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Available climatological and oceanographical data for site investigation program

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SMHI

Mars 2000

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Summary

Information on available data, measurements and models for climate, meteorology, hydrology and oceanography for six communities have been analysed and studied. The six communities are Nyköping, Östhammar, Oskarshamn, Tierp, Hultsfred and Älvkarleby all of them selected by Svensk Kärnbränslehantering AB, SKB, for a pre-study on possibilities for deep disposal of used nuclear fuel. For each of them a thorough and detailed register of available climatological data together with appropriate statistical properties are listed.

The purpose is to compare the six communities concerning climatological and oceanographical data available and analyse the extent of new measurements or model applications needed for all of the selected sites.

Statistical information on precipitation, temperature and runoff has good coverage in all of the six communities. If new information concerning any of these variables is needed in sites where no data collection exist today new installation can be made at low cost. Modelling is also a possibility where SMHI can offer consulting based on long and successful experience.

Data on precipitation in form of snow and days with snow coverage is also available but to a lesser extent. This concerns also days with ground frost and average ground frost level where there is no fully representation of data. If more information is wanted concerning these variables new measurements or model calculations must be initiated. Data on freeze and break-up of ice on lakes is also insufficient but this variable can be calculated with good result by use of one-dimensional models.

Data describing air pressure tendency and wind velocity and direction is available for all communities and this information should be sufficient for the purpose of SKB. This is also valid for the variables global radiation and duration of sunshine where no new data should be needed.

Measured data on evaporation is normally not available in Sweden more than in special research basins. Actual evaporation is though a variable that easily can be calculated by use of models. SMHI has long experience in using the rainfall-runoff model HBV where evaporation can be one of the calculated variables.

There are many lakes in the six communities. Information about all the lakes is stored in a lake database at SMHI. Also lake maps showing area and bottom topography are available for many of them. If maps are missing or must be updated for any of the lakes soundings giving deep profiles is possible. Measurement on water level in the lakes is insufficient in all of the six communities. If water level registrations is essential from any lake gauge installations must be performed. Information on bottom sediments is available only from geological maps.

Data on water exchange, currents, nutrients, oxygen, light condition, temperature and stratification is normally not available in the lakes. But in coastal regions local measurements and investigations have been made in special projects during different periods of time, especially in the communities with nuclear power installations. New installations for data collection is possible and there are seve-ral models with different characteristics for calculation of variables in both the sea and in lakes. SMHI has a deep experience in this field and has worked with oceanographical measurements, modelling activities and model development for many years. Measurements can be done with help of acoustic dopler technique. Modelling activities in coastal regions often include models based on a three-dimensional structure.

Sammanfattning av resultaten

Tillgängligheten av observationer, data, mätningar och modellberäkningar för klimat, meteorologi, hydrologi och oceanografi för sex kommuner har analyserats och sammanställts. De sex kommunerna är Nyköping, Östhammar, Oskarshamn, Tierp, Hultsfred och Älvkarleby. Samtliga har valts ut av Svensk Kärnbränslehantering AB, SKB, för att ingå i förstudien om förutsättningar för djupförvar av utbränt kärnbränsle. För varje kommun listas tillgängliga observationer tillsammans med eventuell grundläggande statistisk information.

Syftet med studien är att jämföra de sex kommunerna vad gäller klimatologiska och oceanografiska data. Vidare görs en analys av förutsättningarna och omfattningarna av eventuella kompletterande mätningar och modellapplikationer som kan komma att krävas för de sex utvalda kommunerna.

Det finns god täckning av statistisk information rörande nederbörd, temperatur och avrinning för samtliga sex kommuner. Om de insamlingsstationer som finns idag är otillräckliga kan nyinstallationer göras utan alltför stora kostnader. Vidare har SMHI lång erfarenhet av att arbeta med matematiska modeller och statistiska beräkningar inom klimatologi och hydrologi och dessa typer av beräkningar kan komplettera och i en del fall även ersätta vissa mätprogram.

Snönederbörd och antal dagar med snötäcke är även de tillgängliga om än med ett något lägre antal mätstationer. Detta gäller även tjäle och tjäldjup. Om ytterligare information önskas angående dessa variabler krävs antingen att nya mätstationer installeras eller att modellberäkningar initieras. Data rörande isläggning och islossning på sjöar i de sex kommunerna är även de bristfälliga, men detta är uppgifter som kan beräknas med hjälp av en-dimensionella modeller.

Lufttryckstendenser, vindhastighet och vindriktning går att beskriva med tillräcklig noggrannhet för samtliga kommuner. Detta gäller även globalstrålning och solskenstid. Därför torde det inte krävas ytterligare mätningar av dessa variabler.

Observationsserier av avdunstning är normalt inte tillgängliga i Sverige mer än från speciella forskningsområden. Däremot kan aktuell avdunstning lätt beräknas med hjälp av hydrologiska modeller.

Det finns väldigt många sjöar inom de sex kommunerna. Information om dessa är samlade i en speciell databas under SMHI:s ansvar. I databasen finns det även information om vilka sjöar som har karterats och som då även har uppgifter om area och bottentopografi. Om det saknas sjökarta för någon sjö eller om sjökartan behöver uppdateras är det förhållandevis enkelt att ta fram nya djupprofiler genom att loda antingen från is eller båt. Vattenståndsmätningar saknas för de flesta sjöar men om information önskas kan en pegel lätt installeras för registrering av nivåerna och dess förändringar. För att få fram information om bottensediment i sjöarna måste befintliga geologiska kartor studeras.

Uppgifter om strömmar, vattenutbyte, näringsämnen, syresättning, temperatur, ljus- och skiktingsförhållanden finns normalt inte tillgängliga för insjöarna. I de kustnära områdena har dock lokala mät- och undersökningsprogram för speciella projekt givit en del data som finns lagrat i databaser. Befintliga modeller och modeller som är under utveckling kan tillsammans med kompletterande mätningar nyttjas för att göra beräkningar av samtliga oceanografiska variabler. Mätningar i kustområden genomförs ofta med modern doppler teknik för att få med det tredimensionella rörelsemönstret i vattenmassan. Tredimensionella modeller används i stor utsträckning i de olika beräkningsuppgifterna.

Content

1 Introduction

Svensk Kärnbränslehantering AB, SKB, plans to continue the siting program in year 2001 with survey of two potential sites. The two sites will be selected in the sex communities Nyköping, Östhammar, Oskarshamn, Tierp, Hultsfred and Älvkarleby. The sites will survey for data relevant to evaluate the construction and function of a planned deep disposal of used nuclear fuel. If possible the characteristic can point out which sites is most suitable. Previous work has been to identify areas suitable in various communities in Sweden based on available data on geology, transport, etc.

For the geological investigations a variable list has been established and an overview program published. A variable list for the surface ecosystems is under preparation. The final goal is to establish a list of variables that must be collected during the field-surveys and a program on how these variables should be measured.

The group of variables concerned in this report describe the climatology, meteorology, hydrology and oceanography for the selected communities. Specification of variables is made and a review of available data in the communities is listed. A description on how data can be collected and model simulations performed is also presented.

The climatological variables in this report include statistical information on precipitation, temperature and runoff. All stations are listed with name, co-ordinates and year with data. The locations are plotted on maps. Observation sites in use up today are also presented and possible complementary measurements and model calculations discussed.

Other variables discussed in the report are snow precipitation, days with snow cover, ground frost and ground frost level. Possible data on ice freeze-up and melt-up is also presented. Air pressure, wind speed and direction is together with information on global radiation, number of days with sunshine and evaporation the last meteorological and hydrological variables to be discussed.

All lakes in Hultsfred, Tierp and Älvkarleby are listed in tables and plotted on maps. Previously defined potential areas in the communities of Nyköping, Östhammar and Oskarshamn made it possible to limit number of lakes to confirm only these potential areas. Also lakes with available lake maps are listed separately. These maps can be used to evaluate bottom topography of the lakes while bottom sediment must be analysed from geological maps.

The methods used in oceanographical measurements and modelling can in most cases also be valid for investigation in lakes. Variables discussed include water exchange, currents, nutrients, oxygen, light condition, temperature and stratification. Water level registrations in sea and lakes are also included among these variables. Three-dimensional measurements and modelling technique is normally introduced in coastal sea water investigations.

A final discussion try to give recommendations in future work concerning installation of data collecting instruments and possible model activities. This will serve as an assistance to SKB in the process in finding a siting list for the involved six communities, Nyköping, Östhammar, Oskarshamn, Tierp, Hultsfred and Älvkarleby.

2 Climate

The Scandinavian peninsula has a very interchanging climate and compared to other areas on the same latitude the winter climate is remarkably mild. There are two main reasons for this:

- The position east of an ocean and west of a big continent. During the winter season the weather over Scandinavia can be influenced either by mild, maritime air masses from the Atlantic or by cold, dry air masses from the the Sibiria. The temperature difference between these air masses can be up to 15–20 °C over Sweden. During summer the conditions are the opposite. The highest temperatures in Sweden appears when warm air moves in from eastern Europe with easterly or southeasterly winds.
- The overlying wind systems of the atmosphere. Over the north Atlantic and the northwestern part of Europe there is a prevailing westerly to southwesterly air stream limitating the cold air over the polar region and the warm air over the central and southeastern parts of Europe. In the frontal zone between these air masses small cyclons are generated and moves towards the northwestern Europe and Scandinavia.

In average about 100 cyclons passes over at least some part of Sweden every year. Most of them are relative weak, especially during summer, and follows only by increasing cloudiness and light or moderate precipitation and moderate winds. Every passage takes about 24 hours in average, but there are great variations. Often the cyclones comes in series, so called cyclon families, where the last in the serie can develope to a more intense storm.

The southwesterly air stream and the cyclons are more intense during the winter period, especially during December and January. At a certain location you can expect in average 10–15 storms per winter season. During a single year you can have considerably deviations from this average.

For analyzing surface meteorological parameters and cloud SMHI has developed a system called the MESAN system (Häggmark, Ivarsson and Olofsson, 1997), which is in use since 1998 and the results are saved in a SMHI database. The following parameters are being analyzed:

- temperature,
- precipitation for different accumulations times,
- snow cover,
- wind speed and direction and gust speed at 10 meter elevation,
- visibility,
- relative humidity,
- cloud information.

Hirlam data are normally used as first guess fields. Observations are taken from different manual observing stations, satellites, radars and automatic stations. Much work has been done to minimize systematic errors in observations and investigating structure functions of first guess errors. The analyze method used is optimal interpolation.

The co-ordinates in this chapter are in RT90-format.

The stations reported under Statistical precipitation (runoff, temperature) are all the stations in the area of interest that have data during a specific period, but not necessarily ongoing. Under Actual precipitation (runoff, temperature) there are only stations with ongoing observations.

2.1 Statistical precipitation

Total precipitation during a certain period is the sum of all kinds of rain, snow, hail, etc. Statistical information includes mean and extremes at a given site in a long time period.

2.1.1 Existing data

Precipitation amount is measured in 12 hour or 24 hour intervals. New automatic observation stations, denoted with an A after the name, monitor data every hour. The data are stored in a MIMER database at SMHI. In order to ensure comparability between data collected at stations all over the world as well as to provide a long-term reference value or 'normal' with which shorter-term (e. g. monthly) data can be compared the members of the World Meteorological Organization (WMO) have agreed to process data over uniform standard periods. Annual means in the following tables are therefore calculated for the period 1961–1990.

MESAN is a system for analysing surface meteorological parameters and clouds. This system has been in use at SMHI for a couple of years now. Field data are saved since 1997. The following precipitation parameters are being analysed:

- Precipitation in mm water for 1, 3, 12 and 24 hours accumulation time, and for new snow-cover in cm.

Data from the analysing and forecast system called HIRLAM (HIgh Resolution Limited Area Model) are used as first guess fields. Observations are taken from manual weather observations, airport observations, climate stations, satellites, radars and automatic stations. The analysing method used is optimal interpolation. Each one of the existing weather observing systems has advantages and disadvantages. The mesoscale analysis integrates observations from different sources in a consistent way after passing a quality control process. Radar data is an example of remote sensing data, which are dense in space and time but has less accuracy than observations from e.g. the synoptic network. The analysis in MESAN refers to mean values for an area of 10 x 10 km^2.

Nyköping

Station no	Station name	Co-ordinates	Period	Annual mean
8745	Landsort	651522 161941	1880–1995	433 mm
8744	Landsort A	651524 161945	1995–	
8740	Oxelösund	650684 157622	1952–	489 mm
8648	Nyköpings flygplats	651837 156409	1945–1978	544 mm
	Nyköping	651664 156895	1859–1961	637 mm[1)]
	Rosenlund	655732 155486	1926–1944	549 mm[1)]
	Solbacka	655372 156638	1919–1944	526 mm[1)]
	Stigtomta fpl	651828 155638	1964–1979	512 mm[1)]
	Sulsta	652434 158325	1918–1954	615 mm[1)]

[1)] Annual mean for the period 1951-80

Östhammar

Station no	Station name	Co-ordinates	Period	Annual mean
10864	Öregrund	669339 164495	1949–1967	587 mm
10832	Örskär	671476 164097	1881–1995	487 mm
10832	Örskär A	671475 164099	1996–	
10815	Östhammar	668510 164176	1988–	613 mm
10811	Risinge	667533 163423	1962–	606 mm
10714	Films kyrkby	668149 161626	1982–	590 mm
10712	Dannemora	667780 161625	1963–1981	604 mm
	Hargsbruk	667664 164377	1882–1952	532 mm[1)]

[1]Annual mean for the period 1951–1980

Oskarshamn

Station no	Station name	Co-ordinates	Period	Annual mean
7722	Ölands norra udde	636108 157776	1880–1995	431 mm
7721	Ölands norra udde A	636089 157763	1996–	
7638	Tovehult	639101 154538	1916–1987	561 mm
7628	Kråkemåla	637184 155073	1990–	
7616	Oskarshamn	634920 153660	1918–	553 mm

Tierp

Station no	Station name	Co-ordinates	Period	Annual mean
10737	Ytterboda	672319 158988	1921–1976	600 mm
10733	Fagerviken	671533 160643	1966–1978	569 mm
10727	Untra	670330 158437	1965–	635 mm
10725	Lövsta	670070 161437	1925–	687 mm
10724	Strömsberg	669925 159782	1966–1977	621 mm
10718	Väsby	668790 158983	1900–1974	535 mm
10714	Films kyrkby	668149 161626	1982–	590 mm
10712	Dannemora	667780 161625	1963–1981	604 mm
10708	Harbo	666944 157945	1975–	587 mm
10701	Vattholma	665815 160680	1905–	606 mm
9759	Drälinge	665384 159851	1879–	551 mm
	Västanå	671951 158997	1899–1954	658 mm[1)]
	Bro	670114 159778	1923–1951	526 mm[1)]

[1)]Annual mean for the period 1951–1980

Hultsfred

Station no	Station name	Co-ordinates	Period	Annual mean
7540	Vimmerby	639372 150260	1910–	535 mm
7538	Hässleby	638938 148592	1902–1987	614 mm
7531	Ungsberg	637609 150664	1911–	528 mm
7529	Pauliström	637157 148218	1922–1988	586 mm
7524	Målilla	636291 150033	1947–	570 mm
7516	Ryningsnäs	634894 150754	1890–1971	553 mm
7514	Blankaström	634338 150654	1920–1977	541 mm
	Hultsfred	637495 150250	1945–1961	595 mm[1)]

[1)]Annual mean for the period 1951–1980

Älvkarleby

Station no	Station name	Co-ordinates	Period	Annual mean
10744	Eggegrund	673601 159516	1881–1976, 1992–1995	400 mm
10744	Eggegrund A	673603 159563	1995–	
10737	Ytterboda	672319 158988	1921–1976	600 mm
10727	Untra	670330 158437	1965–	635 mm
10723	Hedesunda	669920 156689	1988–	504 mm
10708	Harbo	666944 157945	1975–	587 mm
10617	Gysinge	668546 155960	1910–	570 mm
	Västanå	671951 158997	1899–1954	658 mm[1)]
	Bro	670114 159778	1923–1951	526 mm[1)]

[1)]Annual mean for the period 1951–1980

Temporal resolution

Measurements are taken every hour for the stations denoted with A after the name in the list above. For the remaining stations observations are taken every 12th or 24th hour. Time period for the different stations are listed above.

Statistical properties

The observation series can give statistical output as duration curves, extremes and means on a daily, monthly or yearly basis or other selected periods.

The observations can be used to calculate good statistical data for the different locating sites. Information for today and in the future can be taken from the MESAN analysis.

Methods/models used for existing data

Registration of precipitation is done by gauge observations. Statistical methods and a method built on a report regional resolution of precipitation by Bengt Dahlström (Dahlström, 1979). The method used for the MESAN analysis is described in a SMHI report on mesoscale analysis (Häggmark, Ivarsson and Olofsson, 1997).

2.1.2 Conclusions

No new data or observations should be needed for the description of the precipitation climate in the different locations.

2.2 Actual precipitation/year

Total precipitation during a certain period is the sum of all kinds of rain, snow, hail, etc. Statistical information includes mean and extremes at a given site in a long time period.

2.2.1 Existing data

For description see first part of 2.1.1.

Nyköping

Station no	Station name	Co-ordinates	Period	Annual mean
8744	Landsort A	651524 161945	1995–	
8740	Oxelösund	650684 157622	1952–	489 mm

Östhammar

Station no	Station name	Co-ordinates	Period	Annual mean
10832	Örskär A	671475 164099	1996–	
10815	Östhammar	668510 164176	1988–	613 mm
10811	Risinge	667533 163423	1962–	606 mm
10714	Films kyrkby	668149 161626	1982–	590 mm

Oskarshamn

Station no	Station name	Co-ordinates	Period	Annual mean
7721	Ölands norra udde A	636089 157763	1996–	
7628	Kråkemåla	637184 155073	1990–	
7616	Oskarshamn	634920 153660	1918–	553 mm

Tierp

Station no	Station name	Co-ordinates	Period	Annual mean
10727	Untra	670330 158437	1965–	635 mm
10725	Lövsta	670070 161437	1925–	687 mm
10714	Films kyrkby	668149 161626	1982–	590 mm
10708	Harbo	666944 157945	1975–	587 mm
10701	Vattholma	665815 160680	1905–	606 mm
9759	Drälinge	665384 159851	1879–	551 mm

Hultsfred

Station no	Station name	Co-ordinates	Period	Annual mean
7540	Vimmerby	639372 150260	1910–	535 mm
7531	Ungsberg	637609 150664	1911–	528 mm
7524	Målilla	636291 150033	1947–	570 mm

Älvkarleby

Station no	Station name	Co-ordinates	Period	Annual mean
10744	Eggegrund A	673603 159563	1995–	
10727	Untra	670330 158437	1965–	635 mm
10723	Hedesunda	669920 156689	1988–	504 mm
10708	Harbo	666944 157945	1975–	587 mm
10617	Gysinge	668546 155960	1910–	570 mm

Temporal resolution

Measurements are taken every hour for the stations denoted with A after the name in the list above. For the remaining stations observations are taken every 12th or 24th hour. Time period for the different stations are listed above.

Statistical properties

The observation series can give statistical output as means or sums on yearly basis or other selected periods. Information for today and in the future can also be taken from the MESAN analysis, se 2.1.1.

The observations give a good representation to the areas of interest, except for Nyköping, but will not give exact local information. The present observations for Nyköping represent only the coastal area of Nyköping community.

Methods/models used for existing data

Registration of precipitation is done by gauge observations. The method used for the MESAN analysis is described in a SMHI report (Häggmark, Ivarsson and Olofsson, 1997).

2.2.2 Methods for data collection

New observation precipitation gauges can be installed if local and detailed information on precipitation is needed. Data can be collected through a SMHI system and presented for example on Internet.

Observations can also be done by manual measurements and reported manual to e.g SMHI for analyses and control.

Observation of other elements can easily be added to the observing station.

Time schedule

Installation is preferably done during summer.

Potential resources

SMHI has long experience from installation of automatic weather measurement equipment. There are also other technical companies that have enough competence.

Data processing

Data delivered in real-time is preferable, especially for the supervision and control of data. If you want to collect data through the tele system you must have a stationary telephone installation.

With the manual alternative reports can be sent in almost real time or according to individual wishes.

Effects on environment

The instrument will occupy an area of a few m^2, but demands an open space around the instrument of at least about 5–10 m.

2.2.3 Costs

Roughly estimation of costs in 1999 prize level:

Automatic station:
Installation, including instruments, logger, collection of data: 80,000–100,000 SEK.

Support and control of data: 25,000–30,000 SEK per year.

Manual station:
Instruments: 2,000 SEK (including temperature: 10,000 SEK).

Support and control of data: 10,000 SEK (including temperature 25,000–30,000 SEK).

2.2.4 Conclusions

If the existing data on precipitation is insufficient installations of new stations can be made either on a temporary basis for construction purpose or more stationary if a longer time series is needed.

2.3 Month with max/min of precipitation

See 2.1 and 2.2

2.3.1 Existing data – monthly mean precipitation

Nyköping

	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
8745 Landsort	35	22	23	28	26	32	41	46	48	42	50	41
8740 Oxelösund	35	26	27	29	32	42	54	54	53	45	52	41
8648 Nyköpings fpl	41	27	28	33	33	46	65	59	56	50	56	49
Nyköping[1)]	45	36	33	38	41	48	70	78	62	59	68	59
Rosenlund[1)]	40	30	27	32	37	45	66	66	54	51	54	47
Solbacka[1)]	38	28	26	31	35	43	63	64	52	49	52	45
Stigtomta fpl[1)]	36	28	27	30	34	41	58	61	50	48	52	47
Sulsta[1)]	44	33	31	37	39	46	68	75	60	58	66	58

[1)] Monthly mean for the period 1951–1980

Östhammar

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10864 Öregrund	44	33	31	35	36	44	69	74	64	52	58	49
10832 Örskär	34	26	25	29	29	34	50	68	55	45	53	39
10815 Östhammar	44	32	32	36	36	47	74	77	68	57	61	49
10811 Risinge	45	34	30	36	31	43	77	72	65	57	62	53
10714 Films kyrkby	44	30	32	34	35	42	71	75	62	55	60	49
10712 Dannemora	47	37	32	35	35	44	64	79	63	55	64	49
Hargsbruk[1)]	41	30	24	30	33	40	64	64	53	52	54	47

[1)]Monthly mean for the period 1951–1980

Oskarshamn

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
7722 Öl n udde	33	23	25	25	32	32	40	45	52	38	47	39
7638 Tovehult	46	35	34	34	40	45	62	52	59	49	53	52
7616 Oskarshamn	47	34	32	38	40	44	65	55	56	45	49	48

Tierp

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10737 Ytterboda	41	34	34	35	39	42	62	81	70	54	59	50
10733 Fagerviken	41	31	30	34	34	45	65	75	65	50	54	45
10727 Untra	49	38	35	41	39	42	71	79	68	57	63	55
10725 Lövsta	54	31	36	42	36	43	89	95	73	62	72	56
10724 Strömsberg	44	38	34	35	38	46	75	76	66	55	62	52
10718 Väsby	36	28	26	32	34	43	67	71	61	47	52	39
10714 Films kyrkby	44	30	32	34	35	42	71	75	62	55	60	49
10712 Dannemora	47	37	32	35	35	44	64	79	63	55	64	49
10708 Harbo	40	29	32	34	36	47	68	81	63	54	56	46
10701 Vattholma	44	32	31	33	36	46	73	83	64	54	60	51
9759 Drälinge	39	29	28	30	32	42	70	71	60	49	54	45
Västanå[1)]	48	38	33	37	40	46	76	88	65	66	66	55
Bro[1)]	38	31	26	30	32	37	61	69	52	52	53	45

[1)]Monthly mean for the period 1951–1980

Hultsfred

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
7540 Vimmerby	38	30	31	36	42	48	66	55	57	44	45	44
7538 Hässleby	45	36	37	39	47	55	69	63	64	54	53	52
7531 Ungsberg	36	27	29	30	42	49	63	59	59	47	44	43
7529 Pauliström	44	31	34	34	44	52	64	63	66	53	52	48
7524 Målilla	42	32	34	37	45	50	64	61	60	47	49	49
7516 Ryningsnäs	43	31	33	34	43	46	63	56	58	48	51	47
7514 Blankaström	41	30	32	33	44	44	63	59	55	48	49	43
Hultsfred[1)]	45	33	33	39	49	45	68	68	57	55	54	50

[1)] Monthly mean for the period 1951–1980

Älvkarleby

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
10744 Eggegrund	23	19	19	22	29	34	49	56	50	36	37	25
10737 Ytterboda	41	34	34	35	39	42	62	81	70	54	59	50
10727 Untra	49	38	35	41	39	42	71	79	68	57	63	55
10723 Hedesunda	36	25	27	31	32	41	62	64	57	45	47	38
10708 Harbo	40	29	32	34	36	47	68	81	63	54	56	46
10617 Gysinge	40	29	30	35	36	43	66	78	65	53	51	44
Västanå[1)]	48	38	33	37	40	46	76	88	65	66	66	55
Bro[1)]	38	31	26	30	32	37	61	69	52	52	53	45

[1)]Monthly mean for the period 1951–1980

2.4 Part of precipitation as snow

The information of different types of precipitation is reported from manual synoptic stations and from automatic stations with a present weather recorder.

2.4.1 Existing data

Type of precipitation is reported ever hour at stations denoted with A and every 3rd hour at the other stations. The data are stored in a MIMER database at SMHI. In order to ensure comparability between data collected at stations all over the world as well as to provide a long-term reference value or 'normal' with which shorter-term (e. g. monthly) data can be compared the members of the World Meteorological Organization (WMO) have agreed to process data over uniform standard periods. Annual means in the following tables are therefore calculated for the period 1961–1990.

Nyköping

Station no	Station name	Co-ordinates	Period	Annual mean
8745	Landsort	651522 161941	1880–1995	21%, 89 mm
8744	Landsort A	651524 161945	1995–	
8648	Nyköpings flygplats	651837 156409	1945–1978	

Östhammar

Station no	Station name	Co-ordinates	Period	Annual mean
10864	Öregrund	669339 164495	1949–1967	
10832	Örskär	671476 164097	1881–1995	25%, 123 mm
10832	Örskär A	671475 164099	1996–	
10714	Films kyrkby	668149 161626	1982–	
10712	Dannemora	667780 161625	1963–1981	

Oskarshamn

Station no	Station name	Co-ordinates	Period	Annual mean
7722	Ölands norra udde	636108 157776	1880–1995	18,1%, 78 mm
7721	Ölands norra udde A	636089 157763	1996–	

Tierp

Station no	Station name	Co-ordinates	Period	Annual mean
10714	Films kyrkby	668149 161626	1982–	
10712	Dannemora	667780 161625	1963–1981	

Hultsfred

Station no	Station name	Co-ordinates	Period	Annual mean
7524	Målilla	636291 150033	1947–	28,0%, 160 mm

Älvkarleby

Station no	Station name	Co-ordinates	Period	Annual mean
10744	Eggegrund	673601 159516	1881–1976, 1992–1995	
10744	Eggegrund A	673603 159563	1995–	
10740	Gävle	672698 157443	1885–1995	30,7%, 189 mm

Temporal resolution

Measurements are taken every hour for the stations denoted with A in the list above. For the remaining stations observations are taken every 3rd. Time period for the different stations are listed above.

Statistical properties

The observation series can give statistical output as duration curves, extremes and means on a daily, monthly or yearly basis or other selected periods. The observations can be used to calculate good statistical data for the different locations.

The observations for today and in the future represent to a certain extent, but not fully, the areas of interest for Tierp and Hultsfred.

Methods/models used for existing data

The information of different types of precipitation is reported from manual synoptic stations and from automatic stations with a present weather recorder.

2.4.2 Conclusions

No new data or observations should be needed for the description of the snow climate in the different locations, but there will not be enough observations to give exact local information in the future.

2.5 Number of day with snow coverage

The information of snow cover is taken from daily manual reports of snow depth and snow cover.

2.5.1 Existing data

Snow depth is reported in 24-hour intervals provided you have a snow cover. The data are stored in a MIMER database at SMHI.

The following snow parameter is analysed in the MESAN (see: 2.1.1):

- new snow cover in cm

Nyköping

Station no	Station name	Co-ordinates	Period	Annual mean
8648	Nyköpings flygplats	651837 156409	1945–1978	103 days[1)]
	Nyköping	651664 156895	1859–1961	92 days[2)]
	Rosenlund	655732 155486	1926–1944	104 days[2)]
	Stigtomta fpl	651828 155638	1964–1979	87 days[2)]

[1)]Annual mean for the period 1950–1980
[2)]Annual mean for the period 1931–1960

Östhammar

Station no	Station name	Co-ordinates	Period	Annual mean
10864	Öregrund	669339 164495	1949–1967	127 days[1)]
10832	Örskär	671476 164097	1881–1995	107 days[1)]
10815	Östhammar	668510 164176	1988–	
10714	Films kyrkby	668149 161626	1982–	
10712	Dannemora	667780 161625	1963–1981	110 days[1)]

[1)]Annual mean for the period 1950–1980

Oskarshamn

Station no	Station name	Co-ordinates	Period	Annual mean
7638	Tovehult	639101 154538	1916–1987	108 days[1)]
7628	Kråkemåla	637184 155073	1990–	
7616	Oskarshamn	634920 153660	1918–	

[1)]Annual mean for the period 1950–1980

Tierp

Station no	Station name	Co-ordinates	Period	Annual mean
10737	Ytterboda	672319 158988	1921–1976	127 days[1)]
10727	Untra	670330 158437	1965–	141 days[1)]
10714	Films kyrkby	668149 161626	1982–	
10712	Dannemora	667780 161625	1963–1981	110 days[1)]
9759	Drälinge	665384 159851	1879–	92 days[1)]

[1)]Annual mean for the period 1950-1980

Hultsfred

Station no	Station name	Co-ordinates	Period	Annual mean
7540	Vimmerby	639372 150260	1910–	
7538	Hässleby	638938 148592	1902–1987	59 days [1)]
7529	Paulistöm	637157 148218	1922–1988	
7524	Målilla	636291 150033	1947–	93 days [1)]

[1)] Annual mean for the period 1950–1980

Älvkarleby

Station no	Station name	Co-ordinates	Period	Annual mean
10737	Ytterboda	672319 158988	1921–1976	127 days [1)]
10727	Untra	670330 158437	1965–	141 days[1)]

[1)] Annual mean for the period 1950–1980

Temporal resolution

Measurements are taken once a day. Time period for the different stations are listed above.

Statistical properties

The observation series can give statistical output as duration curve, extremes and means on a daily, monthly or yearly basis or other selected periods. The observations can be used to calculate good statistical data for the different locations.

The observations for today and the future represent to a certain extent, but not fully, the areas of interest, except for Nyköping, where there are no observations available.

Methods/models used for existing data

Registration of snow cover is done daily by manual measurement.

2.5.2 Conclusions

No new data or observations should be needed for the description of the snow cover climate in the different locations, but there will not be enough observations to give exact local information in the future.

2.6 Statistical runoff

Runoff is the part of precipitation that flows towards a stream on the ground surface or within the soil and rock. Statistic information on runoff includes mean and extremes at a given site in a long time period. Data can be available either from observations of discharge in a river or minor water courses or calculated by using information from other stations applied to the area of interest.

2.6.1 Existing data

Nyköping

Station no	Station name	River	Co-ordinates	Period	Annual mean
65-50083	Långhalsen unreg.	Nyköpingsån	652178 156543	1909-39	6.8 $l/s*km^2$
65-50083	Långhalsen reg.	Nyköpingsån	652178 156543	1940->	5.7 $l/s*km^2$
66-2254	Kila	Kilaån	651377 154307	1980->	7.1 $l/s*km^2$

Station Långhalsen give information on runoff in 99% of Nyköpingsån total runoff area. From 1940 and onwards the data from Långhalsen is collected from a hydropower production site and influenced by regulation.

Station Kila is situated upstream Kilaån in the western part of Nyköping community well outside the areas of interest.

Östhammar

Station no	Station name	River	Co-ordinates	Period	Annual mean
56-573	Gimo	Olandsån	667489 163287	1922-32	7.7 $l/s*km^2$
56-1256	Fors	Olandsån	667170 163344	1931-59	7.4 $l/s*km^2$

The two observation series are located in Olandsån close to Gimo in the southernmost part of Östhammar community. They give information from the runoff area of Olandsån down to Gimo municipality.

Oskarshamn

Station no	Station name	River	Co-ordinates	Period	Annual mean
74-1619	Forshultesjön	Lillån	634734 153084	1955->	5.7 $l/s*km^2$

Forshultesjön is located in Lillån 5 km West Oskarshamn. Lillån is a tributary to Emån.

Tierp

Station no	Station name	River	Co-ordinates	Period	Annual mean
54-1260	Odensfors	Tämnarån	668382 158822	1930-50	6.6 $l/s*km^2$
54-1053	Näs	Tämnarån	670862 159995	1925-71	7.6 $l/s*km^2$
61-910	Uvlunge	Vendelån	666663 160043	1917-42	7.1 $l/s*km^2$

Odensfors and Näs were both located in river Tämnarån downstream the lake Tämnaren.

Uvlunge was located in river Vendelån about 6 kilometres downstream the lake Vendelsjön.

Hultsfred

Station no	Station name	River	Co-ordinates	Period	Annual mean
73-2291	Solnen	Virån	638341 150697	1980->	4.2
74-1806	Blankaström	Emån	634390 150665	1928->	6.2

Solnen is located in Virån and give information on runoff from the lake Solnen about 10 kilometres North of Hultsfred.

Blankaström is located in main Emå river just South of the border of Hultsfred community.

Älvkarleby

Station no	Station name	River	Co-ordinates	Period	Annual mean
53-2423	Älvkarleby krv	Dalälven	671735 158977	1976->	11.9 $l/s*km^2$
53-320	Klingfors	Dalälven		1910-28	12.7 $l/s*km^2$
53-333	Övre Älvkarleö	Dalälven		1903-14	11.9 $l/s*km^2$

All stations in Älvkarleby community are located in Dalälven main stream. They represent data from total Dalälven discharge and are not representative for the local hydrological runoff situation in Älvkarleby.

Temporal resolution

All measurements done give daily mean runoff data.

Statistical properties

The observation series can give statistical output as duration curve, all kind of extremes and means on a monthly or yearly basis or other selected periods.

Methods/models used for existing data

For most of the station registration of water level by daily gauge observations is the data collecting method. Rating curves are used for calculation of discharge and runoff. Data from hydropower stations is obtained through combinations of release from hydropower production at the station or regulated dams.

2.6.2 Conclusions

The statistical runoff information in SMHI database is not always from the locations where actual data is needed. But they are a good base and can be used to calculate runoff from any discharge area in the communities.

2.6.3 Methods for data collection

Statistical runoff information can be calculated from any area in the communities. The hydrological network with observations on discharge is the basic resource when calculating runoff from any area in Sweden. The method is based on information from all the station in SMHI hydrological database together with the area runoff map for the statistical period 1961-90. The basic output statistical information is maximum runoff with a return period of 100 and 50 years, yearly normal maximum runoff, normal value, yearly normal minimum value and minimum runoff with a return period of 50 years. As supplement it is also possible to calculate duration curves and monthly max, min and mean values.

Background data needs

Digitised map information with total discharge area and all the lakes within the runoff area. Time series, with if possible up to 30 years of data, from representative stations in the hydrological network. Information from older estimations in the region and the runoff generation map for period 1961–1990.

Time schedule

One calculation with the basic statistical information takes up to one day to perform. No monthly values and no duration curve included. If more than one calculation is wanted and the points of interest are close located the process can speed up and the total price will discount.

Potential resources

SMHI has long experience from calculations of statistical runoff. Main applications are constructions of road bridges and water tunnels under roads and railways.

Cost

For one calculation the normal price is 6,000–7,000 SEK. If several calculations in the region are ordered simultaneously the price will be discounted.

2.7 Actual runoff

Actual runoff is the part of precipitation that flows towards a stream on the ground surface or within the soil and rock. Real-time measurements.

2.7.1 Existing data

Nyköping

Station no	Station name	River	Co-ordinates	Area
65-50083	Långhalsen	Nyköpingsån	652178 156543	3592 km^2
66-2254	Kila	Kilaån	651377 154307	140 km^2

Station Långhalsen give information on runoff in 99% of Nyköpingsån total runoff area. Data from station Långhalsen is collected from a hydropower production site and influenced by regulation.

Station Kila is situated upstream Kilaån in the Western part of Nyköping community well outside the areas of interest.

Östhammar

No measurements of actual runoff exist today in the community of Östhammar.

Oskarshamn

Station no	Station name	River	Co-ordinates	Area
74-1619	Forshultesjön	Lillån	634734 153084	103 km^2

Forshultesjön is located in Lillån 5 km West Oskarshamn. Lillån is a tributary to Emån.

Tierp

No measurements of actual runoff performed by SMHI exist today in the community of Tierp. Uppsala community use water from lake Tämnaren during dry summers and they do measurement on the outflow from the lake. The data is stored at the technical office in Uppsala.

Hultsfred

Station no	Station name	River	Co-ordinates	Area
73-2291	Solnen	Virån	638341 150697	9 km^2
74-1806	Blankaström	Emån	634390 150665	3705 km^2

Solnen is located in Virån and give information on runoff from the lake Solnen about 10 kilometres North of Hultsfred.

Blankaström is located in main Emå river just South off the border of Hultsfred community.

Älvarleby

Station no	Station name	River	Co-ordinates	Area
53-2423	Älvkarleby krv	Dalälven	671735 158977	28921 km^2

The station Älvkarleby krv is located in Dalälven main stream. The data represent information from total Dalälven discharge and are not representative for the local hydrological runoff situation in Älvkarleby.

2.7.2 Methods for data collection

New observation gauges can be installed in minor streams if local and detailed information on water level, discharge and runoff is needed. Data can be collected by use of different kind of water level loggers with automatic or local collection system. They can be installed either in the stream where there exist a unique discharge-water stage relationship or at a constructed measuring weir. Discharge and runoff will be calculated by use of rating curves.

Time schedule

Installation is preferably done during the summer period with low flows in the river.

Potential resources

SMHI has long experience from installation of water level measurement equipment and discharge measurements. Also other technical companies have enough competence to do the installations but only few other companies can plot rating curve with acceptable accuracy.

Data processing

Data stored in loggers is normally emptied according to outlined program and stored in databases. Also automatic deliverance in real-time can be arranged, but then a telemetric system must be used with a mobile or stationary telephone installation.

Effects on environment

As a logger can be installed under the ground level it has only minor effect on the environment.

2.7.3 Costs

Roughly estimation of costs in 1999 prize level:

Installation	25,000 SEK
Logger	30,000-40,000 SEK
Rating curve	30,000 SEK
Yearly maintenance	20,000 SEK

If a telemetric system is installed costs will increase depending on type of system.

2.7.4 Conclusions

If the existing data on actual runoff is insufficient installations of new gauging stations can be made either on a temporary basis for construction purposes or more stationary if a longer time-series is wanted. The decision on where to install the stations must be based on detailed field studies to find out appropriate locations either with a well-defined relationship water level/discharge or possibilities to install a measuring weir in the water course.

2.8 Monthly runoff

Runoff is the part of precipitation that flows towards a stream on the ground surface or within the soil and rock. Monthly runoff data is monthly mean, maximum and minimum values. Statistical basic information is available either from measurements at the hydrological discharge stations or based on statistical analysis as described in chapter *2.6 Statistical runoff*.

2.8.1 Existing data

Nyköping

65-50083		Långhalsen unreg.			Nyköpingsån		1909-39		Monthly mean values (l/s*km²)		
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
7.7	7.6	7.6	9.3	11.1	8.7	5.7	4.2	3.8	3.9	5.4	7.1

65-50083		Långhalsen reg.			Nyköpingsån		1940-98		Monthly mean values (l/s*km²)		
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
6.7	7.0	7.7	9.5	9.9	6.3	3.5	2.9	3.1	3.0	3.8	5.6

66–2254		Kila			Kilaån		1980-98		Monthly mean values (l/s*km²)		
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
12.2	12.5	11.5	10.8	7.0	3.4	2.0	1.9	2.3	2.7	7.5	10.6

Östhammar

56–573		Gimo			Olandsån		1922-32		Monthly mean values (l/s*km²)		
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
6.0	4.3	5.2	15.7	14.6	4.5	3.3	5.0	7.4	8.3	10.2	7.8

56–1256	Fors	Olandsån	1931-59	Monthly mean values (l/s*km²)							
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
9.3	8.1	7.2	17.5	12.2	2.8	1.5	1.8	3.3	5.1	9.5	11.2

Oskarshamn

74–1619		Forshultesjön			Lillån		1955-98		Monthly mean values (l/s*km²)		
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
6.7	6.9	8.5	13.9	10.2	3.4	1.6	2.0	1.9	2.5	4.7	6.4

Tierp

54–1260		Odensfors			Tämnarån		1930-50		Monthly mean values (l/s*km²)		
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
8.3	6.8	6.8	10.2	10.6	7.0	4.5	3.4	3.5	4.0	6.3	8.4

54–1053		Näs			Tämnarån		1925-71		Monthly mean values (l/s*km²)		
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
7.7	7.2	8.5	16.3	13.5	5.7	3.4	3.7	4.1	4.8	7.7	8.9

61–910		Uvlunge			Fyrisån		1917-42		Monthly mean values (l/s*km²)		
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
6.9	4.9	5.1	16.6	13.4	3.3	1.7	2.8	6.2	7.3	9.6	7.4

Hultsfred

73–2291		Solnen			Virån		1980-98		Monthly mean values (l/s*km²)		
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
6.3	6.3	7.3	10.2	6.3	2.3	1.5	1.3	1.1	1.3	2.1	4.7

74–1806		Blankaström			Emån		1928-98		Monthly mean values (l/s*km²)		
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
7.5	7.9	8.2	11.2	8.9	4.3	2.8	2.9	3.4	3.9	5.9	7.1

Älvkarleby

53–2423		Älvkarleby krv			Dalälven		1976-98		Monthly mean values (l/s*km²)		
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
10.4	11.0	11.3	13.1	19.2	12.8	9.3	9.2	11.4	12.0	12.2	11.1

53–320		Klingfors			Dalälven		1910-28		Monthly mean values (l/s*km²)		
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
6.5	5.5	5.7	9.5	26.4	25.2	14.7	12.8	13.8	12.3	11.4	8.8

53–333		Övre Älvkarleö			Dalälven		1903-14		Monthly mean values (l/s*km²)		
Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
7.1	5.3	5.3	9.0	26.0	25.0	13.6	10.4	11.8	9.4	11.0	9.0

2.8.2 Costs

Extra costs for statistical analysis of monthly values where no measurements exist is, above standard prize 6,000–7,000 SEK, 3,000 SEK for monthly mean and extremes.

2.9 Evapotranspiration

The amount of water transferred from soil and plants to the atmosphere by evaporation and transpiration.

2.9.1 Existing data

No registration of evapotranspiration data exists under SMHI responsibility. But calculation of potential evapotranspiration is publicised by SMHI in an RMK-report (Eriksson, 1981). The report give information on daily values of potential evapotranspiration calculated for a number of Swedish weather stations. The results presented in tables are monthly and annual means for the period 1961–1978.

Nyköping

Station no	Station name	Co-ordinates	Period	Annual mean
8648	Nyköping flp	651837 156409	1961–1978	563 mm

Östhammar

Station no	Station name	Co-ordinates	Period	Annual mean
9846	Norrtälje	662916 166303	1961-78	511 mm
9753	Uppsala flp	664306 159991	1961-78	545 mm
9752	Uppsala	663902 160180	1961-78	537 mm

Oskarshamn

Station no	Station name	Co-ordinates	Period	Annual mean
7647	Västervik	640721 154670	1961-78	578 mm

Tierp

Station no	Station name	Co-ordinates	Period	Annual mean
10740	Gävle	672698 157443	1961-78	535 mm
9753	Uppsala flp	664306 159991	1961-78	545 mm
9752	Uppsala	663902 160180	1961-78	537 mm

Hultsfred

Station no	Station name	Co-ordinates	Period	Annual mean
7524	Målilla	636291 150033	1961-78	551 mm

Älvkarleby

Station no	Station name	Co-ordinates	Period	Annual mean
10740	Gävle	672698 157443	1961-78	535 mm

2.9.2 Methods for data collection

Observation on actual evaporation is done only in special research basins either by SMHI or by universities working in the field of hydrology. But a well-used method to calculate actual evapotranspiration is hydrological modelling by use of any rainfall-runoff model. One of them is the HBV model in use at SMHI since late 1970-ies. It uses temperature, precipitation and discharge data to calibrate a number of free parameters. To fit the model normally 10-20 years of data is enough for the calibration process. The model can after calibration be used to estimate evaporation, soil moisture content, runoff, water level, etc. The HBV model is described in several documents and reports (Bergström, 1976), (Bergström, 1992).

Background data needs

Measurements of temperature, precipitation and discharge covering a period of at least 10–20 years to be used in the calibration process. The statistical data described in chapters 2.1, 2.6 and 2.11 all give enough information to perform modelling with the HBV rainfall-runoff model in any runoff basin in the 6 communities.

Time schedule

A model set-up and calibration is a process of up to two weeks for each calibrated basin. The time schedule is depending on how detailed the each subbasin is divided.

Potential resources

Organisations with experience from hydrological modelling with the HBV-model.

Data processing

Collection of hydrometeorological data, including precipitation, temperature, discharges and water levels, for a period of at least 10–20 years. Information on potential evapotranspiration can also be of use but only on a monthly statistical basis.

2.9.3 Conclusion

As data is missing and new installation and collection of new data is costly the most cost-efficient way to find out information on actual evaporation is to use a hydrological model. A set-up of the HBV-model in areas of interest can also be used to find out information on other parts of the hydrological cycle as soil moisture content, runoff from basins, water level in lakes, etc.

2.10 In- and outflow areas

Areas where water flows in to or out from groundwater storage.

2.10.1 Existing data

No data exists in SMHI databases.

2.10.2 Conclusions

SMHI has no experience from measurements on inflow and outflow areas. Swedish Geological Survey, SGU, is responsible for the Swedish ground water database.

2.11 Statistical temperature

Temperature measured at certain times during the day is used for calculation of daily mean temperatures. Statistical information includes mean and extremes at a given site for day, month, year or other period.

2.11.1 Existing data

Temperature is recorded at least twice a day, morning and evening, as well as the maximum and minimum temperature for every day and night at the observing stations. These are the minimum numbers of observations you need to have to be able to calculate the daily mean temperature. Some stations have more frequent observing hours, up till every hour. In order to ensure comparability between data collected at stations all over the world as well as to provide a long-term reference value or 'normal' with which shorter-term (e. g. monthly) data can be compared the members of the World Meteorological Organization (WMO) have agreed to process data over uniform standard periods. Annual mean in the following tables are therefore calculated for the period 1961-90.

The following temperature parameter is analysed in the MESAN (see: 2.1.1):

- Temperature 2 meter above ground level

Nyköping

Station no	Station name	Co-ordinates	Period	Annual mean
8745	Landsort	651522 161941	1880–1995	6,2 °C
8744	Landsort A	651524 161945	1995–	
8740	Oxelösund	650684 157622	1952–	6,4 °C
8648	Nyköpings flygplats	651837 156409	1945-1978	5,6 °C
	Stigtomta fpl	651828 155638	1964-1979	

Östhammar

Station no	Station name	Co-ordinates	Period	Annual mean
10864	Öregrund	669339 164495	1949–1967	5,3 °C
10832	Örskär	671476 164097	1881-1995	5,5 °C
10832	Örskär A	671475 164099	1996–	
10811	Risinge	667533 163423	1962–	5,0 °C
10714	Films kyrkby	668149 161626	1982–	5,0 °C
10712	Dannemora	667780 161625	1963–1981	

Oskarshamn

Station no	Station name	Co-ordinates	Period	Annual mean
7722	Ölands norra udde	636108 157776	1880–1995	7,3 °C
7721	Ölands norra udde A	636089 157763	1996–	
7638	Tovehult	639101 154538	1916–1987	6,5 °C
7616	Oskarshamn	634920 153660	1918–	6,5 °C

Tierp

Station no	Station name	Co-ordinates	Period	Annual mean
10733	Fagerviken	671533 160643	1966–1978	5,1 °C
10727	Untra	670330 158437	1965–1987	5,0 °C
10718	Väsby	668790 158983	1962–1975	4,7 °C
10714	Films kyrkby	668149 161626	1982–	5,0 °C
10712	Dannemora	667780 161625	1963–1981	

Hultsfred

Station no	Station name	Co-ordinates	Period	Annual mean
7540	Vimmerby	639372 150260	1910–1989	6,0 °C
7538	Hässleby	638938 148592	1902–1987	5,6 °C
7524	Målilla	636291 150033	1947–	6,0 °C
7514	Blankaström	634338 150654	1920–1977	6,1 °C

Älvkarleby

Station no	Station name	Co-ordinates	Period	Annual mean
10744	Eggegrund	673601 159516	1881–1976, 1992–1995	5,2 °C
10744	Eggegrund A	673603 159563	1995–	
10727	Untra	670330 158437	1965–	5,0 °C

Temporal resolution

Measurements are recorded every hour for the stations denoted with A. For the remaining stations observations are taken every 3rd hour or two-three times a day, including maximum and minimum temperatures. Time period for the different stations are listed above.

Statistical properties

The observation series can give statistical output as duration curves, extremes and means on a daily, monthly or yearly basis or other selected periods.

The observations can be used to calculate good statistical data for the different locations. Information for today and in the future can also be taken from the MESAN analysis for all the communities.

Methods/models used for existing data

Temperature is measured with different types of recorders with the same accuracy. The instrumentation is briefly described in a SMHI PM by Ture Hovberg (Hovberg, 1997). The method used for the MESAN analysis is described in a SMHI report (Häggmark, Ivarsson and Olofsson, 1997).

2.11.2 Conclusions

No new data or observations should be needed for the description of the temperature climate in the different locations.

2.12 Actual temperature

Se 2.11

2.12.1 Existing data

Se 2.11.1

Nyköping

Station no	Station name	Co-ordinates	Period	Annual mean
8744	Landsort A	651524 161945	1995–	
8740	Oxelösund	650684 157622	1952–	6,4 °C

Östhammar

Station no	Station name	Co-ordinates	Period	Annual mean
10832	Örskär A	671475 164099	1996–	
10811	Risinge	667533 163423	1962–	5,0 °C
10714	Films kyrkby	668149 161626	1982–	5,0 °C

Oskarshamn

Station no	Station name	Co-ordinates	Period	Annual mean
7721	Ölands norra udde A	636089 157763	1996–	
7616	Oskarshamn	634920 153660	1918–	6,5 °C

Tierp

Station no	Station name	Co-ordinates	Period	Annual mean
10714	Films kyrkby	668149 161626	1982–	5,0 °C

Hultsfred

Station no	Station name	Co-ordinates	Period	Annual mean
7524	Målilla	636291 150033	1947–	6,0 °C

Älvkarleby

Station no	Station name	Co-ordinates	Period	Annual mean
10744	Eggegrund A	673603 159563	1995–	
10727	Untra	670330 158437	1965–	5,0 °C

Temporal resolution

Measurements are recorded every hour for the stations denoted with A. For the remaining stations observations are taken every 3rd hour or two-three times a day, including maximum and minimum temperatures. Time period for the different stations are listed above.

Statistical properties

The observation series can give statistical output as duration curves, extremes and means on a daily, monthly or yearly basis or other selected periods.

The observations represent to a certain extent, but not fully, the areas of interest, except for Nyköping. Information for today and in the future can also be taken from the MESAN analysis.

Methods/models used for existing data

Temperature is measured with different types of recorders with comparable accuracy. The instrumentation is briefly described in a SMHI PM by Ture Hovberg (Hovberg, 1997). The method used for the MESAN analysis is described in a SMHI report (Häggmark, Ivarsson and Olofsson, 1997).

2.12.2 Methods for data collection

See 2.2.2

2.12.3 Costs

See 2.2.3

2.12.4 Conclusions

If the existing data on temperature data is insufficient installations of new stations can be made either on a temporary basis for construction purpose or more stationary if a longer time series is needed.

2.13 Month with highest/lowest temperature

See 2.11 and 2.12

2.14 Number of days with ground frost

Ground frost has been measured at about 20 stations in Sweden. The measurements have been done at synoptic observing stations run by the Swedish Air Force.

2.14.1 Existing data

Ground frost has been reported once a week from two different places close to each other at every observing site. One of those has been held free from snow and at the other place the snow has been kept uncleared. The type of soil has been determined for every location.

Nyköping

Station no	Station name	Co-ordinates	Period
8637	Norrköping	649839 151819	1966–1980

Östhammar

Station no	Station name	Co-ordinates	Period
9753	Uppsala fpl	664306 159991	1966–1980

Oskarshamn

Station no	Station name	Co-ordinates	Period
6641	Kalmar fpl	628355 152965	1966–1980

Tierp

Station no	Station name	Co-ordinates	Period
9753	Uppsala fpl	664306 159991	1966–1980

Hultsfred

Station no	Station name	Co-ordinates	Period
6641	Kalmar fpl	628355 152965	1966–1980

Älvkarleby

Station no	Station name	Co-ordinates	Period
9753	Uppsala fpl	664306 159991	1966–1980

Temporal resolution

Measurements have been recorded once a week. Time period for the station is listed above.

Statistical properties

The observation series can give statistical output as duration curves, extremes and means on a monthly or yearly basis.

The observations do not fully represent the areas of interest.

Methods/models used for existing data

The ground frost has been measured with an instrument constructed at Swedish University of Agricultural Sciences, SLU, in Uppsala and is described in a report from Flygstaben (Furugård, 1983).

2.15 Average ground frost level

See. 2.14

2.16 Ice freeze-up/break-up

Information on dates for ice freeze-up or ice break-up on lakes and total number of days with ice cover. The data is collected by meteorological observers and distributed to SMHI. Some years in the information series can be missing.

2.16.1 Existing data

Nyköping

Lake	Co-ordinates	Period
Båven	653707 156202	1920->

Lake Båven is a rather big lake located in the northern part of Nyköping community, some 25 kilometres North of Nyköping.

Östhammar

Lake	Co-ordinates	Period
Norrsjön	665138 164175	1981->

There is no ice data from lakes in Östhammar community. Lake Norrsjön is the most nearby series located in Skeboån close to Knutby.

Oskarshamn

There is no ice data from lakes in Oskarshamn community.

Tierp

There is no ice data from lakes in Tierp community.

Hultsfred

Lake	Co-ordinates	Period
Gnötteln	637521 150480	1957->

Lake Gnötteln is located just 4 kilometres Northeast from Hultsfred.

Älvkarleby

There is no ice data from lakes in Älvkarleby community.

2.16.2 Methods for data collection

Detailed information on ice freeze-up/break-up is insufficient. A report describing statistics on ice freeze-up/break-up in Sweden is recently published, (Eklund, 1999). SMHI is also in the process of build-up modelling of temperature in lakes and ice coverage on lakes. A one-dimensional boundary layer model, PROBE, calculates temperature, ice formation, ice growth and ice decay for lakes or sea.

Background data needs

Input to the PROBE model is standard meteorological data available in SMHI databases. The lake is described with use of maps from sounding. These maps give information on lake area and depth topography.

2.16.3 Conclusions

Detailed information on ice freeze-up/melt-up is insufficient. Modelling of these properties can be made by use of one-dimensional boundary layer modelling.

2.17 Air pressure – tendency

Air pressure at certain times during the day are used for calculating air pressure tendency for different periods. Statistical information includes means and extremes at a given site for selected periods.

2.17.1 Existing data

Air pressure is normally recorded at least every third hour at the observing stations. The air pressure climate is similar in the whole of south of Sweden.

The following air pressure parameter is analysed in the MESAN (see : 2.1.1):

- Air pressure at sea level

Nyköping

Station no	Station name	Co-ordinates	Period
8745	Landsort	651522 161941	1880–1995
8744	Landsort A	651524 161945	1995–
8648	Nyköpings flygplats	651837 156409	1945–1978
	Stigtomta fpl	651828 155638	1964–1979

Östhammar

Station no	Station name	Co-ordinates	Period
10864	Öregrund	669339 164495	1949–1967
10832	Örskär A	671475 164099	1996–
10714	Films kyrkby	668149 161626	1982–
10712	Dannemora	667780 161625	1963–1981

Oskarshamn

Station no	Station name	Co-ordinates	Period
7722	Ölands norra udde	636108 157776	1880–1995
7721	Ölands norra udde A	636089 157763	1996–

Tierp

Station no	Station name	Co-ordinates	Period
10714	Films kyrkby	668149 161626	1982–
10712	Dannemora	667780 161625	1963–1981

Hultsfred

Station no	Station name	Co-ordinates	Period
7524	Målilla	636291 150033	1947–

Älvkarleby

Station no	Station name	Co-ordinates	Period
10744	Eggegrund	673601 159516	1881–1976
10740	Gävle	672698 157443	1885–1995
10742	Gävle A	673398 157400	1996–

Temporal resolution

Measurements are taken every hour for the stations denoted with A after the name in the list above. For the remaining stations observations are taken every 3rd hour. Time period for the different stations are listed above.

Statistical properties

The observation series can give statistical output as duration curves, extremes and means on a daily, monthly or yearly basis or other selected periods. The observations can be used to calculate good statistical data for the different locating sites. Information for today and in the future can be taken from the MESAN analysis.

Methods/models used for existing data

Air pressure tendency is recorded from air pressure measurements. The instrumentation is briefly described in a SMHI PM by Ture Hovberg (Hovberg, 1997). The method used for the MESAN analysis is described in a SMHI report (Häggmark, Ivarsson and Olofsson, 1997).

2.17.2 Conclusions

No new data or observations should be needed for the description of the air pressure tendency climate in the different locations.

2.18 Wind velocity

Wind velocity is measured at certain times during the day. Statistical information including means and extremes at a given site can be derived from the measurements.

2.18.1 Existing data

Wind velocity is normally recorded at least every third hour at the observing stations.

The following wind velocity parameters are analysed in the MESAN (see : 2.1.1):

- Wind velocity
- Gust wind
- U-component of wind
- V-component of wind

Nyköping

Station no	Station name	Co-ordinates		Period
8745	Landsort	651522	161941	1880–1995
8744	Landsort A	651524	161945	1995–
8648	Nyköpings flygplats	651837	156409	1945–1978
	Stigtomta fpl	651828	155638	1964–1979

Östhammar

Station no	Station name	Co-ordinates		Period
10864	Öregrund	669339	164495	1949–1967
10832	Örskär	671476	164097	1881-1995
10832	Örskär A	671475	164099	1996–
10714	Films kyrkby	668149	161626	1982–
10712	Dannemora	667780	161625	1963–1981

Oskarshamn

Station no	Station name	Co-ordinates		Period
7722	Ölands norra udde	636108	157776	1880–1995
7721	Ölands norra udde A	636089	157763	1996–

Tierp

Station no	Station name	Co-ordinates		Period
10714	Films kyrkby	668149	161626	1982–
10712	Dannemora	667780	161625	1963–1981

Hultsfred

Station no	Station name	Co-ordinates	Period
7524	Målilla	636291 150033	1947–

Älvkarleby

Station no	Station name	Co-ordinates	Period
10744	Eggegrund	673601 159516	1881–1976, 1992–1995
10744	Eggegrund A	673603 159563	1995–
10742	Gävle A	673398 157400	1996–
10740	Gävle	672698 157443	1885–1995

Temporal resolution

Measurements are taken every hour at the stations denoted with A and normally every 3rd hour at the remaining stations. Time period for the different stations are listed above.

Statistical properties

The observation series can give statistical output as duration curves, extremes and means on a daily, monthly or yearly basis or other selected periods. The observations can be used to calculate good statistical data for the different locating sites. Information for today and in the future can be taken from the MESAN analysis.

Methods/models used for existing data

The instrumentation for measuring wind velocity is briefly described in a SMHI PM by Ture Hovberg (Hovberg, 1997). Statistical information can also be computed for the exact locations. The method used for the MESAN analysis is described in a SMHI report (Häggmark, Ivarsson and Olofsson,1997).

2.18.2 Conclusions

No new data or observations should be needed for the description of the wind velocity climate in the different locations.

2.19 Wind direction

Wind direction is recorded at least every 3rd hour at the observing stations. Statistical information including wind roses at a given site can be derived from the measurements.

2.19.1 Existing data

Wind direction is normally recorded at least every third hour at the observing stations.

The following wind direction parameter is analysed in the MESAN (see : 2.1.1):

- U-component of wind
- V-component of wind

Nyköping

Station no	Station name	Co-ordinates	Period
8745	Landsort	651522 161941	1880–1995
8744	Landsort A	651524 161945	1995–
8648	Nyköpings flygplats	651837 156409	1945–1978
	Stigtomta fpl	651828 155638	1964–1979

Östhammar

Station no	Station name	Co-ordinates	Period
10864	Öregrund	669339 164495	1949–1967
10832	Örskär	671476 164097	1881–1995
10832	Örskär A	671475 164099	1996–
10714	Films kyrkby	668149 161626	1982–
10712	Dannemora	667780 161625	1963–1981

Oskarshamn

Station no	Station name	Co-ordinates	Period
7722	Ölands norra udde	636108 157776	1880–1995
7721	Ölands norra udde A	636089 157763	1996–

Tierp

Station no	Station name	Co-ordinates	Period
10714	Films kyrkby	668149 161626	1982–
10712	Dannemora	667780 161625	1963–1981

Hultsfred

Station no	Station name	Co-ordinates	Period
7524	Målilla	636291 150033	1947–

Älvkarleby

Station no	Station name	Co-ordinates	Period
10744	Eggegrund	673601 159516	1881–1976
10744	Eggegrund A	673603 159563	1995–
10740	Gävle	672698 157443	1885–1995
10742	Gävle A	673398 157400	1996–

Temporal resolution

Measurements are taken every hour at the stations denoted with A and normally every 3rd hour at the remaining stations. Time period for the different stations are listed above.

Statistical properties

The observation series can give statistical output as wind roses on a monthly or yearly basis or other selected periods. The observations can be used to calculate good statistical data for the different locating sites. Correct information for today and in the future can be taken from the MESAN analysis.

Methods/models used for existing data

The instrumentation for measuring wind direction is briefly described in a SMHI PM by Ture Hovberg (Hovberg, 1997). Statistical information can also be computed for the exact locations. The method used for the MESAN analysis is described in a SMHI report (Häggmark, Ivarsson and Olofsson, 1997).

2.19.2 Conclusions

No new data or observations should be needed for the description of the wind direction climate in the different locations.

2.20 Duration of sunshine

Sunshine is registrated continuously or recorded on an hourly basis. Statistical information including means and extremes can be derived from the data at a given site for day, month and year.

2.20.1 Existing data

Duration of sunshine is normally registrated continuously or recorded every hour at the observing stations. In order to ensure comparability between data collected at stations all over the world as well as to provide a long-term reference value or 'normal' with which shorter-term (e. g. monthly) data can be compared the members of the World Meteorological Organization (WMO) have agreed to process data over uniform standard periods. Annual mean in the following tables are therefore calculated for the period 1961-90.

Nyköping

Station no	Station name	Co-ordinates	Period	Annual mean
8665	Norrköping	649525 151987	1955–	1765 h
9873	Stockholm	658315 162863	1908–	1821 h

Östhammar

Station no	Station name	Co-ordinates	Period	Annual mean
	Uppsala-Marsta		1953–1990	
	Uppsala-Ultuna		1963–	1698 h
9873	Stockholm	658315 162863	1908–	1821 h

Oskarshamn

Station no	Station name	Co-ordinates	Period	Annual mean
	Ölands södra udde		1937–1995	1850 h

Tierp

Station no	Station name	Co-ordinates	Period	Annual mean
	Uppsala-Marsta		1953–1990	
	Uppsala-Ultuna		1963–	1698 h
9873	Stockholm	658315 162863	1908–	1821 h

Hultsfred

Station no	Station name	Co-ordinates	Period	Annual mean
6456	Växjö	631198 143435	1983–	1440 h

Älvkarleby

Station no	Station name	Co-ordinates	Period	Annual mean
	Uppsala-Marsta		1953–1990	
	Uppsala-Ultuna		1963–	1698 h
9873	Stockholm	658315 162863	1908–	1821 h

Temporal resolution

Measurements for some stations are taken every hour and the values represent the preceding hour. Other stations have instruments with registration papers. These are sent by post to SMHI every month and evalutated by our staff. Time period for the different stations are listed above.

Statistical properties

The observation series can give statistical output as duration curves, extremes and means on a daily, monthly or yearly basis or other selected periods. The observations can be used to calculate good statistical data for the different locating sites.

Methods/models used for existing data

Different types of standard instruments do measurements of duration of sunshine. The instruments are controlled by SMHI. Duration of sunshine can be calculated by system produced at SMHI using synoptically observations, including cloud information.

2.20.2 Conclusions

No new data or observations should be needed for the description of the sun duration climate for the different locations.

2.21 Global radiation

Global radiation is recorded on an hourly basis. Statistical information including means and extremes can be derived from the data at a given site for day, month, year and other period.

2.21.1 Existing data

Global radiation is normally recorded every hour at the observing stations. In order to ensure comparability between data collected at stations all over the world as well as to provide a long-term reference value or 'normal' with which shorter-term (e.g. monthly) data can be compared the members of the World Meteorological Organization (WMO) have agreed to process data over uniform standard periods. Annual mean in the following tables are therefore calculated for the period 1961-1990.

Nyköping

Station no	Station name	Co-ordinates	Period	Annual mean
8665	Norrköping	649525 151987	1975–	974,9 kWh/m²
9873	Stockholm	658315 162863	1922–	969,5 kWh/m²

Östhammar

Station no	Station name	Co-ordinates	Period	Annual mean
	Uppsala-Ultuna		1963–	943,4 kWh/m²
9873	Stockholm	658315 162863	1922–	969,5 kWh/m²

Oskarshamn

Station no	Station name	Co-ordinates	Period	Annual mean
7864	Visby		1958–	1066,9 kWh/m²

Tierp

Station no	Station name	Co-ordinates	Period	Annual mean
	Uppsala-Ultuna		1963–	943,4 kWh/m²
9873	Stockholm	658315 162863	1922–	969,5 kWh/m²

Hultsfred

Station no	Station name	Co-ordinates	Period	Annual mean
6456	Växjö	631198 143435	1983–	911,6 kWh/m²

Älvkarleby

Station no	Station name	Co-ordinates	Period	Annual mean
	Uppsala-Ultuna		1963–	943,4 kWh/m^2
9873	Stockholm	658315 162863	1922–	969,5 kWh/m^2

Temporal resolution

Measurements are taken every hour. Time period for the different stations are listed above.

Statistical properties

The observation series can give statistical output as duration curves, extremes and means on a daily, monthly or yearly basis or other selected periods. The observations can be used to calculate good statistical data for the different locating sites.

Methods/models used for existing data

Measurements of global radiation are done by a new automatic system since 1983. This is described in a report from Byggforskningsrådet (Josefsson, 1987). Global radiation can also be calculated by a system produced at SMHI using synoptically observations, including cloud information.

2.21.2 Conclusions

No new data or observations should be needed for the description of the global radiation climate for the different locations.

3 Lakes and Oceanography

Occurrence of lakes and available lake topographical maps are listed in this chapter. Oceanographic parameters that are crucial for the water circulation and the water quality are presented in each section. The parameters discussed are water exchange, currents, sea level variations, oxygen concentration, nutrients, stratification, light conditions, temperature and salinity.

Co-ordinates for lakes are presented in RT90-format. All co-ordinates showing oceanografical data and registrations in this chapter are in lat-long format.

3.1 Lakes

The lake database (SSR) was created 1981-83 when information from topographical maps was stored in a database. The database includes all lakes in Sweden with an area over 0.01 km^2. The co-ordinates describe the lake outlet point.

3.1.1 Existing data

For the communities Nyköping, Östhammar and Oskarshamn only lakes in or close to the potential areas are listed. The potential areas are derived from three preliminar SKB reports (Förstudie Nyköping, 1997, Förstudie Östhammar, 1997, and Förstudie Oskarshamn, 1999). As no potential areas are publicised for the other three communities Tierp, Hultsfred and Älvkarleby all the lakes within these communities are listed in the tables. All lakes are plotted on maps in Appendix 1.

Nyköping

Lake	Co-ordinates	Potential area
Sibbofjärden	651593 158749	Studsvik
Käxlan	652226 158153	Studsvik
Råsjön	651762 158220	Studsvik
Ången	651423 158019	Studsvik
Likstammen	653531 158389	Nyköping NE
Runnviken	652857 157591	Nyköping NE
Kvarndammen	653523 157904	Nyköping NE
Fräkenkärret	653509 157951	Nyköping NE
Trönsjön	653462 158219	Nyköping NE
Lästen	653478 158387	Nyköping NE
Nacksjön	653672 156735	Nyköping NW
Ålskäggaren	653601 156599	Nyköping NW
Sågsjön	653429 156685	Nyköping NW
Kvarndammen	653339 156760	Nyköping NW
Ranksjön	653351 156601	Nyköping NW
Morpasjön	653160 156392	Nyköping NW
Lagerlundssjön	653248 156585	Nyköping NW
Glottran	653193 156684	Nyköping NW
Kappstasjön	653202 157022	Nyköping NW
Eknaren	653344 157228	Nyköping NW
Rudsjön	651540 153835	Nyköping NW
Gålsjön	653120 156466	Nyköping NW
Lidsjön	653193 156015	Nyköping NV

Östhammar

Lake	Co-ordinates	Potential area
Gunnarsbo-Lillfjärden	670062 162961	Forsmark
Uddträsket	670019 162937	Forsmark
Labboträsket	669952 162973	Forsmark
Bolundsfjärden	669940 163266	Forsmark
Gällsboträsket	669875 163081	Forsmark
Vambörsfjärden	669816 163246	Forsmark
Djupträsket	669792 163077	Forsmark
Eckarfjärden	669723 163205	Forsmark
Fiskarfjärden	669681 163407	Forsmark
Långsjön	667400 163955	Hargshamn
Gisslaren	666394 164380	Hargshamn
Stordammen	667703 161604	Österbybruk
Oppdammen	667680 161672	Österbybruk
Herrgårdsdammen	667697 161622	Österbybruk
Lillsjön	667674 161864	Österbybruk
Slagsmyren	667388 161605	Österbybruk

Oskarshamn

Lake	Co-ordinates	Potential area
Lammhultesjön	634789 153278	Oskarshamn S
Torra göl	634710 153309	Oskarshamn S
St Grytgölen	634586 153391	Oskarshamn S
Tjuståsasjön	634220 153277	Oskarshamn S
Egelgöl	636245 154331	Oskarshamn N
Fjällgöl	636543 154382	Oskarshamn N
Grangöl	636617 154253	Oskarshamn N
Frisksjön	636827 154947	Oskarshamn N

Tierp

Lake	Co-ordinates	Potential area
Björkefjärd	671065 162064	
Bramsöfjärden	669683 157918	
Dalarna	671408 162145	
Degerträsket	671742 161282	
Ensjön	669972 161263	
Fillsartrusket	668801 161034	
Finnsjön	669564 161462	
Fräkensjön	671881 161389	
Fälaren	669267 161021	
Gubbenhöllsjön	671409 161953	
Hällefjärd	671219 161796	
Ingsjön	669033 157716	
Kyrksjön	668262 160535	
Käringsjön	671341 161859	
Landholmsjön	670424 161382	
Lerorna	671095 161950	
Liss-hålsjön	670987 162170	
Lissglo	671758 161241	
Lissvass	669635 161328	
Marsjön	669267 158361	
Norra Åsjön	670047 162237	
Rumsjön	670567 161354	
Själsjön	671868 161246	
Skälsjön	670108 161862	
Stora Hållsjön	671041 162215	

Storfjärden	671560	161997	
Storfjärden	672061	161621	
Strömaren	669274	160365	
Strönningsvik	670809	162181	
Sågdammen	670000	161395	
Trusksjön	669341	160090	
Trusksjön	670487	159421	
Tämnaren	667402	158923	
Untrafjärden	670297	158347	
Vendelsjön	667217	160102	
Västersjön	671713	161035	
Åkerbysjön	669828	161229	

Hultsfred

Total number of lakes in the community of Hultsfred is 351. They are listed in Appendix 2.

Älvkarleby

Lake	Co-ordinates		Potential area
Bölsjön	672024	159295	
Djupsjön	671895	158664	
Hyttödammen	671050	158242	
Stallfjärden	671710	158979	
Stensångersjön	672265	158535	
Storfjärden	671364	158841	
Trösken	672680	158573	

Spatial coverage and resolution

Information on lakes in SMHI database includes information on name, co-ordinates, topographical and economical map, main precipitation area, community, area class and notes if any.

Temporal resolution

The lake database is updated continuously.

3.1.2 Conclusions

All lakes in Sweden with an area over 0.01 km2 are stored in SMHI database. No extra data collection is needed.

3.2 Lake topography

Bottom topography of lakes. The topography can be analysed from maps produced by bottom sounding.

3.2.1 Existing data

For the communities Nyköping, Östhammar and Oskarshamn only lakes with topographical information in or close to the potential areas are listed. As no potential areas are publicised for the other three communities Tierp, Hultsfred and Älvkarleby all lakes in these communities are listed in the tables.

Nyköping

Lake	Co-ordinates	Map year	Potential area
Likstammen	653531 158389	1955, 1961	Nyköping NE
Runnviken	652857 157591	1962	Nyköping NE
Lidsjön	653193 156015	1950	Nyköping NW

Östhammar

Lake	Co-ordinates	Map year	Potential area
Eckarfjärden	669723 163205	1989	Forsmark
Fiskarfjärden	669681 163407	1989	Forsmark
Gisslaren	666394 164380	1990	Hargshamn
Stordammen	667703 161704	1990	Österbybruk
Lillsjön	667674 161864	1982	Österbybruk
Slagsmyren	667388 161605	1990	Österbybruk

Oskarshamn

Lake	Co-ordinates	Map year	Potential area
Lammhultesjön	634789 153278	1986	Oskarshamn S
St Grytgölen	634586 153391	1986	Oskarshamn S
Frisksjön	636827 154947	1986	Oskarshamn N

Tierp

Lake	Co-ordinates	Map year	Potential area
Dalarna	671408 162145	1989	
Ensjön	669972 161263	1982	
Fillsartrusket	668801 161034	1989	
Finnsjön	669564 161462	1987	
Fälaren	669267 161021	1985	
Ingsjön	669033 157716	?	
Kyrksjön	668262 160535	1990	
Käringsjön	671341 161859	1989	
Landholmsjön	670424 161382	1990	
Lissvass	669635 161328	1982	
Norra Åsjön	670047 162237	1990	
Skälsjön	670108 161862	1982	
Stora Hållsjön	671041 162215	1990	
Storfjärden	671560 161997	1989	
Storfjärden	672061 161621	1989	
Strömaren	669274 160365	1985	

Strönningsvik	670809 162181	1989	
Tämnaren	667402 158923	1964, 1990	
Untrafjärden	670297 158347	1999	
Vendelsjön	667217 160102	1990	
Åkerbysjön	669828 161229	1982	

Hultsfred

The total number of topographical maps in the community of Hultsfred is 102. They are listed in Appendix 3.

Älvkarleby

Lake	Co-ordinates	Map year	Potential area
Bölsjön	672024 159295	1981	
Djupsjön	671895 158664	1989	

Temporal resolution

The maps are not uniform and can vary in scale, size, details etc. They are normally produced by communities or other local authorities and delivered to SMHI's database. At SMHI the maps are analysed and digitised. Bottom topography and area/deep relationship is calculated.

Methods/models used for existing data

The normal method is maps created by sounding either from ice during winter or from boats during summer period. The density of the sound-lines can differ and are not uniform from map to map.

3.2.2 Methods for data collection

If bottom topography is wanted from more lakes sounding can be done either from ice or from boat. After sounding the data is analysed, preferably at SMHI. Maps with depth contour lines will be created and area/deep relationship analysed.

If the lake is big acoustic doppler method by use of ADCP-instrument can be an alternative to other more conventional sounding methods.

Potential resources

Local authorities or companies can after instruction from SMHI do the sounding. SMHI has long experience from ADCP measurement for current analysis as well as for registration on bottom topography in lakes, rivers or at sea. Equipment for bottom topography evaluations after mapping is available at SMHI and can be done on a rather short time schedule.

3.2.3 Conclusions

If the available maps in SMHI's database are not sufficient it is a rather simple process to include new lakes by any type of sounding. An efficient way to calculate topographical maps is to create a graphical area/deep relationship.

3.3 Bottom sediment

SMHI has no data on bottom sediment from lakes. This kind of data can be available from geological maps distributed by the Swedish Geological Services, SGU.

3.4 Lake water level

Water levels in lakes are registered by the hydrological network for measurements of discharge. A number of discharge stations give information on outflow from lakes and from these station also lake water stage is available.

Nyköping

No water level information is available in the potential areas of Nyköping community.

Östhammar

No water level information is available in the potential areas of Östhammar community.

Oskarshamn

Station no	Station name	Lake	Co-ordinates	Period
74-1619	Forshultesjön	Forshultesjön	634734 153084	1954->

Forshultesjön is located in Lillån 5 km west of Oskarshamn. Lillån is a tributary to Emån.

Tierp

Water level data in the lake Tämnaren in Tierp community is available from the technical office in Uppsala community.

Hultsfred

Station no	Station name	Lake	Co-ordinates	Period
73-2291	Solnen	Solnen	638341 150697	1980->

Solnen is located in Virån and about 10 kilometres north of Hultsfred.

Älvkarleby

No lake water level data is available in the Älvkarleby community.

3.4.1 Methods for data collection

New observation gauges can be installed in any lake. Data can be collected by use of different kind of water level loggers with an automatic or local collection system.

Time schedule

Installation is preferably done during the spring, summer or autumn.

Potential resources

SMHI has long experience from installation of water level measurement equipment, but also other technical companies have this competence.

Data processing

Data stored in loggers is normally emptied according to outlined program and stored in databases. Also automatic deliverance in real-time can be arranged, but then a telemetric system must be used with a mobile or stationary telephone installation.

3.4.2 Costs

Roughly estimation of costs in 1999 prize level:

Installation	25,000 SEK
Logger	30,000–40,000 SEK
Yearly maintenance	5,000 SEK

If a telemetric system is installed costs will increase depending on type of system.

3.4.3 Conclusion

Measurement on water level is insufficient. Installation of loggers for water level registration in any lake can easily be done to a modest cost.

3.5 Water exchange and currents in lakes

Water exchange in lakes can be derived from by measurements on wind, currents and rate of flow in the rivers running into the lake.

3.5.1 Existing data

No measurements on the water exchange or currents exist in any of the 6 communities. Wind data is available.

3.5.2 Methods/models for data collection

The rate of flow can be calculated from several methods. Either using a statsitical analysis of rivers in the neighborhood or by using hydrological models, which are applied on a great amount of areas. Measurements of the flow rates is also a recommended method.

Different kinds of current meters are used in current measurements. A system with several meters is anchored at the bottom and registers current speed and direction during a couple of weeks or months. If a two dimensional section shall be measured an ADCP (Acoustic Doppler Current Profiler) instrument is chosen. Also manual measurements can be made.

To get data in a dense grid and covering all different kinds of circulation the best way is to apply a numerical model to simulate currents and temperatures. SMHI has long experience of water circulation modelling, especially 3-D with the PHOENICS model. The simulations need to be validated in the chosen area.

More information on PHOENICS modelling is available in chapter 3.10 *Water exchange and currents in the sea*.

3.6 Lake water nutrients

Nutrients include nitrogen (total-nitrogen, nitrate, nitrite and ammonia), phosphorus (total-phosphorus and phosphate) and silicate. It is defined as a concentration of any of the nutrients.

3.6.1 Existing data

There are no observations from nutrients in lakes available in the 6 communities.

See chapter 3.13 *Sea water nutrients* for description on measurement and modelling on nutrients.

3.7 Lake water oxygen

Oxygen gives the concentration of oxygen in the water. It sets the condition for life in the lake.

3.7.1 Existing data

No measurements on oxygen exist in the lakes in the 6 communities.

See chapter 3.12 *Sea water oxygen* for description on measurements and modelling on oxygen parameters.

3.8 Lake light condition

Light condition is the visibility through the water mass, how much light that is transmitted over a certain distance. It gives a good information about water quality.

3.8.1 Existing data

No measurements on lake light condition exist in the lakes in the 6 communities.

See chapter 3.14 *Sea light condition* for description on measurements of the light penetration.

3.9 Temperature and stratification in lakes

Temperature data gives information about the stratification in lakes. SMHI lake temperature network is closed since some years ago. The up to then collected data does not include any lake within the 6 communities.

3.9.1 Methods for data collection

Temperature is easily measured either with recording temperature chains giving data at dense levels during a longer period or manual recording.

A one-dimensional numerical model, Probe, is a perfect tool to give a highly resoluted information about the stratification during a whole year, described in chapter 2.16 *Ice freeze-up/break-up*.

Potential resources

SMHI has long experience from temperature measurements both in lakes and in the sea.

3.9.2 Costs

Rough estimation of costs in 1999 prize level with an Aanderaa temperature chain is 5,000 SEK per month.

3.10 Water exchange and currents in the sea

Water exchange can be derived by currents, temperature and salinity measurements.

3.10.1 Existing data

Current measurements are carried out for certain projects for shorter periods, e.g. months. Because of this, the data set is irregular over time. Many of the datasets are stored in database MIMER, and some are described in reports.

Nyköping

Automatic registration current measurements were made in Örsbaken during 1980 and 1981. In addition to that, in situ measurements are made during this period.

Co-ordinates	Map year	Potential area
584141 171514	1980-1981	
584006 171246	1980-1981	

Östhammar

There are automatic registration current measurements outside Forsmark at 6 positions during 1985 and 1992 at a few months. In situ measurements are also made each month during 1970-1972 in many stations.

Co-ordinates	Map year	Potential area
602590 181110	1985-1992	
602678 180928	1985-1992	
602625 180930	1985-1992	
602500 181450	1985-1992	
602400 181600	1985-1992	
602366 181592	1985-1992	

Oskarshamn

Automatic registration current measurements were made outside Simpevarp at one station during 28 months at 3 meters depth, see map. In situ measurements were also made at several occasions during 1972–1978.

Co-ordinate	Map year	Potential area
572530 164250	1972-1978	

Tierp and Älvkarleby

See Forsmark measurements in section Östhammar. Automatic registration current measurements using older instruments ("Geodyne") were made in 1967. Results are stored as current roses in reports from that time. This gives a good statistical picture of the directions and velocities. In situ measurements were made in this area during 1966-1970. Hydrographic conditions have been mapped during 1966–1970.

Temporal resolution

The Aanderaa instruments give the current during a longer period at a fixed site. The temporal resolution is preferably between 20 and 60 minutes. ADCP gives a 2-D section at the time when the measurement is made.

Methods used for existing data

Different kinds of methods to process data are used. Data can be presented as trajectories, current roses, components or other ways suitable for the purpose.

3.10.2 Methods/models for data collection

When the current is measured with ADCP (Acoustic Doppler Current Profiler) or Aanderaa instruments. The Aanderaa instruments give the current during a longer period at a fixed site. The temporal resolution is preferably between 20 and 60 minutes. ADCP gives a 2-D section at the time when the measurement is made. Measurements of the motion of floats drifting with the current have been performed.

Information can also be simulated by applying a numerical model to calculate currents, salinities and temperatures. SMHI has long experience in water circulation modelling, especially 3-D modelling with the model PHOENICS. SMHI also has a trajectory model, which can be coupled to the circulation model to simulate outlets of different kinds.

The model system Seatrack

The trajectory model of oil and chemical spills is an optional part of the system. The model system, Seatrack, used at SMHI is developed at our institute. It is an extremely user-friendly system, which in its interior has an advanced 3 dimensional model, a weathering module, a trajectory module and a statistical module. The calculations include weathering of different kinds of oil as well as chemicals with behaviours such as passive, sinking and floating which are included in the system. The results from the analyses are trajectories covering 1 year or 10 years if there is wind data available. It also includes statistical information from a great number of trajectories, such as isolines of the risk for different parts of the area studied and isolines of the time it takes for a spill to reach different areas. It is then possible to start with the areas which are investigated and make statistics for each month from which areas the calculated spills emerge. The results are shown on maps using a well-established Geographical Information System (GIS). The model is used in open water in the sea, coastal areas, lakes and rivers.

The model Phoenics

SMHI normally uses the 3D CFD (Computerised Fluid Dynamics) model PHOENICS used in many applications. One very important project is the study of environmental and dynamical effects of the link between Denmark and Sweden. Many different solutions are studied in detail. All our results from the Link project have been examined and evaluated by an international Expert Panel of physical oceanographers giving us a high score for our calculations.

PHOENICS can be applied close to the coast in the areas including the coastal zone. Current patterns caused by large scale driving forces can be simulated with the relevant seasonal changes, as well as dynamical effects from the bottom friction, the coastline and wind pattern. The results from the simulation of different cases will be calibrated using available oceanographical and wind data.

For larger scale perspectives, 3-D model HIROMB (HIgh Resolution Ocean Model for the Baltic) can be used to forecast (48 hours ahead). Within the HIROMB project, the German Federal Maritime and Hydrographic Agency (BSH) and SMHI R&D have developed an operational ocean model, which covers the North Sea and Baltic Sea region with a horizontal resolution varies from 1 to 3 nautical miles. Atmospheric forcing is provided by HIRLAM (weather model used for forecasting in many countries including Sweden), wave forcing by HYPAS (wave model) and the open boundary forcing consists of river runoff, tides and a storm surge model, covering the north-east Atlantic. The HIROMB model system calculates daily forecasts of currents, salinity and temperature at different depths as well as sea surface elevation, ice coverage and ice thickness.

Time schedule

Installation of current meters is preferably done during spring, summer or autumn period.

The time it takes to apply a circulation model depends on how well resoluted it should be and how complicated the topography is in the area and what the results will be used for. For a model there is in all cases except for Forsmark (Östhammar) and Simpevarp (Oskarshamn) a demand for measurements of currents during 2 months (up to 5 instruments depending of sea area).

Prognoses using HIROMB can be given at any time. The model is already in operational service.

Potential resources

SMHI has long experience from installation of current meter equipment and modelling. Recently (August 1999) the environmental management programme (of which SMHI is part) for the Oresund fixed link gets top mark from independent international expert panel. The environmental management programme is highlighted as leading in its field. In accordance with preliminary investigations, the dredging and landfill activities have been planned carefully to avoid negative environmental effects. As a result the environmental impacts have been minimal. The models used for calculating the flows of salt and oxygen to the Baltic Sea have been very successful and are characterised as "state of the art" modelling (Danish Environmental and Energy minister in Danish paper Ingejeoren).

Data processing

Data stored in loggers is normally emptied according to outlined program and stored in databases. Also automatic deliverance in real-time can be arranged, but then a telemetric system must be used with a mobile or stationary telephone installation.

3.10.3 Costs

To get current data in a few sites, measurements are recommended. To get a more complete idea of the currents in an area, a circulation model is the best. The cost of designing a model is 50,000–100,000 SEK. Rough estimation of costs is in 1999 prize level.

48 hours prognoses of large-scale currents, temperature and salinity can be produced, based on qualified interpretation of HIROMB. The prize depends on what is needed.

Material, special resources

Installation incl. service of ADCP and S4 (automatic recording current meter) is 20,000 SEK per month.

Man hours

Installation and uptake: app. 15,000 SEK. If a telemetric system is installed costs will increase depending on type of system.

3.10.4 Conclusions

Existing current data are irregular both in space and time, but enough are available at two places: Forsmark (Östhammar) and Simpevarp (Oskarshamn). A circulation model PHOENICS receives the best information of the current pattern. The model needs measurements to be verified in all sites except the two mentioned, where it already exists data. There is also a possibility to use a prognosis system based on daily 48 hours forecasts by HIROMB.

3.11 Sea level variations

Sea level is measured as a height above a certain level. Corrections for land rise are made before data is stored in the database.

3.11.1 Existing data

The data are from continuous recordings by mareographs and exists in long time series, (over 100 years). Data are stored in the database SVAR, and user friendly interface for extraction exists. Data can be received in ASCII format.

Nyköping

Sea level data from Marviken and Landsort can be used directly or to calculate the sea level outside Studsvik.

Station	Co-ordinates	Map year	Potential area
Marviken	5833 1650	1964–	
Landsort	5845 1752	1886–	

Östhammar

Sea level is recorded at Forsmark.

Station	Co-ordinates	Map year	Potential area
Forsmark	6024 1814	1975–	

Oskarshamn

Sea level data from Ölands Norra Udde (since 1887) and Oskarshamn (since 1887) can be used directly or to calculate the sea level outside Studsvik.

Station	Co-ordinates	Map year	Potential area
Ölands No Udde	5722 1706	1964–	

Tierp

See Östhammar (sea level station Forsmark).

Älvkarleby

See Östhammar (sea level station Forsmark).

Temporal resolution

The recordings by the mareographs are made with one-hour interval.

Statistical properties

Programs for statistical analysis of sea level data have been developed. For example characteristic sea levels (max, min, average of max, average of min), frequency analysis and return period can be obtained.

Methods used for existing data

Mareographs are used for most existing sea level data.

3.11.2 Methods/models for data collection

Mareographs are very robust instruments. They have bases of concrete and are designed for operation during long periods (over 100 years). A cheaper way of getting sea level data, if one is not interested in data during a period longer than 10 years, is to install an Echolevel gauge instrument.

SMHI can produce sea level prognoses based on the HIROMB model. SMHI Marine Service department performs prognoses of sea level for a site.

Time schedule

Installation of Echolevel can be done during the whole year except for the winter.

Potential resources

SMHI has long experience from sea level measurements. The longest, still ongoing time serie of sea level data (since 1771) is operated by SMHI.

Data processing

Data stored in loggers is normally emptied according to outlined program and stored in databases. Also automatic deliverance in real-time can be arranged, but then a telemetric system must be used with a mobile or stationary telephone installation.

3.11.3 Costs

Roughly estimation of costs in 1999 prize level:

Installation	12,000 SEK
Instrument with recorder*	20,000 SEK
Instrument connected to computer screen	50,000 SEK

*Has to be emptied once a week.

3.11.4 Conclusions

Sea level data from mareograph stations is regularly recorded and covers long periods. It is also possible to use an Echolevel.

3.12 Sea water oxygen

Oxygen is measured as a concentration in water. It gives the conditions for life in the sea.

3.12.1 Existing data

Oxygen concentrations are measured sporadically.

Nyköping

In situ measurements of oxygen concentration are made during the measuring period weekly and monthly in the area outside Nyköping (Örsbaken).

Östhammar

Measurements are made in situ at different stations every month 1970–1972 in the area outside Forsmark.

Oskarshamn

At station REF O3V oxygen concentration is measured since 1995. Samples are taken from the surface and the bottom. At Simpevarp, measurements are made in situ at different stations 1973–1977. During 1966–1977 oxygen is measured at two stations: Hamnehalet at two levels, and at station 21 at four levels. From 1989 measurements are made at station OKG1V at the surface and the bottom.

Station	Co-ordinates	Map year	Potential area
REF O3V	5715,90 1628,80	1995–	
Area of Simpevarp	–	1973–1977	
Hamnehålet	5725,15 1641,20	1966–1977	
21	5724,75 1641,20	1966–1977	
OKG1V	5724,55 1641,70	1989–	

Tierp

In situ measurements are made at 20 occasions in 1970-1971 in the area of Norra Öregrundsgrepen.

Co-ordinates	Map year	Potential area
6038,80 1759,40	1970–1971	
6041,50 1758,50	1970–1971	

Älvkarleby

Some measurements from 18 measuring periods are made during 1966–1970. Some of these stations are within the sea area outside Älvkarleby.

Temporal resolution

At station OKG1V measurements are made every second month. Outside Forsmark and at station REF O3V oxygen samples are taken every month.

Methods used for existing data

Bottles were filled and sent to SMHI laboratory performing analyses using the Winkler method and data are stored in the database SHARK.

3.12.2 Methods/models for data collection

See above. Analysis of oxygen is done using methods in accordance with ICES/ HELCOM.

The model Scobi

A biogeochemical model, the SCOBI model, for the coastal zone, is coupled to different circulation models, PROBE (1-D) and PHOENICS (3-D) and HIROMB (3-D). The SCOBI model involves primary phytoplankton production, nitrogen fixation as well as secondary zooplankton production. It estimates ammonia, nitrate, phosphate, oxygen, phytoplankton, zooplankton and detritus. This work is a part of an integrated atmospheric-riverine-marine biogeochemical model system. SCOBI has been applied to the Hanoe Bay and shows good agreement. This model could be used to show how the oxygen concentration varies in time and space.

Time schedule

Measurements can be carried out any time. Ice might be a complication.

Potential resources

SMHI Oceanographic Laboratory is accredited by SWEDAC (Swedish Board for Accreditation and Conformity Assessment). The laboratory shows very good results in QUASIMEME, an international extensive laboratory quality assurance performance programme with over 180 participating groups.

Data processing

Data is normally stored in the database SHARK, which makes extractions of ASCII files simple.

3.12.3 Costs

Roughly estimation of costs in 1999 prize level:

Boat	1,000 SEK per day
Lab. Analyse	500 SEK per sample

If more than one parameter is included, the total prize will be lower.

3.12.4 Conclusion

Measurements of oxygen concentrations can be arranged and the quality of the reported data will be very high.

3.13 Sea water nutrients

Nutrients include nitrogen (total-nitrogen, nitrate, nitrite and ammonia), phosphorus (total-phosphorus and phosphate) and silicate. Nutrients are defined as concentration of any of the components.

3.13.1 Existing data

Most of the existing data are collected in order to see how the eutrophication affects the sea. When nutrients are mentioned, it sometimes does not include all types of nutrients.

Nyköping

Nutrient measurements were made weekly during 1980–1981 outside Nyköping in Örsbaken.

Östhammar

Measurements were made in situ at different stations every month during 1970–1972 in the area outside Forsmark. However, these measurements do not have a high quality.

Oskarshamn

At station REF O3V nutrients were measured every month since 1995. Samples were taken from the surface and the bottom.

Station	Co-ordinates	Map year	Potential area
REF O3V	5715,90 1628,80	1995–	

Tierp

Älvkarleby

Temporal resolution

See above.

Methods used for existing data

Bottles were filled and sent to SMHI Oceanographic Laboratory who performed analyses and the data is stored in database SHARK. Analyses of nutrients are done using methods in accordance with ICES/HELCOM.

3.13.2 Methods/models for data collection

See above. See also section "Methods/models for data collection" for Oxygen where the biogeochemical model SCOBI is described.

Time schedule

Samples can be taken any time during the year, except when the ice is too thick to break with the boat or too thin to hold for a person plus equipment.

Potential resources

SMHI Oceanographic Laboratory is accredited by SWEDAC (Swedish Board for Accrediation and Conformity Assessment). The laboratory shows very good results in QUASIMEME, an international extensive laboratory quality assurance performance programme with over 180 participating groups.

Data processing

Data is stored in database SHARK, which makes extractions of ASCII files simple.

3.13.3 Costs

Roughly estimation of costs in 1999 prize level:

Boat	1,000 SEK per day
Lab. analyse	500 SEK per sample

If more than one parameter is included, the total prize will be lower.

3.13.4 Conclusions

Measurements of oxygen concentrations can be arranged and the quality of the reported data will be very high.

3.14 Sea light condition

3.14.1 Existing data

Light conditions can be measured in many ways. The most frequent method used at SMHI is the secci depth. It is defined as the depth at which a secci disk (a white disk) of diameter 30-cm can be seen from the surface. Some of the secci data is stored in database SHARK. Sometimes, a transmissiometer has been used to measure the water transparency. There is also some turbidity data.

Nyköping

Secci depth measurements were performed weekly during 1980–1981 outside Nyköping in Örsbaken.

Östhammar

Secci depth and transparency measurements were made at different stations every month 1970–1972.

Oskarshamn

At station REF O3V secci depth has been measured every month since 1995.

Station	Co-ordinates	Map year	Potential area
REF O3V	5715,90 1628,80	1995–	

Tierp

In situ measurements are made at 20 occasions in 1970–1971 in the area of Norra Öregrundsgrepen.

Co-ordinates	Map year	Potential area
6038,80 1759,40	1970–1971	
6041,50 1758,50	1970–1971	

Alvkarleby

Some measurements from 18 measuring periods are made during 1966–1970. Some of the stations are within the sea area outside Älvkarleby.

Temporal resolution

See above.

Methods/models used for existing data

See "Existing data" for secci depth. Transmission was measured for white light over a distance of 50 cm. The transmissiometer is of type Philipp Schenk. Turbidity analyses have been performed at SMHI's laboratory using Sigrist photometer. There are also possibilities to make continuous measurements of transparency and turbidity.

3.14.2 Methods for data collection

Measurement of secci depth is quite simple to perform. Usually, secci depth is measured within a complete program of physical-chemical parameters such as nutrients, oxygen and salinity and temperature.

Time schedule

Can be done any time except when there is ice.

Potential resources

Experience of other types of light measurements than secci depth exists within SMHI.

Data processing

Data is normally stored in database SHARK, which makes extractions of ASCII files simple.

3.14.3 Costs

Roughly estimation of costs in 1999 prize level:

Boat	1,000 SEK per day

If more than one parameter is included, the total prize will be lower.

3.14.4 Conclusions

Measurements of secci depth can be arranged and the quality of the reported data will be very high.

3.15 Sea temperature and stratification

Temperature is easily measured and a good measure for stratification and circulation. Therefore a lot of data exist from different shorter periods.

3.15.1 Existing data

Temperature can be measured to see how the water exchange and vertical ventilation vary. Sometimes, a more complete pattern over a whole area is needed. In some areas, extensive modelling of warm water plumes from power plants has been made. Measurement and model data are stored in reports. Some data is stored in computer files and some data (Aanderaa) is stored on tape. The structure of existing data for temperature is of the same as for current data.

Nyköping

Automatic registration temperature measurements are made in Örsbaken 1980–1981 at two stations. Registration 2 times every hour at 11 levels from surface to bottom.

Weekly measurements are also stored from Grässkären (58°37,00N 17°13,40E) during 1971–1988 in 5 levels.

Co-ordinates	Map years	Potential area
5842,30 1711,50	1980–1981	
5838,95 1720,00	1980–1981	
5837,00 1713,40	1971–1988	

In situ measurements are made during this period weekly and monthly in the area outside Nyköping (Örsbaken).

Östhammar

Automatic registration temperature measurements were made outside Forsmark at different stations from the intake- and outlet area and in the sea outside Forsmark nuclear powerstation. Temperature was in 1972–1978 registrated at several levels 1–2 times every hour.

Co-ordinates	Map year	Potential area
6031,45 1801,70	parts of 1972–1978	
6031,10 1802,80	parts of 1972–1978	
6031,10 1801,70	parts of 1972–1978	
6028,70 1815,10	parts of 1972–1978	
6027,50 1810,00	parts of 1972–1978	
6027,10 1811,90	parts of 1972–1978	
6027,00 1830,40	parts of 1972–1978	
6026,75 1810,90	parts of 1972–1978	
6026,50 1809,20	parts of 1972–1978	
6026,45 1809,20	parts of 1972–1978	
6026,45 1812,20	parts of 1972–1978	
6026,40 1809,20	parts of 1972–1978	
6025,85 1810,40	parts of 1972–1978	
6025,75 1812,80	parts of 1972–1978	
6025,55 1814,50	parts of 1972–1978	
6025,50 1815,00	parts of 1972–1978	
6025,40 1814,50	parts of 1972–1978	
6023,70 1823,20	parts of 1972–1978	
6023,65 1815,00	parts of 1972–1978	
6023,60 1815,00	parts of 1972–1978	
6022,30 1819,40	parts of 1972–1978	
6021,10 1821,10	parts of 1972–1978	

Oskarshamn

Automatic registration temperature measurements were made outside Simpevarp at different stations from the intake- and outlet area and in the open sea outside Simpevarp nuclear power station. Temperature is registrated at several levels 1–2 times every hour during 1972–1978.

From 1989 until today registration measurements are made at several depths at one station Eko. Temperature is also measured in situ at one station OKG1V outside Simpevarp every second month since 1989. Levels: Surface and bottom.

Outside Oskarshamn, at station REF O3V temperature is measured every month since 1995. Levels: 1-meter intervals.

Station	Co-ordinates	Map year	Potential area
	5727,75 1643,50	parts of 1972–1978	
	5727,20 1647,10	parts of 1972–1978	
	5725,47 1642,60	parts of 1972–1978	
	5725,05 1641,30	parts of 1972–1978	
	5724,55 1642,80	parts of 1972–1978	
	5724,30 1641,20	parts of 1972–1978	
	5723,95 1639,10	parts of 1972–1978	
	5722,55 1639,50	parts of 1972–1978	
	5723,90 1639,00	parts of 1972–1978	
Eko	5724,55 1641,70	1989–	
OKG1V	5724,55 1641,70	1989–	
REF O3V	5715,90 1628,80	1995–	

Tierp

See Forsmark in section Oskarshamn. One of the listed stations lies within the area outside Tierp. In situ measurements from 20 occasions 1970–1971 are made at some stations in Norra Öregrundsgrepen. Levels: surface and bottom.

Station	Co-ordinates	Map year	Potential area
	6038,80 1759,40	1970–1971	
	6041,50 1758,50	1970–1971	

Älvkarleby

Some measurements from 18 measuring periods are made during 1966–1970. Some of the stations are within the sea area outside Älvkarleby.

Temporal resolution

See above.

Methods/models used for existing data

Temperature can be measured with several types of instruments, depending on preferred spatial or time resolution. Mainly, there are two types; registrating and in situ measurements. The first type gives the highest time resolution. The registrating instruments hold a chain where sensors are placed as dense as needed in the vertical.

Extensive modelling of temperature fields outside power plants have been done using a model called PRYCH, which is a warm water jet plume model.

3.15.2 Methods for data collection

Time schedule

Temperature measurements using registrating instrument are preferably set out during spring, summer or autumn.

Potential resources

SMHI has long experience of temperature measurements.

Data processing

Data is normally stored in database MIMER, which makes extractions of ASCII files simple.

3.15.3 Costs

Roughly estimation of costs in 1999 prize level:

Temperature and salinity chain 3,000–5,000 SEK per month

3.15.4 Conclusions

See the corresponding section for currents.

3.16 Salinity

Salinity is measured by the water's conductivity. Salinity is mainly used as an indicator for common conditions, water exchange, circulation and stratification.

3.16.1 Existing data

Nyköping

In situ measurements of salinity were made during the period weekly and monthly in the area outside Nyköping (Örsbaken). Weekly salinity measurements are also made at station Grässkären.

Station	Co-ordinates	Map years	Potential area
Grässkären	5837,00 1713,40	1971–1988	

Östhammar

Measurements are made in situ at different stations every month during 1970–1972 in the area outside Forsmark.

Oskarshamn

At station REF O3V oxygen concentration is measured since 1995. Samples are taken from surface and bottom water. At Simpevarp, measurements are made in situ at different stations 1973-1977. During 1966-1977 oxygen is measured at two stations: Hamnehålet at two levels, and at station 21 at four levels. From 1989 measurements are made at station OKG1V . Levels: Surface and bottom.

Station	Co-ordinates	Map year	Potential area
REF O3V	5715,90 1628,80	1995–	
Area of Simpevarp	–	1973–1977	
Hamnehålet	5725,15 1641,20	1966–1977	

Tierp

In situ measurements are made at 20 occasions during 1970–1971 in the area of Norra Öregrundsgrepen.

Co-ordinates	Map year	Potential area
603880 1759,40	1970–1971	
604150 1758,50	1970–1971	

Älvkarleby

Measurements from 18 measuring periods are made during 1966–1970. Some of these stations are within the sea area outside Älvkarleby.

Methods used for existing data

When salinity is measured with registration instruments, the conductivity is measured and then transformed into salinity. In situ measurements of salinity are made by analysing the water and use methods in accordance with ICES/HELCOM.

3.16.2 Methods for data collection

See 3.15.2.

3.16.3 Costs

See 3.15.3.

3.16.4 Conclusions

See 3.15.4.

4 Discussion

Measurements and data collected for many of the climatological and oceanographical variables differ not so much in the spatial resolution between the six communities. But for some of the variables the data are very sparsely collected and new measurements or model calculations must be initiated.

Concerning statistical information on precipitation, temperature and runoff the coverage in all the six communities is sufficient. If new information for any of these variables is needed in sites where no data collection is available new installations can be made at low cost. Modelling is also since many years a well-used method for calculation of these climatic variables and can complete any missing observation or data collection activity.

Snow, frost and ice break-up and freeze-in variables are not as well established as the other climatological data. If these variables are essential and needed for SKB, data collection must be initiated. Ground frost level can be modelled with reasonable accuracy by use of model applications. Evaporation is a variable normally not measured, but can be calculated for specific sites if needed.

Data describing air pressure tendency together with wind velocity and direction is available for all communities and should be sufficient for the purpose of SKB. Also the variables global radiation and duration of sunshine is available with acceptable coverage.

Lake maps showing the bottom topography are available for many of the lakes in the six communities. If any lake map is missing, old or incomplete new surveys of the bottom can easily be done with soundings during winter from ice or during summer from boat. Bottom sediment of the lakes is not measured but can be developed from geological maps.

If a special study is wanted from any lake concerning water exchange, currents, nutrients, light condition, temperature and stratification new measurements must normally be initiated. This type of data is not stored in any standard database at SMHI but can be collected and modelled in special survey activities.

Concerning coastal measurement and model activities a lot of work has been done in the three communities with nuclear power installations. These data can be used also for planning of deep disposal areas but must probably be complemented with new measurements and model set-up.

Models can be suitable not only for the details listed under the different headlines in this report but also for a number of different other applications. If data in available series are missing models can be used to fill in any gaps. They can also be used to prolong the data time series. If any evalution on the infuence in meteorology, hydrology and oceanography from future climate changes different model applications are used and can be used also for any climate change investigation for SKB.

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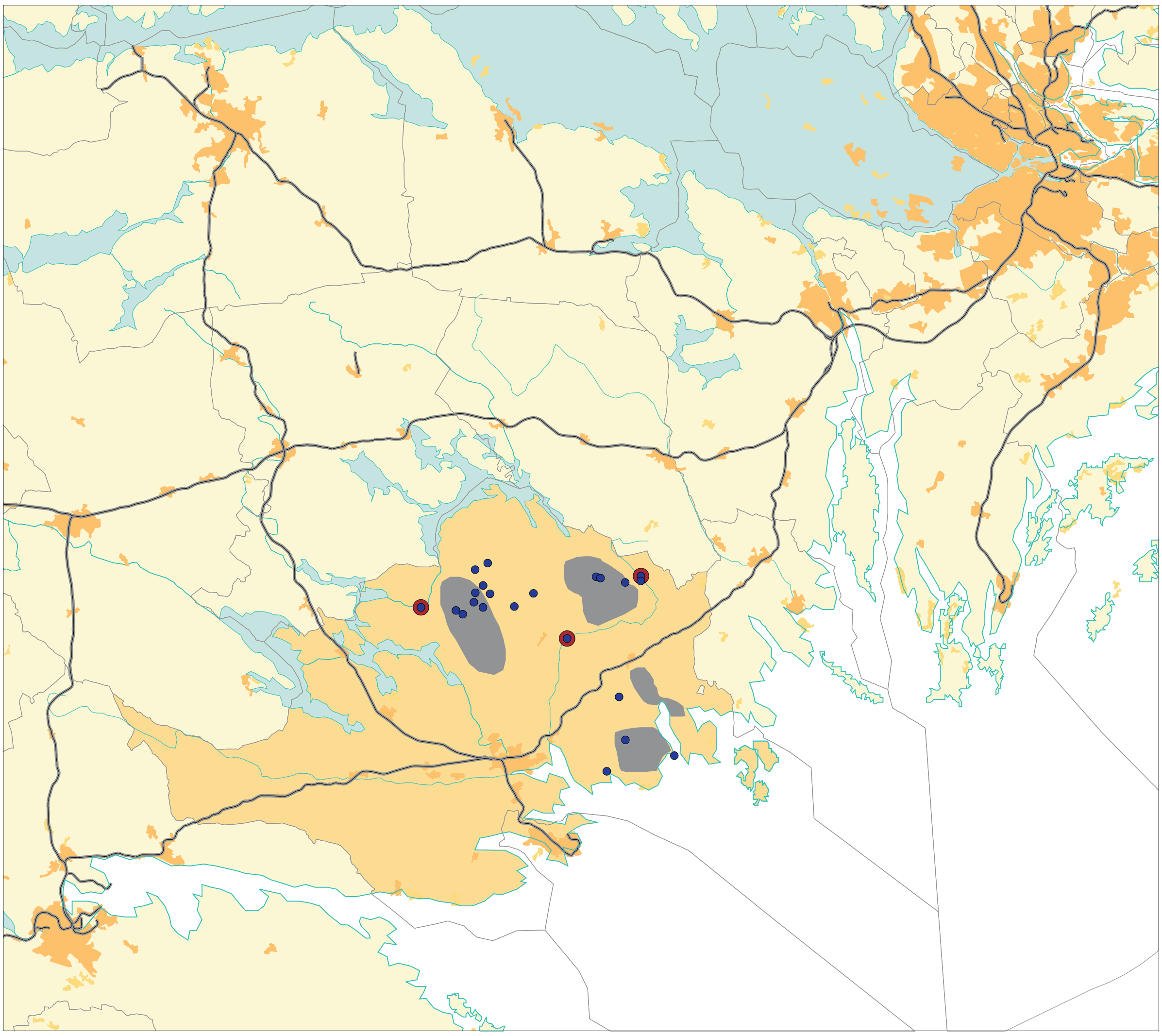
Maps

The maps show geographical location of observation sites and lakes in the six communities. A total number of 12 maps were Oskarshamn + Hultsfred, Nyköping and Älvkarleby + Tierp + Östhammar are joined together. The potential areas, as described by SKB, in Oskarshamn, Nyköping and Östhammar respectively are marked with grey.

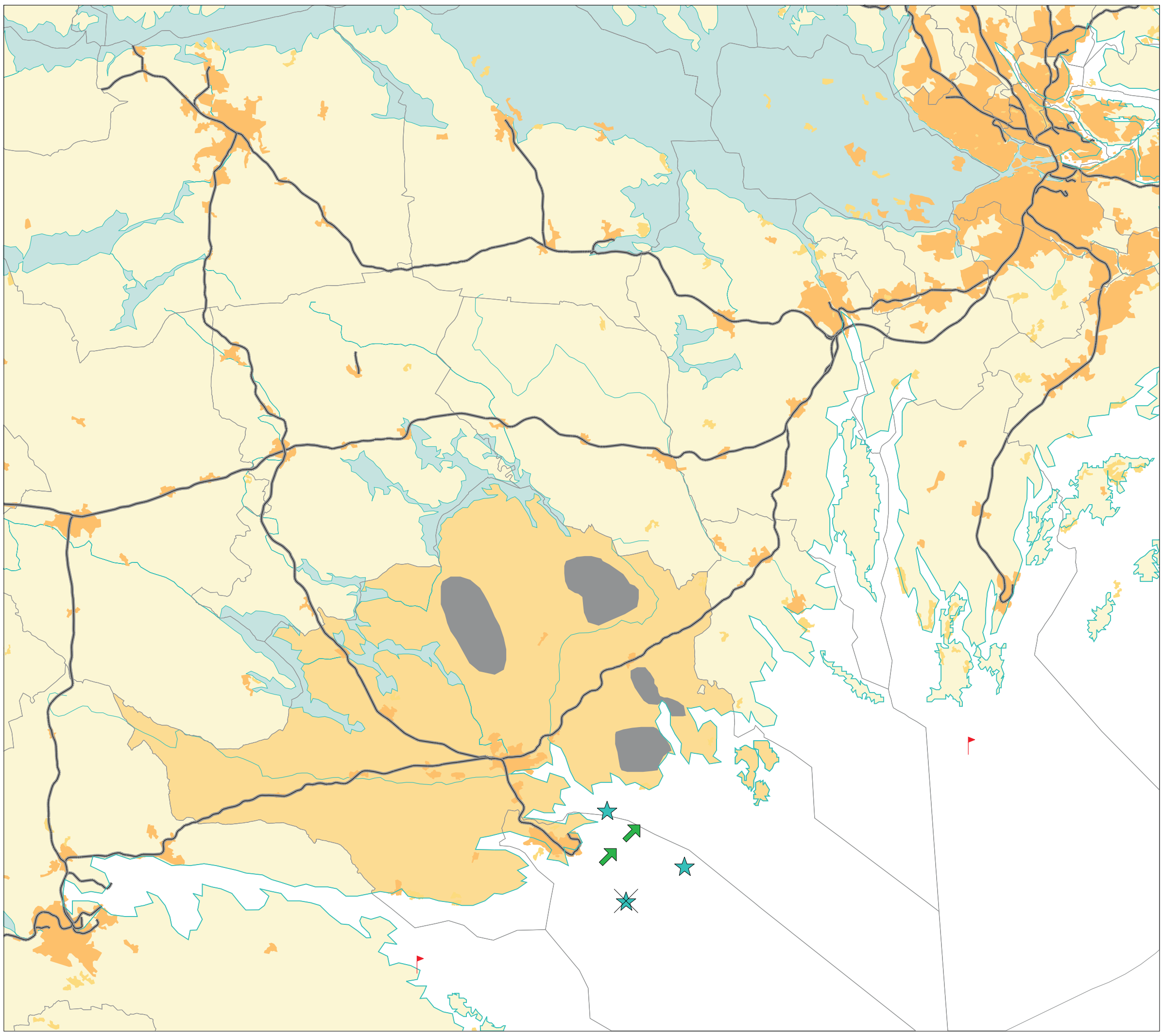
The variables are plotted on four different maps. Map type one show location of precipitation, temperature, wind, radiation and air pressure observation spots. Next maps show runoff, evapotranspiration, ice freeze up/break up and snow coverage. All lakes and map of lakes are plotted on next map. Note that only the lakes in or close to the potential areas are plotted in Nyköping, Oskarshamn and Östhammar community. The last map series presents were data spots for the oceanographical data collection program is located.



SMHI

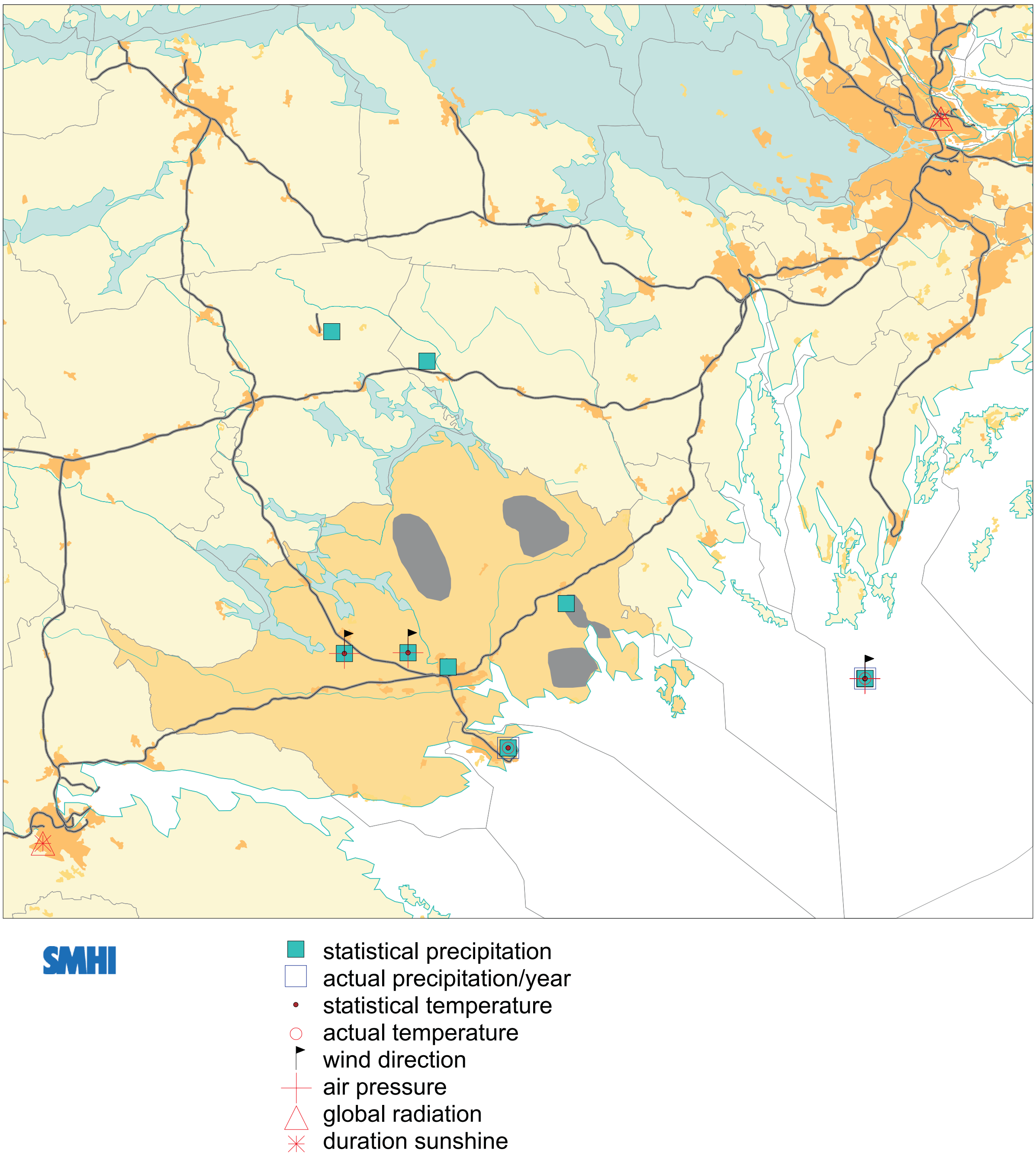
lakes
lakes with bottom topography

Lakes in Nyköping Community.

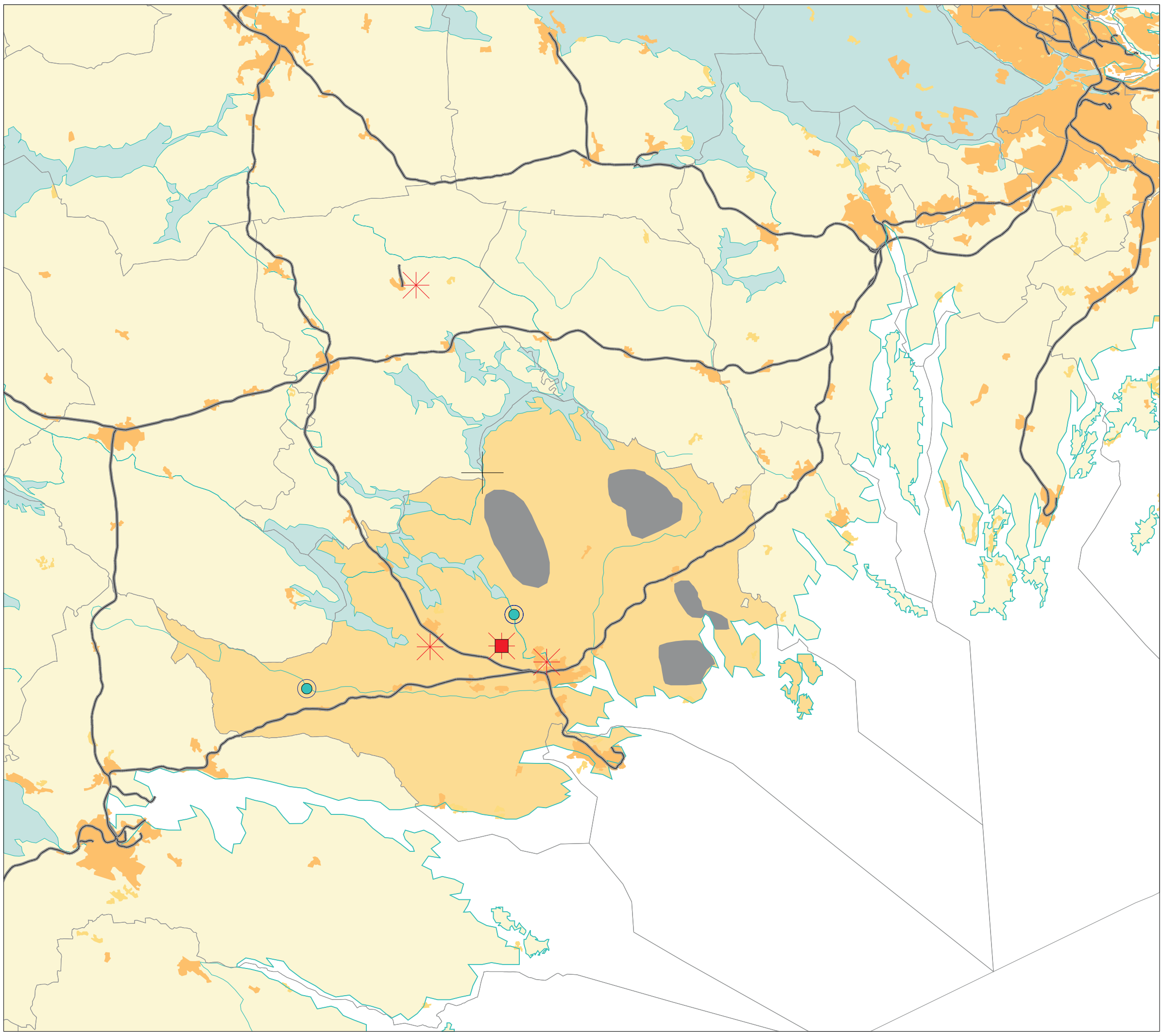


- oxygen light
- oxygen
- temperature
- nutrients
- salinity
- sea level
- water exchange

Stations in Nyköping Community Oceanography.



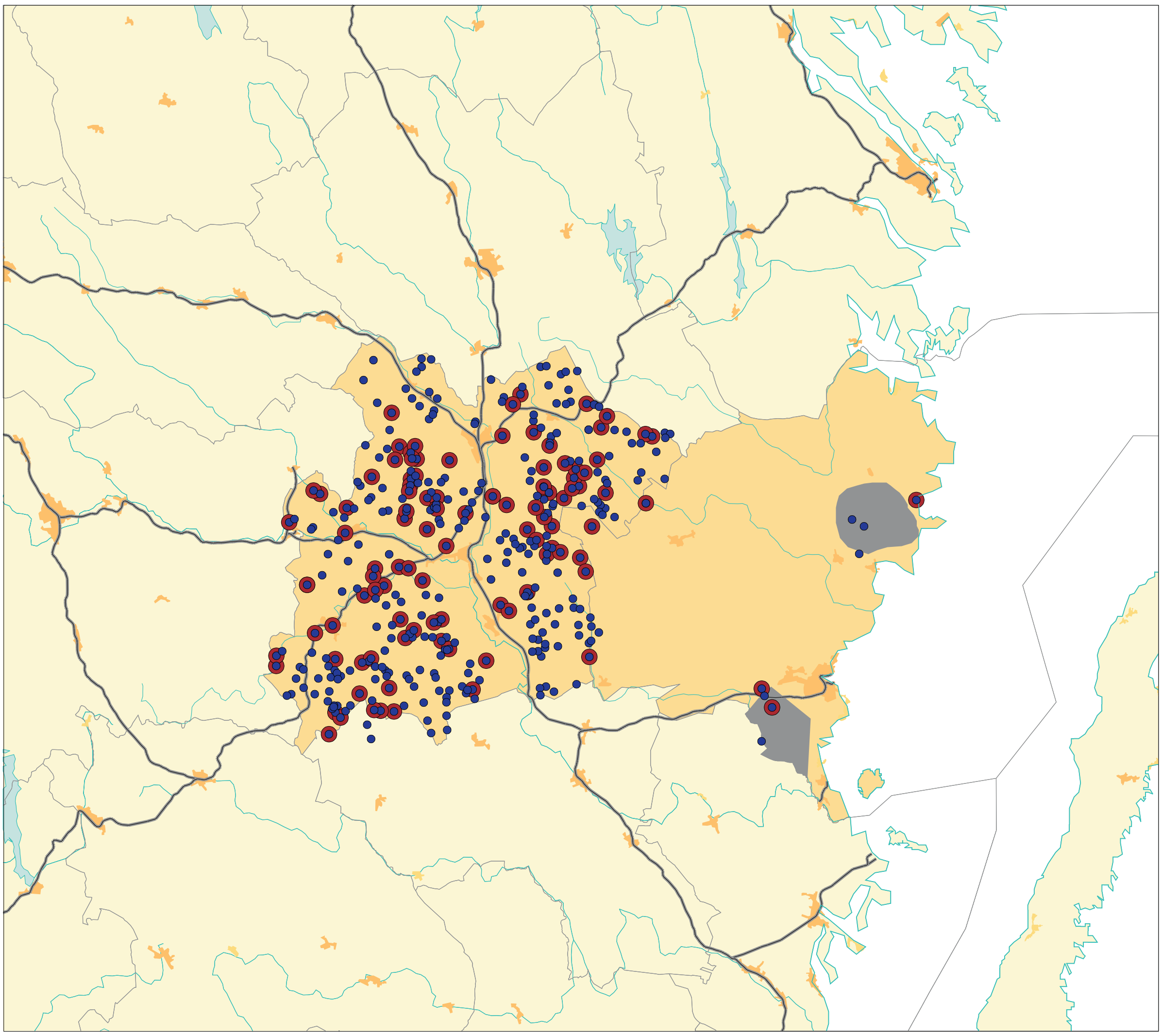
Stations in Nyköping Community. Precipitation, temperature, wind, radiation and air pressure.



SMHI

- actual runoff
- statistical runoff
- evapotranspiration
- ice freeze up/break up
- snow coverage

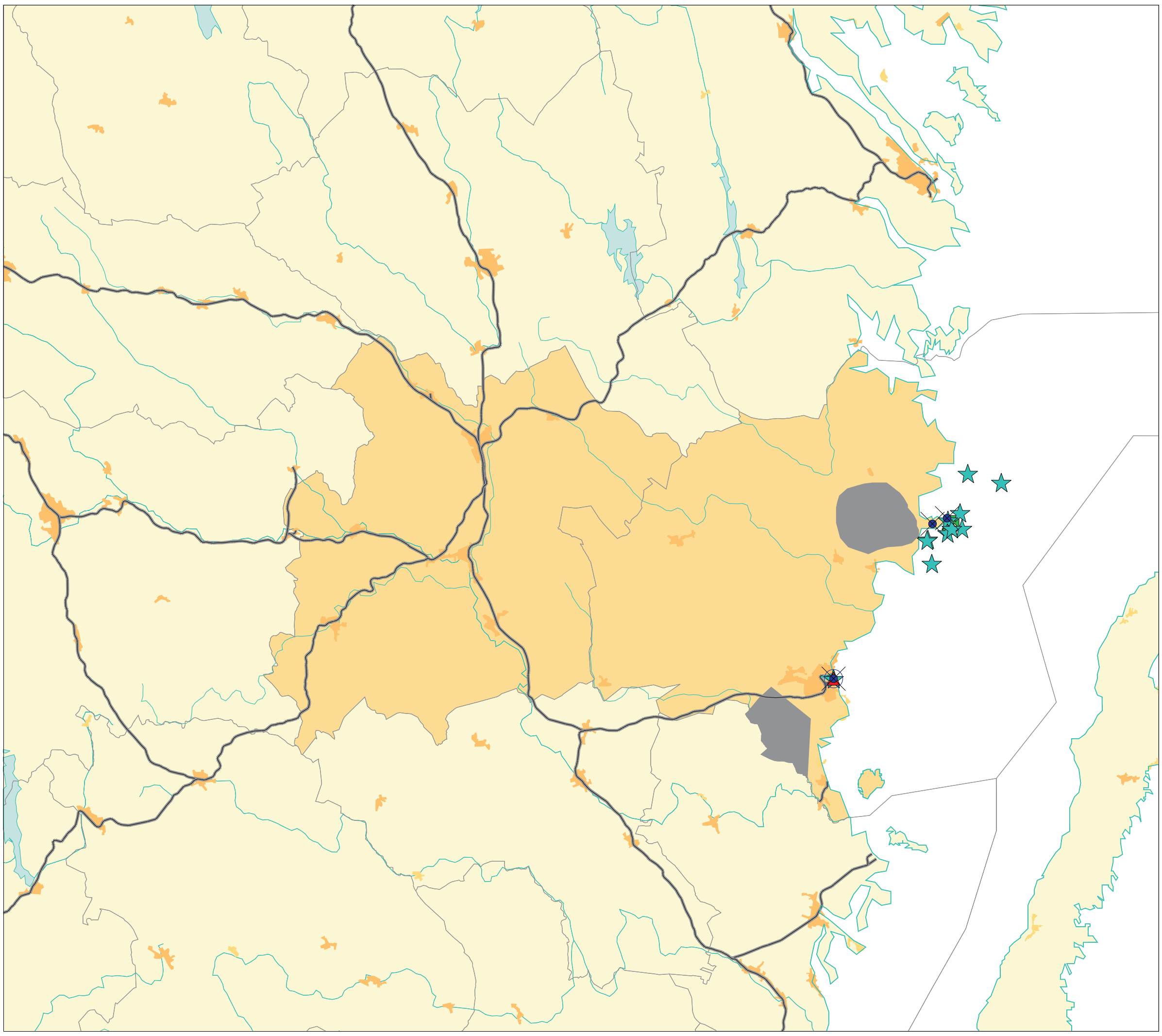
Stations in Nyköping Community. Runoff, evapotranspiration, ice freeze up/break up and snow coverage.



SMHI

- lakes
- lakes with bottom topography

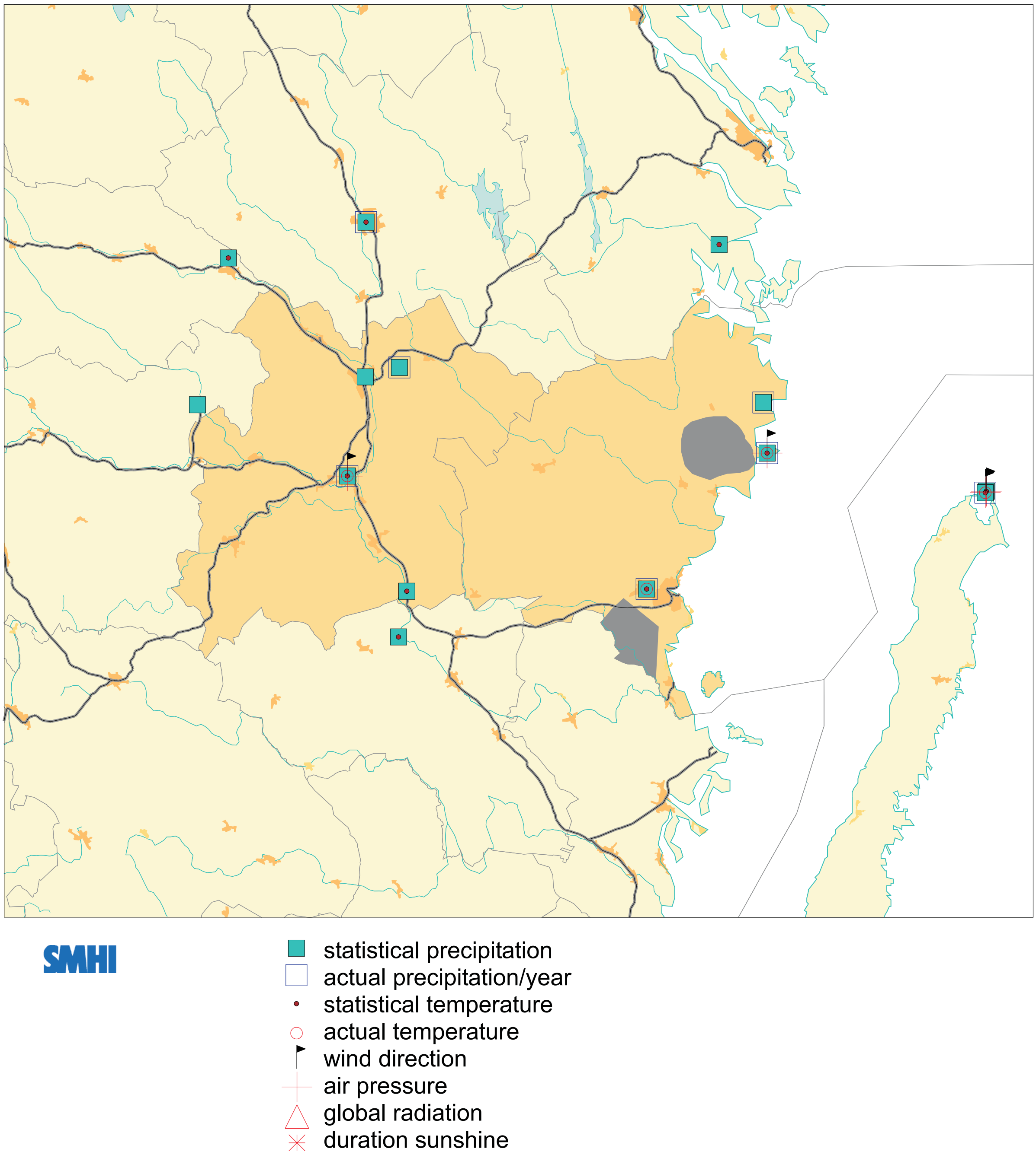
Lakes in Hultsfred and Oskarshamn Community.



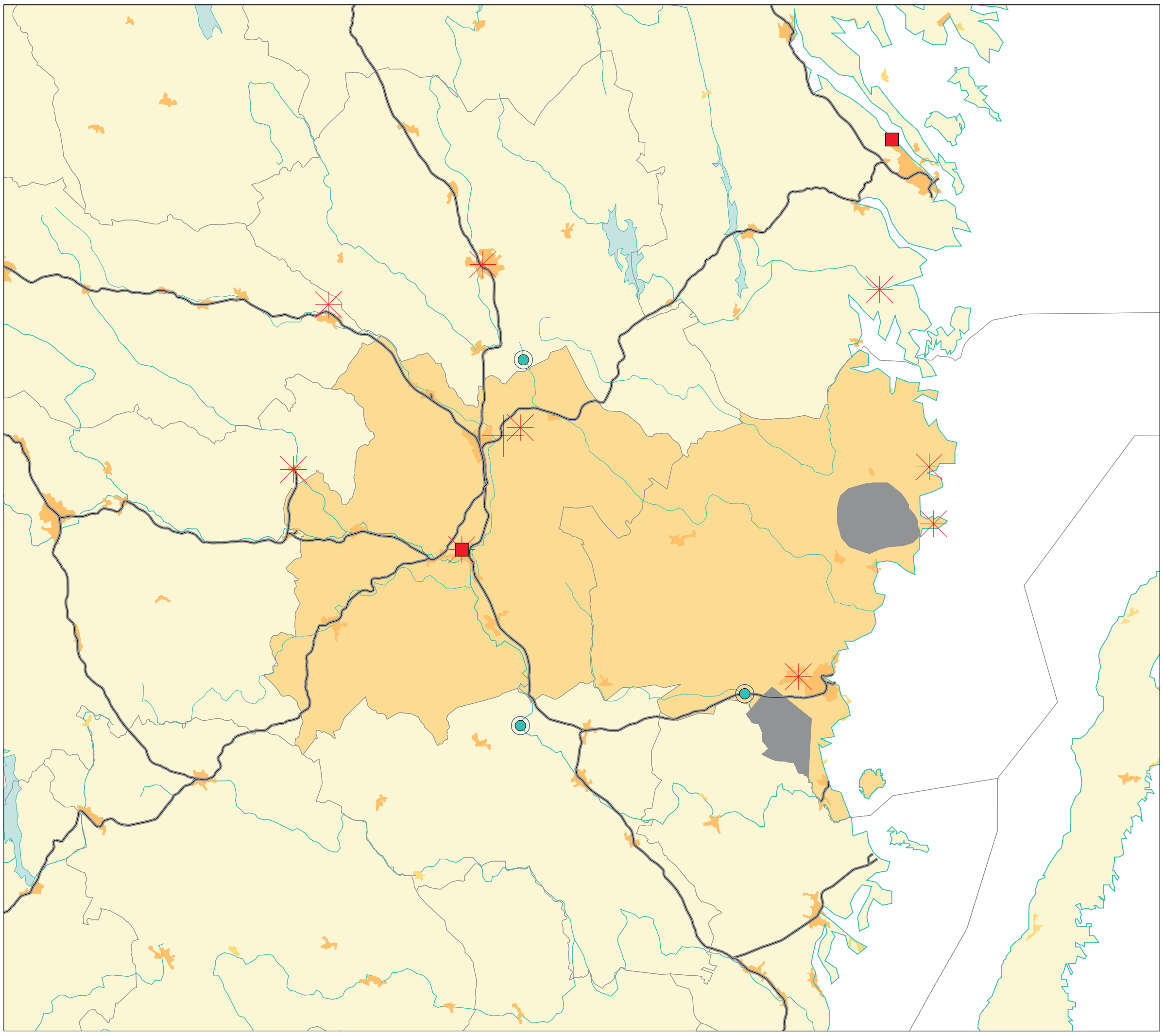
SMHI

- oxygen light
- oxygen
- temperature
- nutrients
- salinity
- sea level
- water exchange

Stations in Hultsfred and Oskarshamn Community Oceanography.



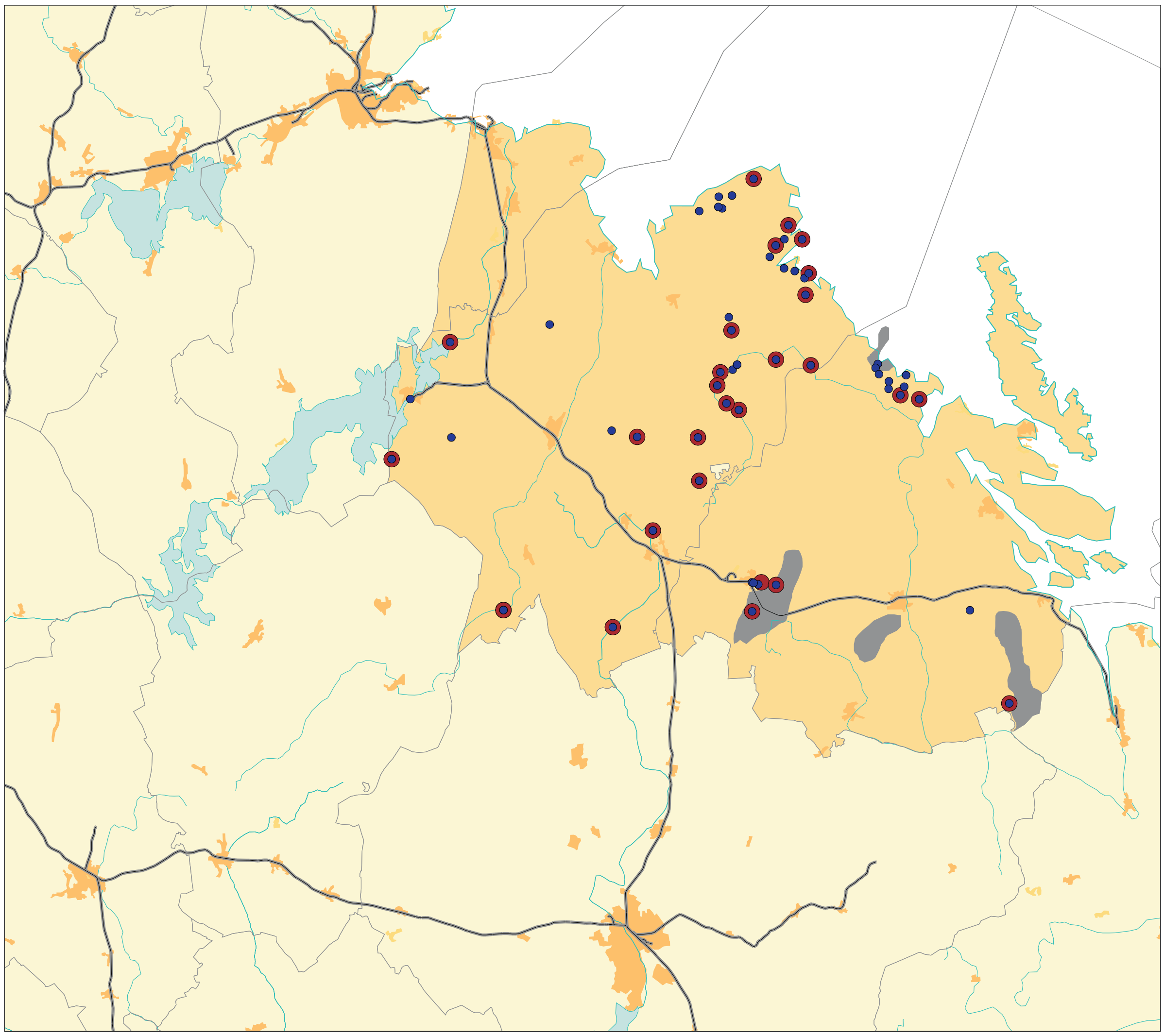
Stations in Hultsfred and Oskarshamn Community. Precipitation, temperature, wind, radiation and air pressure.



SMHI

- actual runoff
- statistical runoff
- evapotranspiration
- ice freeze up/break up
- snow coverage

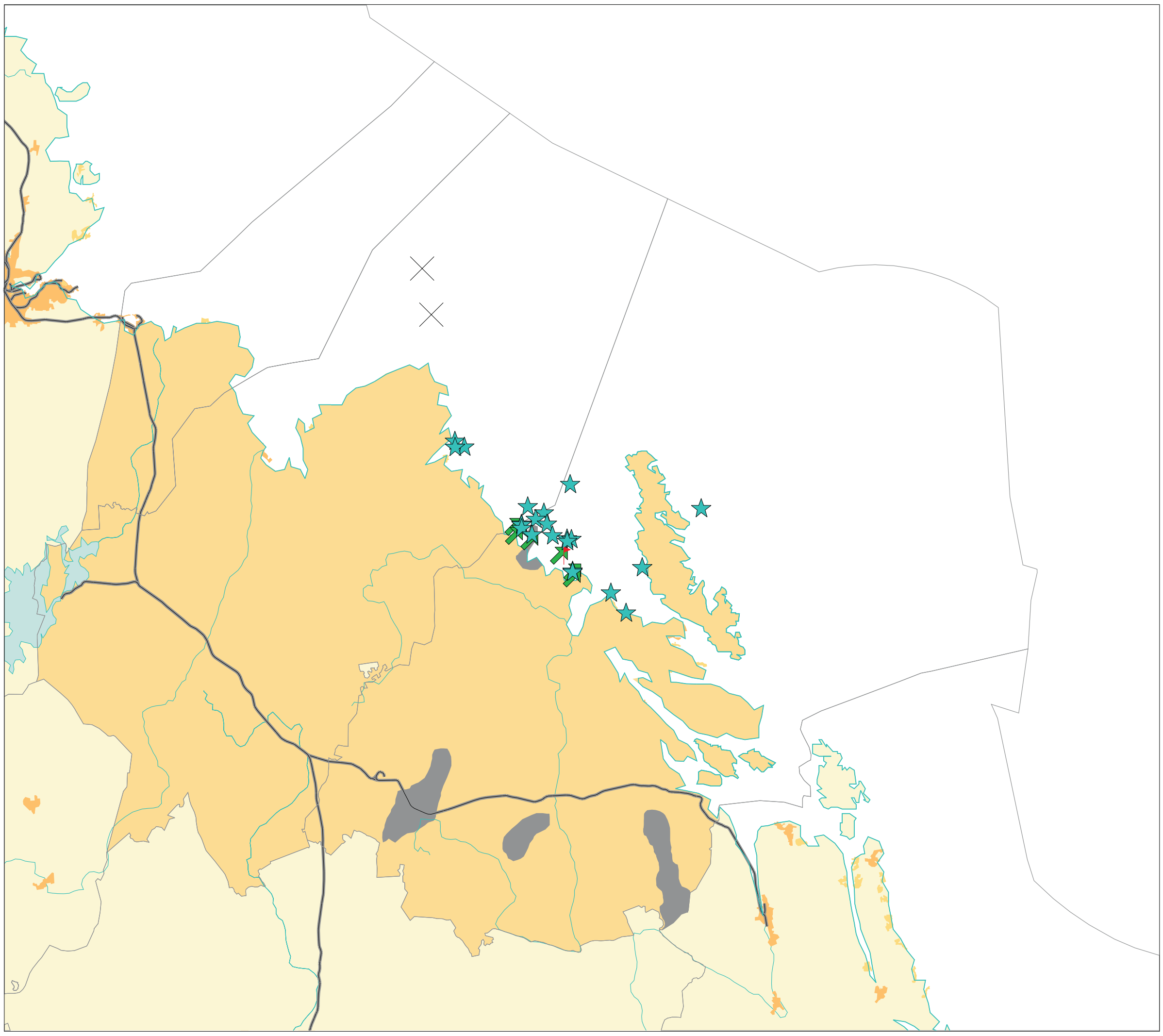
Stations in Hultsfred and Oskarshamn Community. Runoff, evapotranspiration, ice freeze up/ break and snow coverage.

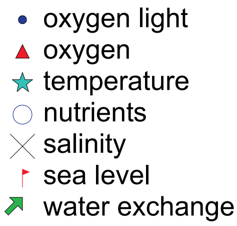


SMHI

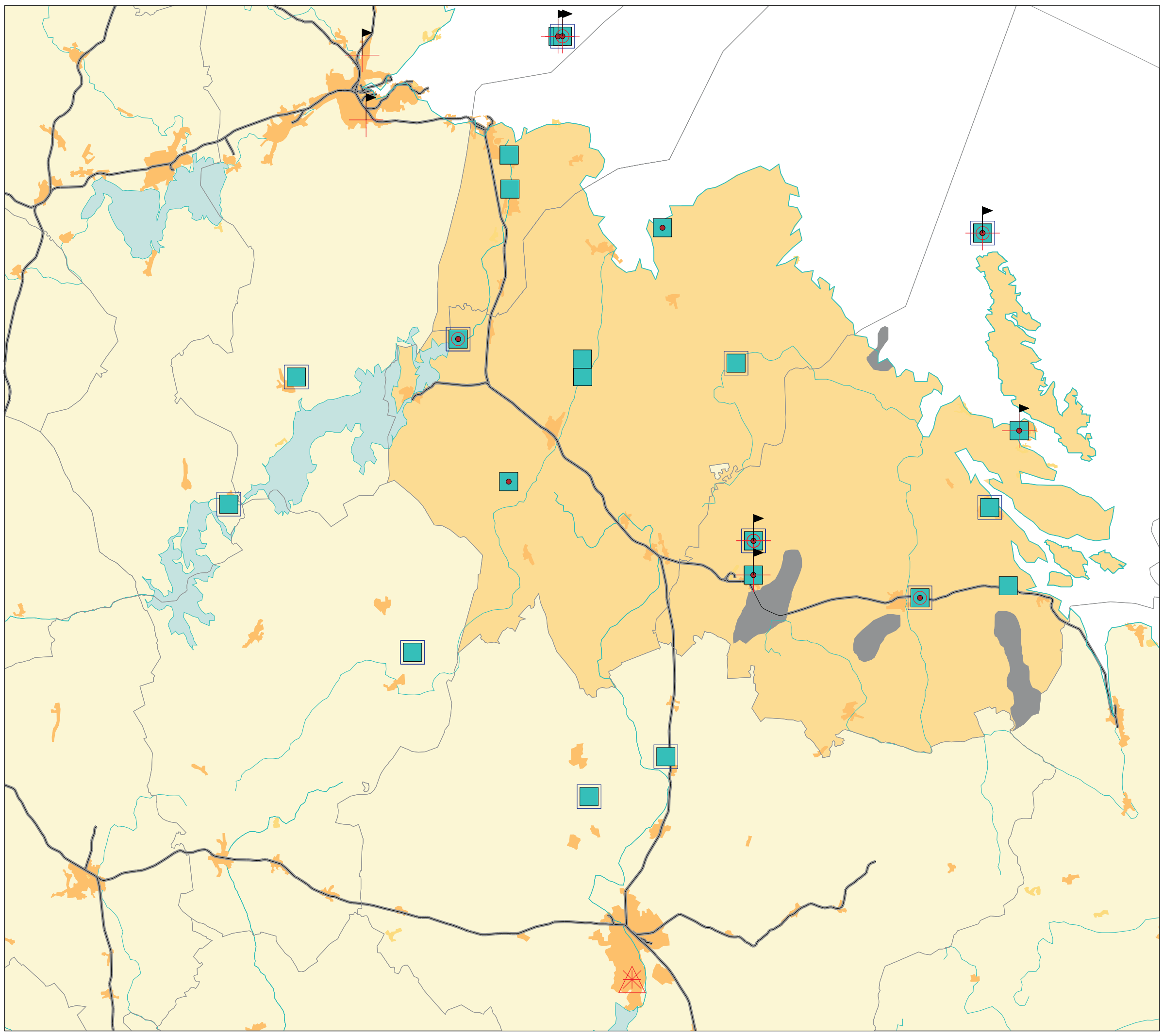
- lakes
- lakes with bottom topography

Lakes in Älvkarleby, Tierp and Östhammar Community.





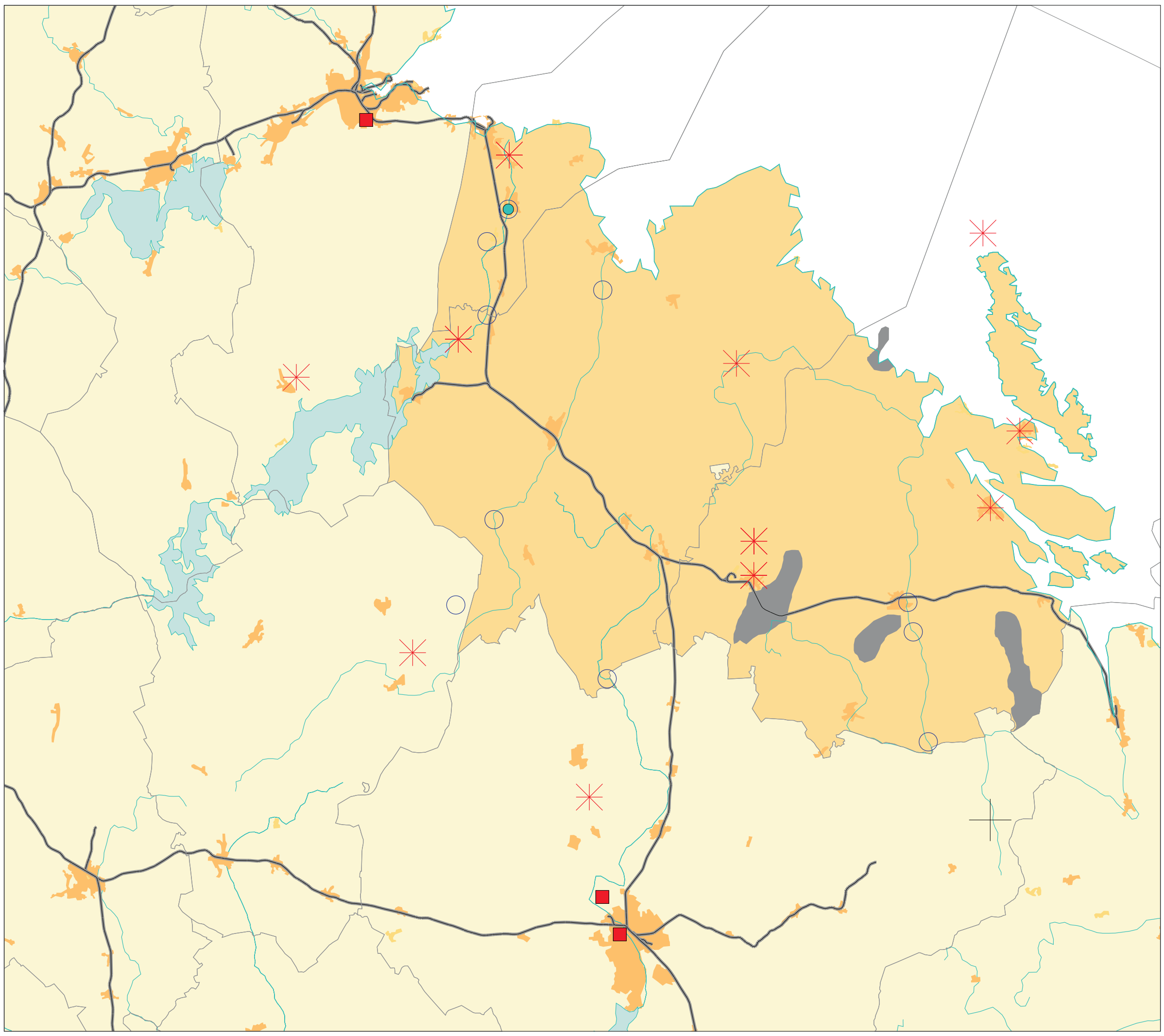
Stations in Älvkarleby, Tierp and Östhammar Community Oceanography.



SMHI

- statistical precipitation
- actual precipitation/year
- statistical temperature
- actual temperature
- wind direction
- air pressure
- global radiation
- duration sunshine

Stations in Älvkarleby, Tierp and Östhammar Community. Precipitation, temperature, wind, radiation and air pressure.



actual runoff
statistical runoff
evapotranspiration
ice freeze up/break up
snow coverage

Stations in Älvkarleby, Tierp and Östhammar Community. Runoff, evapotranspiration, ice freeze up/break up and snow coverage.

Lakes in Hultsfred community

Hultsfred community – Lakes

Name	Lake number	Top. map	Ek. map	Area class	Disch. area	County	Notes	Corr. Code
	637587 151411	06GNV	5c	E	73	8		
Abborregöl	637794 149742	06FNO	5j	E	74	8		
Abborregölen	634604 148698	05FNO	9h	E	74	8	S4	
Abborrgölen	634660 149074	05FNO	9i	E	74	8		
Alen	636150 150522	06GSV	2b	E	74	8		
Alm en	634531 148678	05FNO	9h	E	74	8		
Andgölen	635271 150942	06GSV	0b	E	74	8		
Annegöl	635343 149508	06FSO	0j	E	74	8		R87 1
Arvidsgöl	635476 151300	06GSV	0c	E	74	8	S4	
Aven	635085 149038	06FSO	0i	E	74	8	S4	
Avesjön	634477 148733	05FNO	8h	D	74	8		
Avgöl	637564 151819	06GNV	5d	E	72	8		
Barnegöl	636626 149424	06FSO	3i	E	74	8		
Bastegöl	634812 150949	05GNV	9b	E	74	8		
Bastegöl	635058 150132	06GSV	0a	D	74	8		
Berkgölen	635282 151413	06GSV	0c	E	74	8		
Bjurgölen	635397 150913	06GSV	0b	E	74	8		
Bjursjön	636394 150454	06GSV	2a	E	74	8		
Bjärkagöl	637247 151212	06GSV	4c	D	73	8		
Björksebo göl	638266 150892	06GNV	6b	E	73	8		
Björnasjön	635193 148103	06FSO	0g	E	74	8		
Björnbäcksgölen	636712 149248	06FSO	3i	E	74	8		
Björngölen	634899 148494	05FNO	9g	E	74	8		
Blågöl	638186 151112	06GNV	6c	E	72	8		
Blågöl	638347 149711	06FNO	6j	E	74	8		
Blågölen	634813 150045	05GNV	9a	D	74	8		
Blågölen	634955 149744	05FNO	9j	E	74	8		
Boasjön	637419 149002	06FSO	4i	D	74	8	L1 06	
Boda göl	634881 150233	05GNV	9a	D	74	8		
Bogöl	636761 151022	06GSV	3c	E	73	8		
Borgegöl	635484 150781	06GSV	0b	E	74	8	S1	
Bosjön	636264 150536	06GSV	2b	D	74	8		
Breda viksjön	636587 148179	06FSO	3g	D	74	8		
Bridd	635178 148424	06FSO	0g	D	74	8		
Brogöl	634729 148201	05FNO	9g	E	74	8		
Brogöl	635382 149480	06FSO	0i	E	74	8		
Brågöl	636977 151306	06GSV	3c	E	73	8		R6 90
Brå göl	636787 151029	06GSV	3c	F	73	8		K94
Byegölen	635771 149795	06FSO	1j	E	74	8		K94
Bysjön	635958 149617	06FSO	1j	D	74	8		R690
Bysjön	636242 148597	06FSO	2h	E	74	8		
Bysjön	637612 151545	06GNV	5d	D	73	8		
Böte göl	634443 149671	05FNO	8j	E	74	8		
Dalsjön	637348 152140	06GSV	4e	D	73	8		
Dammasjön	636801 150153	06GSV	3a	E	74	8		
Djupegöl	634794 150886	05GNV	9b	D	74	8		
Djupgöl	634573 148643	05FNO	9h	E	74	8		
Djupsjö	634780 150158	05GNV	9a	D	74	8		
Djupsjön	636408 150600	06GSV	2b	D	74	8		
Djupsjön	637054 149492	06FSO	4i	E	74	8		
Djursbosjön	638123 148981	06FNO	6h	D	74	8		
Egelgöl	636532 148435	06FSO	3g	E	74	8	S4	
Ekenäsegöl	637124 151978	06GSV	4d	F	73	8		K94
Eksjö	635199 149211	06FSO	0i	D	74	8		
Ellarebogöl	635800 150770	06GSV	1b	E	73	8		

Name	Lake number	Top. map	Ek. map	Area class	Disch. area	County	Notes	Corr. Code
Ellaren	635830 150749	06GSV	1b	D	73	8		
Fantegöl	637584 149262	06FNO	5i	E	74	8		
Filingen	638018 151193	06GNV	6c	D	73	8		R93
Flaten	636104 149364	06FSO	2i	C	74	8		
Flaten	638213 151163	06GNV	6c	D	72	8		
Flåtsjön	636834 150930	06GSV	3b	D	73	8		
Fotgölen	637702 149689	06FNO	5j	E	74	8		
Frögöl	635397 151520	06GSV	0d	F	74	8		94
Furan	637553 152233	06GNV	5e	E	72	8		
Fältdammen	637011 149569	06FSO	4j	E	74	8		
Färggölen	636246 150761	06GSV	2b	E	73	8		
Färgsjön	636330 150825	06GSV	2b	D	73	8		
Färgsjön	636985 149486	06FSO	3i	E	74	8		
Fåglegöl	634756 151036	05GNV	9c	E	74	8	S4	
Fårmogölen	637338 149490	06FSO	4i	E	74	8	S4	K 84
Försjö göl	636738 151590	06GSV	3d	E	73	8		
Försjön	634836 151280	05GNV	9c	D	73/74	8		
Försjön	636087 149105	06FSO	2i	D	74	8		
Försjön	636904 151593	06GSV	3d	D	73	8		
Garpen	635870 148914	06FSO	1h	E	74	8		
Gategöl	635022 148293	06FSO	0g	E	74	8		
Gategöl	635117 148578	06FSO	0h	E	74	8		
Gatsjön	637514 152096	06GNV	5e	D	72	8		
Gillen	637733 151609	06GNV	5d	D	73	8		
Gnötteln	637521 150480	06GNV	5a	C	74	8		
Gravstensgöl	636841 149401	06FSO	3i	E	74	8	S4	
Grytgöl	634891 149109	05FNO	9i	E	74	8	S4	
Grytgöl	637302 151632	06GSV	4d	E	73	8		
Grytsjögölen	634931 149447	05FNO	9i	E	74	8		
Grytsjön	634891 149473	05FNO	9i	D	74	8		
Gyllekulle göl	638067 150978	06GNV	6b	E	73	8		
Gäddgöl	637872 151065	06GNV	5c	D	73	8		
Gäddgölen	634741 150088	05GNV	9a	D	74	8		
Gäddgölen	637539 152024	06GNV	5e	E	72	8		
Gärdsjön	634988 149216	05FNO	9i	D	74	8		
Gärssjögölen	637541 152291	06GNV	5e	E	72	8		
Gåpen	634735 148938	05FNO	9h	D	74	8		K85
Gödingegöl	634985 148834	05FNO	9h	E	74	8		
Gölebogöl	635800 149654	06FSO	1j	E	74	8		
Gölen	636167 148814	06FSO	2h	E	74	8		
Gölen	637877 149128	06FNO	5i	E	74	8		
Hagelsgöl	637139 150794	06GSV	4b	E	74	8		
Halmten	637035 150776	06GSV	4b	D	74	8		
Hareputtegöl	636735 148879	06FSO	3h	E	74	8		
Havregöl	635580 149609	06FSO	1j	E	74	8		
Hedasjö	634543 149310	05FNO	9i	D	74	8		
Hemgöl	636686 150969	06GSV	3b	E	73	8	S4	
Hemgölen	635655 151091	06GSV	1c	E	74	8		
Hemsjön	638274 150954	06GNV	6b	D	73	8		
Hesjön	636330 149874	06FSO	2j	D	74	8		
Hjortesjön	635388 148457	06FSO	0g	C	74	8		
Hjortgölen	634759 148611	05FNO	9h	E	74	8		
Hjältan	637045 151591	06GSV	4d	E	73	8		
Holmsjön	634958 150112	05GNV	9a	D	74	8		
Holmsjön	635605 150955	06GSV	1b	D	74	8		
Holmsjön	636703 149444	06FSO	3i	D	74	8		
Horsgölen	636735 149448	06FSO	3i	E	74	8		
Hulingen	636866 150376	06GSV	3a	C	74	8	N2	
Hultarpsgöl	635838 148749	06FSO	1h	E	74	8		
Hultemaren	635336 149433	06FSO	0i	D	74	8		

Name	Lake number	Top. map	Ek. map	Area class	Disch. area	County	Notes	Corr. Code
Hyltasjön	636545 151015	06GSV	3c	D	73	8		
Hällefors damm	637994 149690	06FNO	5j	D	74	8		
Hällegöl	634718 150890	05GNV	9b	E	74	8	S4	
Hällemaren	635303 149823	06FSO	0j	D	74	8		
Hällerumgölen	637443 150992	06GSV	4b	E	73	8		
Hällesjön	637515 151004	06GNV	5b	E	73	8		
Hästhagsgölen	637748 150818	06GNV	5b	E	73	8	S4	
Håvegöl	635136 150899	06GSV	0b	E	74	8		
Håvgölen	634775 150103	05GNV	9a	D	74	8		
Igelhultegöl	636643 151690	06GSV	3d	D	73	8		
Igelsjön	637078 149070	06FSO	4i	D	74	8		
Illern	636541 151446	06GSV	3c	C	73	8	N2	
Ingebosjön	635132 151419	06GSV	0c	D	74	8		
Ingegöl	635557 151429	06GSV	1c	E	74	8		
Järnsjön	636472 148783	06FSO	2h	D	74	8		
Kalvgölen	636763 151335	06GSV	3c	E	73	8		
Kaskegöl	638338 149088	06FNO	6i	E	74	8		
Kavlegöl	637937 150496	06GNV	5a	E	73	8		
Klevbergsgöl	636621 148236	06FSO	3g	E	74	8		
Knaplegölen	637888 151216	06GNV	5c	E	73	8		
Kogöl	635485 151047	06GSV	0c	E	74	8		
Koppgölen	637498 152237	06GSV	4e	D	72	8		
Kringelgöl	636773 151538	06GSV	3d	E	73	8		
Krokan	636614 149794	06FSO	3j	E	74	8		
Krokgölen	634679 150181	05GNV	9a	D	74	8		
Kroksjön	634991 149590	05FNO	9j	E	74	8		
Kungsgölen	634769 149907	05FNO	9j	E	74	8		
Kvarnsjögöl	635509 149788	06FSO	1j	E	74	8		
Kvarnsjön	635538 149823	06FSO	1j	D	74	8		
Kättgölen	635364 151306	06GSV	0c	F	74	8		K94
Lagårdsgölen	638265 149608	06FNO	6j	E	67	8		
Lilla fjärsjön	636643 150931	06GSV	3b	D	73	8		
Lilla granesjön	635035 148039	06FSO	0g	D	74	8	L1 06	
Lilla hammarsjö	637257 149908	06FSO	4j	D	74	8		R 1 84
Lilla hjortsjön	636826 149035	06FSO	3i	E	74	8		
Lilla hjältan	637008 151611	06GSV	4d	E	73	8		K85
Lilla långgöl	636804 151510	06GSV	3d	E	73	8		
Lilla mösjön	635726 149387	06FSO	1i	E	74	8		
Lilla åkebosjön	637271 149555	06FSO	4j	D	74	8	S4	
Lillalen	636045 150693	06GSV	2b	E	73	8		K94
Lillegärdsgölen	636383 150782	06GSV	2b	E	73	8		
Lillegöl	637858 151468	06GNV	5c	E	73	8		
Lillesjö	635694 150460	06GSV	1a	D	74	8		
Lillsjön	636774 150525	06GSV	3b	D	74	8		
Lillsjön	637140 149492	06FSO	4i	E	74	8		R92
Lillån	637842 149586	06FNO	5j	E	74	8		
Linden	637769 149284	06FNO	5i	C	74	8	L1 06	
Lindesjön	635334 149281	06FSO	0i	E	74	8		
Ljungsbergsgöl	635475 149291	06FSO	0i	E	74	8		
Ljusegöl	636981 148946	06FSO	3h	E	74	8		
Lomgölen	637020 149680	06FSO	4j	E	74	8		
Lommegöl	634765 149799	05FNO	9j	E	74	8		
Lommegöl	636695 148655	06FSO	3h	E	74	8		
Lyckegölen	638214 149551	06FNO	6j	E	74	8		
Lysegöl	635027 149107	06FSO	0i	E	74	8		
Lysegöl	635032 148604	06FSO	0h	E	74	8		
Lysgöl	636604 150071	06GSV	3a	E	74	8		
Lysgöl	637066 151254	06GSV	4c	D	73	8		
Lysgöl	637441 151972	06GSV	4d	E	73	8		
Långgöl	635305 151438	06GSV	0c	E	74	8		

Name	Lake number	Top. map	Ek. map	Area class	Disch. area	County	Notes	Corr. Code
Långlidsgölen	634400 149021	05FNO	8i	F	74	8		K94
Långsjön	637159 151272	06GSV	4c	D	73	8		
Långsjön	637969 150675	06GNV	5b	E	73	8		
Magergöl	634925 148735	05FNO	9h	E	74	8		
Magergöl	637441 151878	06GSV	4d	E	73	8		
Magregöl	636346 148926	06FSO	2h	E	74	8		
Magregöl	636569 149810	06FSO	3j	E	74	8		
Maren	635091 150305	06GSV	0a	C	74	8		
Mellanmaren	635217 149904	06FSO	0j	D	74	8		
Melsjön	634960 149254	05FNO	9i	E	74	8		
Melsjön	636089 149465	06FSO	2i	D	74	8		
Mistersjö	635109 148676	06FSO	0h	D	74	8		
Mjösjön	635209 149861	06FSO	0j	D	74	8		
Modegöl	636927 150220	06GSV	3a	E	74	8	S4	
Mogöl	634987 148669	05FNO	9h	E	74	8		
Mogöl	636320 150697	06GSV	2b	E	74	8		K94
Mogölen	637924 149776	06FNO	5j	E	74	8		
Moren	634796 149257	05FNO	9i	C	74	8		
Mossjön	636956 149185	06FSO	3i	D	74	8		
Målasjön	637751 149730	06FNO	5j	D	74	8		
Mårdsjö	635664 151250	06GSV	1c	D	74	8		
Mörkgölen	635194 150865	06GSV	0b	F	74	8		K94
Mörtegöl	636723 150115	06GSV	3a	E	74	8		
Mörtegöl	637835 151524	06GNV	5d	D	73	8		
Mörtsjön	634496 149878	05FNO	8j	D	74	8		
Mösjön	636440 150957	06GSV	2b	D	73	8		
Mösjön	636465 150516	06GSV	2b	D	74	8		
Mösjön	636907 150983	06GSV	3b	D	73	8		
Mösjön	636969 150928	06GSV	3a	D	73	8		K85
Mösjön	637261 149321	06FSO	4i	D	74	8		
Narrveten	635910 148373	06FSO	1g	C	74	8	L1 06	
Nedre svartsjön	636894 148513	06FSO	3h	D	74	8		
Nedsjö göl	637673 150188	06GNV	5a	E	74	8	S4	
Nedsjön	637649 150181	06GNV	5a	E	74	8	S4	
Nerbjärken	637223 151155	06GSV	4c	C	73	8		
Njuren	637380 149238	06FSO	4i	E	74	8		
Norrlången	636191 150318	06GSV	2a	E	74	8		
Notgölarna	636750 149746	06FSO	3j	E	74	8		
Notgölarna	636779 149766	06FSO	3j	E	74	8		K85
Näjern	636792 152028	06GSV	3e	D	73	8		K85
Näsegöl	637682 150814	06GNV	5b	E	73	8		
Oppbjärken	637180 150926	06GSV	4b	D	73	8		
Oppsjön	636395 148708	06FSO	2h	E	74	8		
Ormegöl	635789 150726	06GSV	1b	E	73	8		
Orsgöl	634605 148661	05FNO	9h	E	74	8	S4	
Orssjö	634652 148596	05FNO	9h	E	74	8		
Persgöl	637286 150722	06GSV	4b	E	73	8		
Petgölen	638221 151288	06GNV	6c	E	72	8		
Pipegöl	634309 149710	05FNO	8j	E	74	8		
Porsegöl	635286 149966	06FSO	0j	E	74	8		
Prästnäsagölen	636637 148773	06FSO	3h	E	74	8		
Pukegöl	635208 149884	06FSO	0j	E	74	8		
Ragnegöl	636719 149702	06FSO	3j	E	74	8		
Ramsebosjön	635070 148966	06FSO	0h	D	74	8		
Rensjön	636508 150748	06GSV	3b	D	73	8		
Risagöl	634898 148253	05FNO	9g	D	74	8		
Ruggegöl	635247 151078	06GSV	0c	E	74	8		
Rummegöl	636171 150953	06GSV	2b	E	73	8		
Råden	637860 150593	06GNV	5b	D	73	8		
Rödgöl	637863 151167	06GNV	5c	E	73	8		

Name	Lake number	Top. map	Ek. map	Area class	Disch. area	County	Notes	Corr. Code
Rögöl	636240 149258	06FSO	2i	D	74	8		
Rögölen	635230 150940	06GSV	0b	E	74	8		
Rösjön	636205 151320	06GSV	2c	D	73	8		
Sandgöl	637128 151507	06GSV	4d	E	73	8		
Sandstugugölen	638030 149437	06FNO	6i	E	74	8		
Sjöasjö	636015 148535	06FSO	2h	E	74	8		
Sjökullasjön	634342 149884	05FNO	8j	D	74	8		
Skallegöl	637286 149150	06FSO	4i	F	74	8	K94	
Skatsjön	637559 150818	06GNV	5b	D	73	8		
Skeppsgöl	634591 148659	05FNO	9h	E	74	8		
Sketnesjön	636834 149892	06FSO	3j	E	74	8		
Skiftingsgöl	635880 150833	06GSV	1b	E	73	8		
Skinnsjön	637056 152231	06GSV	4e	E	73	8		
Skiren	634550 149165	05FNO	9i	D	74	8		
Skiren	635795 148991	06FSO	1h	D	74	8		
Skrabbgölen	636910 149712	06FSO	3j	E	74	8		
Skrikegöl	638127 150357	06GNV	6a	E	74	8		
Skriksjön	637405 149367	06FSO	4i	D	74	8		
Skräplegöl	635189 150804	06GSV	0b	E	74	8		
Skurugöl	635688 149224	06FSO	1i	E	74	8		
Skvalpen	634730 148454	05FNO	9g	D	74	8		
Skälsgöl	637251 151307	06GSV	4c	E	73	8		
Skälsgölen	634909 149759	05FNO	9j	E	74	8		
Skärvgölen	634604 149418	05FNO	9i	E	74	8		
Smala viksjön	636509 148417	06FSO	3g	D	74	8		
Snällegöl	634547 148787	05FNO	9h	E	74	8		
Snårgöl	638354 149607	06FNO	6j	E	67	8		
Sommarsgölarna	636700 149187	06FSO	3i	E	74	8		
Sprätgöl	636699 151525	06GSV	3d	E	73	8		
St hammarsjö	636850 149669	06FSO	3j	C	74	8		
Stengölen	636871 150855	06GSV	3b	E	73	8		
Stensjön	636053 151379	06GSV	2c	D	73	8		
Stensjön	636242 150961	06GSV	2b	D	73	8		
Stensjön	636511 149667	06FSO	3j	D	74	8		
Stickmälten	635460 151441	06GSV	0c	E	74	8		
Stockebogöl	636854 149770	06FSO	3j	E	74	8		
Stora fjärsjön	636746 150839	06GSV	3b	D	73	8		
Stora granesjön	635144 148040	06FSO	0g	D	74	8 L1 06		
Stora hjortsjön	636855 149063	06FSO	3i	D	74	8		
Stora järnsjön	636847 151145	06GSV	3c	D	73	8		
Stora långgöl	636836 151470	06GSV	3c	E	73	8		
Stora mösjön	635802 149327	06FSO	1i	E	74	8		
Stora skärsgöl	635317 150867	06GSV	0b	E	74	8		
Stora tranegöl	637039 151941	06GSV	4d	F	73	8	K94	
Stora öjasjön	634558 149095	05FNO	9i	D	74	8		
Storgöl	636684 150081	06GSV	3a	E	74	8		
Stränglan	637065 149859	06FSO	4j	E	74	8		
Svartegöl	634956 148695	05FNO	9h	E	74	8		
Svartgöl	637019 149817	06FSO	4j	E	74	8		
Svartgölen	636351 150619	06GSV	2b	F	74	8	K94	
Svartgölen	637023 148916	06FSO	4h	F	74	8	K95	
Svinegöl	635663 150795	06GSV	1b	E	74	8		
Sävsjön	635503 149740	06FSO	1j	D	74	8		
Sävsjön	636395 150847	06GSV	2b	D	73	8		
Tallången	635761 151240	06GSV	1c	E	74	8		
Tallångsgöl	635649 151317	06GSV	1c	E	74	8		
Tensjö	636309 151016	06GSV	2c	D	73	8		
Tensjögöl	636328 150956	06GSV	2b	E	73	8		K94
Tingsgöl	638049 150695	06GNV	6b	D	73	8		
Tinnsjön	634811 149527	05FNO	9j	D	74	8		

Name	Lake number	Top. map	Ek. map	Area class	Disch. area	County	Notes	Corr. Code
Tinnsjön	635022 149182	06FSO	0i	D	74	8		
Togöl	637551 151066	06GNV	5c	E	73	8		
Togöl	637889 150477	06GNV	5a	E	73	8		
Togölen	634639 149630	05FNO	9j	E	74	8	S4	
Togölen	637925 149505	06FNO	5j	E	74	8		
Torregöl	636667 151560	06GSV	3d	F	73	8		K94
Trehörningen	634799 148335	05FNO	9g	D	74	8		
Trehörningen	635344 149727	06FSO	0j	D	74	8		
Trehörningen	637409 149538	06FSO	4j	E	74	8		
Trehörningsgöl	635350 149642	06FSO	0j	E	74	8		
Triasjö	634297 148608	05FNO	8h	D	74	8		R6 90
Tängelsjö	634997 148332	05FNO	9g	D	74	8		
Tängersjö	637121 151366	06GSV	4c	E	73	8		
Tångegöl	634892 148704	05FNO	9h	E	74	8		
Uttersjön	636641 150297	06GSV	3a	E	74	8		
Vena göl	637608 150897	06GNV	5b	E	73	8	S4	
Vensjön	636742 148800	06FSO	3h	C	74	8	L1 06	
Ver	637263 151504	06GSV	4d	C	73	8		
Virserumssjön	635472 148648	06FSO	0h	C	74	8		
Visgölen	635329 150806	06GSV	0b	E	74	8	S4	
Vrångegöl	635762 149111	06FSO	1i	E	74	8		
Väggöl	634713 148153	05FNO	9g	E	74	8		
Välen	636734 149771	06FSO	3j	D	74	8		
Våmmesjö	635629 150550	06GSV	1b	D	74	8		
Yttre vrången	635901 149203	06FSO	1i	D	74	8		
Yxnasjön	635420 149524	06FSO	0j	D	74	8		
Yxnasjön	635538 149378	06FSO	1i	D	74	8		
Ågöl	636522 150009	06GSV	3a	E	74	8		
Åkebosjön	637089 149542	06FSO	4j	D	74	8		
Ålabäcksgölen	634607 148839	05FNO	9h	F	74	8		K94
Ålegöl	636919 150062	06GSV	3a	E	74	8		
Ålsjön	637867 151388	06GNV	5c	E	73	8		
Ånglegöl	635345 149878	06FSO	0j	E	74	8		
Ånglegöl	636003 149085	06FSO	2i	D	74	8		
Årtgölen	635968 150357	06GSV	1a	F	74	8		K94
Åsegölen	636923 149473	06FSO	3i	D	74	8	S4	K 84
Åsättern	636953 151233	06GSV	3c	D	73	8		
Älesjön	637416 150989	06GSV	4b	D	73	8		
Älgsjön	636262 151106	06GSV	2c	D	73	8		
Älgsjön	637010 150254	06GSV	4a	D	74	8		
Älmtegöl	634641 149876	05FNO	9j	E	74	8		
Älmten	634695 149878	05FNO	9j	D	74	8		
Älsjön	635535 150834	06GSV	1b	E	74	8		
Ängagöl	634245 149063	05FNO	8i	E	74	8		K94
Äsen	635115 149062	06FSO	0i	D	74	8		
Äsgöl	634912 148629	05FNO	9h	E	74	8		
Äsgölen	636305 150666	06GSV	2b	E	74	8		K94
Äshultasjön	635458 149123	06FSO	0i	E	74	8		
Ävjegöl	635146 149815	06FSO	0j	E	74	8		
Ävsjö	634924 149231	05FNO	9i	E	74	8		
Örsjön	637276 149504	06FSO	4j	D	74	8		
Östergöl	637584 151690	06GNV	5d	E	73	8		
Östingen	636042 151075	06GSV	2c	E	73	8	S4	
Övra vrången	635856 149108	06FSO	1i	D	74	8		
Övre mösjön	636972 150924	06GSV	3b	D	73	8		
Övre svartsjön	636930 148442	06FSO	3g	D	74	8		

–– Totalt finns 351 sjöar i denna lista. ––-

Map of lakes in Hultsfred community

Appendix 3

Hultsfred community – Lake maps

Name	Lake number	Map number	Average depth (m)	Max-depth (m)	Vol. (Mm3)	Year	Scale	Top. map	Disch. area	County
Almten	634531 148678	3-3429	3.7	8.5	0.243	19860919	1:2100	05FNO	74	8
Avesjön	634477 148733	3-3789	5.9	18.0	0.636	19860919	1:2800	05FNO	74	8
Barnegöl	636626 149424	3-3812	1.9	5.0	0.069	19860919	1:1600	06FSO	74	8
Breda viksjön	636587 14817	3-2871	3.9	10.0	0.532	19941101	1:2500	06FSO	74	8
Brågöl	636977 151306	3-3761	2.4	5.0	0.169	19860919	1:3200	06GSV	73	8
Bysjön	635958 149617	3-3813	2.0	5.0	1.690	19860919	1:7000	06FSO	74	8
Bysjön	637612 151545	3-2870	2.5	6.0	0.592	19941101	1:2500	06GNV	73	8
Djupsjö	634780 150158	3-2862	4.7	16.0	0.863	19941101	1:2500	05GNV	74	8
Djupsjön	637054 149492	3-2302	4.3	12.0	0.130	19840101	1:1000	06FSO	78	8
Ellaren	635830 150749	3-2869	4.8	14.0	0.818	19941101	1:2500	06GSV	73	8
Flaten	636104 149364	3-3797	3.8	15.0	6.220	19860919	1:14500	06FSO	74	8
Färgsjön	636985 149486	3-2312	4.2	11.5	0.390	19840101	1:2000	06FSO	74	8
Fårmogölen	637338 149490	2-0400	3.6	10.0	0.080	19840101	1:1000	06FSO	74	8
Försjön	636087 149105	3-3820	4.7	19.0	2.737	19860919	1:8700	06FSO	74	8
Försjön	636904 151593	3-3752	4.0	16.5	1.767	19860919	1:6900	06GSV	73	8
Gatsjön	637514 152096	3-2868	3.3	8.0	0.864	19941101	1:2500	06GNV	72	8
Gillen	637733 151609	3-2867	5.8	17.0	1.707	19941101	1:2500	06GNV	73	8
Gnötteln	637521 150480	3-2373	1.7	4.0	3.049	1984	1:10000	06GNV	74	8
Gäddgölen	637539 152024	3-3602	2.3	5.7	0.171	19870213	1:2500	06GNV	72	8
Gåpen	634735 148938	3-3787	7.7	26.0	5.110	19860919	1:6250	05FNO	74	8
Hedasjö	634543 149310	3-3810	1.3	3.2	0.145	19840926	1:4300	05FNO	74	8
Hesjön	636330 149874	3-2309	3.2	7.0	1.150	19840101	1:3000	06FSO	74	8
Hjortesjön	635388 148457	3-2308	4.8	18.5	12.320	19840101	1:10000	06FSO	74	8
Holmsjön	636703 149444	3-2306	3.8	10.5	0.620	19840101	1:2500	06FSO	74	8
Hulingen	636866 150376	3-0750		8.3		1976	1:20000	06GSV	74	8
Hulingen	636866 150376	3-1779	1.7	12.0	11.160	1981	1:20000	06GSV	74	8
Hultemaren	635336 149433	3-3792	6.6	25.0	2.720	19860919	1:3500	06FSO	74	8
Hyltasjön	636545 151015	3-3753	2.2	9.0	0.626	19860919	1:5700	06GSV	73	8
Hällemaren	635303 149823	3-3797	8.7	24.5	2.530	19860919	1:7100	06FSO	74	8
Igelsjön	637078 149070	3-2305	1.4	3.0	0.510	19840101	1:4000	06FSO	74	8
Illern	636541 151446	3-3754	4.9	26.5	19.639	19860919	1:16000	06GSV	73	8
Ingebosjön	635132 151419	2-0335	2.9	15.0	1.378	19860710	1:5000	06GSV	74	8
Järnsjön	636472 148783	3-2866	1.4	4.0	0.363	19941101	1:2500	06FSO	74	8
Kvarnsjön	635538 149823	3-2865	5.1	12.0	0.627	19941101	1:2000	06FSO	74	8
Lilla fjärsjön	636643 150931	3-3755	3.0	9.0	0.363	19860919	1:5700	06GSV	73	8
Lilla granesjön	635035 148039	3-2272	3.2	6.0	0.350	1984	1:2000	06FSO	74	8
Lilla hammarsjö	637257 149908	3-2310	0.6	1.0	0.570	19840101	1:5000	06FSO	74	8
Lilla åkebosjön	637271 149555	3-2273	3.0	5.0	0.340	1984	1:2000	06FSO	74	8
Lillesjö	635694 150460	3-3784	3.2	6.5	0.914	19860919	1:4000	06GSV	74	8
Lillsjön	636774 150525	3-2872	2.6	4.0	1.250	19941101	1:5000	06GSV	74	8
Linden	637769 149284	3-2313	7.8	22.0	27.280	19840101	1:1000	06FNO	74	8
Lysgöl	637066 151254	3-3756	2.8	6.0	0.367	19860919	1:3400	06GSV	73	8
Långsjön	637159 151272	3-3430	3.6	13.5	0.372	19860919	1:3400	06GSV	73	8
Långsjön	637969 150675	3-3515	2.2	7.0	0.187	19860919	1:2800	06GNV	73	8
Maren	635091 150305	3-3795	6.7	22.5	12.920	19860919	1:14500	06GSV	74	8
Mellanmaren	635217 149904	3-3791	11.8	29.0	1.920	19860919	1:4400	06FSO	74	8
Melsjön	636089 149465	3-3802	1.6	3.0	0.464	19860919	1:4000	06FSO	74	8
Mistersjö	635109 148676	3-3814	3.3	11.0	0.849	19860919	1:5000	06FSO	74	8
Moren	634796 149257	3-3785	5.5	22.0	7.975	19860919	1:1300	05FNO	74	8
Mösjön	636907 150983	3-3757	3.7	15.0	0.434	19860919	1:5500	06GSV	73	8
Mösjön	637261 149321	3-2311	2.6	6.5	0.330	19840101	1:5000	06FSO	74	8
Narrveten	635910 148373	3-3569	4.5	13.0	5.706	19861008	1:10000	06FSO	74	8

Name	Lake number	Map number	Average depth (m)	Max-depth (m)	Vol. (Mm3)	Year	Scale	Top. map	Disch. area	County
Narrveten	635910 148373	3-3818	4.0	12.5	4.802	19860919	1:8750	06FSO	74	8
Nedre svartsjön	636894 148513	3-2878	3.2	12.5	0.796	19941101	1:2500	06FSO	74	8
Nerbjärken	637223 151155	3-3758	5.8	21.0	11.918	19860919	1:11500	06GSV	73	8
Näjern	636792 152028	3-2884	2.2	6.0	1.627	19850918	1:5000	06GSV	73	8
Oppbjärken	637180 150926	3-3759	7.4	22.0	6.477	19860919	1:7000	06GSV	73	8
Ramsebosjön	635070 148966	3-3433	5.3	14.5	4.262	19860919	1:7000	06FSO	74	8
Rensjön	636508 150748	3-2880	1.6	2.0	0.248	19941101	1:2500	06GSV	73	8
Råden	637860 150593	3-2877	4.4	12.0	1.926	19941101	1:5000	06GNV	73	8
Rösjön	636205 151320	3-3760	4.2	13.0	1.095	19860919	1:5600	06GSV	73	8
Skatsjön	637559 150818	3-2879	3.5	12.0	1.011	19941101	1:2500	06GNV	73	8
Skiren	634550 149165	3-3788	3.0	8.5	1.883	19860919	1:7000	05FNO	74	8
Skiren	635795 148991	3-3796	1.4	3.5	0.430	19860919	1:6600	06FSO	74	8
Skriksjön	637405 149367	3-2297	4.4	16.0	0.850	19840101	1:5000	06FSO	74	8
St hammarsjö	636850 149669	2-0256	4.9	18.5	6.684	1984	1:5000	06FSO	74	8
Stensjön	636053 151379	1-0236	2.7	6.2	1.376	19861010	1:5000	06GSV	73	8
Stensjön	636242 150961	3-2882	4.0	20.0	1.289	19941101	1:2500	06GSV	73	8
Stensjön	636511 149667	3-2295	3.1	12.5	1.220	19840101	1:4000	06FSO	74	8
Stockebogöl	636854 149770	3-2303	6.8	16.0	0.493	19840101	1:2000	06FSO	74	8
Stockebogöl	636854 149770	3-3793	6.8	16.0	0.490	19840101	1:2600	06FSO	74	8
Stora fjärsjön	636746 150839	3-3762	4.1	16.0	0.570	19860919	1:3300	06GSV	73	8
Stora granesjön	635144 148040	3-3726	1.9	5.2	0.221	19870320	1:2500	06FSO	74	8
Stora järnsjön	636847 151145	3-3763	3.0	7.0	0.318	19860919	1:5500	06GSV	73	8
Stora öjasjön	634558 149095	3-3786	2.9	6.0	1.910	19860919	1:5200	05FNO	74	8
Storgöl	636684 150081	3-2274	2.0	3.5	0.180	1984	1:2000	06GSV	74	8
Sävsjön	635503 149740	3-2873	3.7	9.5	0.625	19941101	1:2500	06FSO	74	8
Sävsjön	636395 150847	3-2874	1.2	2.0	0.132	19941101	1:2000	06GSV	73	8
Tensjö	636309 151016	3-2875	3.4	10.0	0.592	19941101	1:2500	06GSV	73	8
Trehörningen	637409 149538	3-2301	2.9	8.0	0.166	19840101	1:1750	06FSO	74	8
Triasjö	634297 148608	3-3790	3.2	18.0	2.605	19860919	1:6400	05FNO	74	8
Tängersjö	637121 151366	3-3431	2.2	8.5	0.221	19860919	1:3500	06GSV	73	8
Vensjön	636742 148800	3-2876	6.3	17.0	6.586	19941101	1:5000	06FSO	74	8
Ver	637263 151504	3-3764	3.7	11.0	5.653	19860919	1:14300	06GSV	73	8
Virserumssjön	635472 148648	3-2307	5.3	24.5	9.190	19840101	1:7500	06FSO	74	8
Välen	636734 149771	3-2300	3.0	14.0	0.550	19840101	1:2000	06FSO	74	8
Våmmesjö	635629 150550	3-3821	3.6	8.5	3.382	19860919	1:8200	06GSV	74	8
Yttre vrången	635901 149203	3-3801	1.5	8.5	0.766	19860919	1:6300	06FSO	74	8
Yxnasjön	635420 149524	3-3800	3.1	11.0	0.628	19860919	1:7000	06FSO	74	8
Yxnasjön	635538 149378	3-3799	2.3	7.0	0.505	19860919	1:5600	06FSO	74	8
Älesjön	637416 150989	3-2863	2.2	6.0	0.223	19941101	1:2000	06GSV	73	8
Älgsjön	636262 151106	3-3767	3.6	8.5	0.678	19860919	1:4100	06GSV	73	8
Äsen	635115 149062	3-3819	9.5	33.0	8.853	19860919	1:7000	06FSO	74	8
Åkebosjön	637089 149542	3-2298	2.3	14.5	1.200	19840101	1:5000	06FSO	74	8
Ålsjön	637867 151388	3-3765	3.7	8.00.332		19860919	1:3300	06GNV	73	8
Ånglegöl	636003 149085	3-3817	1.9	4.50.414		19860919	1:4000	06FSO	74	8
Åsegölen	636923 149473	3-2864	3.3	6.00.349		19941101	1:2000	06FSO	74	8
Åsättern	636953 151233	3-3766	3.5	15.02.056		19860919	1:13900	06GSV	73	8
Örsjön	637276 149504	3-2299	3.2	14.00.790		19840101	1:2500	06FSO	74	8
Övra vrången	635856 149108	3-3798	2.0	7.01.060		19860919	1:5500	06FSO	74	8
Övre mösjön	636972 150924	3-3768	4.5	15.00.474		19860919	1:6400	06GSV	73	8
Övre svartsjön	636930 148442	3-2883	2.7	7.00.276		19941101	1:2000	06FSO	74	8