

Soilwatch

Ground and Groundwater Environmental Monitoring System



NEW OSLO AIRPORT, GARDERMOEN

The new international airport at Gardermoen, managed by Oslo Lufthavn AS (OSL), is built on Norway's largest self-feeding groundwater aquifer. Great concern was expressed with regard to the security of the groundwater resources in the area, and it was stipulated that construction and operation of the airport should neither change the groundwater balance in the surrounded area nor lead to contamination of either soil or groundwater.

Generally airports are always exposed to potential contaminants that include de-icing fluids for both aeroplanes and runways, and various petroleum products, such as spills from plane refuelling and leakage from tank farms and pipelines. The number of takeoffs and landings at the New Oslo Airport had reached approximately 24 000 by the year 2000. Estimated use of jet fuel that year was 350 000m³. The use of de-icing fluids for 2010 is forecasted to be 1 300 tonnes of glycol for de-icing aeroplanes and 3 tonnes of acetate for de-icing runways.

Early warning of pollution in the soil's unsaturated zone was an important objective. A monitoring system was therefore required to detect incipient pollution in both soil and groundwater so that prompt remedial measures could be taken. However, since a product search and evaluation revealed that there was nothing that fully met the requirements of OSL, the company undertook to initiate the development of a new ground and groundwater environmental monitoring system.

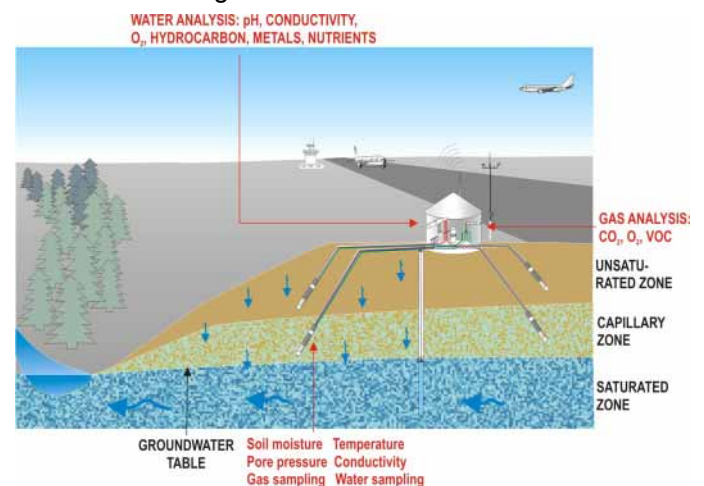
Development contract

SOILWATCH was the result of a public development contract supported by the Research Council of Norway and the Norwegian Industrial and Regional Development

Fund (SND). The Civil Aviation Administration (CAA) and OSL commissioned a team of specialist companies to develop the system. This team consisting of the Norwegian Geotechnical Institute, PRENART Equipment ApS and GEOfuturum AS, and was headed by OCEANOR – Oceanographic Company of Norway ASA, the main contractor.

Project objective

The objective of the project was to develop the technology and methodology for monitoring water quality both in the unsaturated zone and in the groundwater (aquifer), and to determine soil-gas composition in the unsaturated zone. Both automatic (on-line), in-situ measurements and automatic sampling for subsequent laboratory analyses were to be included. Monitoring of most of the parameters was done by pumping gas and water samples to a measurement "head" on the ground. Temperature, soil moisture, conductivity and groundwater level were measured in the ground.



The idea was to combine extensive industry knowledge with existing and new technology in a complete monitoring system, which would fully meet market requirements in this business area.

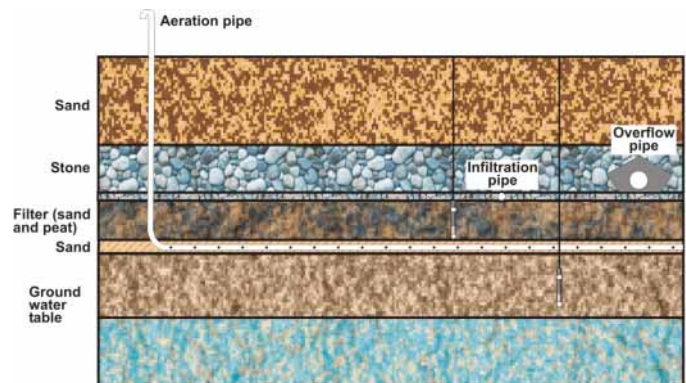
New technology and equipment for pre-investigation of the monitored ground were also to be developed. One such item was an environmental probe to provide information about sedimentary, hydro-geological and chemical variation in the ground. An essential tool to get a correct placement and installation of SOILWATCH sensors and samplers.

SOILWATCH units, Gardermoen

The project was initiated by OSL in 1996. In autumn 1997, a pilot station was established at Gardermoen. This pilot station monitored the soil-infiltration type water treatment plant at the southern end of the western

parallel runway. By October 1998, when the new airport was opened, another four SOILWATCH units were installed at the eastern runway.

Each of the monitoring stations had a groundwater well, including a pump, measuring groundwater level; and 3x3 levels of probes for water and gas sampling, and measuring temperature, soil moisture and conductivity in an unsaturated zone (4 x 2 levels in the pilot station). The soil gas composition was measured and tested for oxygen, carbon dioxide and volatile organic components (VOC) and the stations were equipped with sensors for measuring pH, oxygen, conductivity and temperature in water. In addition, heavy metals and nutrients (nitrate) sensors have been developed and a hydrocarbon sensor tested. Included is an automatic water sampler that triggers when certain variables exceed predefined levels.



Cross section of soil-based treatment plant where the SOILWATCH pilot station is installed at Oslo Airport



Collected data are stored in a logger in the monitoring station and transferred to the environmental management centre at the airport administration where data from SOILWATCH are analysed in combination with meteorological data and data from the rivers close to the new airport. This information can also be used to manage water (from rain and melted snow) in the most optimum way by utilizing the flexibility in water handling infrastructure (pump stations, pipelines and infiltration points). Data collected can also be transferred to remote users.

Other applications

SOILWATCH was primarily developed to meet the needs of Oslo Airport, but is a very flexible system and can easily be adapted to other clients' needs for monitoring:

- potential pollution from fuel tank farms, chemical plants and other industrial plants.
- soil-based wastewater treatment plants.
- waste deposits and contaminated ground, soils and groundwater including monitoring of remedial measures.
- groundwater resources both for public water supply, irrigation and production of bottled, natural mineral water.

Additional new sensors have been developed for heavy metals and nutrients, which will broaden SOILWATCH'S application to include river, lake and marine monitoring.

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