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Identification of catchments, lake-related drainage parameters and lake habitats

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Department of Limnology, Evolutionary Biology Centre
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Department of Ecology and Environmental Science
University of Umeå

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Svensk Kärnbränslehantering AB
Swedish Nuclear Fuel
and Waste Management Co
Box 250, SE-101 24 Stockholm
Tel +46 8 459 84 00

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Reading instruction

During the processing of surface hydrological data from the Forsmark area, a mismatch in specific discharge for the two sub-catchments 2:8 and 2:10 (Gällsboträsket, AFM000094, and Eckarfjärden, AFM000010) was seen early in the process. It was first assumed that it could be an effect of short time series, but in 2006 it became obvious that something was wrong in the delineation of sub-catchments. During a field investigation in late autumn 2006 a small running water draining to Eckarfjärden was identified which had been overseen in the original investigation. The new redrawn borders resulted in a larger sub-catchment for Eckarfjärden and correspondingly smaller sub-catchment for Gällsboträsket. After the revision, the specific discharge of the two areas became approximately the same.

The change of sub-catchment borders is the reason for the revision of this report. The new borders are now shown on all maps and the data in Appendices have been adjusted accordingly. Furthermore, in the revision the soil composition of the areas was updated according to the new soil map produced during the site investigations in Forsmark. Another change is that the areas without lakes or larger brooks situated between the coast line and the other catchments, here called “rest catchment areas”, have also been included, on maps as well as in the Appendices.

The field work performed in order to establish the new borders of the sub-catchments was performed by Per-Olof Johansson, Artesia Grundvattenkonsult AB. The digitizing of the new areas as well as updating of data for the Appendices has been performed by Mårten Strömgren, Umeå University. The new maps have been produced by Ulf Brising, Sweco Position, and Cecilia Berg, Geosigma AB, has prepared this updated report.

Contents

1 Introduction

SKB, The Swedish Nuclear Fuel and Waste Management Company, performs investigations of potential sites for a deep repository of spent nuclear fuel. These sites include currently two different areas: the Forsmark area in Östhammar, and the Simpevarp area in skarshamn. The sites will be investigated for data relevant to evaluate the construction and function of a planned deep repository. Scientists from several fields of investigation participate in this siting program. One part will describe potential effects on the biosphere, and as a tool for this a descriptive ecosystem model has been developed /Löfgren and Lindborg, 2003/. The data gathered about the ecosystems will also be used for the environmental impact assessment of the project.

The most convenient way to handle all information about the ecosystems, terrestrial as well as aquatic, is to sort the data into a system of different catchments. These catchments can then be used in a geographical information system to "cut out" the appropriate data from different layers in the system, in order to calculate transport of different substances and to assess the interactions between different areas and ecosystems.

The Forsmark area is situated between two large river catchments entering the Baltic Sea; River Tämnarån in north (SMHI catchment no 54) and River Forsmarksån in south (SMHI catchment no 55). The area between these two catchments, including the Forsmark area, is called no 54/55 according to the SMHI system. However, the siting programme needs a more detailed resolution, where sub-catchments are identified, e.g. for lakes and rivers/ creeks situated within the site investigation area.

This report describes eight river or lake catchments entering the Baltic Sea and situated within the Forsmark area. Some of these areas have been further divided into sub-catchments, in order to identify the catchment for each lake within the area. As a result, a total of 25 small catchments and sub-catchments have been identified. They are presented in this report, together with some basic data regarding size, land use etc. In addition, all the 25 lakes within the area are described and characterised by lake morphometry and habitat parameters, which are given in tables and maps. The purpose of these data is to serve as the basic information and the structure used when sorting all other information gathered into the geographical information system of the Forsmark area.

The geographical information system created for this investigation has been incorporated in SKB's database SICADA under field note number "Forsmark 115".

2 The structure of this report – instructions for reading

The aim of this report is to serve as a small "dictionary" of the catchments in the Forsmark area. The structure and numbering of the catchments follows the same principles as the SMHI system for identifying and numbering catchments in Sweden, although at a smaller and more detailed scale. While SMHI identifies totally five large water systems in Uppsala county that enters the Baltic Sea, we have identified and numbered eight smaller water systems discharging into the Baltic Sea within the SKB site investigation area of Forsmark. A hierarchic system has been constructed, where each catchment has been further divided if it contains more than a single lake. Each lake within the area thus has its own catchment. The catchments Forsmark 3, 5, 6 and 8 have only one lake each and, consequently, no sub-catchments. Another example, the catchment Forsmark 4, has two lakes, Lake 4:1 and Lake Lillfjärden. The sub-catchment of the upstream Lake Lillfjärden is numbered Forsmark 4:2. The catchment of the downstream Lake 4:1 includes sub-catchment 4:2 but also the downstream "remaining" area Forsmark 4:1. Hence, the catchment of Lake 4:1 is numbered Forsmark 4:1–2. The catchment Forsmark 2 has the most complicated hierarchy, with totally 11 sub-areas connected to each other in different branches of the water system. The different sub-areas have been numbered starting from the most downstream part and then proceeding upwards in the water system. When the water from upstream areas enter the same lake from different branches of the system, the flow direction of the different tributaries is prolonged until they meet the main direction of flow through the lake (the latter may be visualized as a line drawn through the lake). This makes it possible to number the entering tributaries in the order that they attach to the main flow direction, from downstream and upwards. This numbering makes it possible to choose the appropriate level of hierarchy in the data used for evaluation of different aspects of the ecosystems, e.g. for transport calculations of various substances etc. It is possible to evaluate data for the whole catchment, but also for different branches of the water system or for a single upstream lake.

When using this system of numbering, some downstream sub-areas not representing a whole lake catchment are formed (cf Forsmark 4:1 in the example above, which is only one part of the catchment of Lake 4:1, Forsmark 4:1–2). These downstream sub-areas are only briefly mentioned in this report, but data on size, land-use, geology, vegetation etc are included in the tables of Appendix 3–6. The characteristics of these near-lake areas are useful when evaluating the lakes, since the land use and other parameters in the close vicinity may have a profound effect on the lake ecosystem. These sub-areas are of course also useful for sorting and evaluating data of terrestrial and wetland areas and ecosystems.

The Result section starts with an overview map showing the eight Forsmark catchments draining into the Baltic Sea. In the following section (4.1), each of the catchments Forsmark 1 to Forsmark 8 are shown in overview maps of the whole Forsmark siting area, with the relevant sub-areas marked by yellow boundaries. The different lake sub-catchments within the catchment then follow, illustrated by a map of the catchment that shows which sub-area or sub-areas that are included.

The Appendices include tables with all data collected regarding the lakes (Appendix 1 and 2) and all the sub-catchments (Appendix 3–6). All lake catchments included in this report are listed in alphabetical order in the Lake Index, and in order of number in the Appendices. Some of the lakes, for which we have not found any local names, have been named by the number of the sub-catchment that they are situated within.

The terminology used regarding catchment identification is sometimes confusing and differs between English and American language. In this report we follow the English terminology, using “catchment” as an identification of the area draining to a certain point of a water system (usually a lake or river outlet), while “watershed” is defined as the border between different catchments.

3 Methods

3.1 Nomenclature/ Numbering of the catchments

The entire Forsmark site investigation area is situated between the catchment of River Tämnarån (SMHI catchment no 54) and the catchment of River Forsmarksån (SMHI catchment no 55), see Figure 3-1. Consequently, SMHI numbers this area as no 54/55. A systematic inventory of all smaller lakes and creeks entering the Baltic Sea within this area would render a set of catchments that could be numbered 54/55:1, 54/55:2 etc, until the most southern area 54/55:(n), north of the outlet of River Forsmarksån. As this kind of inventory has not been performed yet, the correct numbering of the Forsmark area catchments, situated in the central parts of area 54/55, is unknown. A detailed inventory of lakes and rivers within Uppsala county was earlier performed by /Brunberg and Blomqvist, 1998/, but still the resolution was not as high as in the present study; only two of the larger lakes within the site investigation area were treated as separate catchments. A coupling of the present catchments to the numbering system used in that inventory would generate a series of numbers for each catchment, which would be unnecessary long and sometimes also a bit confusing.

When numbering the catchments that now have been identified, we have used a system that follows the principles of the SMHI system /SMHI, 1985/, but the Forsmark area is treated as a separate area. The catchments discharging into the Baltic Sea are named Forsmark 1 (in north), Forsmark 2, etc until Forsmark 8, the southernmost catchment. By uncoupling the numbering from the SMHI system we avoid future confusion when other smaller sub-catchments of 54/55 may successively be identified.

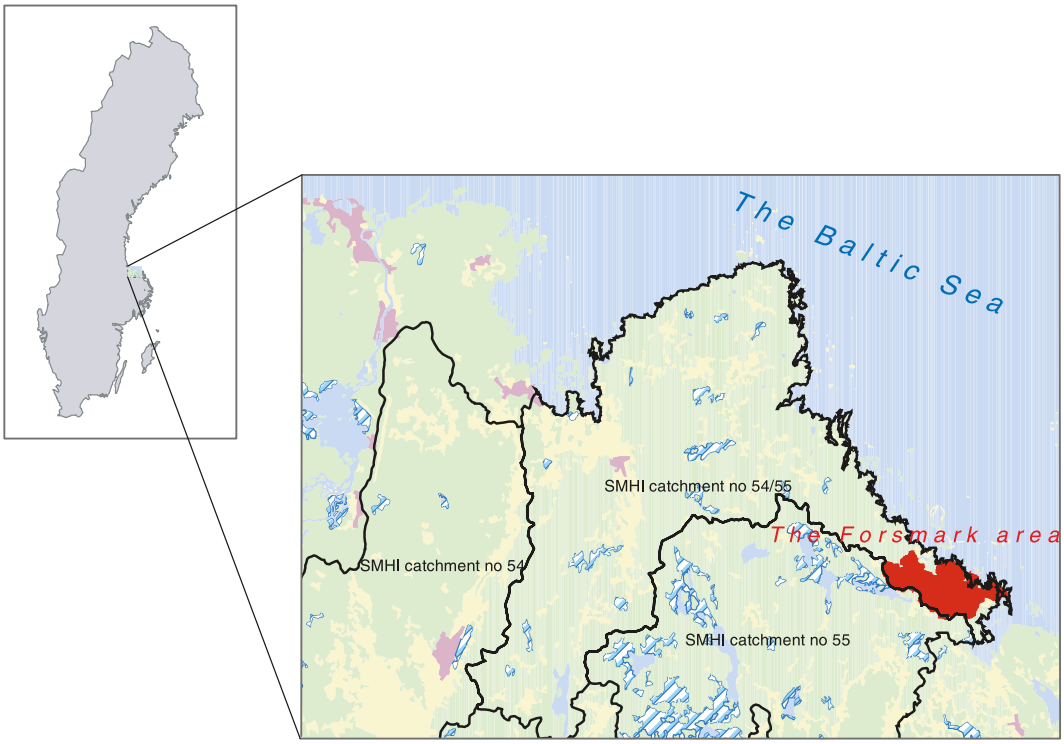

Figure 3-1. *The location of the Forsmark area, situated within the SMHI catchment no 54/55.*

Between the catchments identified here and draining to the sea, intervening areas are formed along the coast, which do not have any lakes or larger creeks. Following the principles of the SMHI numbering system, these areas will be named Forsmark 1/2 (the area between Forsmark 1 and Forsmark 2), Forsmark 2/3, and further to Forsmark 7/8.

3.2 Identification of watersheds

As a first step to identify the watersheds, a digital elevation model (DEM) was used in the ArcGis 8 GIS-programme. The DEM (SKB 10 m resolution grid) was converted to a flow direction grid using the Hydrological Modelling Extension in ArcGis 8. Using hydrological modeling in ArcGis 8 requires a DEM without local sinks. A local sink is defined as a cell situated at a lower level than all surrounding cells. Thus, this area would accumulate water. Local sinks in a DEM are normally due to error in the data. Naturally occurring sinks in a DEM with a cell size larger than 10 m are rare /Mark, 1988/, apart from in areas with glaciers or karst. In order to delete unwanted errors in the DEM, the local sinks can be filled up to the level of the lowest of the adjacent cells. The sinks are filled in with the function *Hydrology < Fill sinks...* and the new DEM is established by right-clicking the name of the layer. Next step towards identifying the watersheds is to make a new grid with flow directions for each cell, using the filled DEM as input. ArcGis calculates the slope gradient direction using the elevation value in the cell and elevation values for the eight adjacent cells. Hence, there are eight possible outcomes, which are classified in the new grid with a value 1 for north, 2 for northeast, 4 for east (always a doubled value) etc to 128 for northwest /Jensson and Dominque, 1988/. The flow direction grid is made with *Hydrology < Flow Direction …* using the filled grid as input and converted to a point layer in shape format using ArcToolbox. The flow direction code values are converted to degrees with geographic rotation format (360 degrees circle, 0 degrees in positive Y-axis and clockwise increase).

Using the filled DEM as input, a new grid with gradient values was created. *Derive Slope* identifies the slope, or maximum rate of change, from each cell to its neighbours. The output slope grid theme represents the degree of slope for each cell location. This new grid was converted to a point layer in shape-format and spatially joint to the flow direction point layer. Each cell in the former DEM is now represented by a point with two attributes; flow direction in degrees (0–360) and slope in degrees (0–90). This point layer is displayed in the GIS-application with an arrow symbol where the directions of the arrows are in the flow direction and the lengths of the arrows are proportional to the slope value. The watersheds were digitized on the screen using the arrows as background. Watersheds situated at clearly formed ridges are easy to distinguish between long arrows directed in opposite directions (see red line in Figure 3-2), while in flat areas, where the arrows are short and the directions are varying or parallel, the exact position of the watershed is difficult to distinguish (see blue line in Figure 3-2). In these areas the watersheds must be verified by field control.

The topography of the Forsmark area is not very dramatic, and in many cases it is difficult or even impossible to identify the watershed from the maps, regardless of which method used (digital, manual). Many of the watersheds suggested from the maps / computer calculations thus had to be verified by field control. This was made during fieldwork periods in 2002, using DGPS equipment and the topographical map. The corrected watersheds were stored in polygon layers in shape-format in the SKB GIS of the Forsmark area.

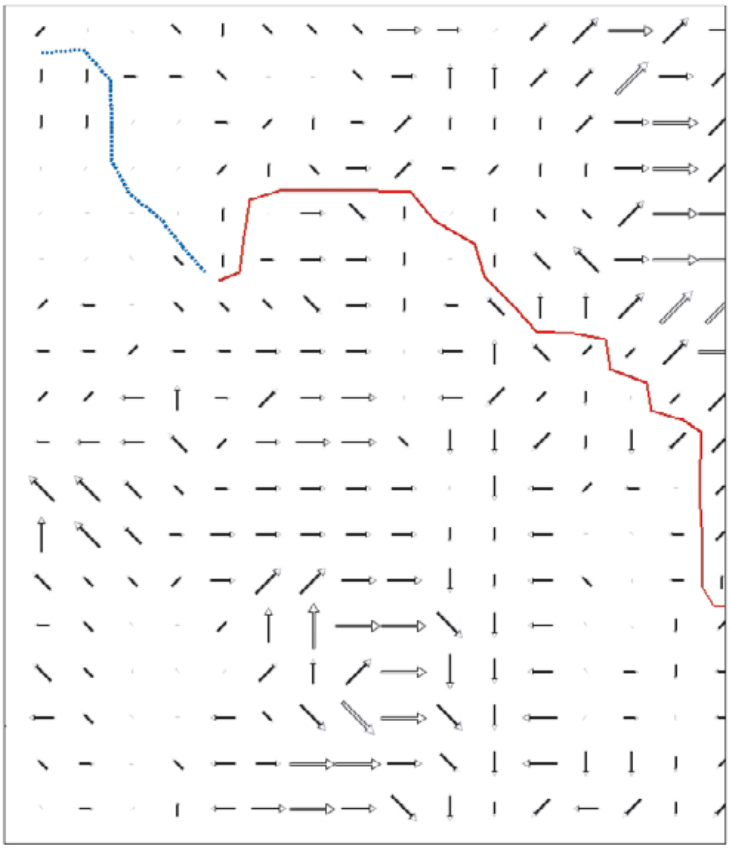

Figure 3-2. *Arrows showing flow direction and slope at each cell in a digital elevation model. The red line represents a watershed distinguished with high accuracy while the blue line represents a watershed that needs to be verified by field control.*

3.3 Data collection and field investigations

Simultaneous with the watershed identifications, data regarding the characteristics of lakes and catchments have also been acquired from various sources and by field investigations during 2002 and 2003. The results have now been compiled and evaluated. Results from all lake catchments within the Forsmark area are reported here, according to the following structure:

The location of the object

The name of the lake, according to the SMHI register of Swedish lakes, is given. In cases when no name of the lake has been found, the lakes have been numbered according to the sub-catchment in which they are located, e.g. Lake 2:2 (in the sub-area Forsmark 2:2), and Lake 4:1 (in the sub-area Forsmark 4:1).

A reference is given to the appropriate number of the Swedish topographical map. The x and y coordinates for the outlet are given, if available from the SMHI register of Swedish lakes /SMHI, 1996/, using the Swedish national grid (RT 90 2,5 G W). A reference to the SMHI catchment number is included, and also to the corresponding sub-catchments of the earlier performed inventory of /Brunberg and Blomqvist, 1998/.

The catchment area and its major constituents

Using overlay technique, the catchment GIS polygones achieved from the determination of watersheds were used to "cut" and calculate the distribution of different land use, vegetation, soils etc, from the digital sources available in the SKB regional GIS (digital elevation models, topographical maps, soil maps, vegetation maps, population densities, number of residences). For each sub-catchment, a number of parameters regarding size, landuse and morphometry have been calculated. All raw data for the different sub-catchments are given in Appendix 3–6, including information from the Swedish digital topographical map, the SKB vegetation map of the Forsmark area, and the digital soil map of SGU. The following information has been extracted and included in the report for each lake catchment:

- The total area of the catchment.
- The % coverage of different land uses, identified from the digital topographical map and classified into forest (Ma 2, Ma 6 and Ma 19), water surface (Ma 1), agriculture (Ma 4) and remaining open land (Ma 5 and Ma 17), respectively. In addition, the percentage coverage of wetland was calculated, adding the categories "veg61–64", "veg72" and "veg74–79" from the SKB vegetation map. The percentage coverage of wetland areas thus represents varying parts of the other calculated land use classes.
- Surface waters within the catchment. Lakes are given, and, if available from the topographic maps, the number and location of inlet creeks. Outlet creeks, if present, have been located from the maps and from field observations.

Lake morphometry parameters

Following the methodology of /Blomqvist et al, 2000/, a number of lake morphometry parameters were measured and/or calculated, respectively. Depth soundings were performed in all the lakes, manually from ice during winter in small lakes, or using the DGPS/echo-sounder equipment described by /Brydsten et al, 2004/ in the larger lakes. From these data, bathymetric maps as well as depth grid maps were constructed for each lake.

A large set of different lake morphometry parameters were calculated. From these data, the lake area, maximum and mean depth, lake volume and the theoretical water renewal time is given in a table for each lake. The full set of morphometric data is given in Appendix 1.

Lake ecosystem parameters

The ecosystem parameters investigated so far, and reported here, includes the habitat diversity of the lake ecosystems. Lake ecosystems can be divided into five major habitats:

1. Littoral type I: The littoral habitat with emergent and floating-leaved vegetation. This habiat is developed in wind-sheltered, shallow areas where the substrate is soft and allows emergent and floating-leaved vegetation to colonise.
2. Littoral type II: The littoral habitat with hard substrate. This habitat develops in wind-exposed areas of larger lakes, but also in smaller lakes, where the lake morphometry includes rocky shores. The photosynthesising organisms colonising in these areas include species that are able to attach to the hard substrate, e.g. periphytic algae.
3. Littoral type III: The littoral habitat with submerged vegetation. This habitat is found in deeper areas of the lakes, where light enough to sustain photosynthetic primary production penetrates down to the sediment. As the lakes in the Forsmark area generally are very shallow and have clear water, this is a common habitat that covers large parts of the bottom areas.

4. The profundal habitat. This habitat, which is more or less absent in the Forsmark area, develops at the sediments of the lakes where light penetration is less than needed to sustain a permanent vegetation of primary producers. Non-photosynthesising organisms dominate this habitat. The profundal organisms are dependent on carbon supplies imported from other habitats of the lake or from allochtonous sources.

5. The pelagic habitat. This habitat includes the open lake water, where a pelagic food-web based on planktic organisms is developed. Depending on the light availability, these plankton are dominated by either photosynthetic production (i.e. by autotrophic phytoplankton) or, if the water is strongly coloured or turbid, by heterotrophic carbon processing (e.g. by heterotrophic or mixotrophic bacterioplankton and phytoplankton). The pelagic habitat covers the same area as the sum of all littoral type II, littoral type III or profundal habitats within a lake.

According to the methodology of /Blomqvist et al, 2000/, the distribution of these major habitats was determined in the field, by walking around the lake and/or from boat. The borders between the habitats were recorded by DGPS equipment. The data were incorporated into the SKB regional GIS, as attributes to the "Lake polygone theme", and used for calculating the areas of each major habitat present within the lake.

Additional remarks

No other systematic inventories have been performed so far, but any additional notes are reported in this section, e.g. obvious damages to the lakes by human activities, notations of red-listed species that have been encountered in the literature or during field work etc. It should be remembered, however, that a lack of such notations does not necessarily mean that there is a lack of damages or rare species. Future investigations are needed to complete these occasional observations.

4 Results

The entire Forsmark area is situated within the SMHI catchment no 54/55, i.e. in the area between River Tämnarån (SMHI catchment no 54) and River Forsmarksån (SMHI catchment no 55), see Figure 3-1. A total of eight catchments have been identified that are situated partly or entirely within the SKB site investigation area (Figure 4-1). These eight catchments have outlets to the Baltic Sea. Between these catchments, coastal areas without lakes or larger creeks are formed, which are delineated by the watersheds of the catchments and the coastal shoreline. These "rest areas" are described in section 4.9 and are included as catchments in the SKB data base, and named "Forsmark 1/2" for the area between the catchments Forsmark 1 and Forsmark 2, "Forsmark 2/3" for the area between the catchments Forsmark 2 and Forsmark 3, etc.

The entire area is covered by the Swedish topographical maps no 12 I NO and 13 I SO. The maximum elevation over the sea level within the area is 27 m (Forsmark 1, see Appendix 3).

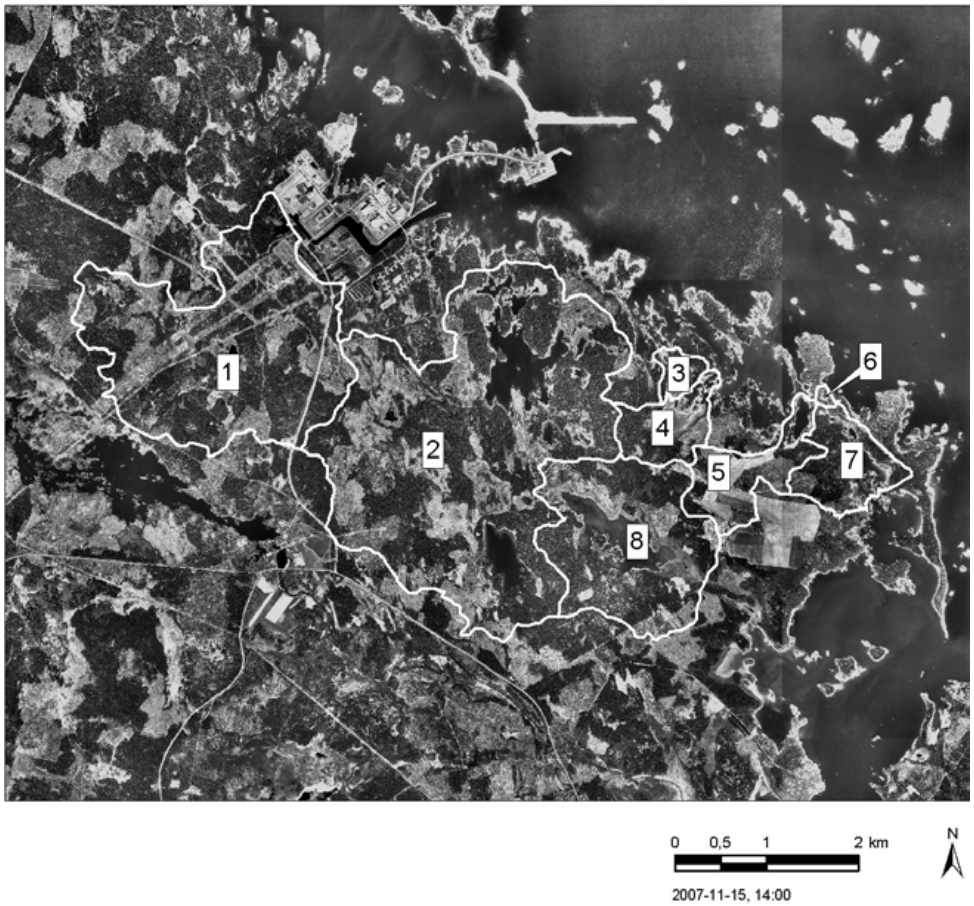

Figure 4-1. *The Forsmark area, with the eight catchments described in this report.*

4.1 The catchment Forsmark 1

This area is divided into four different sub-areas (Figure 4-2): Lake Gunnarsbo-Lillfjärden South (sub-area no 1:1), Lake Gunnarsbo-Lillfjärden North (no 1:2), Lake Labboträsket (sub-area no 1:3) and Lake Gunnarsboträsket (no 1:4). The areas 1:1, 1:3 and 1:4 constitute a chain of lakes, where the water from Gunnarsboträsket enters Labboträsket, which in turn enters Gunnarsbo-Lillfjärden South. Area 1:2 (Lake Gunnarsbo-Lillfjärden North) discharges into Lake Gunnarsbo-Lillfjärden South via a drainage pipe through the encroachment separating the two lake basins.

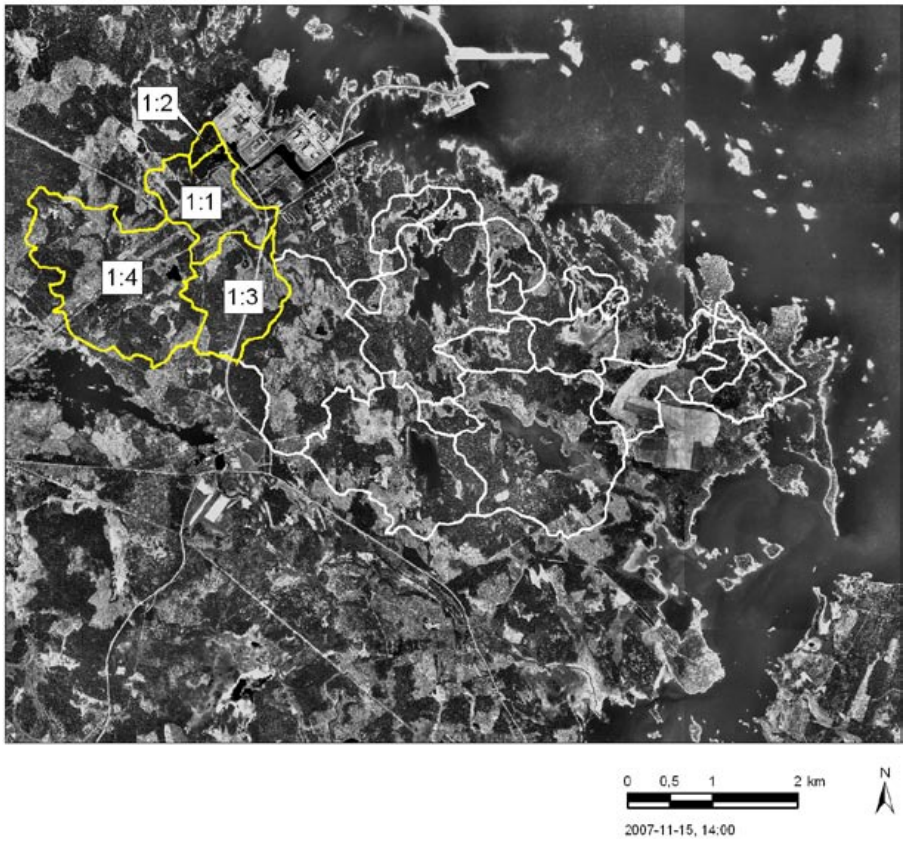

Figure 4-2. *The Forsmark area with the four sub-areas in catchment Forsmark 1 marked with yellow boundaries.*

Forsmark 1:1–4. Lake Gunnarsbo-Lillfjärden South (the entire catchment)

The location of the object

This catchment is part of the SMHI catchment no 54/55 and equals catchments no 54/55:25–26 in /Brunberg and Blomqvist, 1998/.

Topographical map: 13 I SO
Outlet coordinates: 670062, 162961 (SMHI)
Elevation: 1.60 m above sea level

The catchment area and its major constituents

The total catchment area is 5.120 km^2, where forest is the dominating land use (Table 4-1).

Table 4-1. The different land uses within the entire catchment of Lake Gunnarsbo-Lillfjärden South. The data are added from four sub-areas (see Appendix 4 and 6 for data of each sub-area).

Land use	Area [%]
Forest	83
Water surface	1
Agriculture	1
Remaining open land	15
Wetland (included in forest and/or remaining open land)	10

The surface waters within this catchment are Lake Gunnarsbo-Lillfjärden South, Lake Gunnarsbo-Lillfjärden North, Lake Labboträsket, and Lake Gunnarsboträsket. The North and South basin of Lake Gunnarsbo-Lillfjärden are separated by a road, which has been constructed through the original lake basin. The drainage from the North to the South basin is channeled through a pipe, but a diffuse drainage may also occur through the construction material. Lake Gunnarsbo-Lillfjärden South also has one inlet creek from southwest, originating from the two upstream lakes. The outlet passes close by the Forsmark nuclear power plant northeast of the lake, and enters the Baltic Sea in Asphällsfjärden.

Lake morphometry parameters

Figure 4-4 and Figure 4-5 show the bathymetric map and the depth grid map, respectively, for Lake Gunnarsbo-Lillfjärden South basin.

Lake Gunnarsbo-Lillfjärden South basin is very shallow, but is still one of the deepest lakes within the Forsmark area with a maximum depth of 2.2 m. It has furthermore a very short theoretical water renewal time, also when compared to the other lakes in the Forsmark area (Table 4-2).

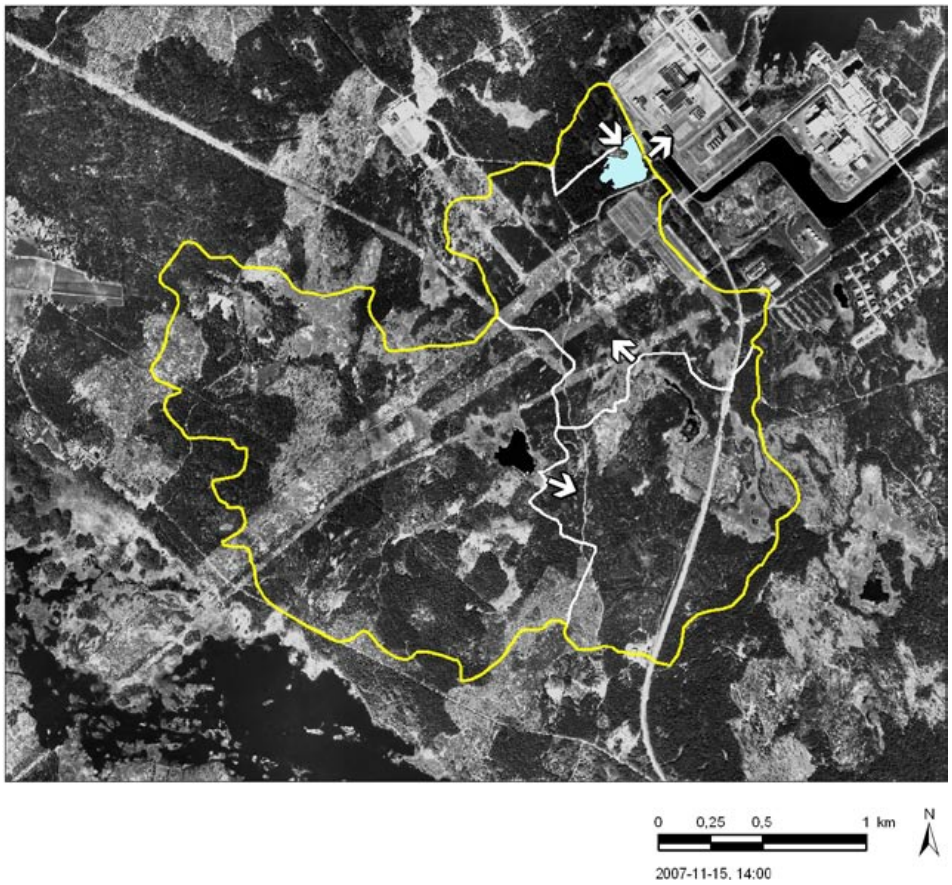

Figure 4-3. *The catchment Forsmark 1 with Lake Gunnarsbo-Lillfjärden South basin and its catchment (sub-areas 1–4) marked with yellow boundaries.*

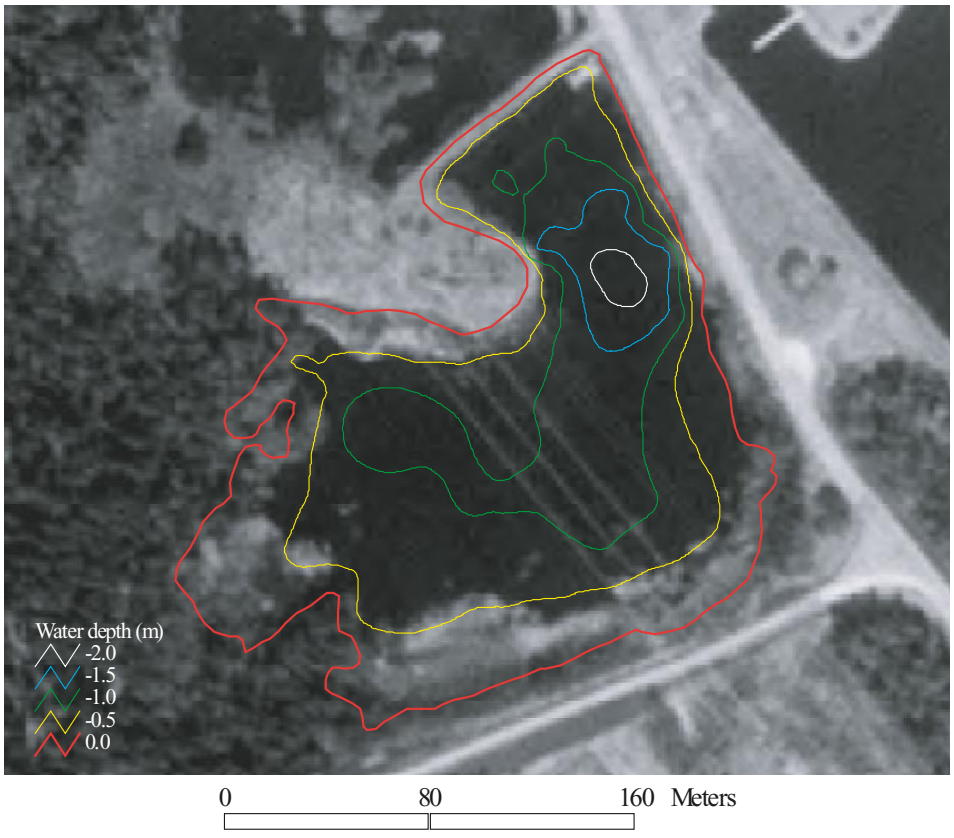

Figure 4-4. *Bathymetric map for Lake Gunnarsbo-Lillfjärden South basin.*

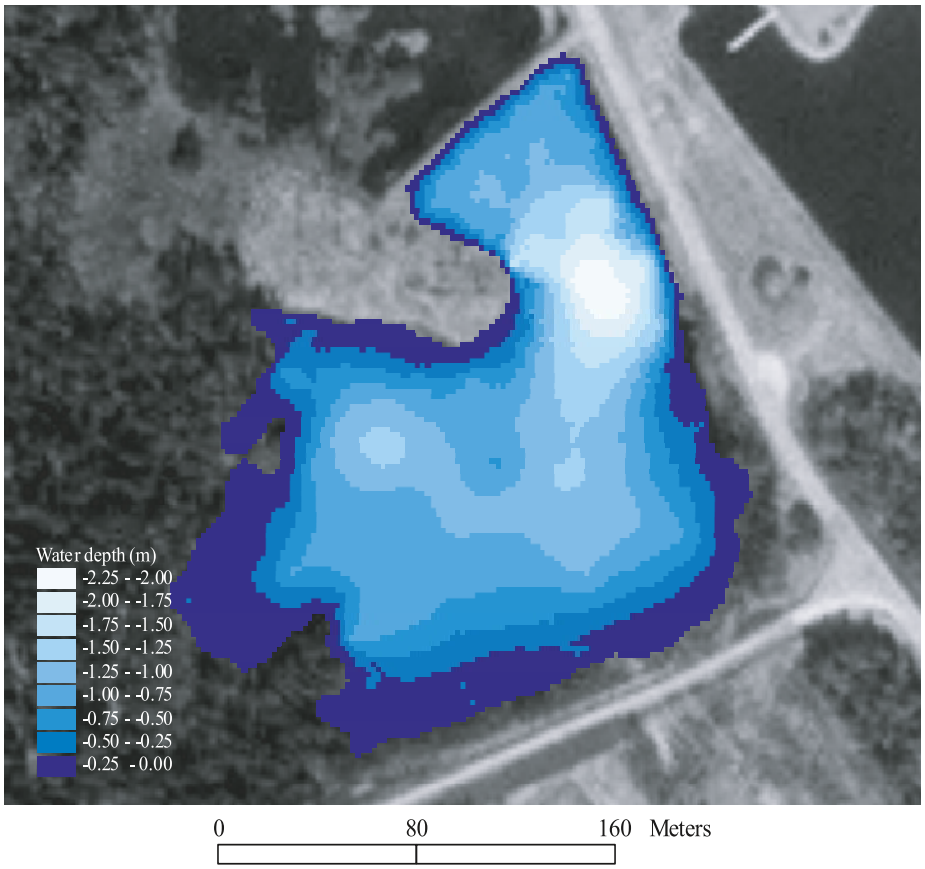

Figure 4-5. *Depth grid map for Lake Gunnarsbo-Lillfjärden South basin.*

Table 4-2. Lake morphometry parameters for Lake Gunnarsbo-Lillfjärden South basin.

Lake morphometry	
Lake area	0.03 km2
Maximum depth	2.2 m
Mean depth	0.7 m
Volume	0.023 Mm3
Theoretical water renewal time	7 days

Lake ecosystem parameters

The ecosystem of Lake Gunnarsbo-Lillfjärden south basin is relatively uncomplicated with three main habitats present; a pelagic habitat, a littoral habitat of type I with emergent and floating-leaved vegetation, and a littoral habitat of type III with submersed vegetation (Table 4-3 and Figure 4-6). Due to the clarity of the water and shallowness of the basin, the entire bottom area is light-exposed and no profundal habitat is present. Neither is there any nearshore hard-bottom habitat present in the lake, with a minor exception of part of the side of the road that has been constructed through the original lake and that now separates the two basins. The three main habitats are of approximately the same size; the pelagic habitat and the littoral habitat with submersed vegetation being of equal size and distribution (Table 4-3).

Table 4-3. Distribution of major habitats in Lake Gunnarsbo-Lillfjärden South basin.

Habitats	Area [%]
Pelagial/Littoral type III	54
Littoral type I	46

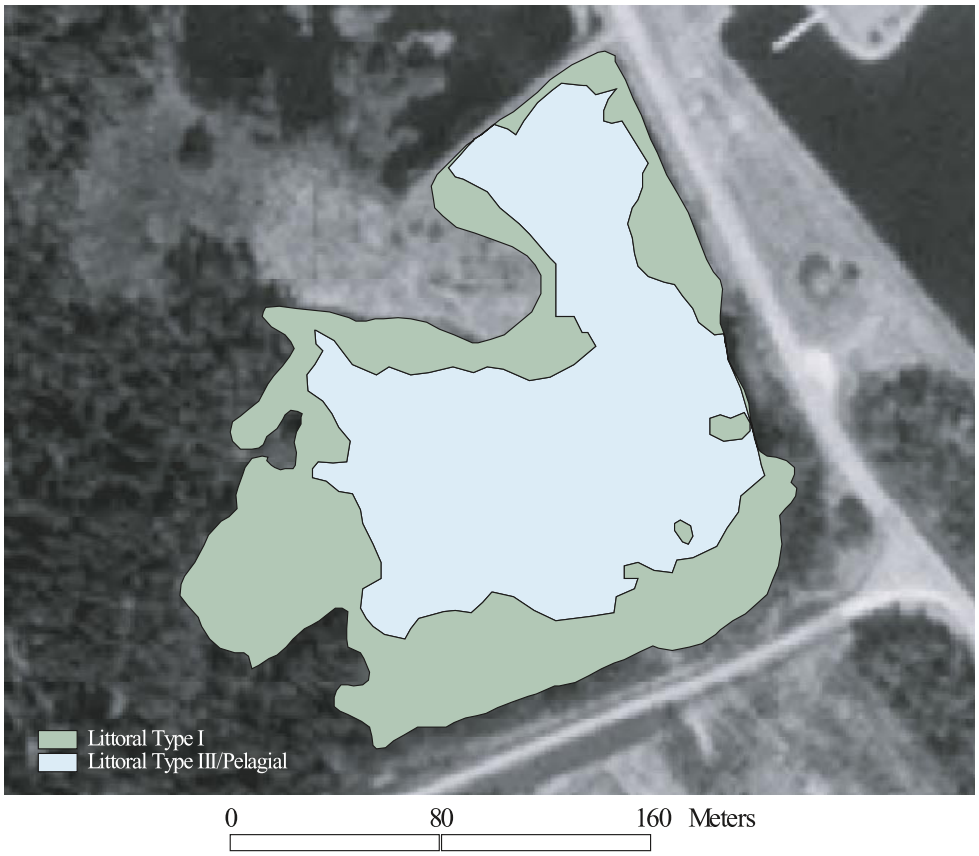

Figure 4-6. *Distribution of major habitats in Lake Gunnarsbo-Lillfjärden South basin.*

Additional remarks

Lake Gunnarsbo-Lillfjärden has been subject to physical damages during the construction of the nuclear power plant. The main damages seem to be that the lake has been isolated from its natural outlet, the new one being double pipes under the adjacent road. Furthermore, at construction of the road, part of the lake has been filled in with construction material and, secondly, a small road has been constructed through the original lake basin separating the north and south basins.

Forsmark 1:1. Lake Gunnarsbo-Lillfjärden South basin (sub-area)

See Appendix 3–6 for data on sub-catchment parameters. For lake data, see Forsmark 1:1–4 (entire catchment).

Forsmark 1:2. Lake Gunnarsbo-Lillfjärden North basin

The location of the object

This catchment is part of the SMHI catchment 54/55 and part of catchment no 54/55:25 in /Brunberg and Blomqvist, 1998/.

Topographical map: 13 I SO
Outlet coordinates: (no data)
Elevation: 1.64 m above sea level

The catchment area and its major constituents

The total lake catchment area is 0.104 km^2 and land use is dominated by forest (Table 4-4).

Table 4-4. The different land uses within the catchment of Gunnarsbo-Lillfjärden North basin.

Land use	Area [%]
Forest	81
Water surface	9
Agriculture	0
Remaining open land	10
Wetland (as parts of the above land use categories)	18

The only surface water within this catchment is Lake Gunnarsbo-Lillfjärden North basin. The lake has no inlet creek. The outlet water leaves the lake via a pipe through the road that separates the lake from Lake Gunnarsbo-Lillfjärden South basin. A diffuse drainage may also occur through the construction material. The outlet from the South basin downstream enters the Baltic Sea in Asphällsfjärden.

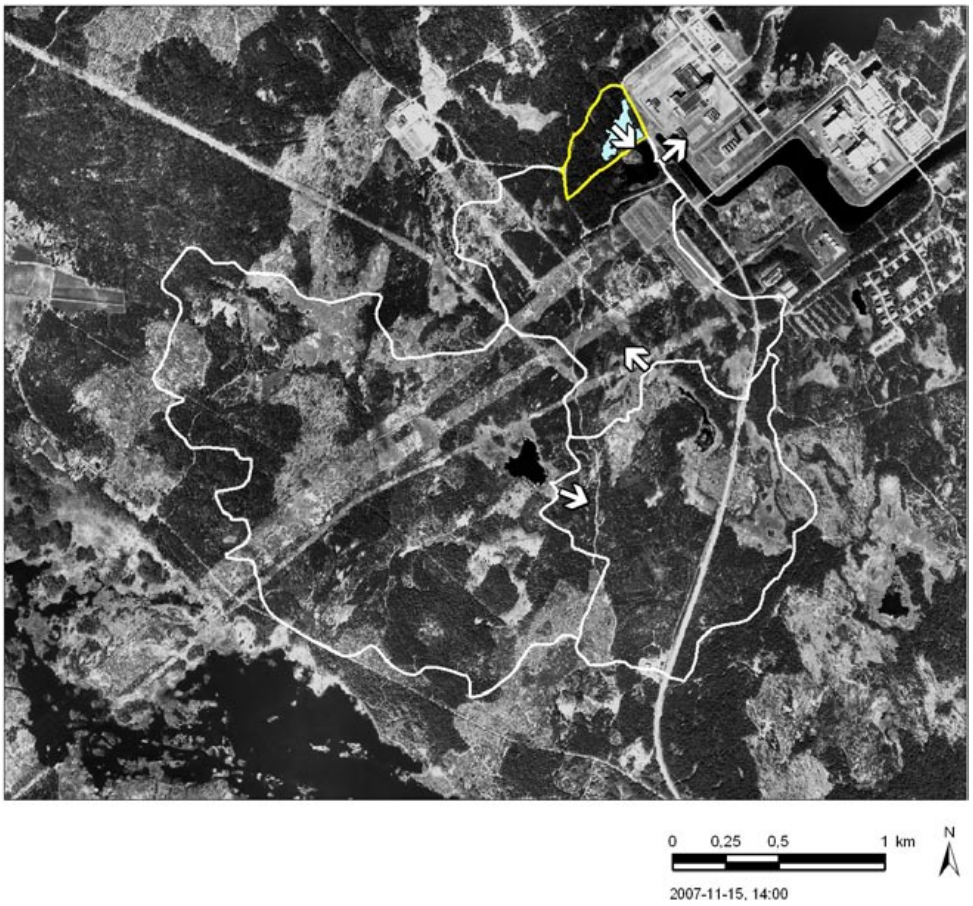

Figure 4-7. *The catchment Forsmark 1 with Lake Gunnarsbo-Lillfjärden North basin and its catchment (sub-area 2) marked with yellow boundaries.*

Lake morphometry parameters

Figure 4-8 and Figure 4-9 show the bathymetric map and the depth grid map, respectively, for Lake Gunnarsbo-Lillfjärden North basin.

Lake Gunnarsbo-Lillfjärden North basin is very shallow (maximum depth 0.9 m) but has a long theoretical water renewal time. The lake has four small islets.

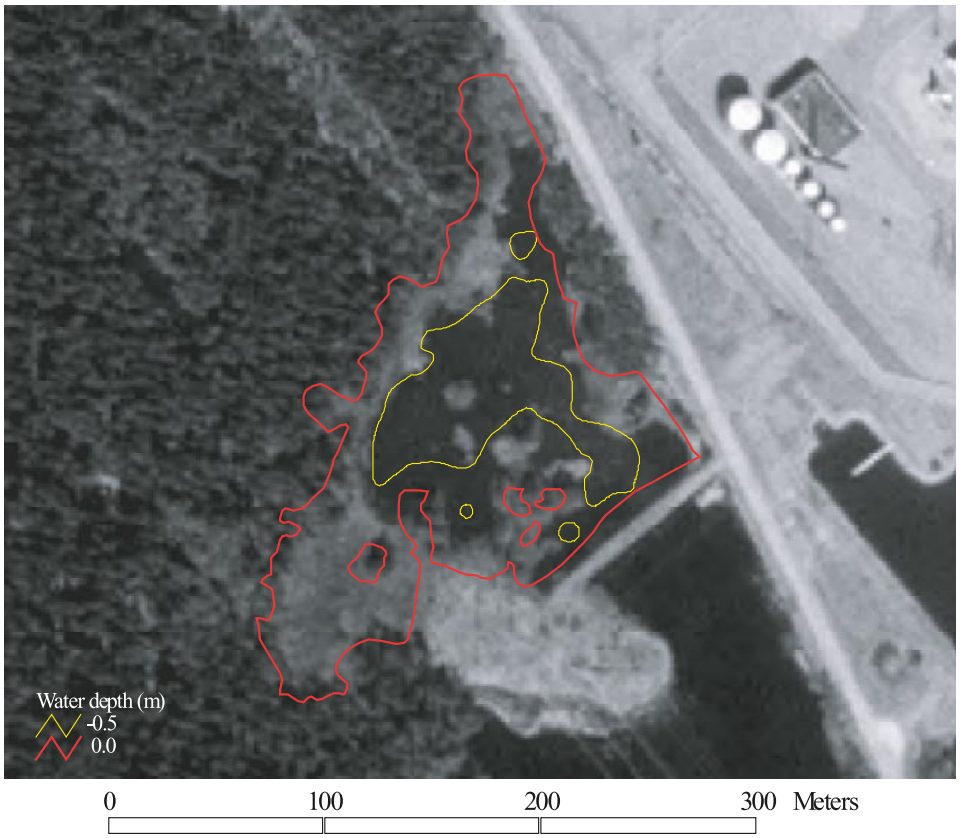

Figure 4-8. *Bathymetric map for Lake Gunnarsbo-Lillfjärden North basin.*

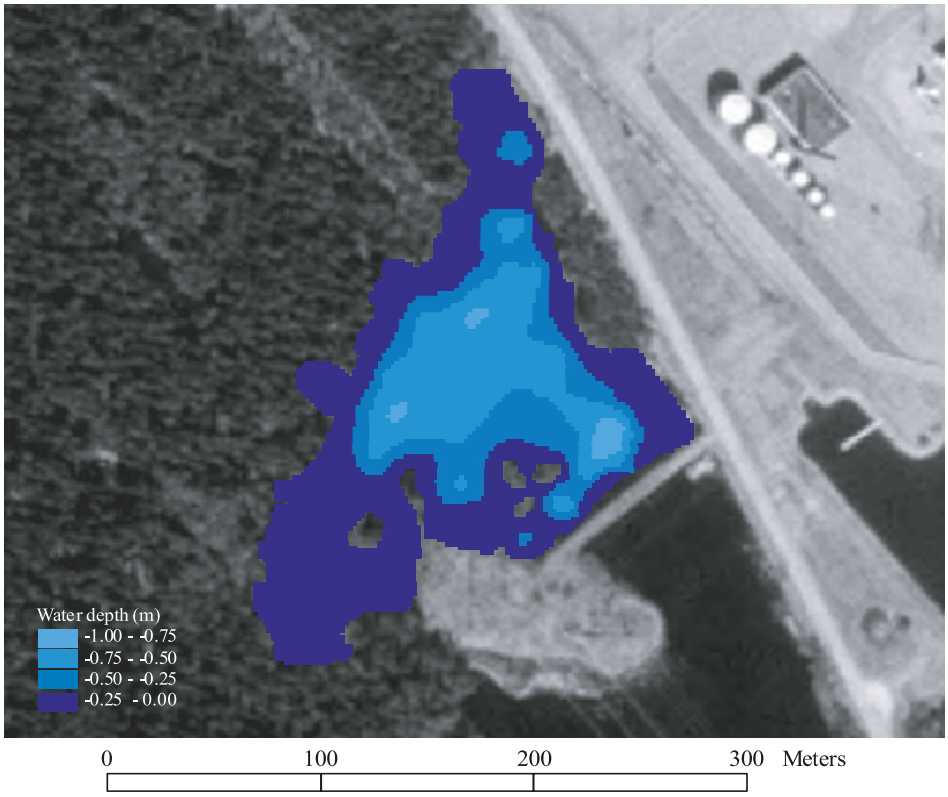

Figure 4-9. *Depth grid map for Lake Gunnarsbo-Lillfjärden North basin.*

Table 4-5. Lake morphometry parameters for Lake Gunnarsbo-Lillfjärden North basin.

Lake morphometry	
Lake area	0.02 km2
Maximum depth	0.9 m
Mean depth	0.3 m
Volume	0.007 Mm3
Theoretical water renewal time	110 days

Lake ecosystem parameters

Three different main habitats have been identified in the ecosystem of Lake Gunnarsbo-Lillfjärden North basin (Table 4-6 and Figure 4-10). Due to the clear water and shallowness of the basin, the entire bottom area is light-exposed and no profundal habitat is present. Neither is there any nearshore hard-bottom habitat (Littoral type II) present in the lake, with a minor exception of part of the side of the road that has been constructed through the original lake and now separates the two basins. Hence, the pelagic habitat and the littoral habitat with submersed vegetation (Littoral type III) have the same distribution. Littoral of type I with emergent and floating-leaved vegetation dominates the lake, covering 78% of the total area.

Table 4-6. Distribution of major habitats in Lake Gunnarsbo-Lillfjärden North basin.

Habitats	Area [%]
Pelagial/Littoral type III	22
Littoral type I	78

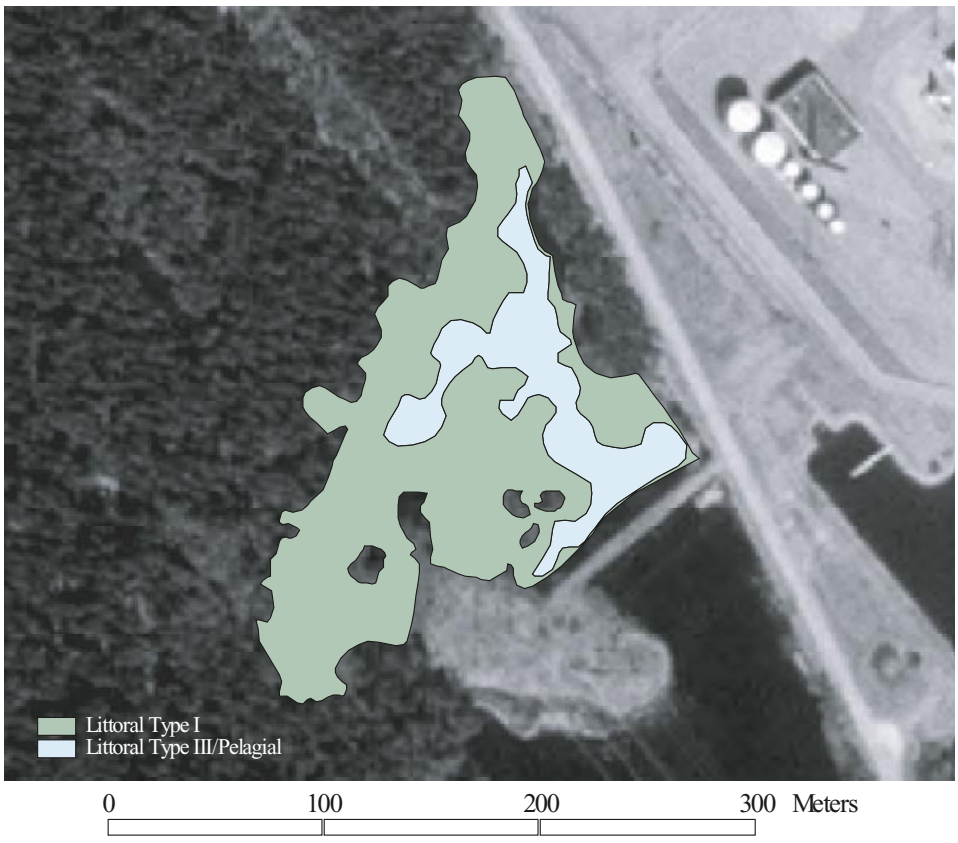

Figure 4-10. *Distribution of major habitats in Lake Gunnarsbo-Lillfjärden North basin.*

Additional remarks

The North basin of Lake Gunnarsbo-Lillfjärden was isolated from the rest of the lake during the construction of the nuclear power plant in Forsmark. It has been severely affected by physical damages. Materials from the construction period have been deposited in the lake, and the outlet from the North basin to the South basin, as well as the outlet from the South basin downstream, have been channeled in pipes. This propably restricts the availability for aquatic organisms to migrate between the Baltic Sea and the lake basins.

Forsmark 1:3–4. Lake Labboträsket (the entire catchment)

The location of the object

This catchment is part of the SMHI area 54/55 and equals catchment no 54/55:25 and parts of 54/55:26 in /Brunberg and Blomqvist,1998/.

Topographical map: 12 I NO
Outlet coordinates: 669952, 162973 (SMHI)
Elevation: 3.56 m above sea level

The catchment area and its major constituents

The total lake catchment area is 3.928 km^2, where forest is the dominating land use (Table 4-7).

Table 4-7. The different land uses within the entire catchment of Lake Labboträsket. The data are added from two sub-areas (see Appendix 4 and 6 for data of each sub-area).

Land use	Area [%]
Forest	87
Water surface	1
Agriculture	1
Remaining open land	11
Wetland (as parts of the above land use categories)	10

The surface waters within this catchment are Lake Labboträsket and Lake Gunnarsboträsket. Lake Labboträsket has one inlet creek originating from Lake Gunnarsboträsket and entering in the south end of the lake (Figure 4-11). The outlet runs north, into Lake Gunnarsbo-Lillfjärden South basin, and later enters the Baltic Sea in Asphällsfjärden.

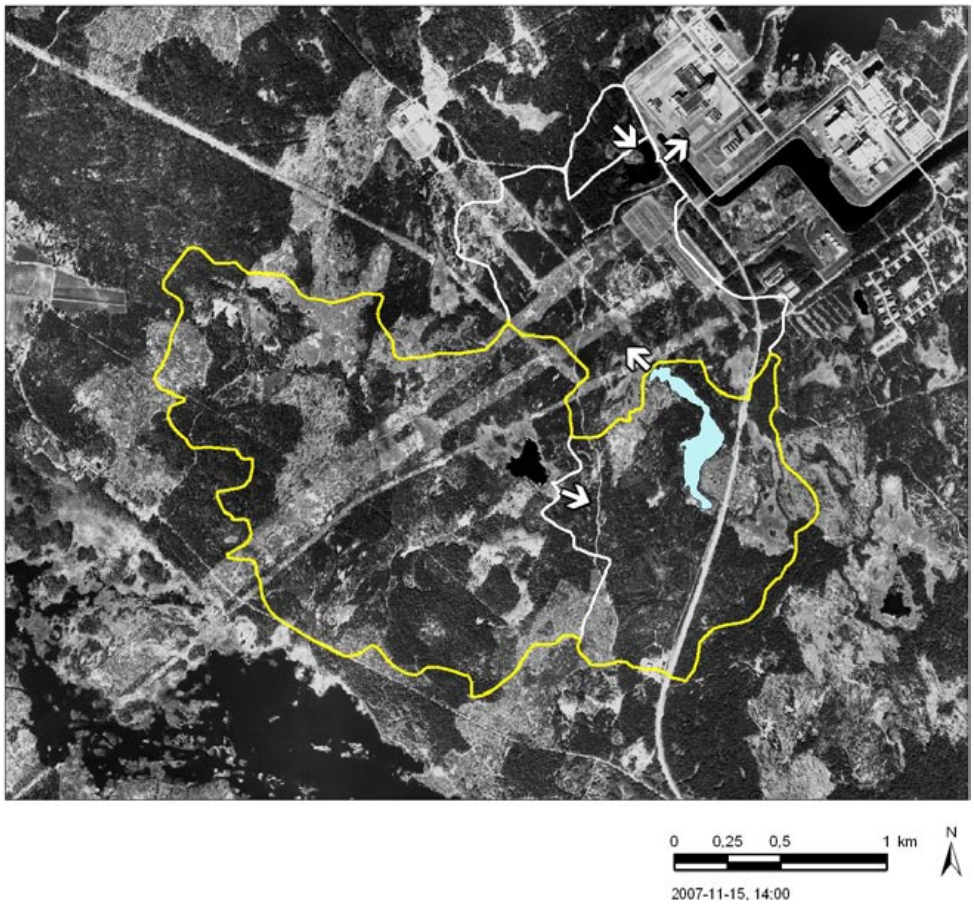

Figure 4-11. *The catchment Forsmark 1 with Lake Labboträsket and its catchment (sub-areas 3-4) marked with yellow boundaries.*

Lake morphometry parameters

Figure 4-12 and Figure 4-13 displays the bathymetric map and the depth grid map, respectively, for Lake Labboträsket.

Lake Labboträsket is shallow and has a very short theoretical water renewal time, also when compared to the other lakes in the Forsmark area (Table 4-8). The lake has no islets.

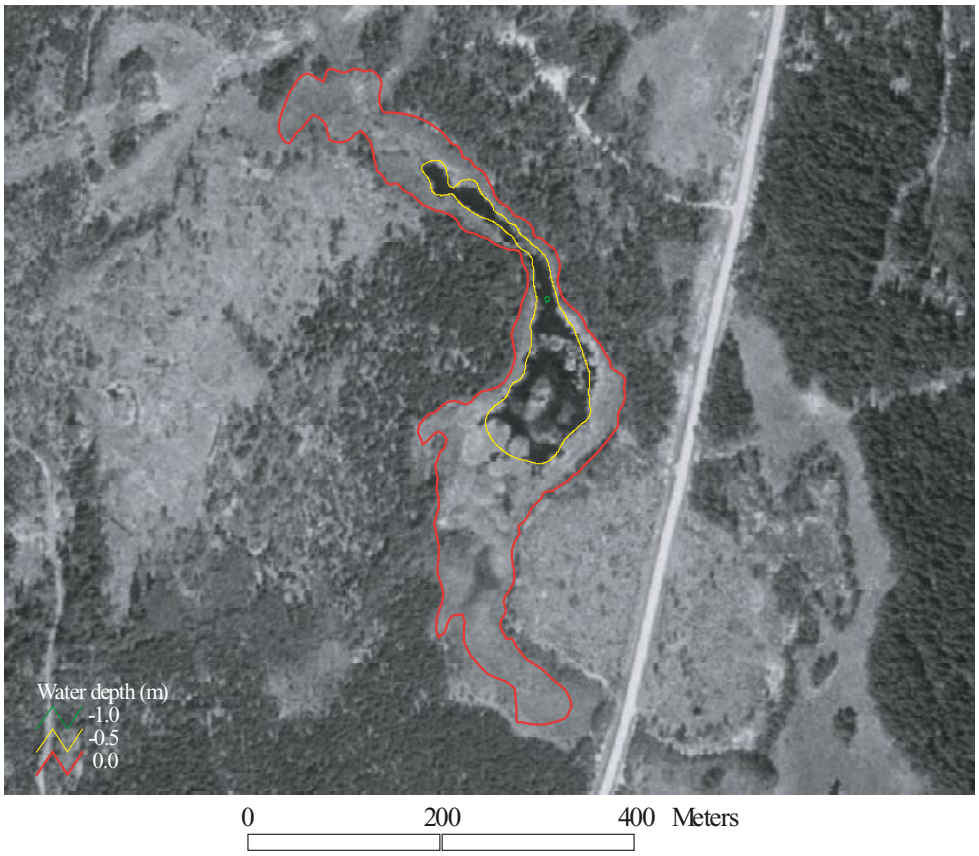

Figure 4-12. *Bathymetric map for Lake Labboträsket.*

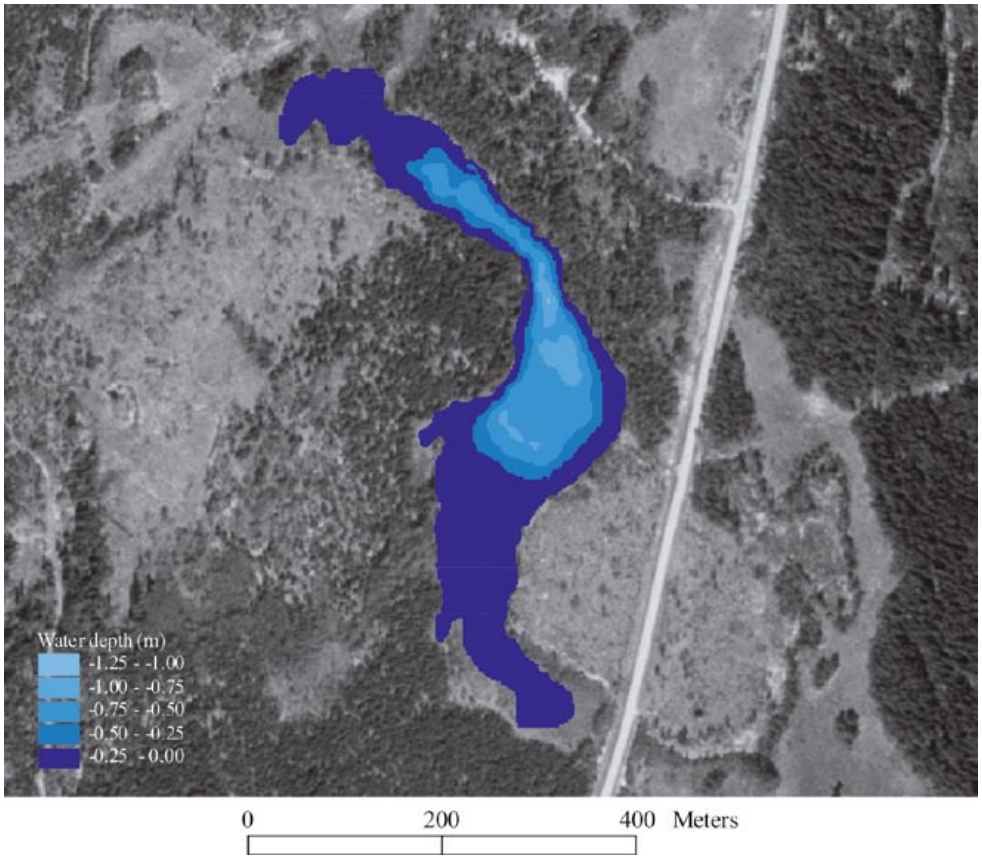

Figure 4-13. *Depth grid map for Lake Labboträsket.*

Table 4-8. Lake morphometry parameters for Lake Labboträsket.

Lake morphometry	
Lake area	0.06 km2
Maximum depth	1.1 m
Mean depth	0.3 m
Volume	0.016 Mm3
Theoretical water renewal time	7 days

Lake ecosystem parameters

Table 4-9 and Figure 4-14 illustrate the distribution of major habitats for Lake Labboträsket. The lake is strongly dominated by a littoral with emergent and floating-leaved vegetation (Littoral type I), covering most of the lake area. In the remaining small areas light penetrates down to the bottom, due to the shallowness and clear water of the lake. Thus, no profundal areas are present and the pelagial and illuminated soft-bottom littoral (Littoral type III) have the same distribution.

Table 4-9. Distribution of major habitats in Lake Labboträsket.

Habitats	Area [%]
Pelagial/Littoral type III	4
Littoral type I	96

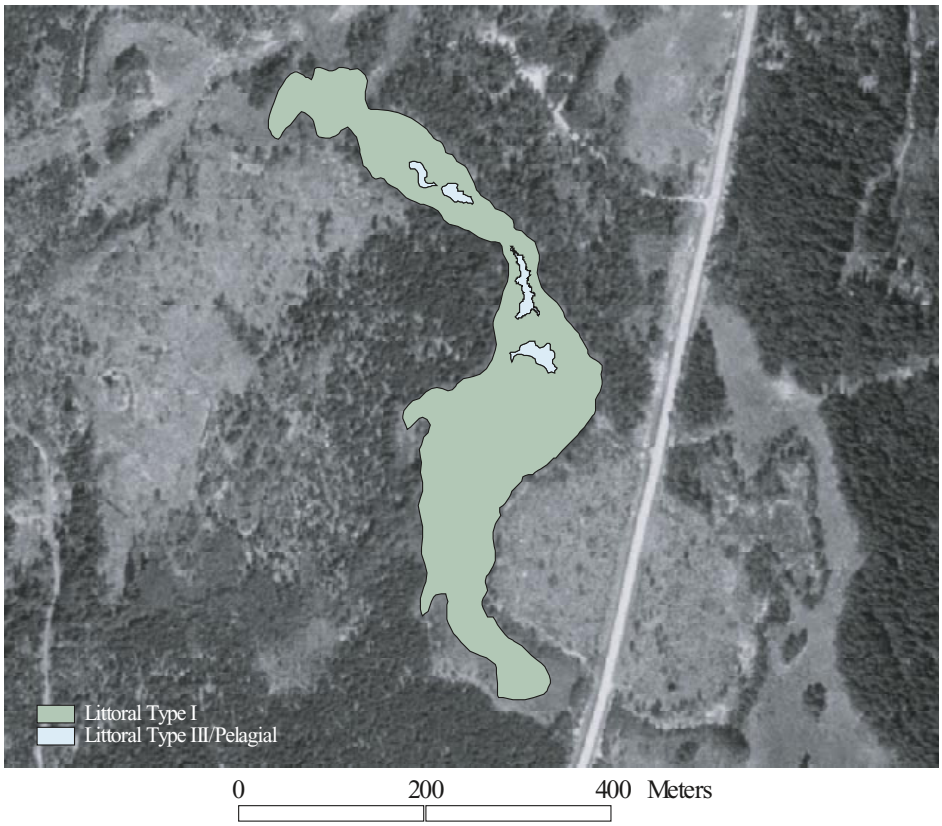

Figure 4-14. *Distribution of major habitats in Lake Labboträsket.*

Additional remarks

The red-listed species *Chara intermedia* and *Hirudinea medicinalis* (medical leech) were observed during a visit in 2002.

Forsmark 1:3. Lake Labboträsket (sub-area)

See Appendix 3–6 for data on sub-catchment parameters. For lake data, see Forsmark 1:3–4 (entire catchment).

Forsmark 1:4. Lake Gunnarsboträsket

The location of the object

This catchment is part of the SMHI area 54/55, and equals catchment no 54/55:26 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: 5.81m above sea level

The catchment area and its major constituents

The total catchment area is 2.734 km^2, dominated by forest (Table 4-10).

Table 4-10. The different land uses within the catchment of Lake Gunnarsboträsket.

Land use	Area [%]
Forest	88
Water surface	1
Agriculture	1
Remaining open land	10
Wetland (as parts of the above land use categories)	7

The only surface water within this catchment is Lake Gunnarsboträsket. The lake has one inlet creek. The outlet in the southeast end of the lake (Figure 4-15) passes through Lake Labboträsket and Lake Gunnarsbo-Lillfjärden South basin. This chain of lakes enters the Baltic Sea in Asphällsfjärden.

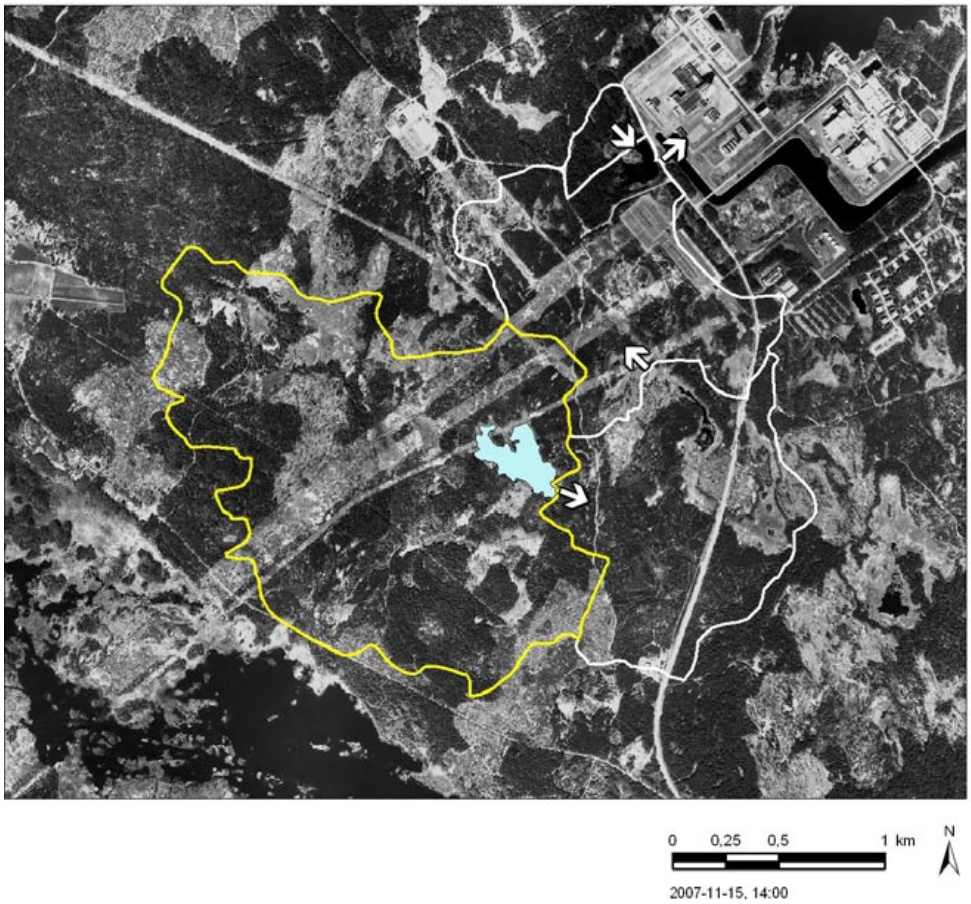

Figure 4-15. *The catchment Forsmark 1 with Lake Gunnarsboträsket and its catchment (sub-area 4) marked with yellow boundaries.*

Lake morphometry parameters

Figure 4-16 and Figure 4-17 show the bathymetric map and the depth grid map, respectively, for Lake Gunnarsboträsket.

Lake Gunnarsboträsket is shallow (maximum depth 1.3 m) and has a short theoretical water renewal time (Table 4-11). The lake has no islets.

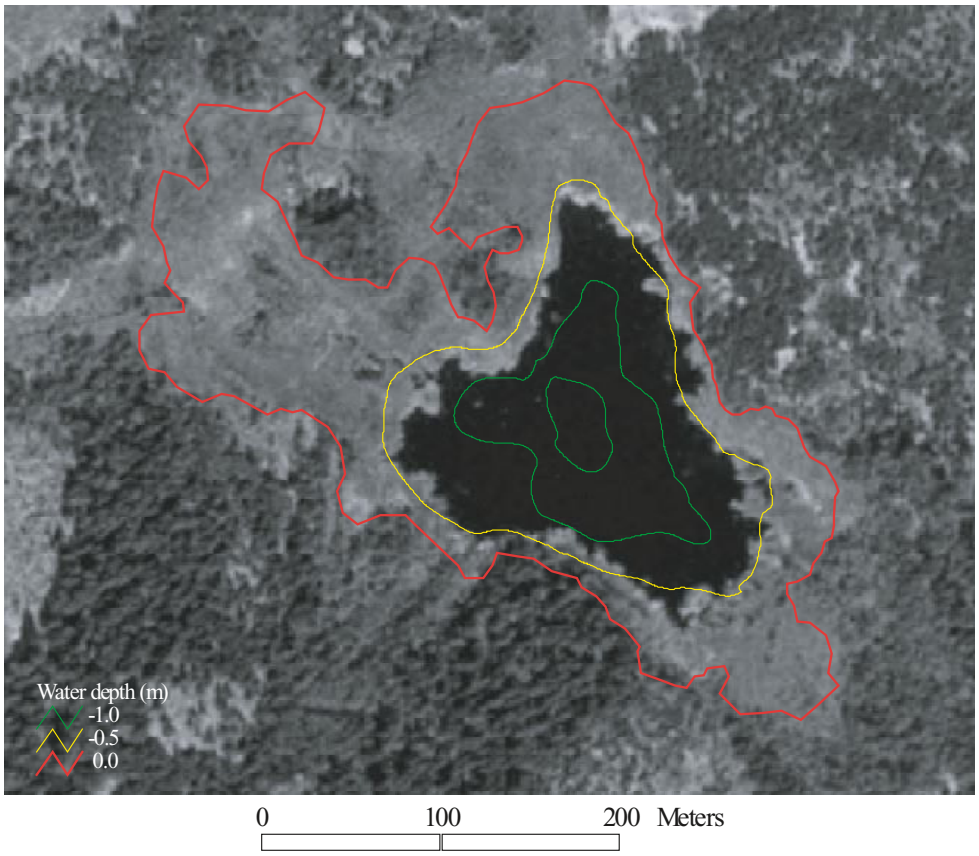

Figure 4-16. *Bathymetric map for Lake Gunnarsboträsket.*

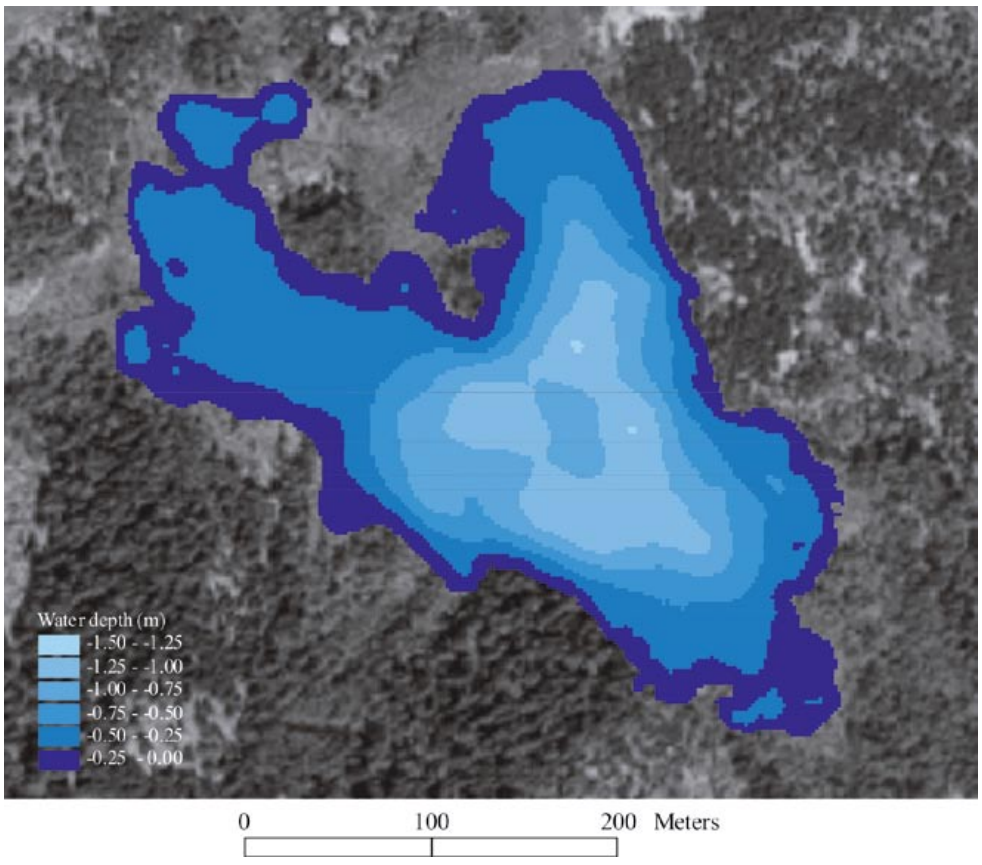

Figure 4-17. *Depth grid map for Lake Gunnarsboträsket.*

Table 4-11. Lake morphometry parameters for Lake Gunnarsboträsket.

Lake morphometry	
Lake area	0.07 km2
Maximum depth	1.3 m
Mean depth	0.5 m
Volume	0.034 Mm3
Theoretical water renewal time	21 days

Lake ecosystem parameters

As in most other lakes in the Forsmark area, the ecosystem of Lake Gunnarsboträsket has only three different main habitats. The littoral habitat with emergent and floating-leaved vegetation (Littoral type I) dominates, covering 74% of the lake area (Table 4-12, Figure 4-18). Due to the clear lake water and the shallowness of the lake basin, the remaining area of the lake has light-exposed bottoms and no profundal habitat exists. Hence, the pelagic habitat and the littoral habitat with submersed vegetation (Littoral type III) have the same distribution.

Table 4-12. Distribution of major habitats in Lake Gunnarsboträsket.

Habitats	Area [%]
Pelagial/Littoral type III	26
Littoral type I	74

Additional remarks

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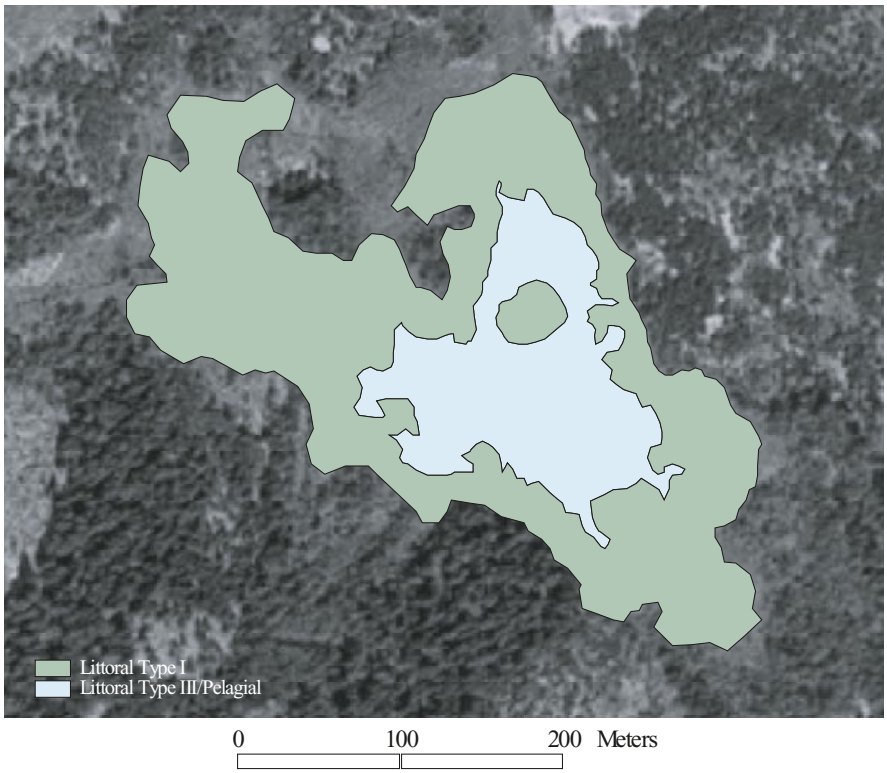

Figure 4-18. *Distribution of major habitats in Lake Gunnarsboträsket.*

4.2 The catchment Forsmark 2

This area is divided into eleven different sub-areas (Figure 4-19): Lake Norra Bassängen (sub-area no 2:1), Lake 2:2 (no 2:2), Lake Bolundsfjärden (sub-area no 2:3), Lake Graven (sub-area no 2:4), Lake Fräkengropen (no 2:5), Lake Vambörsfjärden (no 2:6), Lake Kungsträsket (no 2:7), Lake Gällsboträsket (no 2:8), Lake Stocksjön (sub-area no 2:9), Lake Eckarfjärden (no 2:10) and Lake Puttan (no 2:11).

The upstream sub-areas are all draining to the most downstream sub-area no 2:1, which enters the Baltic Sea in Asphällsfjärden east of the Forsmark nuclear power plant. The central lake in this water system is Lake Bolundsfjärden, which receives water from three branches of the water system: from Lake Graven – Lake Fräkensjön to the east, from Lake Vambörsfjärden to the south, and finally, from Lake Kungsträsket, Lake Gällsboträsket and Lake Stocksjön – Lake Eckarfjärden in south/west. The water draining downstream from Lake Bolundsfjärden enters Lake Norra Bassängen.

Lake Puttan is situated East of Lake Norra Bassängen and North of Lake Bolundsfjärden. The direction of drainage between Lake Puttan and Lake Norra Bassängen is unclear and probably varies during the year. The connection (or lack of connection) between Lake Puttan and Lake Bolundsfjärden also remains to elucidate. Here we have chosen to place Lake Puttan as the last sub-catchment of the area (Forsmark 2:11), draining to Lake Norra Bassängen and then further to the Baltic Sea.

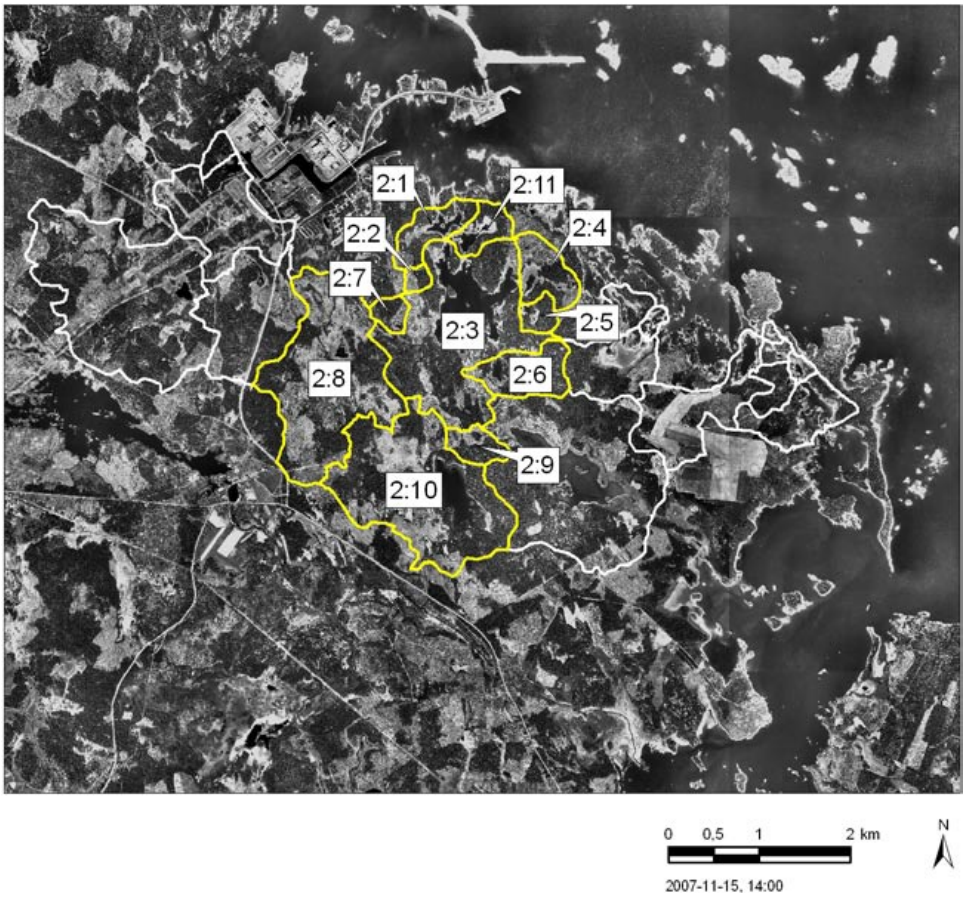

Figure 4-19. *The Forsmark area with the eleven sub-areas in the catchment Forsmark 2 marked with yellow boundaries.*

Forsmark 2:1–11 Norra Bassängen (the entire catchment)

The location of the object

This catchment is part of SMHI catchment no 54/55 and equals catchment no 54/55:27 together with parts of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO and 13 I SO
Outlet coordinates: (no data)
Elevation: 0.56 m above sea level

The catchment area and its major constituents

The total catchment area is 8.668 km^2. Forest dominates the land use (Table 4-13).

Table 4-13. The different land uses within the catchment of Norra Bassängen. The data are added from eleven sub-areas (see Appendix 4 and 6 for data of each sub-area).

Land use	Area [%]
Forest	78
Water surface	10
Agriculture	0
Remaining open land	12
Wetland (as parts of the above land use categories)	12

The surface waters within this lake catchment are Lake Norra Bassängen, Lake 2:2, Lake Bolundsfjärden, Lake Graven, Lake Fräkengropen, Lake Vambörsfjärden, Lake Kungsträsket, Lake Gällsboträsket, Lake Stocksjön, Lake Eckarfjärden and Lake Puttan. Lake Norra Bassängen has three inlet creeks and one small islet (Figure 4-20). The connection between Lake Norra Bassängen and Lake Puttan is on this map indicated as an outlet from Lake Puttan. However, during certain weather conditions the drainage water may switch direction and function as an outlet from Lake Norra Bassängen instead. During these situations, the catchment of Lake Puttan will be excluded from the catchment of Lake Norra Bassängen. The catchment data presented above (Table 4-13) include also the sub-area of Lake Puttan.

Lake morphometry parameters

Figure 4-21 and Figure 4-22 present the bathymetric map and the depth grid map, respectively, for Lake Norra Bassängen.

Lake Norra Bassängen has the largest catchment of all lakes in the Forsmark area. Combined with the small and shallow lake basin, this gives a very short theoretical water renewal time (Table 4-14). The lake has one small islet.

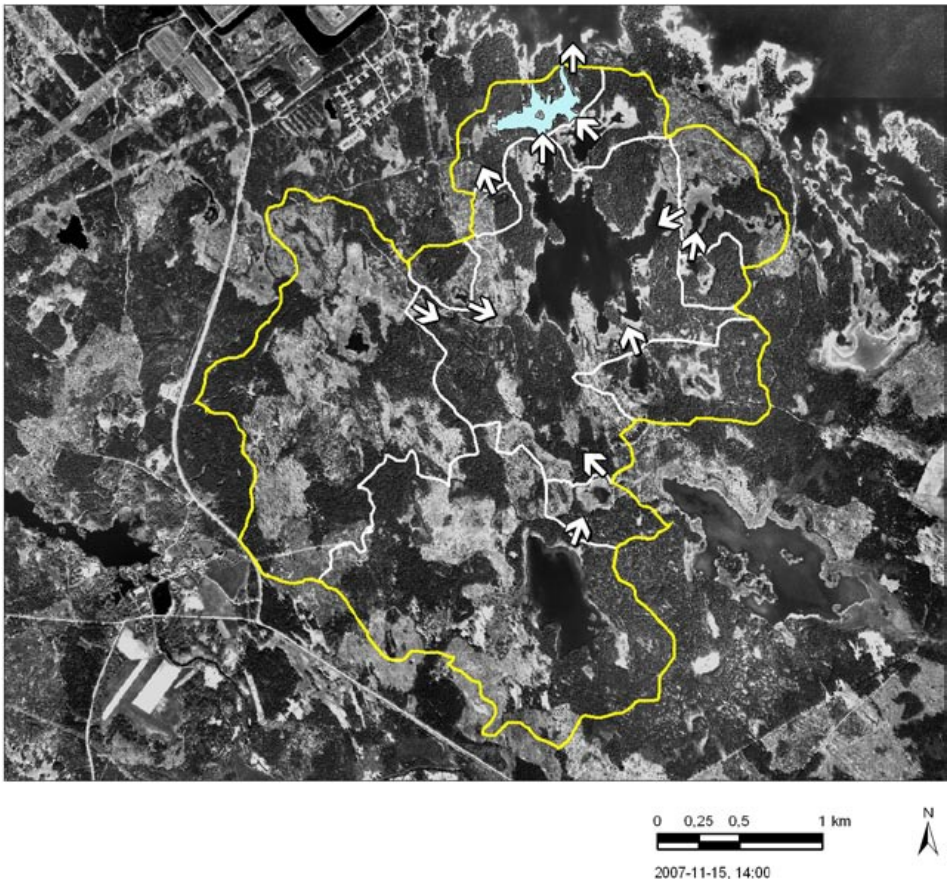

Figure 4-20. *The catchment Forsmark 2 with Lake Norra Bassängen and its catchment (sub-areas 1–11) marked with yellow boundaries.*

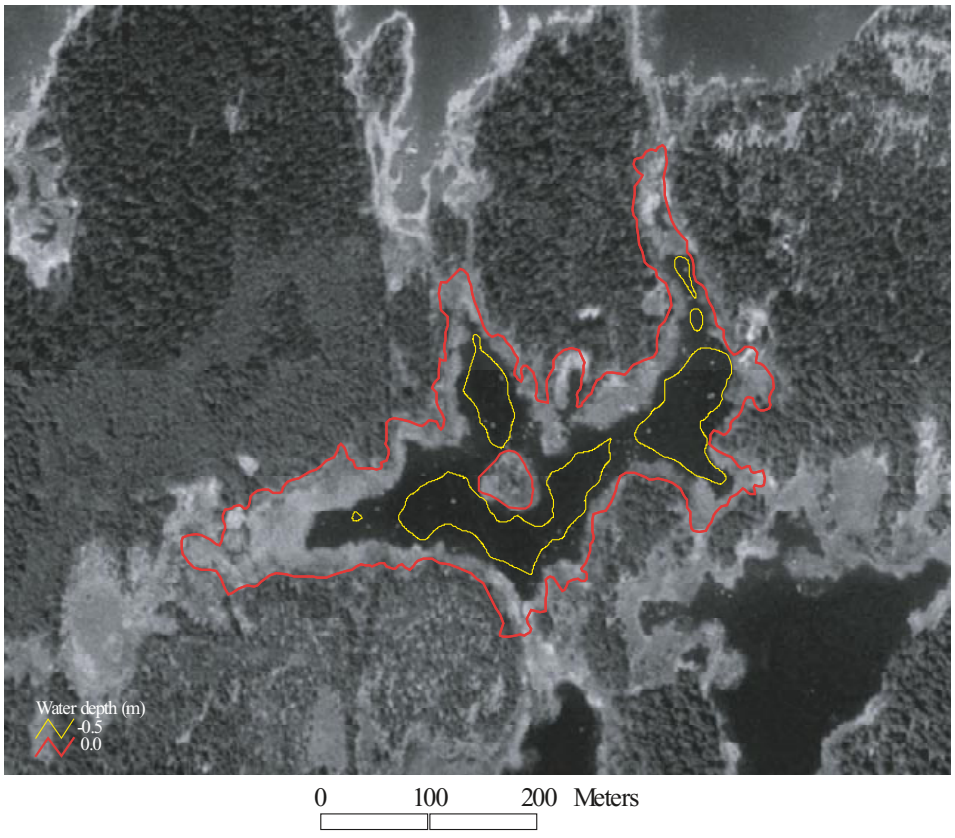

Figure 4-21. *Bathymetric map for Lake Norra Bassängen.*

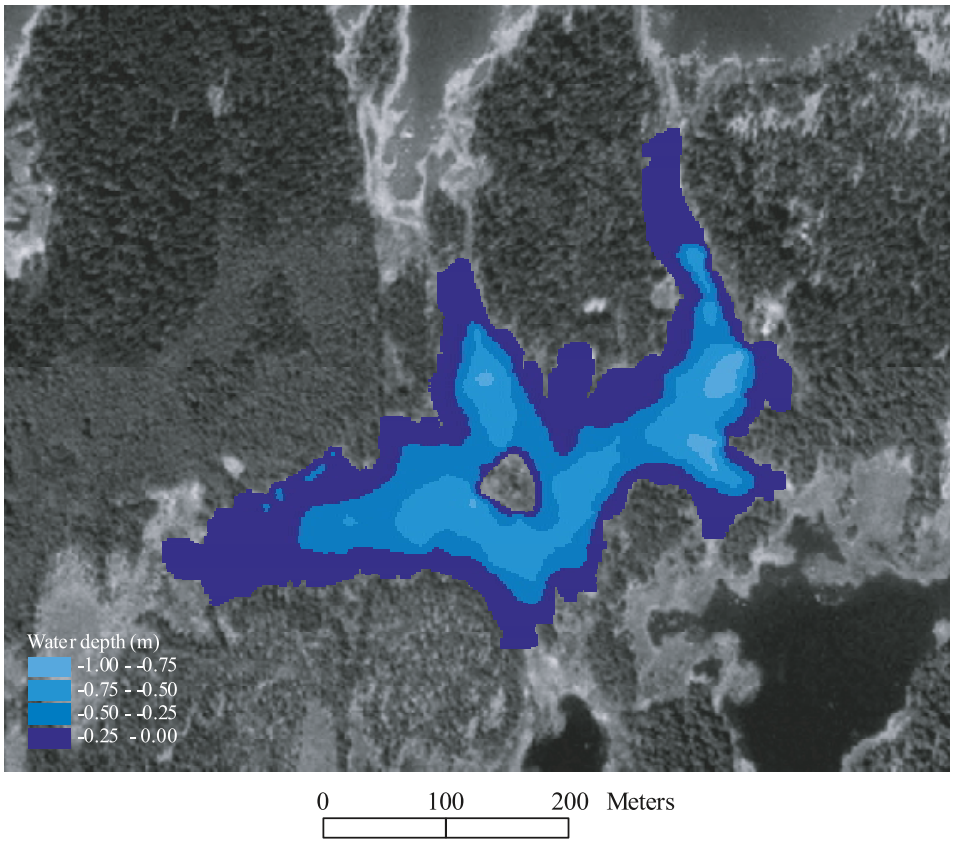

Figure 4-22. *Depth grid map for Lake Norra Bassängen.*

Table 4-14. Lake morphometry parameters for Lake Norra Bassängen.

Lake morphometry	
Lake area	0.08 km2
Maximum depth	0.9 m
Mean depth	0.3 m
Volume	0.024 Mm3
Theoretical water renewal time	5 days

Lake ecosystem parameters

Three different major habitats are present in Lake Norra Bassängen; a pelagic habitat, a littoral habitat of type I with emergent and floating-leaved vegetation, and a littoral habitat of type III with submersed vegetation (Table 4-15, Figure 4-23). Despite that the lake is very shallow, and a relatively large part of the lake area is free from the emergent and floating-leaved vegetation (compared to other lakes in the area). Due to the clarity of the lake water and the shallowness of the basin, the entire bottom area is light-exposed and no profundal habitat is present. The pelagic habitat and the littoral habitat with submersed vegetation thus have the same distribution.

Table 4-15. Distribution of major habitats in Lake Norra Bassängen.

Habitats	Area [%]
Pelagial/Littoral type III	42
Littoral type I	58

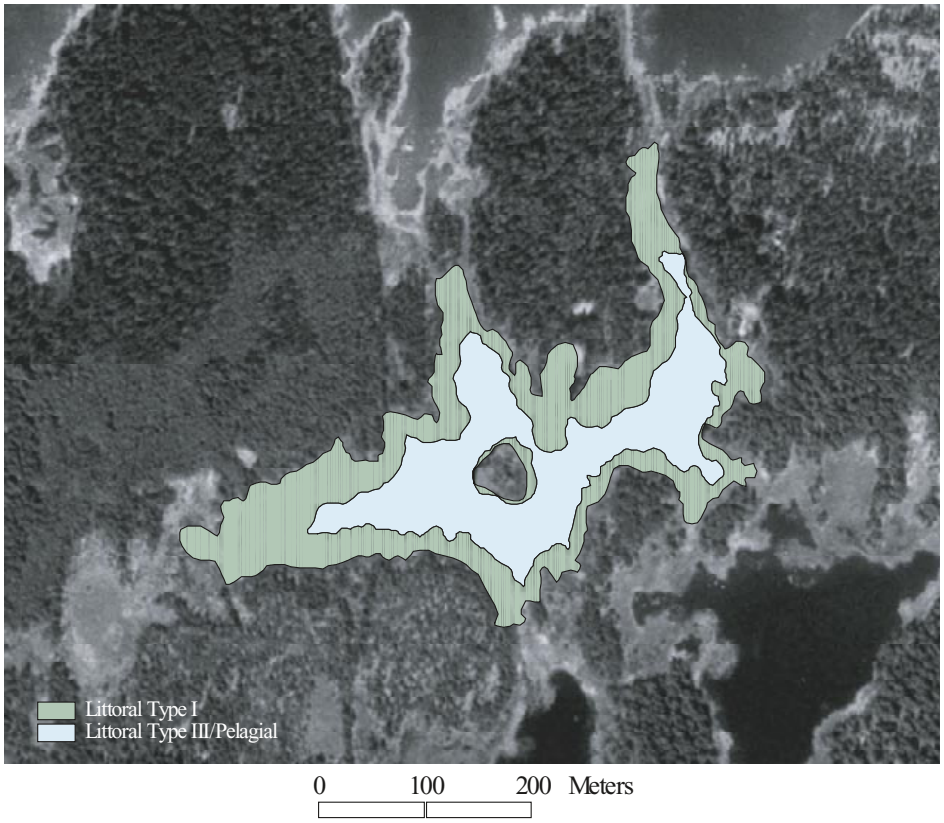

Figure 4-23. *Distribution of major habitats in Lake Norra Bassängen.*

Additional remarks

The drainage conditions of this lake still remain to be elucidated – regarding its connection to Lake Puttan as well as to Lake Bolundsfjärden – in order to determine the correct hydrological conditions within the catchment. Saltwater intrusions probably occur regularly at high water levels in the sea.

Forsmark 2:1. Lake Norra Bassängen (sub-area)

See Appendix 3–6 for data on sub-catchment parameters. For lake data, see Forsmark 2:1–11.

Forsmark 2:2. Lake2:2

The location of the object

This catchment is part of the SMHI catchment 54/55 and part of catchment no 54/55:24 in / Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: 1.82 m above sea level

The catchment area and its major constituents

The total catchment area is 0.071 km^2, and forest dominates the land use (Table 4-16).

Table 4-16. The different land uses within the catchment of Lake 2:2.

Land use	Area [%]
Forest	91
Water surface	9
Agriculture	0
Remaining open land	0
Wetland (as parts of the above land use categories)	0

The only surface water within this catchment is Lake 2:2. The lake has no inlet creeks. The outlet north of the lake passes through Lake Norra Bassängen and enters the Baltic Sea in Asphällsfjärden.

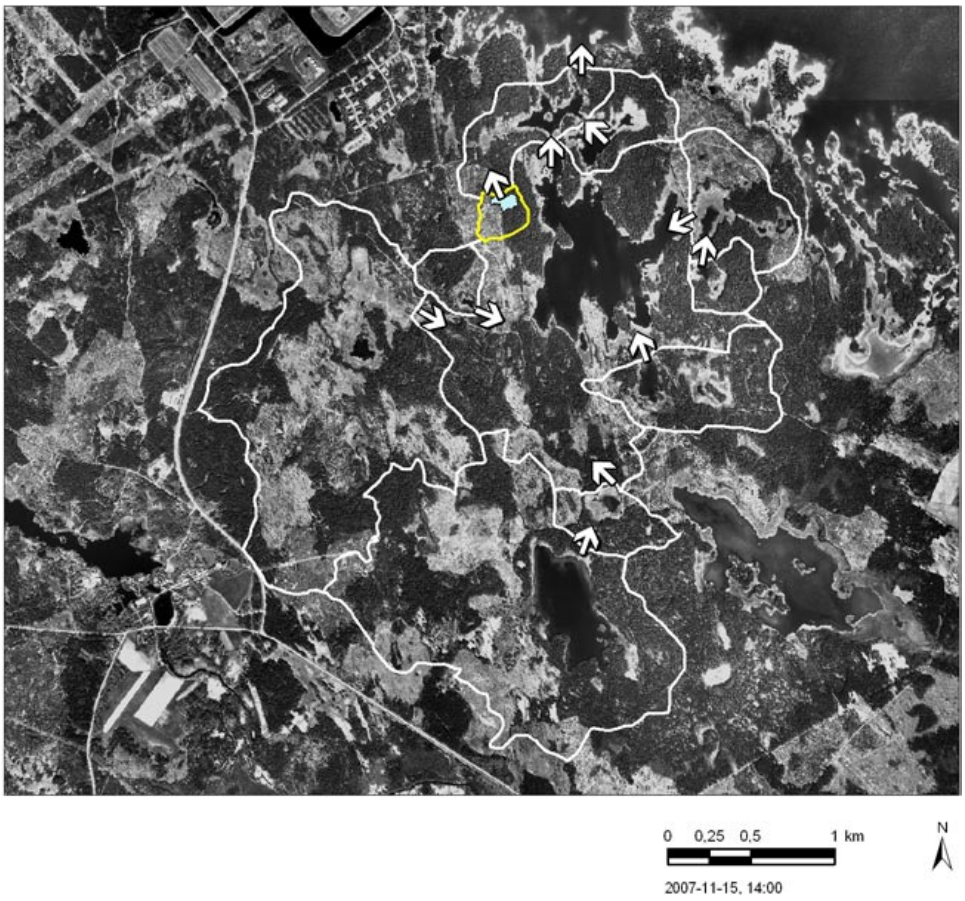

Figure 4-24. *The catchment Forsmark 2 with Lake 2:2 and its catchment marked with yellow boundaries.*

Lake morphometry parameters

Figure 4-25 and Figure 4-26 show the bathymetric map and the depth grid map, respectively, for Lake 2:2. The lake has one small islet.

Lake 2:2 is one of the smallest lakes in the Forsmark area (Table 4-17), with a lake area of 0.01 km^2. The lake is very shallow and the theoretical water renewal time of intermediate length compared to the other lakes in the area.

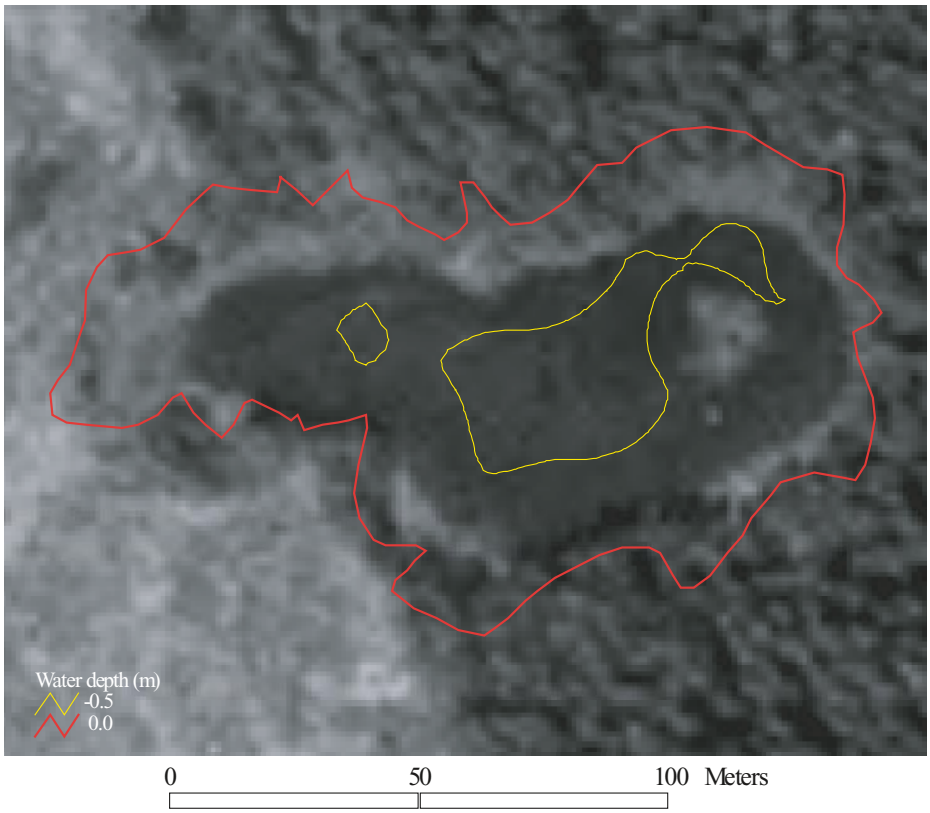

Figure 4-25. *Bathymetric map for Lake 2:2.*

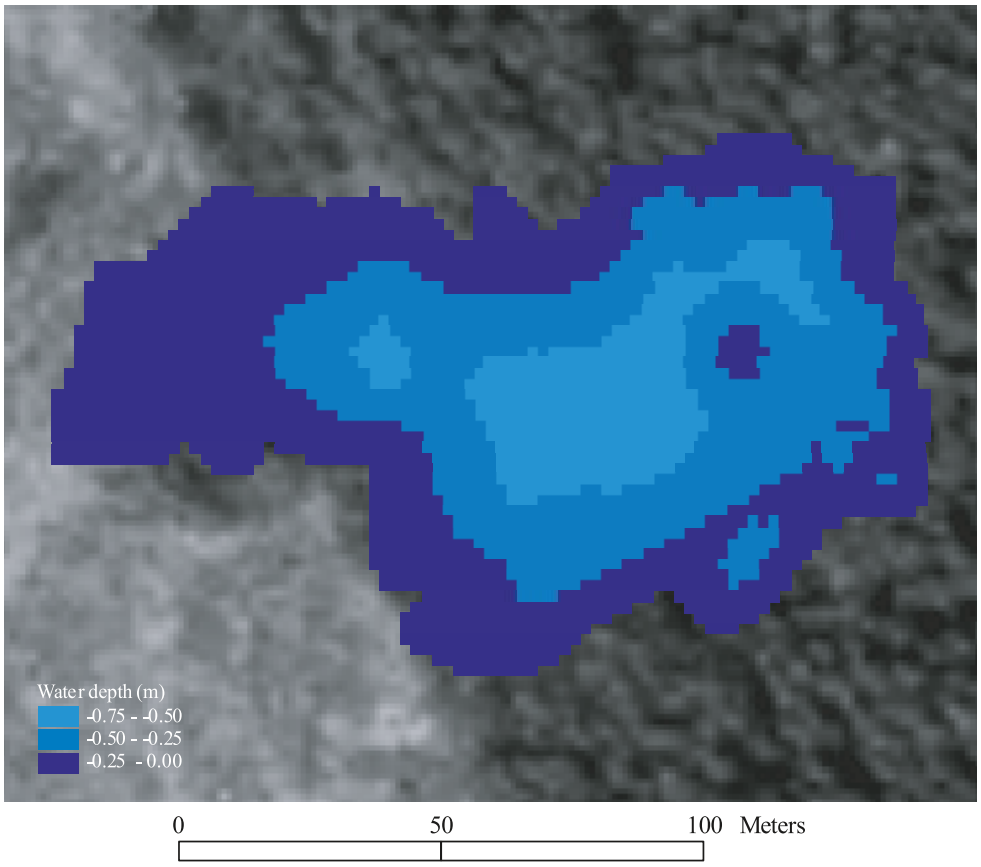

Figure 4-26. *Depth grid map for Lake 2:2.*

Table 4-17. Lake morphometry parameters for Lake 2:2.

Lake morphometry	
Lake area	0.01 km2
Maximum depth	0.6 m
Mean depth	0.3 m
Volume	0.003 Mm3
Theoretical water renewal time	66 days

Lake ecosystem parameters

Three different major habitats are present in Lake 2:2; a pelagic habitat, a littoral habitat of type I with emergent and floating-leaved vegetation, and a littoral habitat of type III with submersed vegetation (Table 4-18, Figure 4-27). Despite that the lake is very shallow, and a relatively large part of the lake area is free from emergent and floating-leaved vegetation (compared to other lakes in the area). Due to the clarity of the lake water and the shallowness of the basin, the entire bottom area is light-exposed and no profundal habitat is present. All the three main habitats have the same size, with Littoral type I covering half of the lake area, and Pelagial/Littoral type III the remaining parts.

Table 4-18. Distribution of major habitats in Lake 2:2.

Habitats	Area [%]
Pelagial/Littoral type III	50
Littoral type I	50

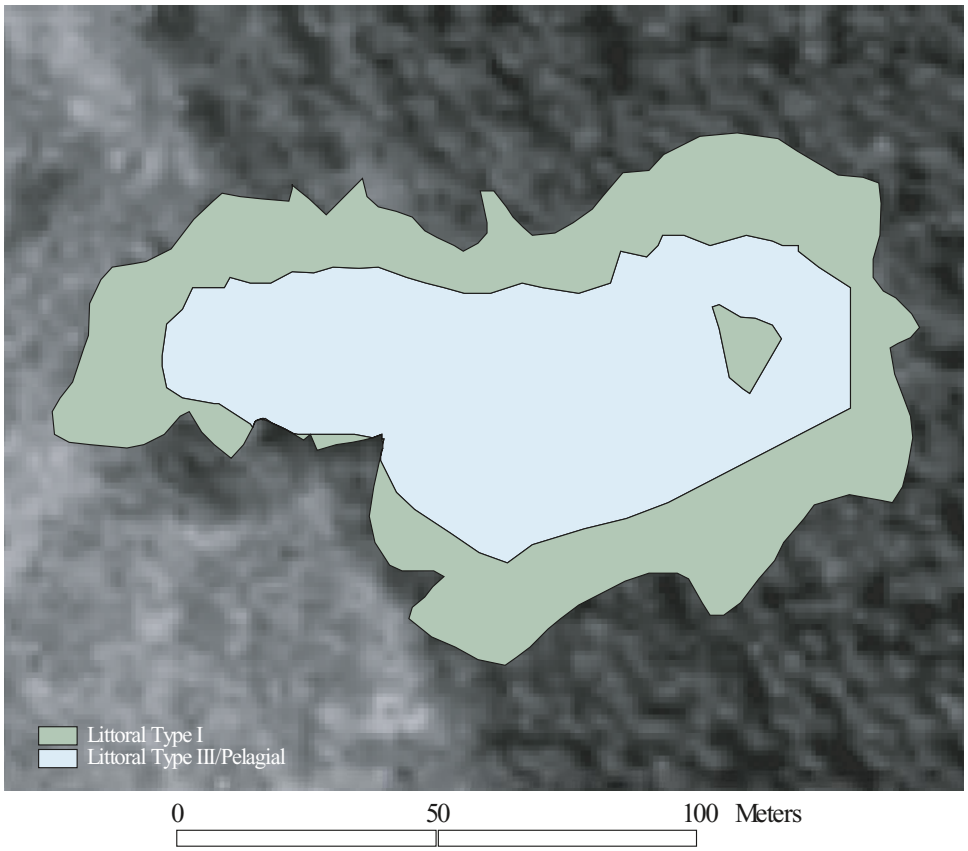

Figure 4-27. *Distribution of major habitats in Lake 2:2.*

Additional remarks

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Forsmark 2:3–10. Lake Bolundsfjärden (the entire catchment)

The location of the object

This catchment is part of the SMHI catchment no 54/55 and equals catchments no 54/55:27 together with parts of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: 669940, 163266 (SMHI)
Elevation: 0.64 m above sea level

The catchment area and its major constituents

The total catchment area is 8.003 km^2, where forest is the dominating land use (Table 4-19).

Table 4-19. The different land uses within the entire catchment of Lake Bolundsfjärden. The data are added from eight sub-areas (see Appendix 4 and 6 for data of each sub-area).

Land use	Area [%]
Forest	79
Water surface	9
Agriculture	0
Remaining open land	11
Wetland (as parts of the above land use categories)	11

The surface waters within this catchment are Lake Bolundsfjärden, Lake Graven, Lake Fräkengropen, Lake Vambörsfjärden, Lake Kungsträsket, Lake Gällsboträsket, Lake Stocksjön and Lake Eckarfjärden. Lake Bolundsfjärden has three inlet creeks and one outlet creek (Figure 4-28). One of the inlets comes from Lake Graven and Lake Fräkengropen in the east, another comeASSs from Lake Vambörsfjärden in the south, and the third, entering from southwest, drains the other four lakes in the catchment. The outlet passes through Lake Norra Bassängen to the north and enters the Baltic Sea in Asphällsfjärden.

Lake morphometry parameters

Figure 4-29 and Figure 4-30 show the bathymetric map and the depth grid map, respectively, for Lake Bolundsfjärden.

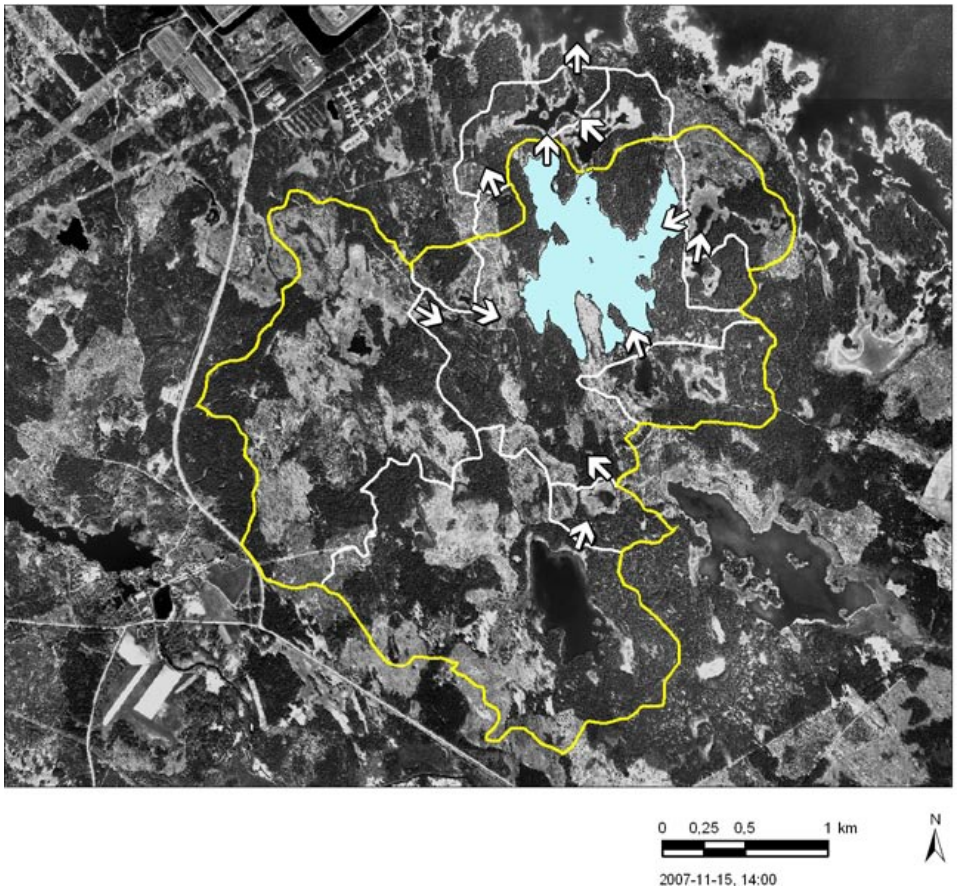

Figure 4-28. *The catchment Forsmark 2 with Lake Bolundsfjärden and its catchment (sub-areas 3–10) marked with yellow boundaries.*

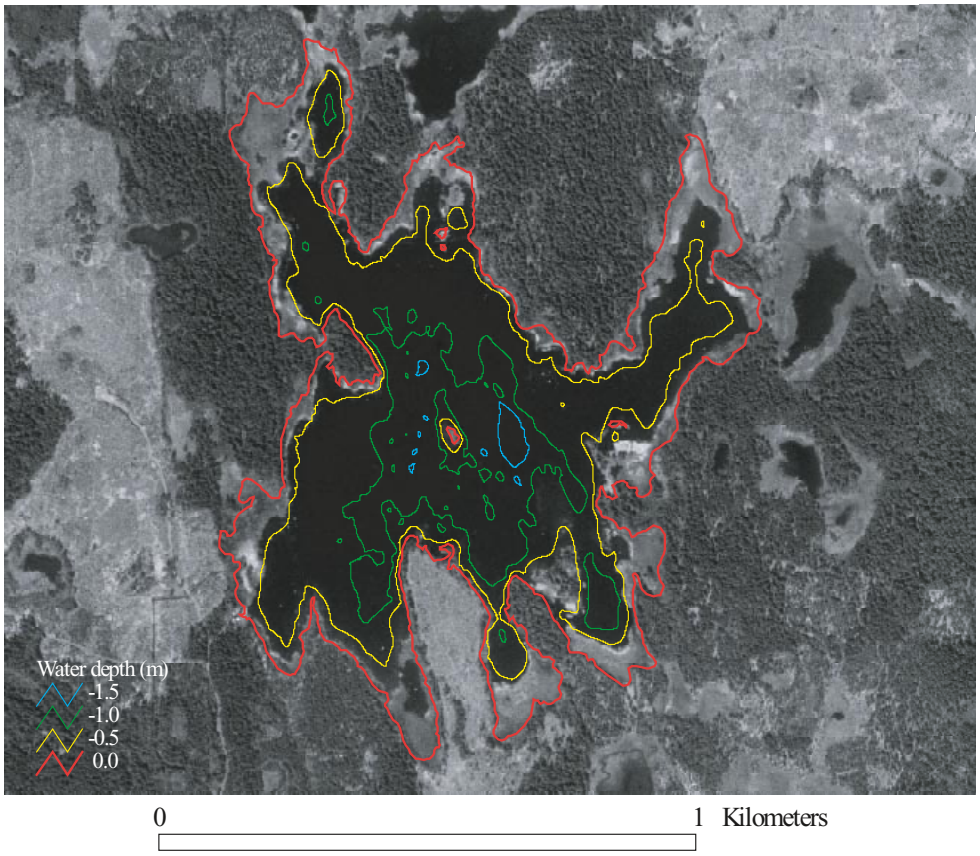

Figure 4-29. *Bathymetric map for Lake Bolundsfjärden.*

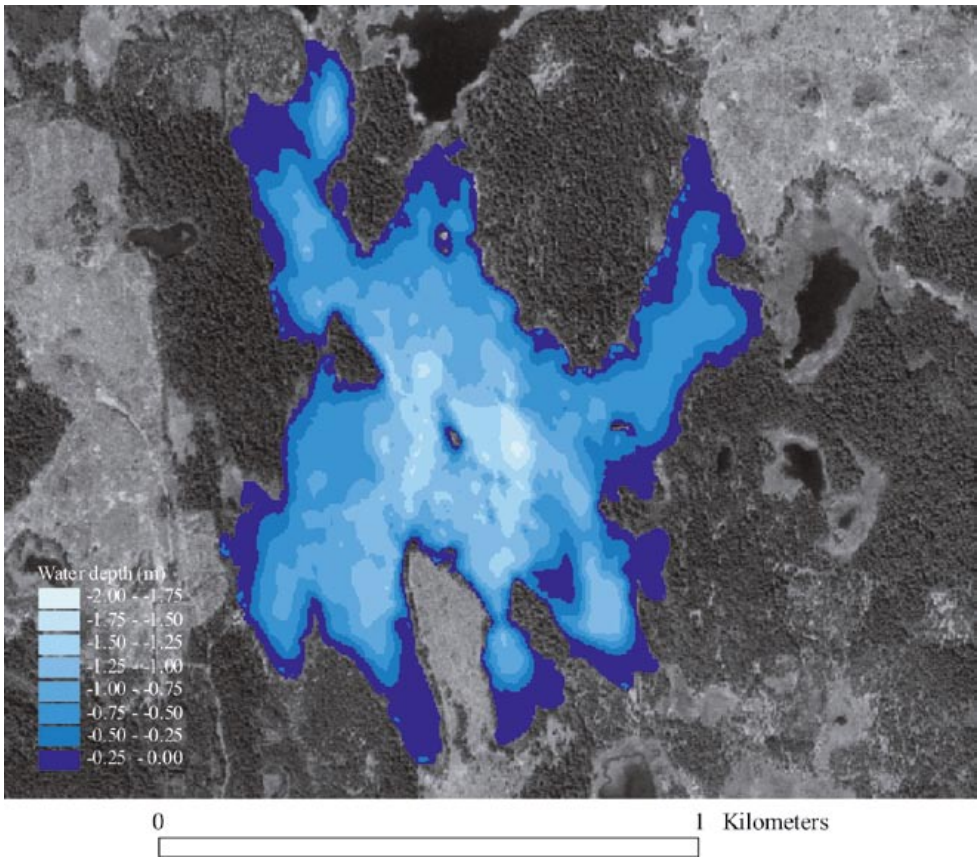

Figure 4-30. *Depth grid map for Lake Bolundsfjärden.*

Lake Bolundsfjärden is one of the largest lakes in the Forsmark area (Table 4-20). It is relatively deep (maximum depth 1.8 m) and has the second largest lake area, which results in the largest lake volume among the lakes in this area. The theoretical water renewal time is of medium length, about 2.5 months. The lake has four small islets.

Table 4-20. Lake morphometry parameters for Lake Bolundsfjärden.

Lake morphometry	
Lake area	0.61 km2
Maximum depth	1.8 m
Mean depth	0.6 m
Volume	0.374 Mm3
Theoretical water renewal time	77 days

Lake ecosystem parameters

Lake Bolundsfjärden has three major habitats, the littoral with emergent and floating-leaved vegetation (Littoral type I), the littoral with submersed vegetation (Littoral type III), and the pelagic habitat. In contrast to many other lakes in the area, the littoral with emergent and floating-leaved vegetation is not the dominating habitat. Instead, the open water surface, i.e. the pelagic habitat, covers 66% of the lake area (Table 4-21, Figure 4-31). Due to the shallowness and clear water of the lake, light penetrates down to all bottom areas and no profundal areas are present. Hence, the littoral with submersed vegetation has the same distribution as the pelagic habitat.

Table 4-21. Distribution of major habitats in Lake Bolundsfjärden.

Habitats	Area [%]
Pelagial/Littoral type III	66
Littoral type I	34

Additional remarks

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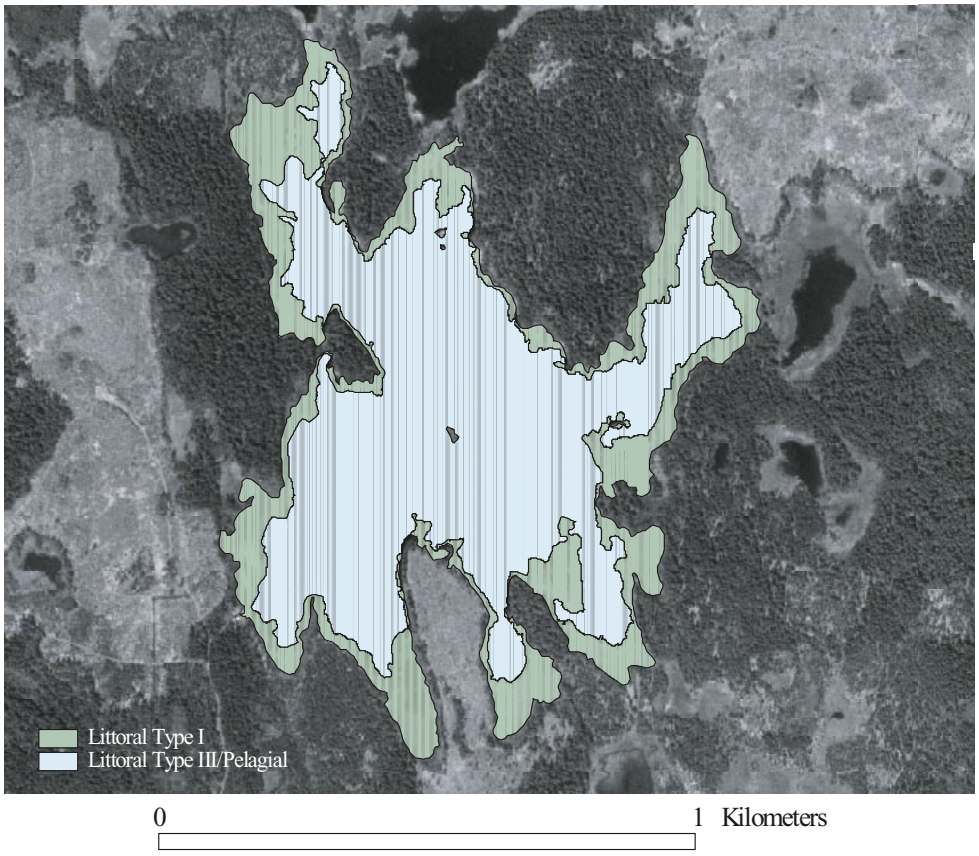

Figure 4-31. *Distribution of major habitats in Lake Bolundsfjärden.*

Forsmark 2:3. Lake Bolundsfjärden (sub-area)

See Appendix 3-6 for data on sub-catchment parameters. For Lake data, see Forsmark 2:3-10 (entire catchment).

Forsmark 2:4-5. Graven (the entire catchment)

The location of the object

This catchment is part of the SMHI catchment 54/55, and part of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: 0.65 m above sea level

The catchment area and its major constituents

The total catchment area is 0.531 km^2. Forest dominates the land use (Table 4-22), but there is also some wetland within the catchment (22%).

Table 4-22. The different land uses within the entire catchment of Lake Graven. The data are added from two sub-areas (see Appendix 4 and 6 for data of each sub-area).

Land use	Area [%]
Forest	74
Water surface	5
Agriculture	0
Remaining open land	21
Wetland (as parts of the above land use categories)	22

The surface waters within this catchment are Lake Graven and Lake Fräkengropen. Lake Graven has one inlet creek, which comes from Lake Fräkengropen in the south (Figure 4-32). The outlet creek, to the west, passes through Lake Bolundsfjärden and Lake Norra Bassängen before it enters the Baltic Sea in Asphällsfjärden.

Lake morphometry parameters

In Figure 4-33 and Figure 4-34 the bathymetric map and the depth grid map, respectively, for Lake Graven are presented.

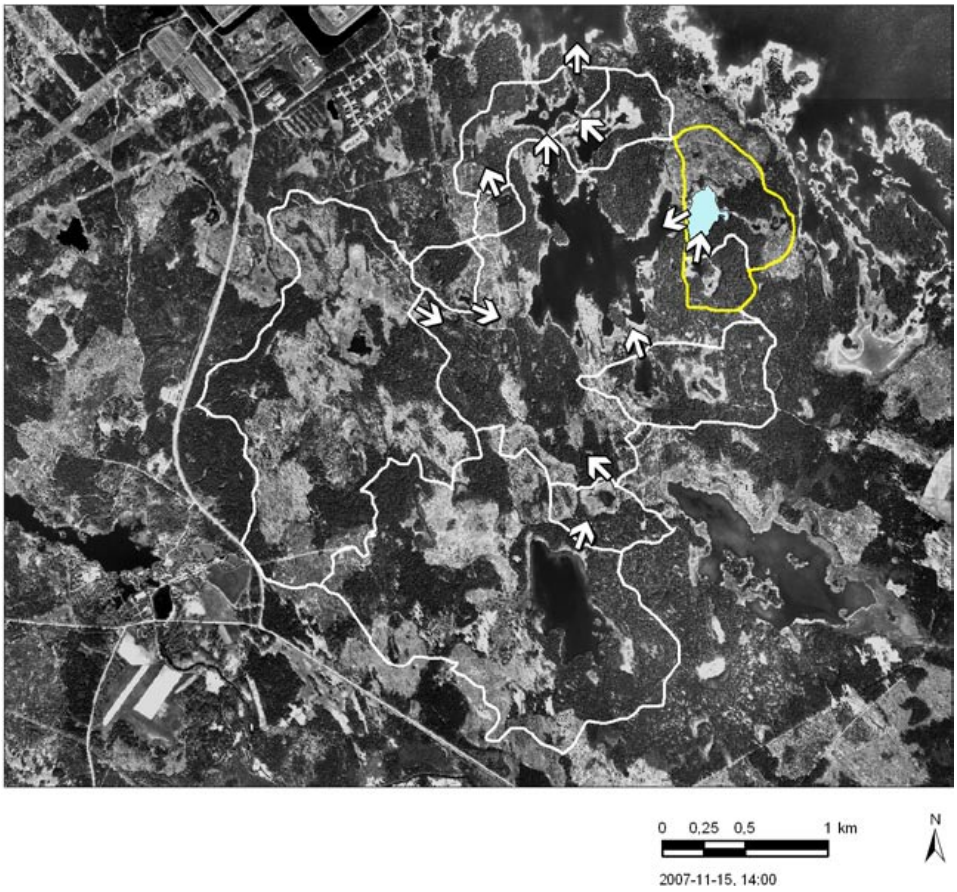

Figure 4-32. *The catchment Forsmark 2 with Lake Graven and its catchment (sub-areas 4–5) marked with yellow boundaries.*

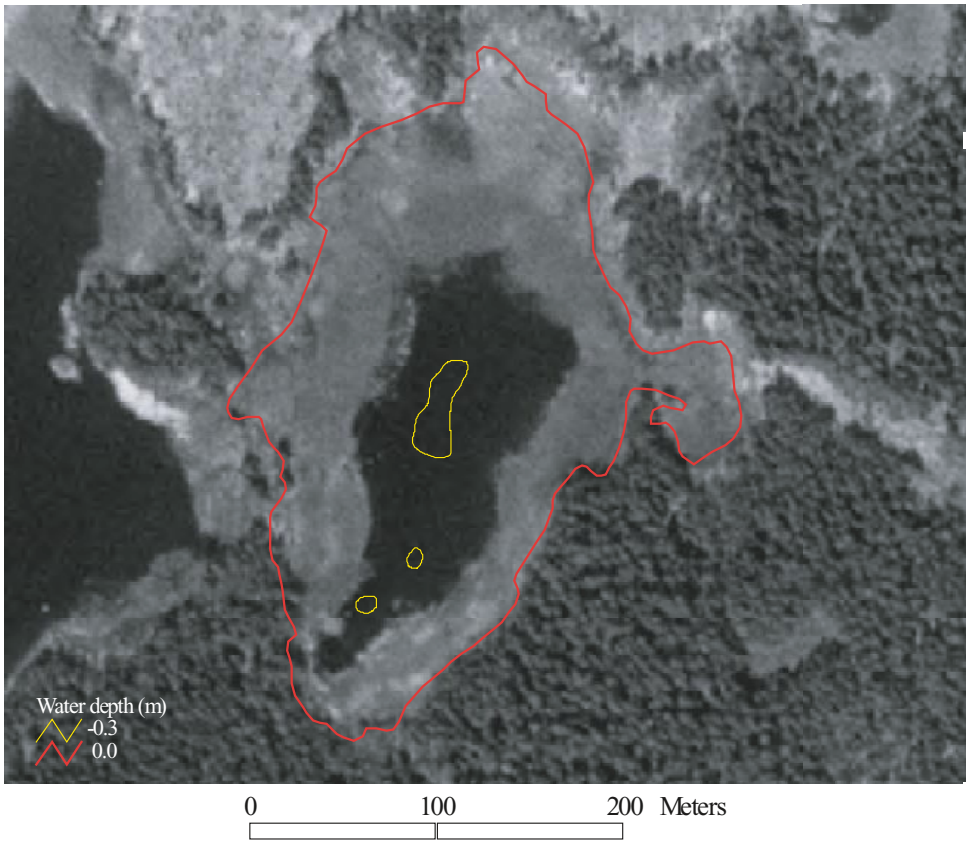

Figure 4-33. *Bathymetric map for Lake Graven.*

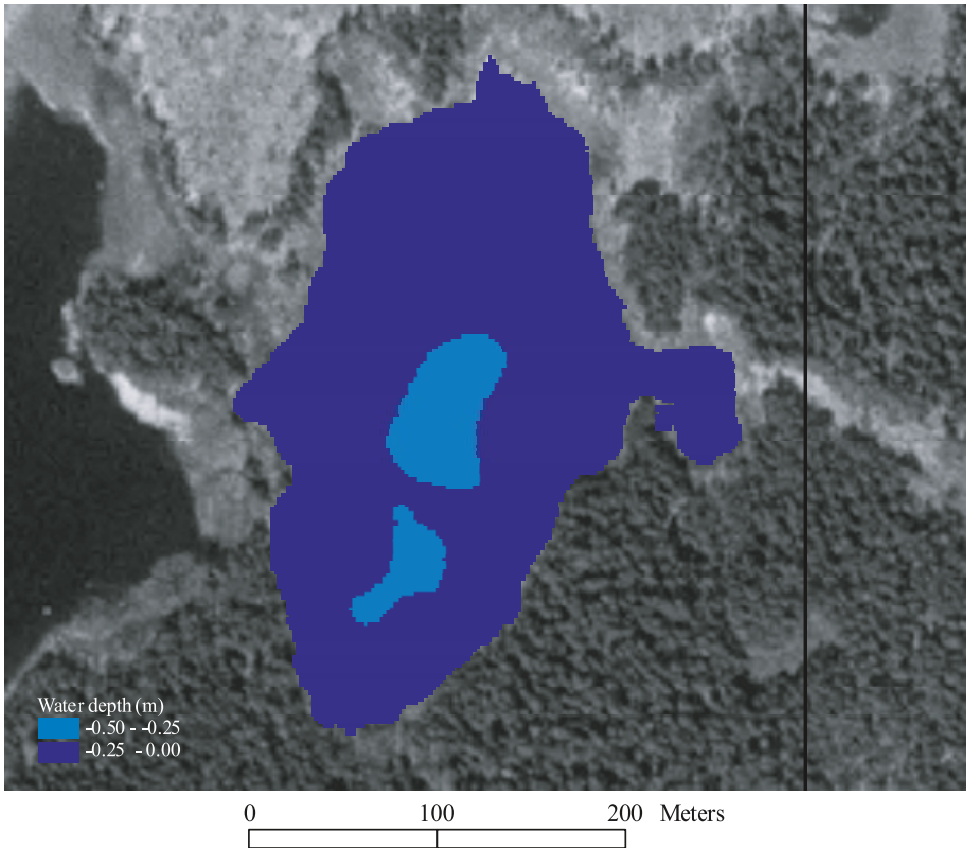

Figure 4-34. *Depth grid map for Lake Graven.*

Despite the name, Lake Graven is a very shallow lake. Mean as well as maximum depth are the lowest among all the lakes in the Forsmark area (Table 4-23). The lake has no islets.

Table 4-23. Lake morphometry parameters for Lake Graven.

Lake morphometry	
Lake area	0.05 km2
Maximum depth	0.4 m
Mean depth	0.1 m
Volume	0.006 Mm3
Theoretical water renewal time	25 days

Lake ecosystem parameters

Lake Graven has three major habitats, of which the littoral with emergent and floating-leaved vegetation (Littoral type I) strongly dominates (Table 4-24, Figure 4-35). Due to the shallowness of the lake, light penetrates down to the bottom and no profundal areas are present. Hence, the pelagic habitat and littoral with submersed vegetation (Littoral type III) have the same distribution.

Table 4-24. Distribution of major habitats in Lake Graven.

Habitats	Area [%]
Pelagial/Littoral type III	16
Littoral type I	84

Additional remarks

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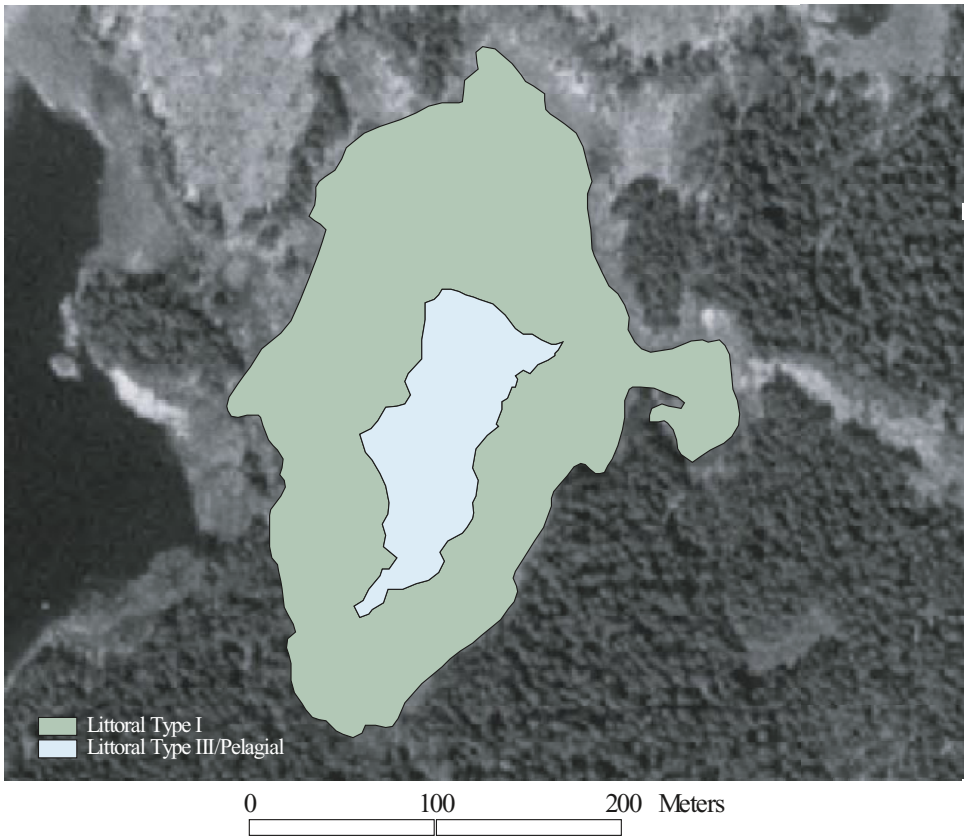

Figure 4-35. *Distribution of major habitats in Lake Graven.*

Forsmark 2:4 Lake Graven (sub-area)

See Appendix 3–6 for data on sub-catchment parameters. For lake data, see Forsmark 2:4–5 (entire catchment).

Forsmark 2:5 Lake Fräkengropen

The location of the object

This catchment is part of the SMHI catchment 54/55 and part of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: 1.35 m above sea level

The catchment area and its major constituents

The total catchment area is 0.139 km^2. Forest dominates the land use (Table 4-25).

Table 4-25. The different land uses within the catchment of Lake Fräkengropen.

Land use	Area [%]
Forest	80
Water surface	4
Agriculture	0
Remaining open land	16
Wetland (as parts of the above land use categories)	16

The only surface water within this catchment is Lake Fräkengropen. This lake has no inlet creeks (Figure 4-36). The outlet creek in the north passes through Lake Graven, Lake Bolundsfjärden and Lake Norra Bassängen before it discharges into the Baltic Sea in Asphällsfjärden.

Additional remarks

Fiskarfjärden is a "brackish water lake" in a late stadium of isolation from Kallrigafjärden. Inflowing seawater from the Baltic Sea can probably still influence the lake during some years.

Lake morphometry parameters

Figure 4-37 and Figure 4-38 show the bathymetric map and the depth grid map, respectively, for Lake Fräkengropen.

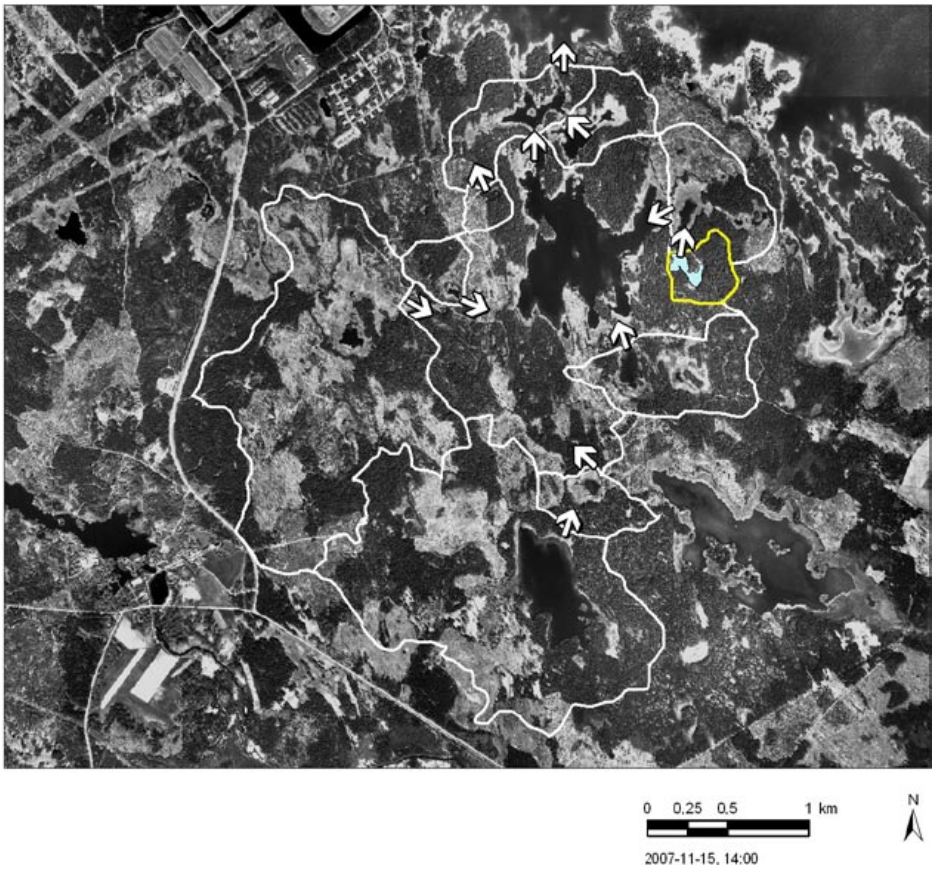

Figure 4-36. *The catchment Forsmark 2 with Lake Fräkengropen and its catchment (sub-area 5) marked with yellow boundaries.*

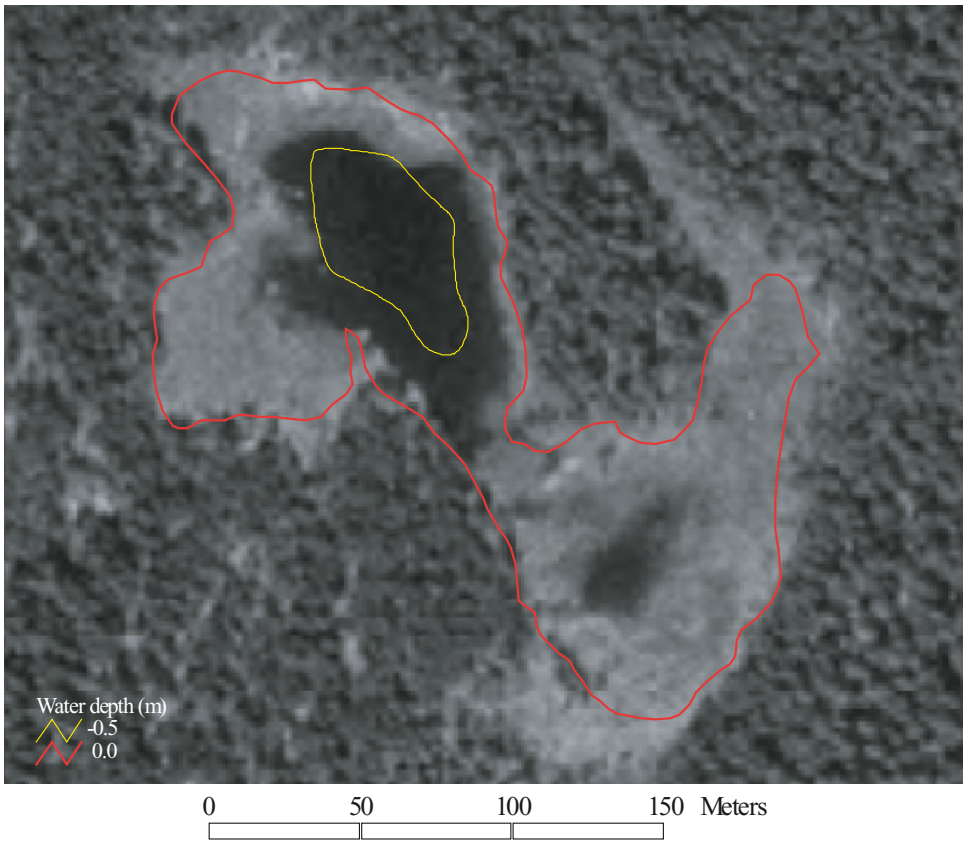

Figure 4-37. *Bathymetric map for Lake Fräkengropen.*

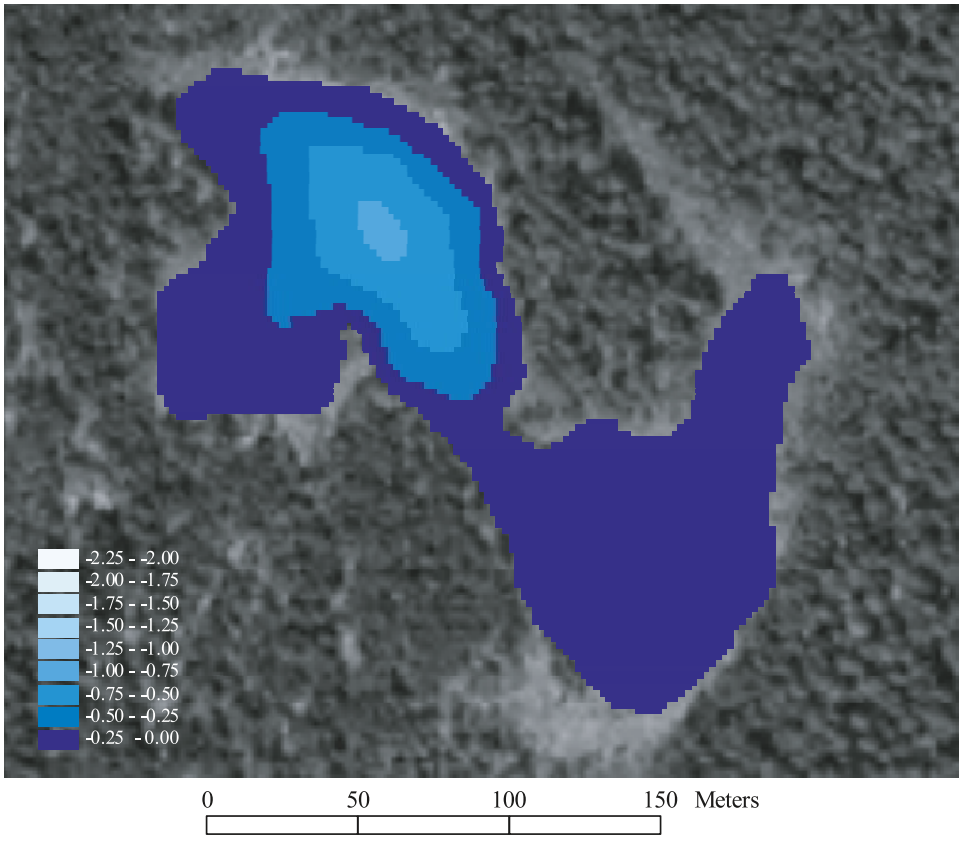

Figure 4-38. *Depth grid map for Lake Fräkengropen.*

Lake Fräkengropen is small and very shallow, and thus also has a small volume (Table 4-26). The lake has no islets.

Table 4-26. Lake morphometry parameters for Lake Fräkengropen.

Lake morphometry	
Lake area	0.02 km2
Maximum depth	0.8 m
Mean depth	0.2 m
Volume	0.004 Mm3
Theoretical water renewal time	44 days

Lake ecosystem parameters

Lake Fräkengropen has three major habitats. The littoral with emergent and floating-leaved vegetation (Littoral type I) strongly dominates the lake and covers 87% of the lake area (Table 4-27, Figure 4-39). Due to the shallowness and clear water of the lake, light penetrates down to all bottom areas and no profundal areas are present. Hence, the pelagic habitat and the littoral with submersed vegetation (Littoral type III) have the same distribution.

Table 4-27. Distribution of major habitats in Lake Fräkengropen.

Habitats	Area [%]
Pelagial/Littoral type III	13
Littoral type I	87

Additional remarks

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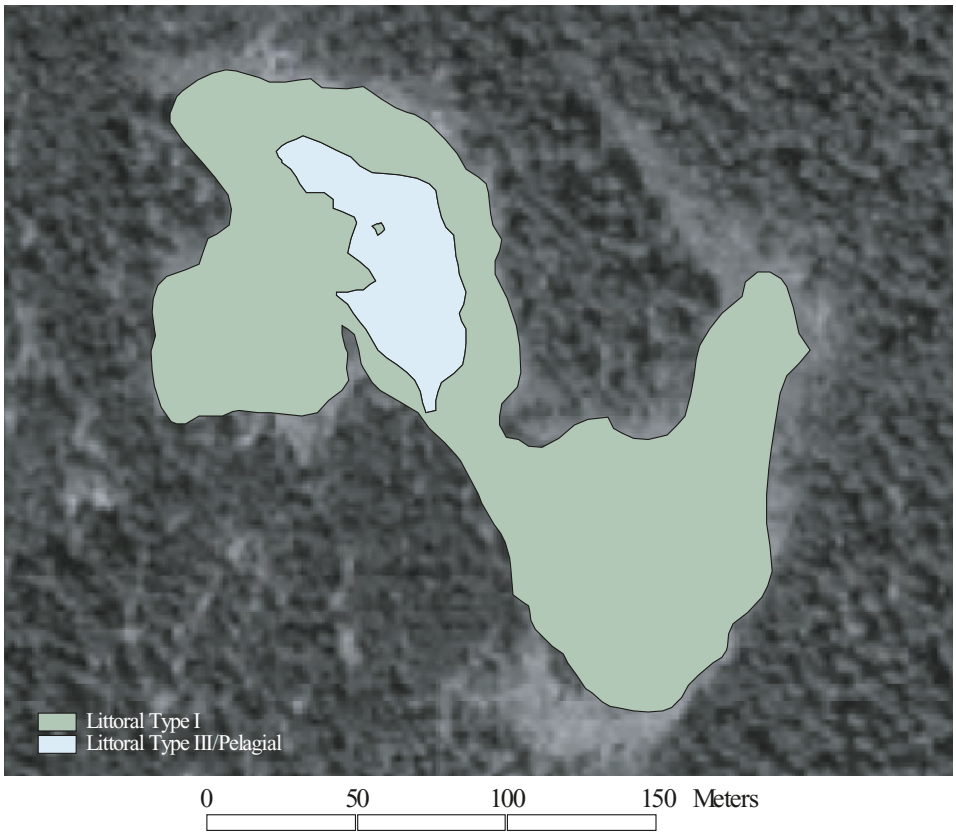

Figure 4-39. *Distribution of major habitats in Lake Fräkengropen.*

Forsmark 2:6. Lake Vambörsfjärden

The location of the object

This catchment is part of the SMHI catchment 54/55 and part of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: 669816, 163246 (SMHI)
Elevation: 1.14 m above sea level

The catchment area and its major constituents

The total catchment area is 0.484 km^2, and the land use is dominated by forest (Table 4-28).

Table 4-28. The different land uses within the catchment of Lake Vambörsfjärden.

Land use	Area [%]
Forest	80
Water surface	5
Agriculture	0
Remaining open land	15
Wetland (as parts of the above land use categories)	17

The only surface water within the catchment is Lake Vambörsfjärden. This lake has no inlet creeks. The outlet creek in the north (Figure 4-40) passes through Lake Bolundsfjärden and Lake Norra Bassängen before it enters the Baltic Sea in Asphällsfjärden.

Lake morphometry parameters

Figure 4-41 and Figure 4-42 presentthe bathymetric map and the depth grid map, respectively, for Lake Vambörsfjärden.

As most lakes in the Forsmark area, Lake Vambörsfjärden is small and shallow (Table 4-29). The theoretical water renewal time is of intermediate length (70 days), compared with other lakes in the area. The lake has two islets.

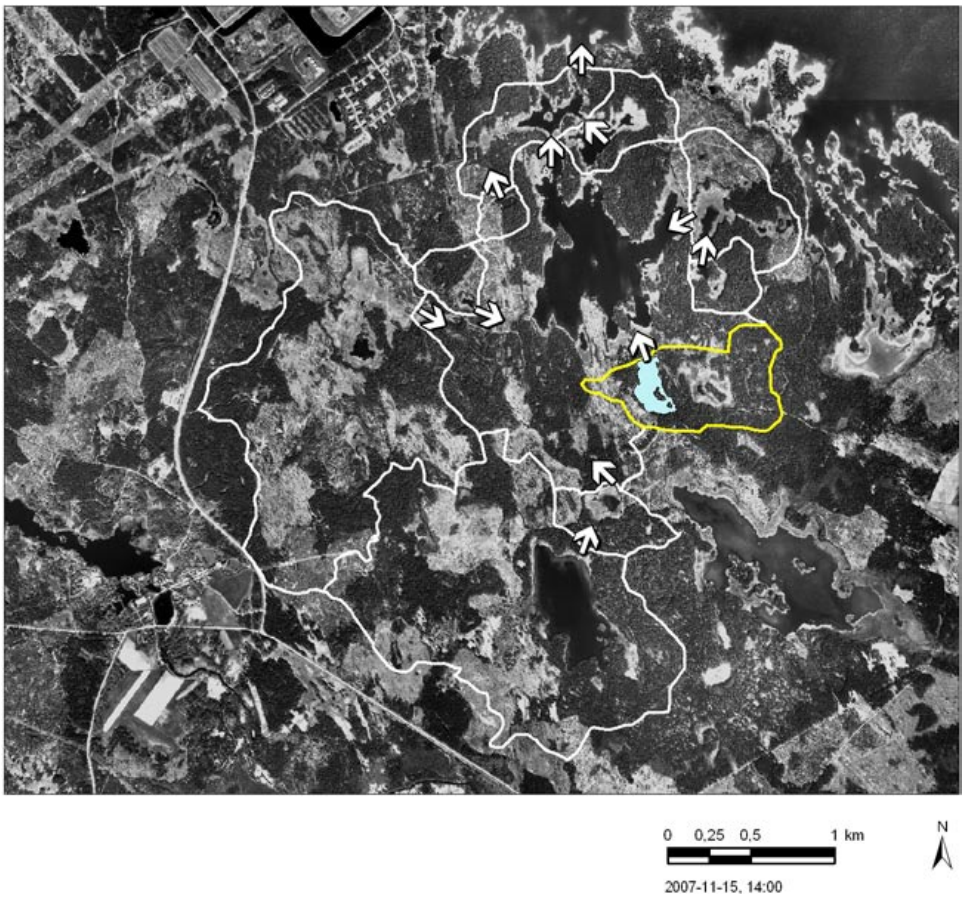

Figure 4-40. *The catchment Forsmark 2 with Lake Vambörsfjärden and its catchment (sub-area 6) marked with yellow boundaries.*

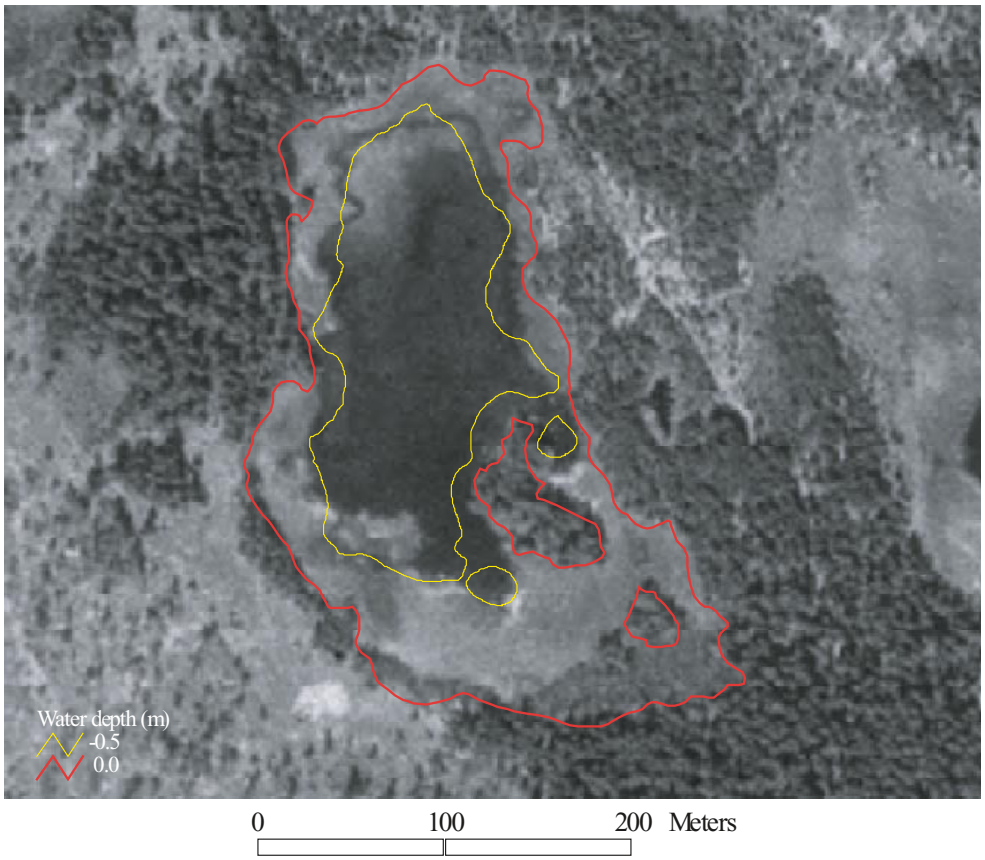

Figure 4-41 *Bathymetric map for Lake Vambörsfjärden.*

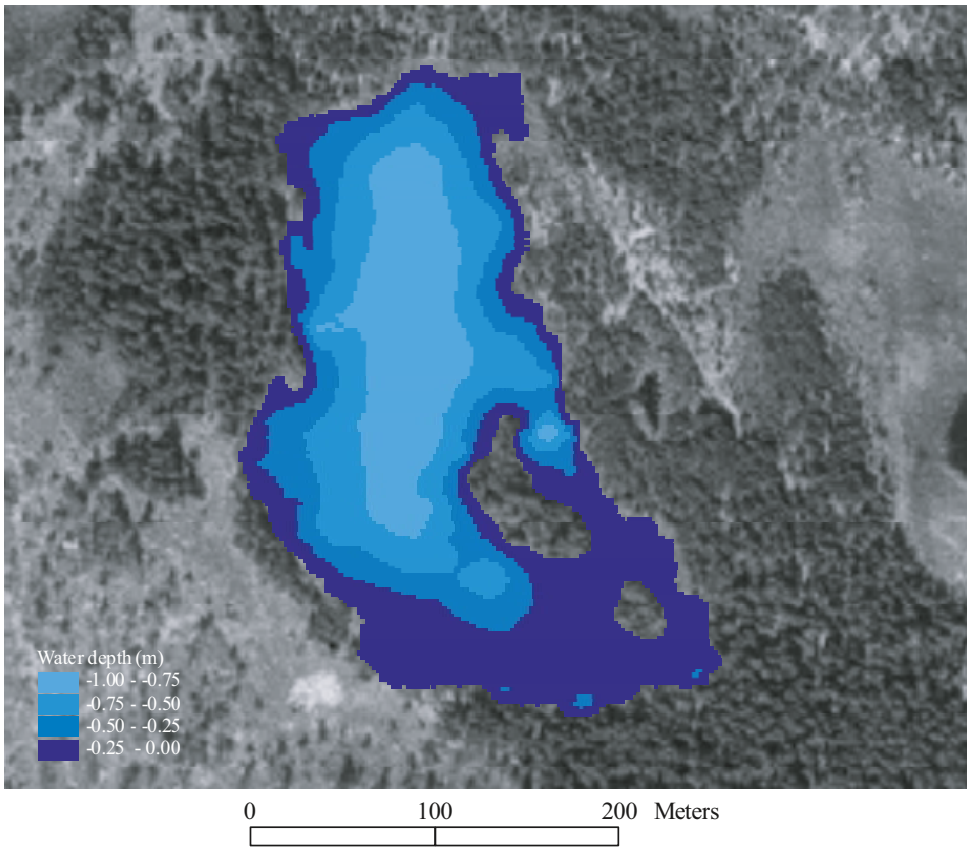

Figure 4-42. *Depth grid map for Lake Vambörsfjärden.*

Table 4-29. Lake morphometry parameters for Lake Vambörsfjärden.

Lake morphometry	
Lake area	0.05 km2
Maximum depth	1.0 m
Mean depth	0.4 m
Volume	0.021 Mm3
Theoretical water renewal time	70 days

Lake ecosystem parameters

Three different main habitats have been identified in the ecosystem of Lake Vambörsfjärden (Table 4-30, Figure 4-43). The littoral with emergent and floating-leaved vegetation (Littoral type I) covers 60% of the lake area, while the rest is occupied by a pelgic habitat together with a littoral with submersed vegetation (Littoral type III). Due to the shallowness and clear water of the lake, light penetrates down to all bottom areas and no profundal habitat is present.

Table 4-30. Distribution of major habitats in Lake Vambörsfjärden.

Habitats	Area [%]
Pelagial/Littoral type III	40
Littoral type I	60

Additional remarks

The red-listed species *Chara intermedia* was found during a visit in 2003.

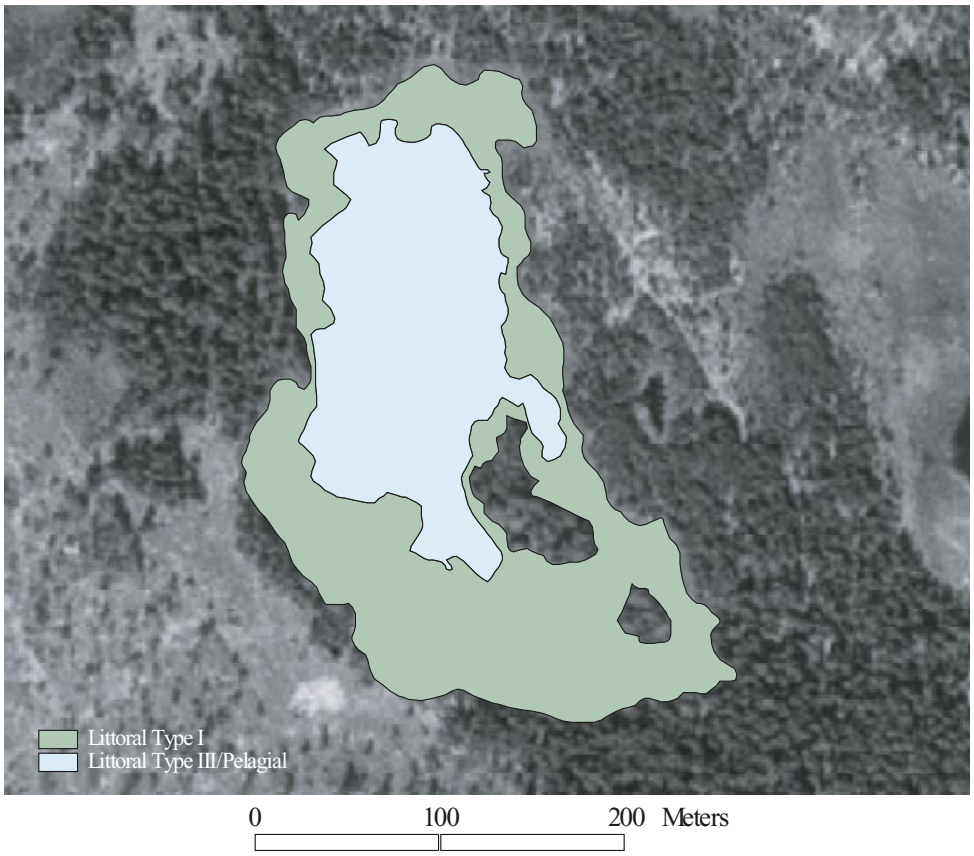

Figure 4-43. *Distribution of major habitats in Lake Vambörsfjärden.*

Forsmark 2:7 Lake Kungsträsket

The location of the object

This catchment is part of the SMHI catchment 54/55 and part of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: 2.60 m above sea level

The catchment area and its major constituents

The total catchment area is 0.126 km^2, which is strongly dominated by forest (Table 4-31).

Table 4-31. The different land uses within the catchment of Lake Kungsträsket.

Land use	Area [%]
Forest	94
Water surface	3
Agriculture	0
Remaining open land	3
Wetland (as parts of the above land use categories)	3

The only surface water within this catchment is Lake Kungsträsket. The lake has no inlet creeks. The outlet creek drains to the east, and the water passes Lake Bolundsfjärden and Lake Norra Bassängen before it enters the Baltic Sea in Asphällsfjärden (Figure 4-44).

Lake morphometry parameters

Figure 4-45 and Figure 4-46 show the bathymetric map and the depth grid map, respectively, for Lake Kungsträsket.

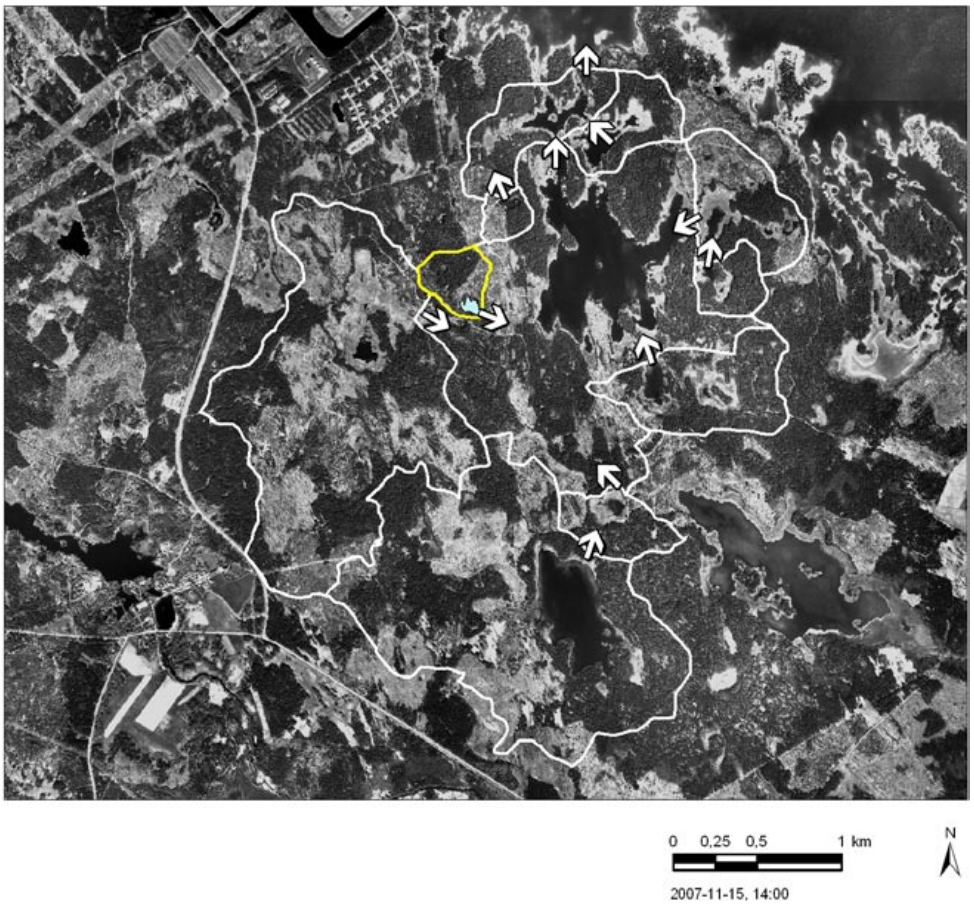

Figure 4-44. *The catchment Forsmark 2 with Lake Kungsträsket and its catchment (sub-area 7) marked with yellow boundaries.*

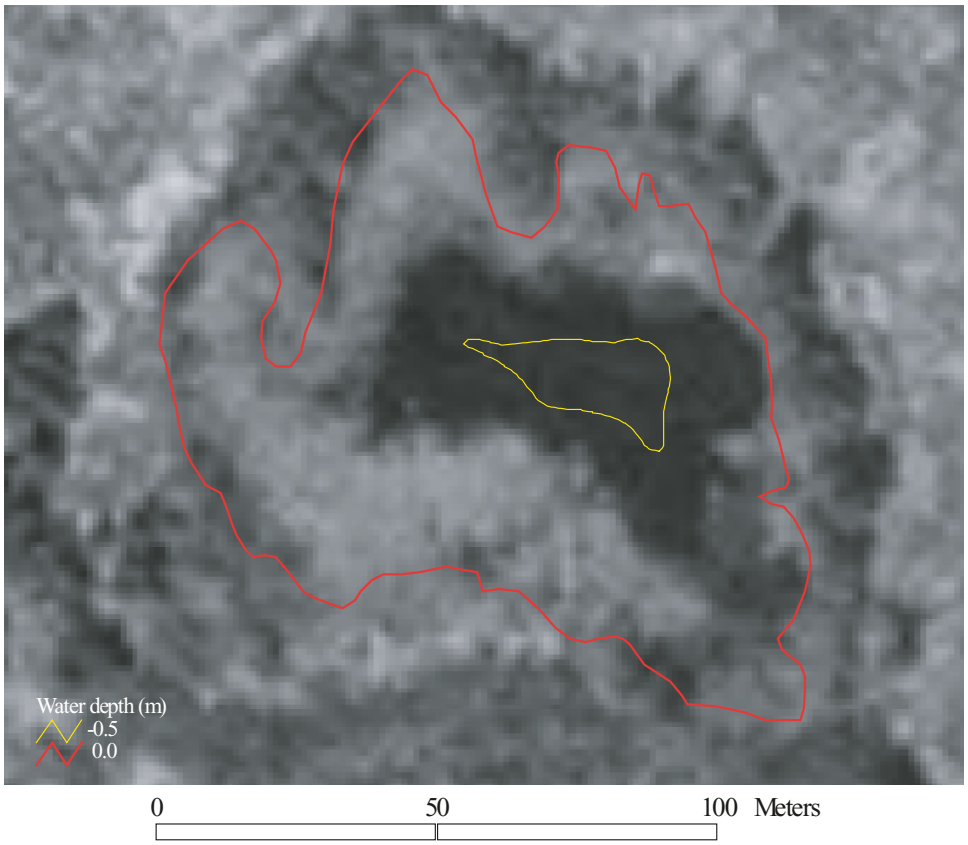

Figure 4-45. *Bathymetric map for Lake Kungsträsket.*

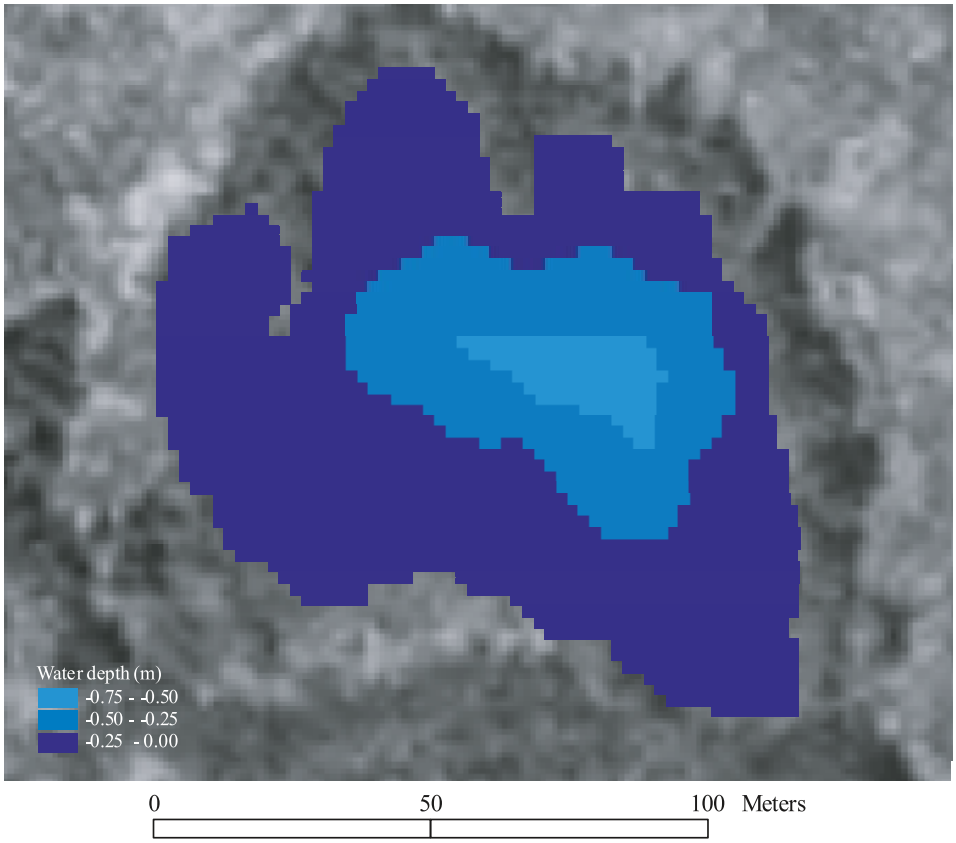

Figure 4-46. *Depth grid map for Lake Kungsträsket.*

Lake Kungsträsket is a very shallow lake (maximum depth 0.5 m, Table 4-32). By the volume it is one of the smallest lakes in the Forsmark area (0.002 Mm^3). It has no islets.

Table 4-32. Lake morphometry parameters for Lake Kungsträsket.

Lake morphometry	
Lake area	0.01 km2
Maximum depth	0.5 m
Mean depth	0.2 m
Volume	0.002 Mm3
Theoretical water renewal time	20 days

Lake ecosystem parameters

The ecosystem of lake Kungsträsket is dominated by the littoral habitat with emergent and floating-leaved vegetation; Littoral type I (Table 4-33, Figure 4-47). The pelagic habitat and the littoral with submersed vegetation (Littoral type III), which due to the shallowness and clear water have the same distribution, occupies 39% of the lake area.

Table 4-33. Distribution of major habitats in Lake Kungsträsket.

Habitats	Area [%]
Pelagial/Littoral type III	39
Littoral type I	61

Additional remarks

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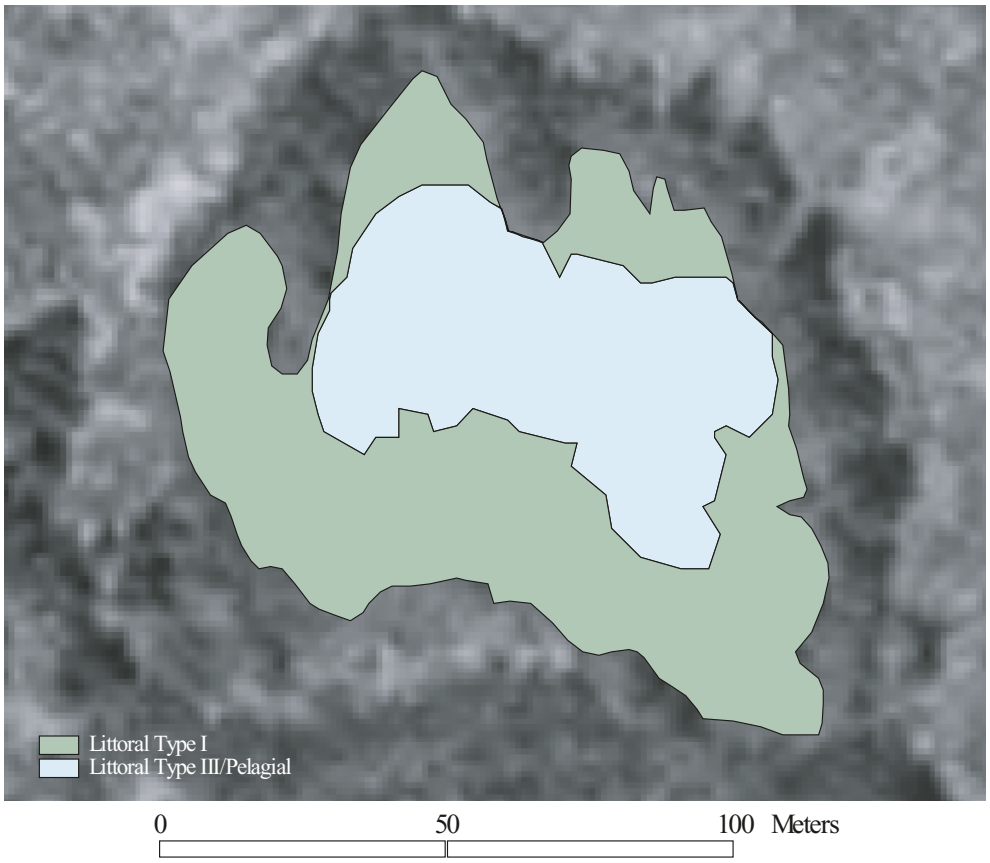

Figure 4-47. *Distribution of major habitats in Lake Kungsträsket.*

Forsmark 2:8. Lake Gällsboträsket

The location of the object

This catchment is part of the SMHI catchment 54/55 and part of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: 669875, 163081 (SMHI)
Elevation: 1.91 m above sea level

The catchment area and its major constituents

The total catchment area is 2.141 km^2, and forest is the dominating land use (Table 4-34).

Table 4-34. The different land uses within the catchment of Lake Gällsboträsket.

Land use	Area [%]
Forest	89
Water surface	1
Agriculture	0
Remaining open land	11
Wetland (as parts of the above land use categories)	11

The only surface water within this catchment is Lake Gällsboträsket. This lake has one inlet creek entering from the south. The outlet creek in the east joins the outlet from Lake Kungsträsket, and further downstream the water passes through Lake Bolundsfjärden and Lake Norra Bassängen before it enters the Baltic Sea in Asphällsfjärden (Figure 4-48).

Lake morphometry parameters

Figure 4-49 and Figure 4-50 shows the bathymetric map and the depth grid map, respectively, for Lake Gällsboträsket.

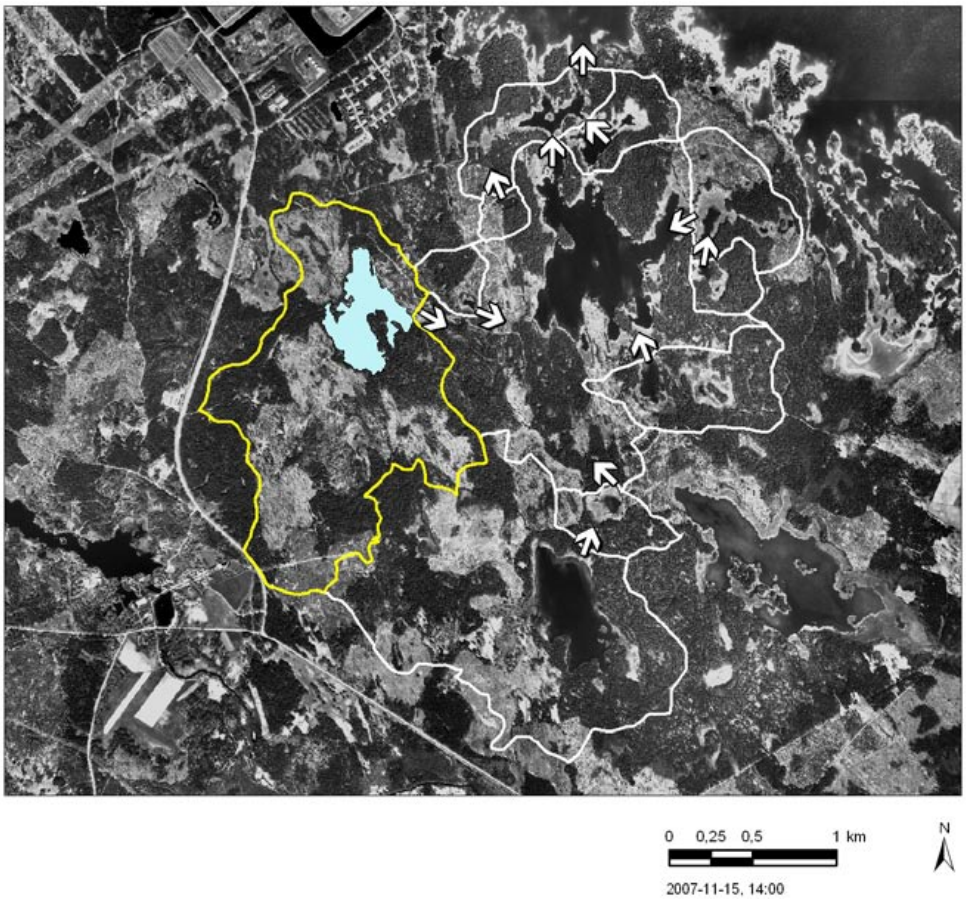

Figure 4-48. *The catchment Forsmark 2 with Lake Gällsboträsket and its catchment (sub-area 8) marked with yellow boundaries.*

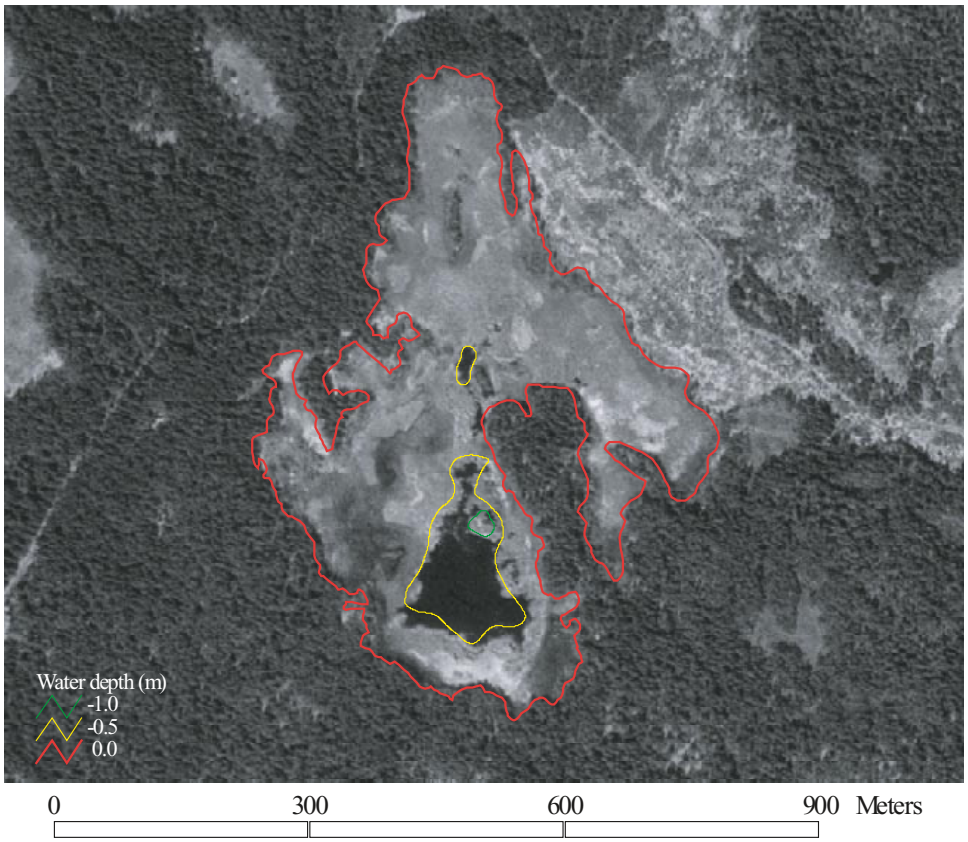

Figure 4-49. *Bathymetric map for Lake Gällsboträsket.*

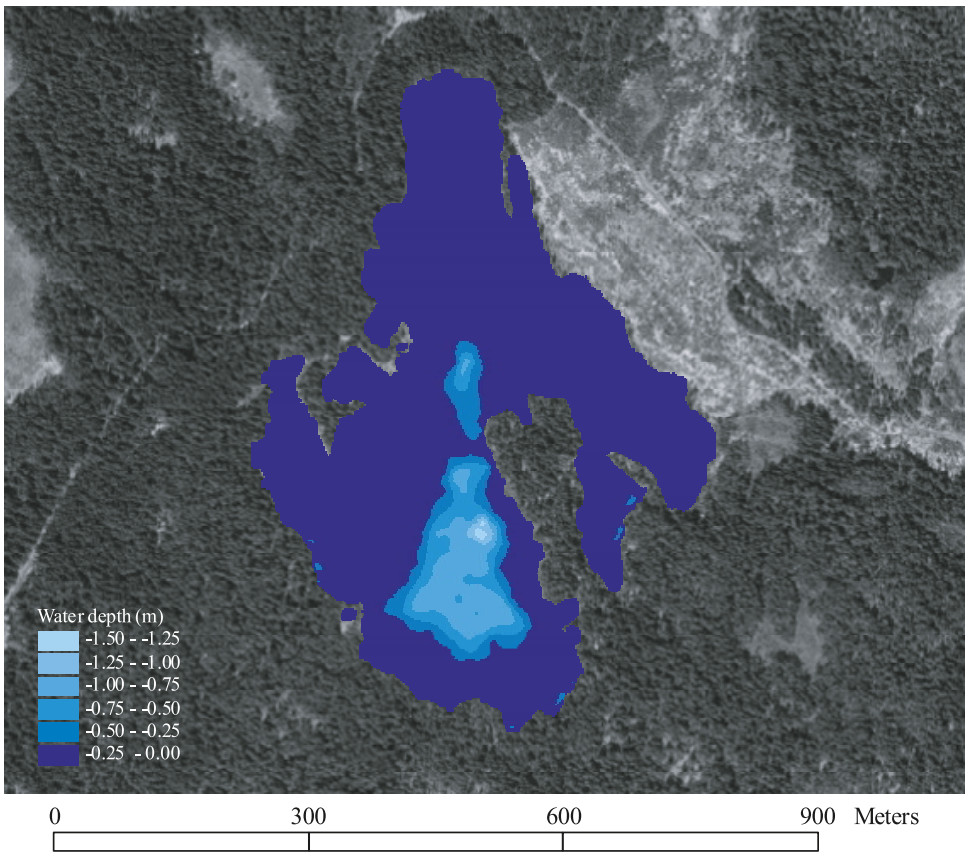

Figure 4-50. *Depth grid map for Lake Gällsboträsket.*

Except for a small part with a maximum depth of 1.5 m (Table 4-35, Figure 4-50), Lake Gällsboträsket is one of the shallowest lakes of the Forsmark area (mean depth 0.2 m). The theoretical water renewal time is short (18 days). The lake has no islets.

Table 4-35. Lake morphometry parameters for Lake Gällsboträsket.

Lake morphometry	
Lake area	0.19 km2
Maximum depth	1.5 m
Mean depth	0.2 m
Volume	0.032 Mm3
Theoretical water renewal time	18 days

Lake ecosystem parameters

The ecosystem of this lake is strongly dominated by a littoral habitat with emergent and floating-leaved vegetation (Littoral type I), which covers 95% of the lake area (Table 4-36, Figure 4-51). The remaining 5% of the area is occupied by a littoral with submerged vegetation (Littoral type III), together with a pelagic habitat. Due to the shallowness and clear water of this lake, light penetrates down to the bottom areas and no profundal areas are present.

Table 4-36. Distribution of major habitats in Lake Gällsboträsket.

Habitats	Area [%]
Pelagial/Littoral type III	5
Littoral type I	95

Additional remarks

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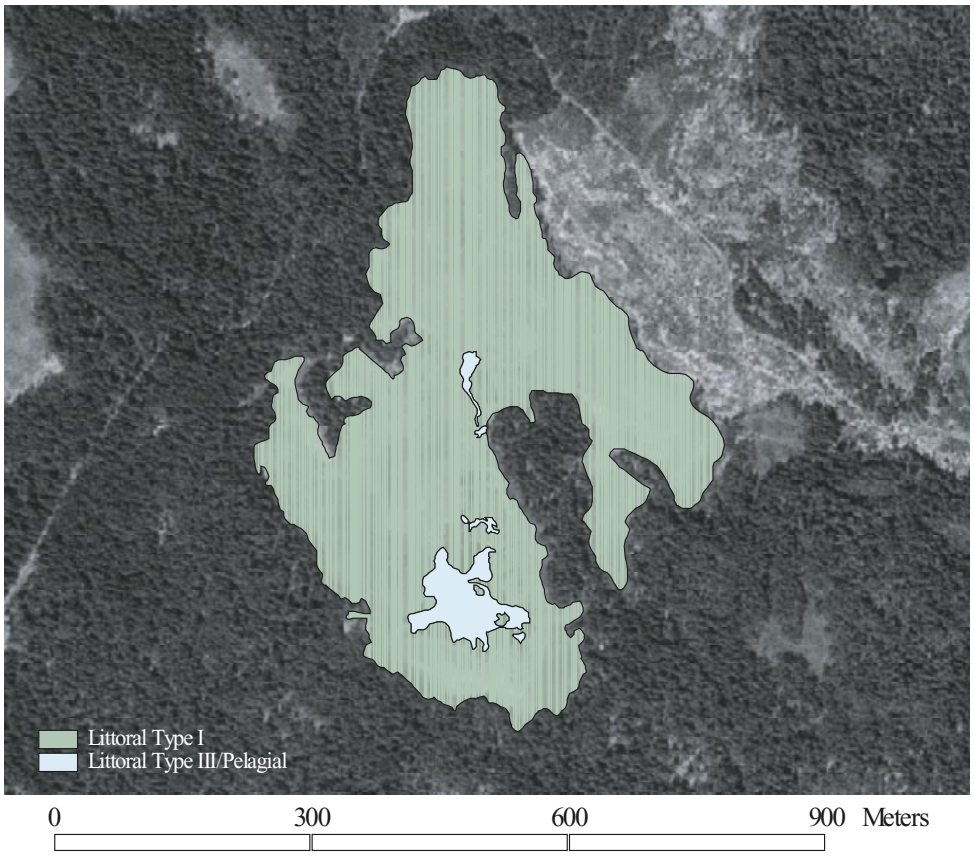

Figure 4-51. *Distribution of major habitats in Lake Gällsboträsket.*

Forsmark 2:9–10. Lake Stocksjön (the entire catchment)

The location of the object

This catchment is part of the SMHI catchment no 54/55, and equals catchment no 54/55:27 together with parts of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: 669762, 163222 (SMHI)
Elevation: 2.92 m above sea level

The catchment area and its major constituents

The total catchment area is 1.477 km^2. Forest is the dominating land use (Table 4-37).

Table 4-37. The different land uses within the entire catchment of Lake Stocksjön. The data are added from two sub-areas (see Appendix 4 and 6 for data of each sub-area).

Land use	Area [%]
Forest	81
Water surface	9
Agriculture	1
Remaining open land	10
Wetland (as parts of the above land use categories)	6

The surface waters within this lake catchment are Lake Stocksjön and Lake Eckarfjärden. Lake Stocksjön has one inlet creek in the south, which comes from Lake Eckarfjärden. The outlet creek in the north joins the outlet creeks from Lakes Gällsboträsket and Kungsträsket on its way down to Lake Bolundsfjärden and Lake Norra Bassängen, and the water finally enters the Baltic Sea in Asphällsfjärden (Figure 4-52).

Lake morphometry parameters

In Figure 4-53 and Figure 4-54 the bathymetric map and the depth grid map, respectively, for Lake Stocksjön are presented.

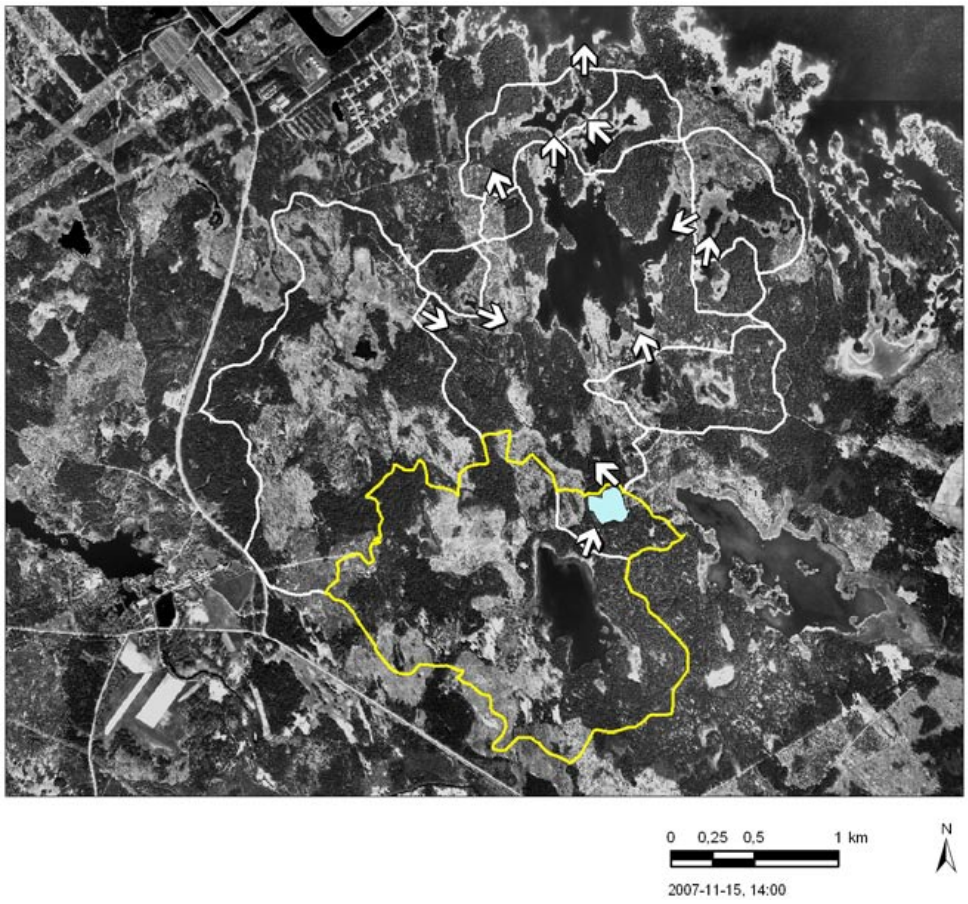

Figure 4-52. *The catchment Forsmark 2 with Lake Stocksjön and its catchment (sub-areas 9–10) marked with yellow boundaries.*

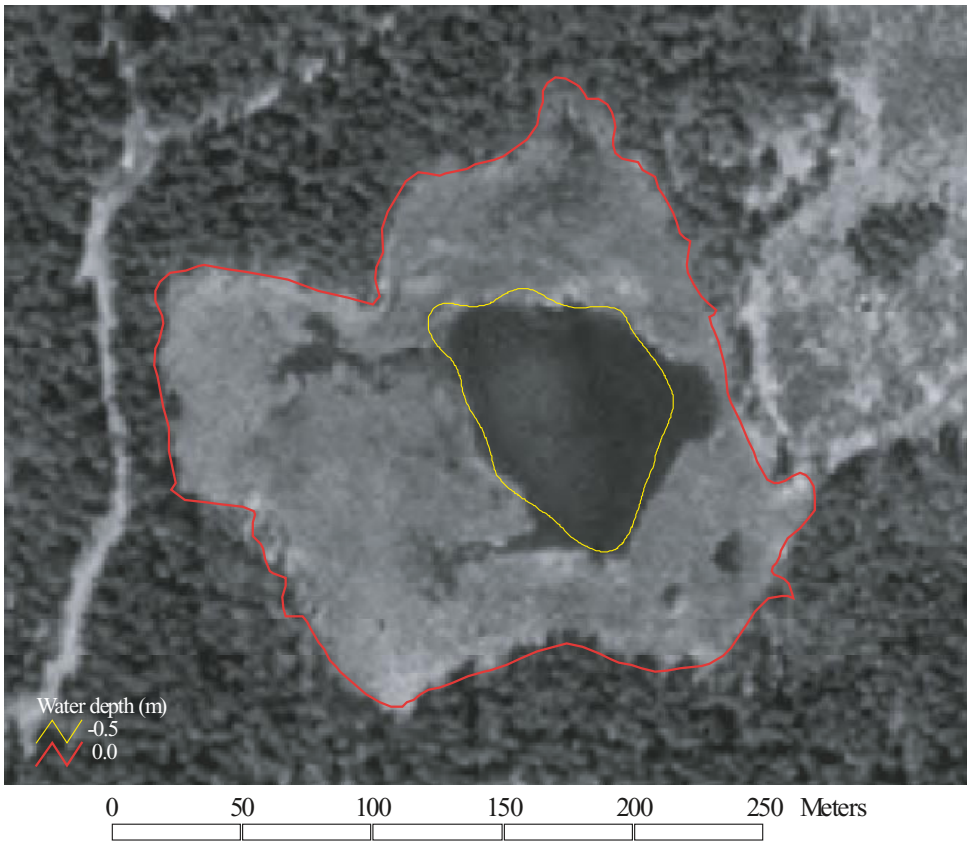

Figure 4-53. *Bathymetric map for Lake Stocksjön.*

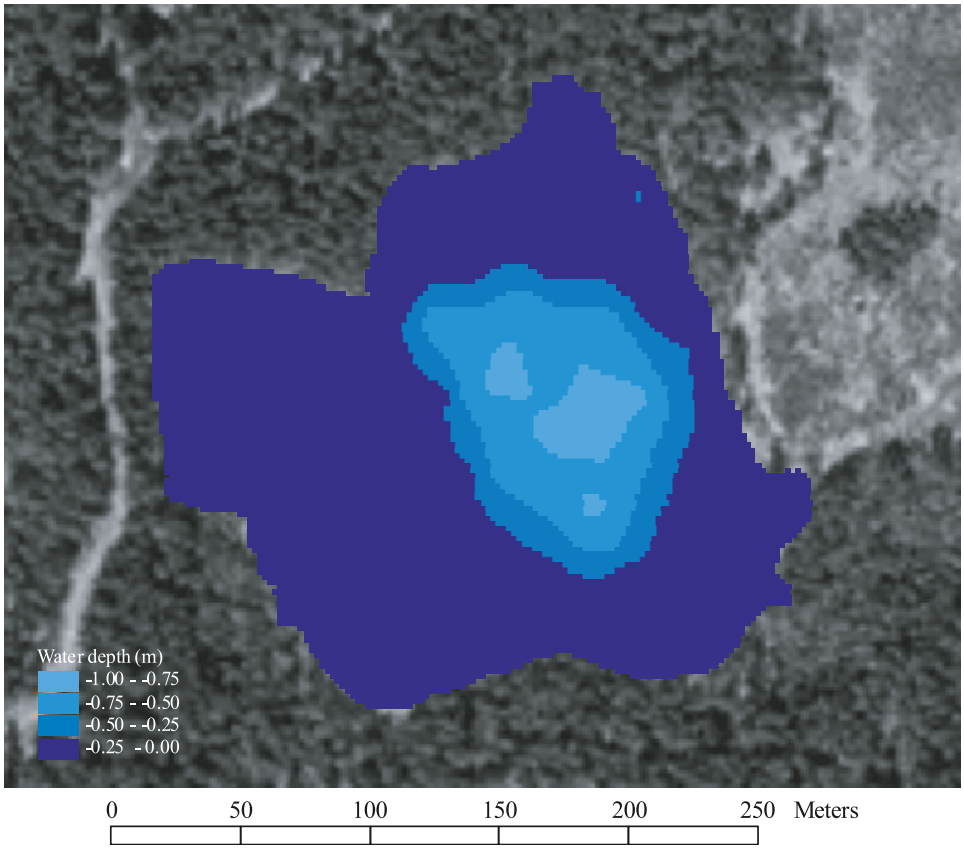

Figure 4-54. *Depth grid map for Lake Stocksjön.*

Lake Stocksjön is a small and shallow lake (Table 4-38), with a very short theoretical water renewal time (9 days). The lake has no islets.

Table 4-38. Lake morphometry parameters for Lake Stocksjön.

Lake morphometry	
Lake area	0.04 km2
Maximum depth	0.8 m
Mean depth	0.2 m
Volume	0.008 Mm3
Theoretical water renewal time	9 days

Lake ecosystem parameters

Three main habitats are present in Lake Stocksjön. The littoral habitat with emergent and floating-leaved vegetation (Littoral type I) strongly dominates the ecosystem, covering 85% of the lake area (Table 4-39, Figure 4-55). Due to the shallowness and clear water of this lake, light penetrates down to all bottom areas and no profundal areas are present. Hence, the pelagic habitat and the littoral with submerged vegetation (Littoral type III) have the same distribution and cover the remaining 15% of the lake area.

Table 4-39. Distribution of major habitats in Lake Stocksjön.

Habitats	Area [%]
Pelagial/Littoral type III	15
Littoral type I	85

Additional remarks

The red-listed speices *Chara intermedia* was found during a visit in 2002.

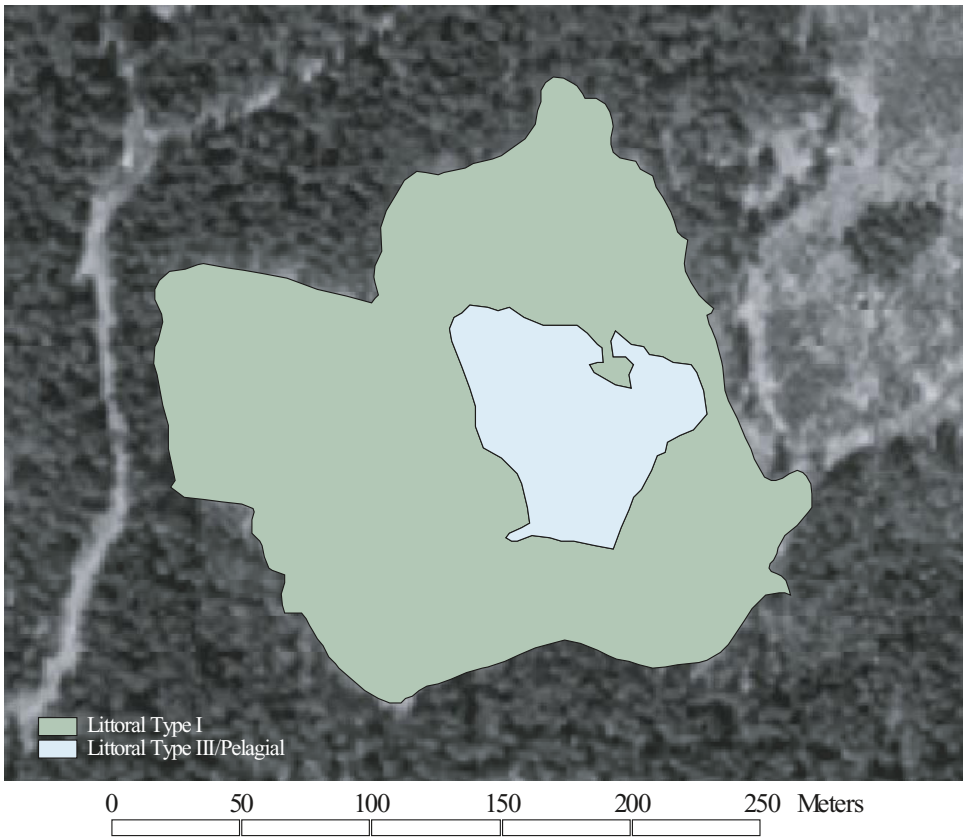

Figure 4-55. *Distribution of major habitats in Lake Stocksjön.*

Forsmark 2:9. Lake Stocksjön (sub-area)

See Appendix 3–6 for data on sub-catchment parameters. For lake data, see Forsmark 2:9–10 (entire catchment).

Forsmark 2:10. Lake Eckarfjärden

The location of the object

This catchment is part of the SMHI catchment 54/55 and equals catchment no 54/55:27 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: 669723, 163205 (SMHI)
Elevation: 5.37 m above sea level

The catchment area and its major constituents

The total catchment area is 1.268 km^2, and the land use is dominated by forest (Table 4-40).

Table 4-40. The different land uses within the catchment of Lake Eckarfjärden.

Land use	Area [%]
Forest	81
Water surface	10
Agriculture	1
Remaining open land	9
Wetland (as parts of the above land use categories)	5

The only surface water within this catchment is Lake Eckarfjärden. The lake has one inlet creek in the southern part. The outlet creek in the north passes through Lake Stocksjön, joins the outlet creeks from lakes Gällsboträsket and Kungsträsket, and the water passes also through Lake Bolundsfjärden and Lake Norra Bassängen before entering the Baltic Sea in Asphällsfjärden (Figure 4-56).

Lake morphometry parameters

Figure 4-57 and Figure 4-58 show the bathymetric map and the depth grid map, respectively, for Lake Eckarfjärden.

Lake Eckarfjärden is one of the larger lakes in the Forsmark area, and it has the largest mean depth of all the lakes (Table 4-41). The theoretical water renewal time is long, close to 11 months. The lake has three small islets.

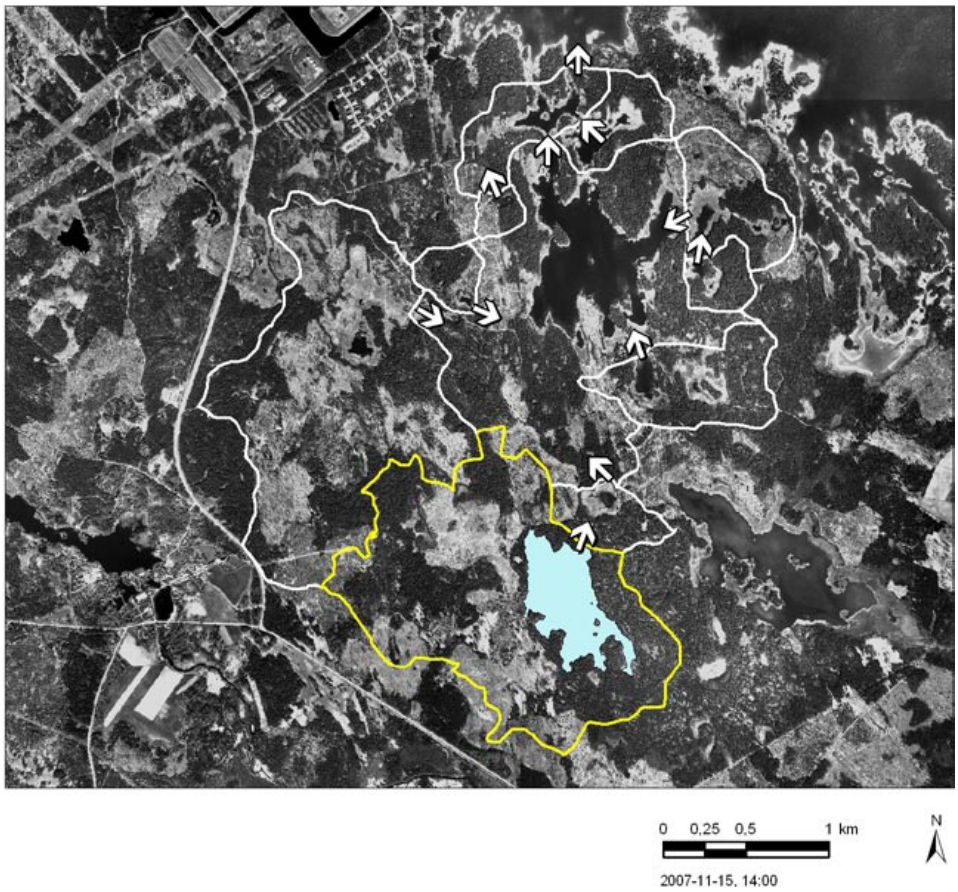

Figure 4-56. *The catchment Forsmark 2 with Lake Eckarfjärden and its catchment (sub-area 10) marked with yellow boundaries.*

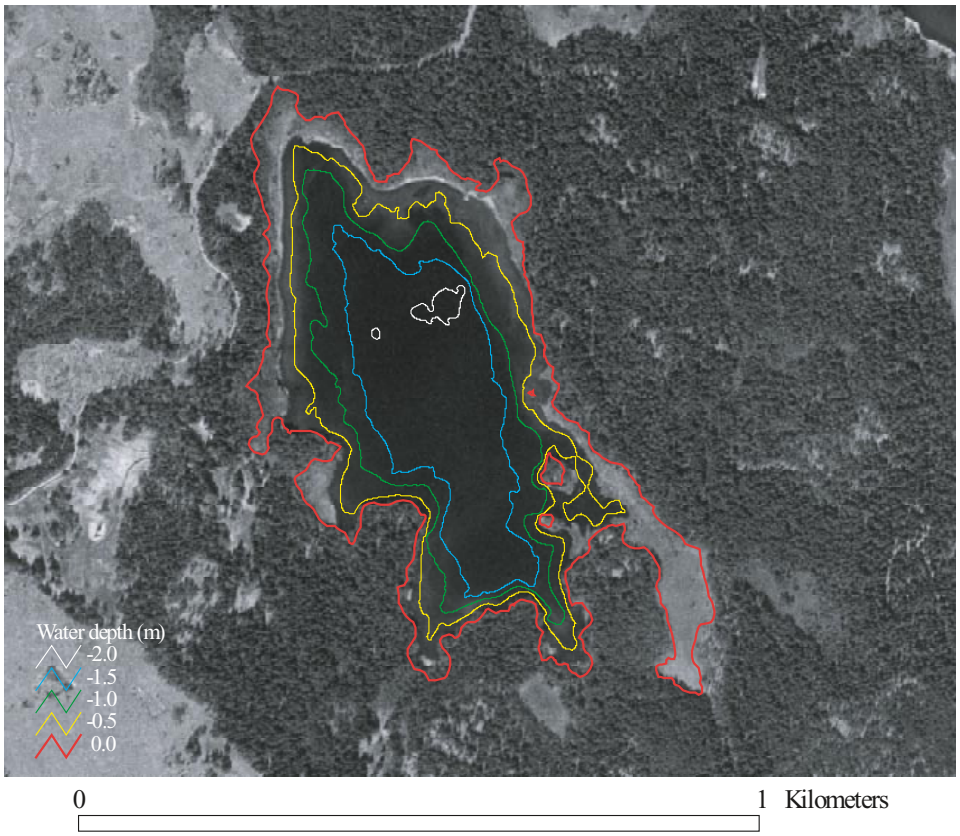

Figure 4-57. *Bathymetric map for Lake Eckarfjärden.*

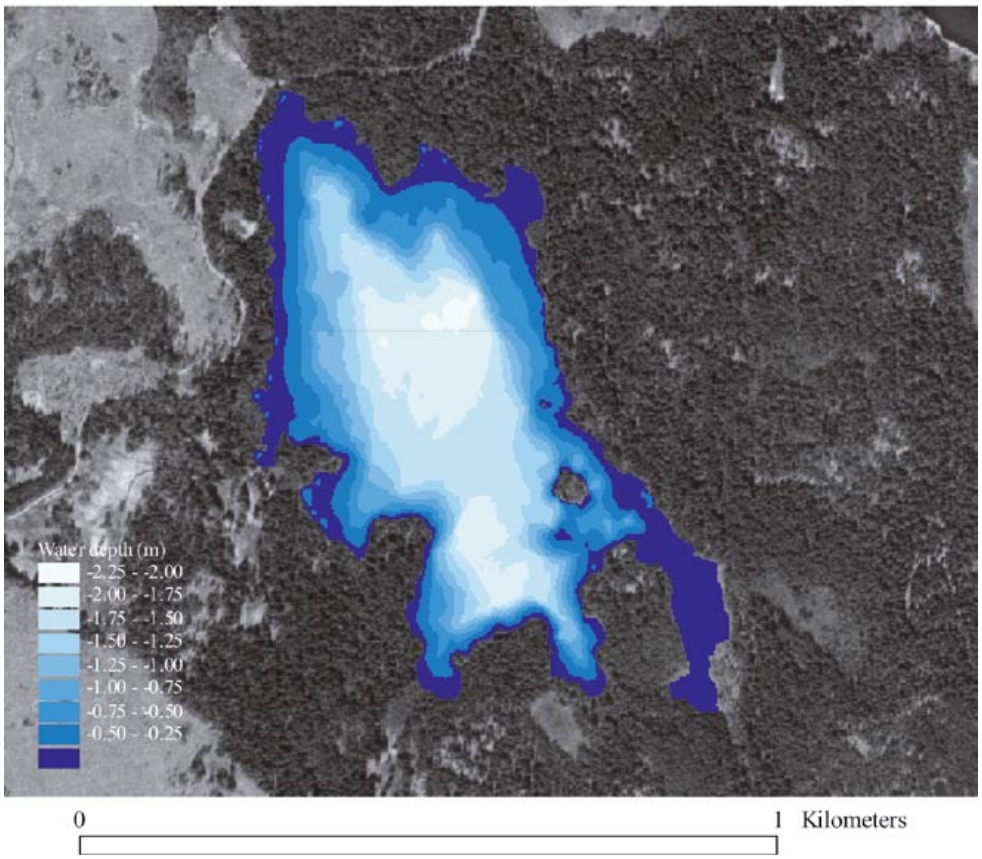

Figure 4-58. *Depth grid map for Lake Eckarfjärden.*

Table 4-41. Lake morphometry parameters for Lake Eckarfjärden.

Lake morphometry	
Lake area	0.28 km2
Maximum depth	2.1 m
Mean depth	0.9 m
Volume	0.257 Mm3
Theoretical water renewal time	328 days

Lake ecosystem parameters

Despite the relatively large depth of this lake, the clarity of the lake water allows light enough for photosynthetic activity to reach all bottom areas. Thus, no profundal habitat is present. Neither is there any nearshore hard-bottom habitat (Littoral type II) present in the lake. The pelagic habitat and the littoral with submersed vegetation (Littoral type III), which have the same distribution, (Table 4-42, Figure 4-59) cover 66% of the lake area. The submersed vegetation in this area is dominated by stoneworths (Chara spp, Figure 4-60). The littoral habitat with emergent and floating-leaved vegetation (Littoral type I) is dominated by the common reed (Phragmites australis).

Table 4-42. Distribution of major habitats in Lake Eckarfjärden.

Habitats	Area [%]
Pelagial/Littoral type III	66
Littoral type I	34

Additional remarks

The water level in this lake has been lowered, due to digging in the outlet creek /Brunberg and Blomqvist, 1998/.

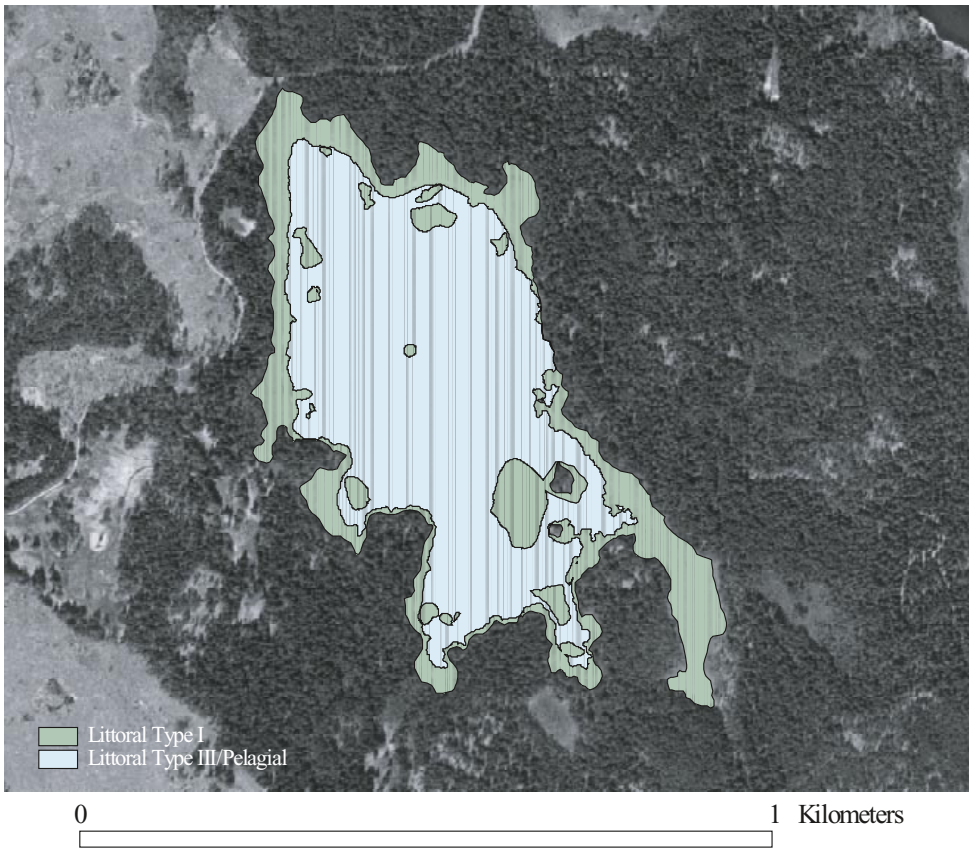

Figure 4-59. *Distribution of major habitats in Lake Eckarfjärden.*

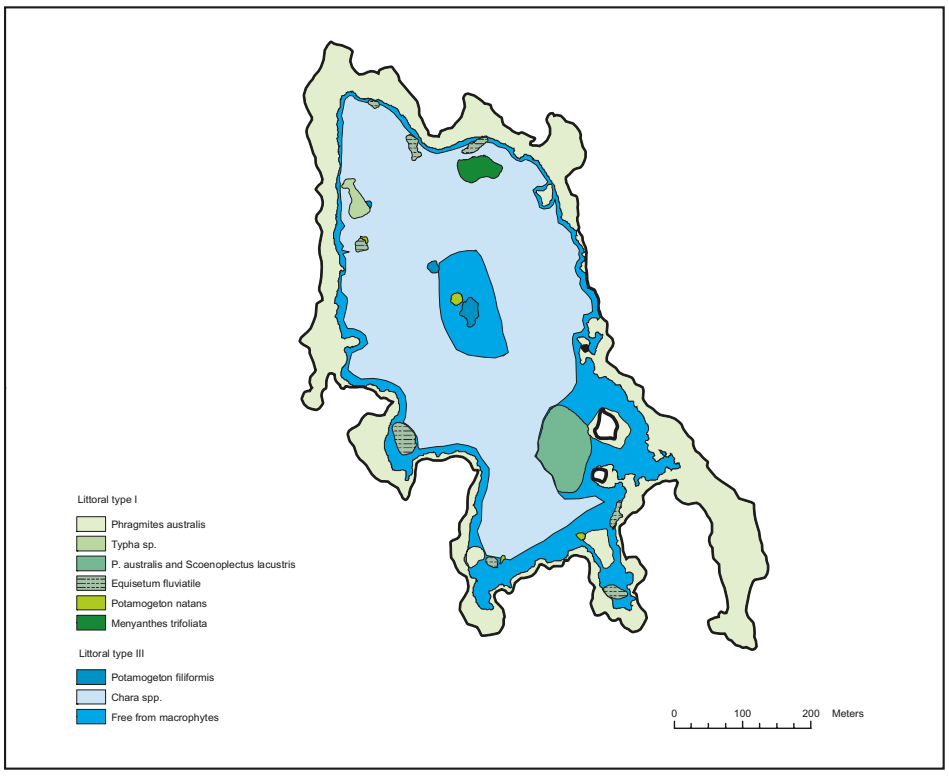

Figure 4-60. *Dominating species of vegetation in the littoral of type I and III in Lake Eckarfjärden.*

Forsmark 2:11. Lake Puttan

The location of the object

This catchment is part of the SMHI catchment no 54/55 and part of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: 0.63 m above sea level

The catchment area and its major constituents

The total catchment area is 0.244 km^2, with forest dominating the land use (Table 4-43).

Table 4-43. The different land uses within the entire catchment of Lake Puttan.

Land use	Area [%]
Forest	58
Water surface	17
Agriculture	0
Remaining open land	25
Wetland (as parts of the above land use categories)	25

The only surface water within this catchment is Lake Puttan. The outlet of Lake Puttan passes through Lake Norra Bassängen and enters the Baltic Sea in Asphällsfjärden. The direction of drainage between Lake Puttan and Lake Norra Bassängen may vary during the year, which means that the entire catchment of Lake Norra Bassängen (2:1–10 in this report) potentially may be included in the catchment (Figure 4-61). However, no outlet creek from lake Puttan has been identified for these situations. The hydrology of the area thus needs to be further investigated.

Lake morphometry parameters

Figure 4-62 and Figure 4-63 show the bathymetric map and the depth grid map, respectively, for Lake Puttan.

Lake Puttan is a small and shallow lake, as most of the lakes in this area. The theoretical water renewal time is very short compared to the other lakes in the Forsmark area (Table 4-44). However, the complicated and yet unknown drainage conditions of the lake may alter the real water exchange considerably.

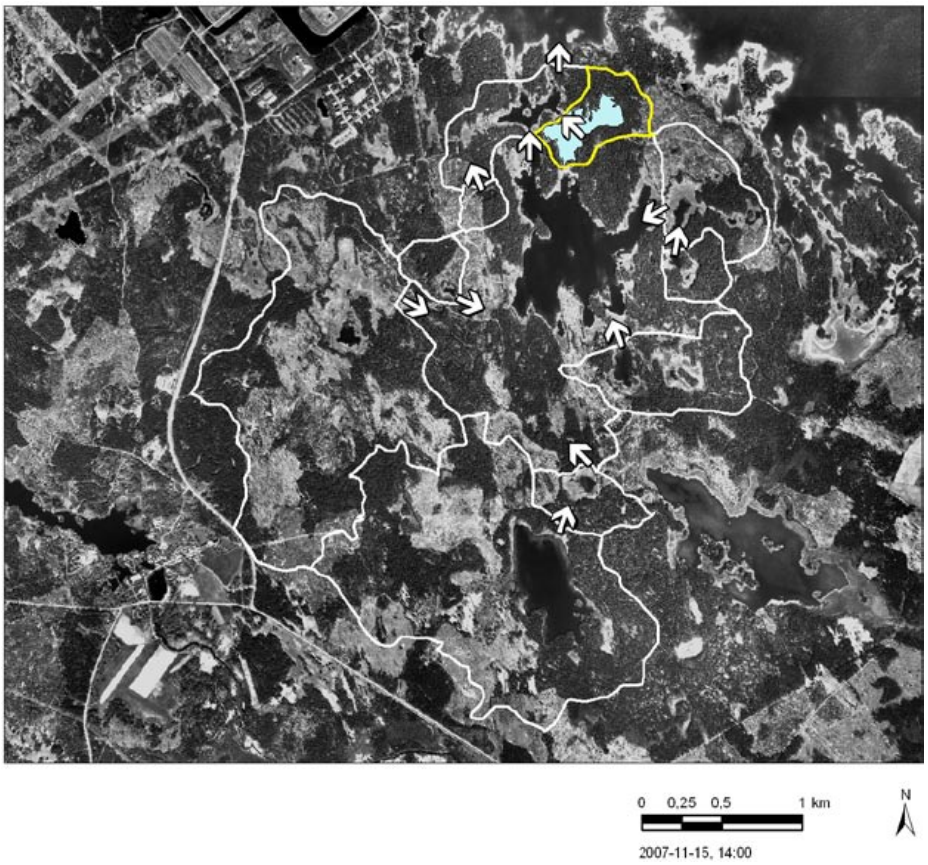

Figure 4-61. *The catchment Forsmark 2 with Lake Puttan and its catchment (sub-area 11) marked with yellow boundaries. During some parts of the year, the entire catchment of Lake Norra Bassängen may be included in the catchment.*

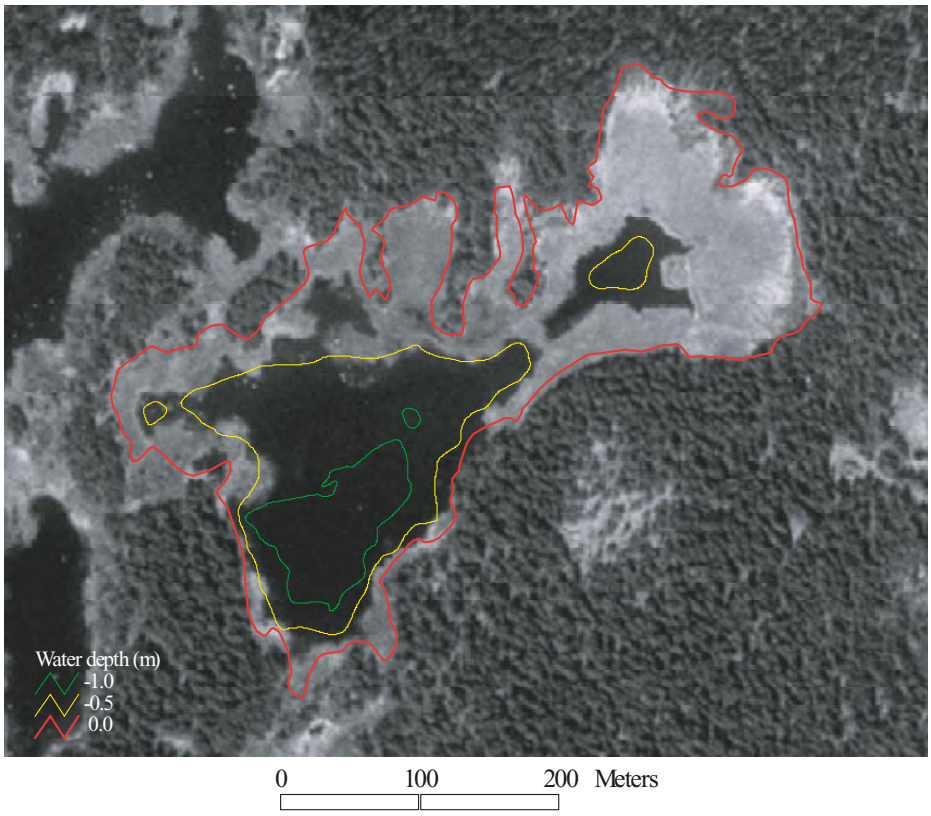

Figure 4-62. *Bathymetric map for Lake Puttan.*

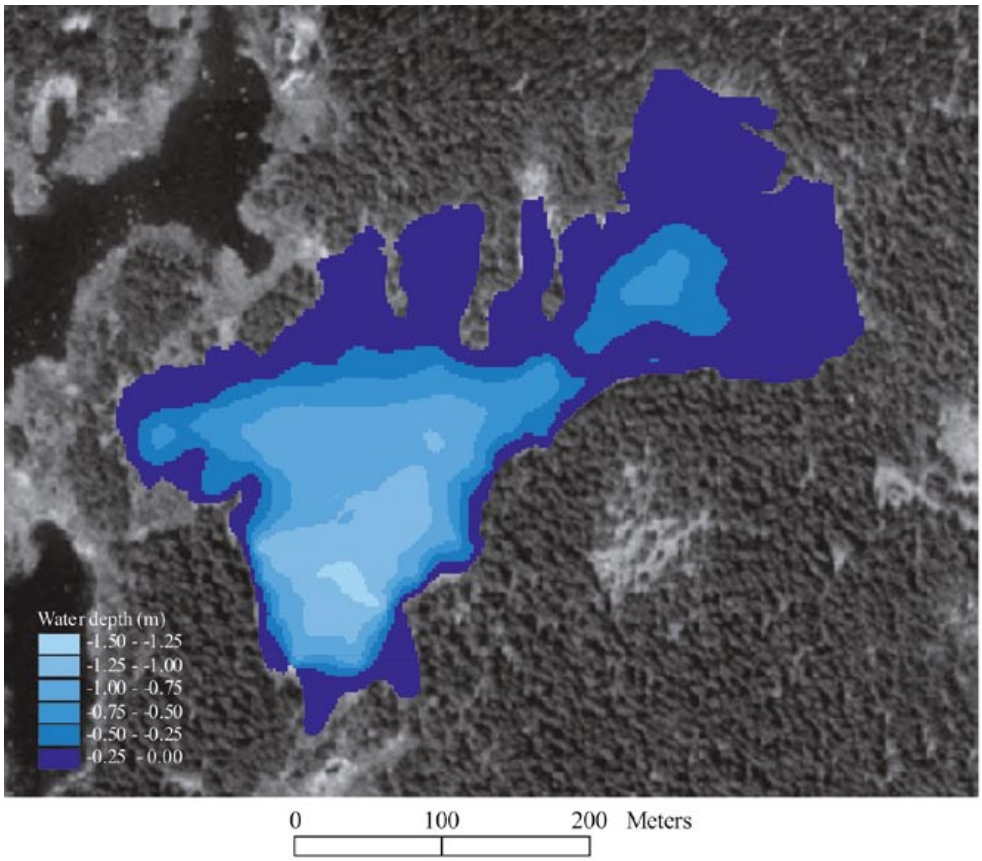

Figure 4-63. *Depth grid map for Lake Puttan.*

Table 4-44. Lake morphometry parameters for Lake Puttan.

Lake morphometry	
Lake area	0.08 km2
Maximum depth	1.3 m
Mean depth	0.4 m
Volume	0.030 Mm3
Theoretical water renewal time	6 days

Lake ecosystem parameters

Lake Puttan has three major habitats, of which the littoral with emergent and floating-leaved vegetation (Littoral type I) covers a large part (68%) of the lake area (Table 4-45, Figure 4-64). Due to the shallowness and clear water of this lake, light penetrates down to all bottom areas and no profundal areas are present. Neither is there any nearshore hard-bottom habitat (Littoral type II) present in the lake. Hence, the pelagic habitat and the littoral with submersed vegetation (Littoral type III) have the same distribution.

Table 4-45. Distribution of major habitats in Lake Puttan.

Habitats	Area [%]
Pelagial/Littoral type III	32
Littoral type I	68

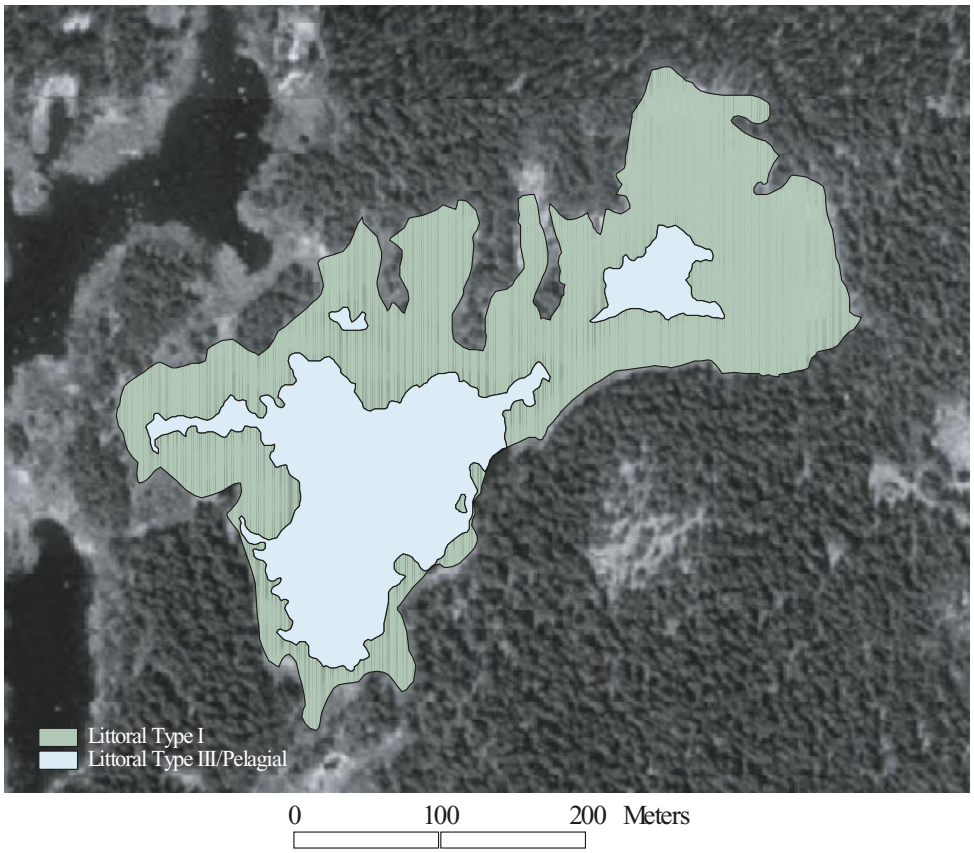

Figure 4-64. *Distribution of major habitats in Lake Puttan.*

Additional remarks

The drainage conditions of this lake still remain to be elucidated – regarding its connection to Lake Norra Bassängen as well as to Lake Bolundsfjärden and directly to the Baltic Sea – in order to determine the correct hydrological conditions within the catchment. Saltwater intrusions probably occur regularly at high water levels in the sea.

It should also be further controlled whether a Littoral of type II is present along the southeast shore of the lake, in the parts where Littoral of type I is absent (Figure 4-64).

4.3 The catchment Forsmark 3

This area consists of one single sub-area (Figure 4-65): Lake Tallsundet (no 3:1). The outlet creek from this lake passes through wetlands before reaching the Baltic Sea in a bay north of Tixelfjärden.

Forsmark 3:1. Lake Tallsundet

The location of the object

This catchment is part of the SMHI catchment no 54/55 and part of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: 0.13 m above sea level

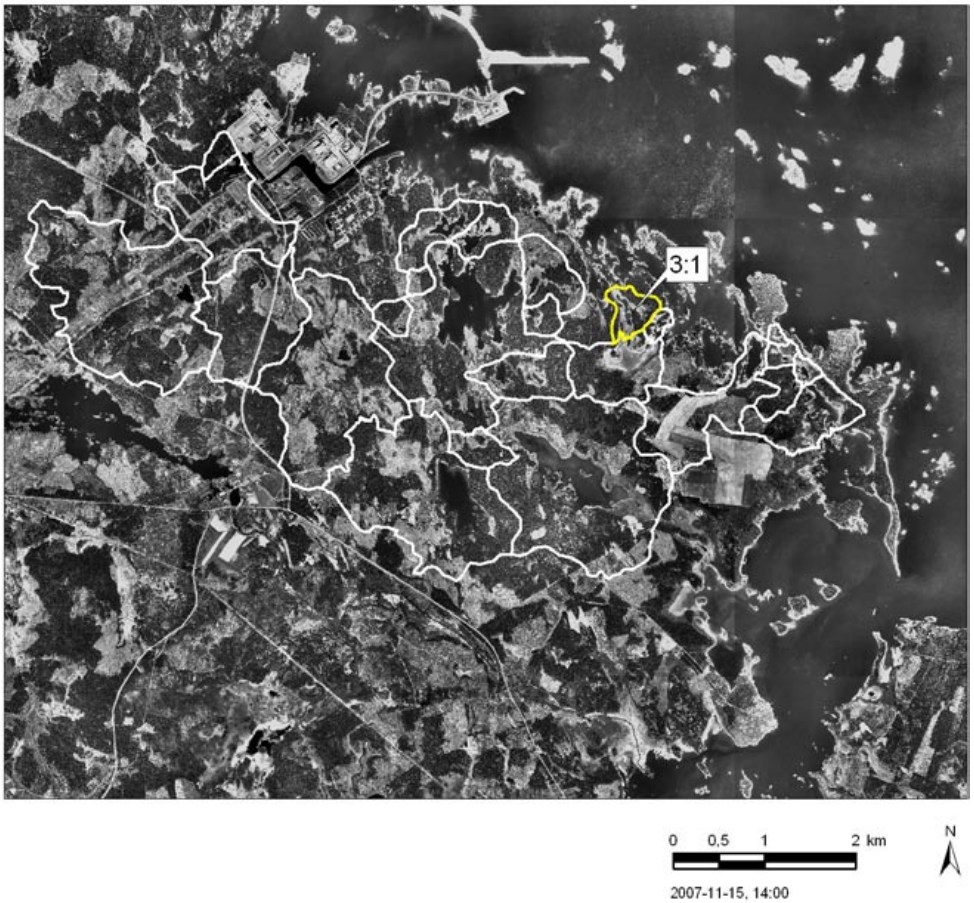

Figure 4-65. *The Forsmark area with the single sub-area in the catchment Forsmark 3 marked with yellow boundaries.*

The catchment area and its major constituents

The total catchment area is 0.215 km^2, and the dominating land use is forest (Table 4-46).

Table 4-46. The different land uses within the catchment of Lake Tallsundet.

Land use	Area [%]
Forest	58
Water surface	11
Agriculture	0
Remaining open land	31
Wetland (as parts of the above land use categories)	35

The only surface water within this catchment is Lake Tallsundet. The lake has no inlet creek. The outlet northwest of the lake passes through wetlands before discharging into the Baltic Sea (Figure 4-66).

Lake morphometry parameters

Figure 4-67 and Figure 4-68 show the bathymetric map and the depth grid map, respectively, for Lake Tallsundet.

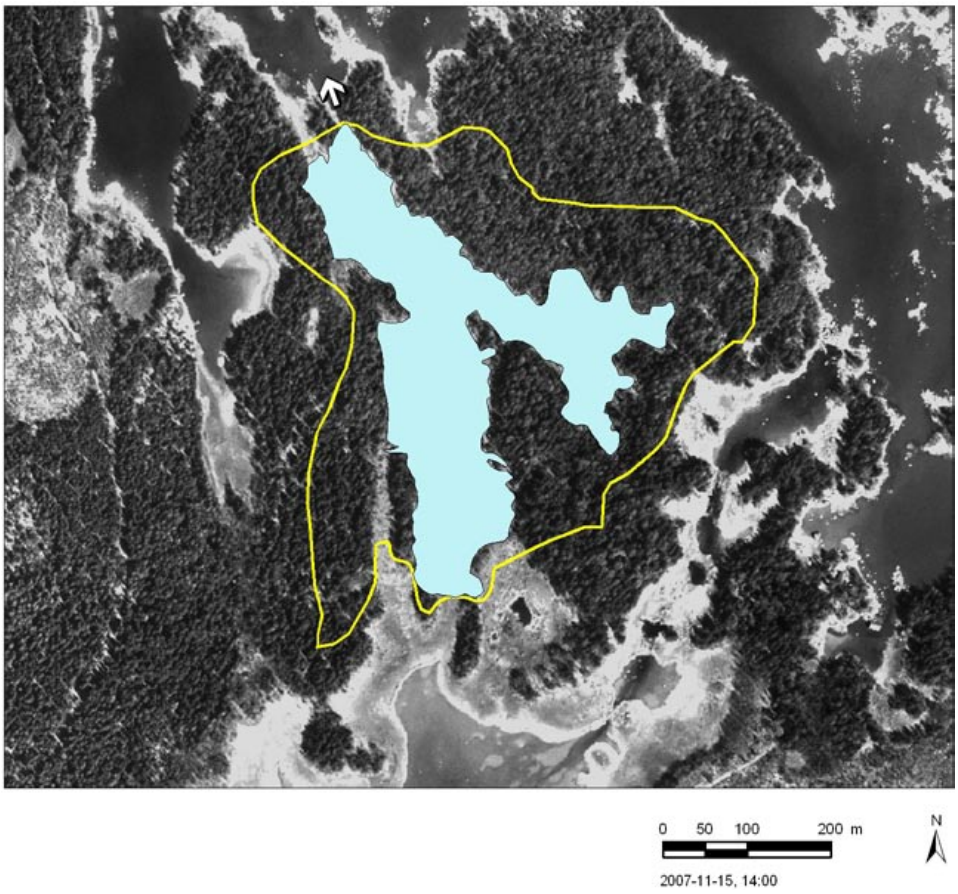

Figure 4-66. *The catchment Forsmark 3 with Lake Tallsundet and its catchment (sub-area 1, the only sub-area within this catchment) marked with yellow boundaries.*

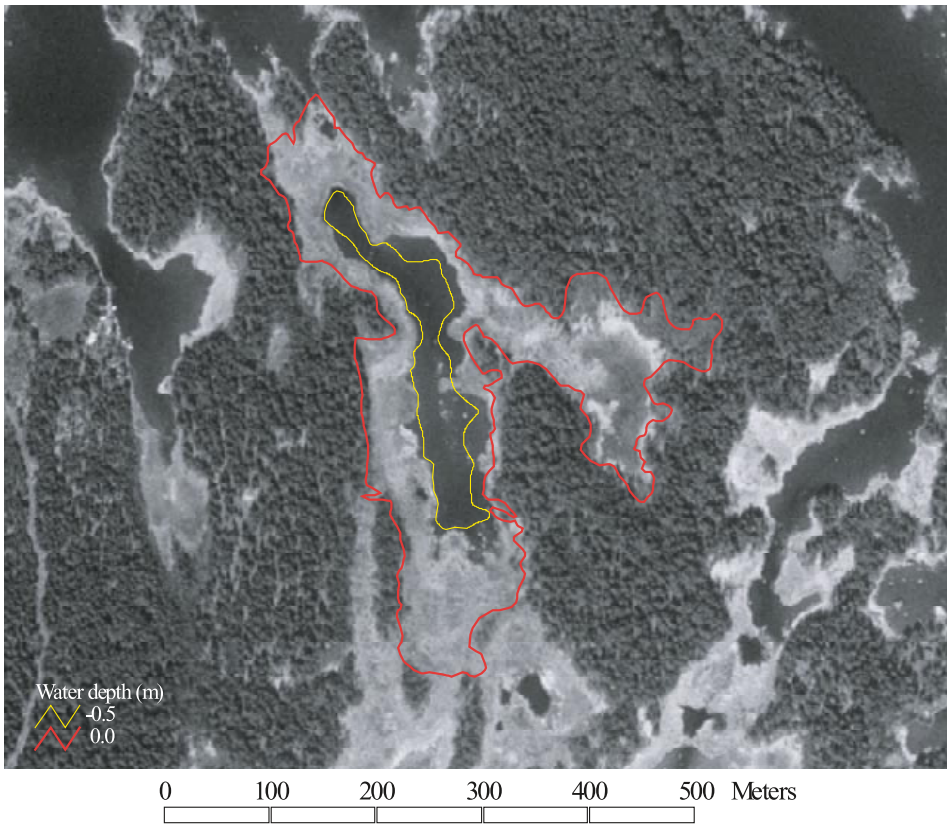

Figure 4-67. *Bathymetric map for Lake Tallsundet.*

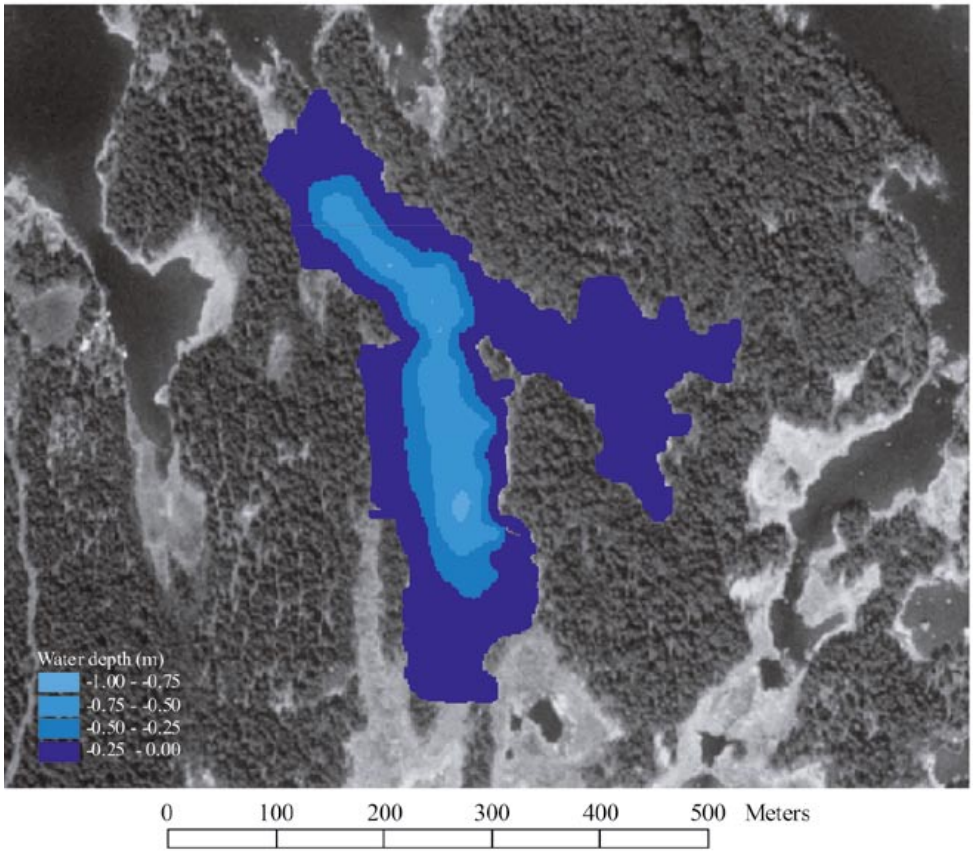

Figure 4-68. *Depth grid map for Lake Tallsundet.*

Lake Tallsundet is a very shallow lake, with a mean depth of 0.2 m (Table 4-47). The theoretical water renewal time is long (close to 5 months), compared to most other lakes in the area. The lake has no islets.

Table 4-47. Lake morphometry parameters for Lake Tallsundet.

Lake morphometry	
Lake area	0.08 km2
Maximum depth	0.8 m
Mean depth	0.2 m
Volume	0.018 Mm3
Theoretical water renewal time	141 days

Lake ecosystem parameters

Three main habitats have been identified in Lake Tallsundet (Table 4-48, Figure 4-69). The littoral habitat with emergent and floating-leaved vegetation (Littoral type I) strongly dominates the ecosystem, and covers 87% of the lake area. The remaining area is occupied by a pelagic habitat and, along the bottom, of a littoral habitat with submersed vegetation (Littoral type III). Due to the shallowness and clear water of this lake, light penetrates down to all bottom areas and no profundal areas are present.

Table 4-48. Distribution of major habitats in Lake Tallsundet.

Habitats	Area [%]
Pelagial/Littoral type III	13
Littoral type I	87

Additional remarks

Saltwater intrusions probably occur regularly in this lake, as the threshold of the lake is situated on a level close to the normal sea level.

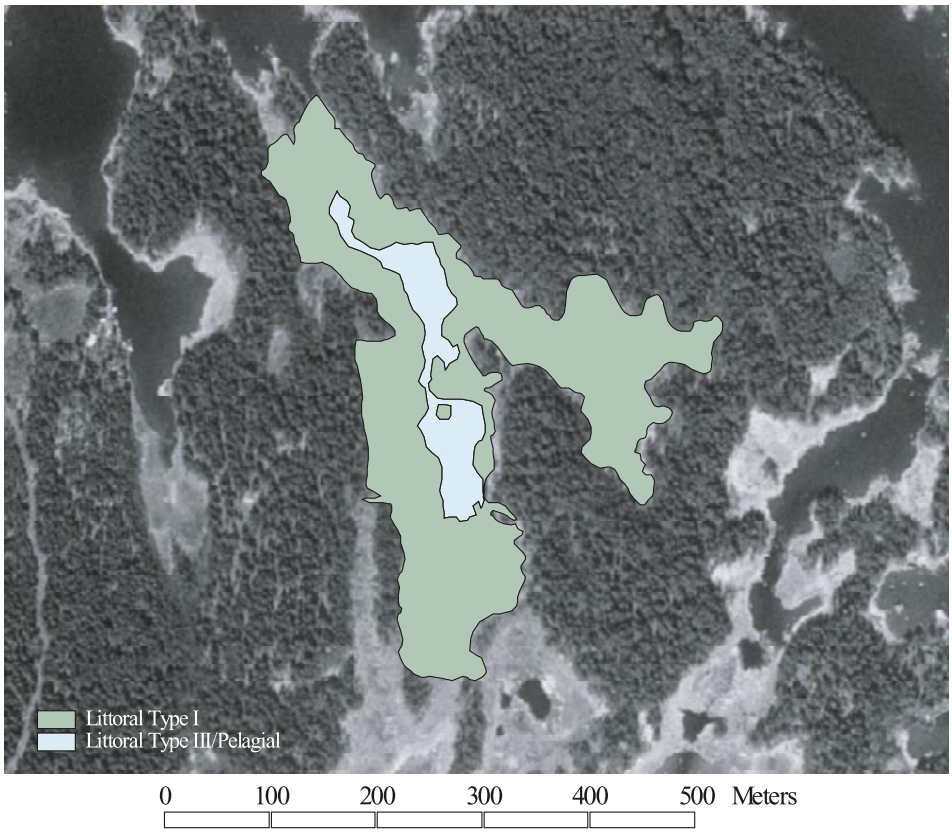

Figure 4-69. *Distribution of major habitats in Lake Tallsundet.*

4.4 The catchment Forsmark 4

This area is divided into two different sub-areas (Figure 4-70): Lake 4:1 (sub-area 4:1) and Lake Lillfjärden (no 4:2). The upstream sub-area 4:2 enters the downstream sub-area 4:1, the outlet of which enters the Baltic Sea in Tixelfjärden.

Forsmark 4:1–2. Lake 4:1 (the entire catchment)

The location of the object

This catchment is part of the SMHI catchment no 54/55 and part of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: –0.29 m above sea level

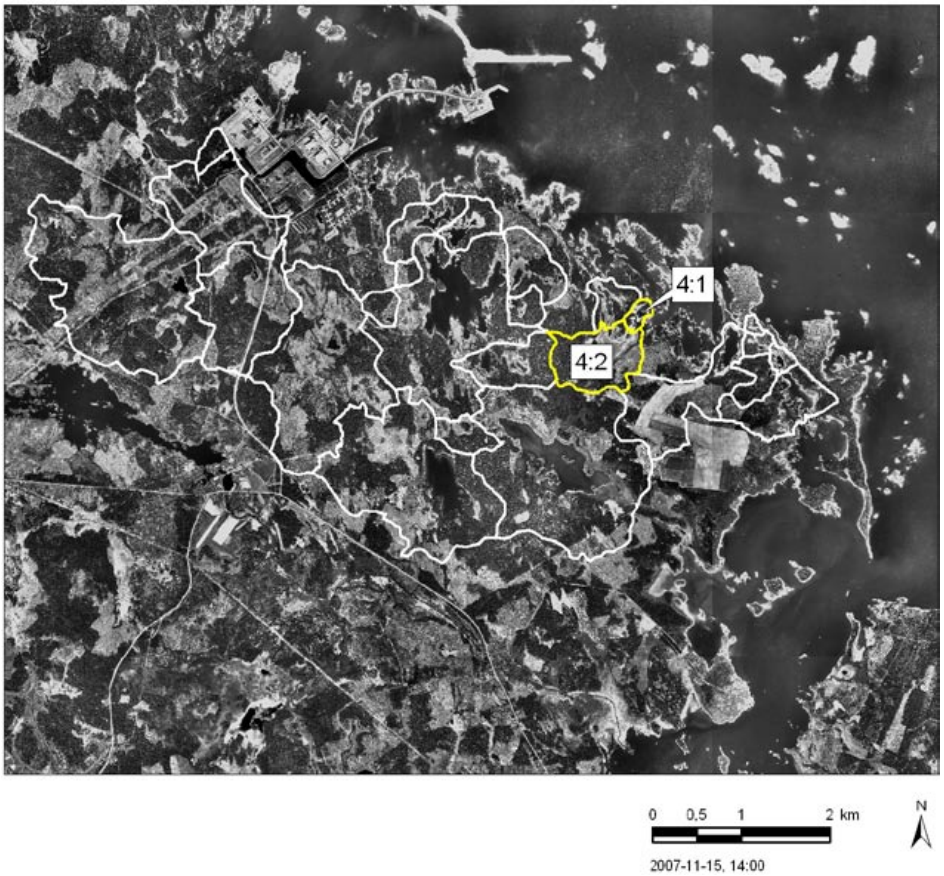

Figure 4-70. *The Forsmark area with the two sub-areas in the catchment Forsmark 4 marked with yellow boundaries.*

The catchment area and its major constituents

The total catchment area is 0.689 km^2, and the land use is dominated by forest (Table 4-49).

Table 4-49. The different land uses within the entire catchment of Lake 4:1. The data are added from two sub-areas (see Appendix 4 and 6 for data of each sub-area).

Land use	Area [%]
Forest	64
Water surface	13
Agriculture	0
Remaining open land	23
Wetland (as parts of the above land use categories)	23

The surface waters within this catchment are Lake 4:1 and Lake Lillfjärden. Lake 4:1 has one inlet creek in the south, originating from Lake Lillfjärden. The outlet creek north of the lake enters the Baltic Sea in Tixelfjärden (Figure 4-71).

Lake morphometry parameters

Figure 4-72 and Figure 4-73 show the bathymetric map and the depth grid map, respectively, for Lake 4:1.

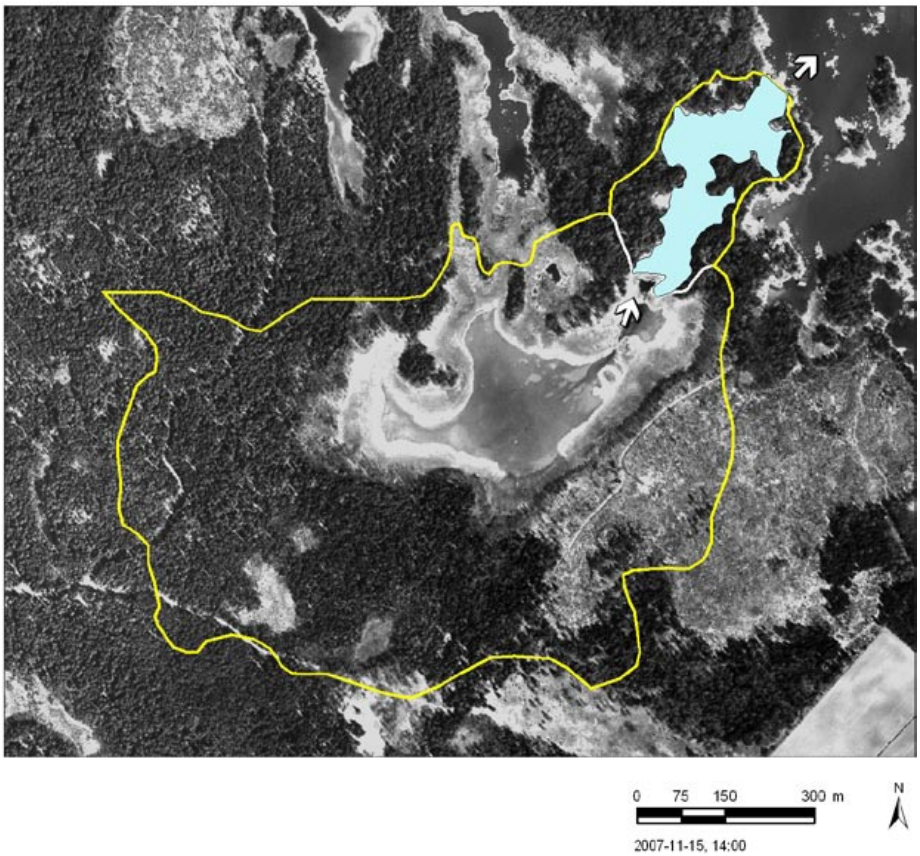

Figure 4-71. *The catchment Forsmark 4 with Lake 4:1 and its catchment (sub-areas 1–2) marked with yellow boundaries.*

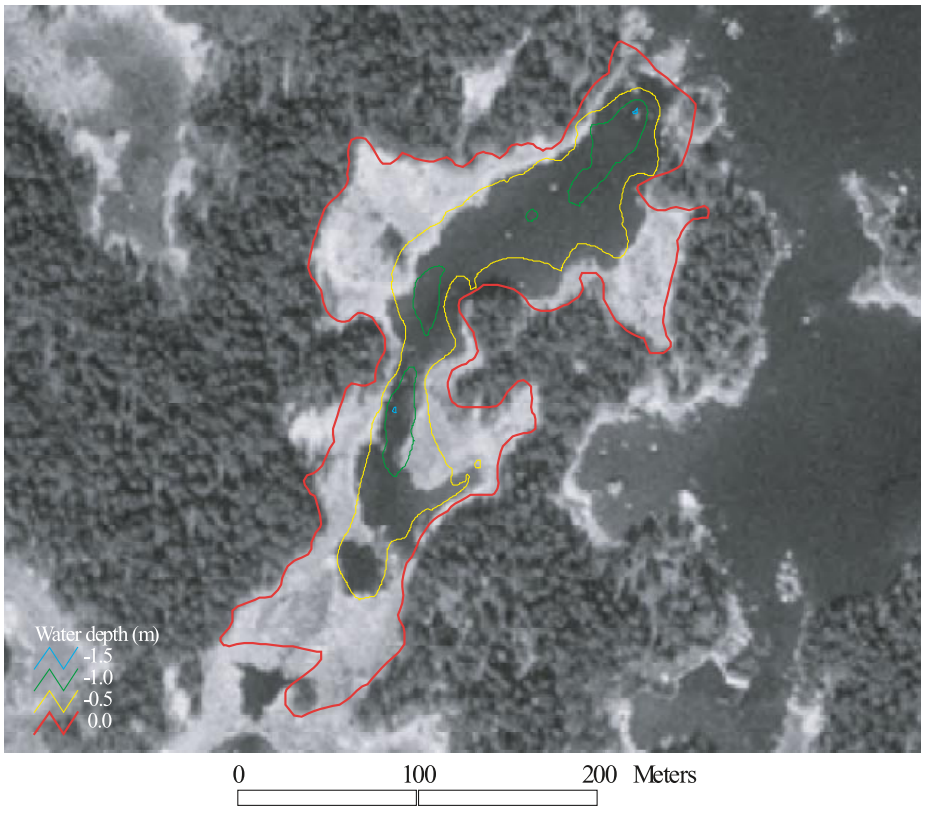

Figure 4-72. *Bathymetric map for Lake 4:1.*

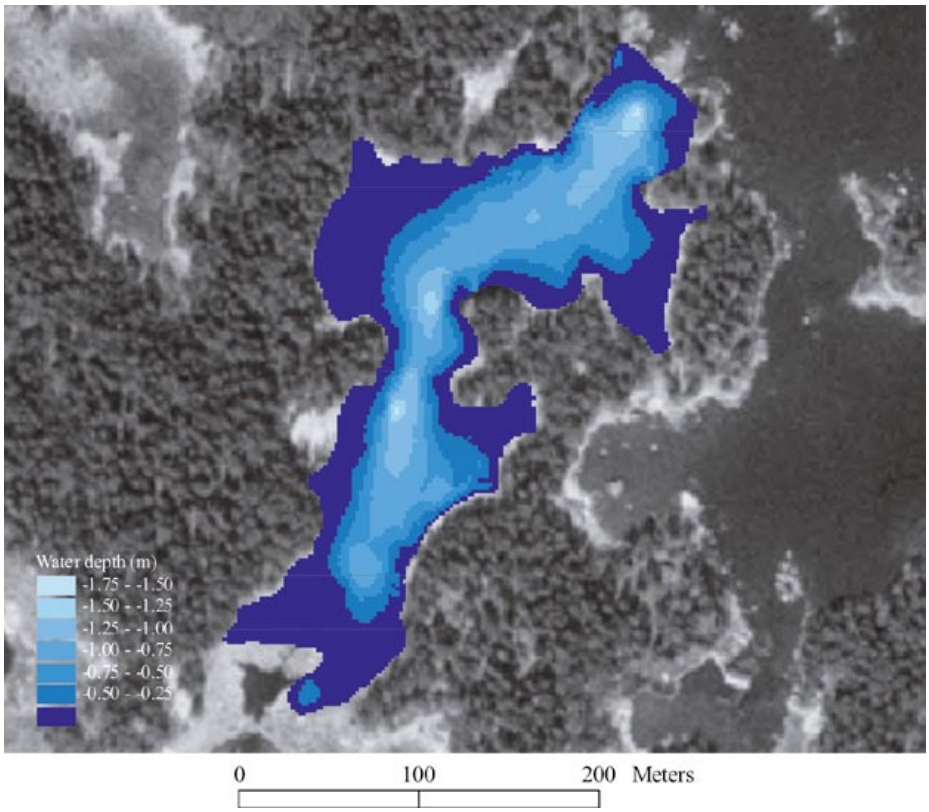

Figure 4-73. *Depth grid map for Lake 4:1.*

Lake 4:1 is small and shallow, but still it is one of the deeper lakes in the Forsmark area (maximum depth 1.5 m, Table 4-50). The theoretical water renewal time is about one month. The lake has no islets.

Table 4-50. Lake morphometry parameters for Lake 4:1.

Lake morphometry	
Lake area	0.04 km2
Maximum depth	1.5 m
Mean depth	0.4 m
Volume	0.013 Mm3
Theoretical water renewal time	32 days

Lake ecosystem parameters

Three major habitats have been identified in Lake 4:1. The littoral habitat with emergent and floating-leaved vegetation (Littoral type I) covers 78% of the lake area (Table 4-51, Figure 4-74). Due to the shallowness and clear water of this lake, light penetrates down to all bottom areas and no profundal areas are present. Hence, the pelagic habitat and the littoral habitat with submersed vegetation (Littoral type III) have the same distribution and occupy the remaining 22% of the lake area.

Table 4-51. Distribution of major habitats in Lake 4:1.

Habitats	Area [%]
Pelagial/Littoral type III	22
Littoral type I	78

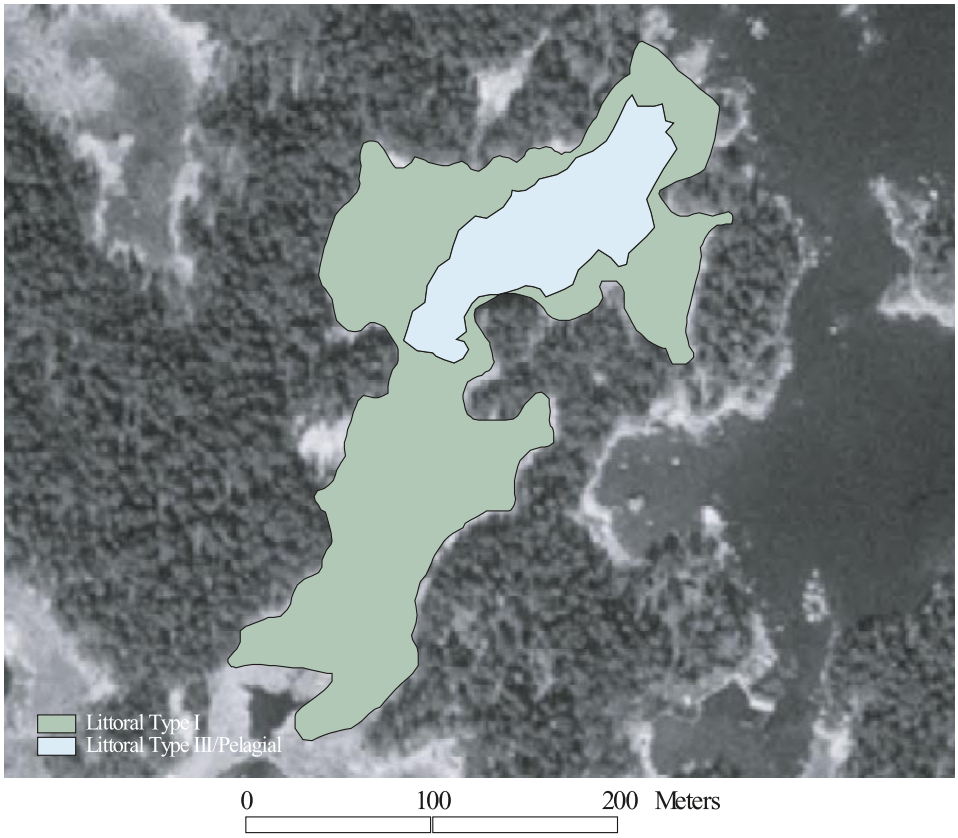

Figure 4-74. *Distribution of major habitats in Lake 4:1.*

Additional remarks

Saltwater intrusions probably occur regularly in this lake, as it is situated on a level below the normal sea level.

Forsmark 4:1. Lake 4:1 (sub-area)

See Appendix 3–6 for data on sub-catchment parameters. For lake data, see Forsmark 4:1–2 (entire catchment).

Forsmark 4:2. Lake Lillfjärden

The location of the object

This catchment is part of the SMHI catchment no 54/55 and part of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: –0.07 m above sea level

The catchment area and its major constituents

The total catchment area is 0.621 km^2, and the land use is dominated by forest (Table 4-52).

Table 4-52. The different land uses within the catchment of lake Lillfjärden.

Land use	Area [%]
Forest	66
Water surface	12
Agriculture	0
Remaining open land	23
Wetland (as parts of the above land use categories)	21

The only surface water within this catchment is Lake Lillfjärden. The lake has no inlets. The outlet northeast of the lake passes through Lake 4:1 before reaching the Baltic Sea in Tixelfjärden (Figure 4-75).

Lake morphometry parameters

Figure 4-76 and Figure 4-77 show the bathymetric map and the depth grid map, respectively, for Lake Lillfjärden.

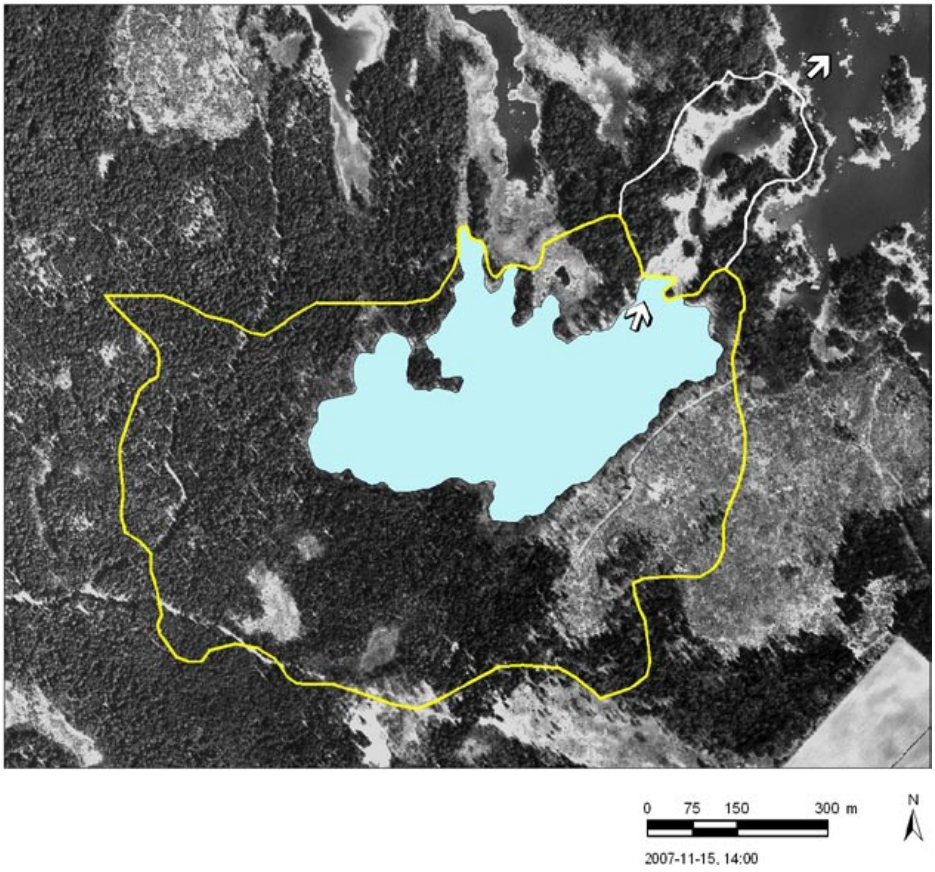

Figure 4-75. *The catchment Forsmark 4 with Lake Lillfjärden and its catchment (sub-area 2) marked with yellow boundaries.*

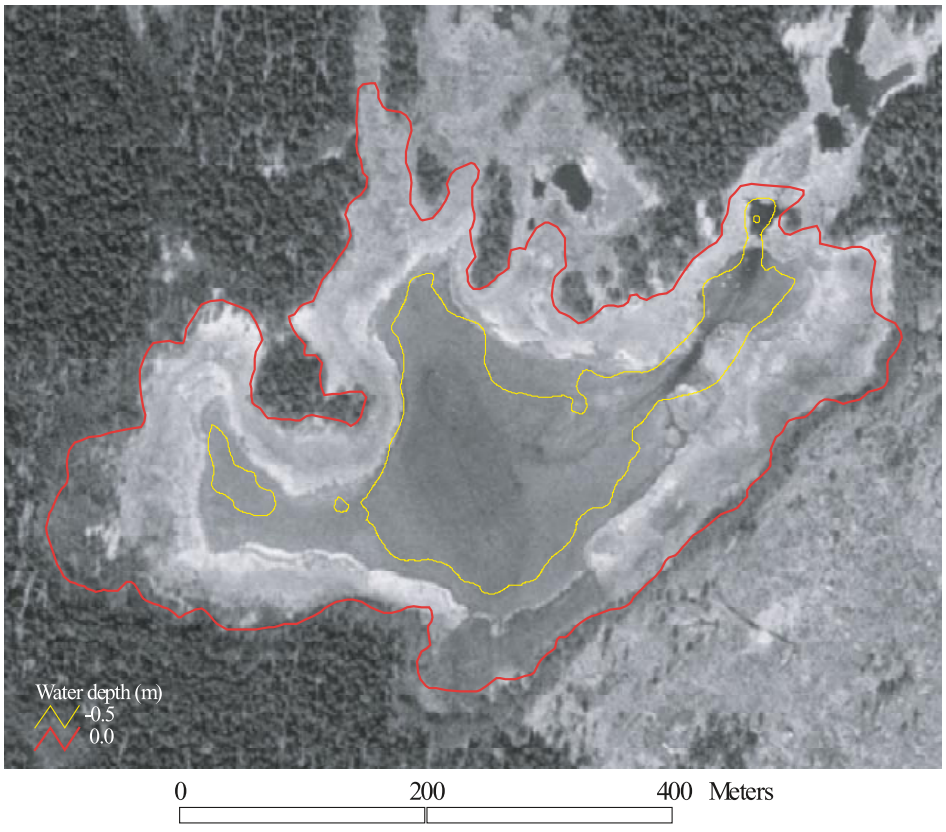

Figure 4-76. *Bathymetric map for Lake Lillfjärden.*

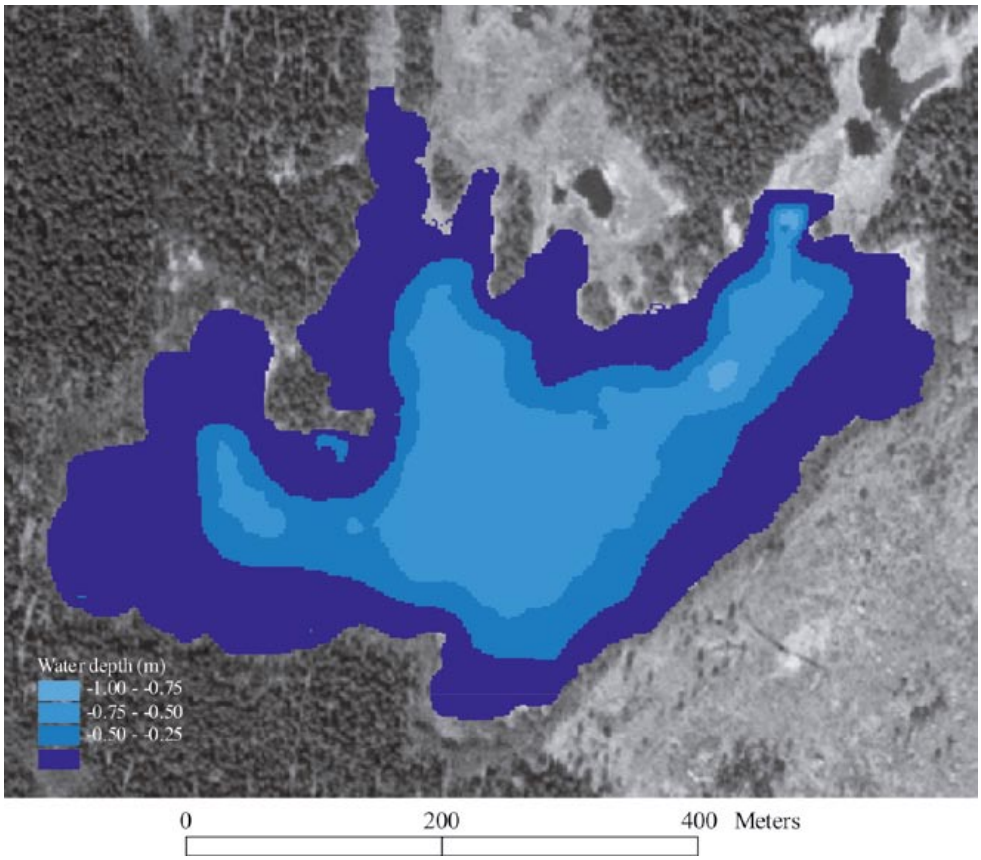

Figure 4-77. *Depth grid map for Lake Lillfjärden.*

Most lakes of the Forsmark area are small and shallow, and Lake Lillfjärden is no exception from this (Table 4-53). The mean depth is only 0.3 m. The theoretical water renewal time is relatively long (about 4 months) compared to the Forsmark lakes in general. The lake has no islets.

Table 4-53. Lake morphometry parameters for Lake Lillfjärden.

Lake morphometry	
Lake area	0.16 km2
Maximum depth	0.9 m
Mean depth	0.3 m
Volume	0.047 Mm3
Theoretical water renewal time	125 days

Lake ecosystem parameters

Three different major habitats are present in Lake Lillfjärden. The littoral habitat with emergent and floating-leaved vegetation (Littoral type I) covers a major part of the lake area, 73% (Table 4-54, Figure 4-78). Due to the shallowness and clear water of the lake, light penetrates down to all bottom areas and no profundal areas are present. Hence, the pelagic habitat and the littoral habitat with submerged vegetation (Littoral type III) have the same distribution and cover the remaining lake area (27%).

Table 4-54. Distribution of major habitats in Lake Lillfjärden.

Habitats	Area [%]
Pelagial/Littoral type III	27
Littoral type I	73

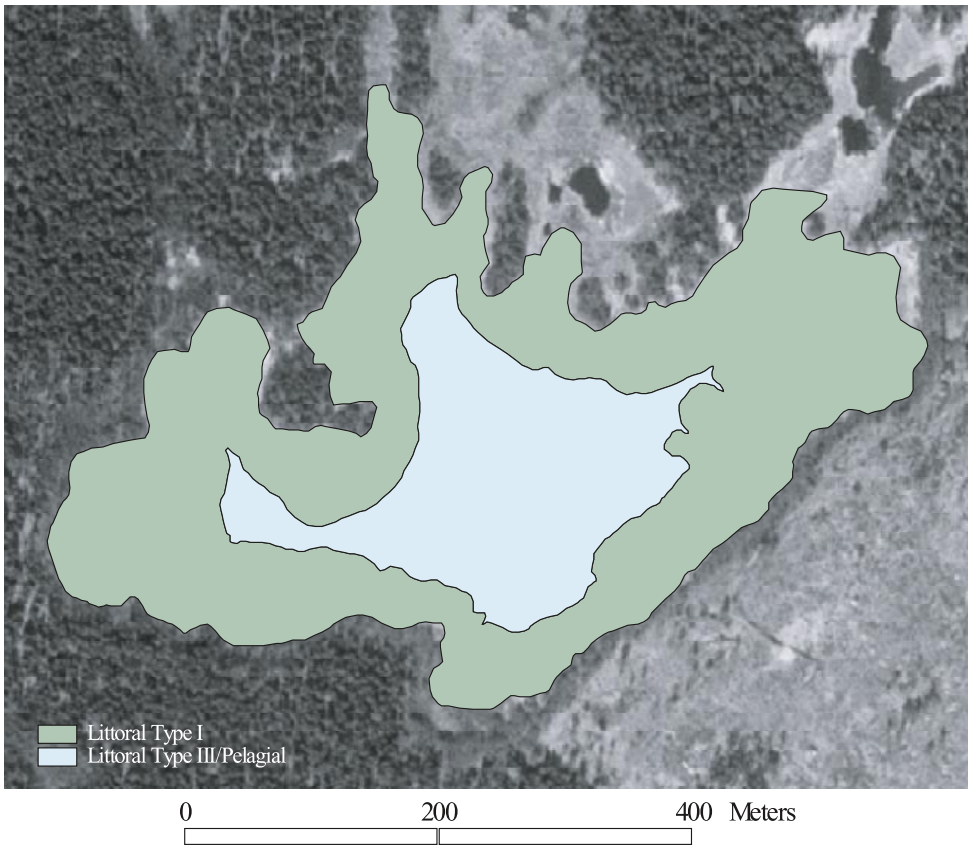

Figure. 4-78. *Distribution of major habitats in Lake Lillfjärden.*

Additional remarks

Saltwater intrusions probably occur regularly in this lake, as the threshold of the lake is situated on a level below the normal sea level.

Structures (cracks) observed in the bottom sediment indicate that the lake sometimes is more or less empty of water during dry periods.

4.5 The catchment Forsmark 5

This area consists of one single sub-area (Figure 4-79): Lake Bredviken (no 5:1). The outlet, situated at the northern end of the catchment, enters the Baltic Sea in Slätorssundet.

Forsmark 5:1. Lake Bredviken

The location of the object

This catchment is part of the SMHI catchment no 54/55 and part of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: –0.12 m above sea level

The catchment area and its major constituents

The total catchment area is 0.944 km^2, and forest is the dominating land use (Table 4-55). There are also some agriculture areas situated in the southern, upstream part of the catchment.

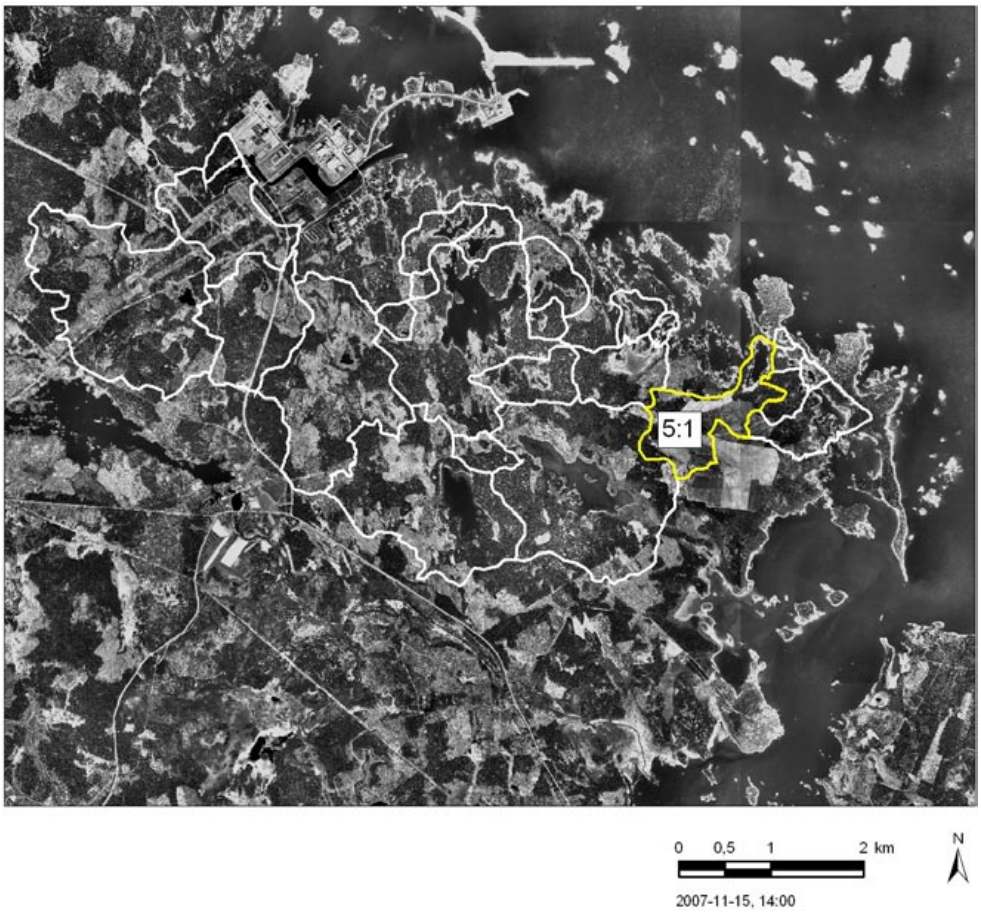

Figure 4-79. *The Forsmark area with the single sub-area in the catchment Forsmark 5 marked with yellow boundaries.*

Table 4-55. The different land uses within the catchment of Lake Bredviken.

Land use	Area [%]
Forest	48
Water surface	7
Agriculture	28
Remaining open land	15
Wetland (as parts of the above land use categories)	4

The only surface water within this lake catchment is Lake Bredviken. The lake has one inlet creek, which drains the agriculture areas of the catchment before it enters the lake in the south (Figure 4-80). The outlet north of the lake passes through wetland before discharging into the Baltic Sea in Slätorssundet.

Lake morphometry parameters

Figure 4-81 and Figure 4-82 present the bathymetric map and the depth grid map, respectively, for Lake Bredviken.

Lake Bredviken is a relatively deep lake, compared to the other lakes of the Forsmark area (Table 4-56), and the theoretical water renewal time is long, about half a year. The lake has four small islets.

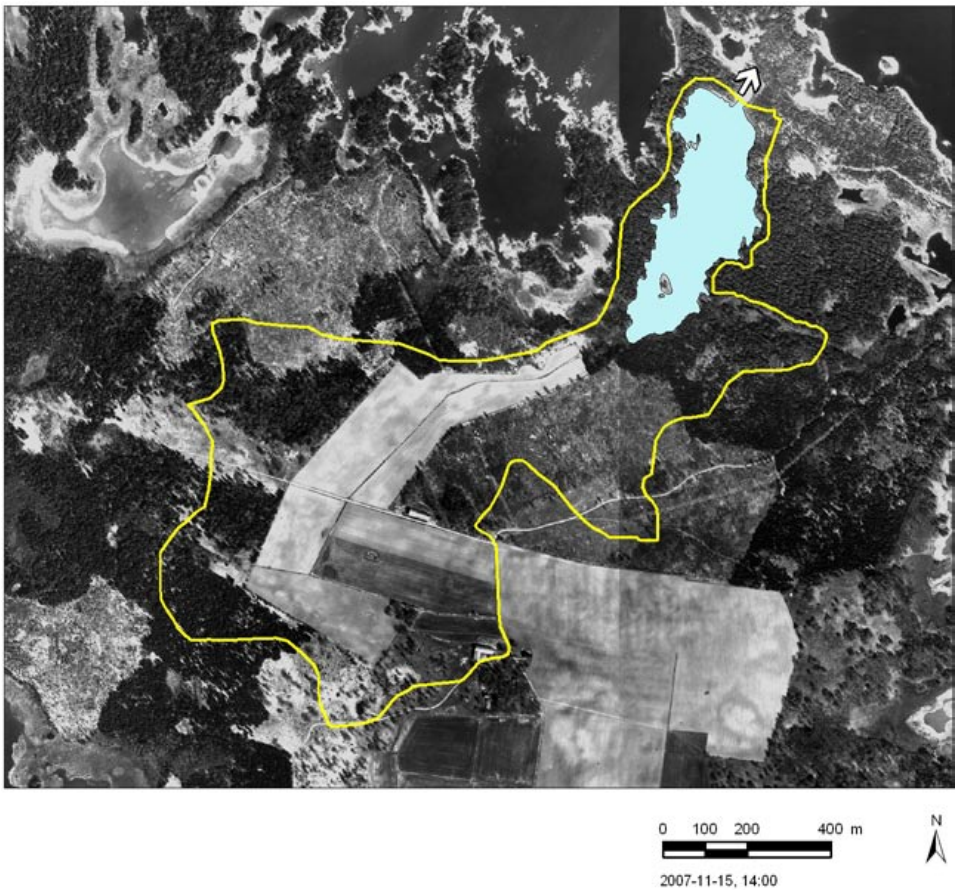

Figure 4-80. *The catchment Forsmark 5 with Lake Bredviken and its catchment (sub-area 1, the only sub-area within this catchment) marked with yellow boundaries.*

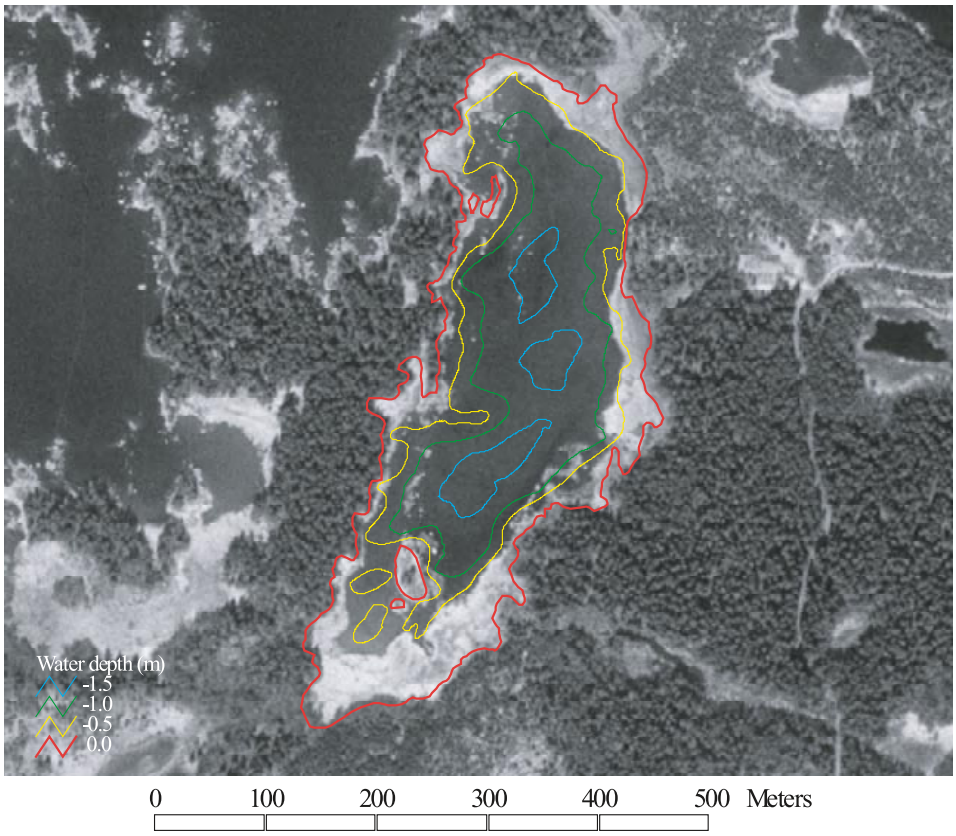

Figure 4-81. *Bathymetric map for Lake Bredviken.*

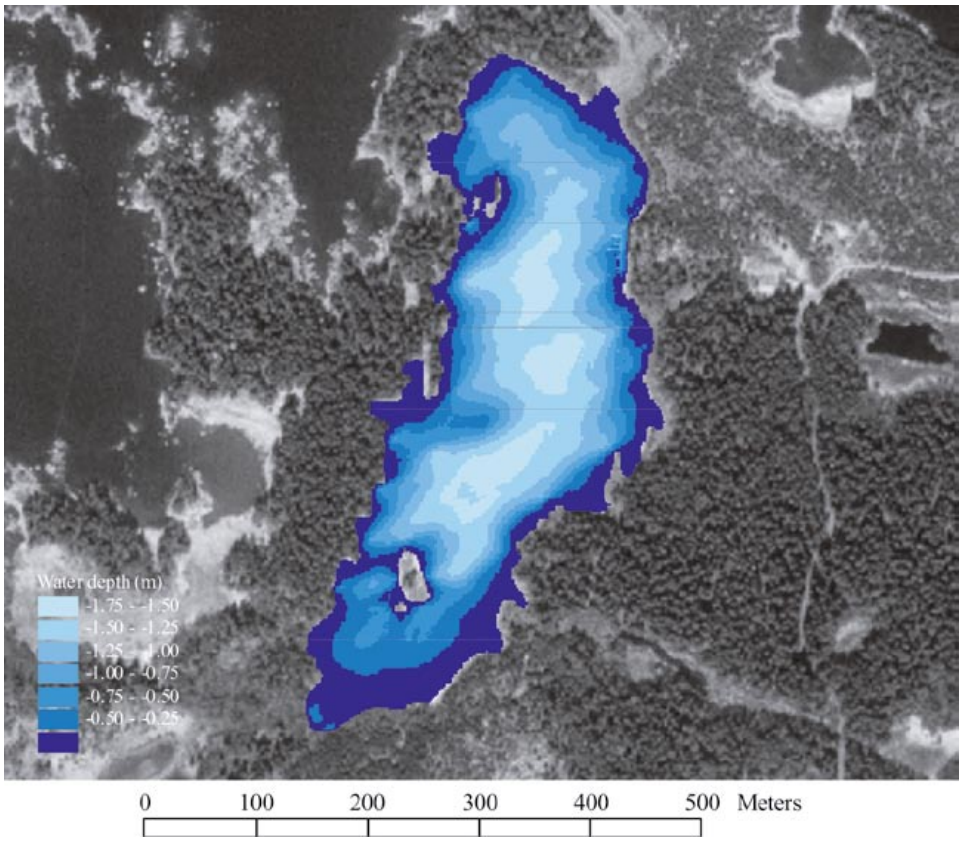

Figure 4-82. *Depth grid map for Lake Bredviken.*

Table 4-56. Lake morphometry parameters for Lake Bredviken.

Lake morphometry	
Lake area	0.10 km2
Maximum depth	1.7 m
Mean depth	0.7 m
Volume	0.072 Mm3
Theoretical water renewal time	191 days

Lake ecosystem parameters

Three major habitats are found in Lake Bredviken (Table 4-57, Figure 4-83). The littoral habitat with emergent and floating-leaved vegetation (Littoral type I) covers roughly half of the lake area. The remaining area is covered by a pelagic habitat and, along the bottom, of a littoral habitat with submersed vegetation (Littoral type III). Due to the clear water of the lake, light penetrates down to all bottom areas and no profundal habitat is present.

Table 4-57. Distribution of major habitats in Lake Bredviken.

Habitats	Area [%]
Pelagial/Littoral type III	55
Littoral type I	45

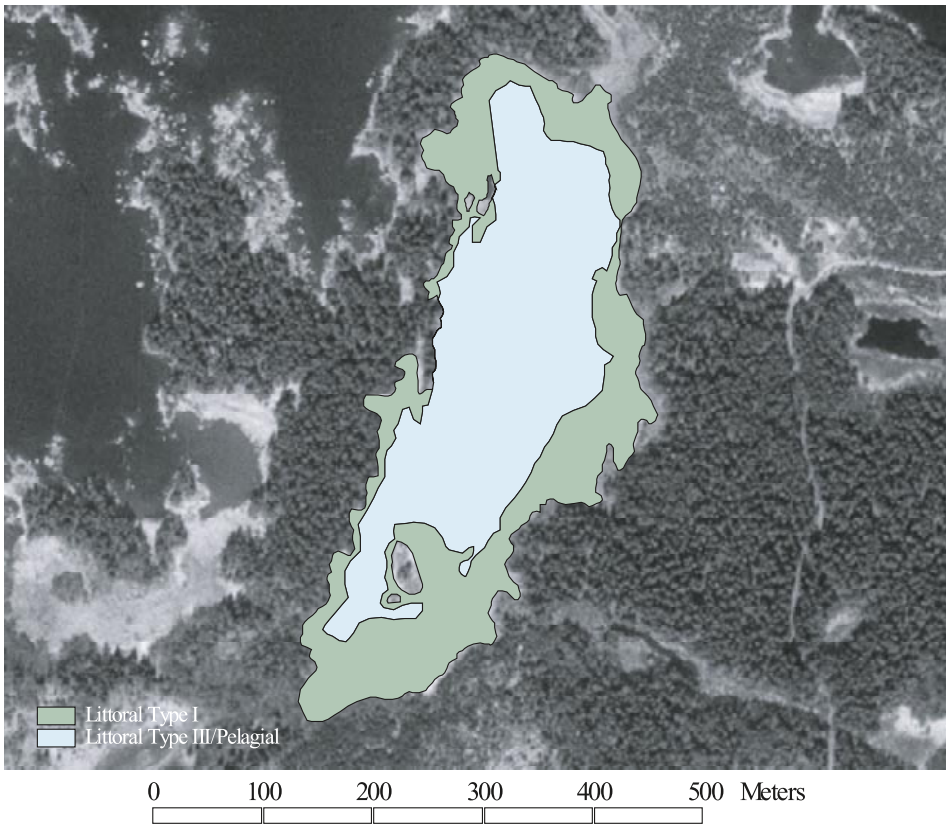

Figure 4-83. *Distribution of major habitats in Lake Bredviken.*

Additional remarks

Saltwater intrusions probably occur regularly in this lake, as it is situated on a level below the normal sea level.

4.6 The catchment Forsmark 6

This is the smallest of the eight Forsmark catchments, and it consists of one single sub-area (Figure 4-84): Lake Simpviken (no 6:1). The outlet from this lake enters the Baltic Sea northeast of the catchment.

Forsmark 6:1. Lake Simpviken

The location of the object

This catchment is part of the SMHI catchment 54/55 and part of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: –0.29 m above sea level

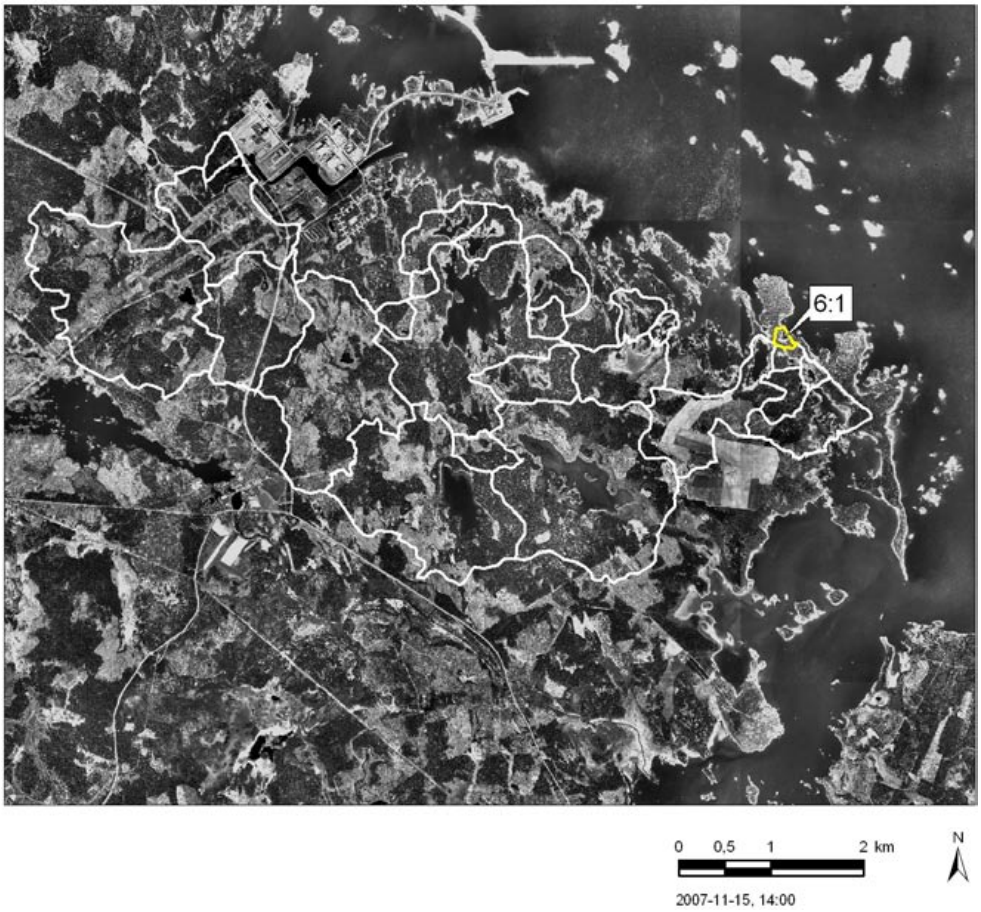

Figure 4-84. *The Forsmark area with the single sub-area in the catchment Forsmark 6 marked with yellow boundaries.*

The catchment area and its major constituents

The total catchment area is 0.035 km^2, and forest is the dominating land use (Table 4-58).

Table 4-58. The different land uses within the catchment of Lake Simpviken.

Land use	Area [%]
Forest	89
Water surface	11
Agriculture	0
Remaining open land	0
Wetland (as parts of the above land use categories)	0

The only surface water within this catchment is Lake Simpviken. This lake has no inlet creeks. The outlet creek enters the Baltic Sea northeast of the lake (Figure 4-85).

Lake morphometry parameters

Figure 4-86 and Figure 4-87 show the bathymetric map and the depth grid map, respectively, for Lake Simpviken.

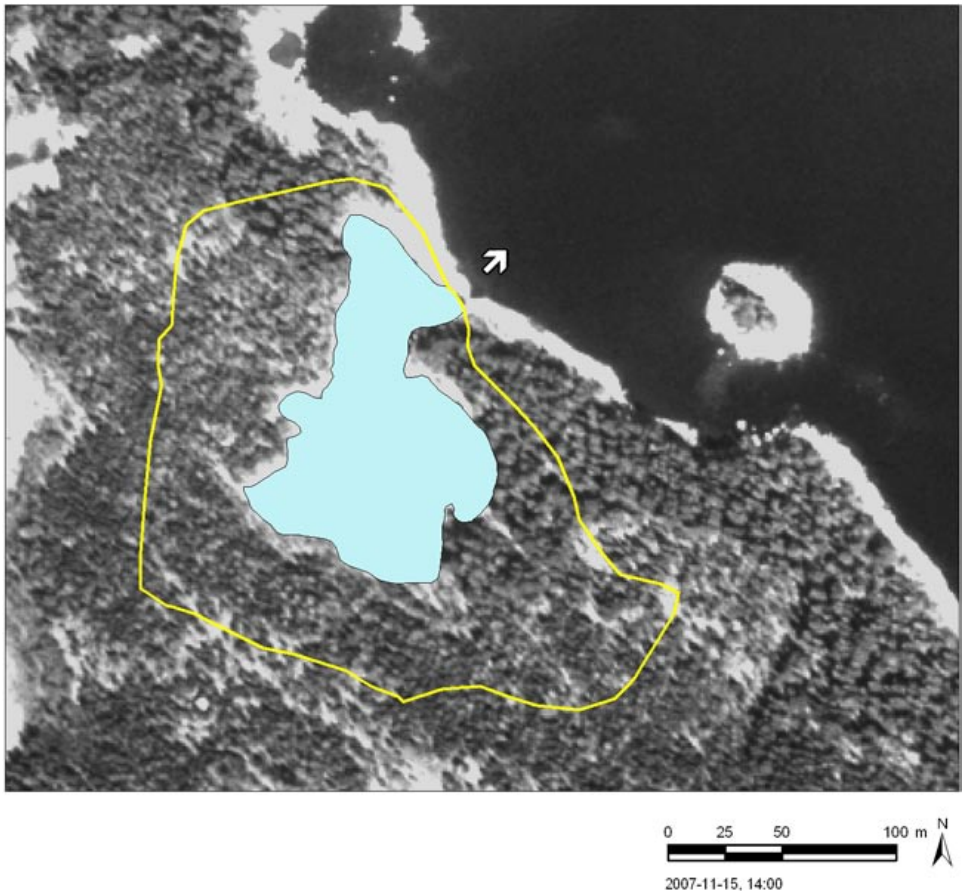

Figure 4-85. *The catchment Forsmark 6 with Lake Simpviken and its catchment (sub-area 1, the only sub-area within this catchment) marked with yellow boundaries.*

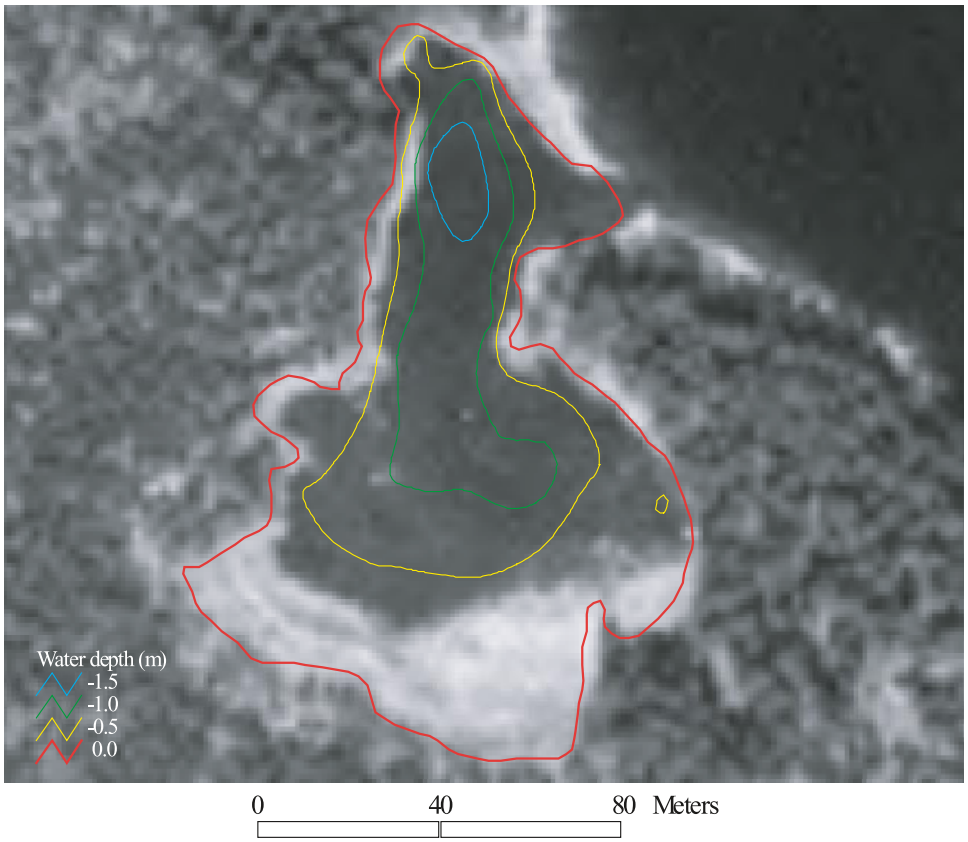

Figure 4-86. *Bathymetric map for Lake Simpviken.*

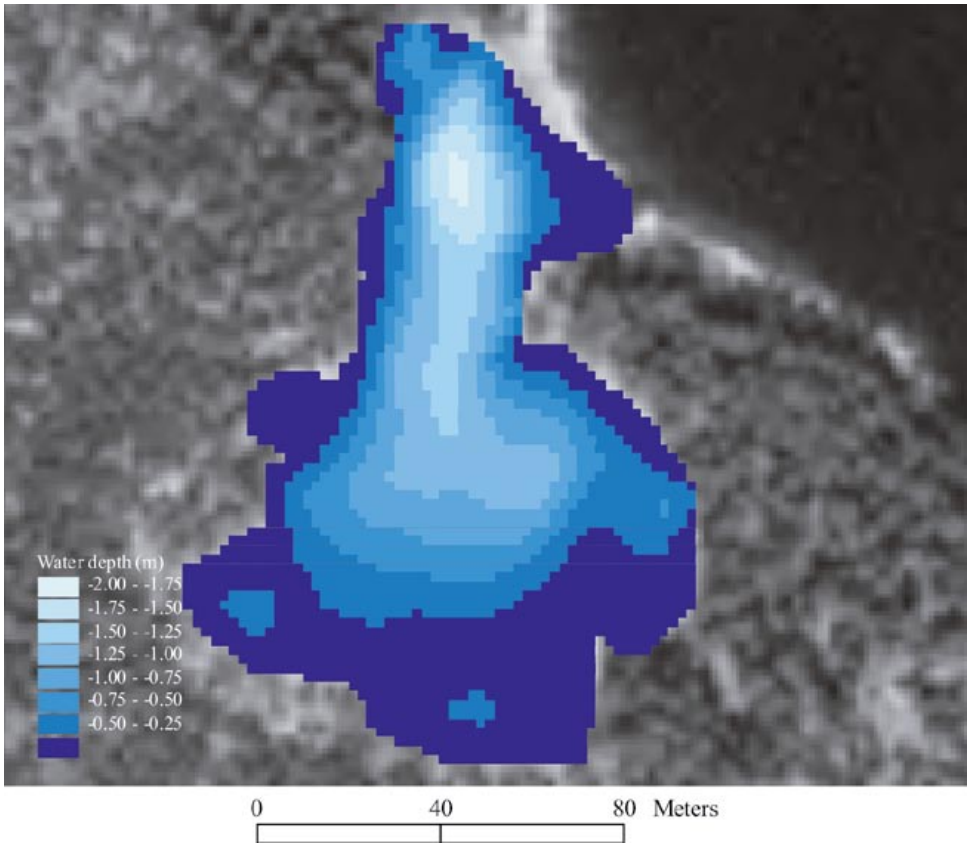

Figure 4-87. *Depth grid map for Lake Simpviken.*

Lake Simpviken is a very small lake, but it is relatively deep (maximum depth 1.8 m) compared to the other lakes in the Forsmark area (Table 4-59). The theoretical water renewal time is long, about 8 months. The lake has no islets.

Table 4-59. Lake morphometry parameters for Lake Simpviken.

Lake morphometry	
Lake area	0.01 km2
Maximum depth	1.8 m
Mean depth	0.5 m
Volume	0.005 Mm3
Theoretical water renewal time	232 days

Lake ecosystem parameters

Despite that the lake is relatively deep compared to other lakes in the area, the strongly dominating habitat is the littoral with emergent and floating-leaved vegetation; Littoral type I (Table 4-60, Figure 4-88). It covers 77% of the lake area. The remaining area hosts a small pelagic habitat together with a littoral habitat with submerged vegetation (Littoral type III). The lake water is very clear, which allows light to penetrate down at all depths. Thus, no profundal habitat is present. However, there are probably some nearshore areas with hard-bottom habitat (Littoral type II) in the northern parts of the lake, the distribution of which have to be further investigated.

Table 4-60. Distribution of major habitats in Lake Simpviken.

Habitats	Area [%]
Pelagial/Littoral type III	23
Littoral type I	77

Additional remarks

Saltwater intrusions probably occur regularly in this lake, as it is situated on a level below the normal sea level.

The distribution of major habitats needs to be further elucidated for this lake, before the final distribution and percentage of cover is determined. The depth chart shows that profundal areas might be present, and the absence of emergent or floating-leaved vegetation (Littoral type I) along some parts of the shoreline indicates that hard-bottom littoral of type II may be present in these areas.

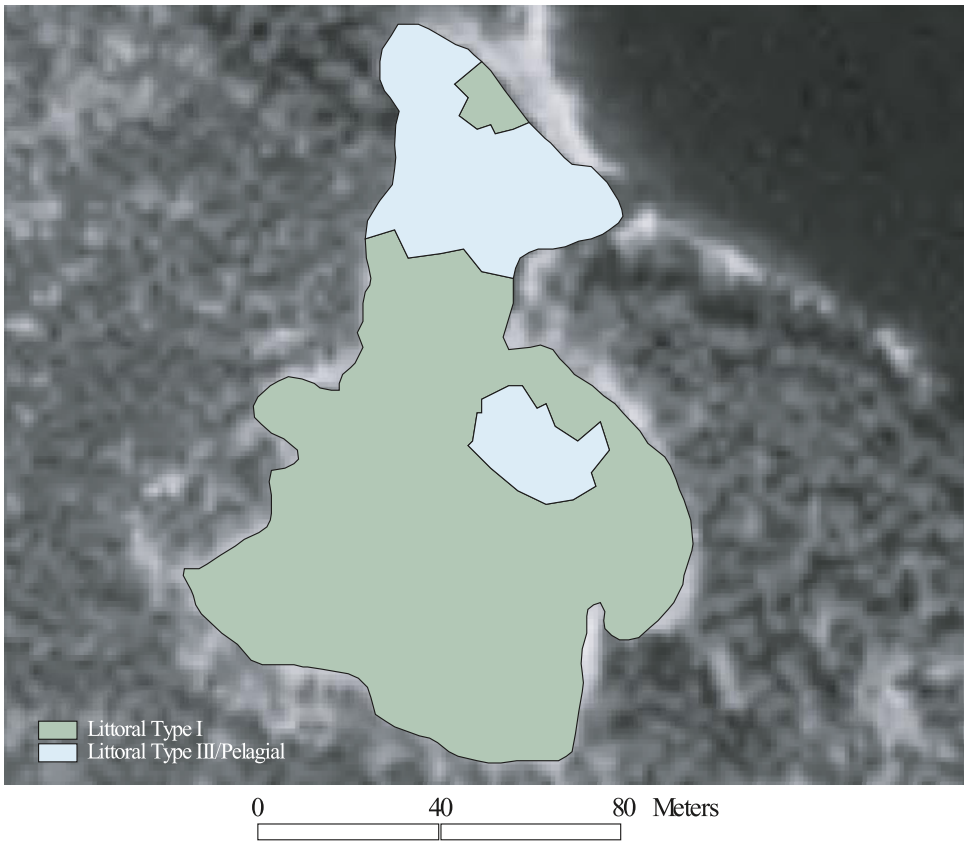

Figure 4-88. *Distribution of major habitats in Lake Simpviken.*

4.7 The catchment Forsmark 7

This area is divided into four different sub-areas (Figure 4-89): Lake 7:1 (sub-area 7:1), Lake Märrbadet (no 7:2), Lake 7:3 (no 7:3) and Lake 7:4 (no 7:4). Lake 7:4 and Lake 7:3 both drain to Lake Märrbadet, which in turn drains to Lake 7:1 and then further downstream enters the Baltic Sea via Djupsundet to Kallrigafjärden, southeast of the catchment.

Forsmark 7:1–4. Lake 7:1 (the entire catchment)

The location of the object

This catchment is part of the SMHI catchment no 54/55 and part of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: –0.26 m above sea level

The catchment area and its major constituents

The total lake catchment area is 0.895 km^2, and forest dominates the land use (Table 4-61).

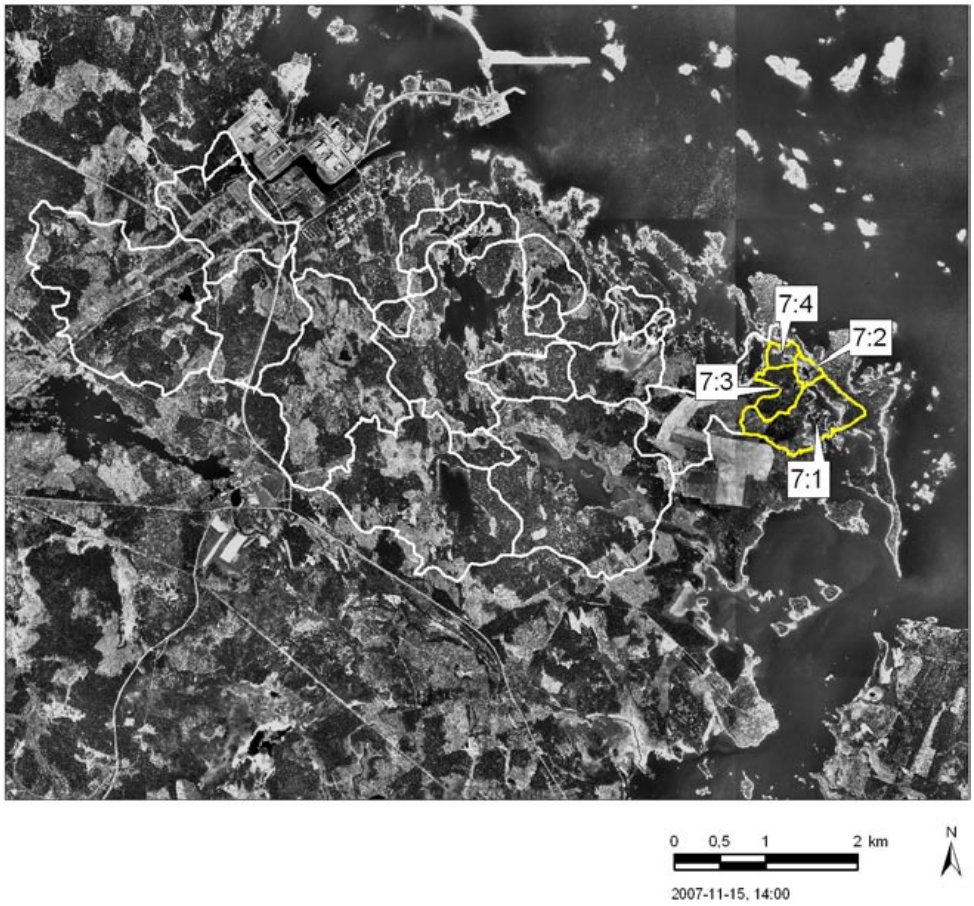

Figure 4-89. *The Forsmark area with the four sub-areas in the catchment Forsmark 7 marked with yellow boundaries.*

Table 4-61. The different land uses within the catchment of Lake 7:1. The data are added from four sub-areas (see Appendix 4 and 6 for data of each sub-area).

Land use	Area [%]
Forest	71
Water surface	13
Agriculture	0
Remaining open land	16
Wetland (as parts of the above land use categories)	14

The surface waters within this catchment are Lake 7:1, Lake Märrbadet, Lake 7:3 and Lake 7:4. Lake 7:1 receives water from the upstream areas via wetlands north of the lake (Figure 4-90). The outlet southeast of the lake passes through Djupsundet and enters the Baltic Sea in Kallrigafjärden.

Lake morphometry parameters

Figure 4-91 and Figure 4-92 present the bathymetric map and the depth grid map, respectively, for Lake 7:1.

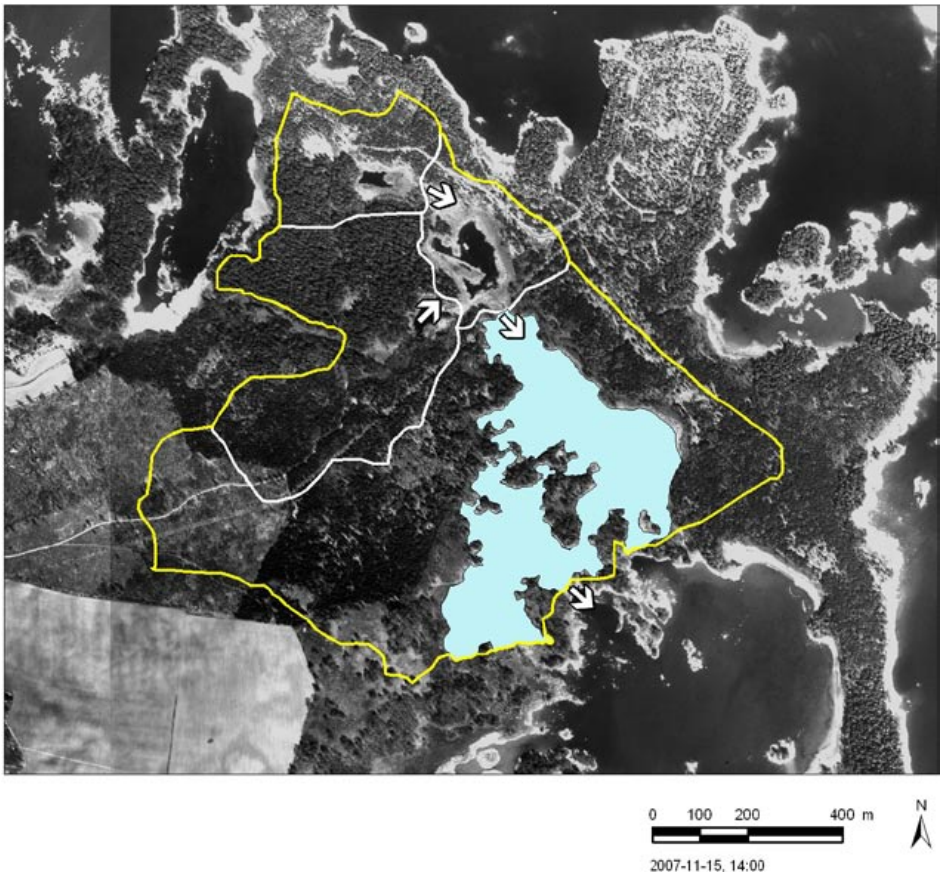

Figure 4-90. *The catchment Forsmark 7 with Lake 7:1 and its catchment (sub-areas 1–4) marked with yellow boundaries.*

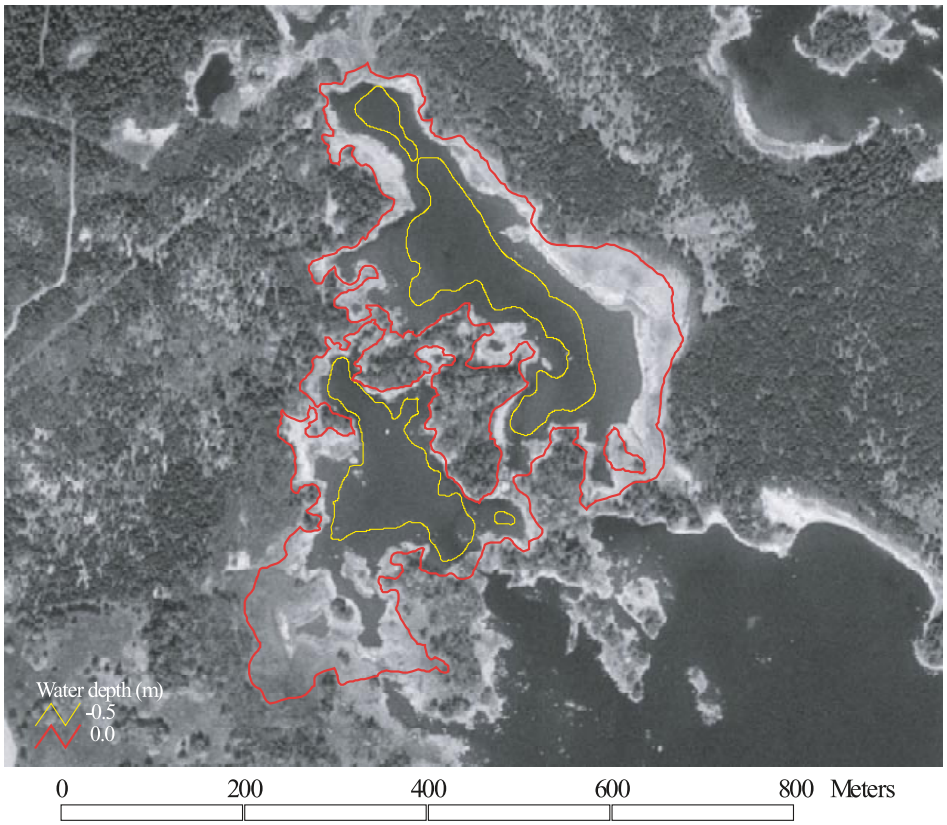

Figure 4-91. *Bathymetric map for Lake 7:1.*

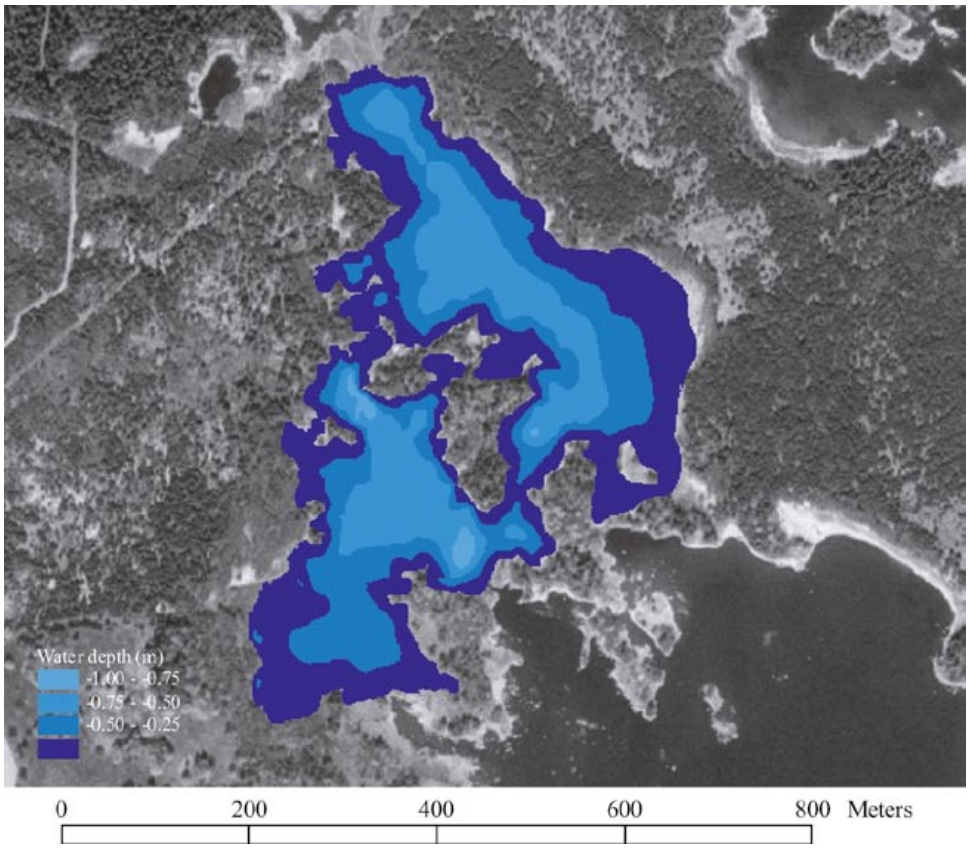

Figure 4-92. *Depth grid map for Lake 7:1.*

Lake 7:1 is a shallow lake (mean depth 0.3 m, Table 4-62) with a theoretical water renewal time of medium length (about 3 months). The lake has two basins, divided by an island (or half-island). There is also one small islet in the northern basin. The southern basin drains via Djupsundet to Kallrigafjärden into the Baltic Sea.

Table 4-62. Lake morphometry parameters for Lake 7:1.

Lake morphometry	
Lake area	0.16 km2
Maximum depth	1.1 m
Mean depth	0.3 m
Volume	0.053 Mm3
Theoretical water renewal time	97 days

Lake ecosystem parameters

Lake 7:1 has three major habitats (Table 4-63 and Figure 4-93). The littoral with emergent and floating-leaved vegetation (Littoral type I) covers roughly half of the lake area. The remaining area hosts a pelagic habitat together with a littoral habitat with submersed vegetation (Littoral type III). Due to the shallowness and clear water of the lake, light penetrates down to all depths and no profundal areas are present.

Table 4-63. Distribution of major habitats in Lake 7:1.

Habitats	Area [%]
Pelagial/Littoral type III	45
Littoral type I	55

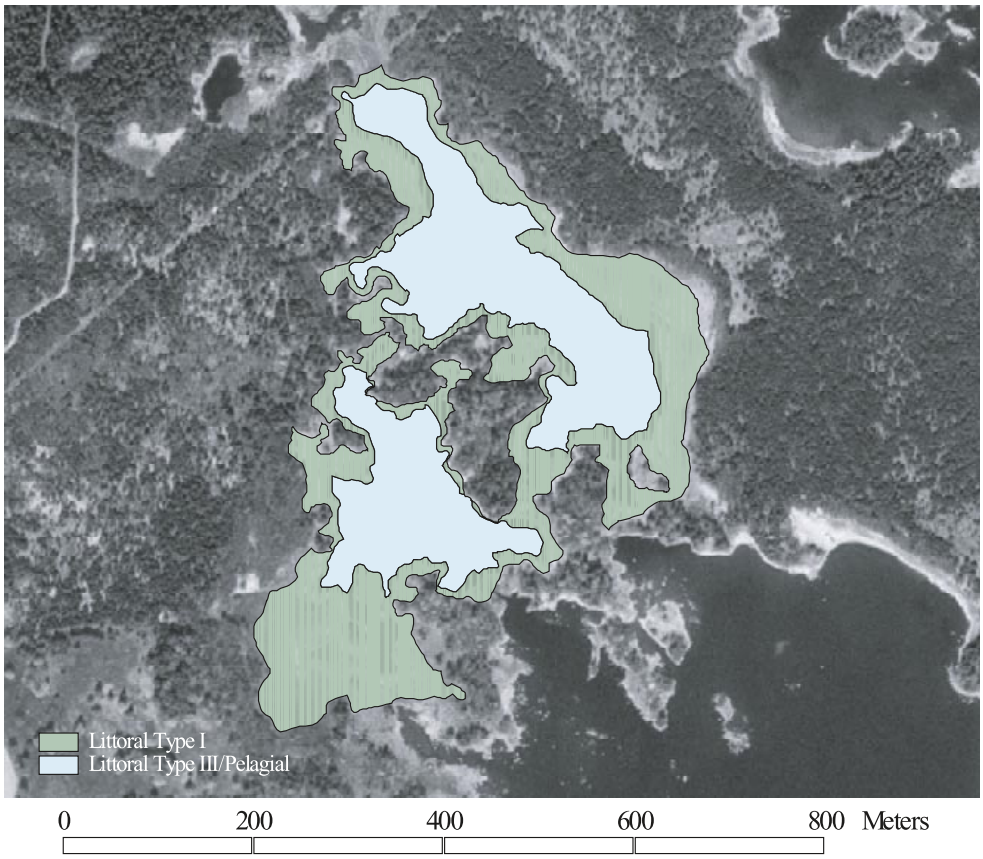

Figure 4-93. *Distribution of major habitats in Lake 7:1.*

Additional remarks

Saltwater intrusions probably occur regularly in this lake, as it is situated on a level below the normal sea level.

Forsmark 7:1. Lake 7:1 (sub-area)

See Appendix 3–6 for data on sub-catchment parameters. For lake data, see Forsmark 7:1–4 (entire catchment).

Forsmark 7:2–4. Lake Märrbadet (the entire catchment)

The location of the object

This catchment is part of the SMHI catchment 54/55 and part of catchment 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: 0.00 m above sea level

The catchment area and its major constituents

The total catchment area is 0.337 km^2. Forest is the dominating land use (Table 4-64).

Table 4-64. The different land uses within the catchment of Lake Märrbadet. The data are added from three sub-areas (see Appendix 4 and 6 for data on each sub-area).

Land use	Area [%]
Forest	81
Water surface	5
Agriculture	0
Remaining open land	16
Wetland (as parts of the above land use categories)	15

The surface waters within this catchment are Lake Märrbadet, Lake 7:3 and Lake 7:4. Lake Märrbadet has no visible inlet according to the topographical map. However, field observations showed that the two upstream Lakes 7:3 and 7:4 drain into this lake. The outlet passes Lake 7:1 before entering the Baltic Sea via Djupsundet to Kallrigafjärden (Figure 4-94).

Lake morphometry parameters

Figure 4-95 and Figure 4-96 show the bathymetric map and the depth grid map, respectively, for Lake Märrbadet.

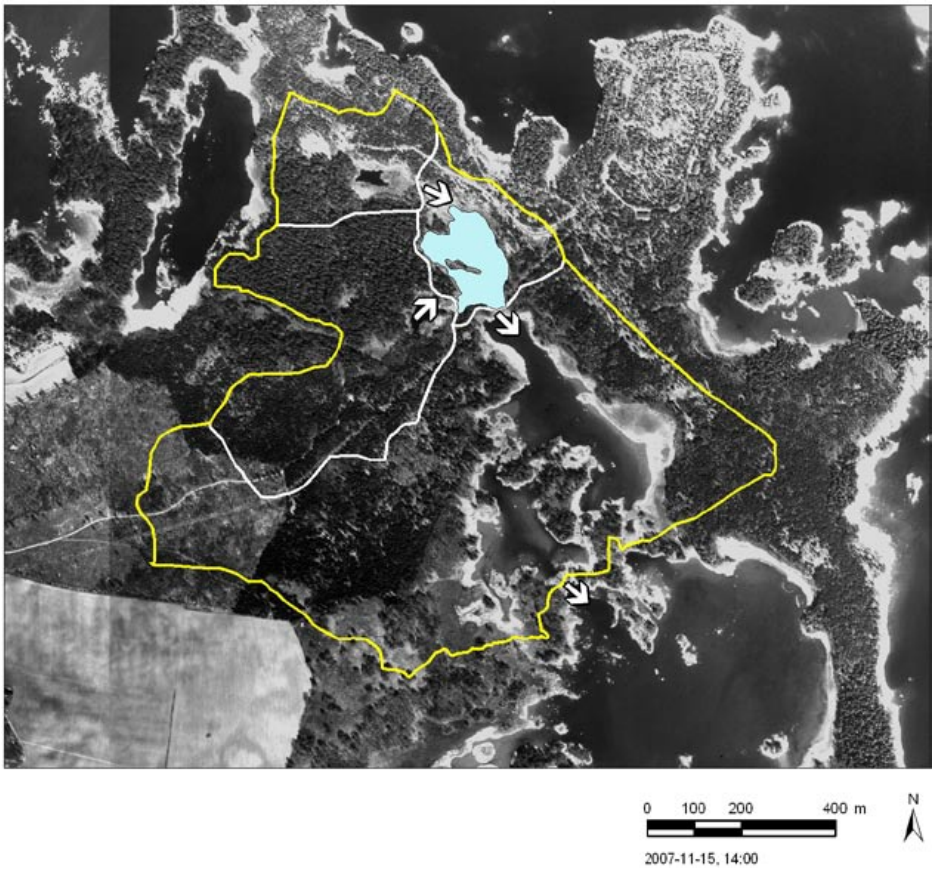

Figure 4-94. *The catchment Forsmark 7 with Lake Märrbadet and its catchment (sub-areas 2–4) marked with yellow boundaries.*

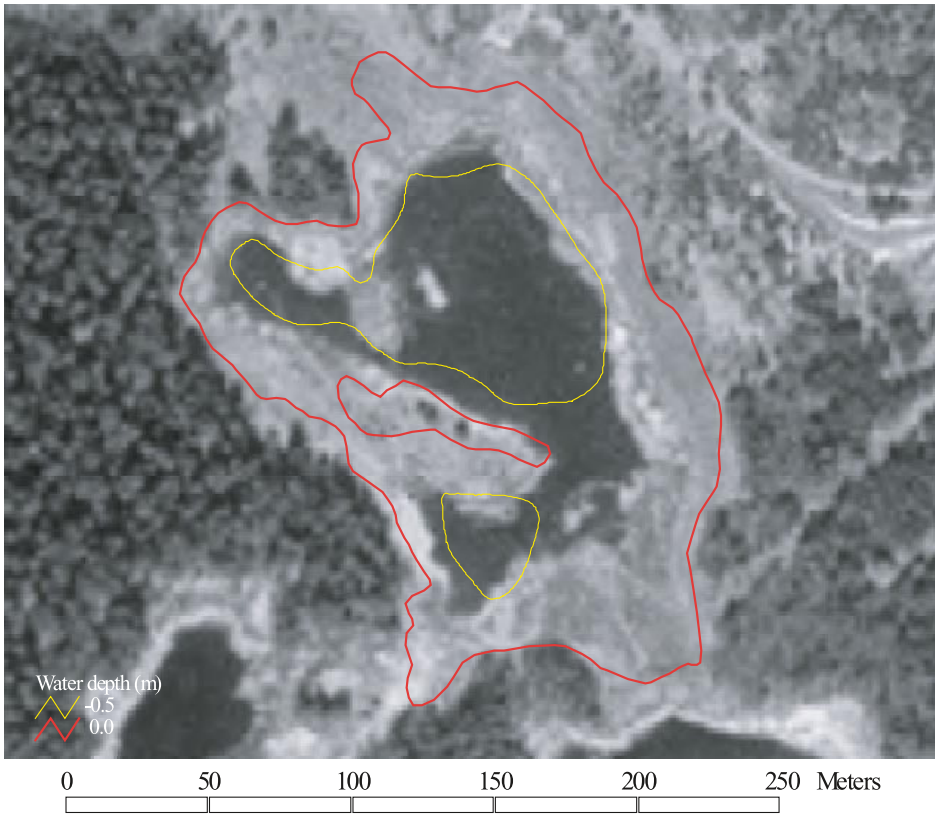

Figure 4-95. *Bathymetric map for Lake Märrbadet.*

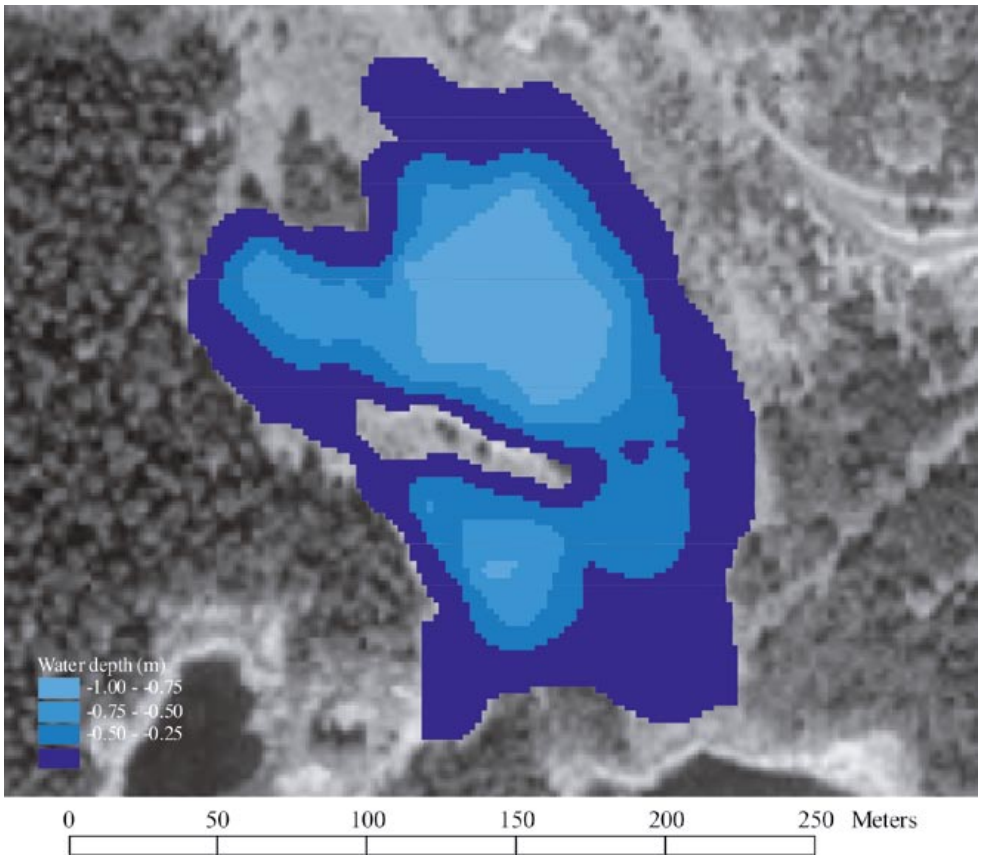

Figure 4-96. *Depth grid map for Lake Märrbadet.*

Table 4-65 shows morphometry parameters for Lake Märrbadet, which is a small and shallow lake with a maximum depth of 1.0 m and a small water volume. The theoretical water renewal time is 42 days. The lake has one islet.

Table 4-65. Lake morphometry parameters for Lake Märrbadet.

Lake morphometry	
Lake area	0.02 km2
Maximum depth	1.0 m
Mean depth	0.4 m
Volume	0.009 Mm3
Theoretical water renewal time	42 days

Lake ecosystem parameters

Three major habitats have been identified in Lake Märrbadet. As in many other lakes in the area, the littoral habitat with emergent and floating-leaved vegetation (Littoral type I) covers most of the lake area (Table 4-66, Figure 4-97). Due to the shallowness and clear water of this lake, light penetrates down to all depths and no profundal areas are present. Hence, the pelagic habitat and the littoral habitat with submersed vegetation (Littoral type III) have the same distribution and cover the remaining area of the lake.

Table 4-66. Distribution of major habitats in Lake Märrbadet.

Habitats	Area [%]
Pelagial/Littoral type III	18
Littoral type I	82

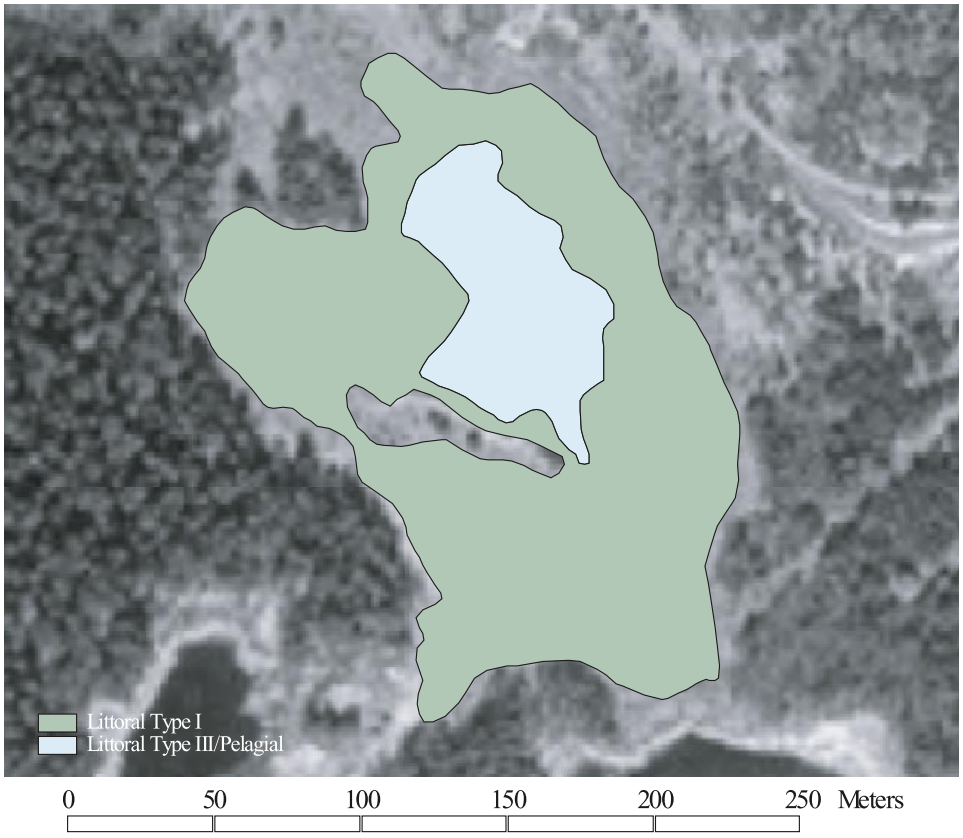

Figure 4-97. *Distribution of major habitats in Lake Märrbadet*

Additional remarks

Saltwater intrusions probably occur regularly in this lake, as it is situated at the same level as the normal sea level.

Forsmark 7:2. Lake Märrbadet (sub-area)

See Appendix 3–6 for data on sub-catchment parameters. For lake data see Forsmark 7:2–4 (entire catchment).

Forsmark 7:3. Lake 7:3

The location of the object

This catchment is part of the SMHI catchment no 54/55 and part of the catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: 0.22 m above sea level

The catchment area and its major constituents

The total catchment area is 0.192 km^2, and forest strongly dominates the land use within the area (Table 4-67).

Table 4-67. The different land uses within the catchment of Lake 7:3.

Land use	Area [%]
Forest	93
Water surface	1
Agriculture	0
Remaining open land	6
Wetland (as parts of the above land use categories)	6

The only surface water within this catchment is Lake 7:3. The outlet from this lake passes through Lake Märrbadet and Lake 7:1, before entering the Baltic Sea via Djupsundet to Kallrigafjärden (Figure 4-98).

Lake morphometry parameters

Figure 4-99 and Figure 4-100 show the bathymetric map and the depth grid map, respectively, for Lake 7:3.

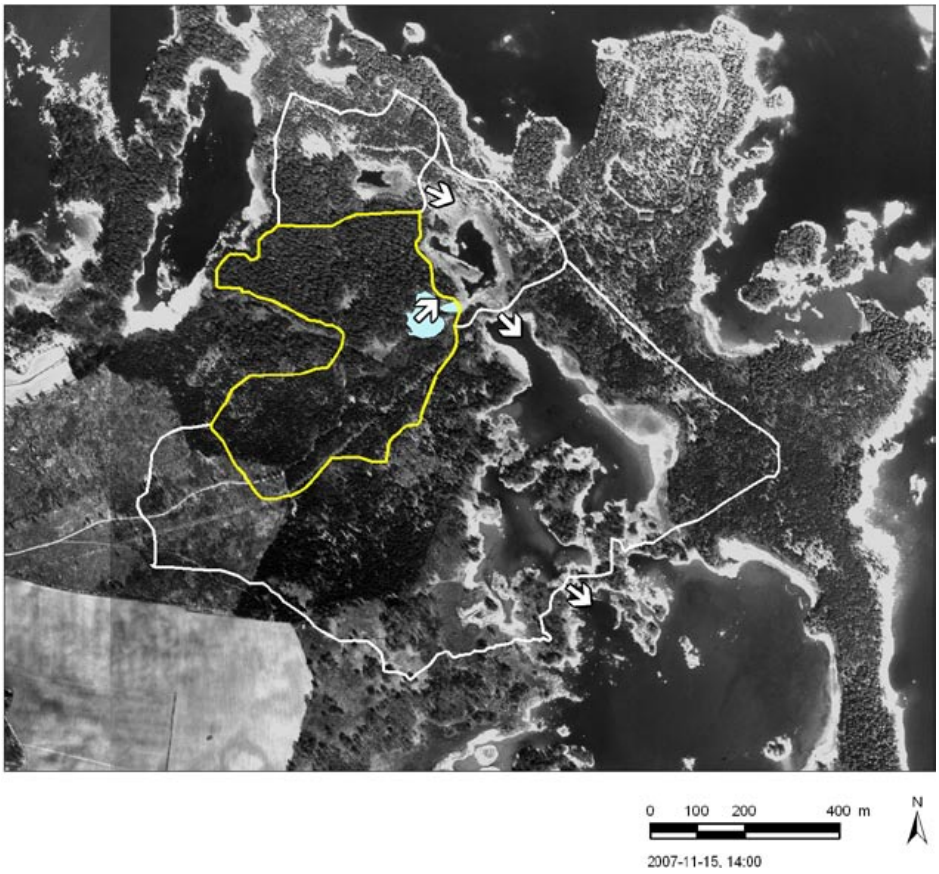

Figure 4-98. *The catchment Forsmark 7 with Lake 7:3 and its catchment (sub-area 3) marked with yellow boundaries.*

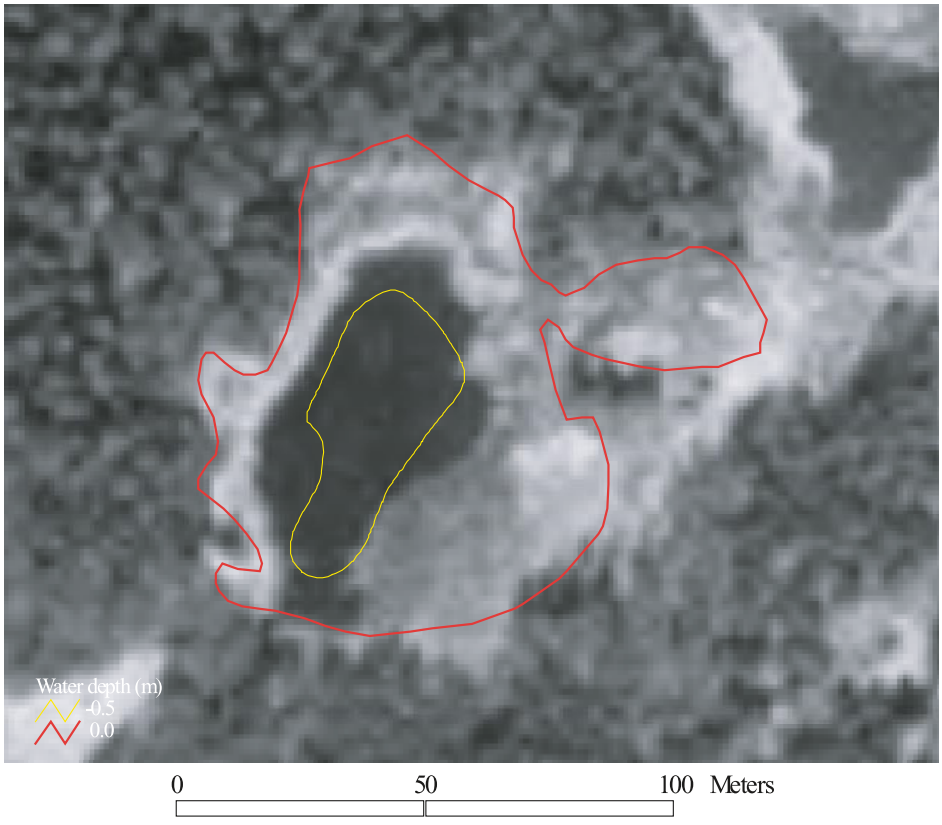

Figure 4-99. *Bathymetric map for Lake 7:3.*

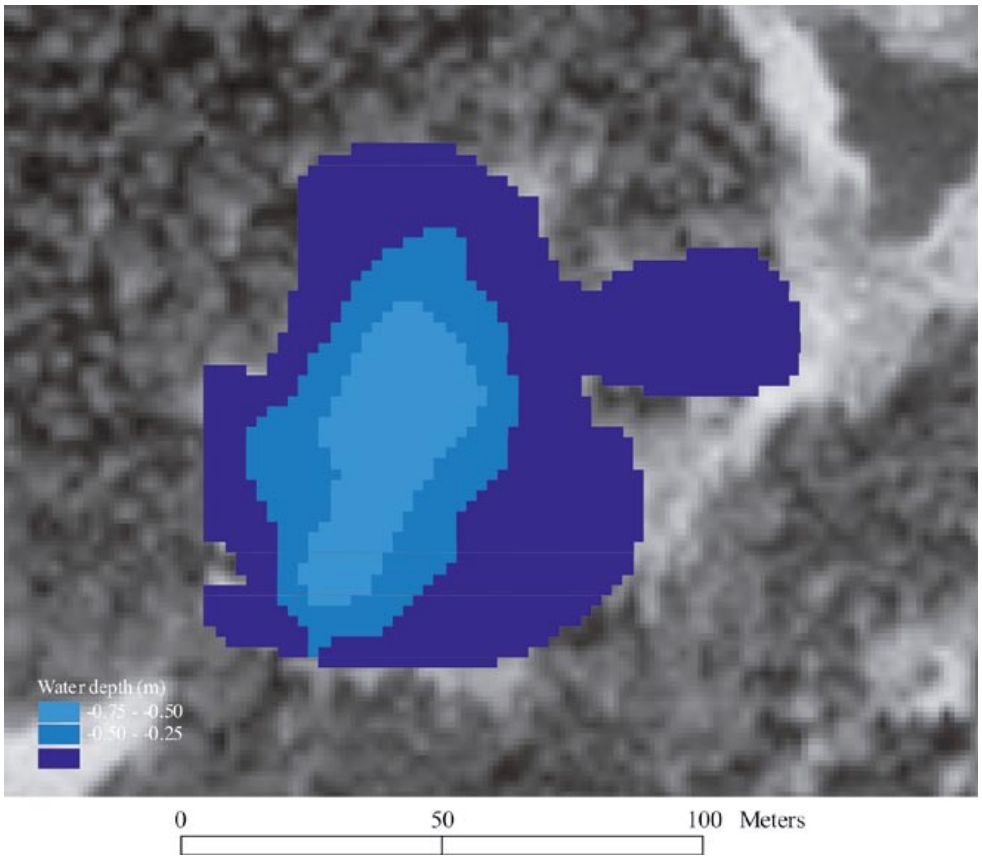

Figure 4-100. *Depth grid map for Lake 7:3.*

Lake 7:3 is small and very shallow (maximum depth 0.7 m). The theoretical water renewal time is only 14 days (Table 4-68).

Table 4-68. Lake morphometry parameters for Lake 7:3.

Lake morphometry	
Lake area	0.01 km2
Maximum depth	0.7 m
Mean depth	0.3 m
Volume	0.002 Mm3
Theoretical water renewal time	14 days

Lake ecosystem parameters

Three major habitats have been identified in Lake 7:3; the littoral habitat with emergent and floating-leaved vegetation (Littoral type I), the littoral with submerged vegetation (Littoral type III) and the pelagic habitat. Due to the shallow lake basin and the clear lake water, no profundal habitat is present. The littoral with emergent and floating-leaved vegetation strongly dominates the system, covering 79% of the lake area (Table 4-69, Figure 4-101).

Table 4-69. Distribution of major habitats in Lake 7:3.

Habitats	Area [%]
Pelagial/Littoral type III	21
Littoral type I	79

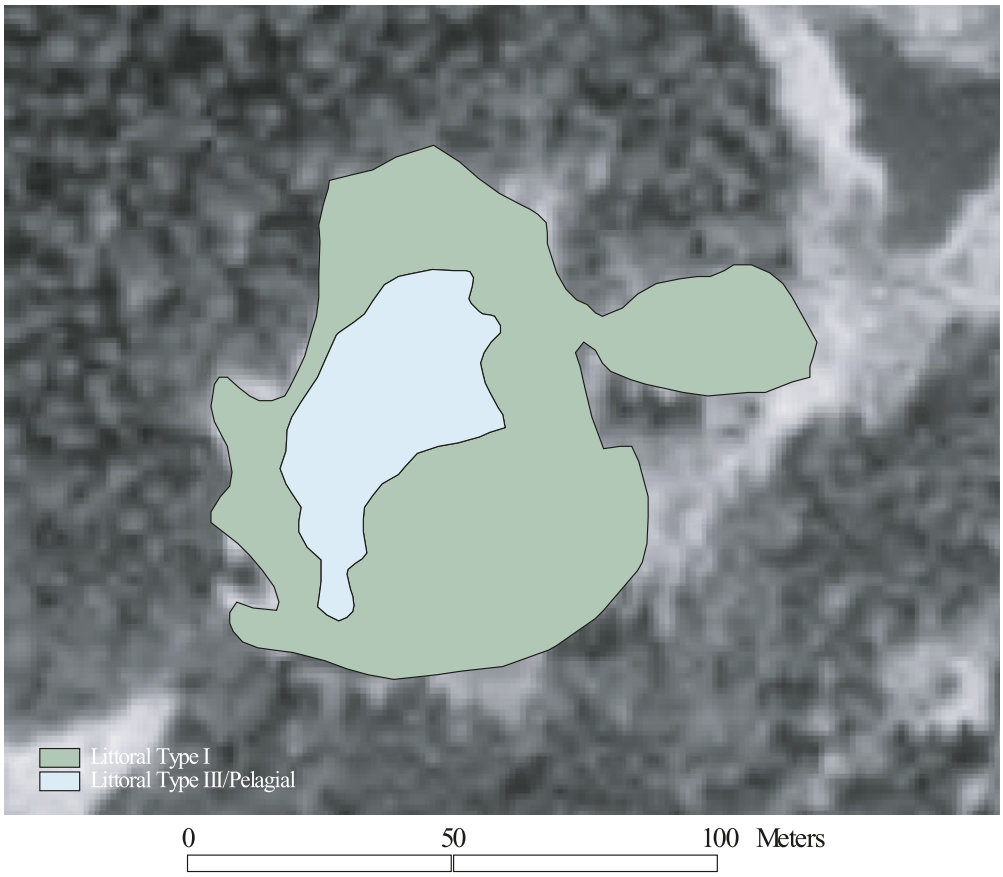

Figure 4-101. *Distribution of major habitats in Lake 7:3.*

Additional remarks

Saltwater intrusions probably occur regularly in this lake, as it is situated on a level close to the normal sea level.

Forsmark 7:4. Lake 7:4

The location of the object

This catchment is part of the SMHI catchment no 54/55 and part of catchment no 54/55:24 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: (no data)
Elevation: 0.38 m above sea level

The catchment area and its major constituents

The total catchment area is 0.077 km^2, and forest strongly dominates the land use within the area (Table 4-70).

Table 4-70. The different land uses within the catchment of Lake 7:4.

Land use	Area [%]
Forest	81
Water surface	2
Agriculture	0
Remaining open land	17
Wetland (included in forest and/or remaining open land)	17

The only surface water within this catchment is Lake 7:4. The outlet from the lake passes through Lake Märrbadet and Lake 7:1 before discharging into the Baltic Sea in Kallrigafjärden (Figure 4-102).

Lake morphometry parameters

Figure 4-103 and Figure 4-104 show the bathymetric map and the depth grid map, respectively, for Lake 7:4.

Lake 7:4 is small and very shallow; the mean depth is only 0.2 m (Table 4-71). The theoretical water renewal time is 49 days.

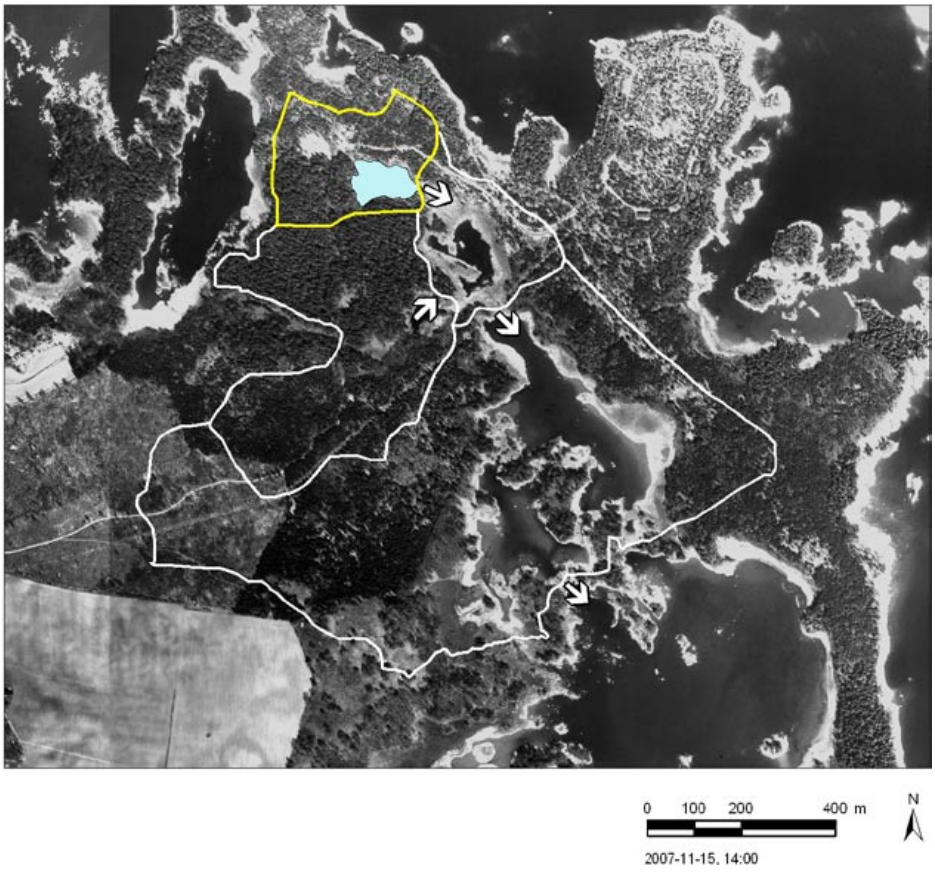

Figure 4-102. *The catchment Forsmark 7 with Lake 7:4 and its catchment (sub-area 7:4) marked with yellow boundaries.*

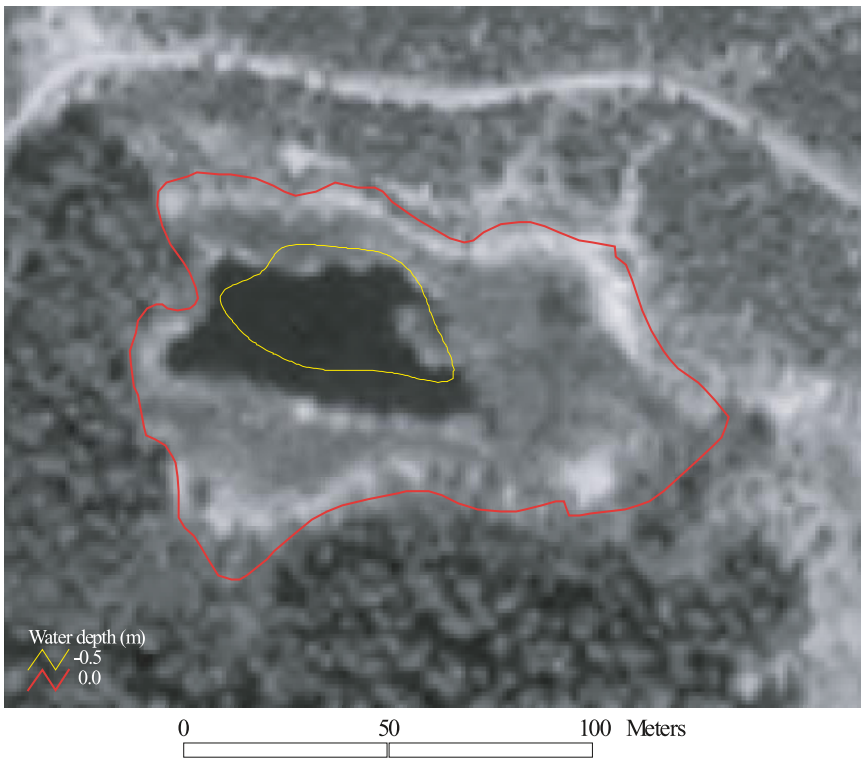

Figure 4-103. *Bathymetric map for Lake 7:4.*

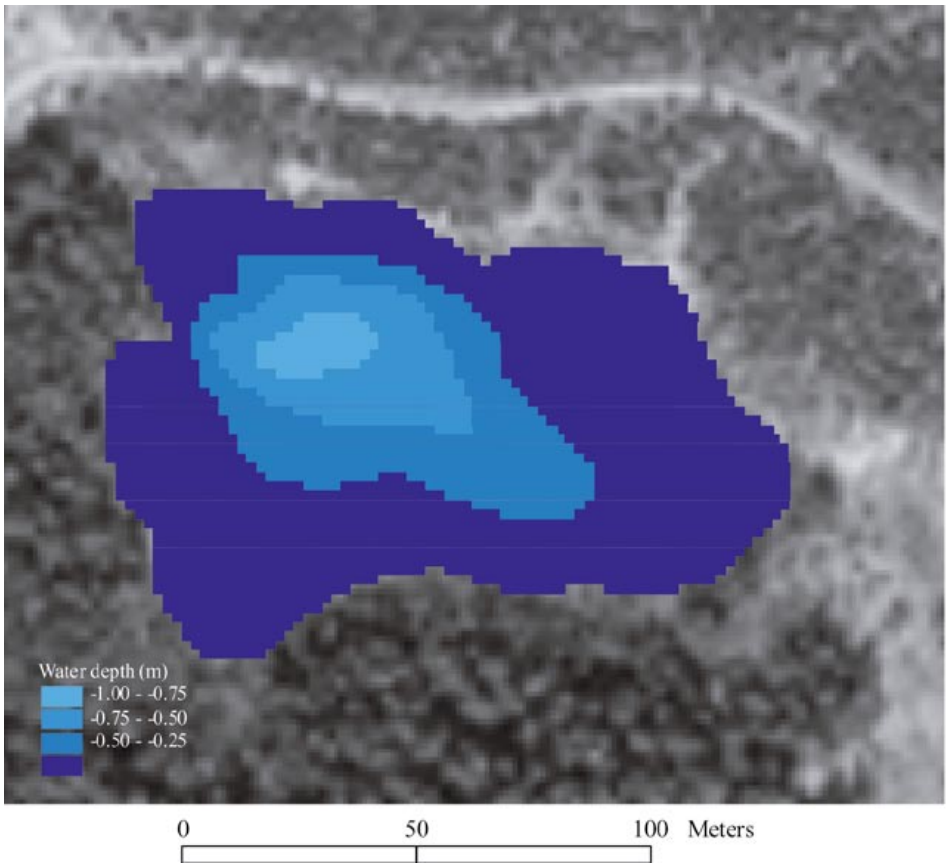

Figure 4-104. *Depth grid map for Lake 7:4.*

Table 4-71. Lake morphometry parameters for Lake 7:4.

Lake morphometry	
Lake area	0.01 km2
Maximum depth	0.8 m
Mean depth	0.2 m
Volume	0.002 Mm3
Theoretical water renewal time	49 days

Lake ecosystem parameters

In the shallow basin of Lake 7:4, the littoral habitat with emergent and floating-leaved vegetation (Littoral type I) covers most of the lake area (91%; Table 4-72, Figure 4-105). No profundal habitat is present, and the littoral habitat with submerged vegetation (Littoral type III), together with a small pelagic habitat, covers the rest of the lake area.

Table 4-72. Distribution of major habitats in Lake 7:4.

Habitats	Area [%]
Pelagial/Littoral type III	9
Littoral type I	91

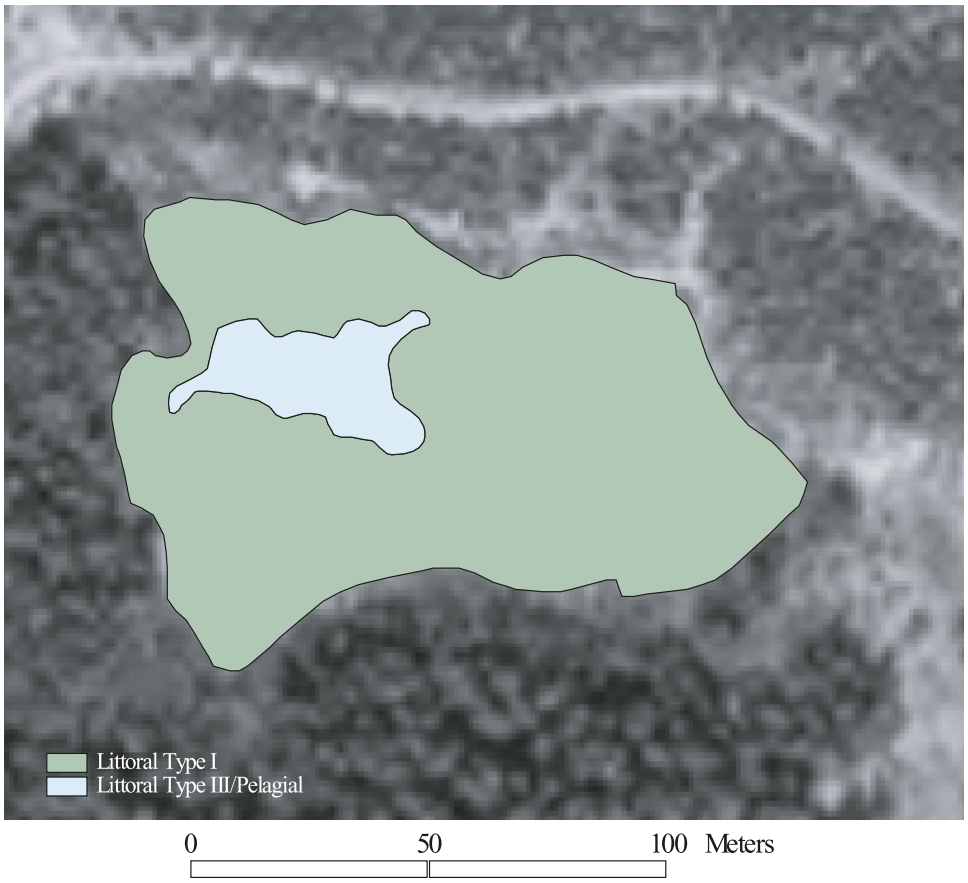

Figure 4-105. *Distribution of major habitats in Lake 7:4.*

Additional remarks

Saltwater intrusions probably occur regularly in this lake, as it is situated on a level close to the normal sea level.

4.8 The catchment Forsmark 8

This area only consists of one sub-area (Figure 4-106): Lake Fiskarfjärden (no 8:1) The outlet is situated in the southeastern end of the lake and drains some wetland areas before entering the Baltic Sea in Kallrigafjärden.

Forsmark 8:1 Lake Fiskarfjärden

The location of the object

This catchment is part of the SMHI catchment no 54/55 and equals catchment 54/55:28 in /Brunberg and Blomqvist, 1998/.

Topographical map: 12 I NO
Outlet coordinates: 669681, 163407 (SMHI)
Elevation: 0.54 m above sea level

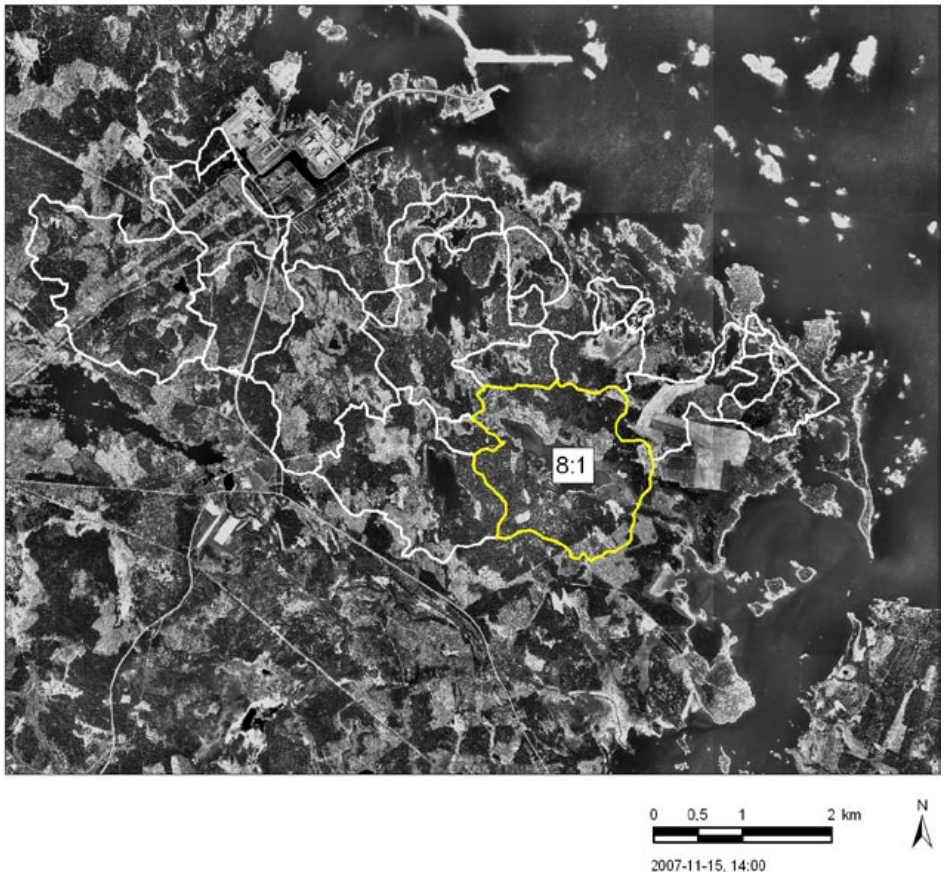

Figure 4-106. *The Forsmark area with the single sub-area in the catchment Forsmark 8 marked with yellow boundaries.*

The catchment area and its major constituents

The total catchment area is 2.926 km^2. Forest is the dominating land use (Table 4-73). Open land covers totally 18% of the area.

Table 4-73. The different land uses within the catchment of Lake Fiskarfjärden.

Land use	Area %
Forest	68
Water surface	14
Agriculture	1
Remaining open land	17
Wetland (as parts of the above land use categories)	16

The only surface water within this catchment is Lake Fiskarfjärden. This lake has no inlet creeks. The outlet drains some wetland areas southeast of the lake before entering the Baltic Sea in Kallrigafjärden (Figure 4-107).

Lake morphometry parameters

Figure 4-108 and Figure 4-109 show the bathymetric map and the depth grid map, respectively, for Lake Fiskarfjärden.

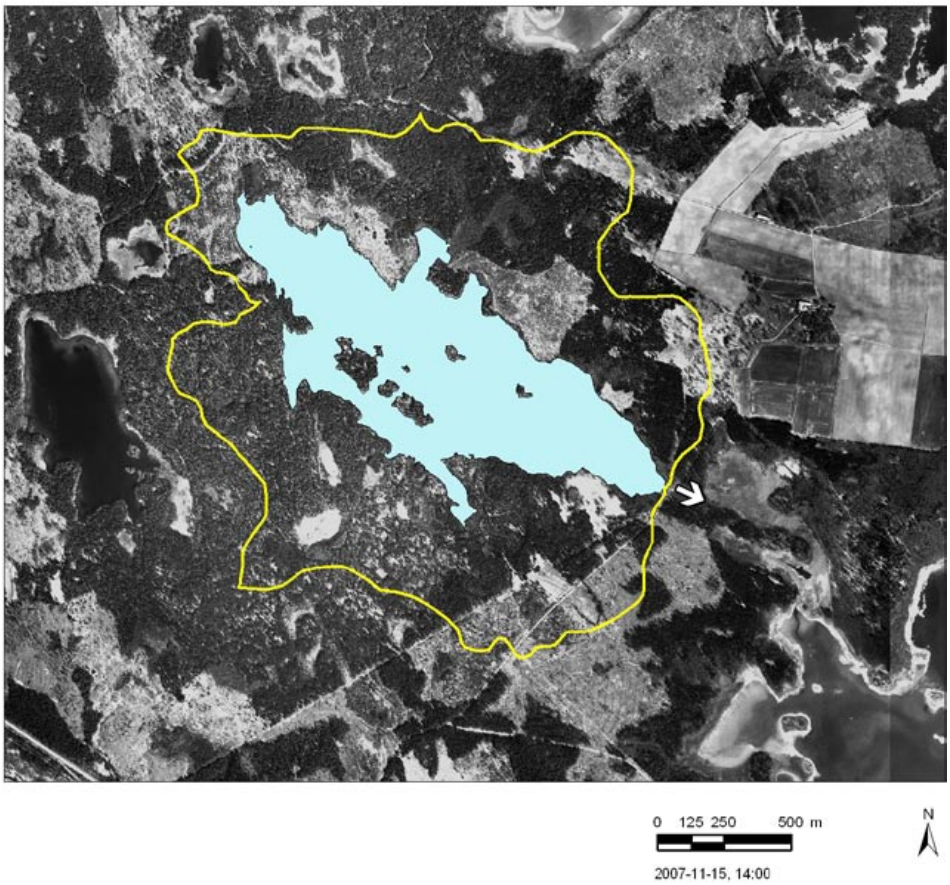

Figure 4-107. *The catchment Forsmark 8 with Lake Fiskarfjärden and its catchment marked with yellow boundaries.*

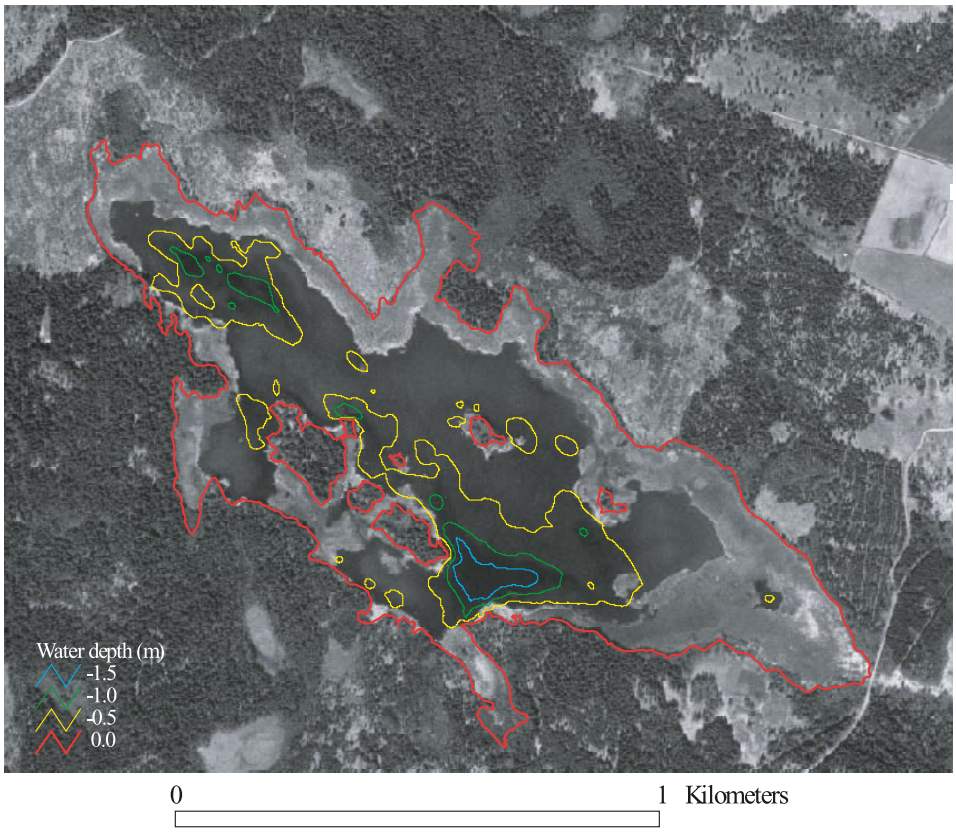

Figure 4-108. *Bathymetric map for Lake Fiskarfjärden.*

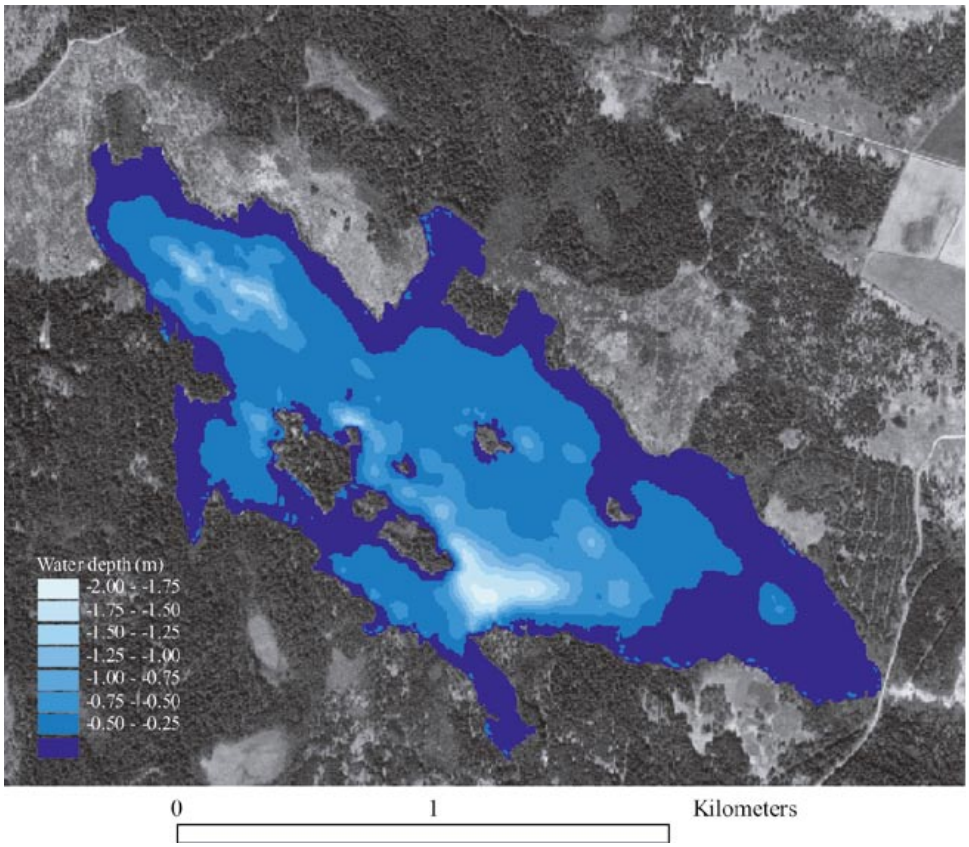

Figure 4-109. *Depth grid map for Lake Fiskarfjärden.*

Lake Fiskarfjärden is a large lake compared to most other lakes in the Forsmark area (Table 4-74). It has the largest lake area and it is relatively deep (maximum depth 1.9 m). The lake volume is one of the largest of the lakes in the area, and the theoretical water renewal time is about 5 months. The lake has six islets.

Table 4-74. Lake morphometry parameters for Lake Fiskarfjärden.

Lake morphometry	
Lake area	0.75 km2
Maximum depth	1.9 m
Mean depth	0.4 m
Volume	0.274 Mm3
Theoretical water renewal time	155 days

Lake ecosystem parameters

Three major habitats are present in Lake Fiskarfjärden; the littoral habitat with emergent and floating-leaved vegetation (Littoral type I), the littoral habitat with submerged vegetation (Littoral type III), and the pelagic habitat (Table 4-75, Figure 4-110). Due to the shallowness and clear water of this lake, light penetrates down to all bottom areas and no profundal habitat is present. Neither is there any littoral habitat with hard bottom (Littoral type II). Half of the lake area is covered by littoral of type III with the overlaying pelagic habitat, the other half is covered by littoral of type I.

Table 4-75. Distribution of major habitats in Lake Fiskarfjärden.

Habitats	Area [%]
Pelagial/Littoral type III	50
Littoral type I	50

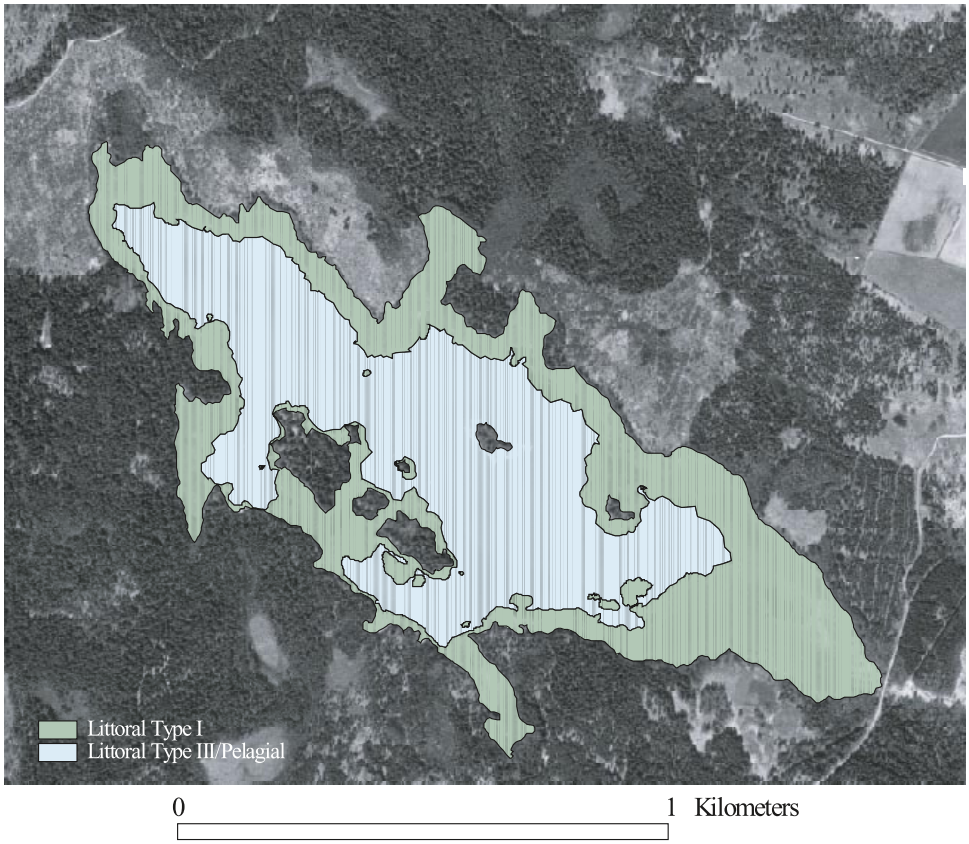

Figure 4-110. *Distribution of major habitats in Lake Fiskarfjärden.*

Additional remarks

Fiskarfjärden is a “brackish water lake” in a late stadium of isolation from Kallrigafjärden. Inflowing seawater from the Baltic Sea can probably still influence the lake during some years.

4.9 “Rest catchment areas” along the coast line

Areas without lakes or larger creeks are formed between the coast line and the catchments described earlier in this report. These seven “rest areas”, draining to the sea, are named Forsmark 1/2 (the area between Forsmark 1 and Forsmark 2), Forsmark 2/3 and so on to Forsmark 7/8. Each “rest area” has been given an idcode, Table 4-76, and is shown in Figure 4-111. For data of different parameters related to the “rest areas” see Appendices 3–6.

Table 4-76. Number of “rest area” and corresponding idcode.

Idcode	Number of “rest area”
AFM001109	Forsmark 1/2
AFM001110	Forsmark 2/3
AFM001111	Forsmark 3/4
AFM001112	Forsmark 5/6
AFM001113	Forsmark 6/7
AFM001114	Forsmark 7/8
AFM001115	Forsmark 4/5

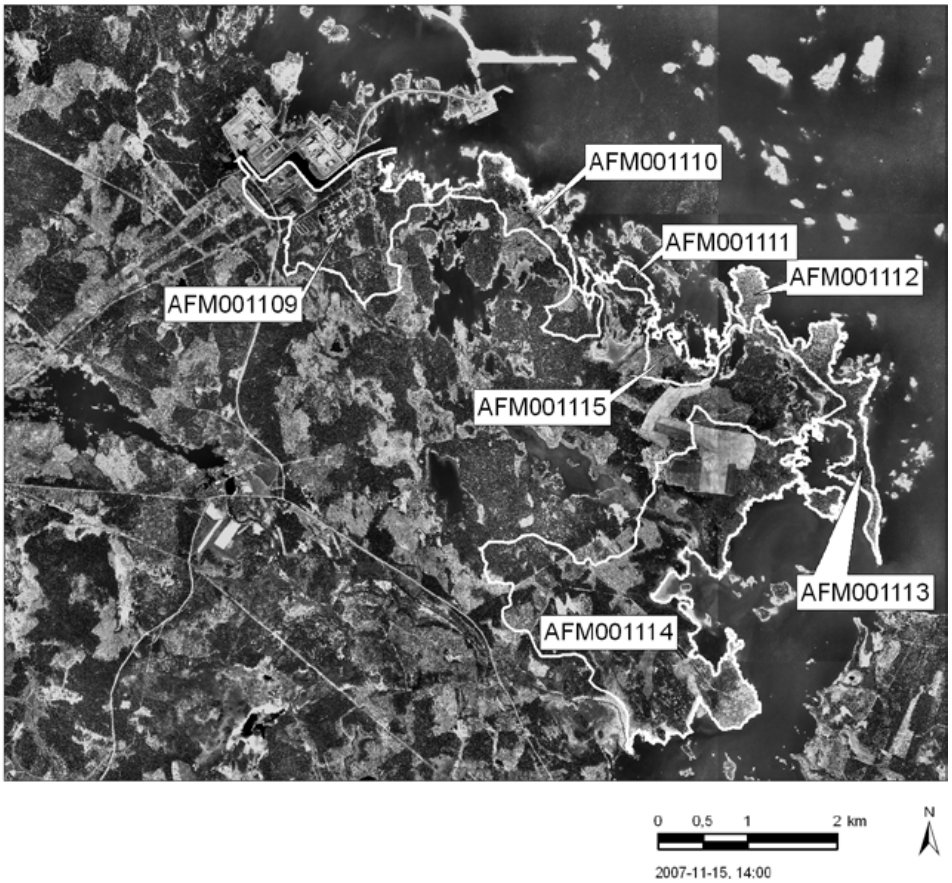

Figure 4-111*. The Forsmark area with the seven “rest catchment areas” delineated by the watersheds of the catchments and the costal shoreline to the Baltic Sea.*

5 Discussion and suggestions for future investigations

The Forsmark area is considered as relatively free from anthropogenic disturbances /Brunberg and Blomqvist, 1998/, apart from activities related to the construction and management of the nuclear power plant, and – in recent years – the currently ongoing site investigation activities within the area. The terrestrial vegetation is strongly dominated by forest, but the area has also a substantial wetland costituent. Nevertheless, this area has, as most other parts of southern Sweden, been affected by human activities for centuries, although at a much less extensive level. Land-use for agricultural purposes is of minor importance and concentrated to the eastern part of the area (Storskäret). Another form of anthropogenic influence is active forestry, with Sveaskog AB as the largest landowner. As in many parts of Uppsala County, and also generally in Sweden, drainage of land has affected the local hydrology and the present distribution of wetland and lake areas. According to /Brunberg and Blomqvist, 1998/ there are no registered drainage projects in the area, and large areas seem relatively free from this kind of damage. Still there are some visible signs of drainage activities within the catchments, such as lowered lake water levels and channelled/deepened creeks from lakes and wetland areas (e.g. Lakes Stocksjön and Eckarfjärden, Forsmark 2:9–10).

This coastal area of Forsmark, with a maximum altitude of 27 m above sea level, has a shoreline displacement of ca 0.5 m per century after the last glaciation /Ignatius et al, 1981/. The area today has 25 lakes, most of which are located at an altitude of 5 m above sea level or lower. Hence, these lake ecosystems are all very young and in some cases they have not even yet been completely isolated from the Baltic Sea. As many as 15 of the lakes are situated at a level of 65 cm or less above the average sea level. In these systems, salt water intrusions may occur more or less frequently, normally at least a couple of times per year during extreme low pressure weather conditions, which is the main course of variations in sea level.

With the exception of the three lakes Bolundsfjärden, Fiskarfjärden and Eckarfjärden, the lake basins in the Forsmark area are generally very small and shallow. The “median lake” of the area has an average depth of only 0.3 m, and a maximum depth of 1 m (Table 5-1).

Table 5-1. Median lake morphometry parameters for the lakes of the Forsmark area.

Lake morphometry	Median	Range
Lake area	0.05 km2	0.01 – 0.75 km2
Maximum depth	1.0 m	0.4 – 2.2 m
Mean depth	0.3 m	0.1 – 0.7 m
Volume	0.018 Mm3	0.002 – 0.374 Mm3
Theoretical water renewal time	44 days	5 – 328 days

The ecosystems that initially develop in the shallow, newly formed lake basins along the coast are unique for Sweden and very rare also on a European, or even worldwide, basis. The lakes first undergo an oligotrophic hardwater stage, which lasts for a relatively short period, about 1000 years. Later the lakes are most likely successively transformed to more softwater ecosystems followed by a mire stage /Brunberg and Blomqvist, 1998/. The possible lines of ontogeny for the lakes still remain to be elucidated.

The oligotrophic hardwater ecosystems are characterised by low phosphorus concentrations, high nitrogen concentrations and high amounts of dissolved organic carbon in the lake water. The water is very clear, due to low biomasses of plankton organisms and relatively low or moderate water colour. The sediments are very soft – the lakes are known as "bottomless" – and covered by a thick "microbial mat" dominated by cyanobacteria and purple sulphur bacteria /Brunberg et al, 2002/.

The oligotrophic hardwater lakes are also known as "Chara lakes", due to the frequent abundance of stoneworths (Charales, kransalger), submerged macro-algae that colonise large areas of the lake bottom. The common reed (*Phragmites australis*, bladvass) mostly dominates the emergent flora; this plant appears already during the lagoon stage, i.e. when the lake is still a bay of the Baltic Sea. Other frequently occurring aquatic plants that we have noticed during field investigations are the submerged Slender-leaved Pondweed (*Potamogeton filiformis*, trådnate), the floating-leaved Water Lilies (*Nymphaeaceae*, näckrosor) and the emergent plants Lesser Bulrush (*Typha angustifolia*, smalkaveldun) and Club-rush (*Schoenoplectus sp.*, säv). No detailed identifications or quantifications of different species have been performed within the investigations reported here.

In general, only three of the five possible main habitats are present in the Forsmark lakes: Littoral type I with emergent and floating-leaved vegetation, Littoral type III with submersed vegetation, and the Pelagic habitat. According to /Blomqvist et al, 2000/, the lower limit of Littoral type III in lakes should be identified from the bottom substrate and measurements of light penetration into the water, which makes it possible to calculate the depth of the euphotic zone. As light penetration data from the lakes are relatively sparse so far, we have assessed the distribution of Littoral type III from lake depth measurements combined with field observations of occurrence of Chara meadows and microbial mats in the lakes. The distributions reported here will most probably be confirmed by the light measurements that are performed within the ongoing lake monitoring programme; no, or at least negligible, areas of profundal are expected. The Littoral type II, with hard substrate, is not reported here for any of the lakes. However, this might be questioned for a few of the lakes and is then indicated in the "additional remarks" section, e.g. for Forsmark 6:1, Lake Simpviken. However, with a few possible exceptions that remains to be confirmed by field control, the distribution of Littoral type III and the Pelagic habitat coincide by area; the pelagic habitat overlies the Littoral type III habitat.

In conclusion, the data available so far regarding the lakes and their catchments within the Forsmark area, are now sorted into catchment and sub-catchment areas and are available from this report, as well as from the SKB local geographical information system of the area. In the future work within the site investigation, data gathered and stored in the SKB database may be sorted according to the same system, using the catchment and the lake habitat borders, respectively, as "frames" to identify and "cut out" the relevant information for each catchment or lake. This is a prerequisite for modelling ecosystem processes within the catchments and also for obtaining an integrated view for management of the terrestrial and aquatic environment.

Within the continued site investigations, still more data regarding the aquatic parts of the catchments remain to be gathered. Among the most apparent, the following parameters can be identified:

1. The elevation over the sea level and exact position of the thresholds of the lake basins should be identified, in order to assess the water exchange between the Baltic Sea and the freshwater bodies. This information is also needed to determine the drainage conditions between some of the freshwater basins in the flat coastal topography of the area.
2. The coastal areas situated between the catchments that now have been identified (e.g. Forsmark 1/2, Forsmark 2/3, etc) should be identified and incorporated into the SKB local GIS. Before this is possible, the relevant coastal line to be used should be determined. We suggest an inventory of the coastal shoreline, according to the same methodology as the lake shoreline inventory. This includes manual GPS recording of the shoreline and, at least, also the Littoral type I, i.e. the wetland/littoral areas covered with emergent or floating-leaved vegetation.
3. All creeks of relevant size should be identified and incorporated as GPS-determined areas within the local SKB GIS. During these field investigations, river ecosystem parameters (equal to the lake ecosystem parameters used for the lakes) should also be identified /cf Blomqvist et al, 2001/.
4. The borders and areas of Littoral type I in the lakes, along creeks and along the coast, also include an identification of wetland areas. Using the same methodology to identify the remaining wetlands within the Forsmark area would create a co-ordinated framework for continued investigations of these areas by specialised wetland ecologists.

In order to prepare for the final modelling of the lake ecosystems in the Forsmark area, the framework of major habitats should be filled with data from qualitative as well as quantitative inventories of biota, and measurements of important ecosystem processes. The corresponding inventories and measurements may be performed, or already existing data gathered, for terrestrial and wetland areas.

6 References

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Appendix 1

Morphometry parameters for lakes in the Forsmark area

ID Code	Catchment number	Name	Elevation [masl]	Area [km^2]	Max. depth [m]	Mean depth [m]	Volume [Mm^3]	Shore length [m]	Mean discharge [m^3/s]	Retention time [Days]	Fetch[1] [m]	Width[2] [m]
	1	***Forsmark 1***										
AFM000073	1:1-4	Gunnarsbo - Lillfj. (south)	1,60	0,03	2,2	0,7	0,023	1034	0,036	7	198	171
AFM000096	1:2	Gunnarsbo - Lillfj. (north)	1,64	0,02	0,9	0,3	0,007	1041	0,001	110	122	61
AFM000048	1:3-4	Labboträsket	3,56	0,06	1,1	0,3	0,016	2185	0,028	7	62	18
AFM000095	1:4	Gunnarsboträsket	5,81	0,07	1,3	0,5	0,034	1848	0,019	21	204	188
	2	***Forsmark 2***										
AFM000074	2:1-11	Norra Bassängen	0,56	0,08	0,9	0,3	0,024	2553	0,059	5	293	177
AFM000092	2:2	Lake 2:2	1,82	0,01	0,6	0,3	0,003	518	0,001	66	129	55
AFM000050	2:3-10	Bolundsfjärden	0,64	0,61	1,8	0,6	0,374	9140	0,056	77	1059	878
AFM000087	2:4-5	Graven	0,65	0,05	0,4	0,1	0,006	1190	0,003	25	153	75
AFM000088	2:5	Fräkengropen	1,35	0,02	0,8	0,2	0,004	909	0,001	44	88	44
AFM000089	2:6	Vambörsfjärden	1,14	0,05	1,0	0,4	0,021	1193	0,003	70	250	132
AFM000093	2:7	Kungsträsket	2,60	0,01	0,5	0,2	0,002	466	0,001	20	85	50
AFM000094	2:8	Gällsboträsket	1,91	0,19	1,5	0,2	0,032	4059	0,020	18	138	90
AFM000090	2:9-10	Stocksjön	2,92	0,04	0,8	0,2	0,008	890	0,013	9	108	82
AFM000010	2:10	Eckarfjärden	5,37	0,28	2,1	0,9	0,257	4405	0,009	328	755	393
AFM000091	2:11	Puttan	0,63	0,08	1,3	0,4	0,030	2390	0,061	6	255	168
	3	***Forsmark 3***										
AFM000086	3:1	Tallsundet	0,13	0,08	0,8	0,2	0,018	2624	0,002	141	154	78
	4	***Forsmark 4***										
AFM000085	4:1-2	Lake 4:1	-0,29	0,04	1,5	0,4	0,013	1520	0,005	32	188	66
AFM000049	4:2	Lillfjärden	-0,07	0,16	0,9	0,3	0,047	2947	0,004	125	367	279
	5	***Forsmark 5***										
AFM000052	5:1	Bredviken	-0,12	0,10	1,7	0,7	0,072	2049	0,004	191	518	67
	6	***Forsmark 6***										
AFM000084	6:1	Simpviken	-0,29	0,01	1,8	0,5	0,005	517	0,000	232	61	36
	7	***Forsmark 7***										
AFM000080	7:1-4	Lake 7:1	-0,26	0,16	1,1	0,3	0,053	4818	0,006	97	489	192
AFM000081	7:2	Märrbadet	0,00	0,02	1,0	0,4	0,009	768	0,002	42	117	71
AFM000082	7:3	Lake 7:3	0,22	0,01	0,7	0,3	0,002	421	0,001	14	66	35
AFM000083	7:4	Lake 7:4	0,38	0,01	0,8	0,2	0,002	434	0,001	49	47	29
	8	***Forsmark 8***										
AFM000051	8:1	Fiskarfjärden	0,54	0,75	1,9	0,4	0,274	7584	0,020	155	1370	555

ID Code	Catchment Number	Name of the lake	Dynamic sediment ratio[3]	Depth ratio[4]	Relative depth ratio[5]	Shoreline development factor[6]
	1	***Forsmark 1***				
AFM000073	1:1-4	Gunnarsbo - Lillfj. (south)	0,26	0,32	15,35	1,61
AFM000096	1:2	Gunnarsbo - Lillfj. (north)	0,50	0,34	7,42	1,94
AFM000048	1:3-4	Labboträsket	0,91	0,25	5,52	2,53
AFM000095	1:4	Gunnarsboträsket	0,51	0,39	6,23	2,01
	2	***Forsmark 2***				
AFM000074	2:1-11	Norra Bassängen	0,88	0,36	4,02	2,62
AFM000092	2:2	Lake 2:2	0,34	0,49	7,64	1,48
AFM000050	2:3-10	Bolundsfjärden	1,27	0,34	2,90	3,30
AFM000087	2:4-5	Graven	1,79	0,35	1,97	1,53
AFM000088	2:5	Fräkengropen	0,72	0,24	7,19	1,85
AFM000089	2:6	Vambörsfjärden	0,50	0,44	5,63	1,55
AFM000093	2:7	Kungsträsket	0,43	0,38	7,70	1,51
AFM000094	2:8	Gällsboträsket	2,49	0,11	4,40	2,66
AFM000090	2:9-10	Stocksjön	0,86	0,27	5,42	1,32
AFM000010	2:10	Eckarfjärden	0,58	0,43	4,99	2,34
AFM000091	2:11	Puttan	0,78	0,29	5,66	2,36
	3	***Forsmark 3***				
AFM000086	3:1	Tallsundet	1,22	0,29	3,58	2,63
	4	***Forsmark 4***				
AFM000085	4:1-2	Lake 4:1	0,49	0,25	10,29	2,30
AFM000049	4:2	Lillfjärden	1,37	0,33	2,77	2,07
	5	***Forsmark 5***				
AFM000052	5:1	Bredviken	0,42	0,43	6,91	1,85
	6	***Forsmark 6***				
AFM000084	6:1	Simpviken	0,18	0,30	23,86	1,54
	7	***Forsmark 7***				
AFM000080	7:1-4	Lake 7:1	1,25	0,30	3,33	3,37
AFM000081	7:2	Märrbadet	0,43	0,36	8,20	1,41
AFM000082	7:3	Lake 7:3	0,31	0,37	10,91	1,49
AFM000083	7:4	Lake 7:4	0,40	0,30	10,50	1,27
	8	**Forsmark 8**				
AFM000051	8:1	Fiskarfjärden	2,38	0,20	2,69	2,47

Explanations of morphometry parameters:

1	Fetch	Maximum length (m), the longest straight line over the water surface
2	Width	Maximum width (m), the longest straight line perpendicular to the length line
3	Dynamic sediment ratio	The dynamic sediment ratio (DSR) as the square rot of the area divided by the mean depth
4	Depth ratio	The depth ratio as the mean depth divided by the maximum depth
5	Relative depth ratio	Relative depth ratio as the ratio of maximum depth to mean diameter represented by the square root of the lake area
6	Shoreline development factor	Shoreline development factor as shore length divided by circumference of a circle with an area equal to that of the lake

Appendix 2

Distribution of major habitats in lakes of the Forsmark area

ID Code	Catchment Number	Name	Lake area [m^2]	Littoral type I [m^2]	Littoral type I [%]	Littoral type III/Pelagial [m^2]	Littoral type III/Pe [%]
	1	***Forsmark 1***					
AFM000073	1:1-4	Gunnarsbo - Lillfj. (south)	33107	15177	46	17930	54
AFM000096	1:2	Gunnarsbo - Lillfj. (north)	23148	17998	78	5150	22
AFM000048	1:3-4	Labboträsket	60042	57843	96	2199	4
AFM000095	1:4	Gunnarsboträsket	67453	49649	74	17804	26
	2	***Forsmark 2***					
AFM000074	2:1-11	Norra Bassängen	76070	44395	58	31675	42
AFM000092	2:2	Lake no 16	9921	4954	50	4975	50
AFM000050	2:3-10	Bolundsfjärden	611312	206719	34	404593	66
AFM000087	2:4-5	Graven	50087	42185	84	7902	16
AFM000088	2:5	Fräkengropen	19423	16913	87	2510	13
AFM000089	2:6	Vambörsfjärden	49577	29781	60	19796	40
AFM000093	2:7	Kungsträsket	7733	4755	62	2978	39
AFM000094	2:8	Gällsboträsket	187048	178344	95	8704	5
AFM000090	2:9-10	Stocksjön	36480	31012	85	5468	15
AFM000010	2:10	Eckarfjärden	283850	95318	34	188532	66
AFM000091	2:11	Puttan	82741	56230	68	26511	32
	3	***Forsmark 3***					
AFM000086	3:1	Tallsundet	79414	68944	87	10470	13
	4	***Forsmark 4***					
AFM000085	4:1-2	Lake no 8	35058	27455	78	7603	22
AFM000049	4:2	Lillfjärden	161269	118167	73	43102	27
	5	***Forsmark 5***					
AFM000052	5:1	Bredviken	97664	44369	45	53295	55
	6	***Forsmark 6***					
AFM000084	6:1	Simpviken	9119	7045	77	2074	23
	7	Forsmark 7					
AFM000080	7:1-4	Lake no 1	163052	89723	55	73329	45
AFM000081	7:2	Märrbadet	23611	19359	82	4252	18
AFM000082	7:3	Lake no 4	6393	5030	79	1362	21
AFM000083	7:4	Lake no 5	9312	8475	91	837	9
	8	***Forsmark 8***					
AFM000051	8:1	Fiskarfjärden	754303	373541	50	380762	50

Appendix 3

Morphometry parameters and population numbers of catchments in the Forsmark area

ID Code	Catchment number	Name	Area [km^2]	Maximum level [masl]	Minimum level [masl]	Difference in elevation [m]	Maximum slope[1] [%]	Perimeter [m]	Shape ratio[2]	Population [number]
	1	***Forsmark 1***								
AFM000073	1:1-4	Gunnarsbo - Lillfj. (south)	5,120	27	1	26	0,57	12509	1,61	5
AFM001099	1:1	*Sub-area: Gunnarsbo-Lillfj. (south)*	1,089	12	1	11	0,77	5627	1,54	0
AFM000096	1:2	Gunnarsbo - Lillfj. (north)	0,104	8	1	7	1,71	1425	1,19	0
AFM000048	1:3-4	Labboträsket	3,928	27	3	24	0,84	11175	1,64	5
AFM001100	1:3	*Sub-area: Labboträsket*	1,193	23	3	20	1,03	5320	1,40	0
AFM000095	1:4	Gunnarsboträsket	2,734	27	5	22	1,11	8534	1,49	0
	2	***Forsmark 2***								
AFM000074	2:1-11	Norra Bassängen	8,668	20	0	20	0,36	16363	1,62	0
AFM001101	2:1	*Sub-area: Norra bassängen*	0,350	8	0	8	0,86	2901	1,39	0
AFM000092	2:2	Lake 2:2	0,071	7	1	6	1,47	1074	1,06	0
AFM000050	2:3-10	Bolundsfjärden	8,003	20	0	20	0,35	15749	1,62	0
AFM001103	2:3	*Sub-area: Bolundsfjärden*	2,244	13	-1	14	0,62	9116	1,75	0
AFM000087	2:4-5	Graven	0,531	7	0	7	0,75	3142	1,22	0
AFM001104	2:4	*Sub-area: Graven*	0,390	6	0	6	0,81	2870	1,30	0
AFM000088	2:5	Fräkengropen	0,139	7	1	6	1,46	1491	1,08	0
AFM000089	2:6	Vambörsfjärden	0,484	8	0	8	1,39	3280	1,34	0
AFM000093	2:7	Kungsträsket	0,126	9	2	7	1,36	1411	1,06	0
AFM000094	2:8	Gällsboträsket	2,141	20	1	19	0,72	7921	1,57	0
AFM000090	2:9-10	Stocksjön	2,477	20	2	18	0,57	8503	1,56	0
AFM001105	2:9	*Sub-area: Stocksjön*	0,210	12	2	10	1,58	2035	1,22	0
AFM000010	2:10	Eckarfjärden	2,268	20	3	17	0,65	7904	1,59	0
AFM000091	2:11	Puttan	0,244	9	1	8	1,71	2278	1,29	0
	3	***Forsmark 3***								
AFM000086	3:1	Tallsundet	0,215	6	0	6	0,76	2230	1,35	0
	4	***Forsmark 4***								
AFM000085	4:1-2	Lake 4:1	0,689	11	0	11	1,34	4288	1,48	0
AFM001106	4:1	*Sub-area: 4:1*	0,069	7	0	7	1,36	1158	1,16	0
AFM000049	4:2	Lillfjärden	0,621	11	0	11	1,34	3784	1,36	0
	5	***Forsmark 5***								
AFM000052	5:1	Bredviken	0,944	10	0	10	0,51	6225	1,84	0
	6	***Forsmark 6***								
AFM000084	6:1	Simpviken	0,035	6	0	6	2,04	761	1,02	0
	7	***Forsmark 7***								
AFM000080	7:1-4	Lake 7:1	0,895	8	0	8	0,86	4789	1,44	0
AFM001107	7:1	*Sub-area: 7:1*	0,558	8	0	8	0,86	3927	1,49	0
AFM000081	7:2-4	Märrbadet	0,337	8	0	8	0,91	3133	1,52	0
AFM001108	7:2	*Sub-area: Märrbadet*	0,069	7	0	7	2,29	1185	1,21	0
AFM000082	7:3	Lake 7:3	0,192	8	0	8	0,92	2340	1,50	0
AFM000083	7:4	Lake 7:4	0,077	5	0	5	0,85	1180	1,10	0
	8	***Forsmark 8***								
AFM000051	8:1	Fiskarfjärden	2,926	13	0	13	0,84	8057	1,36	0

ID Code	Catchment number	Name	Area [km^2]	Maximum level [masl]	Minimum level [masl]	Difference in elevation [m]	Maximum slope[1] [%]	Perimeter [m]	Shape ratio[2]	Population [number]
		Forsmark 1/2								
AFM001109	1/2	"Rest catchment area"	1,862	12	0	12	0,57	10554	2,15	0
		Forsmark 2/3								
AFM001110	2/3	"Rest catchment area"	0,837	9	0	9	0,30	10331	3,23	0
		Forsmark 3/4								
AFM001111	3/4	"Rest catchment area"	0,107	8	0	8	0,59	2201	1,14	0
		Forsmark 5/6								
AFM001112	5/6	"Rest catchment area"	0,178	4	0	4	0,54	2905	1,78	0
		Forsmark 6/7								
AFM001113	6/7	"Rest catchment area"	0,701	9	0	9	0,25	11459	3,81	0
		Forsmark 7/8								
AFM001114	7/8	"Rest catchment area"	5,561	14	0	14	0,25	24835	2,97	0
		Forsmark 4/5								
AFM001115	4/5	"Rest catchment area"	0,389	8	0	8	0,82	8003	1,74	0

ID Code	Catchment number	Name	Water surface MA1 [%]	Coniferous- and mixed forest MA2 [%]	Agriculture land MA4 [%]	Remaining open land MA5 [%]	Cut forest MA6 [%]	Industrial area MA15 [%]	Remaining open land without forest contour MA17 [%]	Deciduous forest MA19 [%]	Wetland (VEG 61-64, 72 and 74-79) [%]
	1	***Forsmark 1***									
AFM000073	1:1-4	Gunnarsbo - Lillfj. (south)	1	73	1	7	11	0	8	0	10
AFM001099	1:1	*Sub-area: Gunnarsbo-Lillfj. (south)*	2	62	0	17	8	0	10	0	12
AFM000096	1:2	Gunnarsbo - Lillfj. (north)	9	81	0	2	0	0	8	0	18
AFM000048	1:3-4	Labboträsket	1	75	1	4	11	0	7	0	10
AFM001100	1:3	*Sub-area: Labboträsket*	1	70	0	1	15	0	13	0	15
AFM000095	1:4	Gunnarsboträsket	1	78	1	6	10	0	5	0	7
	2	***Forsmark 2***									
AFM000074	2:1-11	Norra Bassängen	10	69	0	1	9	0	10	0	12
AFM001101	2:1	*Sub-area: Norra bassängen*	13	60	0	0	10	0	18	0	21
AFM000092	2:2	Lake 2:2	9	45	0	0	46	0	0	0	0
AFM000050	2:3-10	Bolundsfjärden	9	70	0	1	9	0	10	0	11
AFM001103	2:3	*Sub-area: Bolundsfjärden*	20	57	0	0	12	0	11	0	13
AFM000087	2:4-5	Graven	5	74	0	0	0	0	21	0	22
AFM001104	2:4	*Sub-area: Graven*	6	71	0	0	0	0	23	0	24
AFM000088	2:5	Fräkengropen	4	80	0	0	0	0	16	0	16
AFM000089	2:6	Vambörsfjärden	5	70	0	0	10	0	15	0	17
AFM000093	2:7	Kungsträsket	3	69	0	0	24	0	3	0	3
AFM000094	2:8	Gällsboträsket	1	89	0	1	0	0	10	0	11
AFM000090	2:9-10	Stocksjön	9	65	1	4	16	0	5	0	6
AFM001105	2:9	*Sub-area: Stocksjön*	3	77	0	1	0	0	18	0	18
AFM000010	2:10	Eckarfjärden	10	64	1	4	18	0	4	0	5
AFM000091	2:11	Puttan	17	58	0	0	0	0	25	0	25
	3	***Forsmark 3***									
AFM000086	3:1	Tallsundet	11	58	0	0	0	0	31	0	35
	4	***Forsmark 4***									
AFM000085	4:1-2	Lake 4:1	13	64	0	1	0	0	23	0	23
AFM001106	4:1	*Sub-area: 4:1*	17	45	0	0	0	0	38	0	38
AFM000049	4:2	Lillfjärden	12	66	0	1	0	0	21	0	21
	5	***Forsmark 5***									
AFM000052	5:1	Bredviken	7	49	28	11	0	0	4	0	4
	6	***Forsmark 6***									
AFM000084	6:1	Simpviken	11	89	0	0	0	0	0	0	0
	7	***Forsmark 7***									
AFM000080	7:1-4	Lake 7:1	13	70	0	2	0	0	14	1	14
AFM001107	7:1	*Sub-area: 7:1*	18	64	0	3	0	0	13	2	14
AFM000081	7:2-4	Märrbadet	5	81	0	0	0	0	15	0	15
AFM001108	7:2	*Sub-area: Märrbadet*	17	47	0	0	0	0	36	0	36
AFM000082	7:3	Lake 7:3	1	93	0	0	0	0	6	0	6
AFM000083	7:4	Lake 7:4	2	81	0	0	0	0	17	0	17
	8	***Forsmark 8***									
AFM000051	8:1	Fiskarfjärden	14	68	1	4	0	0	13	0	16

"MA": Layers of the digital topographic map. "VEG": Layers of the SKB´s digital vegetation map.

ID Code	Catchment number	Name	Water surface MA1 [%]	Coniferous- and mixed forest MA2 [%]	Agriculture land MA4 [%]	Remaining open land MA5 [%]	Cut forest MA6 [%]	Industrial area MA15 [%]	Remaining open land without forest contour MA17 [%]	Deciduous forest MA19 [%]	Wetland (VEG 61-64, 72 and 74-79) [%]
		Forsmark 1/2									
AFM001109	1/2	"Rest catchment area"	3	63	0	14	3	0	10	0	11
		Forsmark 2/3									
AFM001110	2/3	"Rest catchment area"	4	84	0	3	0	0	9	0	9
		Forsmark 3/4									
AFM001111	3/4	"Rest catchment area"	1	98	0	0	0	0	0	0	0
		Forsmark 5/6									
AFM001112	5/6	"Rest catchment area"	4	92	0	0	0	0	3	0	3
		Forsmark 6/7									
AFM001113	6/7	"Rest catchment area"	4	91	0	0	0	0	5	0	5
		Forsmark 7/8									
AFM001114	7/8	"Rest catchment area"	1	64	10	5	1	0	13	6	17
		Forsmark 4/5									
AFM001115	4/5	"Rest catchment area"	2	88	0	0	0	0	10	0	13

"MA": Layers of the digital topographic map. "VEG": Layers of the SKB´s digital vegetation map.

Appendix 5

Soil composition in the catchments of the Forsmark area

ID Code	Catchment number	Name	J1[1] [%]	J5[2] [%]	J6[3] [%]	J16[4] [%]	J30[5] [%]	J32[6] [%]	J34[7] [%]	J40[8] [%]	J50[9] [%]	J91[10] [%]	J95[11] [%]	J96[12] [%]	J290[13] [%]	J416[14] [%]	J430[15] [%]	J433[16] [%]	J440[17] [%]	J495[18] [%]	J890[19] [%]	J9401[20] [%]
	1	***Forsmark 1***																				
AFM000073	1:1-4	Gunnarsbo - Lillfj. (south)	0	12	0	0	0	0	0	3	0	2	73	0	3	0	0	0	1	0	6	0
AFM001099	1:1	*Sub-area: Gunnarsbo-Lillfj. (south)*	0	16	0	0	0	0	0	0	0	3	65	0	14	0	0	0	0	0	2	0
AFM000096	1:2	Gunnarsbo - Lillfj. (north)	0	6	0	0	0	0	0	0	0	14	76	0	3	0	0	0	0	0	0	0
AFM000048	1:3-4	Labboträsket	0	10	0	0	0	1	1	4	0	1	75	0	0	0	0	0	1	0	7	0
AFM001100	1:3	*Sub-area: Labboträsket*	0	14	0	0	0	0	1	2	0	1	75	0	0	0	0	0	3	0	4	0
AFM000095	1:4	Gunnarsboträsket	0	9	0	0	0	1	0	5	0	1	74	0	0	0	0	0	0	0	8	0
	2	***Forsmark 2***																				
AFM000074	2:1-11	Norra Bassängen	0	5	0	3	1	0	0	1	0	9	70	0	0	0	1	0	1	1	4	1
AFM001101	2:1	*Sub-area: Norra bassängen*	0	0	0	3	0	0	0	0	0	11	79	0	0	0	0	0	0	1	0	0
AFM000092	2:2	Lake 2:2	0	0	0	0	0	0	0	1	0	7	88	0	0	0	1	0	0	0	0	0
AFM000050	2:3-10	Bolundsfjärden	0	5	0	3	1	0	0	1	0	9	70	0	0	0	1	0	1	1	4	1
AFM001103	2:3	*Sub-area: Bolundsfjärden*	0	0	0	1	1	0	0	0	0	20	69	0	0	0	0	0	0	1	2	2
AFM000087	2:4-5	Graven	0	0	0	6	4	0	0	0	0	4	74	0	0	0	7	0	0	1	2	0
AFM001104	2:4	*Sub-area: Graven*	0	0	0	7	2	0	0	0	0	4	76	0	0	0	7	0	0	1	2	0
AFM000088	2:5	Fräkengropen	0	0	0	3	11	0	0	0	0	4	70	0	0	0	6	0	1	1	3	0
AFM000089	2:6	Vambörsfjärden	0	1	0	10	1	0	0	1	0	5	74	0	0	0	1	0	1	0	2	1
AFM000093	2:7	Kungsträsket	0	1	0	3	0	0	0	0	0	2	88	0	0	0	2	0	0	1	2	1
AFM000094	2:8	Gällsboträsket	0	7	0	7	1	0	0	2	0	1	71	0	0	1	1	0	1	2	4	1
AFM000090	2:9-10	Stocksjön	0	10	0	0	1	0	0	2	0	9	67	0	0	0	0	1	1	2	7	1
AFM001105	2:9	*Sub-area: Stocksjön*	0	11	0	0	0	0	0	4	0	3	72	0	0	0	0	0	2	3	4	1
AFM000010	2:10	Eckarfjärden	0	10	0	0	1	0	0	2	0	9	66	0	0	0	0	1	1	2	8	1
AFM000091	2:11	Puttan	0	1	0	8	4	0	0	0	0	15	67	0	0	0	0	1	0	0	2	0
	3	***Forsmark 3***																				
AFM000086	3:1	Tallsundet	0	0	0	18	1	0	0	1	0	7	66	0	0	0	0	0	0	0	1	2
	4	***Forsmark 4***																				
AFM000085	4:1-2	Lake 4:1	0	0	0	11	0	0	0	1	0	9	35	31	0	0	0	0	0	0	3	5
AFM001106	4:1	*Sub-area: 4:1*	0	0	0	16	0	0	0	1	0	24	57	0	0	0	0	0	0	0	1	0
AFM000049	4:2	Lillfjärden	0	0	0	10	1	0	0	1	0	8	33	34	0	0	0	0	0	0	3	6
	5	***Forsmark 5***																				
AFM000052	5:1	Bredviken	0	0	0	0	1	0	0	2	1	7	31	55	0	0	0	0	0	0	2	0
	6	***Forsmark 6***																				
AFM000084	6:1	Simpviken	0	0	0	0	0	0	0	9	27	14	46	0	0	0	0	0	0	0	3	0
	7	***Forsmark 7***																				
AFM000080	7:1-4	Lake 7:1	0	0	0	7	3	0	0	2	11	10	57	6	0	0	0	0	0	0	0	0
AFM001107	7:1	*Sub-area: 7:1*	0	0	0	7	4	0	0	1	8	15	54	10	0	0	0	0	0	0	0	0
AFM000081	7:2-4	Märrbadet	0	0	0	8	2	0	0	5	16	4	63	0	0	0	0	0	0	0	1	1
AFM001108	7:2	*Sub-area: Märrbadet*	0	0	0	26	8	0	0	1	40	13	11	0	0	0	0	0	0	0	0	0
AFM000082	7:3	Lake 7:3	0	0	0	5	0	0	0	5	0	1	89	0	0	0	0	0	0	0	1	0
AFM000083	7:4	Lake 7:4	0	0	0	0	1	0	0	12	34	2	45	0	0	0	0	0	0	0	1	3
	8	***Forsmark 8***																				
AFM000051	8:1	Fiskarfjärden	0	1	0	11	6	0	0	3	0	13	43	14	0	0	1	0	0	0	4	1

"J": Layers of the SGU´s digital soil composition map

ID Code	Catchment number	Name	J1[1] [%]	J5[2] [%]	J6[3] [%]	J16[4] [%]	J30[5] [%]	J32[6] [%]	J34[7] [%]	J40[8] [%]	J50[9] [%]	J91[10] [%]	J95[11] [%]	J96[12] [%]	J290[13] [%]	J416[14] [%]	J430[15] [%]	J433[16] [%]	J440[17] [%]	J495[18] [%]	J890[19] [%]	J9401[20] [%]
		Forsmark 1/2																				
AFM001109	1/2	"Rest catchment area"	0	2	0	1	0	0	0	1	0	3	74	0	11	2	0	0	1	1	4	0
		Forsmark 2/3																				
AFM001110	2/3	"Rest catchment area"	0	0	0	0	2	0	0	0	0	3	81	0	0	0	1	0	0	0	10	1
		Forsmark 3/4																				
AFM001111	3/4	"Rest catchment area"	0	0	0	3	0	0	0	0	0	1	83	0	0	0	0	0	0	0	12	0
		Forsmark 5/6																				
AFM001112	5/6	"Rest catchment area"	0	0	0	0	0	0	0	2	4	1	92	0	0	0	0	0	0	0	1	0
		Forsmark 6/7																				
AFM001113	6/7	"Rest catchment area"	0	0	0	0	7	0	0	0	32	1	56	0	0	0	0	0	0	0	1	1
		Forsmark 7/8																				
AFM001114	7/8	"Rest catchment area"	0	2	0	8	2	0	0	2	0	2	31	37	0	0	1	0	0	0	9	2
		Forsmark 4/5																				
AFM001115	4/5	"Rest catchment area"	0	0	0	1	1	0	0	5	6	1	78	3	0	0	0	0	0	0	2	2

"J": Layers of the SGU´s digital soil composition map

ID Code	Catchment number	Name	J9402[21] [%]	J9403[22] [%]	J9405[23] [%]	J9487[24] [%]	J9489[25] [%]	J9490[26] [%]	B91[27] [%]	B2933[28] [%]	B2934[29] [%]	B2940[30] [%]	B2943[31] [%]	B2947[32] [%]	B2949[33] [%]	B2991[34] [%]
	1	***Forsmark 1***														
AFM000073	1:1-4	Gunnarsbo - Lillfj. (south)	0	0	0	0	0	0	2	0	16	6	67	0	9	0
AFM001099	1:1	*Sub-area: Gunnarsbo-Lillfj. (south)*	0	0	0	0	0	0	3	0	17	1	64	0	16	0
AFM000096	1:2	Gunnarsbo - Lillfj. (north)	0	0	0	0	0	0	14	0	6	0	76	0	3	0
AFM000048	1:3-4	Labboträsket	0	0	0	0	0	0	1	0	17	7	68	0	8	0
AFM001100	1:3	*Sub-area: Labboträsket*	0	0	0	0	0	0	1	0	19	14	61	0	4	0
AFM000095	1:4	Gunnarsboträsket	0	0	0	0	0	0	1	0	16	4	71	0	9	0
	2	***Forsmark 2***														
AFM000074	2:1-11	Norra Bassängen	0	0	0	0	0	1	9	0	14	3	69	0	4	0
AFM001101	2:1	*Sub-area: Norra bassängen*	0	0	0	0	0	4	11	0	4	8	76	0	0	0
AFM000092	2:2	Lake 2:2	0	0	0	0	0	2	7	0	2	9	81	0	0	0
AFM000050	2:3-10	Bolundsfjärden	0	0	0	0	0	1	9	0	15	3	69	0	4	0
AFM001103	2:3	*Sub-area: Bolundsfjärden*	0	1	0	0	0	2	20	0	6	3	69	0	2	0
AFM000087	2:4-5	Graven	0	0	0	0	0	1	4	0	18	2	74	0	2	0
AFM001104	2:4	*Sub-area: Graven*	0	0	0	0	0	1	4	0	17	2	76	0	2	0
AFM000088	2:5	Fräkengropen	0	0	0	0	0	0	4	0	22	2	69	0	3	0
AFM000089	2:6	Vambörsfjärden	0	0	0	0	1	1	5	0	18	10	66	0	2	0
AFM000093	2:7	Kungsträsket	0	0	0	0	0	0	2	0	7	7	82	0	2	0
AFM000094	2:8	Gällsboträsket	0	0	0	0	0	0	1	0	22	3	70	0	5	0
AFM000090	2:9-10	Stocksjön	0	0	0	0	0	0	9	0	15	1	67	0	7	0
AFM001105	2:9	*Sub-area: Stocksjön*	0	0	0	0	0	0	3	0	18	3	73	0	4	0
AFM000010	2:10	Eckarfjärden	0	0	0	0	0	0	9	0	15	1	67	0	8	0
AFM000091	2:11	Puttan	0	0	0	0	2	0	15	0	14	2	67	0	2	0
	3	***Forsmark 3***														
AFM000086	3:1	Tallsundet	0	0	0	0	1	4	7	0	21	38	33	0	1	1
	4	***Forsmark 4***														
AFM000085	4:1-2	Lake 4:1	0	0	1	2	0	1	9	0	19	8	36	24	3	1
AFM001106	4:1	*Sub-area: 4:1*	0	1	0	0	0	0	24	0	18	49	0	0	1	8
AFM000049	4:2	Lillfjärden	0	0	1	2	0	1	8	0	20	3	40	26	3	0
	5	***Forsmark 5***														
AFM000052	5:1	Bredviken	0	0	1	0	0	0	7	0	5	3	29	46	2	9
	6	***Forsmark 6***														
AFM000084	6:1	Simpviken	0	0	0	0	0	0	14	0	36	35	8	0	3	3
	7	***Forsmark 7***														
AFM000080	7:1-4	Lake 7:1	0	0	1	0	0	0	10	0	25	9	21	3	1	30
AFM001107	7:1	*Sub-area: 7:1*	0	0	1	0	1	0	15	0	21	10	30	5	1	19
AFM000081	7:2-4	Märrbadet	1	0	0	0	0	0	4	0	33	8	6	0	1	49
AFM001108	7:2	*Sub-area: Märrbadet*	2	0	0	0	0	0	13	0	76	6	1	0	0	4
AFM000082	7:3	Lake 7:3	0	0	0	0	0	0	1	0	10	11	5	0	1	74
AFM000083	7:4	Lake 7:4	1	0	0	0	0	0	2	0	51	4	13	0	1	28
	8	***Forsmark 8***														
AFM000051	8:1	Fiskarfjärden	0	1	0	0	1	0	13	0	24	3	53	2	4	0

"J": Layers of the SGU´s digital soil composition map

ID Code	Catchment number	Name	J9402[21] [%]	J9403[22] [%]	J9405[23] [%]	J9487[24] [%]	J9489[25] [%]	J9490[26] [%]	B91[27] [%]	B2933[28] [%]	B2934[29] [%]	B2940[30] [%]	B2943[31] [%]	B2947[32] [%]	B2949[33] [%]	B2991[34] [%]
		Forsmark 1/2														
AFM001109	1/2	"Rest catchment area"	0	0	0	0	0	0	3	0	8	7	68	0	15	0
		Forsmark 2/3														
AFM001110	2/3	"Rest catchment area"	0	0	0	0	0	0	3	0	6	1	80	0	10	0
		Forsmark 3/4														
AFM001111	3/4	"Rest catchment area"	0	0	0	0	0	0	1	0	3	80	0	0	13	3
		Forsmark 5/6														
AFM001112	5/6	"Rest catchment area"	0	0	0	0	0	0	1	0	6	80	3	0	1	8
		Forsmark 6/7														
AFM001113	6/7	"Rest catchment area"	0	0	0	0	1	0	1	1	41	40	10	0	1	7
		Forsmark 7/8														
AFM001114	7/8	"Rest catchment area"	0	0	0	0	0	0	2	0	19	2	43	23	9	1
		Forsmark 4/5														
AFM001115	4/5	"Rest catchment area"	0	0	1	0	0	0	1	0	16	31	30	1	2	20

"J": Layers of the SGU´s digital soil composition map.

Explanations of the soil and boulder composition:

1	J1	Bog
2	J5	Fen
3	J6	Gyttja
4	J16	Clay gyttja - Gyttja Clay
5	J30	Littoral sediments, sand
6	J32	Postglacial coarse grained sediment, Gravel
7	J34	Littoral sediments, mainly gravel or cobbles
8	J40	Glacial clay, unspecified
9	J50	Glacifluvial deposits, silty - boulders
10	J91	Water
11	J95	Till, sandy
12	J96	Till, clay sandy to silty
13	J290	Artificial fill
14	J416	Clay gyttja to gyttja clay with thin layer of Peat
15	J430	Littorial sediments, sand with thin layer of Peat
16	J433	Littorial sediments, gravel with thin layer of Peat
17	J440	Glacial clay, unspecified with thin layer of Peat
18	J495	Till, sandy, with thin layer of Peat
19	J890	Precambrian
20	J9401	Glacial clay, unspecified with thin layer of Littorial sediments, sand
21	J9402	Glacial clay, unspecified with thin layer of Littorial sediments, gravel
22	J9403	Littorial sediments, sand with thin layer of Glacifluvial deposits, Clay gyttja to Gyttja clay
23	J9405	Glacial clay, unspecified with thin layer of Postcglacial sediment, Clay gyttja to Gyttja clay
24	J9487	Till, clay sandy to silty; with thin layer of Littorial sediments, sand
25	J9489	Till, sandy; with thin layer of Littorial sediments, sand
26	J9490	Till, sandy; with thin layer of postcglacial sediment, Clay gyttja to Gyttja clay
27	B91	Water
28	B2933	Low to medium boulder frequency (small to large boulders)
29	B2934	Low boulder frequency on other soil types than till (small to large boulders)
30	B2940	High boulder frequency (small to large boulders)
31	B2943	Medium boulder frequency (small to large boulders)
32	B2947	Low boulder frequency (small to large boulders)
33	B2949	Boulder frequency unknown
34	B2991	High to medium boulder frequency (large boulders)

Appendix 6

Different vegetation types in the catchments of the Forsmark area

ID Code	Catchment number	Name	VEG11 [%][1]	VEG12 [%][2]	VEG13 [%][3]	VEG14 [%][4]	VEG15 [%][5]	VEG21 [%][6]	VEG26 [%][7]	VEG30 [%][8]	VEG41 [%][9]	VEG42 [%][10]	VEG43 [%][11]	VEG44 [%][12]	VEG45 [%][13]	VEG46 [%][14]	VEG50 [%][15]
	1	***Forsmark 1***															
AFM000073	1:1-4	Gunnarsbo - Lillfj. (south)	6	6	7	7	2	1	1	5	1	2	11	17	3	5	4
AFM001099	1:1	*Sub-area: Gunnarsbo-Lillfj. (south)*	6	2	4	5	5	0	2	3	2	6	16	8	2	6	3
AFM000096	1:2	Gunnarsbo - Lillfj. (north)	50	2	3	4	6	0	0	4	0	0	0	0	0	0	0
AFM000048	1:3-4	Labboträsket	8	7	8	8	2	2	1	5	1	1	9	20	3	5	5
AFM001100	1:3	*Sub-area: Labboträsket*	7	13	9	15	2	1	0	7	2	0	7	14	0	3	1
AFM000095	1:4	Gunnarsboträsket	4	4	7	5	1	2	1	4	0	2	10	22	4	6	7
	2	***Forsmark 2***															
AFM000074	2:1-11	Norra Bassängen	18	2	16	4	2	0	0	5	1	1	8	15	2	2	1
AFM001101	2:1	*Sub-area: Norra bassängen*	15	6	9	4	2	7	1	8	3	1	10	0	0	0	0
AFM000092	2:2	Lake 2:2	33	0	4	0	4	0	0	0	0	4	25	21	0	0	0
AFM000050	2:3-10	Bolundsfjärden	17	2	17	4	2	0	0	4	1	1	8	16	2	3	1
AFM001103	2:3	*Sub-area: Bolundsfjärden*	24	2	13	4	2	0	0	5	0	2	7	6	0	2	0
AFM000087	2:4-5	Graven	31	1	8	1	0	0	0	4	4	1	16	5	0	2	0
AFM001104	2:4	*Sub-area: Graven*	23	1	6	1	0	0	0	3	5	2	22	6	0	2	0
AFM000088	2:5	Fräkengropen	56	1	13	2	0	0	0	9	0	0	0	0	0	0	0
AFM000089	2:6	Vambörsfjärden	34	3	13	8	1	0	0	4	2	1	10	0	0	2	0
AFM000093	2:7	Kungsträsket	13	2	16	7	3	0	0	2	0	1	15	35	0	0	0
AFM000094	2:8	Gällsboträsket	7	2	14	3	2	0	1	2	0	0	10	41	0	1	5
AFM000090	2:9-10	Stocksjön	14	2	26	4	3	0	0	7	0	0	5	8	6	5	0
AFM001105	2:9	*Sub-area: Stocksjön*	17	0	44	4	3	0	0	6	0	0	2	1	0	0	0
AFM000010	2:10	Eckarfjärden	14	2	24	4	3	0	0	7	0	0	5	9	7	5	0
AFM000091	2:11	Puttan	32	2	5	2	2	0	0	9	0	0	4	2	0	0	0
	3	***Forsmark 3***															
AFM000086	3:1	Tallsundet	21	4	6	6	0	0	0	18	0	0	0	0	0	0	0
	4	***Forsmark 4***															
AFM000085	4:1-2	Lake 4:1	25	4	3	3	0	0	0	14	0	0	4	10	0	0	0
AFM001106	4:1	*Sub-area: 4:1*	9	0	14	7	0	0	0	15	0	0	0	0	0	0	0
AFM000049	4:2	Lillfjärden	27	5	2	2	0	0	0	14	0	0	5	11	0	0	0
	5	***Forsmark 5***															
AFM000052	5:1	Bredviken	3	7	1	2	0	2	1	8	1	1	2	21	0	0	1
	6	***Forsmark 6***															
AFM000084	6:1	Simpviken	4	4	10	12	0	4	4	0	4	0	6	40	0	0	0
	7	***Forsmark 7***															
AFM000080	7:1-4	Lake 7:1	10	22	0	5	0	4	2	2	2	3	5	16	0	0	0
AFM001107	7:1	*Sub-area: 7:1*	0	23	0	7	0	5	3	0	2	3	5	17	0	0	0
AFM000081	7:2-4	Märrbadet	25	20	0	2	0	2	1	5	3	3	5	14	0	0	0
AFM001108	7:2	*Sub-area: Märrbadet*	2	6	1	5	0	0	1	2	1	0	18	10	0	0	0
AFM000082	7:3	Lake 7:3	35	33	0	1	0	3	1	3	3	6	0	7	0	0	0
AFM000083	7:4	Lake 7:4	20	2	0	3	0	0	0	14	4	0	4	34	0	0	0
	8	***Forsmark 8***															
AFM000051	8:1	Fiskarfjärden	15	8	12	3	1	1	1	7	0	0	5	10	0	0	1

"VEG": Layers of the SKB´s digital vegetation map.

	number		[%][1]	[%][2]	[%][3]	[%][4]	[%][5]	[%][6]	[%][7]	[%][8]	[%][9]	[%][10]	[%][11]	[%][12]	[%][13]	[%][14]	[%][15]
		Forsmark 1/2															
AFM001109	1/2	"Rest catchment area"	13	3	10	10	7	2	2	6	1	2	8	2	0	0	1
		Forsmark 2/3															
AFM001110	2/3	"Rest catchment area"	24	3	12	7	9	0	0	8	1	2	12	4	0	2	0
		Forsmark 3/4															
AFM001111	3/4	"Rest catchment area"	21	0	17	17	10	0	0	31	0	0	2	0	0	0	0
		Forsmark 5/6															
AFM001112	5/6	"Rest catchment area"	30	12	11	9	1	0	0	20	2	0	1	5	0	0	0
		Forsmark 6/7															
AFM001113	6/7	"Rest catchment area"	16	17	11	24	2	0	1	7	0	5	4	1	0	0	0
		Forsmark 7/8															
AFM001114	7/8	"Rest catchment area"	6	6	6	6	2	9	7	5	0	1	6	12	0	1	1
		Forsmark 4/5															
AFM001115	4/5	"Rest catchment area"	10	7	4	8	3	5	0	10	0	0	5	32	0	0	0

"VEG": Layers of the SKB´s digital vegetation map.

ID Code	Catchment number	Name	VEG61 [%][16]	VEG62 [%][17]	VEG63 [%][18]	VEG64 [%][19]	VEG72 [%][20]	VEG74 [%][21]	VEG75 [%][22]	VEG76 [%][23]	VEG77 [%][24]	VEG78 [%][25]	VEG79 [%][26]	VEG81 [%][27]	VEG82 [%][28]	VEG83 [%][29]	VEG92 [%][30]	VEG96 [%][31]	VEG100 [%][32]
	1	***Forsmark 1***																	
AFM000073	1:1-4	Gunnarsbo - Lillfj. (south)	0	1	1	0	0	0	1	0	5	1	0	1	3	0	0	4	1
AFM001099	1:1	*Sub-area: Gunnarsbo-Lillfj. (south)*	0	2	0	0	0	0	2	0	7	1	0	0	0	0	1	16	2
AFM000096	1:2	Gunnarsbo - Lillfj. (north)	0	11	0	0	0	0	0	0	7	0	0	0	0	0	0	2	10
AFM000048	1:3-4	Labboträsket	0	1	1	0	0	0	1	0	4	1	0	1	3	0	0	0	1
AFM001100	1:3	*Sub-area: Labboträsket*	1	1	1	0	0	0	1	0	8	3	0	0	0	0	0	1	1
AFM000095	1:4	Gunnarsboträsket	0	1	2	0	0	0	1	0	3	0	0	1	5	0	0	0	1
	2	***Forsmark 2***																	
AFM000074	2:1-11	Norra Bassängen	0	1	0	0	0	0	1	0	8	0	1	0	1	0	0	0	10
AFM001101	2:1	*Sub-area: Norra bassängen*	0	3	0	0	0	0	4	0	12	2	0	0	0	0	0	0	13
AFM000092	2:2	Lake 2:2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
AFM000050	2:3-10	Bolundsfjärden	0	1	0	0	0	0	0	0	8	0	1	0	1	0	0	0	9
AFM001103	2:3	*Sub-area: Bolundsfjärden*	0	2	0	0	0	0	1	0	10	0	0	0	0	0	0	0	20
AFM000087	2:4-5	Graven	0	1	0	0	0	0	1	0	20	0	0	0	0	0	0	0	5
AFM001104	2:4	*Sub-area: Graven*	0	1	0	0	0	0	2	1	21	0	0	0	0	0	0	0	6
AFM000088	2:5	Fräkengropen	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	4
AFM000089	2:6	Vambörsfjärden	0	3	0	0	0	0	0	0	13	1	0	0	0	0	0	0	5
AFM000093	2:7	Kungsträsket	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	3
AFM000094	2:8	Gällsboträsket	0	1	0	0	0	0	1	0	5	0	4	0	1	0	0	0	1
AFM000090	2:9-10	Stocksjön	0	1	0	0	0	0	0	0	5	0	0	1	4	0	0	0	9
AFM001105	2:9	*Sub-area: Stocksjön*	0	0	0	0	0	0	1	0	17	0	0	0	1	0	0	0	3
AFM000010	2:10	Eckarfjärden	0	1	0	0	0	0	0	0	4	0	0	1	4	0	0	0	10
AFM000091	2:11	Puttan	0	0	0	0	0	0	2	2	17	5	0	0	0	0	0	0	17
	3	***Forsmark 3***																	
AFM000086	3:1	Tallsundet	0	1	2	0	0	0	3	4	20	4	0	0	0	0	0	0	11
	4	***Forsmark 4***																	
AFM000085	4:1-2	Lake 4:1	0	0	0	0	0	0	6	2	12	3	0	0	1	0	0	0	13
AFM001106	4:1	*Sub-area: 4:1*	0	0	0	0	0	0	7	1	30	0	0	0	0	0	0	0	17
AFM000049	4:2	Lillfjärden	0	0	0	0	0	0	6	2	10	3	0	0	1	0	0	0	12
	5	***Forsmark 5***																	
AFM000052	5:1	Bredviken	0	0	0	0	0	0	1	0	3	0	0	28	11	0	0	0	7
	6	***Forsmark 6***																	
AFM000084	6:1	Simpviken	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
	7	***Forsmark 7***																	
AFM000080	7:1-4	Lake 7:1	0	0	0	0	0	0	2	3	6	1	0	0	2	0	0	0	13
AFM001107	7:1	*Sub-area: 7:1*	0	0	1	0	0	1	2	3	6	1	0	0	3	0	0	0	18
AFM000081	7:2-4	Märrbadet	0	0	0	0	0	0	4	3	7	1	0	0	0	0	0	0	5
AFM001108	7:2	*Sub-area: Märrbadet*	0	0	0	0	0	0	13	6	12	4	0	0	0	0	0	0	17
AFM000082	7:3	Lake 7:3	0	0	0	0	0	0	0	2	4	0	0	0	0	0	0	0	1
AFM000083	7:4	Lake 7:4	0	0	0	0	0	0	4	5	8	0	0	0	0	0	0	0	2
	8	***Forsmark 8***																	
AFM000051	8:1	Fiskarfjärden	1	1	1	0	0	0	1	1	6	2	3	1	4	0	0	0	14

"VEG": Layers of the SKB´s digital vegetation map.

ID Code	Catchment number	Name	VEG61 [%][16]	VEG62 [%][17]	VEG63 [%][18]	VEG64 [%][19]	VEG72 [%][20]	VEG74 [%][21]	VEG75 [%][22]	VEG76 [%][23]	VEG77 [%][24]	VEG78 [%][25]	VEG79 [%][26]	VEG81 [%][27]	VEG82 [%][28]	VEG83 [%][29]	VEG92 [%][30]	VEG96 [%][31]	VEG100 [%][32]
		Forsmark 1/2																	
AFM001109	1/2	"Rest catchment area"	0	1	0	0	0	0	1	0	9	0	0	0	0	0	0	13	3
		Forsmark 2/3																	
AFM001110	2/3	"Rest catchment area"	0	1	0	0	0	0	0	0	7	0	0	0	0	4	0	0	4
		Forsmark 3/4																	
AFM001111	3/4	"Rest catchment area"	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
		Forsmark 5/6																	
AFM001112	5/6	"Rest catchment area"	0	0	0	0	0	1	1	1	2	0	0	0	0	0	0	0	5
		Forsmark 6/7																	
AFM001113	6/7	"Rest catchment area"	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	5
		Forsmark 7/8																	
AFM001114	7/8	"Rest catchment area"	0	1	3	0	0	1	3	3	3	0	0	10	4	0	0	0	1
		Forsmark 4/5																	
AFM001115	4/5	"Rest catchment area"	0	1	2	0	0	0	3	3	3	3	0	0	0	0	0	0	2

"VEG": Layers of the SKB´s digital vegetation map.

Lake index

Lake index for lakes in the Forsmark area