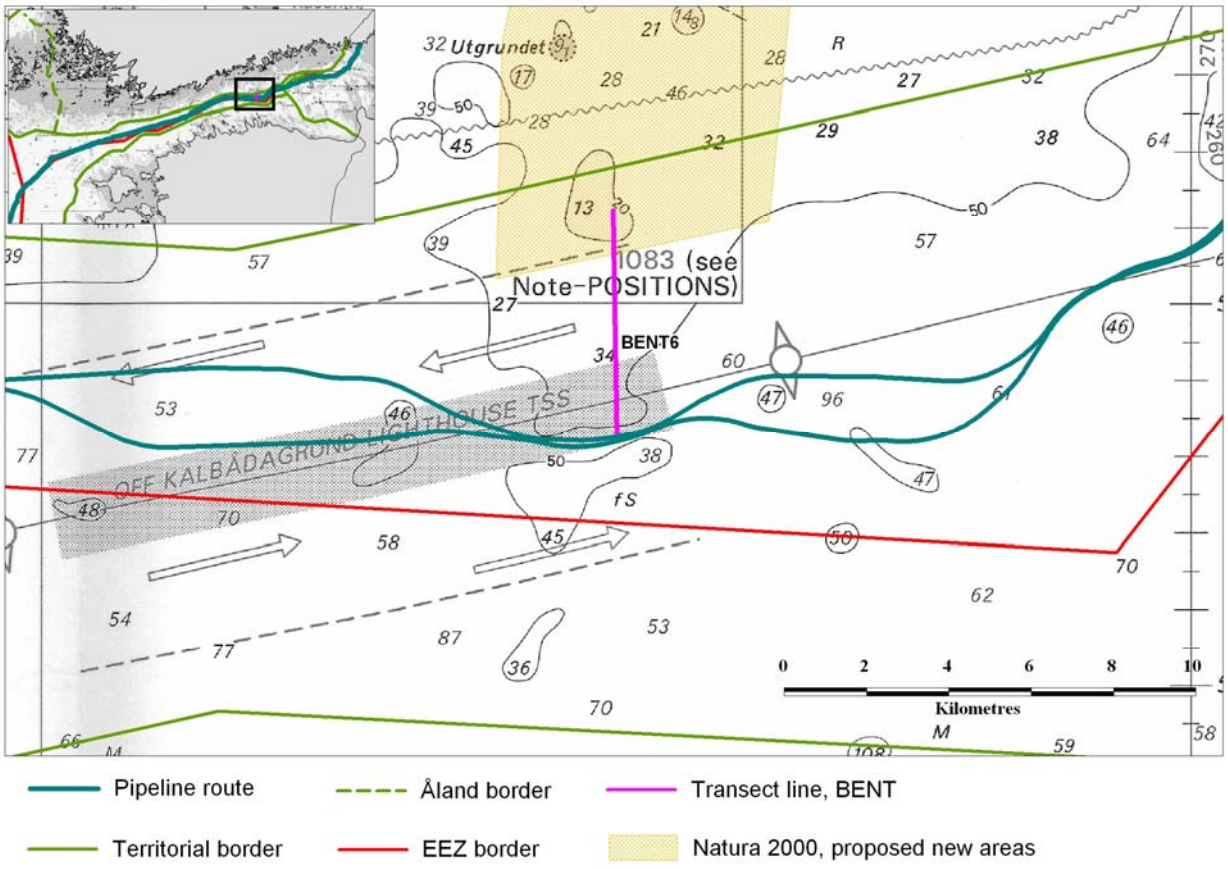

Figure 22. Location of benthos monitoring transect (BENT6) at the Sandkallan area. The depth along transect varies between 32 and 66 metres. The depths in background map are approximations.

Table 12. The monitoring programme for benthos during operation

Benthos monitoring					
Project activity	**Parameter**	**Unit**	**Method**	**Location**	**Timing / frequency**
Operation	Abundance of species and individuals - benthos, oxygen concentration	ind./m^2, species/m^2 (abundance), mg/l (oxygen)	Van Veen grab (0.1 m^2) or similar	Sediment sampling transect s (BENT3 – munitions clearance and BENT2 – rock placement)	Once before activity and once after activity. Once a year during 3 years after construction (in total 5 times)
	Abundance of species and individuals at Sandkallan area (epifauna)	number of individuals and species at certain part of transect	ROV visual inspection (Video and photographs)	5 km long south to north transect between pipeline and proposed Sandkallan Natura 2000 area, still photo every 50 meters (BENT6)	Once after the construction of the second pipeline and once after two years of operation
	Abundance of species and individuals on pipeline (epifauna)	number of individuals and species on the pipeline	ROV visual inspection	Pipeline in the Finnish EEZ with water depth < 50 m	During the external ROV technical inspection done before year 2016
	Abundance of species and individuals – benthos, oxygen concentration	ind./m^2, species/m^2 (abundance), biomass, mg/l (oxygen)	Van Veen grab (0.1 m^2) or similar	Benthos sampling at HELCOM stations LL7, LL5 and LL6A and their two parallel sites x and y.	Once before installation of the first pipeline and, annually after construction of the first pipeline for 5 years.

6.5 Social impacts and impacts on fishery

An assessment of the potential social impacts resulting from the Nord Stream Project has been performed within the EIA report (Ch. 8.4.8). On average, these impacts have been assessed to be moderate. Social impacts will be monitored with questionnaires after two years of completion of construction, similar to one done in EIA phase. Planned survey is presented in more detailed in Appendix 3.

In addition to the general citizen survey a specific survey targeting the fishermen will be performed. For this purpose a so-called “fishery questionnaire” will be developed. The target group includes all the fishermen trawling in the Gulf of Finland. The survey will be carried out to obtain a better perspective on how fishermen have experienced the construction of the pipelines and how the presence of the pipelines has affected their fishing behaviour.

In addition to the fishery questionnaire, the fishing vessels’ avoidance of the pipeline area and changes in fishing patterns will be monitored. For this purpose the tracking data gathered prior to construction will be compared with the tracking data that will be gathered two years after the pipeline system construction.

The data gathered through questionnaires will be processed by means of a statistical programme and analyzed as an expert assessment. The results will be presented in graphs and diagrams including explanatory text in a narrative form. The reports will be submitted in an electronic format and as a hard copy.

The proposed monitoring programme for impacts on fishery during operation is presented in Table 13.

Table 13. The monitoring programme for impacts on fishery during operation

Monitoring impacts on fishery					
Project activity	**Parameter**	**Unit**	**Method**	**Location**	**Timing / frequency**
During operation	Impact on fishery	Impacts on fishing behaviour	Questionnaire to professional fishermen	Fishermen trawling in the Gulf of Finland	Two years after the construction
		Changes in fishing patterns	Comparison of vessel specific tracking data to data gathered prior to construction	Vessels fishing in the pipeline area in the Finnish EEZ	Two years after the construction

7 Technical Inspections during Operation

In addition to environmental monitoring regular inspection surveys of the pipeline system will be carried out as part of the inspection, maintenance and repair (IMR) programme through the operation phase. The main goal of inspection surveys is to ensure the safe and reliable operation of the pipeline system throughout its lifetime. Basic requirements to inspections of the pipeline system are established in Offshore Standard DNV-OS-F101 which is the governing code for design, construction and operation of the Nord Stream Pipeline System.

Before the start of operation of the pipeline system an Inspection Programme will be developed. It will describe the main types of inspections, their requirements and frequency. All the inspection requirements identified during the design phase as affecting the overall pipeline integrity (safety and reliability) during operation shall be covered in the Inspection Programme.

Four types of inspections are foreseen:

- External offshore inspection for the main marine section of the system (deeper than approximately 15 meters),
- Shallow water and onshore inspections surveys using geophysical surveys of the buried sections (Russia and Germany)
- External inspections of the exposed onshore section (Russia and Germany)
- Internal inspection over the full pipeline length (pig-trap to pig-trap)

External Offshore Inspection will evaluate the pipeline seabed configuration and the external condition of pipelines. This inspection survey will be executed from onboard of a vessel equipped with ROVs or AUVs having visual, acoustic and electro-magnetic instruments. During offshore external inspection the following is determined:

- Pipeline plan position and vertical profile
- Adjacent seabed profiles,
- Presence of objects in the vicinity of the pipeline.
- Condition of pipeline concrete weight coat and field joints
- Condition of the anodes (cathodic protection level)

All collected data are compared with previous surveys to allow comparison to the design and as-built condition. Historical trending is used to assess the development of such items as free spans, seabed scour, areas prone to damage, and consumption and physical loss of anodes (prediction of anode wastage).

Shallow water and onshore inspections surveys of the buried sections: These surveys utilise geophysical techniques to confirm the seabed bathymetry, plan position of the pipeline, the depth of burial and less frequently the cathodic protection. Historical trending of the gathered survey data will be used to assess such parameters as the long term stability of the seabed and pipeline depth of burial.

External inspections of the exposed onshore sections mainly concern ground stability, condition of the pipelines and associated infrastructure and the cathodic protection.

Internal inspection is executed with internal pipeline guides. Intelligent pigs that run through the entire pipeline length with the gas flow inspect for possible metal losses of pipeline body due to corrosion and change of local pipe geometry (dents).

The first inspections under the Nord Stream Inspection Programme will take place as soon as possible after putting the pipeline system into operation. These first surveys will be baseline inspections. The frequency of next inspections will depend on the results of baseline inspections and likewise, the starting date of each following inspection will depend on the results of the previous one.

The Inspection Programme will also provide for special inspections in case of any unexpected events which may impair the safety and reliability of the system. If the pipeline parameters are discovered to deviate critically from the design limits in any of the inspections, appropriate maintenance or repair programme will be implemented.

8 Reporting of Monitoring Results

As stated under Project-wide monitoring principles in Ch. 2, 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 the Finnish and Swedish languages. The report will be delivered to the relevant authorities within two months from the end of each year (by the end of February). The annual report among others:

- summarises the monitoring results from all monitored activities and for all parameters
- compares the results for sediment spreading to modelling results and
- assesses the actual impacts of the project based on measured parameters and compares these to assessed impacts.

If authorities want to deliver the annual report to the participants of the Espoo process, Nord Stream can publish the report also in English.

In addition to the annual report the authorities will receive quarterly monitoring reports in Finnish and Swedish during the construction phase. The first monitoring quarter begins on 01/04/2010 and the report will be delivered to authorities in English within two months from the end of the quarter and in Finnish and Swedish within three months from the end of the quarter. The quarterly report among others:

- presents the monitoring results from the quarter
- discusses all possible unexpected events / anomalies and
- provides a rough estimate of impacts.

During the operational phase monitoring results will be reported only yearly basis. Reports will be delivered to relevant authorities as hard copies in agreed manner within two months from the end of the monitoring period (end of February).

Unexpected events and chance finds will be reported immediately according to the procedure that will be developed in consultation with relevant authorities.

9 References

/1/ Nord Stream AG, 2009, Nord Stream Espoo Report.

/2/ Nord Stream AG, 2009, Environmental impact assessment report, Natural gas pipeline through the Baltic Sea, Environmental impact assessment in the exclusive economic zone of Finland.

/3/ Nord Stream AG, 2009, Environmental Assessment of Pipeline Installation in the Gulf of Finland by using DP Lay Vessel.

10 Revision Record

Rev.	Date	Description	Prepared	Checked	Approved		
			Nord Stream				
E	2010-08-30	Re-Issue for use	TSA/TKU	JKU	SBO		
D	2010-04-19	Issue for use	TSA/TKU	JKU	SBO		
C2	2009-02-08	Issue for consultation	TSA/TKU	JKU	SBO		
C1	2009-01-22	Issue for consultation	TSA/TKU	JKU	SBO		
B	2009-11-05	Issue for consultation	TSA/TKU	JKU	SBO		
A1	2009-09-18	Issue for consultation	TSA/TKU	JKU	SBO		
A	2009-08-25	Issue for consultation	TSA/TKU	JKU	SBO		
03	2009-06-08	Issue for consultation	JKU/TSA	MHA	SBO		
02	2009-05-12	Issue for comments	JKU	TSA			

Appendix 1 Distances from pipeline construction activities to HELCOM and FIMR long-term monitoring stations

	Station code	Station type	Monitored parameter	Location with respect to pipeline KP	Closest distance to pipeline [km]		Closest distance to rock placement for NW pipeline [km]			Closest distance to rock placement for SE pipeline [km]			Closest distance to munitions clearance sites - phase 1 and 2	
			(W)ater (S)ediment (B)enthos		NW	SE	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Distance [km]	ID
DP lay barge	LL3A	HELCOM	W S B	124	5.6	5.7	31.3	31.3	7.6	14.7	13.8	12.7	53.2	F1B
	LL4A	HELCOM	W B	139	3.2	4.2	16.7	16.6	5.8	4.5	4.3	4.3	37.3	F1B
	GF2	FIMR / HELCOM	W S B	158	6.8	5.2	7.1	7.1	7.1	7.6	5.3	5.3	23.5	F1B
	14	HELCOM (Estonia)	W	172	7.4	5.8	10.1	9.7	9.6	10.2	6.5	6.5	11.6	F1B
	LL5	FIMR	W B	173	1.6	3.5	9.7	9.4	9.3	9.8	4.1	4.1	8.3	F1B
	LL6A	FIMR	W B	205	1.4	1.6	17.6	12.1	12.1	15.3	3.8	3.8	2.3	F2
	LL7 / F3	HELCOM	W S B	218	1.2	1.1	4.9	4.5	3.5	4.6	4.5	1.4	1.2	F38G
	GF1	FIMR	W S B	235	11.5	10.7	11.6	11.6	11.6	11.8	11.8	11.8	12.0	F7
	LL9	FIMR	W B	267	3.2	3.8	5.7	5.7	5.2	6.5	6.5	6.5	5.8	F22
	JML	FIMR / HELCOM	W S B	293	3.0	2.9	30.5	3.1	3.1	30.6	11.9	11.9	5.8	F46
	LL11A	HELCOM	W B	308	6.1	6.6	45.5	16.7	7.3	45.8	7.8	7.7	11.7	F46
	LL11 / BMPF5	HELCOM	W B	311	2.1	2.6	48.2	18.7	6.8	48.4	6.9	6.9	8.5	F23
	22	HELCOM	W B	323	11.2	10.8	62.0	33.1	22.0	44.8	21.5	21.5	12.4	F23
	LL12 / H1	HELCOM	W B	336	1.8	1.7	72.9	32.2	31.1	31.2	16.8	16.8	4.5	F33
Anchored lay barge	LL13	FIMR	W B	364	7.2	7.1	100.4	9.4	9.4	8.8	8.4	8.5	8.4	F25/F26
	AS7	FIMR	W S	388	10.9	11.7	125.5	14.5	14.5	23.9	18.0	18.0	17.0	F35
	25	HELCOM (Estonia)	W	398	5.34	5.60	135.0	5.5	5.5	31.0	6.8	6.8	20.7	F36
	LL15	FIMR	W B	410	14.3	13.9	145.8	19.0	16.5	43.9	14.7	14.7	16.7	F36
	BY27	HELCOM (Sweden)	W	415	0.84	1.55	151.0	17.9	13.4	47.1	1.55	1.55	3.5	F36
	LL17 / H2	HELCOM	W B	459	9.8	9.6	187.3	12.2	10.9	84.8	20.7	12.3	36.8	F36
	NCB	FIMR	W S	495	2.1	2.4	225.8	43.7	6.8	123.1	5.4	5.4	73.8	F36
	BY29	HELCOM (Sweden)	W	500	9.6	9.7	234.1	51.1	15.5	130.9	9.7	9.7	81.4	F36

Appendix 2 Selected locations for monitoring during construction and operation

Monitoring station							Distance. km		
Sensoring	**Code**	**KP**	**Activity**	**Rock placement amount and phase**	**Seabed quality**	**Depth, m**	**Estonian EEZ border**	**Rock placement**	**Natura 2000 area**
Vessel operated automatic sensoring and fixed sensors	VOFIXIW1	297	Rock placement	Approx. 92,000 m^3, tie-in	Very soft clay	79	5.8		15.3 (FI0100107) 18.8 (FI0100005)
	VOFIXIW2	262	Rock placement	Approx, 7,400 m^3, 2. SE	Very soft clay	67	0.6		20,7 (FI0100089)
	VOFIXIW3	164	Rock placement	Approx, 3,700 m^3, 1. NW	Dense sand	66	2.2		14.8 (FI0100077) 4.0 (FI0100106)
Vessel operated automatic sensoring, HELCOM / FIMR	VOHE3**	292	Rock placement	Approx. 2,600 m^3, 2. NW	Very soft clay	80	5.6	3.1	15.8 (FI0100107) 19.0 (FI0100005)
Vessel operated automatic sensoring and fixed sensors	LAY1	181 - 185	Pipelay	-	Hard bottom complex	50 - 62	1.7	-	15.7 (FI0100106) 21.8 (FI0100026)
	LAY2	Approx. 495	Pipelay	-	Soft sediment	Approx. 180	1.3	-	98.0 (FI0200090 / FI0200164)
Fixed sensor, transboundary impacts from Russia	FIX3	-	Dredging in Russia	-	-	Approx. 40	Russian border 0.6	Dredging 26.0	0 (FI0408001)
Long term monitoring	CONTROL1	295	Whole construction phase	-	Hard clay	22	21.4	-	0.17 (FI0100107) 3.40 (FI0100005)
	CONTROL2	100	Whole construction phase	-	Mud	40	4.05	-	1.16 (FI0400002) 2.62 (FI0408001)
Sediment sampling	SED2	297	Rock placement	Approx. 92,000 m^3, tie-in	Very soft clay	-	-	-	-
	SED3	243	Munitions clearance	-	Very soft clay	-	-	-	-
Benthos sampling (soft seabed)	BENT2	297	Rock placement	Approx. 92,000 m^3, tie-in	Very soft clay	-	-	-	-
	BENT3	243	Munitions clearance	-	Very soft clay	-	-	-	-
Benthos sampling transect (Sandkallan)	BENT6	164	All activities	-	Hard bottom complex	32 - 66	2.03 – 7.6	0.12	0 (FI0100106) 9.8 (FI0100077)
Parallel monitoring of HELCOM stations*	LL5, LL6A, LL7 and x and y from all of these i.e. LL5x)	-	All activities and pipelines on seabed	-	-	-	-	-	-

* More detailed information on HELCOM stations is presented in previous Appendix 1. ** Monitoring will be adjusted according to amounts and locations of rock placement specified later.

Appendix 3 Monitoring social impacts during operation – questionnaire

An assessment of the potential social impacts resulting from the Nord Stream Project has been performed within the EIA (Ch. 8.4.8). On average, these impacts have been assessed to be moderate. Social concerns included e.g. the reliability of project partners, the reliability of the impact assessment and the magnitude of potential environmental impacts. The aim of monitoring of social impacts is to document potential changes (e.g. increase, decrease or different focus) in opinions, attitudes and worries and if necessary implement measures to reduce the concerns raised by the citizens through outreach programs

Social impacts will be monitored by means of a quantitative method that generates statistical data. The survey conducted during the EIA phase and the impact assessment form the basis for the monitoring. Two years after the completion of the pipeline system construction a social impact assessment survey similar to that carried out in the EIA phase will be conducted. The target group includes the population in the 33 coastal municipalities where the EIA report was put on public display. The scope of the survey consists of ca. 2,000 questionnaires that will be sent out by mail to recipients selected based on random sampling. The themes covered in the survey will be comparable to the EIA phase, although some adjustments will be made based on issues raised during the construction phase and first years of operation. The survey will be carried out to obtain information e.g. about:

- How the project has affected the citizens' use of the areas close to the project area?
- How the project has affected the citizen's sense of security and civic confidence?
- How the citizens feel about the impacts of the project?
- How the impacts of the project have affected the citizens' living environment?

The data gathered though surveys will be processed by means of a statistical programme and analyzed as an expert assessment. The results will be presented in graphs and diagrams including explanatory text in a narrative form. The reports will be submitted in an electronic format and as a hard copy.

The proposed monitoring programme for social and economic impacts during operation is presented in Table 3a.

Table 3a. The monitoring programme for social impacts during operation

Social impacts monitoring					
Project activity	**Parameter**	**Unit**	**Method**	**Location**	**Timing / frequency**
Operation	Impact on citizens	Change in opinion, feelings etc.	Questionnaire to residents	Similar target group as in the EIA phase	Two years after the construction

Appendix 4 Monitoring programme for munitions clearance in phase 2 Finland