

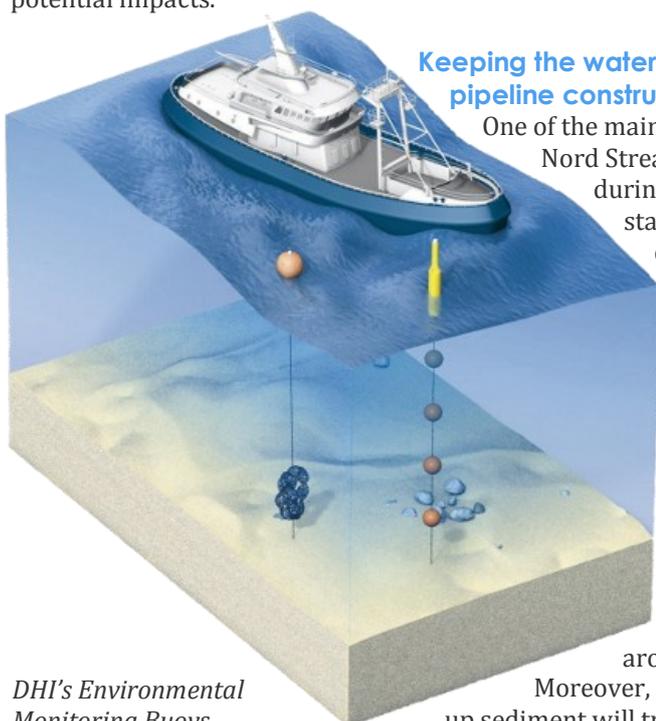
## The yellow watchmen

Monitoring buoys ensure environmental safety during offshore pipe laying



As the global distribution of the ever increasing energy demands and the world's largest stocks of fossil fuels is uneven, transport of energy is an important issue.

The Nord Stream Pipeline crosses the Baltic Sea, forming the most direct connection between the vast natural gas reserves in Russia and energy markets in the European Union. The pipeline passes through the waters of five countries, making its construction and permission and consultation process a major feat. One important aspect of this process was the best possible protection of the affected environment and the mitigation of potential impacts.



### Keeping the water clear during pipeline construction

One of the main impacts of the Nord Stream pipeline occurs during the construction stage. Mounting and depositing the pipeline on the seabed brings about a major disturbance of this habitat, stirring up considerable amounts of sediment and provoking the destruction of benthic communities around the pipeline.

Moreover, some of the stirred up sediment will travel with the currents and be deposited elsewhere, affecting even distant communities. Therefore, Nord Stream AG needed to keep a close eye on the amount of sediment in the water column around the construction works.

*DHI's Environmental Monitoring Buoys measured turbidity and a number of other parameters at various depths from the seafloor to the surface. (Source: Nord Stream AG)*

### Monitoring of sediment spill

A large section of the Nord Stream pipeline travels through Swedish waters. The Swedish authorities had defined a maximum allowable sediment spill rate for that section. Any exceedance of that limit – i.e. too much sediment in the water column – or failure to deliver the required data would result in a temporary termination of the construction works. Besides the potential environmental damage, the effects of any delay could be fatal: on the one

## SUMMARY

### Client

Nord Stream AG

### Challenge

Monitoring and continuous recording of sediment spill during gas pipeline construction to avoid delays in operation and protect the environment

### Solution

Deployment of customised environmental monitoring buoys carrying sophisticated instruments and a satellite communication unit

### Value

- Unhindered pipe laying operations
- No costly delays
- Constant supervision and protection of the local environment

### Location/Country

Baltic Sea, Sweden

### Client testimonial

“ We have enjoyed not only a professionally managed project on the highest possible scientific level but also excellent cooperation in a friendly and flexible atmosphere. The excellent accomplishments in the 2011 campaign have strengthened our relationship with the authorities and allow us to optimize the monitoring programme.”

Nord Stream





Once the buoys have been deployed from seagoing vessels, they float upright above the construction site like yellow watchmen.

hand by the extra costs imposed on this billion-dollar project, on the other by a consequential lack of resources as the barge laying the pipes may have other obligations after the scheduled completion of the project.

### The tailor-made yellow watchmen

DHI deployed four environmental monitoring buoys that were equipped with a set of sophisticated instruments, recording water velocity and direction, water temperature, salinity and sediment concentration in various depths through the water column.

The buoys were customised versions of DHI's general monitoring buoy system, designed to record and forward data from a number of instruments on the seafloor and in the water column in depths of up to 40 m. Each of these 10-m tall buoys moreover contained a satellite communication unit and a computer serving to connect the various units. All electrical components were standard devices manipulated and tailor-made to the specific purpose. The instruments registered data in 10-minute intervals and transmitted them to DHI via satellite link once an hour.

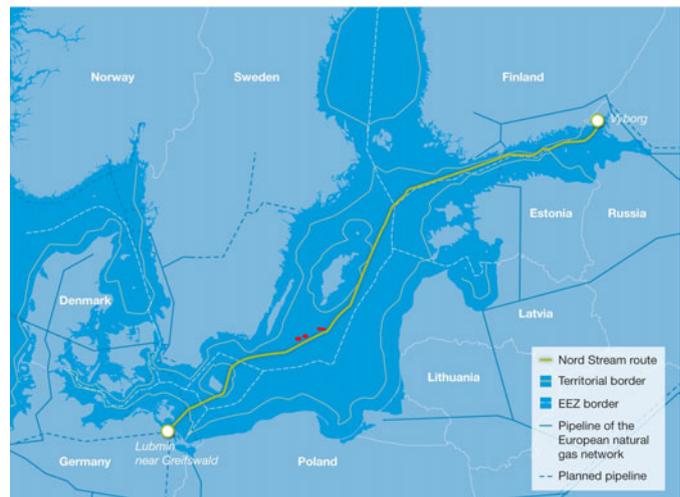
DHI stored the data in the DHI Data Handling Centre, where they were also analysed, quality-checked and post-processed. Subsequently, DHI also provided a web presentation of the recorded data through the DHI Data Handling Centre.

### Resisting the harsh conditions

The job was a tough one – for the personnel as well as the equipment. The assembling and test of the buoys were successfully carried out under extreme time pressure. The buoys were deployed on the open sea for nine months in wintry conditions with snow and ice. Satellite communication had to be gradually optimised, including

the associated necessary service visits to the buoys. But the customisable monitoring buoy system stood the test. Following DHI's monitoring campaign, the Swedish authorities were convinced that the pipe laying process did not endanger the environment, and even refrained from demanding an additional monitoring for the laying of a second pipe.

Line 1 – the first of the two pipelines – took up business in November 2011. Line 2 is scheduled to be completed and active by the end of 2012. Each line has the capacity to transport 27.5 billion cubic metres of natural gas a year. Thereby, according to Nord Stream the pipeline will meet almost one third of the European Union's additional gas import requirement by the year 2030. Thanks to DHI's environmental monitoring system, the waters of the Baltic Sea aren't blurred by these prospects.



The Nord Stream Pipeline connects Vyborg (Russia) to Lubmin (Germany), on its way crossing the territories of five Baltic States. The red dots indicate the locations of DHI's buoys. (Source: Nord Stream AG, modified)

November 2011