

P-04-277

Oskarshamn site investigation

Hydrogeological inventory in the Oskarshamn area

Mats Nyborg, Emelie Vestin, Peter Wilén
SwedPower AB

September 2004

Svensk Kärnbränslehantering AB

Swedish Nuclear Fuel
and Waste Management Co
Box 5864
SE-102 40 Stockholm Sweden
Tel 08-459 84 00
+46 8 459 84 00
Fax 08-661 57 19
+46 8 661 57 19



ISSN 1651-4416

SKB P-04-277

Oskarshamn site investigation

Hydrogeological inventory in the Oskarshamn area

Mats Nyborg, Emelie Vestin, Peter Wilén
SwedPower AB

September 2004

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

A pdf version of this document can be downloaded from www.skb.se

Abstract

On behalf of Swedish Nuclear Fuel and Waste Management Company (SKB), SwedPower AB has performed a hydrogeological inventory concerning a limited geographic area within the SKB regional model area, close to the Oskarshamn nuclear plant.

The objective of the work may be summarised in:

- To identify and document water related activities over a period 100 years.
- To summarise existing information about the geological formations water pursuing properties.
- Put together a general hydrological- and hydrogeological map over the survey area from the collected material.

The work has resulted in a geographical database (GIS database) describing the results received including maps over water activities and finally, a general hydrogeological map over the survey area.

Practically, the work has been implemented in two parts, (1) an archive inventory pursues the basis data together with existing map materials and (2) a field activity have been conducted in order to verify the results from the archive study.

Sammanfattning

På uppdrag av Svensk kärnbränslehantering AB (SKB) har SwedPower AB utfört hydrogeologisk inventering och fältarbete avseende ett begränsat geografiskt område inom det regionala modellområdet, Oskarshamns kommun.

Syftet med arbetet har varit att:

- Identifiera och dokumentera vattenrelaterade anläggningar över en period om 100 år.
- Sammanfatta befintliga uppgifter om de i undersökningsområdet förekommande geologiska formationernas vattenförande egenskaper.
- Sammanställa en hydrologisk och hydrogeologisk karta över undersökningsområdet utgående från insamlat material.

Den hydrogeologiska inventeringen har haft som målsättning att så ingående som möjligt dokumentera de hydrogeologiska utgångsförutsättningarna med avseende på de i undersökningsområdet förekommande geologiska formationernas vattenförande egenskaper. Till uppdraget har vidare hört att identifiera och dokumentera i området förekommande vattenpåverkande anläggningar som förekommit över en period om 100 år. Arbetet har resulterat i ett antal geografiska databaser (GIS) beskrivande erhållna resultat däribland kartor över vattenverksamheter samt en översiktlig hydrogeologisk karta över undersökningsområdet.

Arbetet har genomförts i två delar, en arkivinventering för insamling av underlagsdata och befintligt kartmaterial, samt en fältinsats för att verifiera resultat från arkivinsamlingen.

Contents

1	Introduction	7
1.1	Background data	8
1.1.1	General description of hydrology	8
1.1.2	Bedrock geology	10
1.1.3	Quaternary geology	11
2	Objective and scope	11
3	Equipment	13
3.1	Description of equipment	13
4	Execution	15
4.1	Preparations	15
4.1.1	Fundamental map material	15
4.1.2	Geographic reference	16
4.1.3	GIS environment	16
4.2	The archive inventory phase	16
4.2.1	Land drainage operations	16
4.2.2	Permissions for water operations	17
4.2.3	Information from the Registration authority	17
4.2.4	Water wells	18
4.2.5	Springs	18
4.2.6	Calculation of watersheds	19
4.2.7	Quaternary and bedrock geology	19
4.2.8	Other data owners	19
4.3	Field inventory	20
5	Results	21
5.1	Comments	21
5.1.1	General comments regarding produced maps	21
5.1.2	General map overview	21
5.1.3	Map of watershed areas	21
5.1.4	Hydrogeological map	23
5.1.5	Maps of water activities	24
	References	25
Appendix 1	Land drainage operations year 1903–2004	27
Appendix 2	Permit for water operation	29
Appendix 3a	Field observations 040609–040610	33
Appendix 3b	Photos from fieldwork	34
Appendix 4	Wells SKB-Oskarshamn	61
Appendix 5	General map overview	65
Appendix 6a	Map of watershed areas	67
Appendix 6b	Map over surface drainage	69
Appendix 7	Map over general hydrogeology	71
Appendix 8	Map over land drainage options	73
Appendix 9	Map over permits for water operations	75
Appendix 10	List of contents in separate file	77

1 Introduction

This report documents the work and results from a combined archive and field inventory study of a limited area in Oskarshamns municipality. The study is a component of the Swedish Nuclear Fuel and Waste Management Company (SKB) Oskarshamn site investigation. The work has been carried out in accordance with activity plan SKB PS 400-03-051. In Table 1-1 the controlling documents for performing this activity are listed. Both activity plan and documents are SKB's internal control documents. In Table 1-2 the primer data reference is listed.

The investigation area is located in the province of Småland, within the municipality of Oskarshamn, adjacent to the Oskarshamn nuclear power station on the southeast coast of Sweden. The area is limited of the Baltic Sea in east and Highway E22 in the west (see overview in Figure 1-1).

The access to the area is good. The European highway E22 runs to the west of the area, and at the village Fårbo a wide road runs east and then northeast, past the village Figeholm, to the Simpevarp peninsula, Äspö and Ävrö. From Simpevarp, there is a northwest running connection through the village Misterhult to the highway E22. The area is in principle encircled by these major roads. In addition, the area is intersected by a number of local and minor roads.

Table 1-1. Controlling documents for the performance of the activity.

Activity plan	Number	Version
Hydrogeologisk inventering.	AP PS 400-03-051	0.9
Methods description	Number	Version
Instruktion för inmätning och avvägning av objekt.	SKB MD 110.001	
Inventering av brunnar och anläggningsdata för hydrogeologisk områdesdokumentation.	SKB MD 390.001	
Execution programme for the initial site investigations at Simpevarp.	SKB P-02-06	
Geovetenskapligt program för platsundersökning vid Simpevarp.	SKB R-01-44	
Hydrogeological site descriptive model – a strategy for its development during site investigations.	SKB R-03-08	
Hantering av primärdata vid platsundersökningar.	SKB SDP-508	
Miljökontrollprogram platsundersökningar.	SKB SDP-301	
Layout för GIS kartor.	IP-005	
Foton och bilder.	SD-073	
GIS data inleverans.	SD-081	

Table 1-2. Data references.

Subactivity	Database	Identity number
Compilation of archive inventory	SICADA	Field note 357

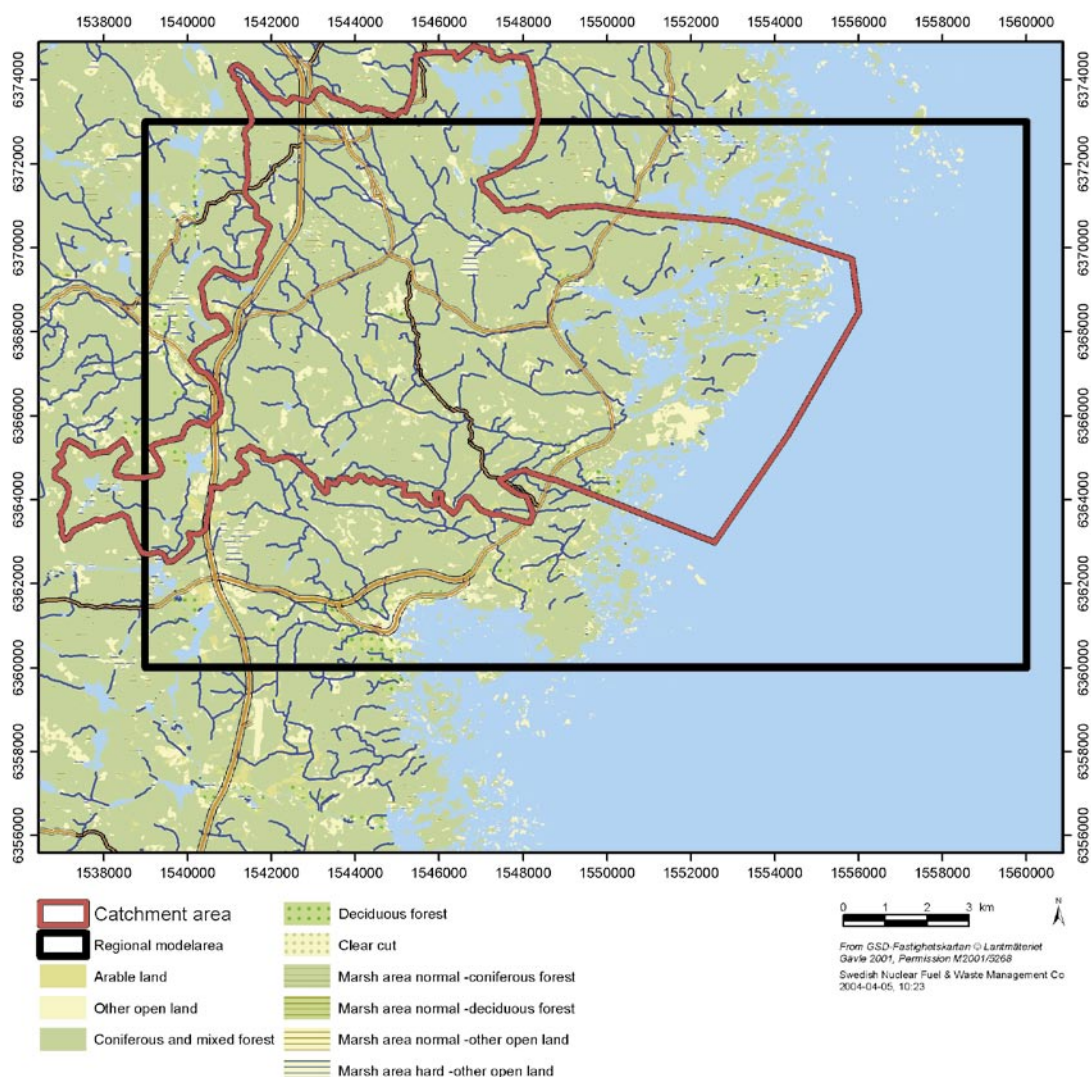


Figure 1-1. Map showing inventory area (red line) delineated on basis of watershed areas and the regional SKB model area (black rectangle) (retrieved from Figure 3.1.5 in SKB Report R-03-08 /Rhén et al. 2003/).

Most of the background data for the model area and its surroundings have been compiled and presented in a number of SKB reports. In the present report, references are generally made to these reports.

1.1 Background data

1.1.1 General description of hydrology

The variables describing conditions of surface hydrology in the area are discharge and runoff areas. Compilations and evaluations of existing data are presented by /Lindell et al. 1999; Losjö et al. 1999/ and /Larsson-McCann et al. 2002/.

The SMHI hydrological station 1619 (“Forshultesjön nedre”), located south of Oskarshamn (south of investigation area), has been chosen to represent the Oskarshamn area. It has a continuous record series with registrations since 1955, with an annual mean specific discharge of 5.7 l/s×km² and a runoff area of 103.2 km².

The investigation area forms part of the sub-Cambrian peneplan and have a general inclination against east. The terrain relief is low but pronounced due to a thin till cover. The highest point within the area is 54.8 m.a.s.l, located within the esker Tunaåsen, south of the village Jämserum. The region is situated in a fissure valley landscape, which changes into an archipelago closer to the Baltic Sea. Three major catchment areas, Laxemarån, Kärrviksån and Slåthulteboån dominate the surface drainage within the study area (Figure 1-2). For details regarding catchement areas see 4.2.6 and Appendix 6a. The catchment areas are dominated by forest. Coniferous forest with some contribution of deciduous trees is most common, with some small areas of arable land. The region contains relatively few lakes.

Quaternary deposits generally vary between 0–10 metres in thickness. Current knowledge of the hydraulic conductivity and porosity of these deposits are more or less constrained to data found in the literature /SKB, 2001/.

The topography of the model area is indicated in Figure 1-3. The general trend of the topography in the region is towards the Baltic Sea, with a slope of c 3‰ /SKB, 2001/.

In addition, it should be noted that several local major to regional fracture zones, some of which are likely to reach extensive depths, intersects the upstream side of the area /SKB, 2001/.

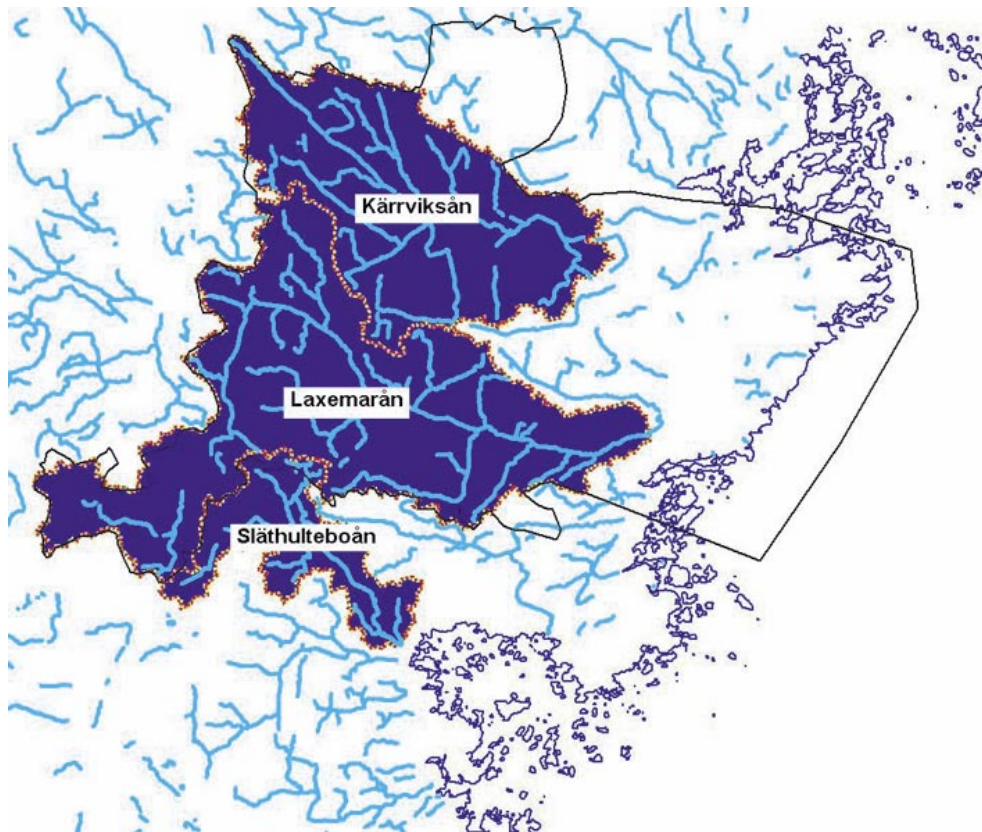


Figure 1-2. Map showing the delineations of the three main catchement areas within the study area.

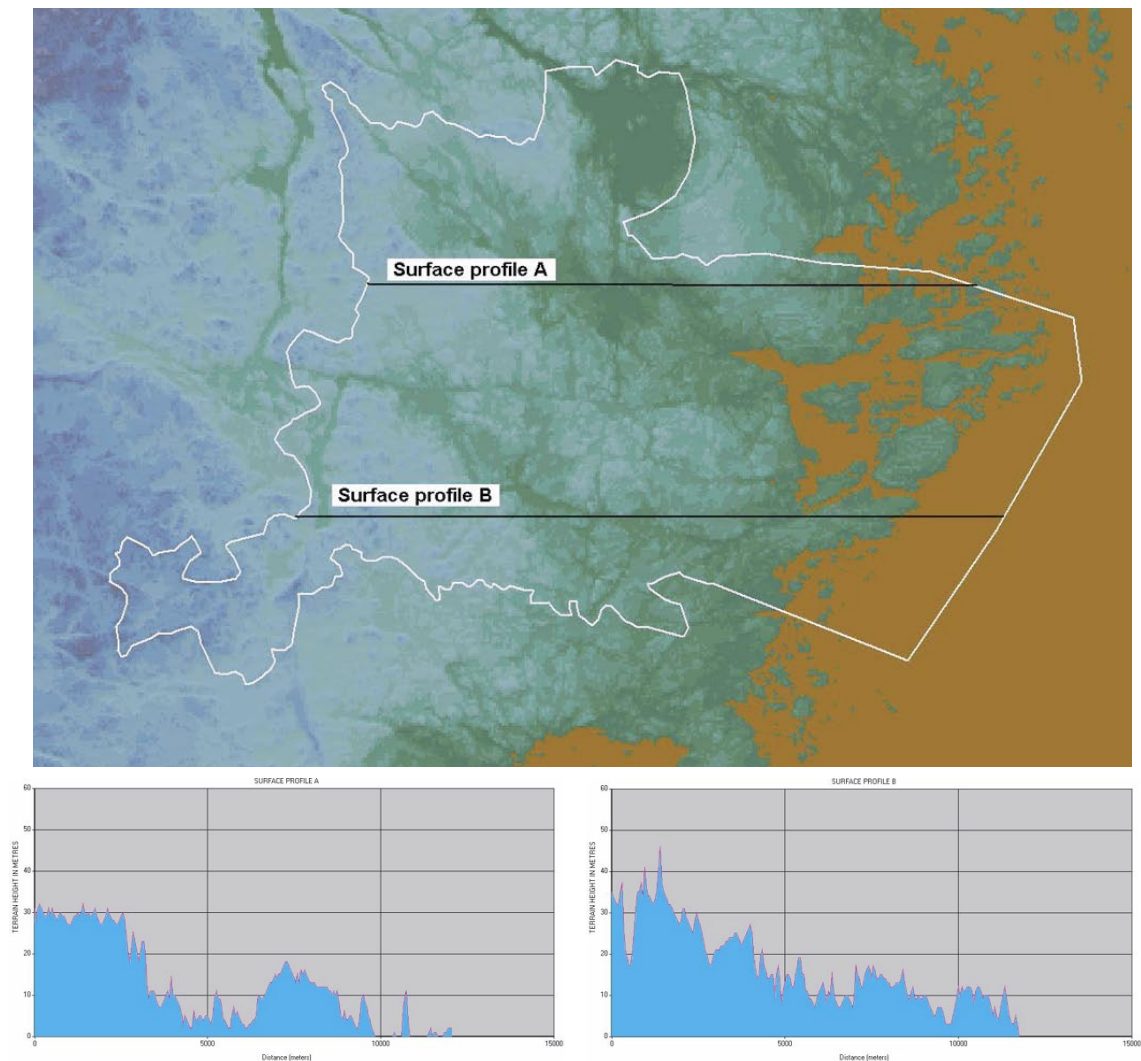


Figure 1-3. Map showing the general topographical outline of the area. Please note the distinct topographical appearance of the three main catchment areas. The topography along the two E–W trending lines is shown below the map.

1.1.2 Bedrock geology

The following brief description of the bedrock geology has been compiled from the SKB Report Simpevarp Version 0 /SKB, 2001/.

The area forms part of an area of Precambrian crystalline rocks, referred to as the Fennoscandian Shield. The area lies within a major geological province within the shield, which extends from the Loftahammar area in the north to Blekinge in the south, and from coastal areas in the east to the area south of lake Vättern in the west.

Deformation zones with direction N–W to E–W strike form the boundaries to this province, both to the north and to the south. Furthermore, the network of deformation zones with direction N–S strike, which form the eastern, frontal part of the Sveconorwegian orogenic belt, defines the western boundary of the geological province. Major deformation zones also occur within the province, in particular in the area west of Oskarshamn.

Volcanic and intrusive igneous rocks, which vary in age from c 1,850 to 1,770 million years and which are included in the so-called Transscandinavian Igneous Belt, dominate the area.

Lineaments, which can be followed for at least 1–2 km and which are possible local major or regional fracture zones, appears to form an irregular, cross-cutting structural pattern in the area.

1.1.3 Quaternary geology

No modern Quaternary maps based on extensive field investigations are available for the area. A compilation was carried out during the feasibility study (Simpevarp version 0) utilizing a Quaternary deposit map of reconnaissance character at the scale 1:50,000 /SGAB, 1986/, which is mainly based on an interpretation of aerial photographs.

The following description of the Quaternary geology is a summary compiled from the SKB Report Simpevarp version 0 /SKB, 2001/.

The Quaternary deposits on land in the regional model area consist of glacial or post-glacial deposits. The glacial deposits were deposited either directly from the inland ice or from the water derived from the melting of this ice. These deposits include till, glaciofluvial sand and gravel, and clay. Glacial striae on bedrock outcrops, as well as the orientation of moraine ridges and eskers, indicate an ice movement from the NW. The post-glacial deposits were formed after the inland ice had melted and retreated from the area during the time period c 12,500 to 12,300 years ago /Bergman et al. 1998; 1999/. The area lies beneath the highest shoreline, which was established after retreat of the ice, and the older of these units were deposited when present land areas lay beneath the sea. Subsequently, following regression of the sea, younger post-glacial sediments were deposited beneath lakes and on land. They include gravel, sand and clay deposits, and organic deposits dominated by fen peat.

2 Objective and scope

On behalf of Swedish Nuclear Fuel and Waste Management Company (SKB), SwedPower AB has performed a hydrogeological inventory concerning a limited geographic area within the SKB regional model area, close to the Oskarshamn nuclear power plant.

The scope of the investigations have been to produce an inventory of water related activities, i.e. a body of documentation which presents an integrated description of the area and its setting, covering the current state of both the hydrological and hydrogeological activities which have affected the area. The description presents all collected data and interpreted parameters of importance for the overall understanding of the area, suitable as input data for technical design and environmental impact assessment in future studies.

The outcome of the investigation should have two main components: (1) a written description of objects found, summarising the state of knowledge, (2) the primary archived data from the investigation will be documented in databases.

The objective of the work may be summarised in:

- To identify and document water related activities over a period 100 years.
- To summarise existing information about the hydrological properties of the geological formations.
- Put together a general hydrological- and hydrogeological map over the survey area from the collected material.

The work has resulted in a geographical database (GIS database) describing the results received including maps over water activities and finally, a general hydrogeological map over the survey area.

Practically, the work has been implemented in two parts, (1) an archive inventory to collect the basis data together with existing map materials and (2) a field activity in order to verify the results from the archive study.

3 Equipment

3.1 Description of equipment

The following equipment was used during field activities to facilitate the investigation: a hand held GPS (Garmin Etrex Venture), a digital camera (Nikon Coolpix 3100), a laptop computer (Compaq Evo N610c). The ArcView desktop GIS software was used to enable direct geographical navigation using the GPS hardware with colour infrared orthoimages as geographic reference.

4 Execution

4.1 Preparations

4.1.1 Fundamental map material

An analysis over existing map material was done early in the project with materials acquired from SKB and the Geological Survey of Sweden (SGU).

The major source of digital and analogue geographical data is the National Land Survey of Sweden (in Swedish Lantmäteriet). Important digital information that has been acquired from the GIS database of SKB, is briefly described below. All data described are represented in the Swedish national grid.

The coordinate system is for:

- X/Y (Northing/Easting): the national 2.5 gon V, RT 90 system.
- Z (elevation): the national RH 70 levelling system.

The topographic map (previously called the green map or version T5) represents a uniform national coverage regarding the presentation of area, line and point objects, adapted to the scale 1:50,000. The information is divided into separate layers that contain information regarding roads, railways, streams, contours, land-use classifications etc.

The cadastral index map (previously called the economic map) provides presentation of area, line and point objects, adapted to the scale 1:10,000–20,000. The database contains information regarding administrative divisions and real estate boundaries, hydrography, land-use etc.

Digital orthoimages is stored in a raster format produced by scanning, image processing and ortho-rectification of high-quality aerial photographs. When the database is created or updated, the latest aerial photography taken for the national mapping program is utilized and a national coverage is provided. Up-to-date raster databases are produced on a regular basis. The base material used for this study comprises 8-bit near infrared imagery for each 5×5 km grid and have a spatial resolution of 0.2 metres.

Elevation data, covering the land area, is available for the whole of Sweden from the GSD – Elevation database. The elevation data are produced as 50 m grid cells by means of stereo-model digitalisation of aerial photographs and automatic digitalisation of elevation curves from the cadastral index maps. The data have a maximum standard error of ± 2.5 metres, and are delivered with an accuracy of 0.1 metres. The latest revision of the database was completed in 1993.

The following materials were received from SKB:

- Fastighetskartan in digital format.
- Contoured height information (digital 5 metre curves LMV/1 metre curves SKB).
- Digital map of the bedrock geology /SKB, 2001/.
- Digital map of the Quaternary geology /SKB, 2001/.
- Orthoimages (digital colour infrared orthoimages with 0.2 metres pixel size).

Satellite imagery was used for the regional setup (internal SwedPower Landsat ETM image data, acquired in 2001).

Further, extracts were ordered from the Geological Survey of Sweden (SGU) regarding existing wells as well as extracts from their spring archive.

On basis of the collected material, air photos and map materials over Quaternary geology, bedrock geology and hydrogeology was put together creating basic working map materials before the fieldwork. Based on the topographical information derived, approximate watershed areas were defined prior to the fieldwork.

4.1.2 Geographic reference

The area concerns the following map-sheets in the economic map-sheet subdivision system:

06G2H, 06G2I, 06G2J, 06G3H, 06G3I, 06G3J, 06G4I, 06G4J, 06H2A, 06H3A, 06H3B, 06H4A, 06H4B.

4.1.3 GIS environment

An inventory database has been created to provide an overview of the information identified in this inventory. All geographic information has been handled in an ArcGis-environment. This includes production of map materials before fieldwork, the digitalisation of archive materials and the production of maps for fieldwork.

4.2 The archive inventory phase

Inventory of archives took place regarding the following information of hydrogeological importance:

- Performed land drainage operations.
- Permissions for water operations.
- Information from the Registration authority.
- Water wells.
- Springs.
- Watersheds.
- Geology.
- Other data owners.

4.2.1 Land drainage operations

In the county board's archives, documents exist over land drainage operations and plans for subsurface drains since approximately year 1900. The term land drainage means "permanent water drainage of land in order to increase its suitability for certain purposes" i.e. for agricultural activity or exploitation. Ditching, dewatering, embankments and subsurface drains are examples of different types of land drainage. There exists at least 20,000 ditching operations in the country, most of them added at the end of 19th century and the first half of 20th century. Ditching in order to win new land occurs meagrely any longer;

on the other hand existing operations need to be maintained. It should be noted that the water law ceased at the turn of the year 1998/99. The regulation regarding water drainage is now part of the Swedish Environmental Code (MB) and the law “Lag med särskilda bestämmelser om vattenverksamhet (LVV)”.

In order to make possible identification of these plans within the survey area, contact was taken with Lantbruksenheten at the county board of Kalmar län. The county board’s archives comprise of two parts;

- (1) “land drainage operations” and,
- (2) “subsurface drainage plans” for individual farms.

A “land drainage operation” most often consists of several landowners that join in order to drain a certain area to improve the cultivation conditions. The documents that exist in the archives comprise maps and written materials. The maps show ditches, parcels, road barrels and other information that are required in order to describe the drain. The written material contains information on how the company is identified i.e. who the owners are and what rules apply for structure and maintenance. Normally, dimensions on ditches and cost estimates are documented.

Lists were received over the “land drainage operations” carried out during the latest 100 years for the area in question. In total 30 “land drainage operations” have been found, see Appendix 1 for a complete listing. For a compiled map visualisation of the operations see Appendix 8 – Map over land drainage operations.

4.2.2 Permissions for water operations

A water operation is an activity or measures that either aims to change the water depths or situation, dewater, lead away groundwater or increase the groundwater quantity through water infiltration. Normally, permission is required for such activities or measures. Examples on water activities are power plant dams- or regulation dams, various constructions in waters as bridges and tunnels, dredging, and water supply (not for house needs).

A permit for water operations is means a court-taken decision concerning conditions related to water activity. Before 1999 six Water Courts existed in Sweden (with location in Luleå, Umeå, Östersund, Stockholm, Växjö and Vänersborg). January 1, 1999, the new Swedish Environmental Code was inferred and at the same time the new Environmental Courts initiated its activity. The five regional Environment Courts exist at the same places as the previous Water Courts, where they constitute part of the District Courts in respective city.

Information about existing permits for water operations was retrieved from the Oskarshamns municipality, the County Board of Kalmar and OKG AB. However, since the District court of Växjö handles the actual archive, the actual documentations were ordered from them. A summary and short description of permissions is presented in Appendix 2. A map visualisation is presented in Appendix 9 – Map of permits for water operations.

4.2.3 Information from the Registration authority

All real estates are registered in the Real Estate Register (in Swedish Fastighetsregistret). Basic information about owners and various rights exists in the real estate register’s registration part. The Registration authority (in Swedish Inskrivningsmyndigheten – IM) handles that part of the register. Typical issues handled by the Registration authority are matters in reference to title deeds, mortgages and the registration of certain rights.

The rights are compulsory services and various user rights. IM checks that the formal requirements for various registration measures are met, that transfer documents meet certain formal requirements and that the necessary consent and conditions have been left. Registration authorities exist at seven courts in the country. For the project, information has been retrieved from the Registration authority in Eksjö.

In order to retrieve information about ditching, compulsory service etc. applicable for estates involved, the real estates were chosen and information about these was acquired from the authority. The selection of real estates took place so that those real estates that was crossed by or border to a watercourse and those real estates that consists of waters and wetland was chosen out, which constituted approximately half of the real estates. No registrations could be considered to have any impact on the surface- or groundwater conditions in the area.

4.2.4 Water wells

Archived information concerning water wells was acquired from SKB. These data originally comes from the hydrogeological database of SGU. Groundwater documentation at SGU consists of a national groundwater network and archives of well records. Information from well drillings and groundwater investigations is stored in the well archives. There are also separate databases on springs and groundwater quality in the archives, as well as a manual file of reports on groundwater conditions. Data from the archives are used both for disseminating information to the public as well as providing information to well drillers and for research work, e.g., statistical analysis. The well archive contains data about wells' technical construction, depth, water capacity, water table, geographic location, and information about stratigraphy.

Within the survey area, 78 wells were found in the well archive. Most of these are drilled wells.

The results of a detailed SKB inventory of wells /Morosini and Hultgren, 2003/ for the southern and central part of the study area has been included in this study. The majority of the 209 wells found in the SKB inventory do not exist in the SGU database. The addition of the SKB database to this study explains the more dense distribution of wells for this part of the study area, see Appendix 7 – Map of general hydrogeology.

Some of the wells exist in the SKB inventory as well as in the SGU database with a minor discrepancy in location, typically within 10 metres. This positional difference is interpreted as an uncertainty in determination of position in the SGU database. The well locations shown in the map of Appendix 7 contains the results of both investigations.

A summary over water wells found may be viewed in Appendix 4 – Wells, SKB-Oskarshamn. In the Appendix the Columns 2–10, 12 and 14, have been retrieved from the well archive of SGU while SwedPower AB has computed the columns 1, 11, 13, 15, 16 and 17.

4.2.5 Springs

As part of groundwater documentation at SGU is also a separate database on springs. This database covers approximately 1,600 springs throughout Sweden. A spring is defined as a flow of natural groundwater emerging on ground. The database contains information about chemical composition, geographical location, amount of flow, type of aquifer, and water quality.

Within the survey area, no registered springs exist in Geological Survey of Sweden's archives.

In an attempt to locate sources within the survey area two rural culture societies has been contacted. Neither these associations could provide any information about springs within the survey area.

4.2.6 Calculation of watersheds

Information of watershed areas as established by the Swedish Meteorological and Hydrological Institute (SMHI) was received from SKB /Lärke and Hillgren, 2003/.

Each respective area has been computed from Swedish Meteorological and Hydrological Institute's archive SVAR (Svenskt Vattenarkiv), in which all Sweden's main watershed areas – and sub watershed areas are indicated using the Swedish Green map (in Swedish Gröna kartan) as base (map scale 1:50,000). After establishing of watershed for each point the area of each watershed has been calculated with the aid of a square net of 5×5 mm. The error of calculation is estimated to ± 1%.

The watersheds areas are indicated on the enclosed map see Appendix 6a – Map over watershed areas.

4.2.7 Quaternary and bedrock geology

Map data regarding Quaternary and bedrock geology have been used for the compilation of the hydrogeological map described in section 5.1.4 and presented in Appendix 7.

The map data available concerning bedrock and Quaternary deposits originates from earlier work carried out within SKB activities. The main source of information has been the work carried out within "Simpevarp – Site descriptive model version 0" (report R-02-35 /SKB, 2001/). GIS-data describing Quaternary geology – as well as bedrock geology was received from SKB.

The GIS dataset that describes the Quaternary geology was found afflicted with a positional error of about 100 metres. The positional error is characterised by non-linearity, which means that a simple positional correction via an affine adjustment is insufficient. A more complex second order polynomial correction was found to decrease the error to about 10 metres.

It should also be noted that the northern and western part of the survey area exceeds the borders for SKB's regional model area. In order to have a complete geological coverage for the area, the data have been complemented with SGU map series Ac no 5 Oskarshamn.

4.2.8 Other data owners

One big gravel pit exists within the survey area, located in Köksmåla. The county board currently treats a number of applications related to permits for increased quarrying of gravel in reference to Köksmåla (see Appendix 10b for details).

A former gravel pit exists outside the survey area, in connection with Fårbo water supply. Presently, no permits exists in relation to quarrying within this pit.

A big groundwater water supply plant exists in Fårbo, just outside the survey area. The plant supplies the municipalities of Fårbo and Misterhult with drinking water. At the end of the 1990's the average water consumption was 600 m³ per day. However, most households within the survey area have water maintenance via individual wells. The Fårbo water supply is regulated through a permit for water operation enclosed in Appendix 10a and 10d.

It has been found that a number of surveys have been conducted concerning water supply in Fårbo. Among these can be mentioned a survey for establishing a proposal for a protection area with regulations for Fårbo water supply, performed during 2000–2001 /VBB VIAK, 2001/. The proposal including the proposed regulations is presented in Appendix 10a.

4.3 Field inventory

The field inventory of objects found during the archive work phase took place in June 2004.

The following information was retrieved during the fieldwork:

- Verification of the object.
- The object GPS coordinate (typically a coordinate in a central position of the area in question).
- Verification of the objects borders.
- Photo of the object or surroundings.
- General analysis of surface – and groundwater dividers.
- General control of geological units.

The field inventory took two days and was performed using car and by walking. The route was logged directly via GPS to a portable computer with access to a map environment where position continuously was shown. The environment made it possible to track each observation to locality and coordinate.

A summary over field observations may be found in Appendix 3a – Field observations. Photos from each observed location are presented in Appendix 3b – Photos from fieldwork.

The locations for field observations can be found visualised in Appendix 8 and 9 – Map of land drainage operations and Map of permits for water operations.

5 Results

5.1 Comments

The results from the inventory are presented in two ways:

- As analogue hard-copy lists
- As GIS-data in ArcGIS format

Lists of water activities or related objects are presented in Appendix 1–5.

Mapping data is presented and delivered in ArcGIS format together with printed maps. The produced maps (digitally delivered in Adobe pdf format) have been attached in Appendix 6–9 printed at scale 1:50,000.

In Appendix 10 – Compilation of archive material, reports and other documents are presented.

5.1.1 General comments regarding produced maps

All map handling have been produced using ESRI ArcGIS 8.2 desktop GIS software. The LMV fastighetskartan have been utilised as background for all map layers produced.

5.1.2 General map overview

A general overview of the area is presented in Appendix 5 – General map overview. Information available concerns land-use, nature reserves, water streams and roads. Text refers to names of local districts or small villages.

5.1.3 Map of watershed areas

The map depicting watershed areas (Appendix 6a – Map of watershed areas) represents part of a database produced by the Swedish Meteorological and Hydrological Institute (SMHI). Appendix 6b – Map over surface drainage shows surface runoff within each watershed area. In Table 5-1 each main- and subwatershed have been listed together with area distribution. The direction of surface runoff has been estimated on the basis of the regions terrain height variations; the inclination (slope) in the landscape has been calculated together with the inclination's direction (aspect). The computed direction has been drawn on the map as an arrow (see Figure 5-1 for detail where direction of flow have been superimposed on an infrared orthoimage).

Table 5-1. Watershed statistics. Please see Appendix 6a and ArcGIS data for mapping details.

Id code	Main watershed	Sub watershed	Area (km²)	Id code	Main watershed	Sub watershed	Area (km²)
ASM002446	1	1:1	0.070	ASM001506	10	10:17	0.398
ASM002447	2	2:1	0.380	ASM002499	10	10:18	0.058
ASM002472	3	3:2	0.470	ASM001448	10	10:19	0.495

Id code	Main watershed	Sub watershed	Area (km²)	Id code	Main watershed	Sub watershed	Area (km²)
ASM002473	3	3:1	0.530	ASM002450	10	10:20	2.579
ASM002449	4	4:1	0.632	ASM002453	10	10:21	0.445
ASM002474	5	5:20	0.117	ASM001510	10	10:22	0.562
ASM001474	5	5:7	0.450	ASM001511	10	10:23	0.740
ASM001483	5	5:17	0.151	ASM001512	10	10:24	0.494
ASM001479	5	5:13	0.647	ASM002459	10	10:25	0.099
ASM001472	5	5:4	1.104	ASM001446	10	10:26	0.678
ASM002479	5	5:18	1.180	ASM001514	10	10:27	0.487
ASM001480	5	5:14	0.103	ASM001515	10	10:28	0.337
ASM001470	5	5:3	0.398	ASM001516	10	10:29	0.533
ASM001478	5	5:11	0.493	ASM002478	10	10:32	0.023
ASM001476	5	5:9	3.619	ASM002480	10	10:30	6.068
ASM001471	5	5:5	2.794	ASM002482	10	10:31	0.867
ASM001469	5	5:2	0.968	ASM001444	11	11:1	0.523
ASM002486	5	5:1	6.657	ASM002485	12	12:2	0.331
ASM002487	5	5:6	1.200	ASM002495	12	12:3	0.126
ASM001475	5	5:8	1.421	ASM002498	12	12:1	1.597
ASM002489	5	5:10	1.198	ASM001518	13	13:1	1.033
ASM002490	5	5:12	0.836	ASM002497	14	14:2	0.435
ASM002491	5	5:15	1.872	ASM001517	14	14:1	0.903
ASM002492	5	5:16	1.109	ASM002462	15	15:1	0.967
ASM002493	5	5:19	0.837	ASM002463	16	16:1	0.504
ASM001486	6	6:1	2.003	ASM002494	17	17:1	4.694
ASM001484	7	7:1	0.213	ASM001533	17	17:2	0.512
ASM001445	7	7:2	1.848	ASM001520	17	17:3	0.081
ASM002460	8	8:1	0.499	ASM001521	17	17:4	0.204
ASM002483	9	9:1	1.845	ASM001522	17	17:5	0.571
ASM001489	9	9:2	0.767	ASM001523	17	17:6	0.958
ASM001490	9	9:3	0.222	ASM002481	18	18:1	4.574
ASM001494	10	10:4	1.001	ASM001525	18	18:2	0.771
ASM002476	10	10:1	12.646	ASM001526	18	18:3	0.401
ASM001492	10	10:2	0.460	ASM002477	18	18:4	0.659
ASM001493	10	10:3	0.319	ASM001528	18	18:5	0.320
ASM001495	10	10:5	0.290	ASM002475	18	18:6	1.055
ASM001496	10	10:6	0.890	ASM002455	18	18:7	0.761
ASM001497	10	10:7	0.609	ASM001531	18	18:8	0.302
ASM001498	10	10:8	2.771	ASM001532	18	18:9	0.111
ASM001499	10	10:9	0.711	ASM002464	19	19:1	0.184
ASM002457	10	10:10	1.389	ASM002465	20	20:1	0.111
ASM001501	10	10:11	0.806	ASM002471	21	21:1	0.063
ASM002454	10	10:12	0.808	ASM002466	22	22:1	0.359
ASM001503	10	10:13	0.416	ASM002467	23	23:1	0.307
ASM002452	10	10:14	2.375	ASM002468	24	24:1	0.192
ASM002451	10	10:15	0.325	ASM002469	25	25:1	0.131
ASM001447	10	10:16	0.295	ASM002470	26	26:1	0.165

Id code	Catchment area of stream	Main watershed	Sub watershed	Area (km²)
ASM001468	Kärrviksån	5	1–20	27,154
ASM001491	Laxemarån	10	1–32	40,976
ASM001524	Slåthulteboån	18	1–9	8,958

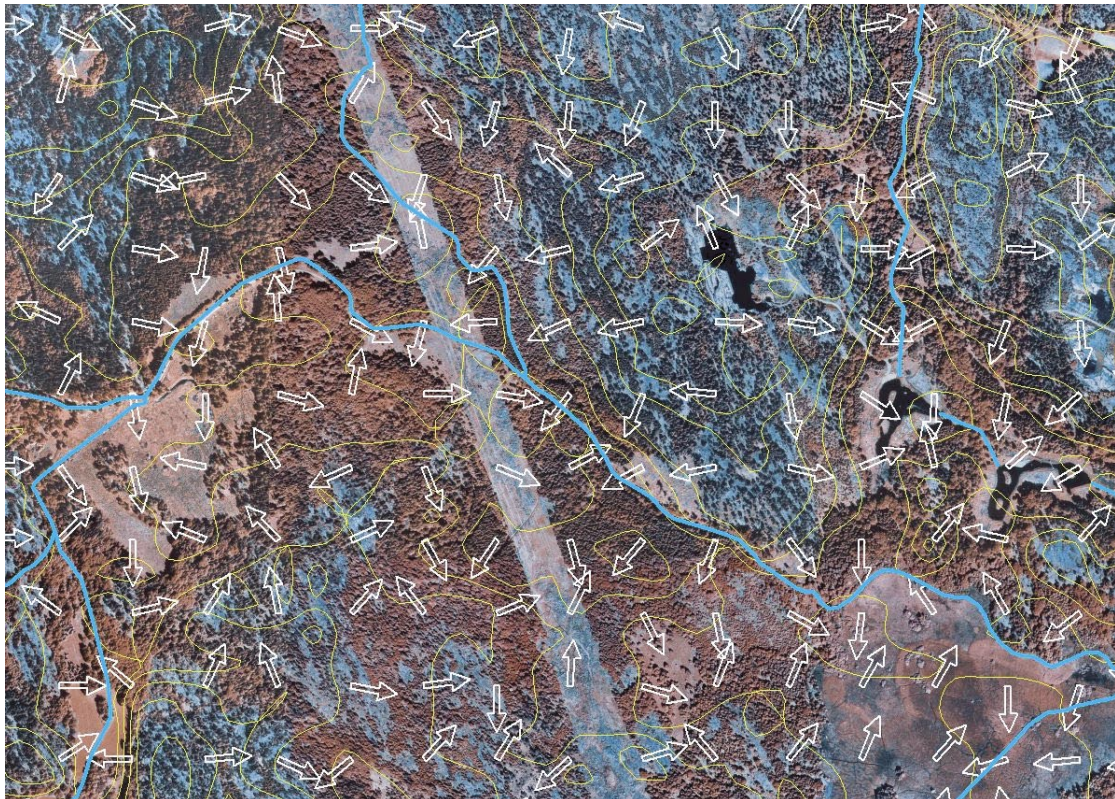


Figure 5-1. Cartographic model describing the distribution of surface runoff (detail from Misterhult district). Vectors describing direction of runoff have been superimposed on ortoimagery. White arrows represent the direction of surface runoff. Water streams in blue colour and height contours in yellow. Centre coordinate Easting and Northing 1546300/6370560.

5.1.4 Hydrogeological map

The hydrogeological map, Appendix 7 – Map over general hydrogeology, shows hydrogeological properties present in the provided mapped geological units /SKB, 2001/. Primarily, the map in Appendix 7 constitutes an attempt to describe the groundwater occurrence related to an assessment of the amount of water resources and the possibilities for water discharge.

The basis for the assessment of groundwater discharge relates to the information found in SGU well archive. Within the area, 78 wells have been reported.

SKB have implemented an internal well inventory within smaller regional model area, in which 209 well were found. Only two of these wells have useable information regarding water capacity. Information about capacity for these two wells has been added in the work to generate the hydrogeological map.

In the work to put together the possibilities for groundwater discharge, each well have been evaluated with respect to whether well properties should be linked to the layers of the unconsolidated sediment or to the bedrock. In order to estimate a typical value of capacity for each geological unit, a procedure have been used to calculate the median value of capacity for those wells that geographically lies within respectively geological unit. However, it should be noted that the total number of wells are small, especially concerning excavated wells, why the statistical representativity in general is low.

On top of the hydrogeological map the assessed groundwater capacity of unconsolidated sediments and hard rock have been superimposed together with indications of the existence of fracture zones. The used colours and tones are understood from the map legend. The map basically follows Geological Survey of Sweden's colour scheme, where blue colour is used in order to state pore aquifers and green in order to state fractured bedrock aquifer. The possibility to take out groundwater from the bedrock is presented with different green and turquoise colour tones. The sparse access to wells in unconsolidated sediments is the reason why similar processing cannot be done for groundwater in these sediments. For groundwater in gravel and sand, capacity has been estimated based on their general characteristics. Areas with less favourable relations are presented with brown colours for both types of aquifers.

Close to marked fracture zones, the groundwater capacity may exceed the possible capacity presented for the ambient bedrock.

5.1.5 Maps of water activities

The various water activities for the area is presented in Appendix 8 and 9 – Map over land drainage operations and Map over permits for water operations, as registered at the county board in Kalmar, Växjö District Court and registrations in the Real Estate Register concerning water rights/obligations.

The majority of the permits for water operations are related to the activities of OKG AB. In the Map over permits for water operations shown in Appendix 9, all permissions related to OKG have, of simplicity reasons, been merged into one single reddish colour. For a more exact geographical coverage of each permit (a total of 21), please see the ArcGIS-database.

There are a number of uncertainties associated with the geographical position of the permits for water operations and the final map produced.

- The map was produced from copies of the original maps, received from respective authority. Each map was scanned to a digital raster format and transferred to a vector format through “heads-up” digitalisation. The vector dataset was then imported to an ArcGIS environment where attributes and topology and were added.
- It should be noted that the borders indicated for each land drainage operation have been retrieved solely from the application itself. The borders significance as a hydrogeologic boundary should therefore be considered as unknown. The borders can be assumed to be an estimate from the applicant concerning the influenced area.
- Regarding the location of a “land drainage operation”, the position marked as a point annotation in the GIS database is placed on the same position as can be found in the application. However, please note that the location may have at least two reasons; positioned central in the area of estimated influence, or positioned close to the applying real estate. It cannot be verified which method that has been used.

A summary over “land drainage operations”, may be found in Appendix 1 – Land drainage operations 1903–2004.

A summary over “permissions for water operations” may be found in Appendix 2 – Permit for water operations.

For the complete documentation of permissions, including maps and sketches, see Appendix 10 – Compilation of archive material.

References

- Bergman T, Isaksson H, Johansson R, Lindén A H, Lindgren J, Lindroos H, Rudmark L, Wahlgren C-H, 1998.** Förstudie Oskarshamn. Jordarter, bergarter och deformationszoner. SKB R-98-56, Svensk Kärnbränslehantering AB.
- Bergman T, Follin S, Isaksson H, Johansson R, Lindén A H, Lindroos H, Rudmark L, Stanfors R, Wahlgren C-H, 1999.** Förstudie Oskarshamn. Erfarenheter från geovetenskapliga undersökningar i nordöstra delen av kommunen. SKB R-99-04, Svensk Kärnbränslehantering AB.
- Larsson-McCann S, Karlsson A, Nord M, Sjögren J, Johansson L, Ivarsson M, Kindell S, 2002.** Meteorological, hydrological and oceanographical information and data for the site investigation programme in the community of Oskarsham. SKB TR-02-03, Svensk Kärnbränslehantering AB.
- Lindell S, Ambjörn C, Juhlin B, Larsson-McCann S, Lindquist K, 1999.** Available climatological and oceanographical data for site investigation program. SKB R-99-70, Svensk Kärnbränslehantering AB.
- Losjö K, Johansson B, Bringefelt B, Oleskog I, Bergström S, 1999.** SKB TR-99-01 Groundwater recharge – climatic and vegetation induced variations. Simulations in the Emån and Äspö areas in southern Sweden. SKB TR-99-01, Svensk Kärnbränslehantering AB.
- Lärke A, Hillgren R, 2003.** Rekognosering av mätplatser för ythydrologiska mätningar i Simpevarpsområdet. SKB P-03-04, Svensk Kärnbränslehantering AB.
- Morosini M, Hultgren H, 2003.** Inventering av privata brunnar i Simpevarpsområdet, 2001–2002. SKB P-03-05, Svensk Kärnbränslehantering AB.
- Rhén I, Follin S, Hermansson J, 2003.** Hydrogeological Site Descriptive Model – a strategy for its development during site investigations. SKB R-03-08, Svensk Kärnbränslehantering AB.
- SGAB, 1986.** Oskarshamn kommun. Översiktlig flygbildstolkad jordartskarta i skala 1:50 000. Intern rapport 86–324.
- SKB, 2001.** Simpevarp site descriptive model version 0. SKB R-02-35, Svensk Kärnbränslehantering AB.
- VBB VIAK, 2001.** Skyddsområde Fårbo vattentäkt, Oskarshamns kommun. Rapport VBB/VIAK 2001.

Land drainage operations year 1903–2004

Case no	Operation description	Picture no
P 515	Basteböla, Övrahammar and Skurö, drainage survey 1909	
P 557	Botestorp and Snarås, drainage survey 1911	
P 689	Botestorp and Köksmåla, drainage survey 1916-17	
P 321	Figihult and Jämserum, drainage of the lowered Ficksjö, 1902-03	
P 650	Glostad, drainage survey 1913-14	
P 696	Gässhult, Misterhult and Späckemåla, lowering of Gässjön and drainage of land 1918	
P 556	Cancelled lowering of lake Götmares and Mjösjön belonging to Hemman Götebo and Tjustgöl among others 1908	
P 659	Jämserum, Värnamo and Plittorp, drainage survey 1916	
P 456	Plåttorp and Skringaremåla, water conduct 1907	
P 457	Stora Laxemar, Ström and Åby, water conduct 1907	
P 514	Uthammar, Hägnad, Övrahammar and Skurö villages, drainage survey 1909	
LN 13	Simpevarp drainage operation 1955	
LN 15	Gässhult drainage operation 1955	1a, b, c
179	Gästern, sea lowering operation in Gässhult among others	5a, b, c
432	Götmares sea lowering operation 1933	
1228	Götmares sea lowering operation 1933	
1150	Jämserum among others drain operation 1925	9a
513	Jämserum drainage operation 1937	
1344	Jämserum drainage operation 1937	
779	Köksmåla drainage operation 1943	8a, b
401	Lilla Laxemar stream Mederhults drainage operation 1935	4a, b
1230	Lilla Laxemar among others drainage operation 1933	
854	Mederhults drainage operation 1949	2a, b
771	Plittorp-st. Bastehults drain operation 1944	3a
620	Plåttorp drainage operation 1939	10a, b
1107	Släthult drain operation 1927	
316	Släthults drain operation 1927	
1008	Stora Laxemar among others drainage operation 1922	7a, b, c
1229	Ström-Åby drainage operation 1933	
410	Ström-Åby drainage operation 1933	6a, b, c

Tabel over Land drainage operations within the investigation area from 1903 to 2004.

Explanations: The case number P stands for Public Act and have been tried according to the '1879 års dikningslag'. LN are acts which have been tried according to the land drainage section in the Swedish water law (1918 års Vattenlag). LN stands for 'Lantbruksnämnden' (a Swedish authority). Operations only abbreviated with a number have been tried by the Swedish authority 'Statens Lantbruksingenjörer'.

Permit for water operation

Object no	Case no	Date	Permit no	Summary	Commentary
1	AD 29/1966	1968-04-26	A 26/1968	Application of permission to lead away water from lake Fårbo in parish Misterhult, Kalmar län	Fårbo water reservoir, application to infiltrate water from the lake Fårbo to enable an increased water use.
2	AD 41/1963	1964-08-21	A 46/1964	Permit to construct a surface water reservoir (Söråviken) and to pump in water from the Laxemarå	Waterlevel +1,50 Quantity 20 l/s to the Söråviken.
3	AD 42/1970	1971-12-08	A 68/1971	Increase of amount of water lead away according to part judgement 1965-05-13 in AD 51/1965 and permit for water conduct from Trästen to Jämsen	Respectively 70 l/s and 50 l/s are granted temporarily. No limit to volume from Söråviken.
4	AD 42/1970	1972-09-15	DVA 70/1972	Permit for a new water inlet, pumpstation and pipe to lead away water of an amount of 70 l/s from Laxemarå to Söråviken.	Due to salt water ingress the inlet will be moved to property Ström 1:7
5	AD 42/1970	1973-09-19	DVA 57/1973	Declaration of legality of changes made of the pumpstation and water pipes, permit for clearings in Laxemarå.	
6	AD 42/1970	1974-05-10	DVA 35/1974	Permit to raise the level of the Sörå reservoir and take water from the reservoir, away leading of water from Laxemarå.	Water level +2.50. A maximum amount of water lead away of 120 l/s from Laxemar stream.
7	AD 42/1970	1976-05-31	DVA 19/1976	Permit to lead water from the lake Trästen to lake Jämsen.	Maximum lead of water 50 l/s.
8	AD 42/1970	1978-10-25	DVA 44/1978	Sampling and analysis stop. Postponed questions are written off.	Final verdict
9	VA 34/1981	1982-04-02	DVA 12/1982	Water conduct from lake Götömar, construction of intake and intake pipe, water pipe, clearing of Gerseboå.	Present water catchment, Leading of water of 23 l/s

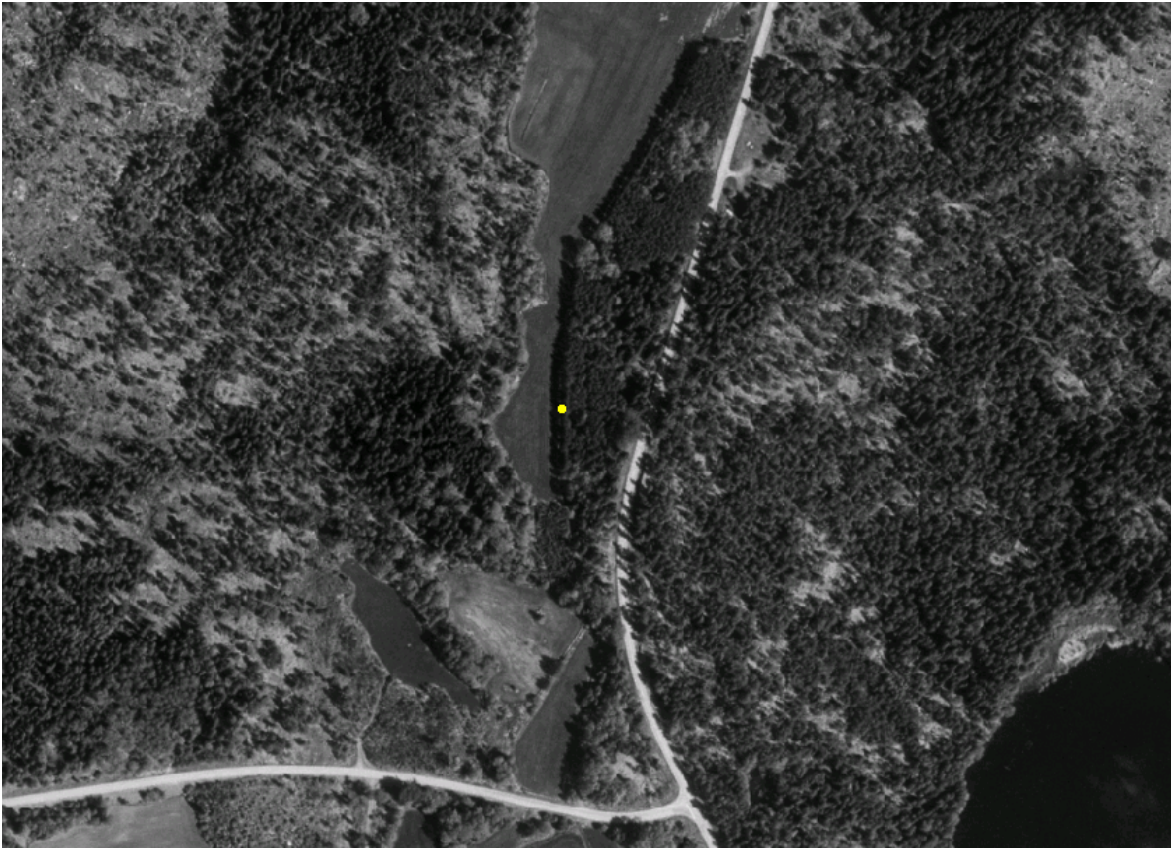
Object no	Case no	Date	Permit no	Summary	Commentary
10	VA 5/1989	1990-09-11	DVA 42/1990	Äspö, road embankment and drum by the so-called Äspöhålet between the islands Mjälén-Jungfrun and Äspö and leading away water from SKB:s hard rock laboratory.	
11	VA 50/1973	1980-09-18	DVA 52/1980	Permit for O3 for deep-water intake within public area, building of intake tunnel, dredging, building of dock.	
12	AD 51/1965	1966-05-13	A 35/1966	Permit to lead away water and discharge industrial wastewater etc. for O1	25 m ³ /s to O1 for cooling
13	AD 51/1965	1969-05-06	A 28/1969	Certain adjustment in the part judgement of admission 1966-05-13	
14	AD 10/1969	1969-12-03	A 64/1969	Permit to lead away water, discharge of industrial wastewater etc. for O1 and O2.	55 m ³ /s to O1 and O2 for cooling
15	AD 51/1965	1983-07-08	DVA 38/1983	Conditions for leading away sea water for cooling and for discharge of equivalent amount to Hamnefjärden until the board of concession for environmental protection has established common regulations for O1, O2 and O3	Case dismissed for further process through decision SVA 1/85 1985-12-05.
16	AD 10/1969	1983-07-08	DVA 38/1983	Same as AD 51/1965 (O2)	
17	VA 50/1973	1983-07-08	DVA 39/1983	Permit for O3 tillstånd to lead away water for cooling and discharge of equivalent amount.	50 m ³ /s to O3. Part judgement.
18	VA 50/1973	1991-06-14	DVA 31/1991	Application of permit to build a third unit (O-III) of Oskarshamns nuclear power plant on the Simpevarp peninsula.	Fishing protection measure in form of setting up a cleaning pit. Arrangement for trawling is not necessary.

Object no	Case no	Date	Permit no	Summary	Commentary
19		1992-08-17	I 1379	Postponed question in case of permit for expansion of nuclear power plant; determination of investigation program regarding impact in the recipient from discharge of cooling water.	Board of concession.
20	VA 1/1987	1991-07-03	DVA 37/1991	Lake Götömar, leading away water for OKG. Now treatment of postponed questions.	Final verdict
21	VA 34/1981	1984-10-26	DVA 97/1984	Lake Götömar, leading away water for OKG. Treatment of postponed questions.	Final verdict
22	VA 10/1987	1987-12-09	DVA 52/1987	Cassation of right according to part judgement 1976-05-31. The right was for leading of water from Trästen to Virås catchment area in Laxemarå and of obligation in water resources management, tearing out survival arrangement, cassation of obligations along Laxemarå and cassation of requirement of measurement by Ström	Laxemar stream is reserve cathment area for leading water to the Sörå reservoir. The pumping to Sörå is today equivalent with the leakage and evaporation.

Field observations 040609–040610

Observation no	Type of object	Object description	Object code	Coordinates RT 90		Picture no	In picture	Direction
1	Drainage operation	Gässhult	LN15 (1955)	1548592	6368456	1a	Eastern ditch	S
						1b	North western ditch	W
2	Drainage operation	Mederhult	854 (1949)	1546982	6367911	2a	Ditch	WNW
						2b	Ditch reversed direction	ESE
3	Drain operation	Pliittorp-st. Bastehult	771 (1944)	1544826	6366581	3a	Ditch	N
4	Drainage operation	Mederhult, Lilla Laxemar m.fl.	401 (1935), 1230 (1933)	1548206	6366864	4a	Ditch	NW
						4b	Ditch	SE
5	Lowering of sea level	Gässhult m.fl. - Gästern	179	1546475	6369666	5a	Gästern	NE
						5b	Gästern	ESE
						5c	Gästern	SE
6	Drainage operation	Ström-Åby	410 (1933), 1229 (1933)	1547029	6364855	6a	Ditch west of road	SW
						6b	Ditch west of road	SW
						6c	Ditch east of road	NE
						6d	Ditch east of road	NE
7	Drainage operation	Stora Laxemar m.fl.	1008 (1922)	1546825	6364469	7a	Field and ditch	SW
						7b	Ditch	SW
						7c	Ditch	NE
8	Drainage operation	Köksmåla	779 (1943)	1539967	6363545	8a	Ditch (partly in culvert)	W
						8b	Ditch	E
9	Drain operation	Jämserum m.fl.	1150 (1943)	1540033	6364156	9a	Stream/ditch	S
10	Drainage operation	Plåttorp	620 (1939)	1540606	6366998	10a	Ditch	SW
						10b	Ditch	NE
21	Permit for water operations	Götmaresen	DVA 12/1982	1546846	6371938	21a	Well & pumphouse	N
						21b	Pumphouse & lake	N
						21c	Lake	N
						21d	Lake	E
22	Permit for water operations	Simpevarp	DVA 35/1974	1550481	6366037	22a	End of lake	NE
						22b	Pump house	N
						22c	End of lake	NE
						22d	End of lake	NW
23	Permit for water operations	Fårbo vattentäkt:	A26/1968	1540739	6361678	23a	Tanks	SW
						23b	Water supply plant	SW
						23c	Water supply plant	N
						23d	Water supply plant	W
						23e	Pump house?	E
						23f	Fårbosjön toward the water supply plant	

Photos from fieldwork



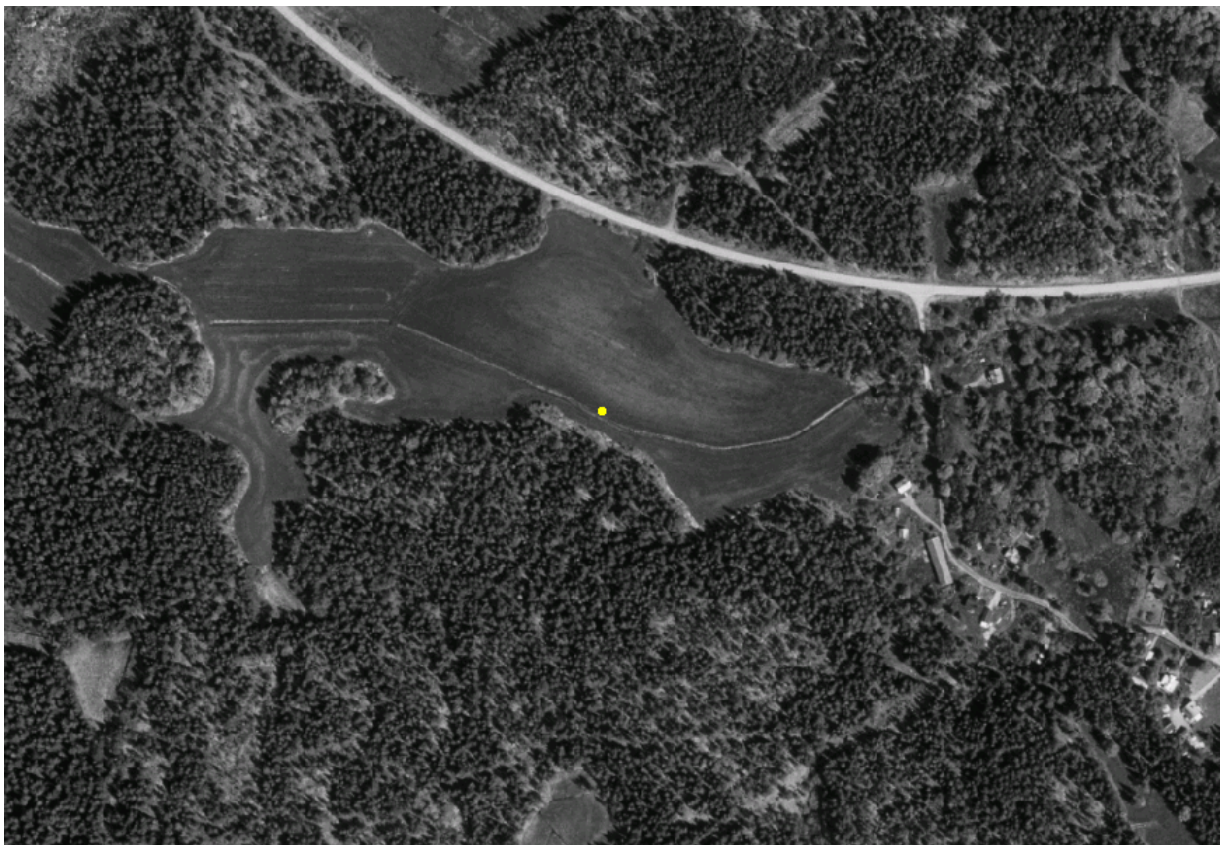
Id observation point 1 - overview.



Id observation point 1, photo a. Direction south.



Field observation point 1, photo b. Direction west.



Field observation point 2 – overview.



Field observation point 2, photo a. Direction west-northwest.



Field observation point 2, photo b. Direction east-southeast.



Field observation point 3 – overview.



Field observation point 3, photo a. Direction north.



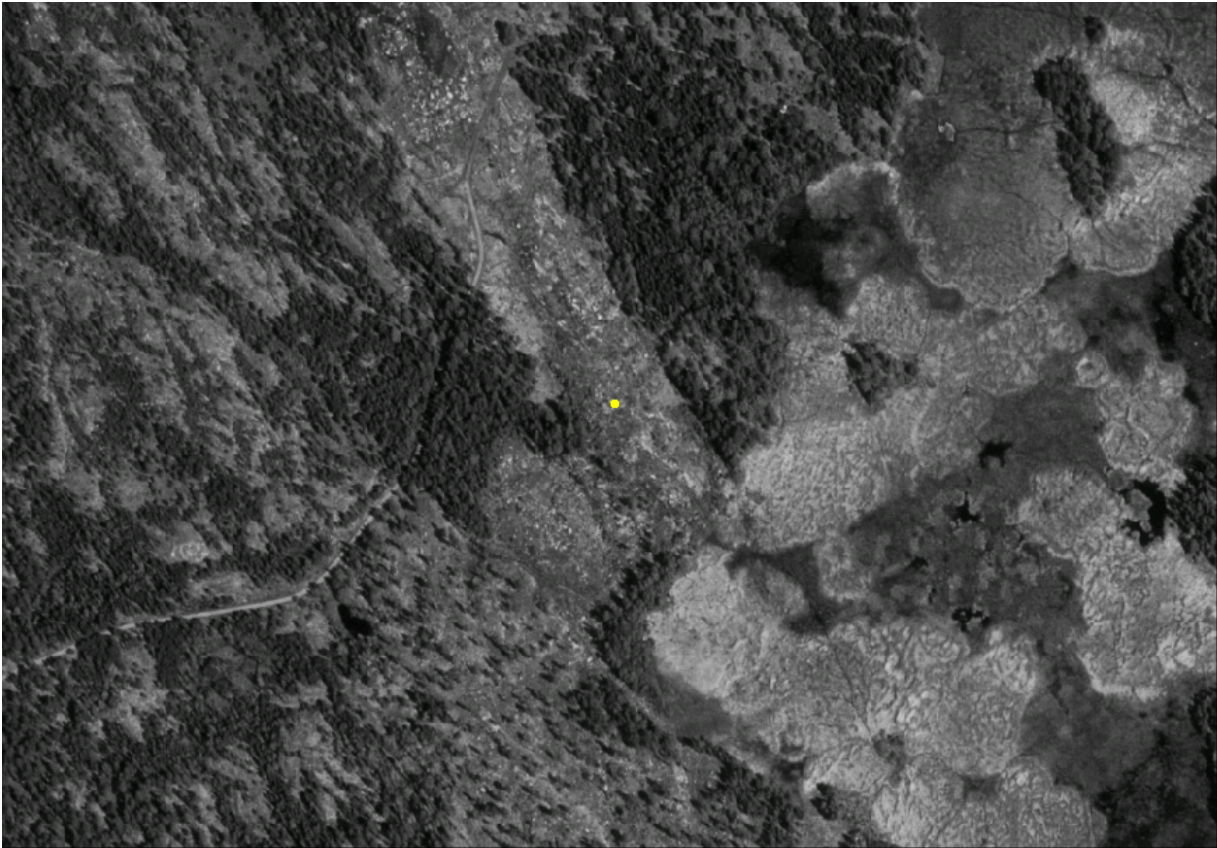
Field observation point 4 – overview.



Field observation point 4, photo a. Direction northwest.



Field observation point 4, photo b. Direction southeast.



Field observation point 5 – overview.



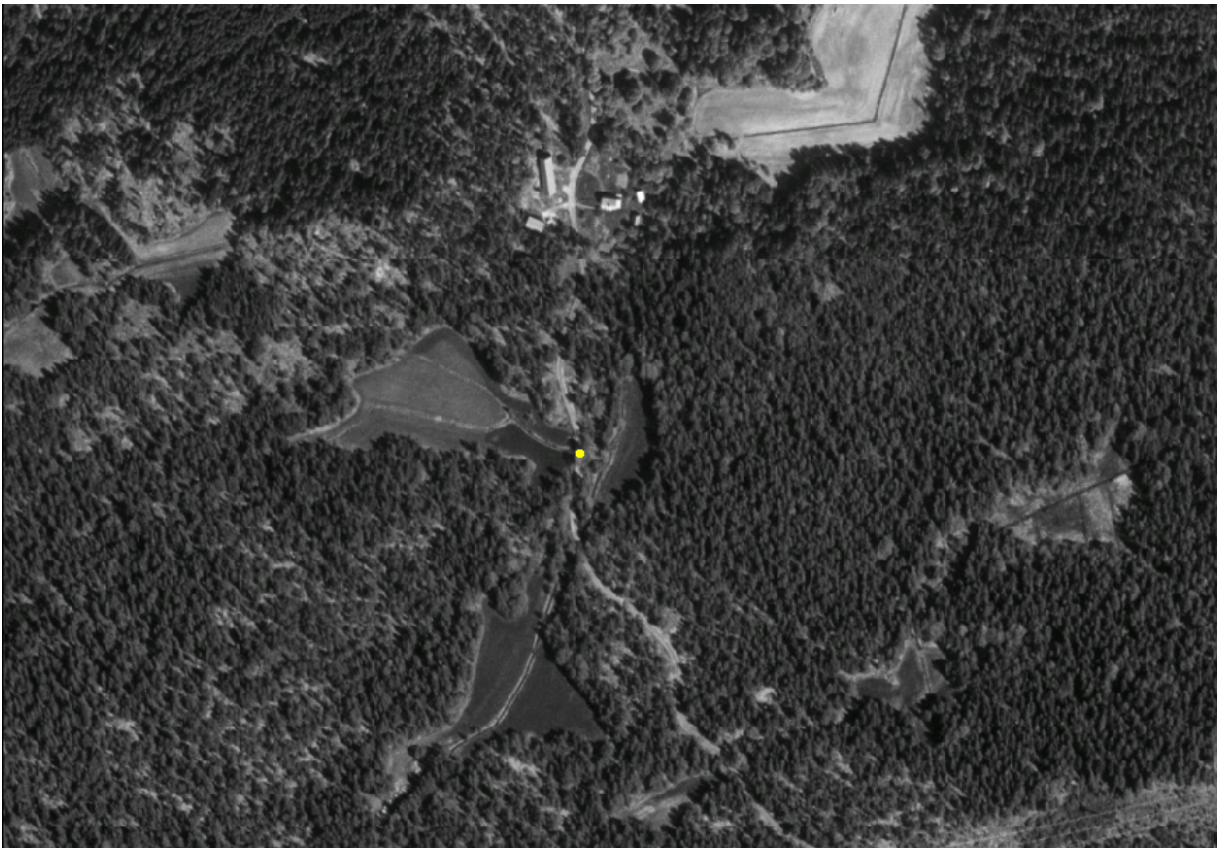
Field observation point 5, photo a. Direction northeast.



Field observation point 5, photo b. Direction eastsoutheast.



Field observation point 5, photo c. Direction southeast



Field observation point 6 – overview.



Field observation point 6, photo a. Direction southwest.



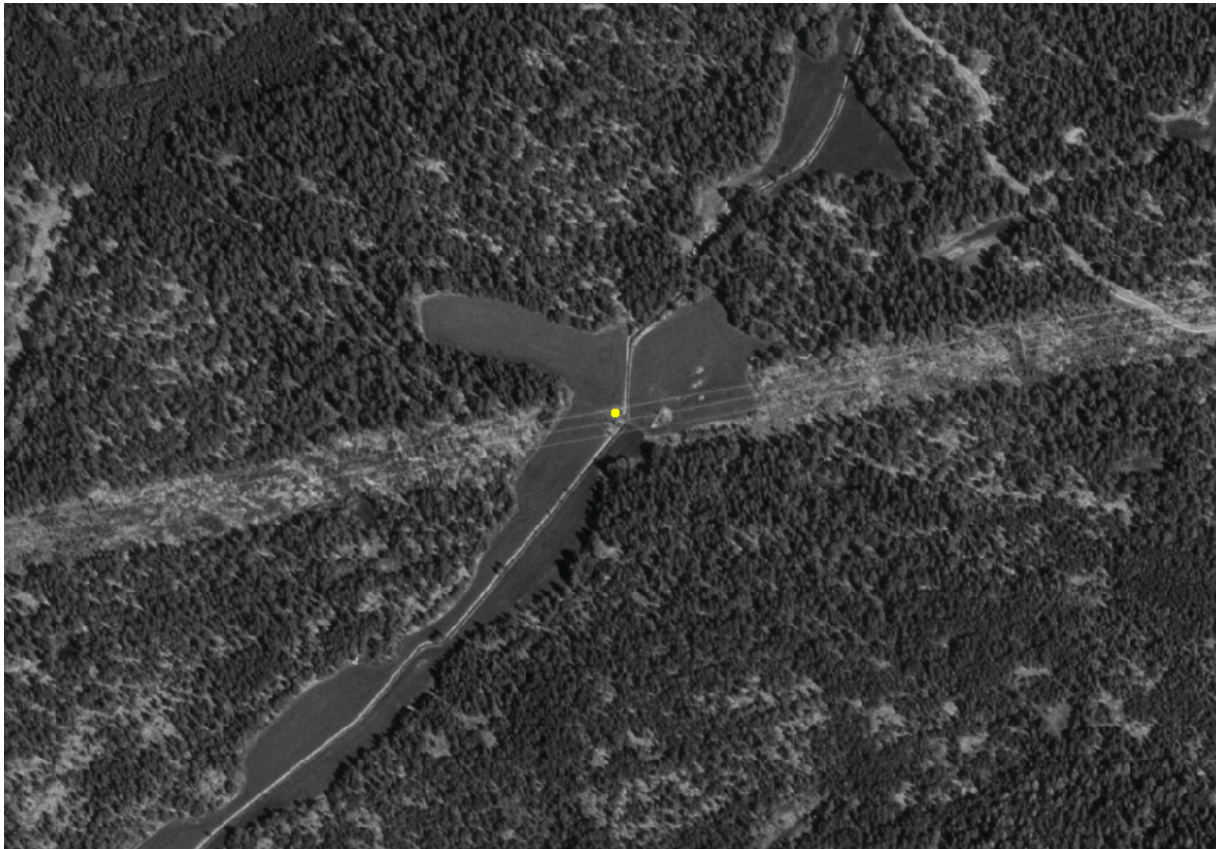
Field observation point 6, photo b. Direction southwest.



Field observation point 6, photo c. Direction northeast.



Field observation point 6, photo d. Direction northeast.



Field observation point 7 – overview.



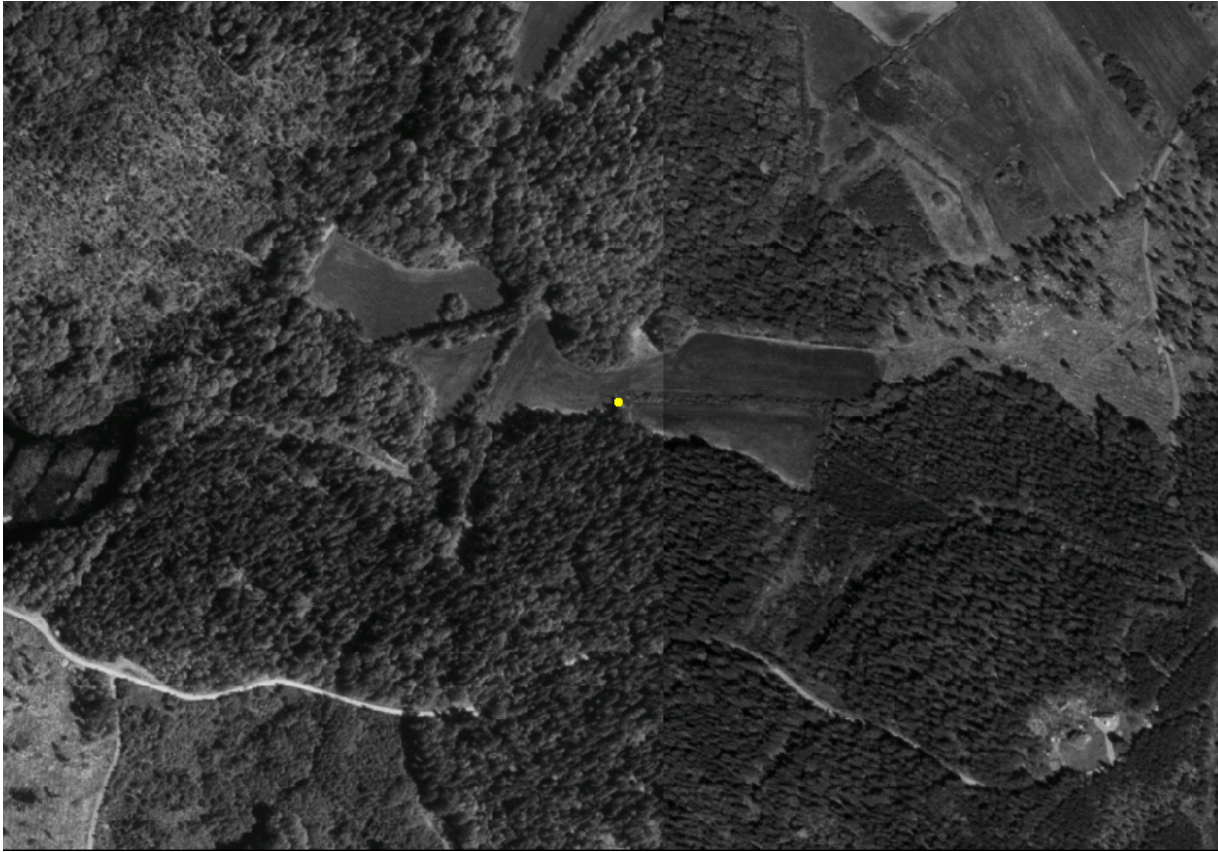
Field observation point 7, photo a. Direction southwest.



Field observation point 7, photo b. Direction



Field observation point 7, photo c. Direction northeast.



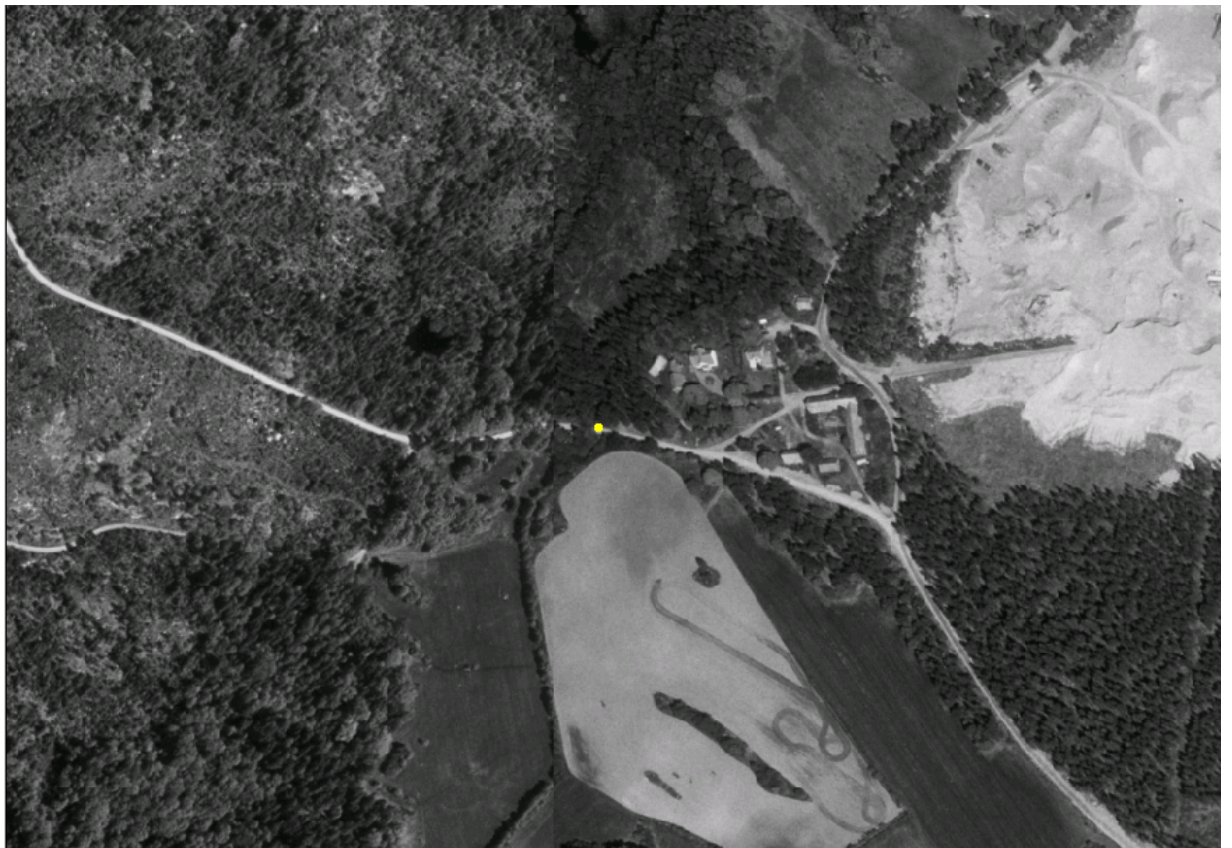
Field observation point 8 – overview.



Field observation point 8, photo a. Direction west.



Field observation point 8, photo b. Direction east.



Field observation point 9 – overview.



Field observation point 9, photo a. Direction south.



Field observation point 10 – overview.



Field observation point 10, photo a. Direction southwest.



Field observation point 10, photo b. Direction northeast.



Field observation point 21 – overview.



Field observation point 21, photo a. Direction north.



Field observation point 21, photo b. Direction north.



Field observation point 21, photo c. Direction north.



Field observation point 21, photo d. Direction east.



Field observation point 22 – overview.



Field observation point 22, photo a. Direction northeast.



Field observation point 22, photo b. Direction north.



Field observation point 22, photo c. Direction northeast.



Field observation point 22, photo d. Direction northwest.



Field observation point 23 – overview.



Field observation point 23, photo a. Direction southwest.



Field observation point 23, photo b. Direction southwest.



Field observation point 23, photo c. Direction north.



Field observation point 23, photo d. Direction west.



Field observation point 23, photo e. Direction east.



Field observation point 23, photo f. Lake Fårbo against the waterplant.

Wells SKB-Oskarshamn

No	SGU Id	Coordinate X	Coordinate Y	Estate	Region	Date of drilling	drill diameter (mm)	Total drill depth (m)	Drill depth in soil (m)	Drill depth in rock (m)	Use	Aquifer	Water capacity (l/h)	Water capacity (l/s)	Specific capacity (l/s*m)	Geological unit
1	66200001	6365880	1543350	VÄRNAMO 1:13		19771211	130	44,00	1,00	43,00	HUS	Rock	2200	0,61	0,0142	3
2	66200002	6366230	1544980	VÄRNAMO 1:5	FÄRBO		133	30,00	0,00	30,00	HUS	Rock	2000	0,56	0,0185	3
3	66200004	6366930	1544850	STORA BASTHULT 1:21	ST BASTHULT	19760517	133	43,00	0,50	42,50	HUS	Rock	3000	0,83	0,0196	3
4	66200005	6372490	1543690	MISTERHULT 1:3	MISTERHULT	19780109	0	6,50	6,50		KOM	Soil	10400	2,89		7
5	66200009	6364690	1540600	JÄMSERUM 1:34	FÄRBO	19770525	113	64,00	11,00	53,00		Rock	420	0,12	0,0022	3
6	66200011	6372030	1544070				0	5,80	5,80		OBS	Soil	10800	3,00		11
7	66200012	6371990	1544280				0	3,60	3,60		OBS	Soil	3600	1,00		11
8	66200013	6372100	1546750				0	6,10	6,10		OBS	Soil	-9999			11
9	66200014	6371960	1546830				0	3,20	3,20		OBS	Soil	3600	1,00		11
10	66200015	6372030	1544060				0	6,00	6,00		OBS	Soil	7200	2,00		11
11	66200016	6372020	1544080				0	6,00	6,00		OBS	Soil	10000	2,78		11
12	66200017	6371910	1544330				0	2,40	2,40			Soil	-9999			11
13	66200023	6365200	1540690	JÄMSERUM 1:22	FÄRBO	19760515	113	16,00	13,00	3,00		Rock	8000	2,22	0,7407	3
14	66200024	6372220	1544000		MISTERHULT	197611	0	3,60	3,60		OBS	Soil	-9999			11
15	66200025	6372130	1544040		MISTERHULT	197611	0	4,00	4,00		OBS	Soil	-9999			11
16	66200026	6372250	1544010		MISTERHULT	197611	0	1,60	1,60		OBS	Soil	-9999			11
17	66200027	6372230	1544000		MISTERHULT	197611	0	5,40	5,40		OBS	Soil	3600	1,00		11
18	66200028	6372010	1544100		MISTERHULT	197611	0	3,80	3,80		OBS	Soil	-9999			11
19	66200044	6370350	1547650	GÄSSHULT 1:2	GÄSTERSNÄS	19780702	0	2,50	2,50		HUS	Soil	-9999			11
20	66200045	6370300	1549370		GRÖNLID	19780702	0	2,50	2,50		HUS	Soil	-9999			12
21	66200046	6371850	1547450			19780703	0	1,10	1,10			Soil	-9999			12
22	66200100	6365060	1547070	ÄBY 1:4	RIKET FIGEHOLM	19790808	112	76,00	0,50	75,50		Rock	240	0,07	0,0009	2
23	66200101	6369150	1549010	GÄSSHULT 1:9	KÄRSVIK	19790809	110	64,00	0,00	64,00		Rock	3	0,00	0,0000	3
24	66200102	6368760	1549640	GÄSSHULT 1:7	KÄRSVIK	19810623	112	82,00	0,50	81,50		Rock	720	0,20	0,0025	1
25	66200111	6374510	1545520	GÖTEBO 1:4	BERGÅSA	19780922	110	46,00	2,00	44,00		Rock	2500	0,69	0,0158	3
26	66200112	6374610	1545580	VÄLLEHORVA 1:2	VÄLLEHORVA	19811028	104	70,00	7,00	63,00		Rock	200	0,06	0,0009	3
27	66200113	6371800	1546650	GÄSSHULT 1:1	GÄSSHULT	19791127	110	65,00	0,00	65,00		Rock	500	0,14	0,0021	6
28	66200125	6372470	1542520	MISTERHULT 4:3	HÖGHULT	1985	0	114,00	1,00	113,00	HUS	Rock	700	0,19	0,0017	5
29	66200129	6364500	1545500	FJÄLLTPR	FIGEHOLM	19810224	107	79,00	3,00	76,00		Rock	800	0,22	0,0029	3
30	66200134	6365810	1545220	VÄRNAMO 1:10	VÄRNAMOHORVA	19920220	104	107,00	0,70	106,30		Rock	400	0,11	0,0010	3
31	66200142	6367760	1547250	MEDERHULT 1:20	FIGEHOLM	19830525	0	40,00	2,00	38,00		Rock	700	0,19	0,0051	3
32	66200144	6369000	1548730	GÄSSHULT 1:14	GÄSSHULT	19801026	107	82,00	2,40	79,60		Rock	200	0,06	0,0007	3
33	66200149	6365810	1545110	VÄRNAMO 1:8	VÄRNAMO	19780710	115	82,00	3,00	79,00	HUS	Rock	600	0,17	0,0021	3
34	66200151	6365150	1540750	JÄMSERUM 1:76	FIGEHOLM	19771006	114	27,00	16,50	10,50		Rock	8000	2,22	0,2116	3
35	66200156	6365090	1549140	STORA LAXEMAR 1:5, 1:9	FIGEHOLM	19861114	140	100,00	1,00	99,00	LAN	Rock	150	0,04	0,0004	2
36	66200157	6363320	1540320	KÖKSMÅLA 10:7	FIGEHOLM	1984	0	43,00	1,00	42,00	HUS	Rock	1000	0,28	0,0066	3
37	66200184	6367030	1549070	LILLA LAXEMAR 1:7	FIGEHOLM	19900716	140	46,00	3,50	42,50	HUS	Rock	2500	0,69	0,0163	3
38	66200203	6370310	1547620	GÄSSHULT 1:2	GÄSSHULT	199007	107	33,00	5,00	28,00		Rock	3000	0,83	0,0298	6
39	66290067	6371600	1544400		MISTERHULT	1931	100	101,00	5,00	96,00		Rock	120	0,03	0,0003	3
40	66290068	6371600	1544400		MISTERHULT		150	125,70	-9999,00	125,70		Rock	150	0,04	0,0003	3

Geological unit

1=Granodiorite to quartz monzodiorite, hornblende-bearing, grey to reddish grey, medium-grained, equigranular or weakly porphyritic

2=Diorite and gabbro, medium- to coarse-grained

3=Granite to granodiorite, reddish grey to greyish red, medium- to coarse-grained, generally porphyritic

4=Granite to quartz syenite, greyish red to red, fine- to medium-grained, equigranular

5=Granite to quartz syenite, greyish red to red, medium- to coarse-grained, equigranular

6=Granite, red, coarse-grained, fine to medium-grained equigranular

11=Glaciofluvial sand and gravel

12=Silt

Column 2-10, 12 and 14, are retrieved from the wellarchive at SGU while column 1, 11, 13, 15, 16, and 17 are computed by SwedPower

Wells that coincide geographically are shaded

No = code specific to this inventory

Coordinates = Coordinates are indicated in the system of RT90, 2,5 gon W

SGU Id = identity in SGU database

Specific capacity = Water capacity divided by drilling depth in meters

No	SGU Id	Coordinate X	Coordinate Y	Estate	Region	Date of drilling	Drill diameter (mm)	Total drill depth (m)	Drill depth in soil (m)	Drill depth in rock (m)	Use	Aquifer	Water capacity (l/h)	Water capacity (l/s)	Specific capacity (l/s*m)	Geological unit
41	66290070	6365500	1545200		MISTERHULT		100	60,40	-9999,00	60,40		Rock	1500	0,42	0,0069	3
42	66290072	6365000	1548700		FIGEHOLM		110	67,00	-9999,00	67,00		Rock	700	0,19	0,0029	2
43	66290081	6371600	1544400	KOMMUNALKONTORET	MISTERHULT	1963	150	109,30	2,50	106,80		Rock	1600	0,44	0,0042	3
44	66290082	6371600	1544400		MISTERHULT	1963	150	110,50	1,70	108,80		Rock	950	0,26	0,0024	3
45	67100001	6369160	1554150	LÅNGÖ 1:23	KRÅKELUND	19760519	133	15,00	3,00	12,00		Rock	120	0,03	0,0028	3
46	67100002	6369060	1554500	LÅNGÖ 1:17	KRÅKELUND	19760518	133	56,00	0,50	55,50	HUS	Rock	2	0,00	0,0000	1
47	67100004	6369440	1554990	LÅNGÖ 1:26	KRÅKELUND	19760520	0	37,00	2,00	35,00		Rock	30	0,01	0,0002	1
48	67100008	6367530	1552240	LÅNGÖ 2:16	LÅNGÖ	19800602	112	28,00	2,00	26,00		Rock	400	0,11	0,0043	3
49	67100023	6364980	1550790	STRÖM 1:7, 1:10	FIGEHOLM	19860926	135	40,00	2,50	37,50	HUS	Rock	4800	1,33	0,0356	3
50	67100024	6365500	1551500	SIMPEVARP	FIGEHOLM	1979	112	6,00	5,00	1,00		Rock	0	0,00	0,0000	2
51	67100025	6365500	1551500	SIMPEVARP	FIGEHOLM	1979	112	5,60	5,00	0,60		Rock	0	0,00	0,0000	2
52	67100026	6365500	1551500	SIMPEVARP	FIGEHOLM	1979	112	9,00	8,00	1,00		Rock	0	0,00	0,0000	2
53	67100027	6365500	1551500	SIMPEVARP	FIGEHOLM	1979	112	7,00	4,80	2,20		Rock	0	0,00	0,0000	2
54	67100028	6365500	1551500	SIMPEVARP	FIGEHOLM	1979	111	8,00	0,00	8,00		Rock	0	0,00	0,0000	2
55	67100029	6365500	1551500	SIMPEVARP	FIGEHOLM	1979	110	8,00	0,00	8,00		Rock	100	0,03	0,0035	2
56	67100030	6365500	1551500	SIMPEVARP	FIGEHOLM	1979	110	8,00	0,00	8,00		Rock	0	0,00	0,0000	2
57	67100037	6364970	1550300	GLOSTAD 1:5	FIGEHOLM	19890125	160	59,00	2,00	57,00	HUS	Rock	4000	1,11	0,0195	2
58	67100039	6366210	1550290	LILLA LAXEMAR 2:9	FIGEHOLM	19890419	0	56,00	0,00	56,00	HUS	Rock	300	0,08	0,0015	3
59	67100044	6369380	1555240	LÅNGÖ 1:13	KRÅKELUND	199107	140	36,00	0,80	35,20	HUS	Rock	500	0,14	0,0039	3
60	67100045	6369380	1555240	LÅNGÖ 1:13	KRÅKELUND	199110	115	57,00	1,00	56,00	HUS	Rock	150	0,04	0,0007	3
61	67100046	6366210	1550230	LILLA LAXEMAR 1:9	L LAXEMAR	19920109	109	31,00	0,60	30,40		Rock	200	0,06	0,0018	2
62	67190017	6365520	1550300	STORA LAXEMAR		19670115	112	38,50	0,00	38,50	HUS	Rock	1300	0,36	0,0094	2
63	67190069	6365600	1551800		SIMPEVARP	1960	150	98,00	10,00	88,00		Rock	4200	1,17	0,0133	2
64	67190070	6365600	1551800		SIMPEVARP	1960	150	114,00	2,70	111,30		Rock	180	0,05	0,0004	4
65	67190071	6368800	1554500		UT-LÅNGÖ	1966	115	83,00	0,00	83,00		Rock	500	0,14	0,0017	4
66	67190072	6368800	1554500		UT-LÅNGÖ	1966	115	41,00	0,00	41,00		Rock	1300	0,36	0,0088	4
67	67190073	6368800	1554500		UT-LÅNGÖ	1966	115	47,00	0,00	47,00		Rock	1080	0,30	0,0064	4
68	67190074	6368800	1554500		UT-LÅNGÖ	1966	115	44,00	0,00	44,00		Rock	1320	0,37	0,0083	4
69	67190075	6368800	1554500		UT-LÅNGÖ	1966	115	44,00	0,00	44,00		Rock	1120	0,31	0,0071	4
70	67190076	6369500	1555100		EKUDDEN	1966	115	77,00	0,00	77,00		Rock	100	0,03	0,0004	1
71	994010148	6367950	1552890	LÅNGÖ 2:14	LÅNGÖ	19931112	111	66,00	2,00	64,00	HUS	Rock	300	0,08	0,0013	3
72	994035087	6368580	1545195	MISTERHULT 4:15	BASTHULT	19941019	113	110,00	0,50	109,50	HUS	Rock	50	0,01	0,0001	3
73	995033198	6365626	1551998	SIMPEVARP 1:8	FIGEHOLM	19950704	115	50,00	0,00	50,00		Rock	-9999			2
74	995033206	6365626	1551998	SIMPEVARP 1:8	FIGEHOLM	19950706	115	50,00	0,00	50,00		Rock	-9999			2
75	995033222	6365626	1551998	SIMPEVARP 1:8	FIGEHOLM	19950710	115	37,00	0,00	37,00		Rock	1000	0,28	0,0075	2
76	995033230	6365626	1551998	SIMPEVARP 1:8	FIGEHOLM	19950713	115	90,00	0,00	90,00		Rock	100	0,03	0,0003	2
77	995038296	6367058	1545046	STORA BASTHULT 1:17	FIGEHOLM	19950530	112	75,00	2,00	73,00	HUS	Rock	1100	0,31	0,0042	3
78	995038353	6368798	1549431	GÄSSHULT 1:3		19950825	112	47,00	4,00	43,00	HUS	Rock	5000	1,39	0,0323	4

Geological unit

1=Granodiorite to quartz monzodiorite, hornblende-bearing, grey to reddish grey, medium-grained, equigranular or weakly porphyritic

2=Diorite and gabbro, medium- to coarse-grained

3=Granite to granodiorite, reddish grey to greyish red, medium- to coarse-grained, generally porphyritic

4=Granite to quartz syenite, greyish red to red, fine- to medium-grained, equigranular

5=Granite to quartz syenite, greyish red to red, medium- to coarse-grained, equigranular

6=Granite, red, coarse-grained, fine to medium-grained equigranular

11=Glaciofluvial sand and gravel

12=Silt

Column 2-10, 12 and 14, are retrieved from the wellarchive at SGU while column 1, 11,

13, 15, 16, and 17 are computed by SwedPower

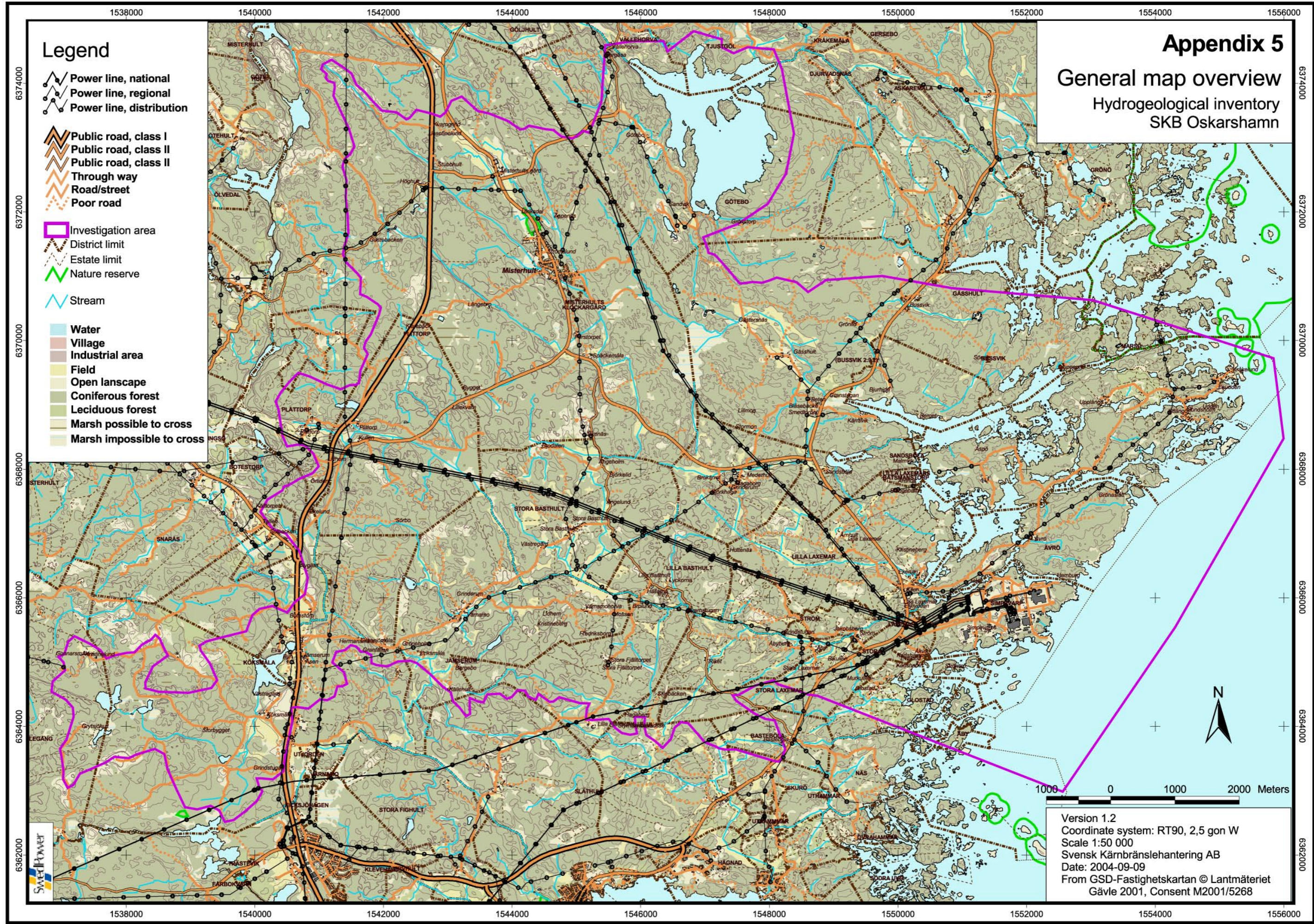
Wells that coincide geographically are shaded

No = code specific to this inventory

Coordinates = Coordinates are indicated in the system of RT90, 2,5 gon W

SGU Id = identity in SGU database

Specific capacity = Water capacity divided by drilling depth in meters

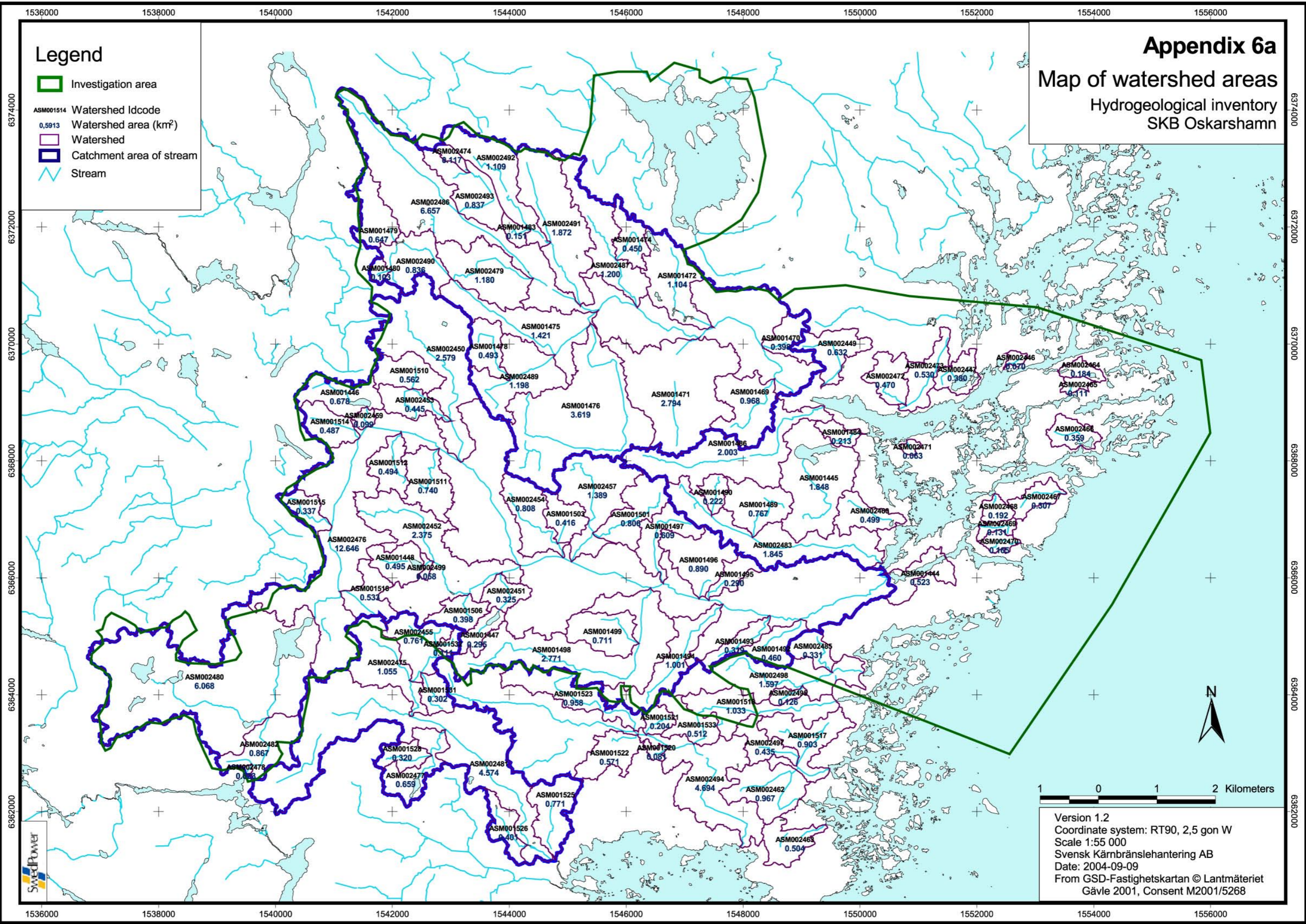


Appendix 5
General map overview
 Hydrogeological inventory
 SKB Oskarshamn

Legend

- Power line, national
- Power line, regional
- Power line, distribution
- Public road, class I
- Public road, class II
- Public road, class II
- Through way
- Road/street
- Poor road
- Investigation area
- District limit
- Estate limit
- Nature reserve
- Stream
- Water
- Village
- Industrial area
- Field
- Open lanscape
- Coniferous forest
- Leciduous forest
- Marsh possible to cross
- Marsh impossible to cross

Version 1.2
 Coordinate system: RT90, 2,5 gon W
 Scale 1:50 000
 Svensk Kärnbränslehantering AB
 Date: 2004-09-09
 From GSD-Fastighetskartan © Lantmäteriet
 Gävle 2001, Consent M2001/5268



Appendix 6a

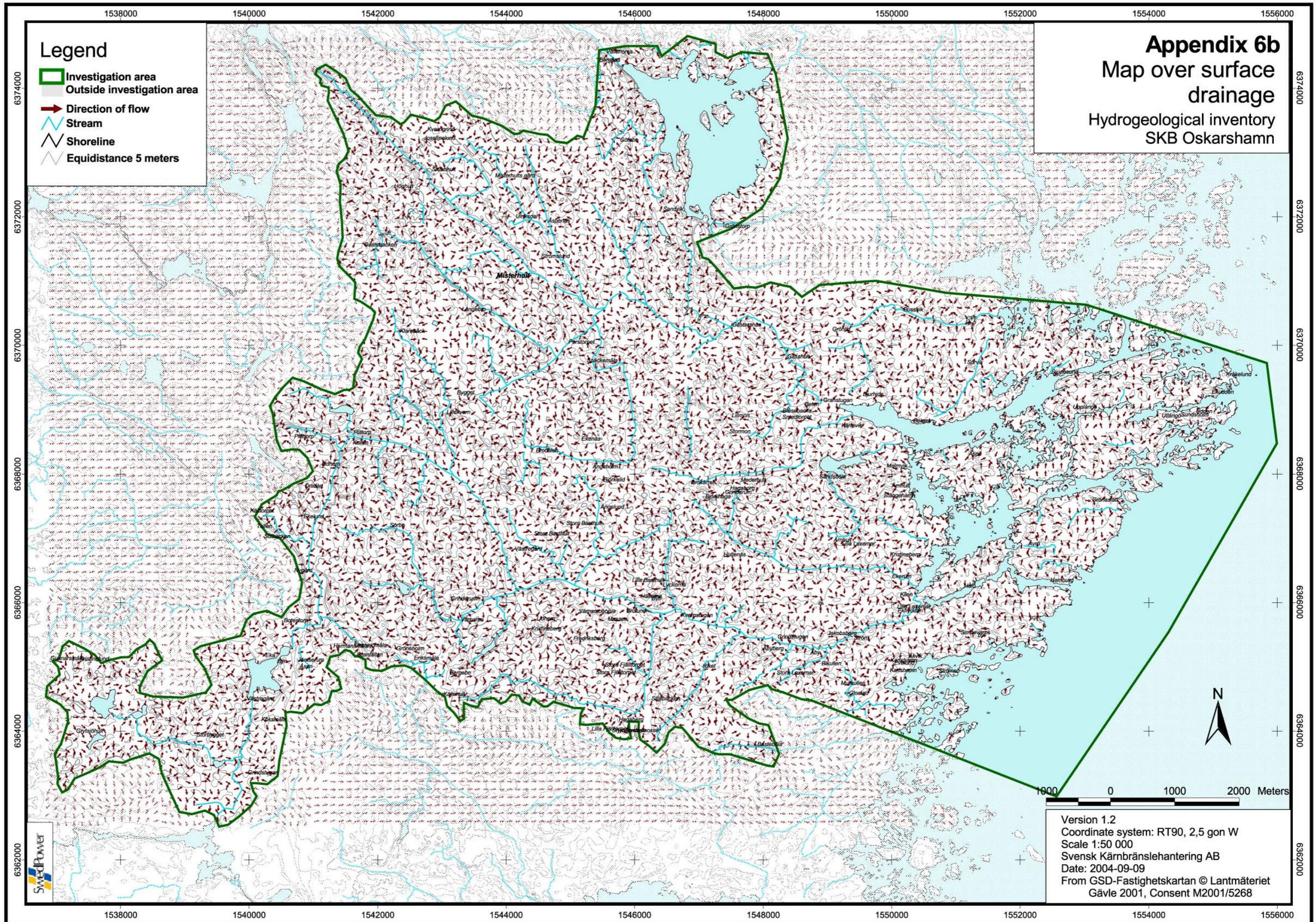
Map of watershed areas

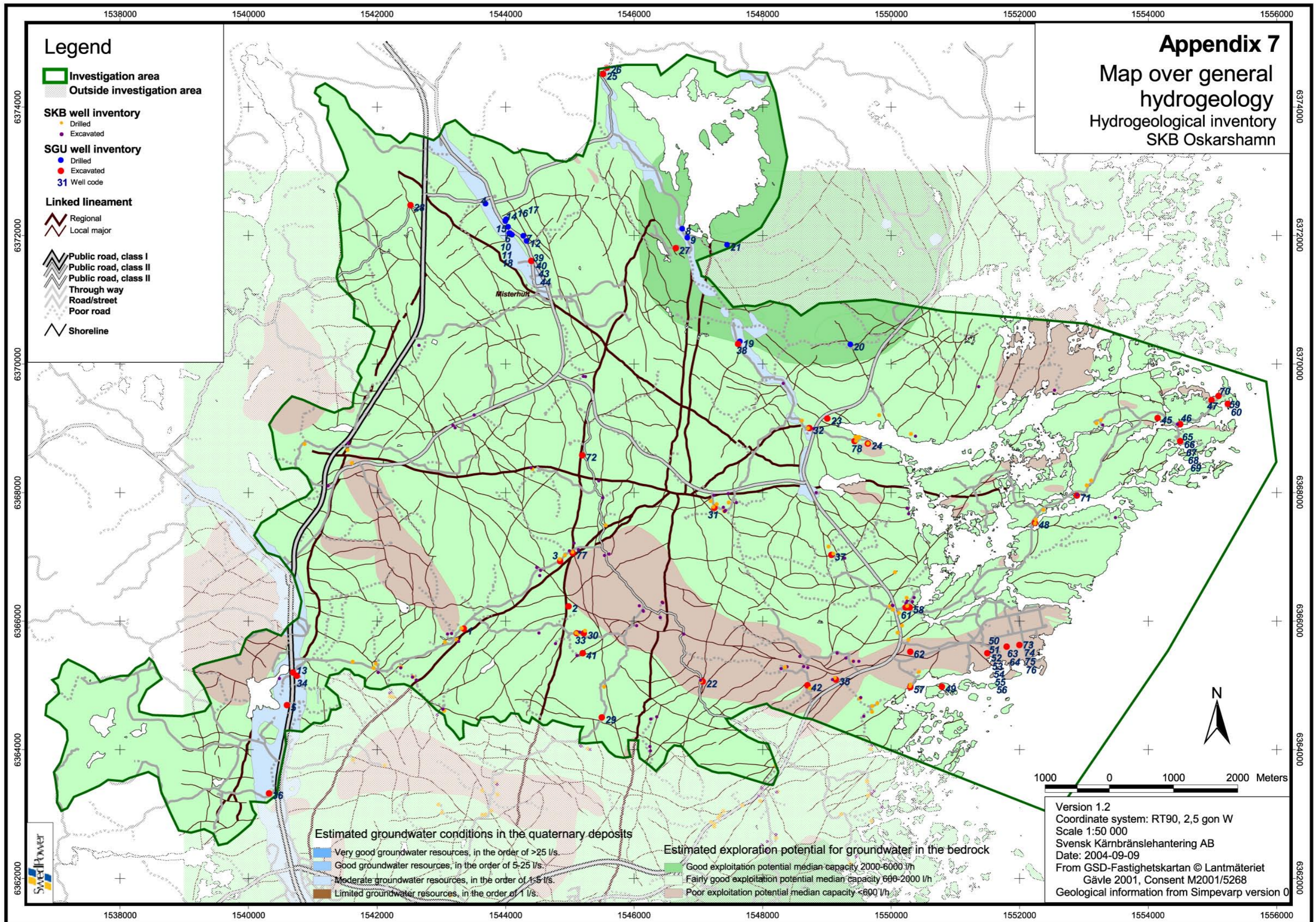
Hydrogeological inventory

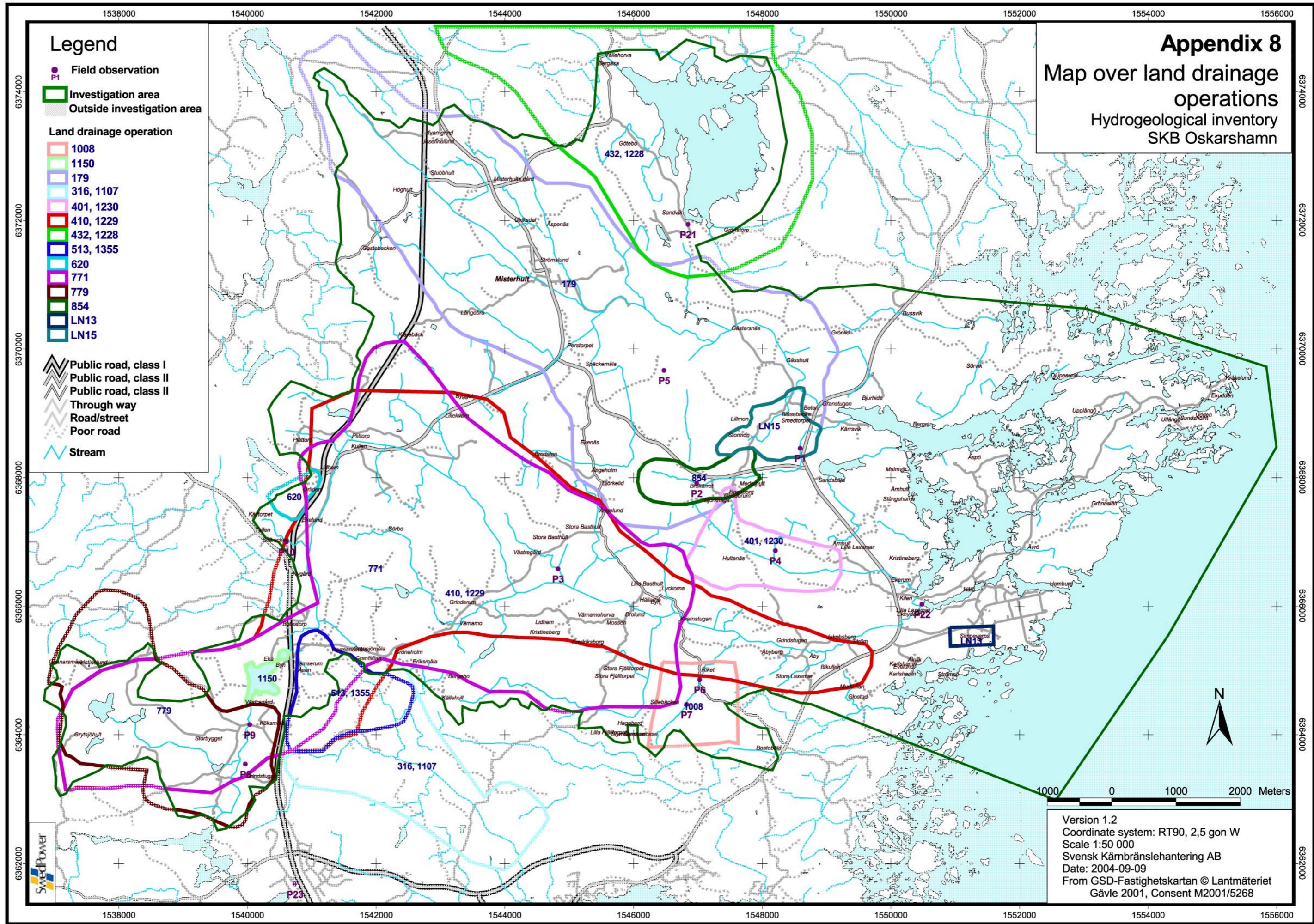
SKB Oskarshamn

- Legend**
- Investigation area
 - ASM001514 Watershed lcode
 - 0,5913 Watershed area (km²)
 - Watershed
 - Catchment area of stream
 - ~ Stream

Version 1.2
 Coordinate system: RT90, 2,5 gon W
 Scale 1:55 000
 Svensk Kärnbränslehantering AB
 Date: 2004-09-09
 From GSD-Fastighetskartan © Lantmäteriet
 Gävle 2001, Consent M2001/5268





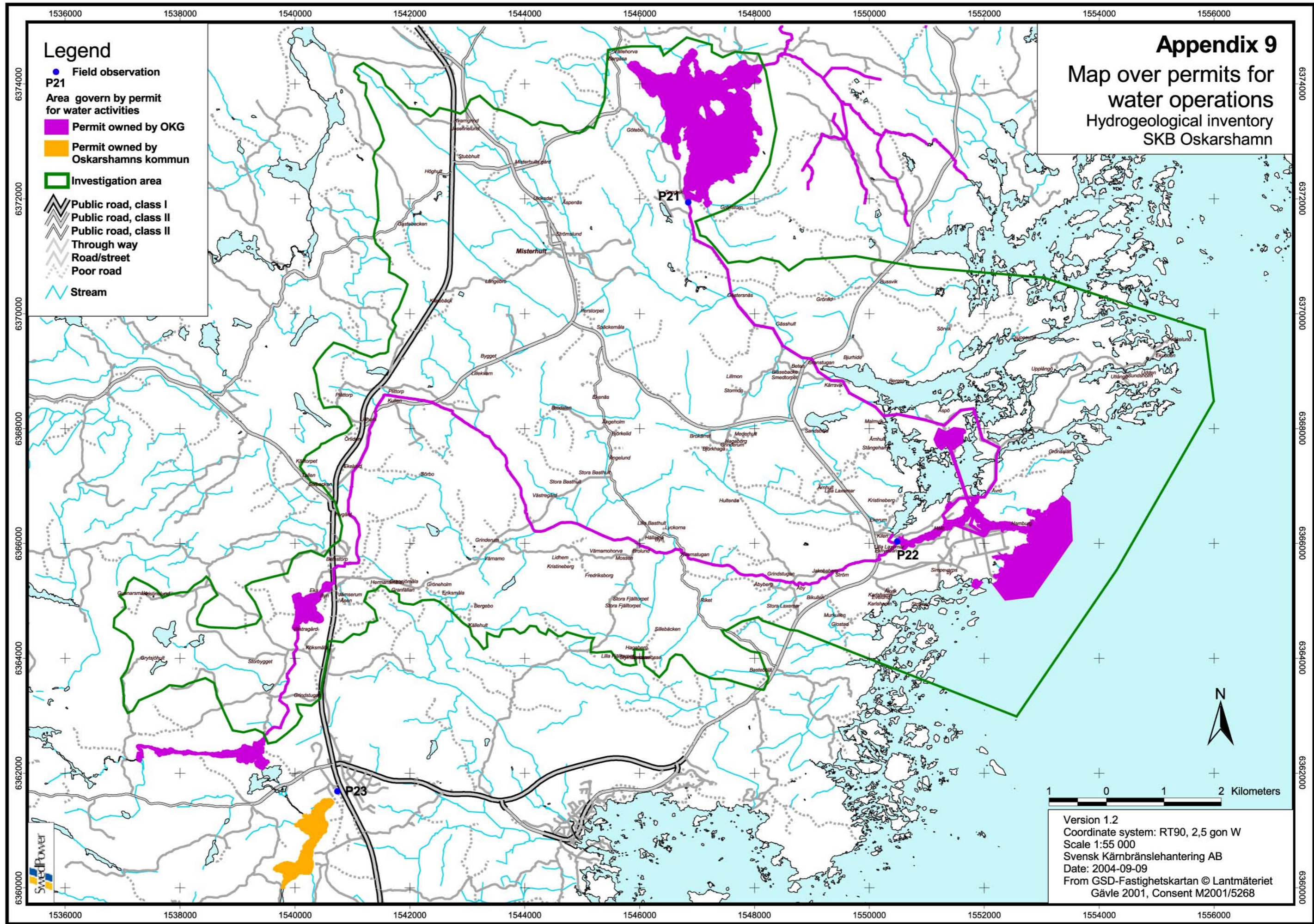


Appendix 8
Map over land drainage operations
 Hydrogeological inventory
 SKB Oskarshamn

Legend

- P1 Field observation
 - Investigation area
 - Outside investigation area
- Land drainage operation**
- 1008
 - 1150
 - 179
 - 316, 1107
 - 401, 1230
 - 410, 1229
 - 432, 1228
 - 513, 1355
 - 620
 - 771
 - 779
 - 854
 - LN13
 - LN15
- Public road, class I
 - Public road, class II
 - Through way
 - Road/street
 - Poor road
 - ~ Stream

Version 1.2
 Coordinate system: RT90, 2,5 gon W
 Scale 1:50 000
 Svensk Kärnbränslehantering AB
 Date: 2004-09-09
 From GSD-Fastighetskartan © Lantmäteriet
 Gävle 2001, Consent M2001/5268



Appendix 9
Map over permits for
water operations
 Hydrogeological inventory
 SKB Oskarshamn

- Legend**
- Field observation
 - P21**
Area govern by permit for water activities
 - Permit owned by OKG
 - Permit owned by Oskarshamns kommun
 - ▭ Investigation area
 - ▬ Public road, class I
 - ▬ Public road, class II
 - ▬ Public road, class II
 - ▬ Through way
 - ▬ Road/street
 - ▬ Poor road
 - ▬ Stream

Version 1.2
 Coordinate system: RT90, 2,5 gon W
 Scale 1:55 000
 Svensk Kärnbränslehantering AB
 Date: 2004-09-09
 From GSD-Fastighetskartan © Lantmäteriet
 Gävle 2001, Consent M2001/5268

List of contents in separate file

Enclosed separate to this report to SKB

Appendix

- 10 a) Archive materials concerning larger groundwater supplies
 - Fårbo
 - Misterhult
- 10 b) Archive materials concerning other quarries
 - Gravel quarry in Köksmåla
- 10 c) Archive materials concerning land drainage operations
- 10 d) Archive materials concerning permits for water operations
 - Fårbo groundwater supply
 - Permits concerning OKG