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Mapping of reed in shallow bays

SFR-Site Forsmark

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Abstract

The regolith-lake development model (RLDM) describes the development of shallow bays to lakes and the infilling of lakes in the Forsmark area during an interglacial. The sensitivity analysis has shown the need for an update of the infill procedure in the RLDM. Data from the mapping of reed in shallow bays in the Forsmark area will be used to improve the infill procedure of an updated RLDM.

The field work was performed in August 26–31, 2010. The mapping of reed was done in 124 points. In these points, coordinates and water depth were mapped using an echo sounder and a DGPS. Quaternary deposits and the thickness of soft sediments were mapped using an earth probe.

Measurement points were delivered in ESRI shape format with coordinates in RT90 2.5 gon W and altitudes in the RHB70 system for storage in SKB's GIS data base.

Sammanfattning

Regolith-sjö utvecklingsmodellen (RLDM) beskriver utvecklingen av grunda havsvikar till sjöar och igenväxningen av sjöar i Formarksområdet under en interglacial. En känslighetsanalys har visat att det finns ett behov att uppdatera igenväxningsproceduren i RLDM. Data från en studie av vass i grunda havsvikar i Forsmarksområdet kommer att användas för att förbättra igenväxningsproceduren i en uppdaterad RLDM.

Fältarbetet utfördes 25–31 Augusti, 2010. Karteringen av vass gjordes i 124 punkter. I dessa punkter karterades kordinater och vattendjup med ett ekolod och en DGPS. Kvartära avlagringar och tjockleken på mjuka sediment karterades med en jordsond.

Mätpunkter levererades i ESRI shape-format med koordinaterna i RT90 2.5 gon W och nivåerna i RHB70 systemet för inlagring i SKB's GIS-databas.

Contents

1 Introduction

SKB is conducting investigations prior to a future enlargement of the SFR repository for low- and medium level nuclear waste situated close to Forsmark nuclear power plant in the Östhammar community. These investigations are concentrated on specific issues of importance for the safety assessment for the enlargement of the SFR-repository. This study is part of a larger investigation program.

This document reports the performance and results from a mapping of reed in shallow bays in the Forsmark area. The work was carried out in accordance with activity plan AP SFR-10-005. The controlling documents for performing this activity are listed in Table 1-1. Both activity plan and method documents are SKB's internal controlling documents.

The regolith-lake development model (RLDM) /Brydsten and Strömgren 2010/ describes the development of shallow bays to lakes and the infilling of lakes in the Forsmark area during an interglacial. The sensitivity analysis has shown the need for an update of the infill procedure in the RLDM. Data from this study will be used to improve the infill procedure of an updated RLDM.

Original data from this activity are delivered to SKB in ESRI shape format (points) and stored in the GIS database (Table 1-2) and traceable by the activity plan number (AP SFR-10-005). Only data in databases are accepted for further interpretation and modeling. The data presented in this report are regarded as copies of the original data.

The mapping of reed in shallow bays was performed in August 26–31, 2010.

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

Activity plan	Number	Version
Kartering av vassutbredning och bottentyp i grunda havsvikar i Forsmarksområdet	AP SFR-10-005	1.0

Table 1-2. Data references.

Sub-activity	Database
Kartering av vassutbredning och bottentyp i grunda havsvikar i Forsmarksområdet	GIS

2 Equipment

The field equipment used to map reed and water depth was a small boat (approximately 4.6 m), a digital echo sounder (Simrad EQ32 Mk 11) and a DGPS (Trimble Pro XR) connected to computer (Itronix GoBook) using ESRI ArcPad real time software. The mapping of the quaternary deposits was done using this equipment and an earth probe.

3 Execution

3.1 Execution of field work

A field work was performed in Forsmark in August 26–31, 2010. In this study, areas in shallow bays colonized by reed were mapped. Following parameters were mapped:

- Reed beds in shallow bays.
- Water depth.
- Quaternary deposits.
- The thickness of soft sediments.

As a preparation of the field work, IR Orthophotos were studied. From these images 20 areas with reed were identified. During the field work all of these areas were visited, but measurements were not performed in all of them, since reed was only growing on land in some of these areas and reed was only growing in very shallow water depth in other areas. Mapping in such areas would have been very difficult and finding data showing the maximum water depth in which reed colonizes was more important, since water depth is one of the parameters used to model the infilling procedure in the existing regolith-lake development model (RLDM) /Brydsten and Strömgren 2010/.On the other hand some new areas were identified and mapped during the field work.

Measurements were done in 124 points (Figure 3-1). In these points, coordinates and water depth were mapped using a small boat with an outboard motor, an echo sounder and a DGPS. Due to the shallow water depth and a lot of boulders and stones oars was used in most of the mapping. All coordinates were measured using a mean value of 6 seconds. In all of these 124 points, a mapping of quaternary deposits and measurements of the thickness of soft sediments were also done using an earth probe.

Finding coordinates showing where reed grows furthest out in a shallow bay, i.e. there is no reed outside this point, was also important, since this gives threshold values of how wave exposure limits the colonization of reed, and consequently could be used to improve the infill procedure in the RLDM. The attribute “Start” was assigned to these points (Figure 3-2). Possibly coordinates showing where reed stops growing further in a shallow bay could also be used to improve the infill procedure in the RLDM, although during the mapping we noticed that in these areas it is more likely that the colonization of reed is limited by local topography and bedrock outcrops and not by the degree of wave exposure. The attribute “Stop” was assigned to these points (Figure 3-2). However, in the shallow bays new reed beds are often found further in from these points. All these reed beds are not mapped. The reason for this is partly due to that only a few days were available for performing the field work and mapping more areas generating a wider spatial distribution of the mapped points were thus prioritized. We also noticed by looking at the eco sounder and the bottom that similar data already was mapped further out in the bays.

All depth values measured during the field work were adjusted due to different water levels in the sea over time. Using sea level records from Forsmark with hourly accuracy, the water depth values were adjusted to zero sea level in the RHB70 height system.

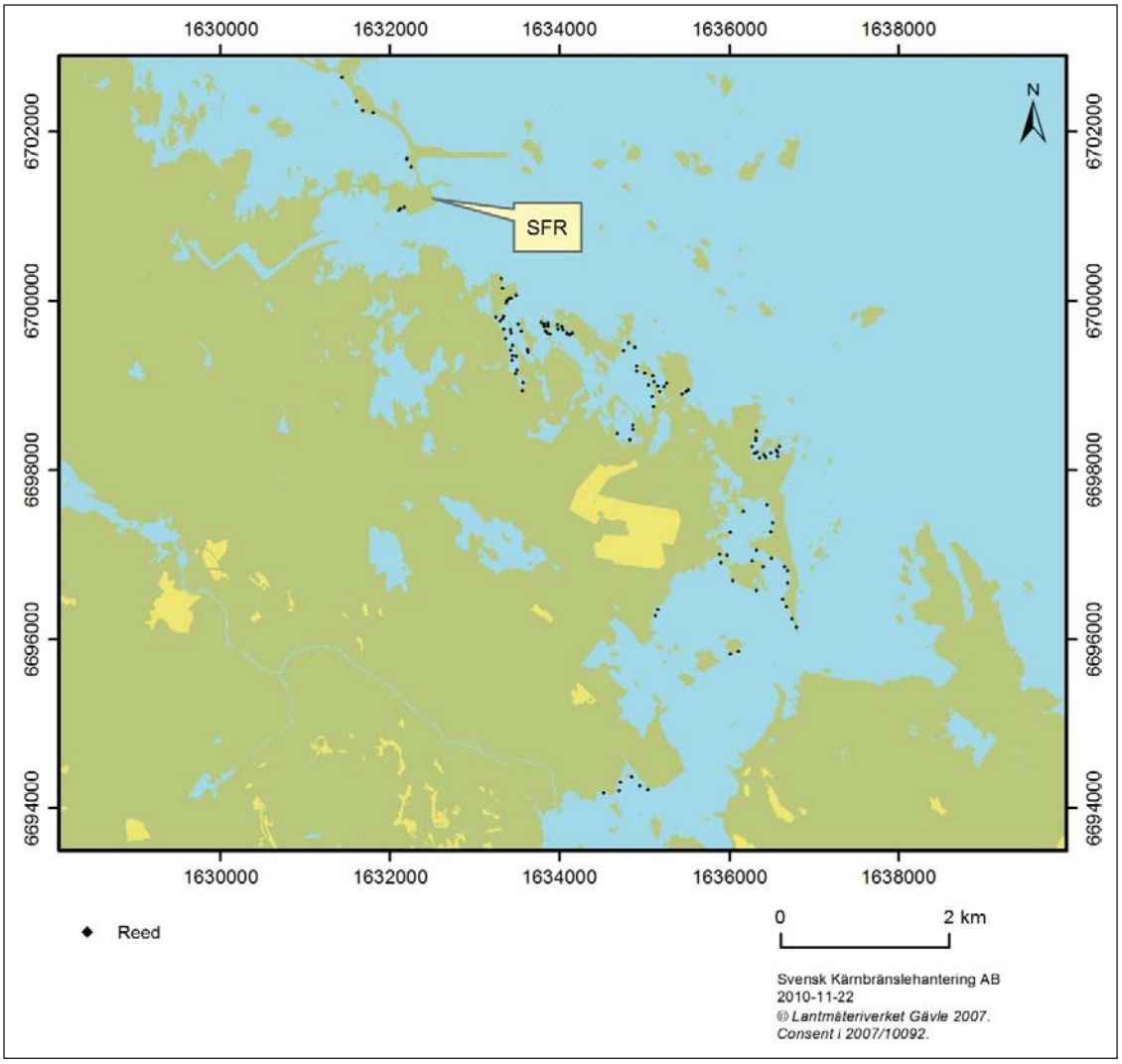

Figure 3-1. *Measured points in the mapping of reed in shallow bays in the Forsmark area. In total 124 points were measured during the field work.*

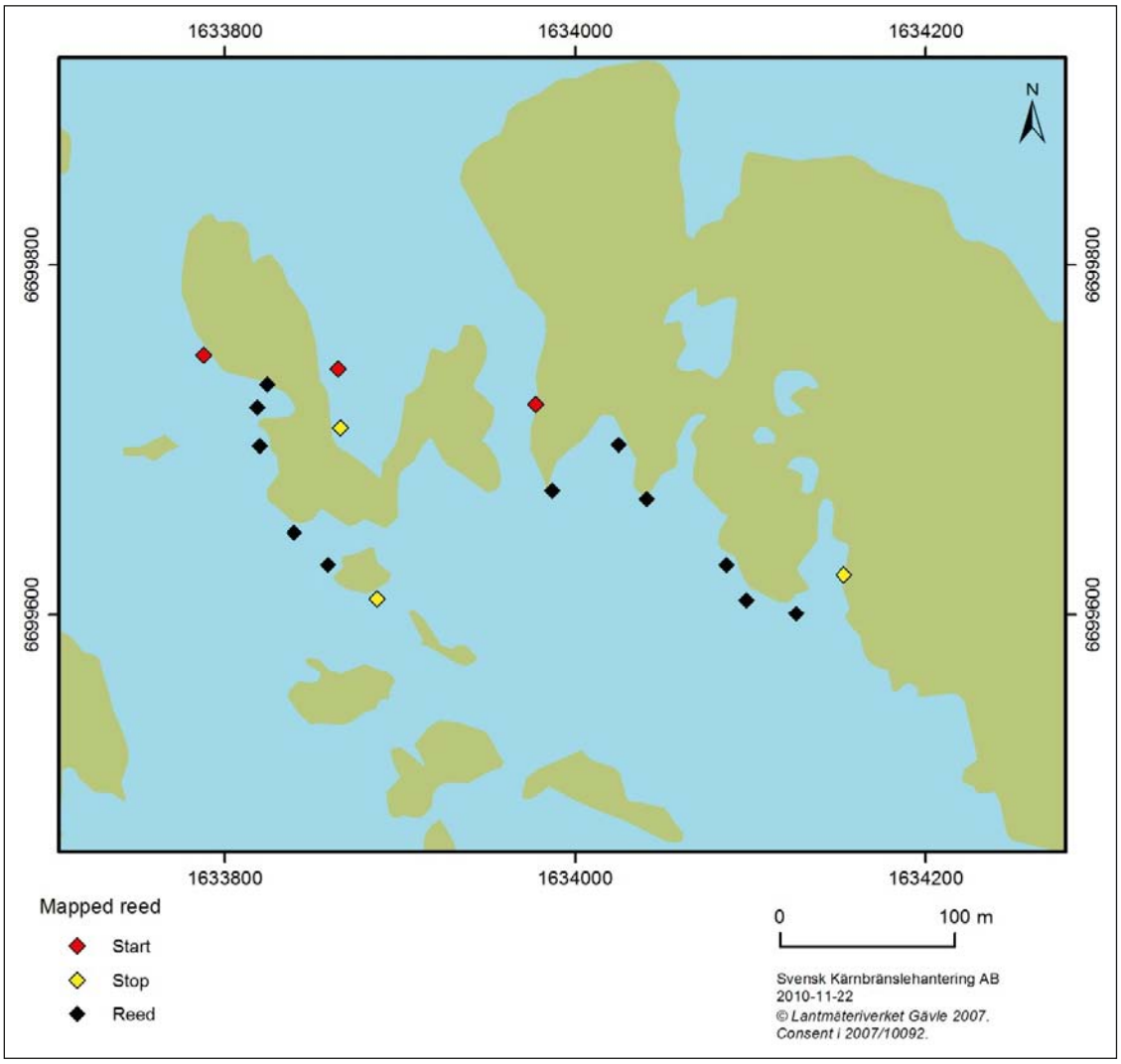

Figure 3-2. *Points from areas where reed was mapped in shallow bays in the Forsmark area. The attribute "Start" was assigned to coordinates showing where reed grows furthest out in a shallow bay, i.e. there is no reed outside this point (Figure 3-2). The attribute "Stop" was assigned to coordinates showing where reed stops growing further in a shallow bay.*

4 Noncomformities

Nonconformities have not been reported during the performance of this activity.

5 Results

In this section a general description of the data obtained from the mapping of reed is presented. No analysis or conclusions of how these data will be used to improve the regolith-lake development model (RLDM) is presented in this report.

Table 5-1 shows descriptive statistics for water depth and soft sediment depth from the mapping of reed in shallow bays. In total 124 points were measured (see Figure 3-1). The average water depth is 0.82 m, which is close to the median value of 0.77 m. The standard deviation is 0.39 m and the minimum and maximum values are 0.13 and 1.83 m, respectively.

The average thickness of soft sediment is 0.16 m and the median value is 0.00 m. The standard deviation is 0.38 m and the minimum and maximum values are 0.00 and 2.60 m, respectively. Not shown in the table is that in 75 of 124 measurements no soft sediment exists and in 105 of 124 measurements the depth of soft sediments are 0.2 m or less.

Table 5-1. Descriptive statistics for measured water depths and thickness sediment depths during the mapping of reed in shallow bays.

Measured parameter	Number of measurements	Average value (m)	Median value (m)	Standard deviation (m)	Minimum value (m)	Maximum value (m)
Water depth	124	0.82	0.77	0.39	0.13	1.83
Thickness of soft sediment	124	0.16	0.00	0.38	0.00	2.60

Table 5-2 shows quaternary deposits mapped in the survey of reed in shallow bays. Till was found in 106 of 124 measurements. In 6 points the quaternary deposit was classified as unknown. Sand and gravel was found in 5 points, respectively. In 2 points bedrock underlies soft sediments.

Table 5-2. Descriptive statistics for quaternary deposits identified during the mapping of reed in shallow bays.

Quaternary deposit	Number of measurements (total number = 124)
Till	106
Unknown	6
Sand	5
Gravel	5
Bedrock	2

In Figure 5-1 the coordinates where reed grows furthest out in a shallow bay is shown, i.e. there is no reed outside this point.

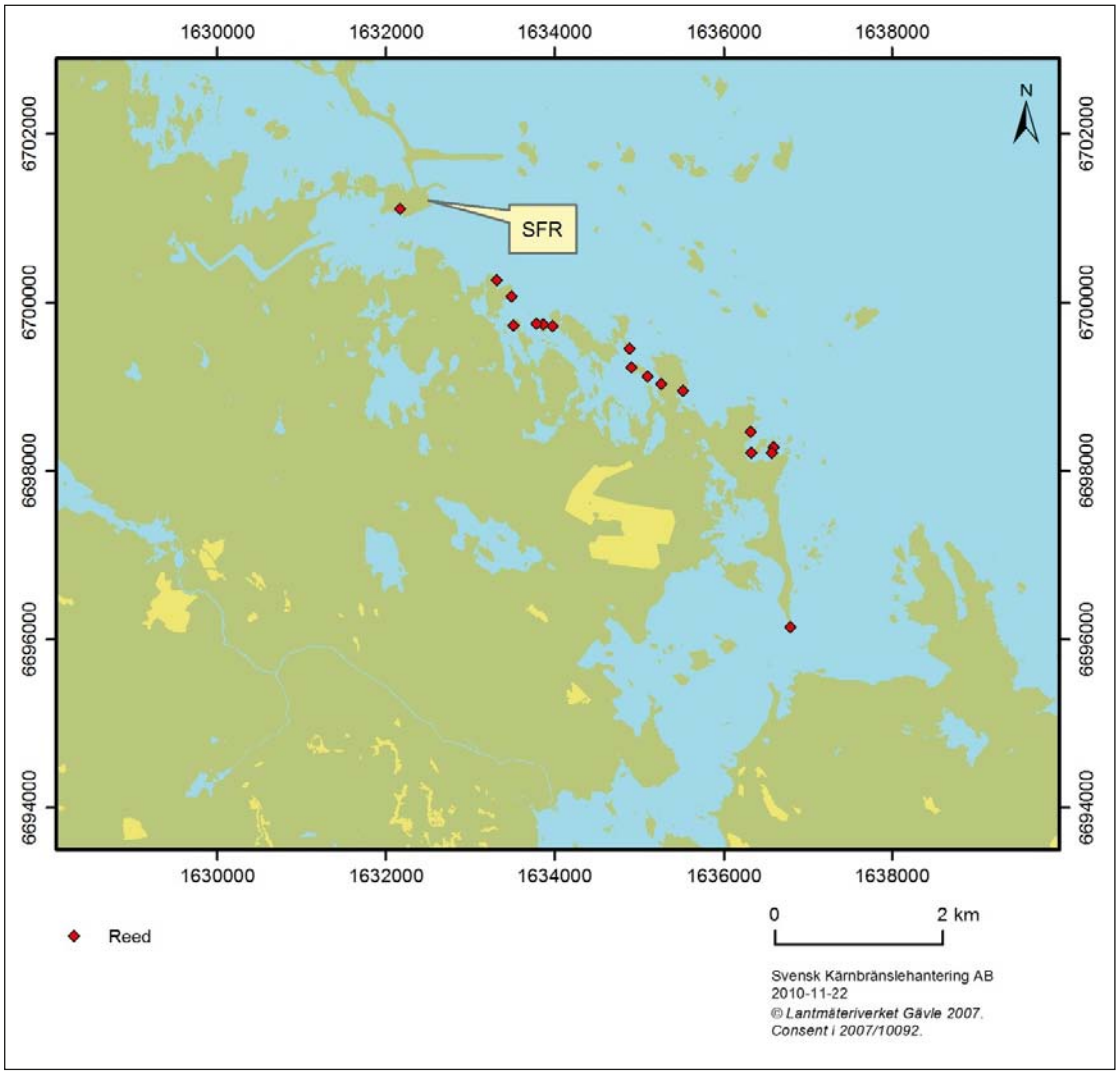

Figure 5-1. *Coordinates showing where reed grows furthest out in a shallow bay, i.e. there is no reed outside this point.*

The following data file are delivered to SKB and stored in the GIS-database:

Forsmark_vass_matpunkter	ESRI shape format, water depth, thickness of soft sediment, quaternary deposits, and other attributes.
	Excel file with metadata.

6 References

SKB's (Svensk Kärnbränslehantering AB) publications can be found at www.skb.se/publications.

Brydsten L, Strömgren M, 2010. A coupled regolith-lake development model applied to the Forsmark site. SKB TR-10-56, Svensk Kärnbränslehantering AB.