

Oskarshamn site investigation

Installation of four monitoring wells, SSM000001, SSM000002, SSM000004 and SSM000005 in the Simpevarp subarea

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This report concerns a study which was conducted for SKB. The conclusions and viewpoints presented in the report are those of the author and do not necessarily coincide with those of the client.

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Summary

The installations of four wells for environmental monitoring was made close to percussion holes and core drilled holes. Hole depths in the monitoring wells vary between 1.3 and 2.6 metres.

The installations were made by contractor WSP AB, Kalmar. Supportive means to the drilling operations were supplied by SKB personnel regarding planning, coordination, infrastructure, sampling and on-site measurements.

Monitoring wells SSM000001 and SSM000002 were auger drilled with a Geotech 202D rig with a 72 mm auger.

The pits for monitoring wells SSM000004 and SSM000005 were dug with a backhoe excavator.

- Inner pipes of inert PE-plastic material were installed to facilitate sampling and future monitoring.
- Soil samples were collected over half metre intervals from the drilled holes and stored for future reference.
- Ground water reference samples were collected from each well and frozen.
- Well completion was accomplished by securing the holes with lockable steel caps and fitting pressure transducers for ground water level monitoring.

The core or percussion hole corresponding to each monitoring well is shown in Table 3-1.

A summary of well data is given in Table 3-2.

Observations of encountered soil types are given in the geological summary in Table 3-3.

1 Introduction

SKB performs site investigations to locate a deep repository for high level radioactive waste /1/. The investigations are performed in two Swedish municipalities: Östhammar and Oskarshamn. The investigation area in Oskarshamn is situated close to the nuclear power plant at Simpevarp /2/, see Figure 1-1.

Drilling is an important activity performed within the frame of the site investigations. Three main types of boreholes are produced: core drilled boreholes, percussion drilled boreholes in hard rock and boreholes drilled through unconsolidated soil. The initial phase of the investigations in the Oskarshamn area includes drilling of three 1000 m deep boreholes in the Simpevarp subarea. Percussion holes are needed as additional sources of information and as water supply for core drilling.

Before the start of the above drillings, shallow wells in unconsolidated soil are needed to comply with SKB environmental monitoring procedures. The environmental control procedure requires that at least one monitoring well be installed near a percussion hole or a core hole and that reference samples for water and soil are collected.

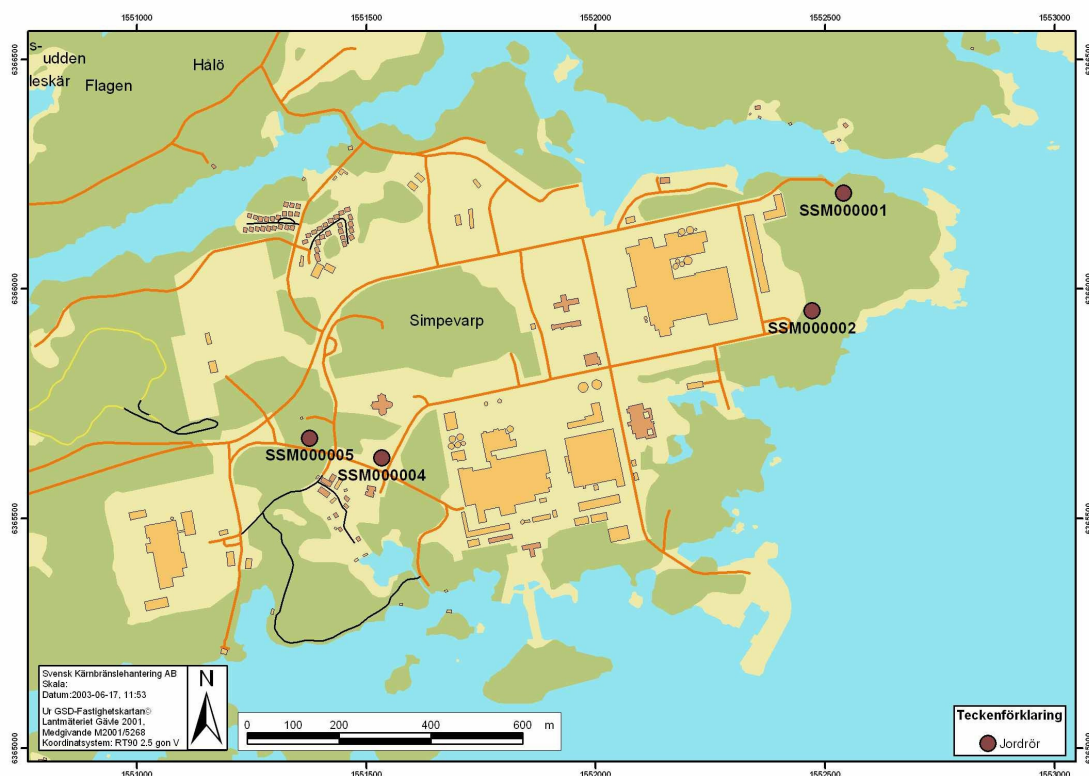


Figure 1-1. Location of ground water monitoring wells in the Simpevarp subarea.

The drilling and all related on-site operations were performed according to specific Activity Plans, AP PS 400-02-16 (wells SSM000001 and SSM000002) and AP PS 400-02-029 (wells SSM000004 and SSM000005). The activity plans are SKB internal documents.

2 Equipment and methods

The work was performed mainly in accordance with SKB MD 630.003, Version 1.0 (Method Description for Soil Drilling), SKB internal document, and consisted of:

- Preparations
- Probing
- Auger drilling and excavation
- Sampling and measurements
- Borehole completion
- Data handling
- Environmental control

There will be differences between the procedures in the method descriptions and the actual installation and sampling since the method descriptions for soil drilling and the instruction for environmental control of shallow groundwater and soil during drilling and pumping in bedrock (SKB internal documents) were not established and approved at the time of installation of the monitoring wells described in this report.

2.1 Preparations

The preparation stage included the contractor's functional control of his equipment with particular attention given to potential fuel leaks or leakage of hydraulic oil. The machinery and chemicals used have to comply with SKB MD 600.006, Version 1.0 (Method Instruction for Chemical Products and Materials), SKB internal document.

The equipment has to be cleaned in accordance with SKB MD 600.004, Version 1.0 (Method Instruction for Cleaning Borehole Equipment and certain Ground-based Equipment), SKB internal document.

A field inspection at the drill site was made prior to any other field work by the Activity Leader and the SKB Resident Ecologist.

2.2 Probing

Probing from the Geotech 202D drill rig with 22 mm rods was made in situations where shallow depth to bedrock or soil conditions that could be difficult to penetrate with an auger drill could be suspected.

Based on the experiences from the two first holes (SSM000001 and SSM000002), the construction of the latter two wells (SSM000004 and SSM000005) was preceded by probing.

2.3 Auger drilling and excavation

2.3.1 Auger drilling

Monitoring wells SSM000001 and SSM000002 were drilled with a Geotech 202D rig with a 72 mm auger.

Inner tubes in inert PE-plastic material (diameter 63/50 mm) were installed with a slotted bottom metre section.

A bentonite seal was inserted from surface to a depth of 0.5 metre to prevent water influx.

2.3.2 Excavation

The pits for monitoring wells SSM000004 and SSM000005 were dug with a backhoe. An inner tubing of inert PE plastic (diameter 63/50 mm) was lowered into the pit. The lowermost metre section of the inner tubing was slotted.

The pits were backfilled with soil and the top 0.5 metre section was sealed with bentonite to prevent influx of shallow water.

2.4 Sampling and measurements

Sampling and measurements done by the contractor or SKB field coordinator included:

- Collecting of one reference sample for every ½ meter interval of drilling.
- Collecting one initial ground water sample.

Soil samples were collected over half metre intervals from the drilled holes, frozen and stored for future reference. Samples could not be collected in intervals with coarse gravel fill (SSM000004, 0–1 metre)

Ground water samples were collected from each well and frozen for future reference.

The collecting of a composite reference samples from the soil surrounding each core drill site (ie not from the drill hole) was not required at the time. The method instruction (SKB MD 300.003) was approved after the wells in this report were installed.

2.5 Borehole completion

The boreholes were secured from unauthorized access by mounting steel hoods with concrete rings over the hole openings. The steel hoods were fitted with lockable caps in order to facilitate access for measurements and sampling.

Pressure transducers for ground water level monitoring were fitted into the inner pipes.

2.6 Data handling

The daily logs from the contractor's field work and the duties performed by SKB field coordinators were forwarded to the Activity Leader and subsequently entered into the SKB database, SICADA.

2.7 Environmental control

The SKB routine for environmental control (SDP-301) was followed throughout the activity. A checklist was filled in and signed by the Activity Leader and filed in the SKB archive.

All waste generated during the establishment, drilling and completion phases have been removed and disposed of properly.

3 Results

The installation of four wells for environmental monitoring was made close to percussion drilled holes and core drilled holes.

The data for the wells are stored in the Sicada database under the following field note numbers:

SSM000001: Sicada field note number 15

SSM000002: Sicada field note number 15

SSM000004: Sicada field note number 35

SSM000005: Sicada field note number 35

Table 3-1. Monitoring well and corresponding hole

Environmental monitoring well	Percussion hole	Core hole
SSM000001	HSH01	
SSM000002		KSH01
SSM000004		KSH02
SSM000005	HSH02	

The installations were made by contractor WSP AB, Kalmar. Supportive means to the drilling operations were supplied by SKB personnel regarding planning, coordination, infrastructure, sampling and on-site measurements.

An overview of technical data from the wells is given in Table 3-2.

Table 3-2. Technical summary

	SSM000001	SSM000002	SSM000004	SSM000005
Easting RT90	1552540	1552471	1551534	1551376
Northing RT90	6366208	6365952	6365631	6365675
Elevation (m a s l) RH70	2,788	2,399	5,490	6,980
Depth (m) (below surface)	2.2	2.1	2.6	1.3
Construction method	Auger drilled	Auger drilled	Dug	Dug
Auger drill diameter	72	72	N/A	N/A
Inner tube diameter (mm)	63/50	63/50	63/50	63/50
Inner tube length (m)	3 m (1 m slotted)	3 m (1 m slotted)	3 m (1 m slotted)	2 m (1 m slotted)
Azimuth (0–360)	120	266	122	35
Dip (0–90)	–87	–87	–74	–68
Groundwater level (masl)	1.6	0.9	N/A	5.0
Transducer Serial No	N/A	10616	10621	11036
Transducer type	N/A	TROLL	TROLL	TROLL
Transducer depth (in-hole)	N/A	2.5	2.9	1.7

3.1 Borehole design

Schematic cross-sections showing elevation, depth to ground water and total depth of the wells are given in appendices 1 and 2.

3.2 Geological summary

Geological observations from drilling or excavation are given in Table 3-3.

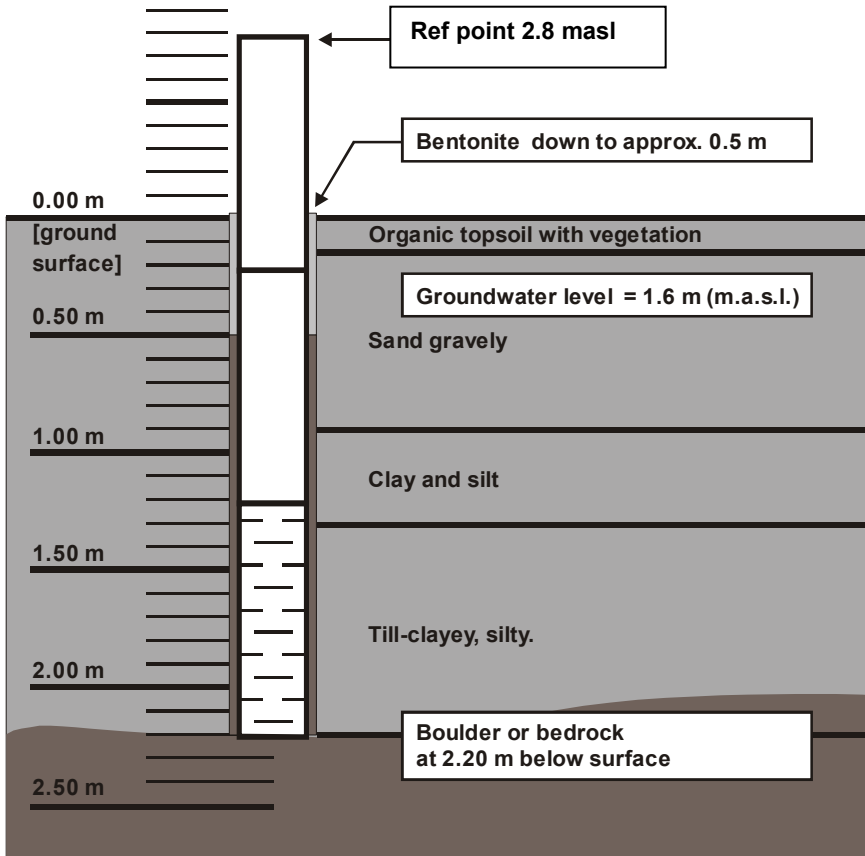
Table 3-3. Geological summary

Well ID	Date	From (m)	To (m)	Soil
SSM000001	2002-10-08	0.00	0.15	Organic topsoil with vegetation
		0.15	0.90	Sand-gravelly
		0.90	1.30	Clay and silt
		1.30	2.20	Till-clayey, silty. Boulder or bedrock at 2.20 m.
SSM000002	2002-10-08	0.00	0.10	Organic topsoil with vegetation
		0.10	0.60	Sand-pebbly, gravelly
		0.60	0.90	Clay-silty
		0.90	2.10	Till-clayey, silty. Boulder or bedrock at 2.10 m.
SSM000004	2002-12-12	0.00	1.00	Fill material
		1.00	2.60	Till-cobbly, blocky. Bedrock surface at 2.60 m.
SSM000005	2002-12-12	0.00	0.15	Organic topsoil with vegetation
		0.15	1.50	Till-sandy. Probable bedrock surface at 1.50 m.

4 References

- /1/ **SKB, 2001.** Platsundersökningar. Undersökningsmetoder och generellt genomförandeprogram SKB R-01-10, Svensk Kärnbränslehantering AB.
- /2/ **SKB, 2001.** Geovetenskapligt program för platsundersökning vid Simpevarp. SKB R-01-44, Svensk Kärnbränslehantering AB.

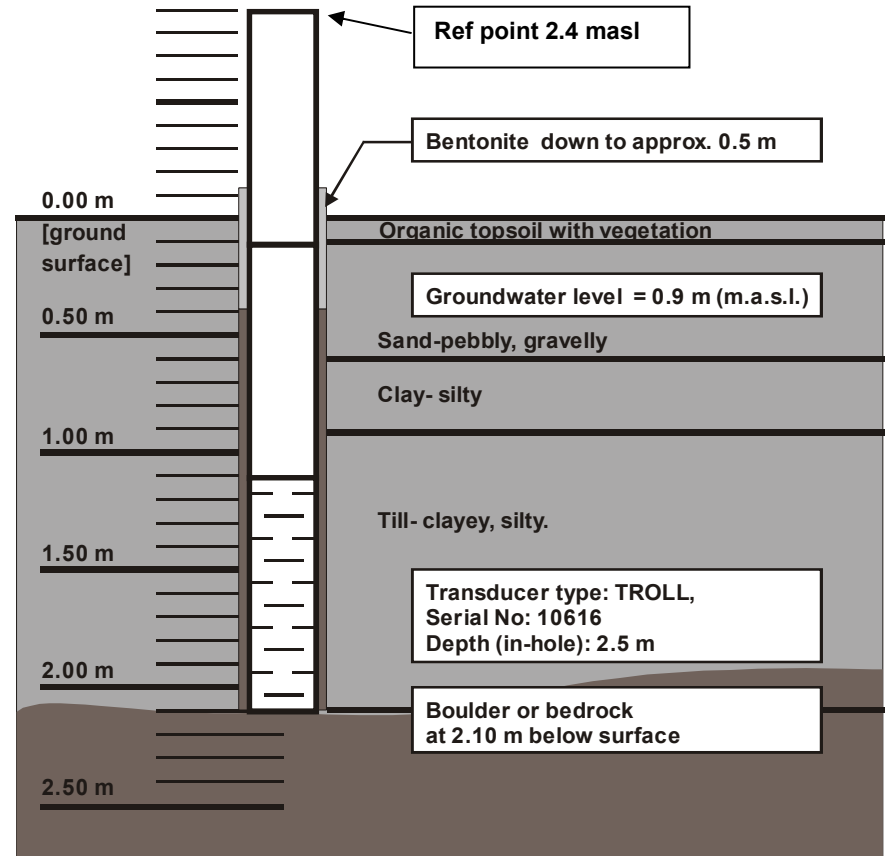
SSM000001



Date: 2002-10-08
Method: Auger drilled
 Diameter = 72 mm
Inner tube: $\phi_o = 63$ mm
 $\phi_i = 50$ mm

Reference point
 Northing: 6366208 (m), RT90 2.5 gon V 0:-15
 Easting: 1552540 (m), RT90 2.5 gon V 0:-15
 Elevation: 2.788 (m), RHB 70
Orientation
 Azimuth: 120 (0-360 degrees, ref. north)
 Dip: -87 (0 = horizontal, -90 = vertical)

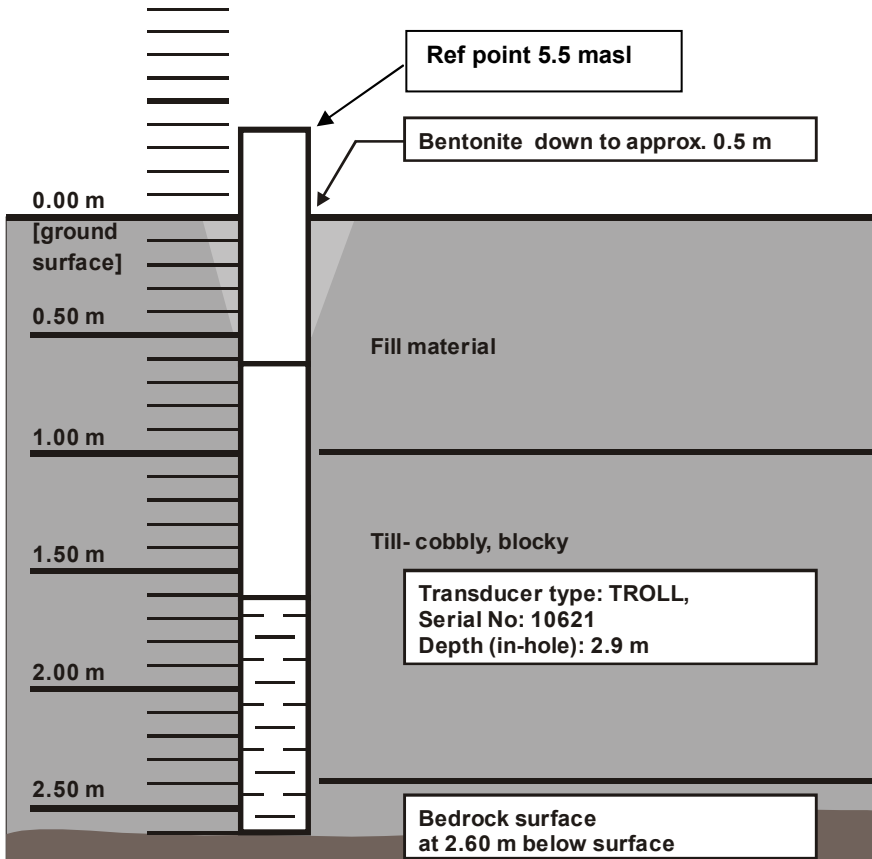
SSM000002



Date: 2002-10-08
Method: Auger drilled
 Diameter = 72 mm
Inner tube: $\phi_o = 63$ mm
 $\phi_i = 50$ mm

Reference point
 Northing: 6365952 (m), RT90 2.5 gon V 0:-15
 Easting: 1552471 (m), RT90 2.5 gon V 0:-15
 Elevation: 2.399 (m), RHB 70
Orientation
 Azimuth: 266 (0-360 degrees, ref. north)
 Dip: -87 (0 = horizontal, -90 = vertical)

SSM000004



Date:

2002-12-12

Method:

Dug

Inner tube:

$\varnothing_o = 63$ mm

$\varnothing_i = 50$ mm

Reference point

Northing: 6365631 (m), RT90 2.5 gon V 0:-15

Easting: 1551534 (m), RT90 2.5 gon V 0:-15

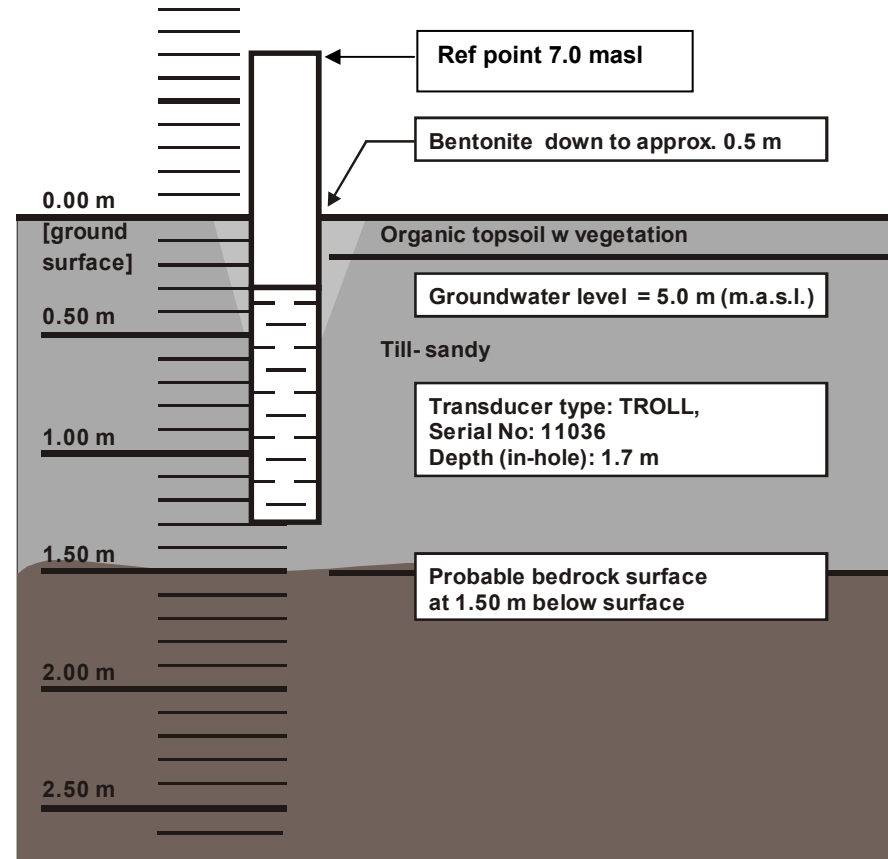
Elevation: 5.490 (m), RHB 70

Orientation

Azimuth: 122 (0-360 degrees, ref. north)

Dip: -74 (0 = horizontal, -90 = vertical)

SSM000005



Date:

2002-12-12

Method:

Dug

Inner tube:

$\varnothing_o = 63$ mm

$\varnothing_i = 50$ mm

Reference point

Northing: 6365675 (m), RT90 2.5 gon V 0:-15

Easting: 1551376 (m), RT90 2.5 gon V 0:-15

Elevation: 6.980 (m), RHB 70

Orientation

Azimuth: 35 (0-360 degrees, ref. north)

Dip: -68 (0 = horizontal, -90 = vertical)