

Client: SSAB

Project: Mjölner, FAS 4

Ground investigation report Geotechnic (GIR/GEO)

Document information

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Drawings

<i>Drawing number</i>	<i>Drawing type</i>	<i>Scale</i>	<i>Format</i>
G-01.1-001	Plan	1:2000	A1
G-01.2-001 to -015	Sections	L 1:500 H 1:100	A1
G-01.6-001 to -012	JB-2-soundings	1:100	A1

1 Object

On behalf of SSAB, ÅF Infrastructure AB (AFRY) have conducted a geotechnical investigation at SSABs industrial area in Svartön, Luleå. This Ground Investigation Report (GIR) presents the results from the investigation.

2 Aim and Scope

The aim of the of the geotechnical investigation was to study the existing geotechnical conditions with reference to the ground, bedrock and groundwater. This due to ensure the geotechnical characteristics for the design and construction of future structures in the area.

As basis for the investigation, a preliminary building layout has been used.

3 Existing conditions

3.1 General information

The investigated area is located in SSAB:s industrial area in Svartön, Luleå. In the area there are existing roads and railroads, cables and trenches in ground.

3.2 Topography and surface conditions

The whole area is industrial, and the ground consist of filled material from the surface. There is no vegetation in the area.

The ground levels in the investigated point varies between approximately +3,5 to +5,5.

3.3 Geotechnical conditions

3.3.1 General conditions

In general, the area was created by filling out the area during the 1970:s with the purpose to build a new steel factory, "Stålverk 80." The filling material was mainly dredged soil from the sea, where waterways for ships had been dredged to increase the water depth.

Performed investigations show that the current material from the surface, in general consist of at least 1-2 m fillings of gravelly sand, but locally up to 5-8 m.

Beneath the fillings there are mainly loose sediments consisting of clay, silt and sand which in some areas are sulphate containing It is not clear if those sediments are fillings, dredged soil, or natural. Beneath the sediments there is a moraine which initially is loose to medium firm in the surface.



Figur 3.1. Quarternary map of the area (from SGU)

4 Directorial documents

The following directorial documents or standards have been used:

- SS-EN 1997-1 and SS-EN 1997-2 with associated national annex
- SGF System of Notation
- Notation leaflet 'Berg och Jord' [*Rock and Soil*], SGF's notation system for notations in accordance with SS-EN 14688-1, IEG dated 23 February 2010

- AMA Anläggning 17 [*AMA Installation 17*]
- SGF Fälthandbok 1:2013 [*SGF Field Handbook 1:2013*]
- TK Geo 13

The application of the relevant reference documents to each survey method is shown in Table 4-1 and Table 4-2 below.

Table 4-1 Planning and revision

Method of investigation	Standard or other reference document
Field planning	Field planning SS-EN 1997-2
Field preparation	Field preparation SS-EN 1997-2
Geotechnical field investigations	Geotechnical field handbook, Report 1:2013 and SS-EN-ISO22475-1
Eurocode 7	IEG Rapport 2:2008 (rev 2) IEG Rapport 6:2008 (rev 1)

4.1 Field investigations

Table 4-2 Directorial documents for field investigations and methods.

Method	Standard or other reference document
Ram sounding (Hfa)	Geotechnical field handbook SGF Report 1:2013
Soil-rock sounding (Jb-2)	Geotechnical field handbook SGF Report 1:2013 SGF Report 2:99 Description of method of Soil-rock sounding
Helical auger sampler (Skr)	Geotechnical field handbook SGF Report 1:2013
Groundwater well (GW)	Geotechnical field handbook SGF Report 1:2013 SGI Information 11 Measurement of groundwater level and pore pressure
Percussion sounding (Slb)	Geotechnical field handbook SGF Report 1:2013

5 Survey

Survey was performed with RTK-GPS. Surveying took place according to geotechnical measurement category B according to SGF and was performed by responsible field engineer. Coordinate system and height system was set to SWEREF 99 21:45 and RH2000.

6 Ground Investigation

6.1 Geotechnical field investigations

6.1.1 Geotechnical category

The investigations were conducted in accordance with the criteria applicable to Geotechnical Category 2, as in IEG Report 2:2008.

6.1.2 Field engineers

The geotechnical drillings have been performed under the direction of Mikael Björkhed, Kristoffer Nordberg, Anton Wennberg and Evelina Almqvist, employed at ÅF Infrastructure.

6.1.3 Equipment

Three Geomachine GM85 was used for the investigations. Water was used to flush out the JB-2 sounding cuttings.

6.1.4 Investigations conducted

Field investigations were conducted by ÅF Infrastructure AB during May 2022.

Table 6-1

Method	Aim	No. of points
<i>Soil-rock drilling (Jb-2)</i>	<i>Determination of the boundary between soil and bedrock,</i>	23
<i>Ram sounding (Hfa)</i>	<i>Determination of soil layer structure, relative stability, strength and deformation characteristics.</i>	50
<i>Helical auger sampling (Skr)</i>	<i>Extraction of disturbed soil samples.</i>	10
<i>Groundwater well (Gw)</i>	<i>Measurement of groundwater level</i>	7

6.1.5 Previous investigations

For a previous layout, investigations was carried out during 2021.

The fieldwork performed in 2021 includes 86 pieces of survey points and are presented in Table 6-12.

Table 6-1 Conducted geotechnical investigations

Method	Aim	No. of points
<i>Soil-rock drilling (Jb-2)</i>	<i>Determination of the boundary between soil and bedrock,</i>	20
<i>Ram sounding (Hfa)</i>	<i>Determination of soil layer structure, relative stability, strength and deformation characteristics.</i>	65
<i>Helical auger sampling (Skr)</i>	<i>Extraction of disturbed soil samples.</i>	44
<i>Groundwater well (Gw)</i>	<i>Measurement of groundwater level</i>	7

6.2 Hydrogeological investigations

A total of 7 groundwater wells were installed. The pipes have been measured according to Table 6-2.

Table 6-2 Information from the groundwater wells

ID	Date	Groundwater level (RH2000)
22AF063	2022-06-07	+1,302
22AF065	2022-06-07	+2,995
22AF058	2022-06-07	+1,677
22AF045	2022-06-07	+2,109
22AF041	2022-06-07	+2,08
22AF035	2022-06-07	+1,844
22AF020	2022-06-07	+1,288
22AF054	2022-06-07	+1,451
22AF052	2022-06-07	+2,89
22AF047	2022-06-07	+2,014
22AF009	2022-06-07	+1,798
22AF061	2022-06-07	+1,726
22AF003	2022-06-07	+2,751
22AF005	2022-06-07	+2,654

7 Laboratory investigations

No laboratory investigations were performed in this project.

8 Derived values

Due to a rather high distance between investigation points and a large variety in parameters throughout the area, it is difficult to make a proper evaluation based on the RAM-soundings performed.