

**R-04-12**

**Nature values and site accessibility  
maps of Forsmark and Simpevarp**

**Version 1.2**

Lasse Kyläkorpi, SwedPower AB

December 2004

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

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# Summary

During the planning process of the site investigations, a methodology and a tool for compiling and assessing areas of environmental and/or cultural (incl. socio-economics) concerns was developed. The method also considers that different ecological features require different approaches to conservation and protection. This means that the accessibility to an area is dependent on both the characteristics of the value in question as well as the type of activity that is planned. The aim was to produce a map showing areas suitable and not suitable for e.g. drilling, road construction or other disturbing activities, i.e. an accessibility map. The purpose was also to produce a document with site-specific information of environmental and/or cultural interests for the forthcoming work with environmental impact assessments.

In this report the procedure for producing accessibility maps is described, and the Forsmark and Simpevarp regional model areas are assessed with regards to environmental and cultural sensitivity. The aim is to give a comprehensive understanding of the nature and conservation values of Forsmark and Simpevarp regional model areas. And also to describe the concept of accessibility maps with regards to the production, handling and update processes.

In chapter 3.1 and 3.2 the procedure for the accessibility maps of Forsmark and Simpevarp, respectively, is described with regards to what input data was used, and how that data was handled. In chapter 3.3, the handling guideline for how to use and update the maps is briefly described.

# Sammanfattning

Under planeringsprocessen av platsundersökningarna utvecklades en metod och ett verktyg för att sammanställa och uppskatta natur och/eller kultur (inkl. socio-ekonomiska) värden. I metoden tas det även hänsyn till att olika naturvärden kräver olika tillvägagångssätt vid bevarande och skydd. Detta innebär att tillgängligheten till ett område är beroende av både värdets karaktär samt vad för typ av aktivitet som är planerad. Målet var att producera en karta som visade på områdenas lämplighet och olämplighet för ex. borrhning, vägbygge eller andra aktiviteter, dvs. en tillgänglighetskarta. Syftet var även att producera ett dokument med platsspecifik information om natur och/eller kultur intressen för det kommande arbetet med miljökonsekvensbeskrivningar.

I denna rapport beskrivs processen med att ta fram en tillgänglighetskarta och Forsmark samt Simpevarp regionala modell områden är bedömda med tanke på dess natur och kultur värden. Syftet är att ge en omfattande förståelse av natur och bevarande värdet av Forsmark och Simpevarps regionala modell område, men även att beskriva konceptet tillgänglighetskarter i sig med tanke på produktion, hantering och uppdaterings processer.

I kapitel 3.1 och 3.2 beskrivs förfarandet med tillgänglighetskartan över Forsmark respektive Simpevarp med tanke på vad för data som användes och hur den var hanterad. I kapitel 3.3 beskrivs kortfattat handlingsplanen för hur tillgänglighetskartan används och uppdateras.

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# 1 Introduction

During the planning process of the site investigations, a methodology and a tool for compiling and assessing areas of environmental and/or cultural (incl. socio-economic) concerns was developed. This aimed at producing a map showing areas suitable and not suitable for e.g. drilling, road construction or other disturbing activities, i.e. an accessibility map. As well as documenting site-specific information of environmental and/or cultural interest for the forthcoming work with environmental impact assessments.

The purpose of the accessibility map was to ensure that;

- crucial environmental values does not get harmed,
- if disturbance on such values is unavoidable, the effects and consequences can be estimated and described in the EIA-process and in discussions with the authorities,
- new values identified during the site investigations are taken care of,
- all relevant data is stored in one database,
- the data could be visualised for planning purposes,
- the SKB's own field monitoring does not get disturbed.

The basis for this map was an aggregation of spatially defined areas, such as legally protected areas, ecologically sensitive areas, buffered watercourses and buildings, cultural amenities, but also locations for SKB's monitoring activities that had to be left undisturbed as far as possible.

Different ecological features require different approaches to conservation and protection. For example, floral values seldom need any large buffer zones to be preserved, whereas some mammals normally need relatively large areas surrounding their primary habitat if conservatory actions are to be successful. This means that the accessibility to an area is dependent on both the characteristics of the value in question as well as the type of activity that is planned. Besides spatial requirements, there are also temporal factors to keep in mind, i.e. the accessibility of an area can vary over time. For example, the bird fauna can be very sensitive for disturbance during the nesting period, and less sensitive during the rest of the year.

All this leads to the conclusion that the interpretation of the accessibility maps has to be made by ecologically trained personnel, since some features can be handled and defined within the map while others cannot.

## 1.1 This report

In this report, the procedure for producing accessibility maps is described and the Forsmark and Simpevarp regional model areas are assessed with regards to environmental and cultural sensitivity.

The aim of this report is to:

1. give a comprehensive understanding of the nature and conservation values of the Forsmark and Simpevarp regional model areas (for use in e.g. further planning of the site investigations and the forthcoming work with environmental impact assessments),
2. describe the concept of accessibility maps with regards to the production, handling and update processes.

In chapter 2, the nature values of the regional model areas of Forsmark (2.1) and Simpevarp (2.2) are compiled, assessed and described.

In chapter 3, the process of producing the accessibility maps is described, as well as the data input to the maps of Forsmark (3.1) and Simpevarp (3.2). Furthermore, in (3.3) SKB's guideline for the handling of the map is described, which has been developed to quality assure both the use and future updates of the maps.

## 2 Nature values

### 2.1 Forsmark regional model area

The landscape of the Forsmark region is pronouncedly flat, comprising big areas of wetland and coniferous forest on moraine. The calcareous moraine is an important contribution to the rich flora and calcareous influenced Chara-lakes /Bergström et al., 1977; Brunberg and Blomqvist, 1999/. The archipelago is relatively poor with islands compared to a major part of the Stockholm archipelago. The landscape is greatly influenced by the shore level displacement. The flat moraine shores outside Forsmark are rich in calcareous sediments, resulting in a vegetation dominated by broad-leaved trees and thickly wooded vegetation on the islands. The islands in Kallriga-fjärden are of botanical interest, containing partly natural coniferous forests rich with deciduous trees and herb-rich undergrowth /Naturvårdsprogram för Uppsala län, 1987/.

The forests are dominated by Scotch pine and Norway spruce forests situated on till. The spruce becomes more abundant where a deeper soil cover is found along with more mesic-moist conditions. The field layer is here heavily influenced by the lime content and is characterised by herbs and broad-leaved grasses along with a number of orchid species. The deciduous tree species are dominated by *Betula pubescens*, *Alnus glutinosa* and *Sorbus acuparia*, but also *Acer platanoides* and *Fraxinus excelsior* is fairly common. Especially *F. excelsior* may be abundant along sheltered seashores. *Quercus robur* and *Ulmus glabra* are close to their northern limit and are very scarce.

Arable land, pastures and clear cuts dominate the open land. Arable land and pastures are found close to settlements. The pastures were earlier intensively used but are today a part of the abandoned farmland following the nation wide general regression of agriculture activities. Where grazing still exist the intensity is low /Bergström et al., 1977/.

As a consequence of the forestry activities in the area there are a lot of clear-cuts to be found in different successional stages. *Betula pendula* is the dominating species in many of the earlier successional stages until it is replaced by young *Picea abies* or *Pinus silvestris* depending on soil type and/or management.

The Forsmark catchment area has a high percent of wetlands compared to Uppland in general. The wetlands are characterised by a high calcareous influence making the extremely to moderate rich fen types common in this area. These fen types lack the dominance of *Sphagnum* species in the ground layer and is instead dominated by brown mosses e.g. *Scorpidium scorpioides*. Roughly there may be two types of wetlands identified. Those that accumulate peat and those where decomposition is fairly high thereby minimising peat formation.

Streams and rivers are rare due to the flat terrain. The river Forsmarksån is the largest water course and drains the chain of lakes beginning east in the Florarna nature reserve and ending into the Kallrigafjärden /Bergström et al., 1977/. Because of dams and water regulations, the water flow in river Forsmarksån is strongly affected, which has also affected the natural thresholds in the lakes and other parts of the catchments /Brunberg and Blomqvist, 1999/.



There are only a few unexploited lakes in the municipality, since a major part of them are dammed, lowered or turned into cultivated land. The lakes are often small and shallow with nutrient poor water and swampy shores containing a lot of Rush (*Schoenoplectus lacustris*), Reed (*Phragmites australis*) and Sedges (*Carex sp.*).

### 2.1.1 Forest habitats

The valuable forest habitats of the area mainly consist of woodland key habitats (nyckelbiotoper), areas with high conservation value where redlisted species are likely to occur (Nitare and Norén, 1992/), and areas with nature values (naturvärden), which has the potential to become key habitats. National woodland key habitat inventories have been performed by the National Board of Forestry on all privately owned land. Additional key habitat surveys have been performed within the regional model area on request by SKB, whereby the total number and total area of woodland key habitats and areas with nature values increased with a factor of 4 and 8, respectively. The main corporate land owner in the area, Sveaskog, has identified some additional areas with particular demands for conservation. Besides these, the area also holds some primeval forests and wet forests (see Table 2-1 and Figure 2-1).

**Table 2-1. Summarized information of ecologically valuable forest areas within the regional model area of Forsmark.**

Value	Characteristics	Surveyor	No. of objects	Area (km <sup>2</sup> )
Woodland key habitat (Nyckelbiotop)*	Red listed species are likely to be present	National Board of Forestry	46	1.30
Area with nature values (Naturvärde)*	High potential for red listed species	National Board of Forestry	38	2.22
Conservation area (Naturvård – orörd)	Forests with high conservation value	Sveaskog	6	0.48
Conservation management (Naturvård – skötsel)	Forests with some conservation value	Sveaskog	6	0.98
Combined goals (Kombinerade mål)	Forests with some conservation value	Sveaskog	4	1.33
Primeval forest (Urskog)	Forests not, or only marginally, affected by forestry. Protected by law	Naturvårdsverket (Swedish EPA)	4	0.91
Wet forest (Sumpskog)	Moist, dense forests with high conservation value	National Board of Forestry	55	1.07

\* Additional key habitat surveys have been performed on initiative by SKB.

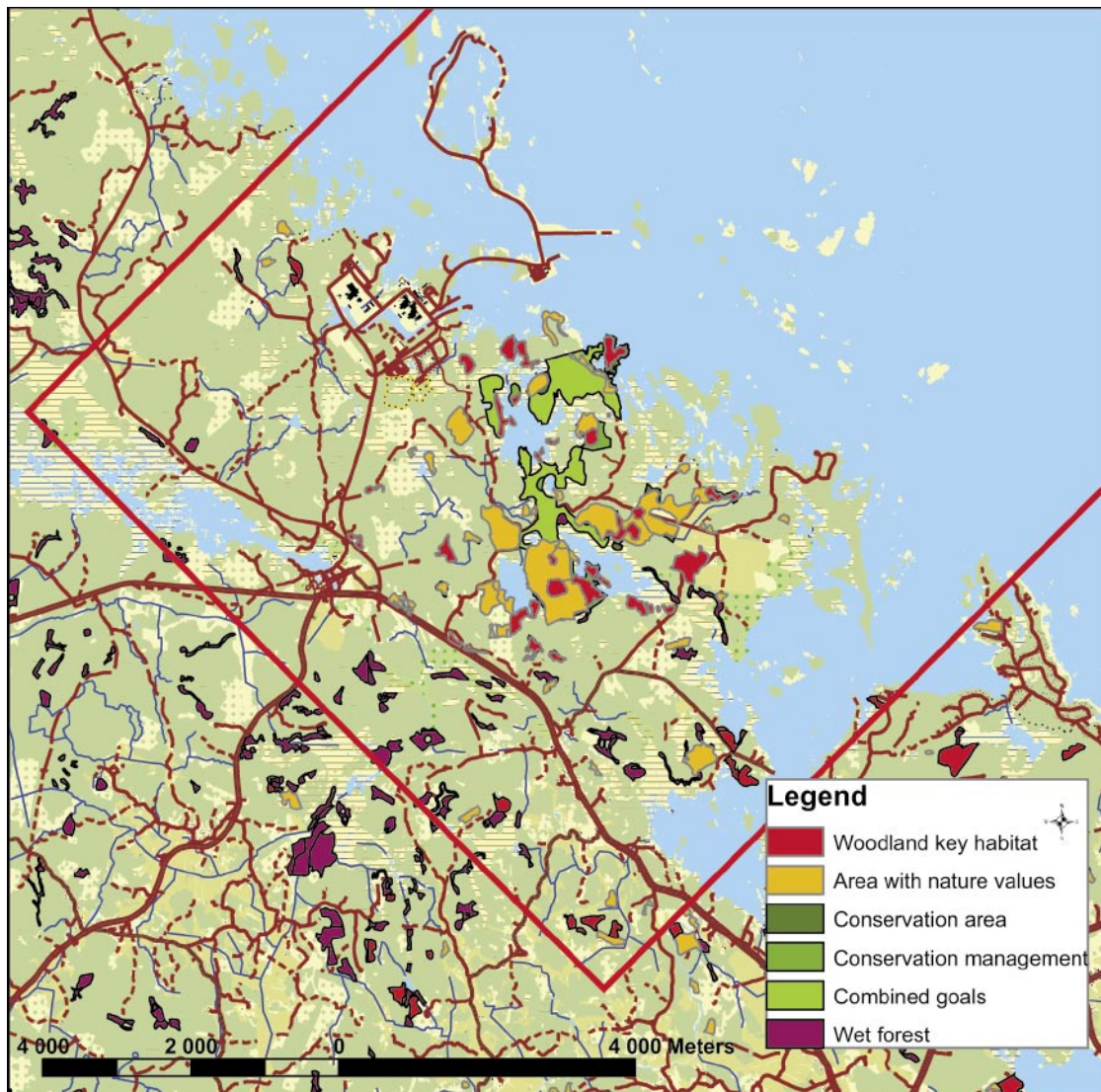


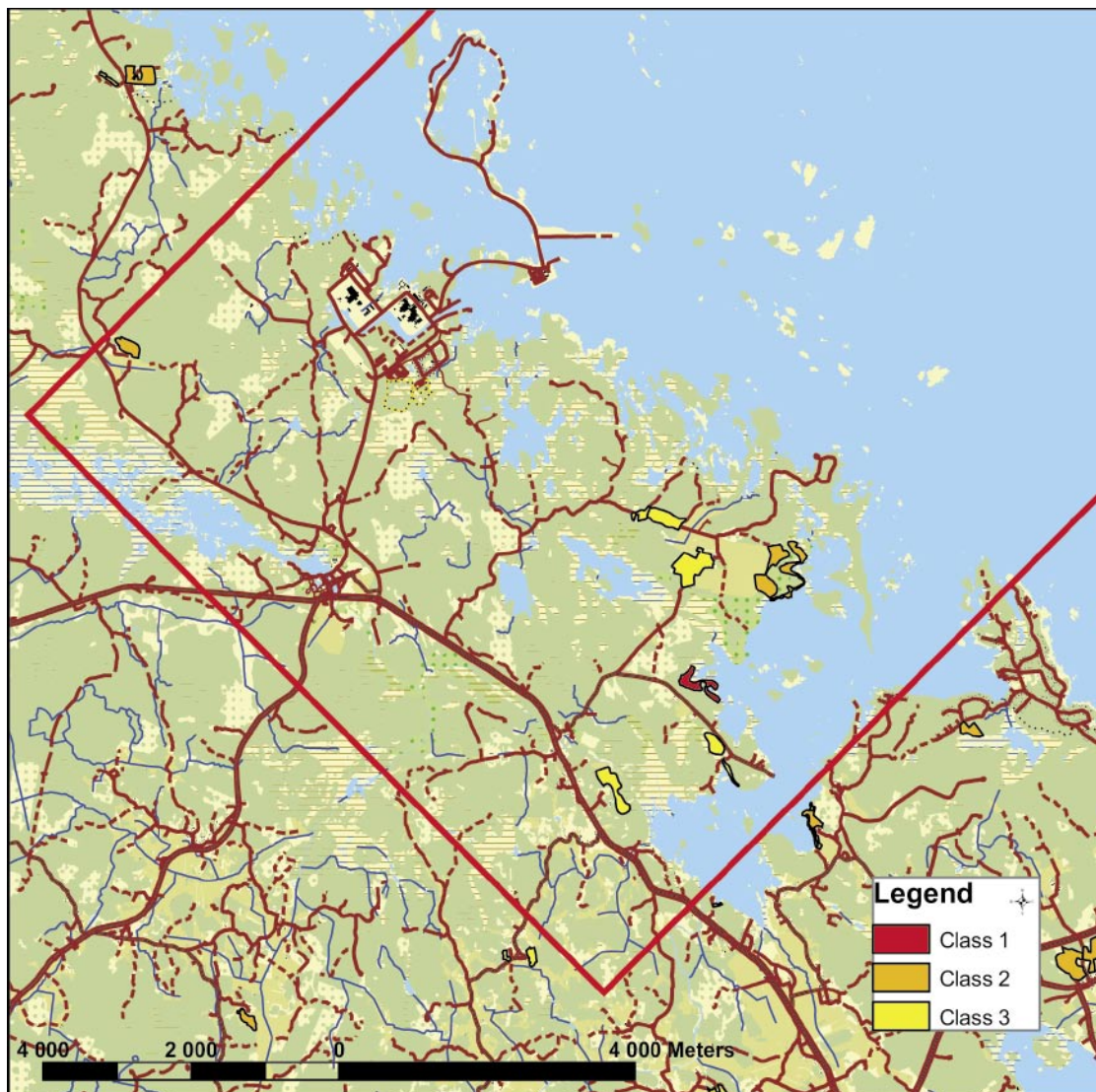
Figure 2-1. Valuable forest areas within the regional model area.

### 2.1.2 Open land habitats

The valuable open land areas within the regional model area have been identified by the national survey programme for ancient meadows and pastures. These areas are classified into three different value categories, 1–3, of which class 1 objects are of the highest value (högsta naturvärde) and class 3 objects are of high value (högt naturvärde). A total number of 10 objects have been found within the regional model area (see Figure 2-2), which can be compared with the 934 objects found within Uppsala county.

Table 2-2. Summarized information of ecologically valuable meadows and pastures within the regional model area of Forsmark.

Value	Characteristics	Surveyor	No. of objects	Area (km <sup>2</sup> )
Ancient meadows and pastures (Ängs- och hagmarker)	Class 1	Naturvårdsverket (Swedish EPA)	1	0.08
"	Class 2	"	3	0.25
"	Class 3	"	6	0.43



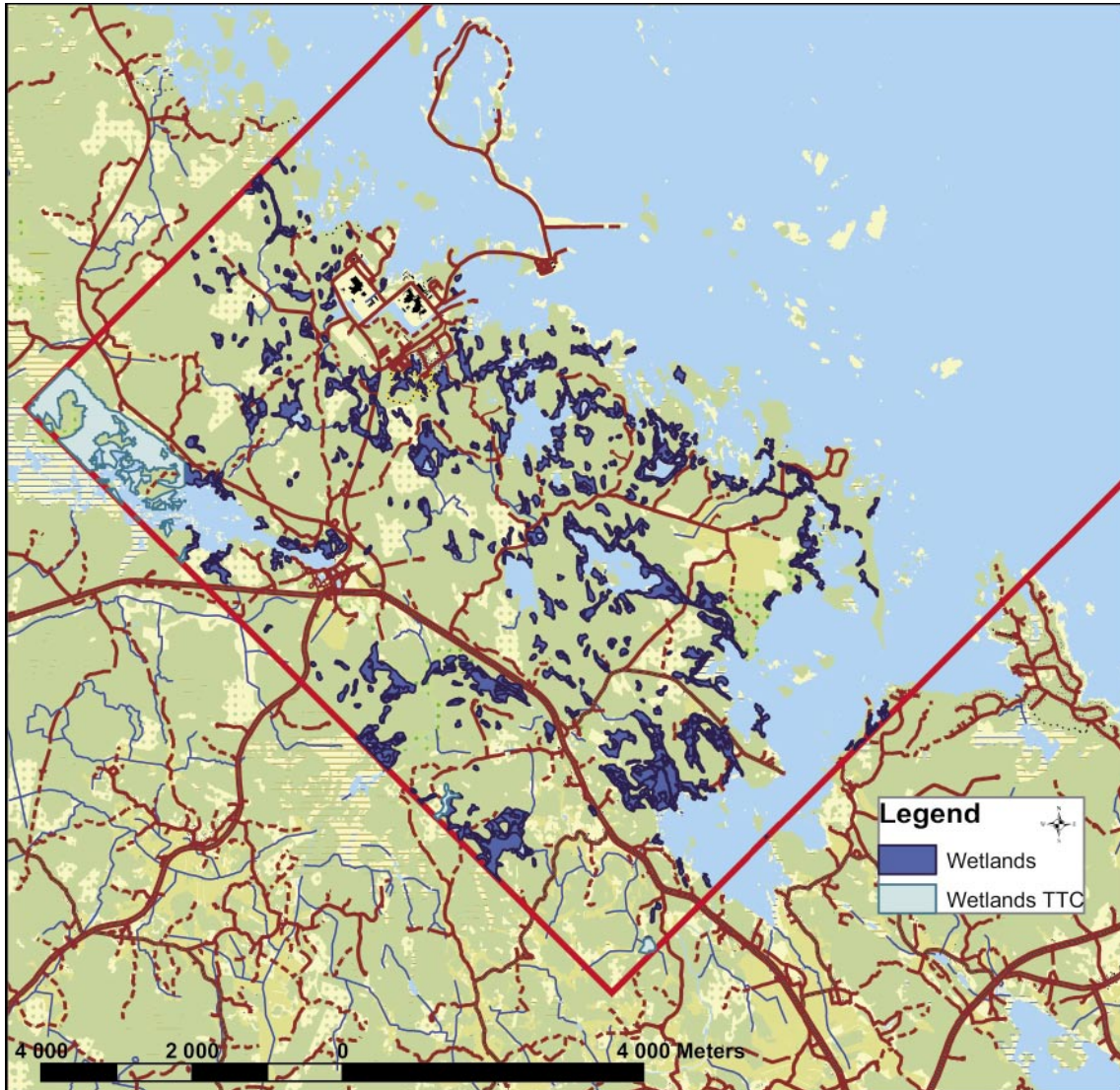
*Figure 2-2. Valuable open land areas within the regional model area.*

### 2.1.3 Wetland habitats

National surveys of valuable wetlands have been performed during the 1980's on initiative of Naturvårdsverket (the Swedish Environmental Protection Agency). No wetlands were recorded from the Forsmark regional model area during this study. However, since wetlands normally hold sensitive ecological features, SKB has acknowledged the need to document the wetlands existing in the area. These objects have been identified by using the vegetation map of the area /Boresjö Bronge and Wester, 2003/. Since this map does not cover the south-west and south corners of the model area, data from the Swedish Terrain Type Classification (TTC) have been used to fill out these spatial gaps. In Table 2-3 and Figure 2-3 below, the wetlands of the area are shown.

**Table 2-3. Summarized information of wetlands within the regional model area of Forsmark.**

Value	Origin	No. of objects	Area (km <sup>2</sup> )
Wetlands (Våtmark)	Derived from the vegetation map	1,146	6.16
Wetlands TTC (Våtmark TTC)	Derived from TTC	50	0.08



*Figure 2-3. Wetland areas within the regional model area.*

## 2.1.4 Redlisted species

The Swedish Species Information Centre (ArtDatabanken) works with knowledge about biodiversity in Sweden. The main tasks are to collect, evaluate and store the most important information about threatened and rare plant and animal species. The centre is responsible for a national register of observations of redlisted species (rödlistade arter). SKB has asked for and received withdrawals from that register for the Forsmark regional model area and its surroundings.

During the site investigations, SKB has recorded additional observations of redlisted and protected (fridlysta) species, cf. /Green, 2004a; Andrén, 2004a/. In Table 2-4 below, the information from the register withdrawal and SKBs surveys is summarised. For policy reasons, no map illustrating the sites of redlisted species observations will be presented here.

**Table 2-4. Summarized information of observations of redlisted or protected species within the regional model area of Forsmark.**

Value	No. of observations*	No. of species*
Redlisted vascular plants	15 + 1	9 + 1
Protected vascular plants	0 + 26	0 + 7
Redlisted lichen	0 + 0	0 + 0
Redlisted charophysee	0 + 0	0 + 0
Redlisted mosses	0 + 2	0 + 1
Redlisted invertebrates	1 + 0	1 + 0
Redlisted amphibians	0 + 3	0 + 2
Redlisted birds	0 + 603	0 + 47

\* The first digit gives the number of observations and species recorded in the register at Swedish Species Information Centre, whereas the second digit gives the number of observations and species recorded during SKB's own investigations.

## 2.1.5 Fauna

Two kinds of areas of importance exist here, legally protected areas and other areas identified as important for the bird populations. The latter have been defined during studies initiated by SKB, aiming at determining all areas of ecological importance within the Forsmark area /Spangenberg and Eriksson, 2000; Sevastik, unpublished/. For policy reasons, no map showing areas of importance for birds will be given here.

**Table 2-5. Summarized information of observations of valuable faunal areas.**

Value	Characteristics	Surveyor	No. of objects	Area (km <sup>2</sup> )
Faunal protection areas (Djurskyddsområden)	Bird sanctuaries, legally protected	County administrative board	2	2.25
Areas of avian importance (Fågelkomplettering)	Areas identified by /Sevastik, unpubl./	SKB	4	–
Denied access during migration period (Fågelskydd)	Areas with no access during July 15 to October 15	County administrative board	1	–
Most important avian areas (Ornitologiskt mest värdefulla områden)	Areas identified by /Spangenberg and Eriksson, 2000/	Hushållningssällskapet	10	–

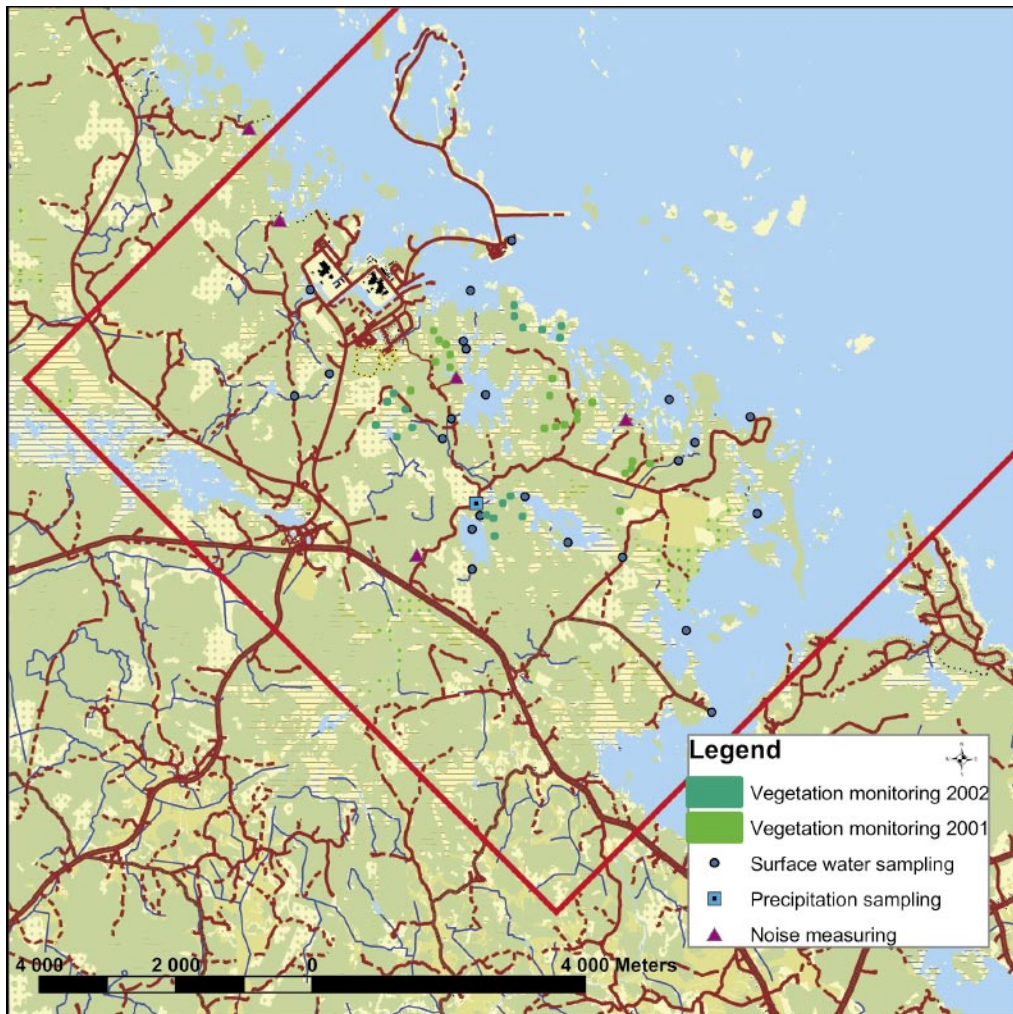
### 2.1.6 Monitoring activities

As part of the site investigations, SKB has initiated several monitoring schemes within the model areas. In the Forsmark area, the ongoing activities are focused on vegetation, hydrology/water quality and noise measurements at the drilling sites. Beside these, a number of surveys concerning mammals /Cederlund et al., 2003/, amphibians /Andrén, 2004a/, avian population /Green, 2004a/ etc. have been conducted. However, since the results sometimes are restricted due to policy reasons, these sampling sites are not shown here.

**Table 2-6. Summarized information of SKB's monitoring activities in Forsmark.**

Activity	No. of sites
Vegetation 2002 (Vegetationsprovytor 2002)	18
Vegetation 2001 (Vegetationsprovytor 2001)	20
Surface water sampling (Ytvattenprovtagning)	23*
Precipitation sampling (Vattenprovtagning nederbörd)	1
Noise measurement (Bullermätning)	5

\* Has been decreased to 11 sites.



*Figure 2-4. Monitoring activities within the area.*

## 2.1.7 Conservation areas

### Legally protected areas

Areas legally protected for nature conservation reasons exist in the model area. Two nature reserves are within the border of the regional model area, but only one of them, Kallrigafjärden, is directly adjacent to the most interesting area. There are plans, according to the county administrative board, to turn a part of the site survey area into a nature reserve. The exact delimitation of that area is not known.

Besides nature reserves, the regional model area also holds two faunal protection areas (see above) and two nature objects (naturminnen). The nature objects are both two very old pine trees, one of which is found on the island of Gräsö, outside and north-east of Figure 2-5 below.

**Table 2-7. Summarized information of the legally protected conservation areas.**

Value	Name/characteristics	No. of objects	Area (km <sup>2</sup> )
Nature reserve (Naturreservat)	Kallrigafjärden	1	11.46
	Skaten-Rångsen (part of)	1	0.78
Faunal protection area (Djurskyddsområde)	Länsman	1	0.40
	Öregrundsgrepen	1	1.85
Nature object (Naturminne)	Old pine tree south of Forsmark	1	–
	Old pine tree on the island of Gräsö	1	–



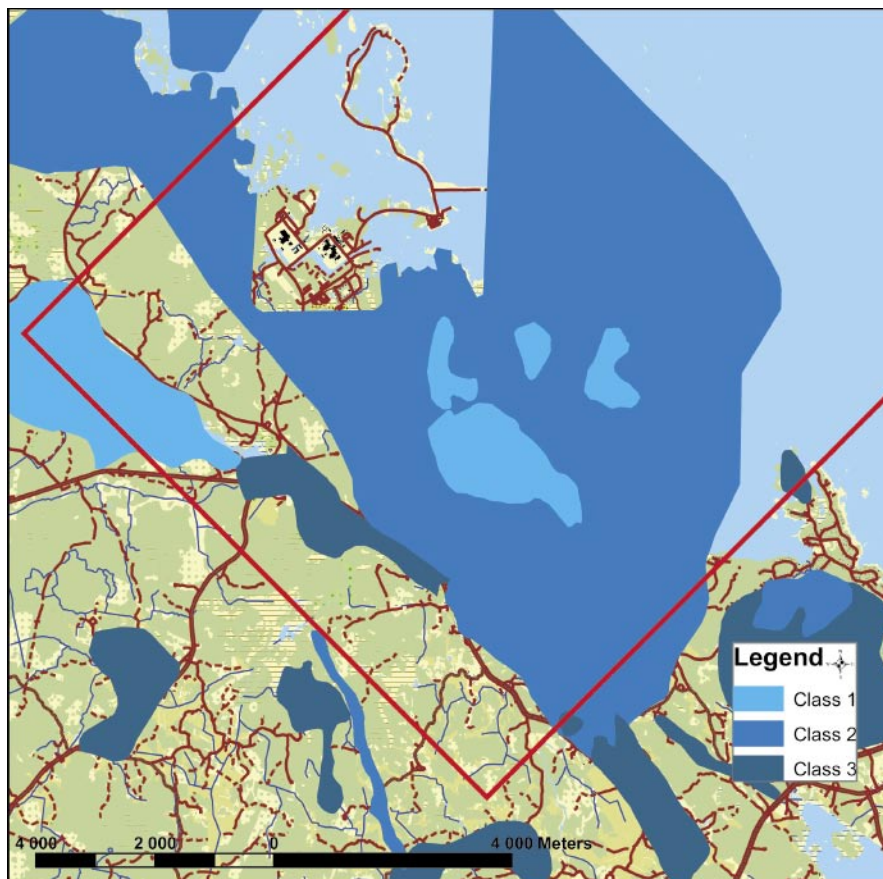
*Figure 2-5. The protected conservation areas within the area.*

### Conservation programme

Each county in Sweden has made surveys of ecologically valuable areas, used as a basis for the physical planning within the county. Areas with high conservation value are divided into three classes; 1–3, of which class 1 objects are of the highest value (högsta naturvärde) and class 3 objects are of high value (högt naturvärde). Within the Forsmark regional model area, a total number of twelve areas within the conservation programme of Uppsala county are found, out of which only three are completely within the area (see Table 2-8 and Figure 2-6 below).

**Table 2-8. Summarized information of the areas belonging to the county conservation programme.**

Value	Characteristics	Responsible	No. of objects	Area (km <sup>2</sup> )
Conservation programme (Naturvårdsprogram)	Class 1	County administrative board	5	8.60
"	Class 2	"	3	53.55
"	Class 3	"	4	3.37



**Figure 2-6.** Areas of the county administrative board's conservation programme within the area.

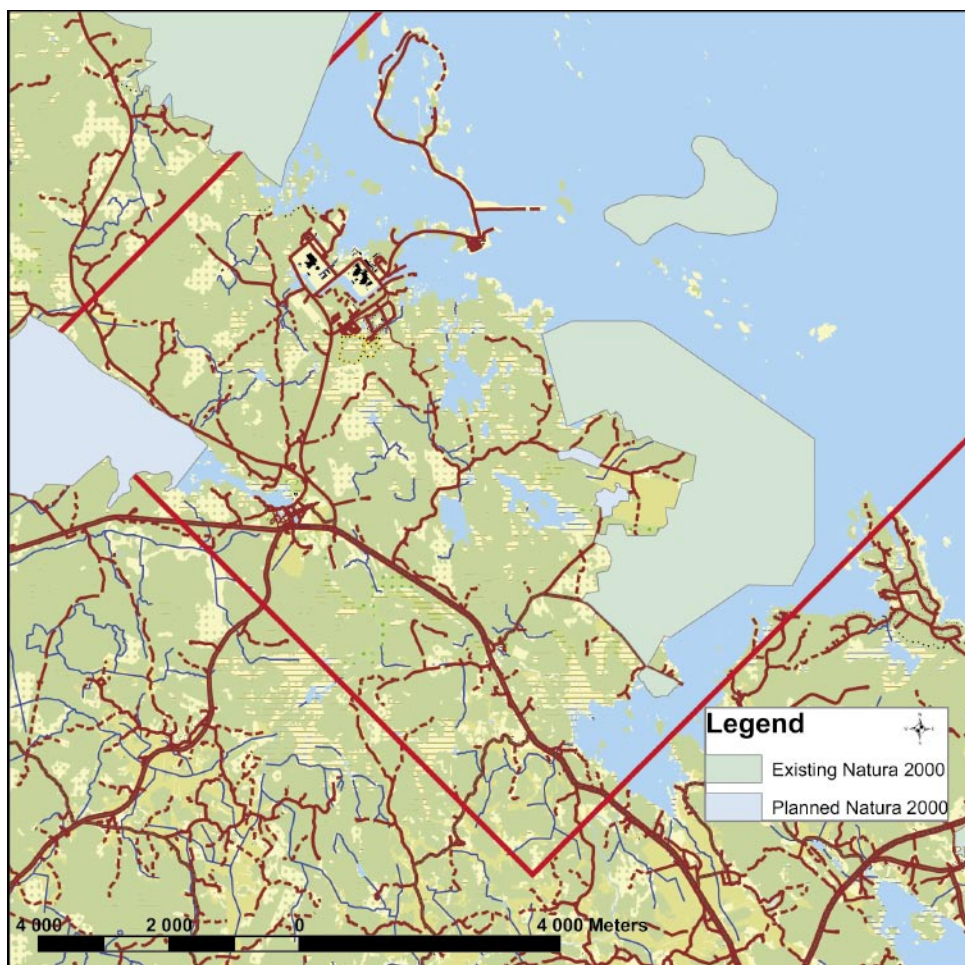


## Natura 2000

Supported by the Habitat and Bird directives of the EEC, a number of areas have been identified as particularly important to preserve. These areas are part of a network of areas throughout Europe, known as Natura 2000. Three existing Natura 2000 areas are completely or partially within the Forsmark regional model area. Two of these are the nature reserves and the third is one of the bird sanctuaries already mentioned (see Table 2-9 and Figure 2-7 below). New features in the map are Bruksdammen and Storskäret, and these two are yet to be legally protected.

**Table 2-9. Summarized information of the Natura 2000 sites within the regional model area.**

Value	Namn	Protection	EEC directive	Area (km <sup>2</sup> )
Natura 2000 area	Kallrigafjärden	Nature reserve	Habitat	11.64
"	Skaten-Rångsen	"	Habitat	0.74
"	Forsmarksbruk	Bird sanctuary	Bird	2.06
"	Bruksdammen	Forthcoming nature reserve	Habitat	5.97
"	Storskäret	Forthcoming nature reserve	Habitat	0.26



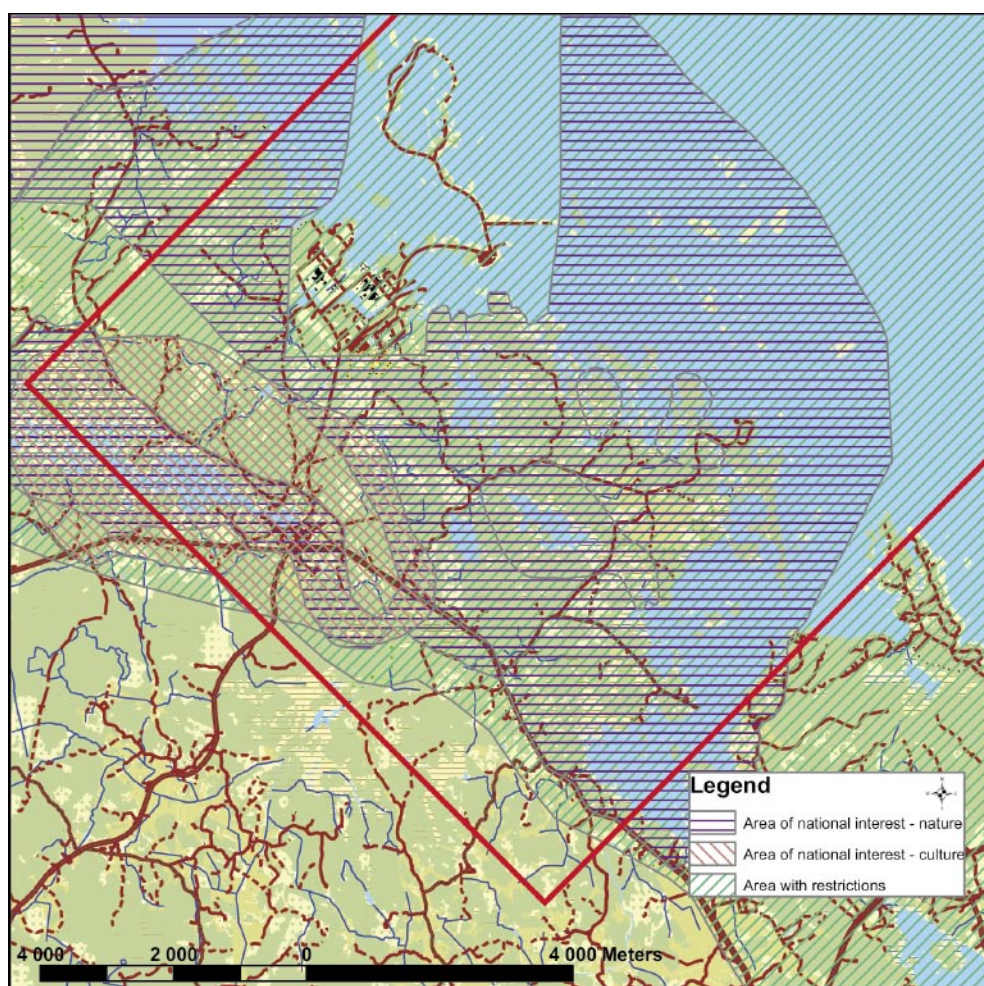
**Figure 2-7. The Natura 2000 sites within the area.**

### Areas of national interest

An area of national interest (riksintresse) is considered valuable to protect in a national perspective, but it does not mean that it by default is protected by law. The basis for achieving this status can be that the area is important for either culture, nature or outdoor life of Sweden. In the Forsmark area, seven areas of national interest are partially or completely within the regional model area (see Table 2-10 and Figure 2-8 below).

**Table 2-10. Summarized information of the areas of national interest.**

Value	Name	No. of objects	Area (km <sup>2</sup> )
Area of national interest – nature (Riksintresse natur)	–	6	77.12
Area of national interest – culture (Riksintresse kultur)	Forsmarks bruk	1	19.33
Area with restrictions against disturbing activities (Särskilda bestämmelser enligt 4 kap MB)	Östhammar	1	160.03



*Figure 2-8. Areas of national interests within the area.*

## 2.2 Simpevarp regional model area

The Simpevarp region is situated in a fissure valley landscape, which changes into an archipelago closer to the Baltic Sea. It is characterised by a relatively low topographical relief. The area rests on a bedrock dominated by Småland “granite”, with a high degree of exposed rock /Gustafson and Eriksson Nilsson, 1995; Hammarström and Olsson, 1996/.

The vegetation is very much influenced by the bedrock, quaternary deposits and human land management. Bedrock does mainly consist of granites. The quaternary deposits are mainly till while silt and clay have been deposited in the valleys. This pattern is clearly manifested in the vegetation where pine forests dominate on the till, and all the arable land and pastures (abandoned arable land) are found in the valleys. Human management has been restricted to agriculture activities in the valleys while forestry has been the dominating activity elsewhere.

The forests are dominated by dry pine forests situated on bedrock or nutrient poor thin soils with shrubs, mostly *Calluna vulgaris*, and grasses, such as *Deschampsia flexuosa*, *Agrostis vinealis* and *Festuca ovina*, and with lichens and mosses dominating in the ground layer. When these pine forests get moister *Vaccinium vitis-ideae* and *Vaccinium myrtillus* gets more common in the field layer. The spruce becomes abundant where a deeper soil cover is found, however the deciduous tree species are an important constituent near the coast, i.e. mainly *Quercus robur* but also *Corylus avellana*, *Sorbus acuparia*, *S. intermedia* and *Acer platanoides*, making the mixed forest the second most common forest type. *Q. robur* is often the dominant tree species when more or less pure deciduous forests are found. The character of these forests is a function of boulder frequency, nutrient availability and earlier history of management at the specific spot.

Arable land, pastures and clear cuts dominate the open land. Arable land and pastures are found in the valleys close to settlements. The pastures were earlier intensively used but are today a part of the abandoned farmland following the nation wide general regression of agriculture activities.

The dominating wetland type is the poor mire that is accumulating peat /Rühling, 1997; SNV, 1984/. A special type of semi wetland is found in the pine-dominated bedrocks where water filled depressions (“hällkar” in Swedish) are formed. These get all their water from precipitation and have therefore a sphagnum-dominated community, much bog like, with *Ledum palustre* and *Pinus silvestris*, with a peat layer accumulating on the bedrock. These may vary a lot in size and may in some cases be large.

As a consequence of the forestry activities in the area there are a lot of clear-cuts to be found in different successional stages. *Betula pendula* is the dominating species in many of the earlier successional stages until it is replaced by young *Picea abies* or *Pinus silvestris* depending on soil type and/or management.

About 7,100 ha of the area in the Oskarshamn municipality is cultivated land and c. 2,400 ha is pastures and meadows /Birgersson et al., 1998/. The amount of arable land has decreased over the years.

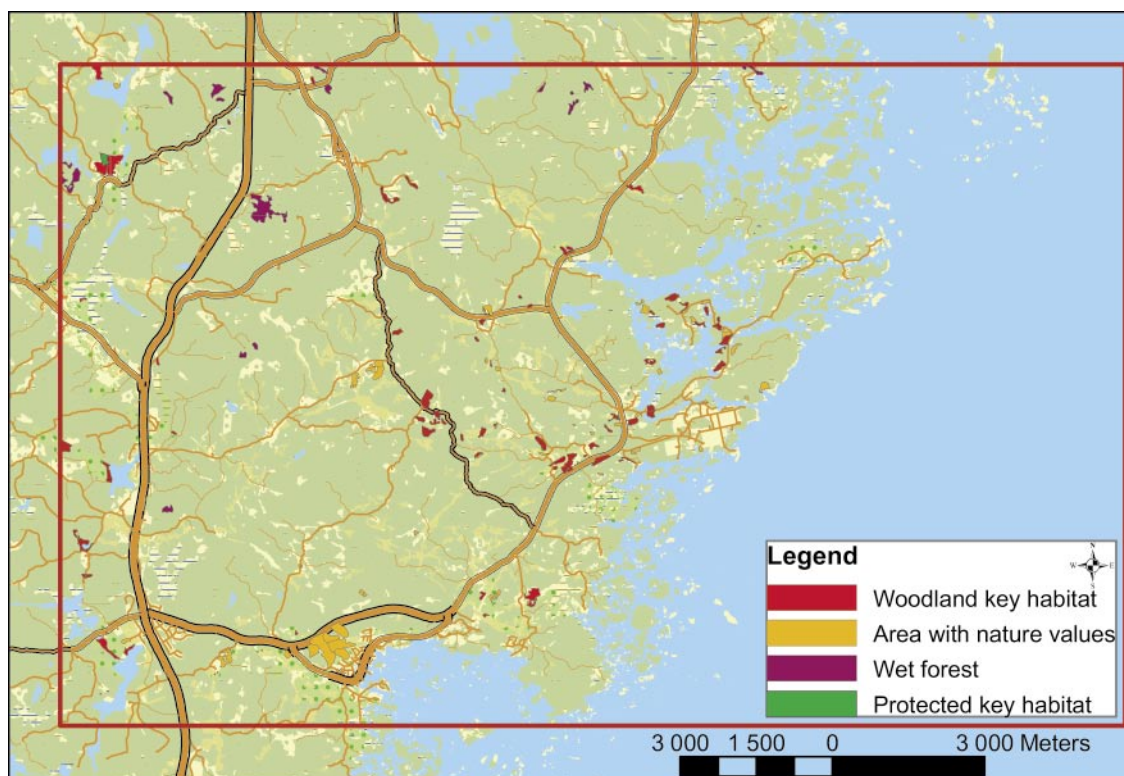
## 2.2.1 Forest habitats

The valuable forest habitats of the area mainly consist of woodland key habitats (nyckelbiotoper) and areas with nature values (naturvärden). National inventories have been performed by the National Board of Forestry on privately owned land. Additional key habitat surveys have been performed within the central part of the area on request by SKB. The number and total area of woodland key habitats and areas with nature values then increased by approximately 50%. The main corporate land owner in the area, AssiDomän, has also identified and reported the woodland key habitats and areas with nature values in their forests. Besides these, the area also holds some wet forests and one protected key habitat (see Table 2-11 and Figure 2-9 below).

**Table 2-11. Summarized information of ecologically valuable forest areas within the regional model area of Simpevarp.**

Value	Characteristics	Surveyor	No. of objects	Area (km <sup>2</sup> )
Woodland key habitat* (Nyckelbiotop)	Red listed species are likely to be present	National Board of Forestry	88	1.37
Area with nature values* (Naturvärde)	High potential for red listed species	National Board of Forestry	45	0.55
Woodland key habitat (Nyckelbiotop)	Red listed species are likely to be present	AssiDomän	9	0.18
Area with nature values (Naturvärde)	High potential for red listed species	AssiDomän	11	0.08
Wet forest (Sumpskogar)	Moist, dense forests with high conservation value	National Board of Forestry	21	0.47
Protected key habitat (Biotopnaturvårdsavtal)	Red listed species are likely to be present	National Board of Forestry	1	0.03

\* Additional key habitat surveys have been performed on initiative from SKB.



**Figure 2-9.** Valuable forest areas within the regional model area.

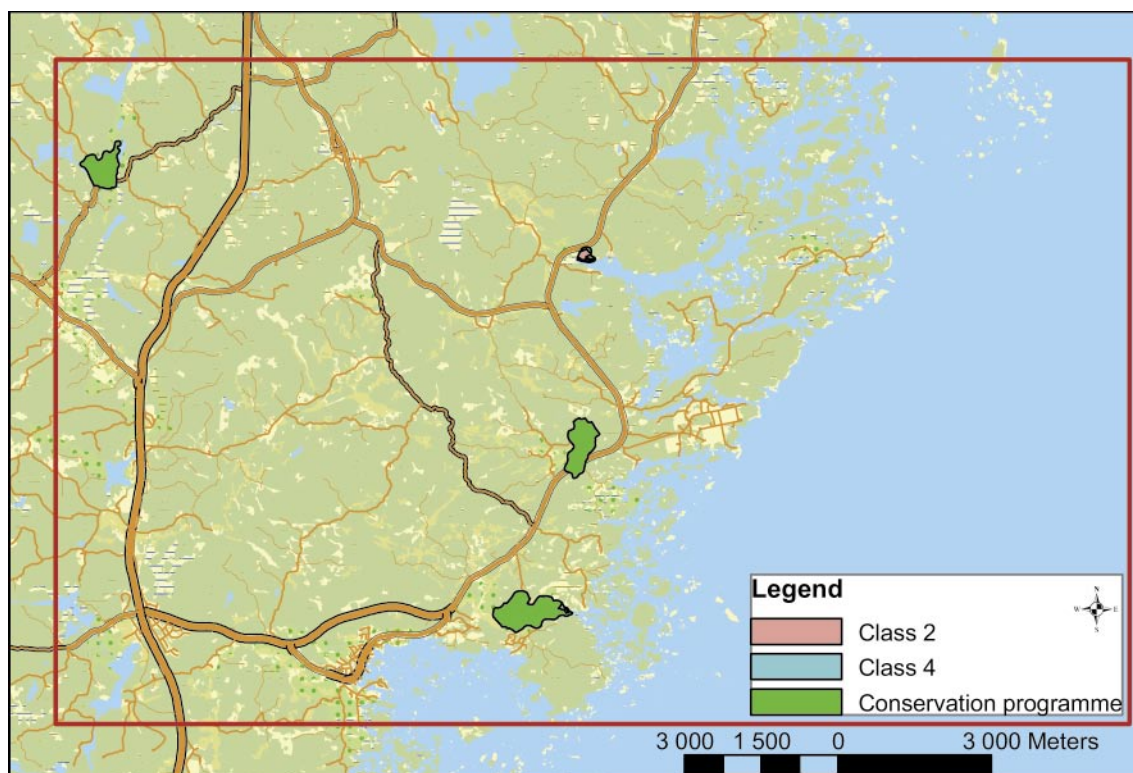
## 2.2.2 Open land habitats

The valuable open land areas within the regional model area have been identified by the national survey programme for ancient meadows and pastures. These areas are classified into three different value categories, class 2, class 4 and conservation programme.

Class 2 objects are of the highest value (högsta naturvärde) and conservation programme are of high value (högt naturvärde). A total number of 2 objects have been found within the regional model area (see Figure 2-10), which can be compared with the 1,686 objects found within Kalmar county. Beside these areas, 4 areas within the cultural conservation programme of the county administrative board are situated in the area.

**Table 2-12. Summarized information of ecologically valuable open land areas within the regional model area of Simpevarp.**

Value	Characteristics	Surveyor	No. of objects	Area (km <sup>2</sup> )
Ancient meadows and pastures (Ångs- och hagmarker)	Class 2	Naturvårdsverket (Swedish EPA)	1	0.04
"	Class 4	Naturvårdsverket (Swedish EPA)	1	0.01
Conservation programme (Bevarandeprogram)	–	County Board	4	1.61



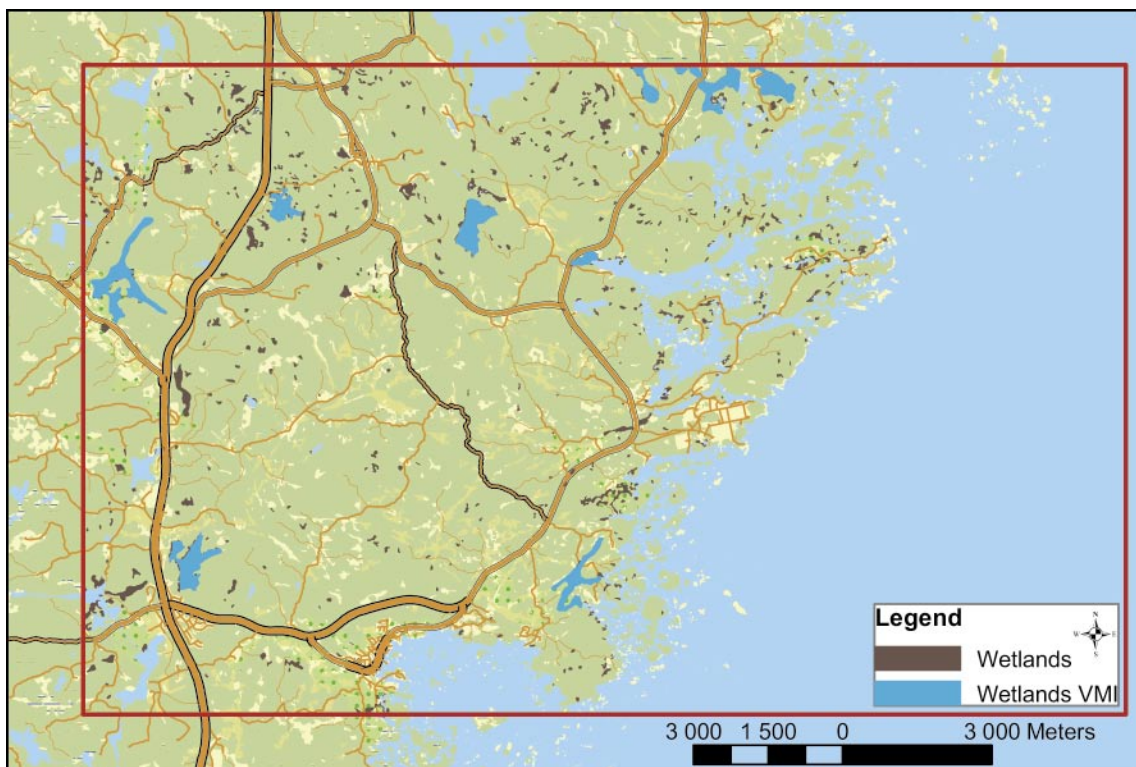
**Figure 2-10.** Valuable open land areas within the regional model area.

### 2.2.3 Wetland habitats

National surveys of valuable wetlands have been performed during the 1980's on initiative of Naturvårdsverket. Ten wetland areas were recorded from the Simpevarp regional model area in this study. Besides these, since wetlands normally hold sensitive ecological features, SKB has documented the other wetlands situated in the area. These objects have been identified by using the vegetation map of the area /Boresjö Bronge and Wester, 2003/. In Table 2-13 and Figure 2-11 below, the wetlands of the area are shown.

**Table 2-13. Summarized information of wetlands within the regional model area of Forsmark.**

Value	Characteristics	Responsible	No. of objects	Area (km <sup>2</sup> )
Wetlands (VMI)	Class 2	EPA	4	1.69
"	Class 3	EPA	4	1.75
"	Class 4	EPA	2	0.60
Wetlands (Våtmarker)	Derived from the vegetation map		1,007	4.97



*Figure 2-11. Wetland areas within the regional model area.*

## 2.2.4 Redlisted species

The Swedish Species Information Centre (ArtDatabanken) works with knowledge about biodiversity in Sweden. The main tasks are to collect, evaluate and store the most important information about threatened and rare plant and animal species. The centre is responsible for a national register of observations of redlisted species. SKB has asked for and received withdrawals from that register for the Simpevarp regional model area and its surroundings.

During the site investigations, SKB has recorded additional observations of redlisted species cf. /Green, 2004b; Andrén, 2004b/. In Table 2-14 below, the information from the register withdrawal and SKBs surveys is summarised. For policy reasons, no map illustrating the sites of redlisted species observations will be presented here.

**Table 2-14. Summarized information of observations of redlisted species within the regional model area of Simpevarp.**

Value	No. of observations*	No. of species*
Redlisted vascular plants	146 + 0	21 + 0
Redlisted lichen	17 + 0	4 + 0
Redlisted fungi	10 + 0	8 + 0
Redlisted mosses	5 + 0	3 + 0
Redlisted invertebrates	4 + 0	4 + 0
Redlisted amphibians	0 + 3	0 + 2
Redlisted birds	–	0 + 29

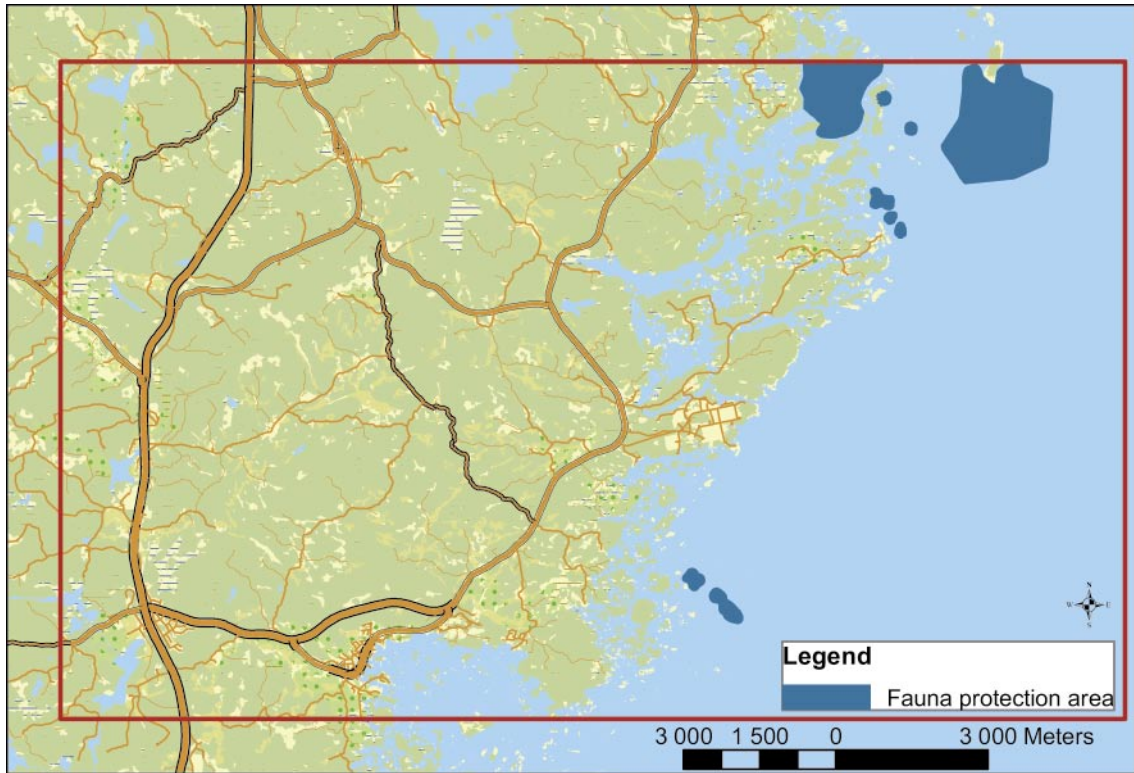
\* The first digit gives the number of observations and species recorded in the register at Swedish Species Information Centre, whereas the second digit gives the number of observations and species recorded during SKB's own investigations.

## 2.2.5 Fauna

The sites of faunal interest in the area are exclusively based on avian values. Ten bird sanctuaries are found within the border of the regional model area, all situated off-coast in the archipelago (see Table 2-15 and Figure 2-12 below).

**Table 2-15. Summarized information of faunal protection areas within the regional model area of Simpevarp.**

Value	Characteristics	Responsible	No. of objects	Area (km <sup>2</sup> )
Faunal protection areas (Djurskyddsområde)	Bird sanctuaries, legally protected	County administrative board	10	7.42



*Figure 2-12. Fauna protection areas within the regional model area.*

## 2.2.6 Monitoring activities

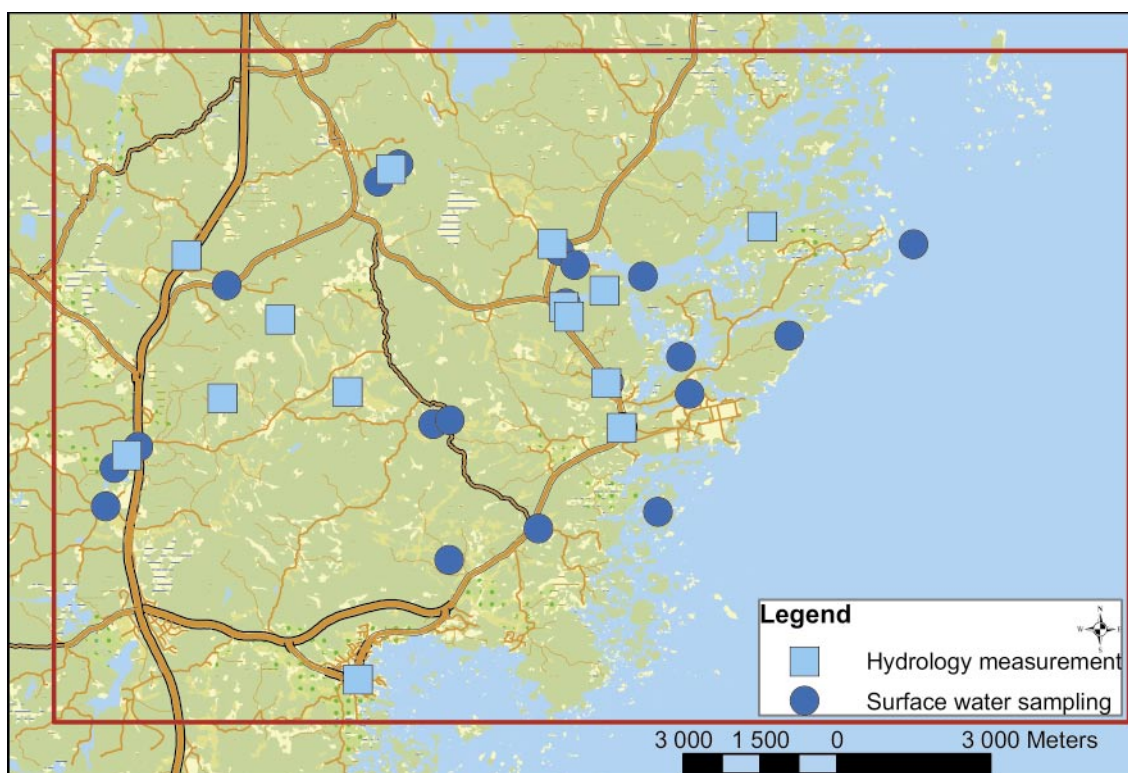
As part of the site investigations, SKB has initiated several monitoring schemes within the model areas. In the Simpevarp area, the ongoing activities are focused on hydrology measurements and surface water quality sampling (see Table 2-16 and Figure 2-13 below). Besides these, a number of surveys concerning mammals, amphibians /Andrén, 2004b/ and avian population /Green, 2004b/ etc. have been conducted. However, since the results sometimes are restricted due to policy reasons, these sampling sites are not shown here.

**Table 2-16. Summarized information of SKBs monitoring activities.**

Activity	Characteristics	No. of objects
Surface water sampling (Ytprovtagning)	4 sites at sea, 3 at lakes, 14 at streams	21
Hydrology measurement stations (Hydrologiska stationer)	2 sites at sea, 4 at lakes, 8 at streams	14
Vegetation 2001	(Vegetation sampling sites 2001)	5*
Vegetation 2002	(Vegetation sampling sites 2002)	15*
Vegetation 2003	(Vegetation sampling sites 2003)	5*

\* Marked numbers are not shown in Figure 2-13.





**Figure 2-13.** Monitoring activities within the area. Marked numbers (\*) from table 2-16 are not shown in the figure.

## 2.2.7 Conservation areas

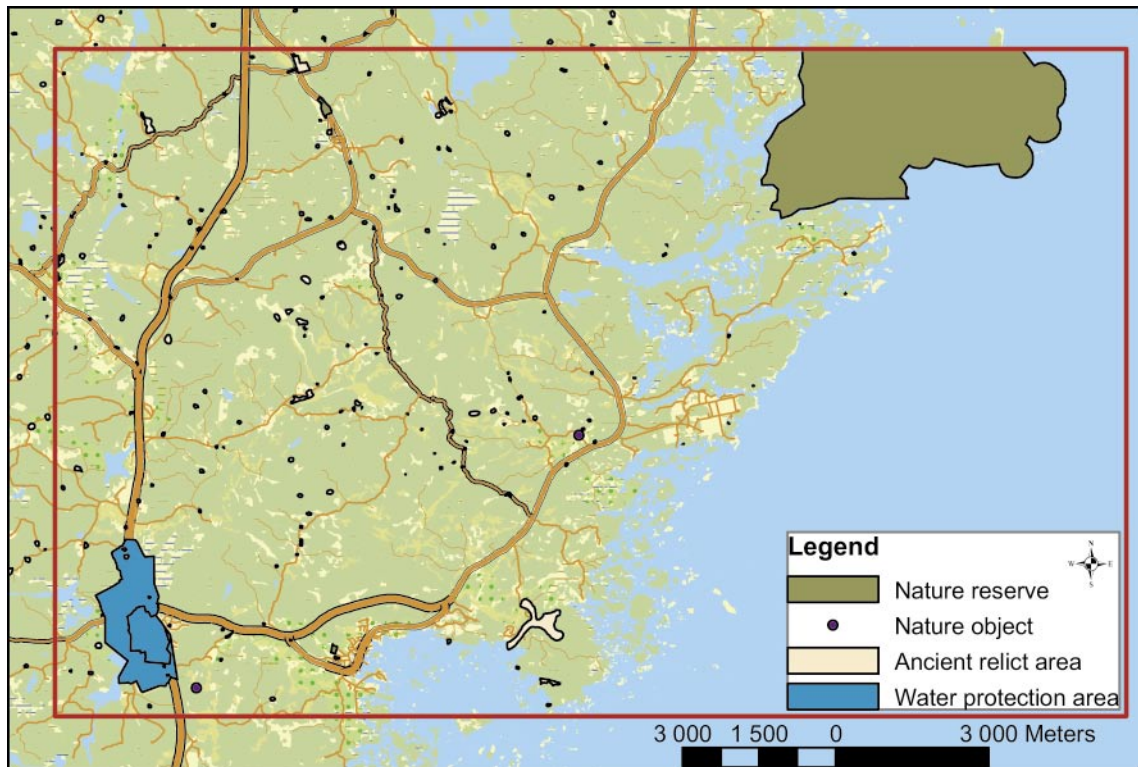
### **Legally protected areas**

Areas legally protected for nature conservation reasons exist in the area. Three nature reserves are within the border of the regional model area, but two of them are very small. One is large, Misterhults skärgård, and is the northern part of the archipelago.

Besides nature reserves, the regional model area also holds two fresh water protection areas (vattenskyddsområden) and two nature objects (naturminnen). A large number of areas with ancient cultural relicts are also within the area.

**Table 2-17. Summarized information of the legally protected conservation areas.**

Value	Name	Characteristics	No. of objects	Area (km <sup>2</sup> )
Nature reserve (Naturreservat)	Stenhagen	Area with hardwood forest (ädellövskog)	1	0.01
"	Talldungen	Boulder ridge with old pine forest	1	0.05
"	Misterhults skärgård	Archipelago with interesting cultural history and fauna	1	85.00
Nature object (Naturminne)	–	Single object or very small areas, protected by law	2	–
Ancient relict area (Fornlämningsområde)	–	Areas with ancient cultural remains	294	1.73
Water protection area (Vattenskyddsområde)	–	Fresh water reserves	2	2.69



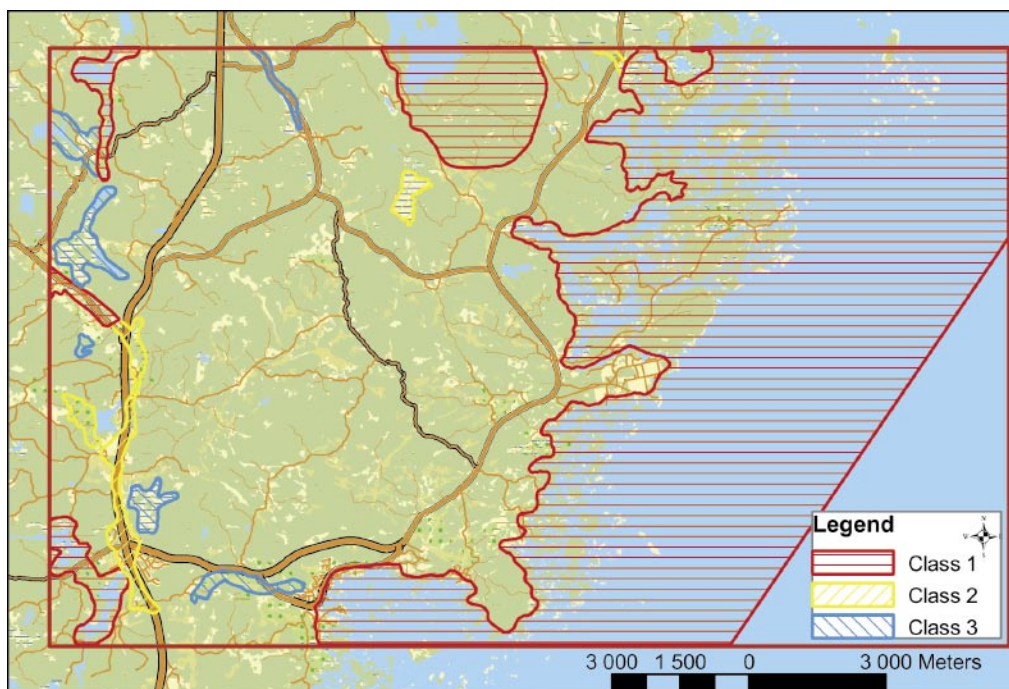
*Figure 2-14. The protected conservation areas within the area.*

### **Conservation programme**

Each county in Sweden has made surveys of ecologically valuable areas, used as a basis for the physical planning within the county. Areas with high conservation value are divided into three classes; 1–3, of which class 1 object are of the highest value (högsta naturvärde) and class 3 objects are of high value (högt naturvärde). Within the Simpevarp regional model area, a total number of 15 areas within the conservation programme of Kalmar county are found (see Table 2-18 and Figure 2-15 below).

**Table 2-18. Summarized information of the areas belonging to the county conservation programme.**

Value	Characteristics	Responsible	No. of objects	Area (km <sup>2</sup> )
Conservation programme (Naturvårdsprogram)	Class 1	County administrative board	5	412.87
"	Class 2	"	4	3.51
"	Class 3	"	6	11.02



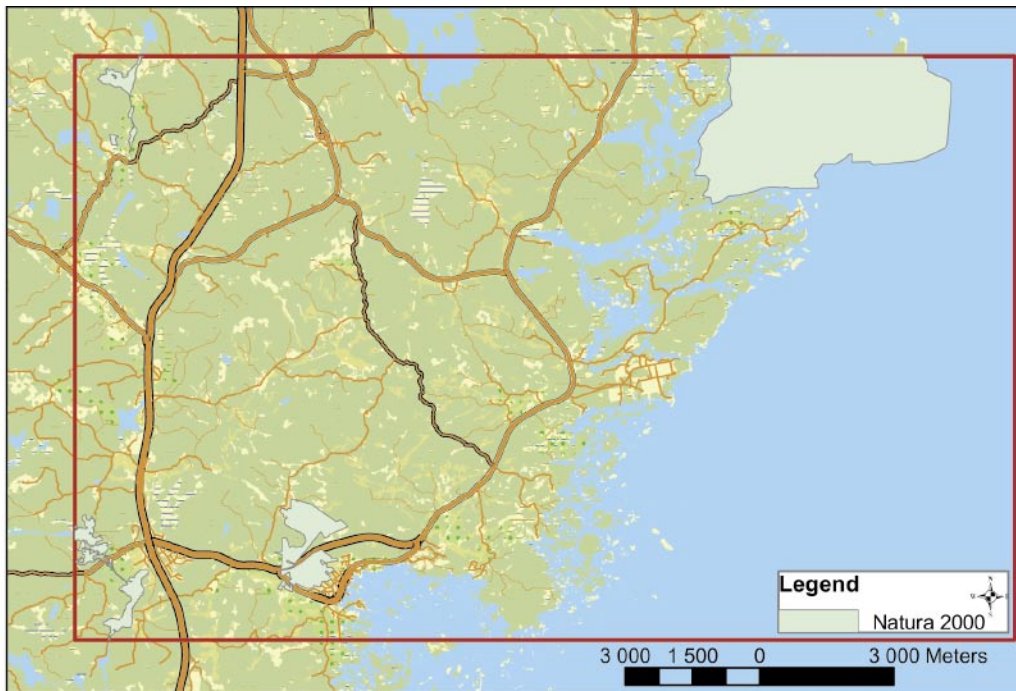
**Figure 2-15.** Areas of the county administrative board's conservation programme within the area.

### **Natura 2000**

Supported by the Habitat- and Birddirectives of the EEC, a number of areas have been identified as particularly important to preserve. These areas are part of a network of areas throughout Europe, known as Natura 2000. Five Natura 2000 areas are completely or partially within the Simpevarp regional model area. One of these is the nature reserve Misterhults skärgård and two are sections of the streams Virån and Marströmmen (see Table 2-19 and Figure 2-16 below).

**Table 2-19. Summarized information of the Natura 2000 sites within the regional model area.**

<b>Value</b>	<b>Name</b>	<b>Directive</b>	<b>Area (km<sup>2</sup>)</b>
Natura 2000 area	Viråns vattensystem	Habitat	0.82
"	Ölvedals biotopskyddsområde	Habitat	0.03
"	Stora Ramm och Marströmmen	Habitat	0.34
"	Misterhult	Bird	13.54
"	Figeholm	Habitat	1.56



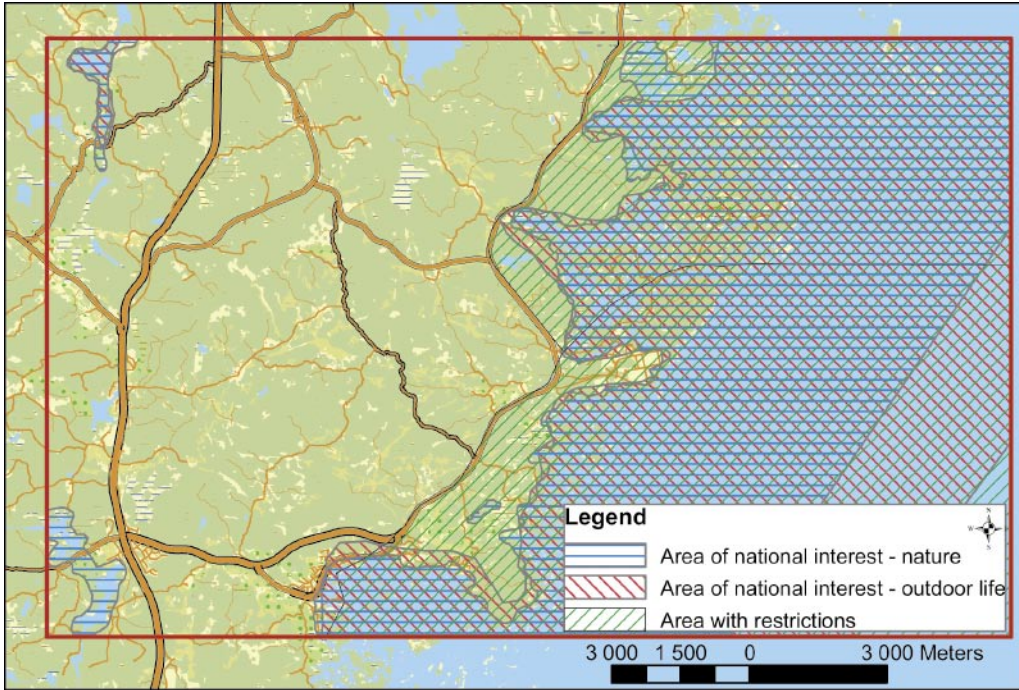
*Figure 2-16. The Natura 2000 sites within the area.*

### **Areas of national interest**

An area of national interest (riksintresse) is considered valuable to protect in a national perspective, but it does not mean that it by default is protected by law. The basis for achieving this status can be that the area is important for the culture, nature or outdoor life of Sweden. In the Simpevarp area, six areas of national interest are partially or completely within the regional model area (see Table 2-20 and Figure 2-17 below).

**Table 2-20. Summarized information of the areas of national interest.**

Value	No. of objects	Area (km <sup>2</sup> )
Area of national interest – outdoor life (Riksintresse friluftsliv)	2	1,567.68
Area of national interest – nature (Riksintresse naturvård)	4	1,218.64
Area with restrictions against disturbing activities (Särskilda bestämmelser enligt 4 kap MB)	2	2,077.68



*Figure 2-17. Areas of national interests within the area.*

### 3 Accessibility maps

An accessibility map is a compilation of all spatially defined areas and features relevant for an areas conservation value. Some of the areas are needed as input because they are protected by laws or regulations (e.g. nature reserves), other are there because SKB and/or the society find them important to preserve for aesthetical, social, ecological, historical or even economical reasons (e.g. red listed species, private wells, gravel occurrences etc.). Below, these types of areas are defined as either legally protected areas or areas protected for policy reasons.

Some of the areas are used in the map with their original spatial delimitations, since it will be sufficient to preserve their values. Other areas, however, have been buffered with a defined distance, because a buffer zone has been regarded necessary in order to leave the value, or an important process, undisturbed. Information of what features have been buffered and by how much, is given below.

The overall procedure for producing accessibility maps can be summarised in three different steps:

1. Selection of input data
2. Processing
3. Result

In chapter 3.1 and 3.2 below, the procedure for the accessibility maps of Forsmark and Simpevarp, respectively, is described with regards to what input data was used, and how that data was handled. In chapter 3.3, the handling guideline for how to use and update the maps is briefly described.

#### 3.1 Forsmark regional model area

##### 3.1.1 Selection of input data

The input to the map is a variety of spatially defined areas, such as legally protected areas, ecologically sensitive areas, buffered watercourses and buildings, cultural amenities etc. but also locations for SKB's monitoring activities that also need to be undisturbed.

##### ***Legally protected areas***

In Table 3-1 below, the legally protected areas used as input to the accessibility map of Forsmark are given.

**Table 3-1. Legally protected areas in Forsmark regional model area.**

<b>Value</b>	<b>No. of objects</b>
Nature reserves	2
Nature objects	2
Fauna protection area	2
Areas with restrictions (4 kap MB)	1
Sea and lake shores	Yes

### ***Areas protected for policy reasons***

In Table 3-2 below, the areas protected for policy reasons used as input to the accessibility map of Forsmark are given.

**Table 3-2. Policy areas in Forsmark regional model area.**

<b>Value</b>	<b>No. of objects</b>
Conservation programme areas	12
Areas of national interest	7
Red listed species	651
Natura 2000 sites	5
Wet forests	55
Woodland key habitats and areas with nature values	84
Ancient meadows and pastures	10
Residential properties (buildings and wells)	Yes
SKB's own sampling sites	Yes
Primeval forests	4
Natural gravel occurrences	Yes

### 3.1.2 Processing

As mentioned above, some features need to be buffered in order to secure their values, whereas others can be used with their original delimitations. In Table 3-3 below, the different features used in the map and the way they were processed are presented.

**Table 3-3. Initial processing of input data.**

Area of interest	Value	Characteristics	Delimitation
Nature values	Nature reserves	Legally protected	Polygon boundary
	Woodland key habitats	Ecologically sensitive	Polygon boundary
	Red listed species	Ecologically sensitive/ Legally protected	Occurrence buffered 100 m
	Watercourses	Ecologically sensitive	Buffered 50 m
	Lakes	Ecologically sensitive	Shoreline buffered 100 m
	Sea shoreline	Ecologically sensitive/ Legally protected	Shoreline buffered 300 m
	Wetlands	Ecologically sensitive	Polygon boundary
	Sensitive bird habitats	Ecologically sensitive	Polygon boundary
	Marsh forests	Ecologically sensitive	Polygon boundary
	Primeval forests	Ecologically sensitive/ Legally protected	Polygon boundary
	Natura 2000 areas	Ecologically sensitive/ Legally protected	Polygon boundary
	Wildlife reserves	Ecologically sensitive/ Legally protected	Polygon boundary
	Bird sanctuaries	Ecologically sensitive/ Legally protected	Polygon boundary
	Ancient meadows and pastures	Ecologically sensitive	Polygon boundary
Cultural values	Ancient monuments	Legally protected	Polygon boundary
Socio-economic values	Residential properties	Legally protected/ policy reasons	Buildings buffered 100 m
	Wells		Buffered 100 m
	Gravel assets		Polygon boundary
Monitoring sites	Precipitation monitoring		Polygon boundary
	Vegetation monitoring		Polygon boundary
	Surface water monitoring		Polygon boundary

### 3.1.3 Results

One way to display the results of the procedure described above, is to create a map containing the different sensitive objects. For policy reasons, such a map will not be shown here.



## 3.2 Simpevarp regional model area

### 3.2.1 Selection of input data

The input to the map is a variety of spatially defined areas, such as legally protected areas, ecologically sensitive areas, buffered watercourses and buildings, cultural amenities etc. but also locations for SKB's monitoring activities that also need to be left undisturbed.

#### ***Legally protected areas***

In Table 3-4 below, the legally protected areas used as input to the accessibility map of Simpevarp are given.

**Table 3-4. Legally protected areas in Simpevarp regional model area.**

<b>Value</b>	<b>No. of objects</b>
Nature reserves	3
Nature objects	2
Bird sanctuaries	10
Areas with restrictions (4 kap MB)	2
Sea and lake shores	Yes
Water protection areas	2
Ancient relicts areas	294
Protected key habitats	1

#### ***Areas protected for policy reasons***

In Table 3-5 below, the areas protected for policy reasons used as input to the accessibility map of Simpevarp are given.

**Table 3-5. Policy areas in Simpevarp regional model area.**

<b>Value</b>	<b>No. of objects</b>
Conservation programme areas	15
Areas of national interest	6
Red listed species	>200
Natura 2000 sites	5
Wet forests	21
Woodland key habitats and areas with nature values	153
Ancient meadows and pastures	2
Residential properties (buildnings)	Yes
SKB's own sampling sites	Yes
Valuable wetlands	10

### 3.2.2 Processing

As mentioned above, some features need to be buffered in order to secure their values, whereas others can be used with their original delimitations. In Table 3-6 below, the different features used in the map and the way they were processed are presented.

**Table 3-6. Initial processing of input data.**

<b>Area of interest</b>	<b>Value</b>	<b>Characteristics</b>	<b>Delimitation</b>
Nature values	Nature reserves	Legally protected	Polygon boundary
	Woodland key habitats	Ecologically sensitive	Polygon boundary
	Red listed species	Ecologically sensitive/ Legally protected	Occurrence buffered 100 m
	Watercourses	Ecologically sensitive	Buffered 50 m
	Lakes	Ecologically sensitive	Shoreline buffered 100 m
	Sea shoreline	Ecologically sensitive/ Legally protected	Shoreline buffered 300 m
	Wetlands	Ecologically sensitive	Polygon boundary
	Sensitive bird habitats	Ecologically sensitive	Polygon boundary
	Marsh forests	Ecologically sensitive	Polygon boundary
	Primeval forests	Ecologically sensitive	Polygon boundary
	Natura 2000 areas	Ecologically sensitive	Polygon boundary
	Wildlife reserves	Ecologically sensitive/ Legally protected	Polygon boundary
	Bird sanctuaries	Ecologically sensitive/ Legally protected	Polygon boundary
	Ancient meadows and pastures	Ecologically sensitive	Polygon boundary
Cultural values	Ancient monuments	Legally protected	Polygon boundary
Socio-economic values	Residential properties	Legally protected/ policy reasons	Buildings buffered 300 m
	Wells		Buffered 100 m
	Gravel assets		Polygon boundary
Monitoring sites	Precipitation monitoring		Polygon boundary
	Vegetation monitoring		Polygon boundary

### 3.2.3 Results

One way to display the results of the procedure described above, is to create a map containing the different sensitive objects. For policy reasons, such a map will not be shown here.

### **3.3 Handling guideline**

The handling of the accessibility maps can be divided into four different steps; 1 – accessibility assessment, 2 – sensitivity assessment, 3 – field check and 4 – follow-up check. These steps and instructions for how to deal with updates and version handling are briefly described below. A full description of the procedure is available in the SKB instructions SKB MD 900.001 and 900.002 (in Swedish only).

It is important to point out that the accessibility maps are restricted and only authorized personnel at SKB have access to them.

#### **3.3.1 Accessibility assessment**

The main purpose with this step is to assess if a planned activity could interfere with areas of environmental or cultural concern. The recommended way to proceed is as follows:

1. A GIS-theme that defines the activity's spatial delimitation is produced.
2. The theme is imported to the accessibility map.
3. The activity theme is activated and spatially compared to the sensitive themes of the accessibility map.
4. If the activity is situated within a sensitive theme, a sensitivity assessment (as described below) must be conducted.

#### **3.3.2 Sensitivity assessment**

If the planned activity is situated within a sensitive theme, an assessment of the unaccessible areas must be conducted. This is done by the site ecologist as follows:

1. The sensitive themes are activated one at a time. All themes need to be checked since several themes can be overlapping an area.
2. The themes or objects that are affected by the activity are registered in the accessibility protocol. Themes lacking environmental or cultural concern (e.g. roads) do not need to be registered.
3. Hereafter, those themes that are affected are activated again. For each theme, the type of object is documented.
4. The site ecologist reports the impact of the planned activity to the activity leader.  
Important aspects to pay attention to are:
  - The impact: Depending on the nature of the activity (and the area's sensitivity), it could be possible to carry it out without any significant disturbance. E.g. noise has no known impact on vegetation.
  - The time frame: Is the area sensitive all year round, or only during some particular periods (e.g. birds nesting periods)? Is it possible to reschedule the activity so that no actual disturbance occurs?

The sensitivity assessment is documented in the accessibility protocol. In many cases it will be possible to adjust the activity so that the impact is minimised. In some other cases it will be necessary to consult the appropriate authorities and/or land owners if an activity need to be performed in a sensitive area. This decision is to be made by the site manager after consulting the site ecologist.

If a cultural amenity can be affected, the county administrative board need to be consulted. This is handled by the site ecologist.

If a decision is made to carry out the activity, the site ecologist will decide if a field check of the environmental and cultural values of the area is needed prior to the start of the activity. The accessibility protocol must be signed by the site ecologist. The original document is stored in the activity leader's activity file while the ecologist keeps a copy.

### **3.3.3 Field check**

The purpose with the field check is to confirm on a detailed level that the planned activity will not harm the environmental and cultural values of the affected area.

If a field check is necessary depends on the nature of the activity and the area, and it is decided by the site ecologist.

According to the environmental control programme of SKB, a field check is to be performed prior to certain kinds of activities. However, the site ecologist can decide that field checks should be performed also for other kinds of activities if found necessary.

The field check is performed by the site ecologist, or by someone appointed by the site ecologist (hereafter called the field controller).

In the Forsmark area, presence of the following values is to be studied:

1. Sensitive animal or plant species (species in the red lists and species protected by law).
2. Sensitive habitats (key habitats in forests and cultivated areas).

In the Simpevarp area, the field check will also contain studies of cultural amenities.

In order to document the baseline situation, a part of the field check routine is to take photographs of the area in question. Any occurrence of species or habitats as described above is to be documented in the field protocol (latest version available on the SKB intranet).

Together with the activity leader, an assessment of the possible effect of the activity on the values in the area is performed. If no effects are expected, the site ecologist approves the activity. If negative effects are possible, the activity needs to be redesigned.

If it is not possible to redesign the activity without disturbing the overall project, the site manager will decide on how to proceed, i.e. if the activity is to be performed at all and if the authorities need to be contacted.

During the field check, the site ecologist also need to decide if a follow-up check (as described below) should be performed. If so, the parameters that need to be checked are noted in the field protocol.

The protocol is signed by the field controller and the activity leader. The original document is stored in the activity leader's activity file while the ecologist keeps a copy.

The field controller can also suggest proper monitoring activities, e.g. sampling or registration of ground water. This decision should primarily be based on possible downstream effects. The site ecologist consults the activity leader and decides what to do. In some cases it could be motivated to mark sensitive objects on site (e.g. protected species) in order to avoid damages.

### **3.3.4 Follow-up check**

The follow-up check is performed after the activity has been performed, and aims at controlling that any possible restrictions decided earlier in the process has been complied, and that the goals sought for has been achieved. The check can, when suitable, also be performed during the activity.

The check is performed by the site ecologist, or by someone appointed by the site ecologist (the field controller). The check is documented in a particular protocol (latest version available on the SKB intranet).

The protocol is signed by the field controller and the activity leader. The original document is stored in the activity leader's activity file while the ecologist keeps a copy.

If the field controller finds that restrictions have not been complied, or that value objects still have been harnessed, the site ecologist decides on what measures to take.

In these cases, a divergence report (avvikelsesrapport) is to be written, in accordance with /SKB, 2002/. In some cases it is necessary to inform the authorities (most often the county administrative board). In all cases the site manager needs to be informed.

The flow of data and information in accessibility assessment, field check and follow-up check is given in Appendix 1.

### **3.3.5 Updates of the accessibility map**

New information of the regional model areas is continuously being revealed, partly as a result of SKB's own site investigations and partly by various surveys and inventories performed by different authorities, organisations and companies. For this reason, the maps need to updated regularly. Below, the process for how SKB deals with updating of the maps is briefly described.

#### ***The National Board of Forestry (Skogsvårdsstyrelsen)***

In the Simpevarp area, the site ecologist subscribes for data from the National Board of Forestry, and receives a data delivery each month, if any updates are available.

In the Forsmark area, SKB has made an agreement with the land owners that no felling is to be made during site investigations. It is therefore not necessary to subscribe for this kind of data for this area.

#### ***The County Administrative Board (Länsstyrelsen)***

Data from the County Administrative Board is downloaded twice a year by the site GIS-operators. Because of difficulties to decide whether the GIS-themes are updated or not, all files are downloaded each time. These new files then replaces the older ones.

#### ***SKB:s own site investigations***

The data generated from SKB:s own site investigations are updated parallel with the investigations and when the site ecologist finds it necessary to update the accessibility map.

A flow chart for how to deal with data gathering and map updates is illustrated in Appendix 2.

### **3.3.6 Version handling**

In order to study earlier versions of the accessibility map, to track changes and to enable comparisons of the accessibility at different times, reliable version handling of mxd- and shape-files is necessary.

At every point of data freeze, a new version of the accessibility map is created. The data that at this point is used in the map is stored in a database. Changes in between points of data freeze are stored on a data server.

#### ***Mxd-files***

In the site specific catalogues, the current versions of the accessibility maps are found. In the sub catalogues Versioner, copies of the earlier versions of the maps are found.

At every change, a copy of the map document is saved here and is named with the date in question, e.g. forsmark\_tillgänglighetskarta\_20030401.mxd. In the same catalogue, a Readme-file with comments on the different versions is available.

#### ***Shape-files***

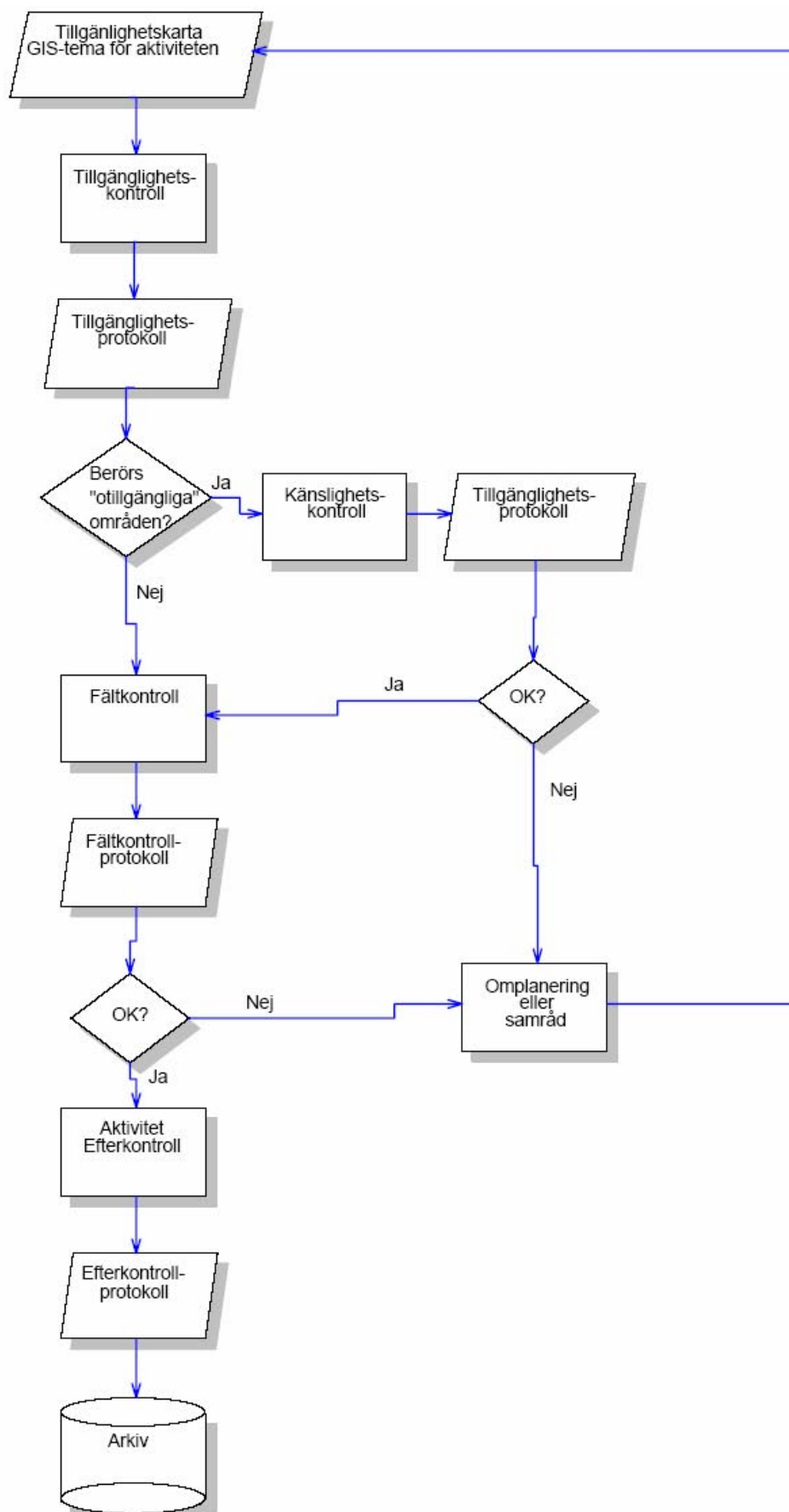
At every point of data freeze, the current files are saved in the database with the current version number.

At changes in between points of data freeze, a copy of the entire data catalogue is saved in a compressed format in the catalogue Versioner, and is named with the date in question, e.g. tillgangl\_fm\_20030401. In the same catalogue, a Readme-file with comments on the different versions is available.

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**Accessibility assessment, field check and follow-up check  
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Data gathering (in Swedish)

