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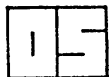
NATIONAL ENERGY AUTHORITY

**STADUR
SEAWATER FROM WELLS
HYDROLOGICAL INVESTIGATIONS
Final report**

Orkustofnun
Vatnaskil Consulting Engineers
Prepared for Iceland Salmon Ltd.

OS-86003/JHD-01

January 1986



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GRENSÁSVEGI 9, 108 REYKJAVÍK

Sverrir Þórhallsson

Bessi Aðalsteinsson

Freysteinn Sigurðsson

Gunnar Þorbergsson

Hrefna Kristmannsdóttir

Kristján H. Sigurðsson

Sæþór L. Jónsson

Verkfræðistofan Vatnaskil hf.

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Our date
1986.01.23

Your date

Our ref.
STh/sv

Your ref.

... Islandsfax hf.
Sudurlandsbraut 32
108 Reykjavik
...

Re: Staður, Hydrological Investigations. Final Report.

This report concludes the scientific investigations undertaken to advice Iceland Salmon Ltd. on an economical method of freshwater and seawater supply for the aquaculture complex at Staður. For that purpose multidisciplinary work was required. This included geological and hydrological field work as well as hydrological modelling and chemical analysis. These studies have been carried out over the past year and a half. The work started before Iceland Salmon Ltd. was founded and land and waterrights at Staður were obtained. The studies have kept pace with the subsequent rapid build-up at Staður.

It should be emphasised that the water system at Staður is a delicate one, the freshwater layer being only some 20 meters thick. Thus, in spite of the good permeability, high yield, and generally encouraging results obtained in our investigations, caution should be exercised and systematic collection of data should continue. This data can be collected by your staff at Staður, and we are ready to advice you on the frequency and type of measurements to be made. The data can later be analysed and used to evaluate the effects of higher pumping rates than were tested and modelled.

This investigation involved quite a bit of novel research work on the part of the investigators - the National Energy Authority (Orkustofnun) - and the consulting engineering firm Vatnaskil. For this reason we include in this report all of the data collected and all results obtained for the seawater investigations.

Finally, I would like, on behalf of the many specialists that collaborated on this job, to thank Iceland Salmon Ltd. for the good cooperation and assistance given in carrying out this work.

Sincerely yours

Sverrir Thorhallsson, Group Leader.

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SUMMARY OF RESULTS

1 PERMEABILITY

The geology of the Staður area is characterized by lava sequences of high permeability. The lava has a strong vertical-horizontal anisotropy, caused by scoriaceous and open lava contacts. This, and different fluid densities, combine in keeping the freshwater layer and seawater segregated. One indication of the high permeability is the large tidal response, which was measured to be 70% in the area of the seawater wells at Staður, and 30% in the freshwater fissure Lambagjá. The corresponding time lag for tidal response is 0.5 and 2.5 hours respectively. The tidal response was measured in all observation wells and the permeability calculated. The permeability was found to be primarily governed by faults, with little interconnection across fault systems. The local permeability around the production wells is estimated to be 0.01 m/s.

2 FRESHWATER LENS

On the basis of down-hole logs the freshwater layer was shown to have an equivalent thickness of 17 m at Staður close to the coast, and 20 m thick 1.5 km inland at Lambagjá. The salinity of the freshwater increases towards the shore and reaches 10‰/oo. The increase towards the shore is correlated with larger tidal fluctuations. Pumping tests of an excavation made at the fissure Staðargjá (site A) and also at the Lagoon (site B) proved that it is not possible to obtain seawater from the lava without drilling wells and casing off the freshwater lens.

3 CHEMICAL COMPOSITION

The salinity of the undisturbed seawater below 35 m depth at the well-site at Staður was measured to be 32-33‰/oo - roughly the same as for offshore seawater. The water pumped from the production wells was moreover saturated with oxygen (8-9 ppm O₂). The iron concentration, which is high in the groundwater just east of Staður, was less than 0.1 ppm Fe⁺⁺. The concentration of heavy metals for each element was less than 1 ppb (Cd, Pb, Cu), and zinc was less than 30 ppb. These results indicate that seawater, with a chemical composition similar to that of offshore seawater, can be pumped from the wells.

4 TEMPERATURE OF SEAWATER

Although down-hole logs from each well are few, they indicate that under natural conditions (no pumping) the temperature may vary from 5.5 °C in winter to 7.5 °C in summer. At the freshwater fissure Lambagjá (approx. 1.5 km inland) the underlying seawater was measured to have a temperature of 8°, indicating warmer seawater inland. The average monthly ocean temperature in Grindavík for the years 1930-1960 ranges from 5.0 °C to 11.0 °C, depending on the season. Heat transport calculations were carried out, using the Galerkin finite element method as part of the hydrological modelling. The purpose was to determine the influence on the temperature of the pumped seawater, of different pumping rates and of two possible well sites. The results show smaller seasonal changes in temperature than are found in the ocean.

Site	Pumping rate 200 l/s		Pumping rate 1500 l/s	
	temp range °C	lag	temp range °C	lag
At well SH-14	6.7 - 7.8	115 d	5.8 - 9.0	30 d
At well SH-15	6.2 - 8.7	60 d	5.6 - 9.6	20 d

5 MASS TRANSPORT

Finite element hydrological modelling showed that, upon prolonged pumping at flowrates of 200-1500 l/s, approximately 70-90% of the seawater mass will originate from the ocean, and 10-30% from the seawater found in the lava inland. Model studies showed the time lag for mass transport of seawater from the ocean to the production wells to be only a few days.

6 YIELD OF PRODUCTION WELLS

Based on the results of the pumping tests if the two large-diameter production wells, the following drawdown is calculated for several pumping rates.

Pumping Rate l/s	Drawdown (m) Well SH-14	Drawdown (m) Well SH-15
50	0.2	
100	0.6	0.05
150	1.2	0.1
200	1.9	0.2
250	2.9	0.3
300	3.9	0.4
350	5.2	0.5
400	6.6	0.7

7 SEAWATER PRODUCTION FROM THE AREA

The safe yield of the area is shown to be at least 1,500 l/s. The wells can be spaced at distances of 20-50 m, and should be as close to the shore as possible.

1 INTRODUCTION

This report describes the highly encouraging findings of the scientific investigations carried out for Iceland Salmon Ltd. (Íslandslax hf.) on the seawater supply for the aquaculture complex at Staður. These investigations were carried out according to a proposal made by the National Energy Authority (Orkustofnun) and the consulting engineering firm Vatnaskil on August 30, 1984: "Proposal for the Investigation Aquaculture Complex at Staður" (Appendix I).

The results of the freshwater investigations have been submitted in two separate reports: "Staður - Hydrological Investigations - Prefeasibility Report" (December 1984) and "Staður - Hydrological Investigations - Final Results" (March 1985). The following report deals specifically with the seawater investigations.

As part of this work several slim observation wells and two large-diameter production wells were drilled. The locations of the wells and sites investigated are shown on fig. 1 (Location Map), and fig. 2 (Staðargjá - Location Map): The two production wells are numbered SH-14 and SH-15, but the other wells SH-1 to SH-13.

Pumping tests were made at two sites adjacent to the Staðargjá fissure, sites marked A and B; the water produced there was found to be mixed with freshwater, and thus unsuitable for the intended purpose. Subsequently two production wells were drilled, which were shown by pumping tests to give high yields of seawater. These promising results were a factor in the decision of Iceland Salmon Ltd. to cancel plans for excavating a channel to the coast to supply seawater.

This report will focus on the findings of the numerous measurements and observations made over a period of one year and a half. To give an overview of the project, a bar chart of the field activities is shown on fig. 3. Data evaluation was carried out simultaneously, and the preliminary findings have been reported at meetings and in letters.

The main conclusions of the scientific investigations are presented in the summary, and the other chapters report all findings concerning this comprehensive work. This project has demonstrated that Staður is a unique location, for within the project area freshwater, seawater and geothermal hot water can all be produced in large quantities from wells on land.

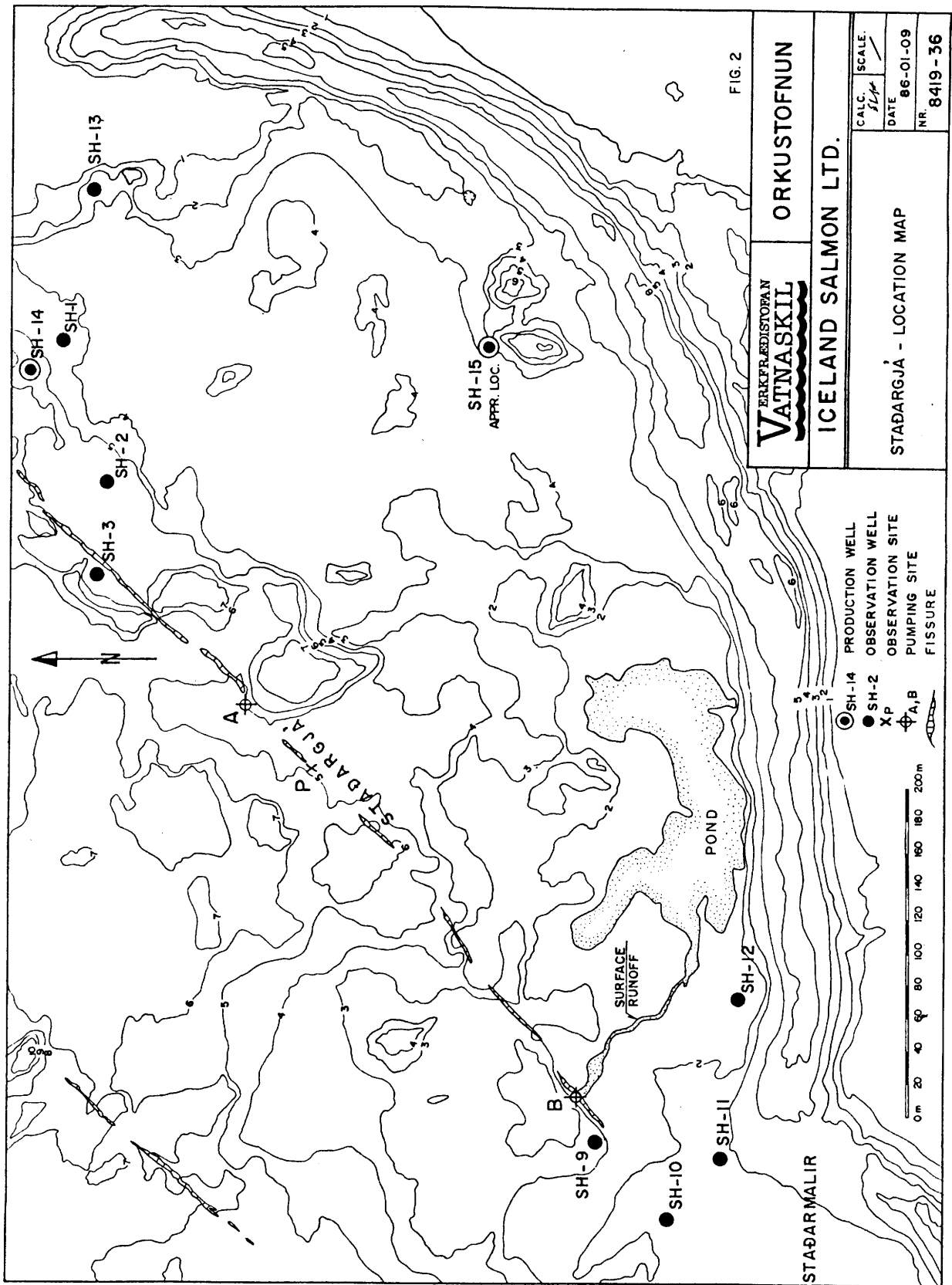
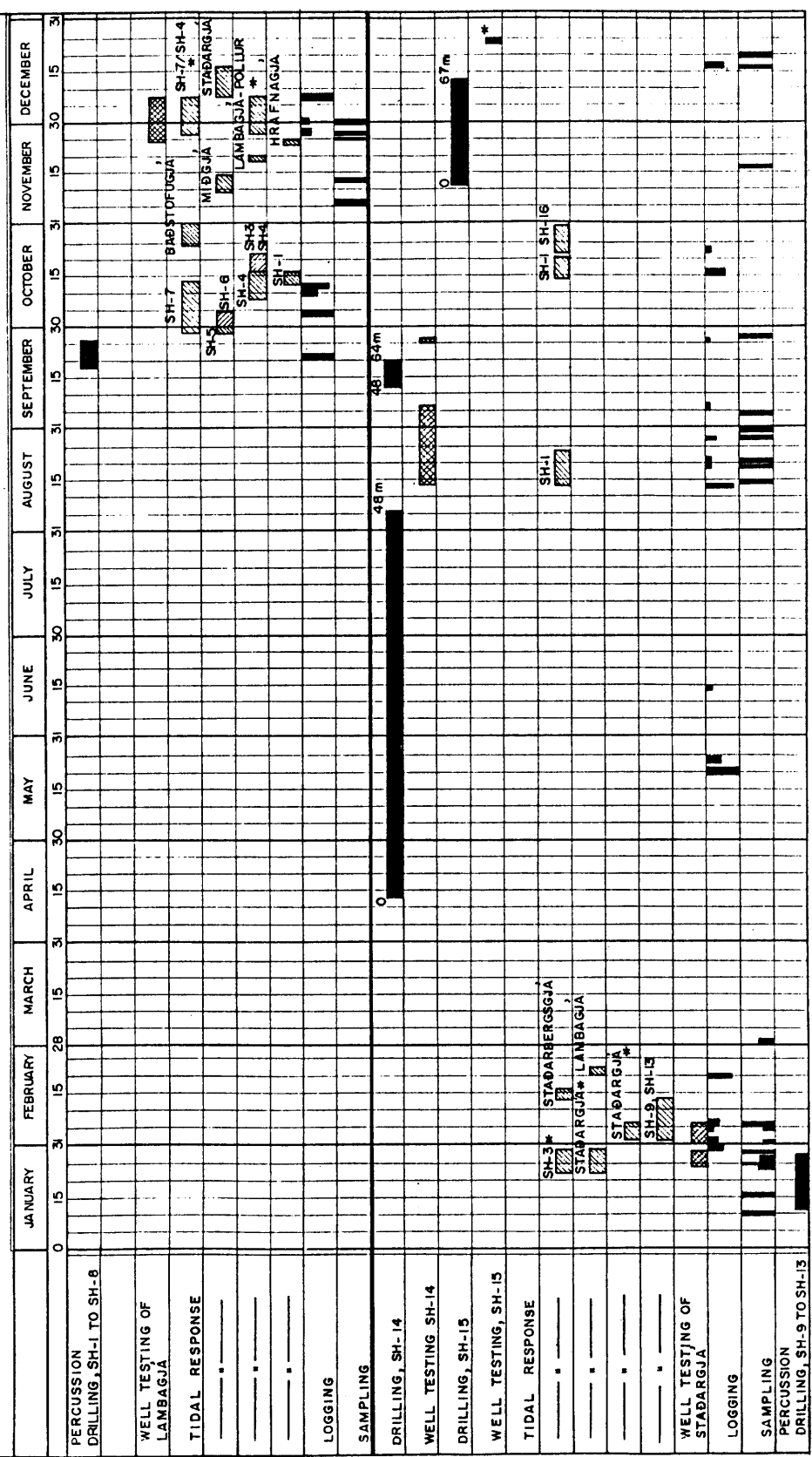


FIGURE 2 Staðargjá - location map

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BAR CHART OF FIELD ACTIVITIES

FIG. 3
* PUMPING TEST



1984

1985

FIGURE 3 Bar chart of field activities

2 HYDROGEOLOGY AND WELL-LOGS

2.1 Geological setting

The seawater in the bedrock is topped by a thin freshwater layer. The yield of every single well as well as the extraction area as a whole depends on the permeability of the bedrock. The permeability again depends on the geological structure. The geological structure of the Staður area is shown on fig. 4. It is part of the geological structural systems of the Reykjanes peninsula and must be understood in that context. The boundary between the freshwater and seawater is detectable by logging temperature and resistivity profiles in wells.

2.2 Hydrogeology

The Reykjanes peninsula is wholly volcanic and stratigraphically young. So far as is known, all rocks on it date from the recent magnetic epoch, i. e. Brunhes. In the western part of the peninsula signs of at least two glacials are found. The lavas erupted during Recent time and the interglacials form extensive lava fields, spreading out from the volcanic zone proper. During the glacials the volcanic materials were heaped up in mountains subglacially as hyaloclastic rocks, ranging, with increasing fragmentation and decreasing permeability, from pillow lavas over breccias to fine grained tuffs.

The E-W-stretching volcanic zone is composed of a number of volcanic systems, each consisting of a great shieldvolcano and a number of eruptive fissures, arranged on narrow volcanic strips. The volcanic systems and most of the eruptive fissures have a SW-NE orientation. The hyaloclastite mountains, have the same orientation appearing as ridges, massives and rows of hills. These mountains are located in close relation to the recent volcanic strips. The volcanic systems are accompanied by swarms of recent, tectonic fissures with similar orientation.

Due to greater spreading of the volcanic strips in the western part of the peninsula the geological setting is and of mountain ridges with broad, flat areas of thick lava sequences in between. This produces an anisotropy, which is enhanced by the tectonic fissures. In the lava sequences a very strong vertical-horizontal anisotropy is present, because the permeability along the scoriaceous and open lava contacts is much higher than in the dense and massive interior of the lavafloes. The belts in the lavas from the shield volcanoes have a similar effect.

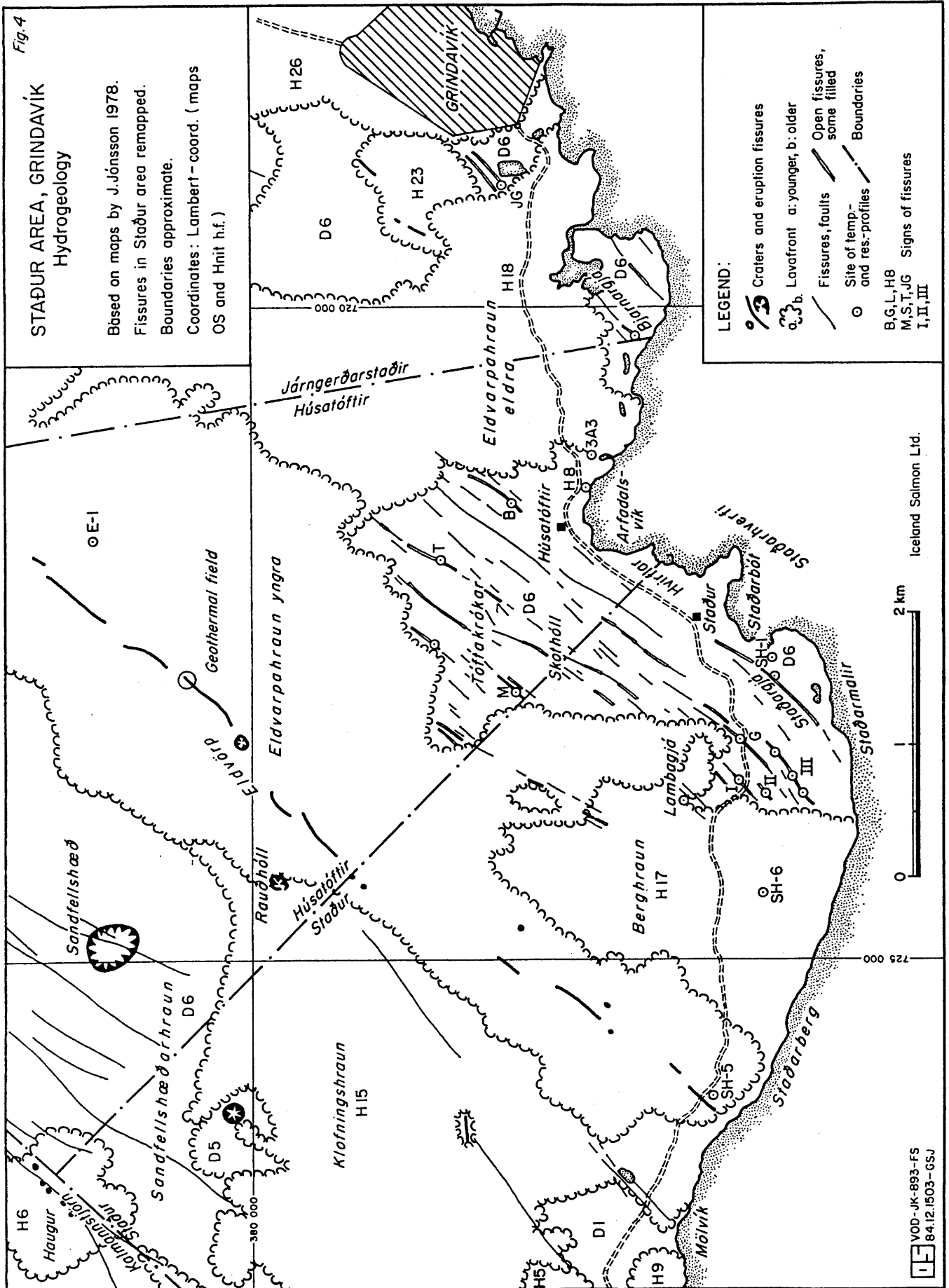


FIGURE 4 Hydrogeology of the Staður area



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Fig 5

STAÐUR. DRILL LOGS SH-14, SH-15
(based on drillers diaries)

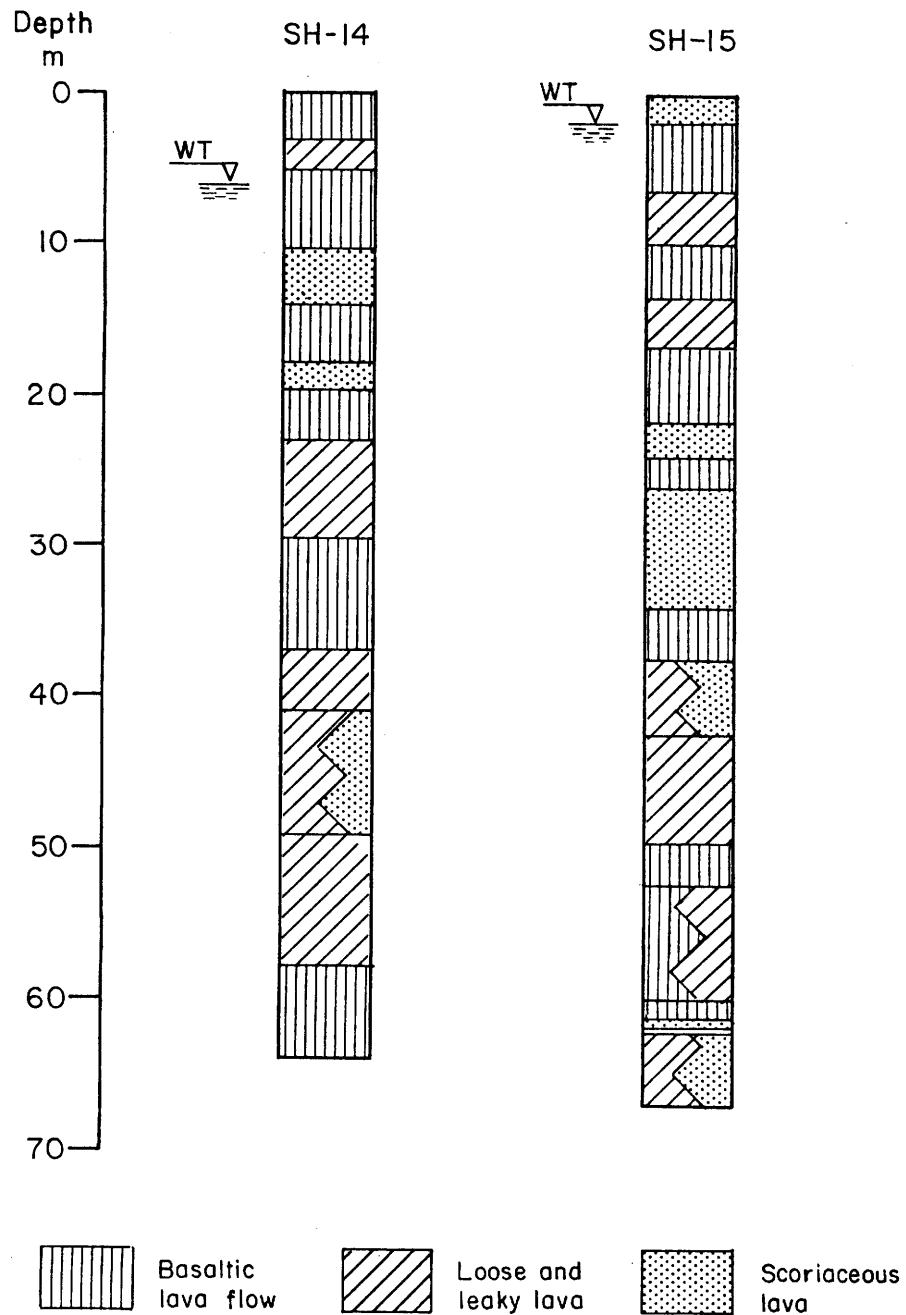


FIGURE 5 Drill logs SH-14 and SH-15

The Staður area is covered by lava from the shield volcano Sandfells-hæð. Below it are possibly other, older lavas from the same source, dating even from the last interglacial. On both sides of Staður, the Sandfells-hæð lava is in turn covered by younger but thinner lavaflows, at Staðarberg and at Húsatóftir, as well as farther inland. The Sandfells-hæð lava has flowed into the sea. Its front is now some meters below the present sealevel. The lava is composed of flow units, with scoriaceous contacts and belting planes. The overall permeability is high but the units have only limited extension, so that local variations in the permeability are relatively great. These structures are obvious in the drill-logs. It can be estimated from the drill-logs of the production wells (fig. 5) that the productive part of SH-15 would be greater than in SH-14 (30 m vs. 20 m), and the permeability probably also higher. The lava sequence at Stadur is highly anisotropic, with the highest permeability in the SW-NE direction and along the contact/bedding planes. There are numerous open fissures cutting the area, increasing the permeability, strengthening the anisotropy and providing local channels for the groundwater flow.

Offshore, the tremendous surf of the open sea has pressed sediments and marine vegetation like seaweed into the pores and fissures in the lava. Together with probable, anomalous cooling structures at the lava front this drastically reduces the permeability of the frontal part of the lava.

2.3 Well-logs, temperature and resistivity

Because of the very high permeability of the rocks the freshwater in the westernmost part of the Reykjanes peninsula occurs as a relatively thin layer, floating on the heavier seawater below. This layer is thickest in the central part of the peninsula, where it reaches a thickness of 50 m. It thins out toward the coast, being less than 25 m thick at Lambagjá. At the lower limit of the freshwater layer, there is a transition zone with temperature and salinity rapidly increasing downward. It probably results from diffusion, friction of flow and inhomogeneities in the rock structures. Near to the coast the tidal effect on the groundwater seems to be dominantly responsible for this as there is a close connection between the salinity and the tidal response (fig. 6). Close to the shoreline the salinity of the "freshwater" layer exceeds the 10‰ isohaline. It is therefore questionable whether one can speak of a "freshwater" layer under such circumstances.

The well-logs show the distribution of temperature and salinity in the fresh or salt groundwater (fig. 7, fig. 8). The accuracy of the

temperature measurements is $\pm 0.2^{\circ}\text{C}$, but the relative error in the same profile is only $\pm 0.1^{\circ}\text{C}$. The lower resistivity readings are not very accurate, but they are comparable from one profile to another. A drilled well constitutes a local disturbance in the groundwater flow in the rocks, because the water can flow so much more easily along the open well. The drilling itself also causes some disturbance of the natural conditions, which can last for weeks.

The number of logs varies from one well to another. The well-logs are shown in Appendix 1. The logs from SH-2 span one year (fig. 9). In the seawater, close to the bottom of the well, the temperature fell during Oct.- Dec. 1984 from $7\frac{1}{2}^{\circ}\text{C}$ to $5\frac{1}{2}^{\circ}\text{C}$ but rose again to the former value in Aug.-Oct. 1985. This probably represents a seasonal level fluctuation. Similar changes in temperature were observed in well SH-13 in Jan.-Oct. 1985 (fig. 10). In other wells, penetrating down into the seawater, the period of observation was much shorter. In October 1984 the temperature in the seawater in SH-8 at Lambagjá was 8°C or more. This could indicate higher temperature in the seawater inland than at the coast. That would be in accordance with our knowledge of the temperature farther inland. The temperature in the freshwater layer seems to respond somewhat faster to seasonal climatic fluctuations. Close to the coast, the temperature of outflowing "freshwater" is clearly controlled by the sea temperature.

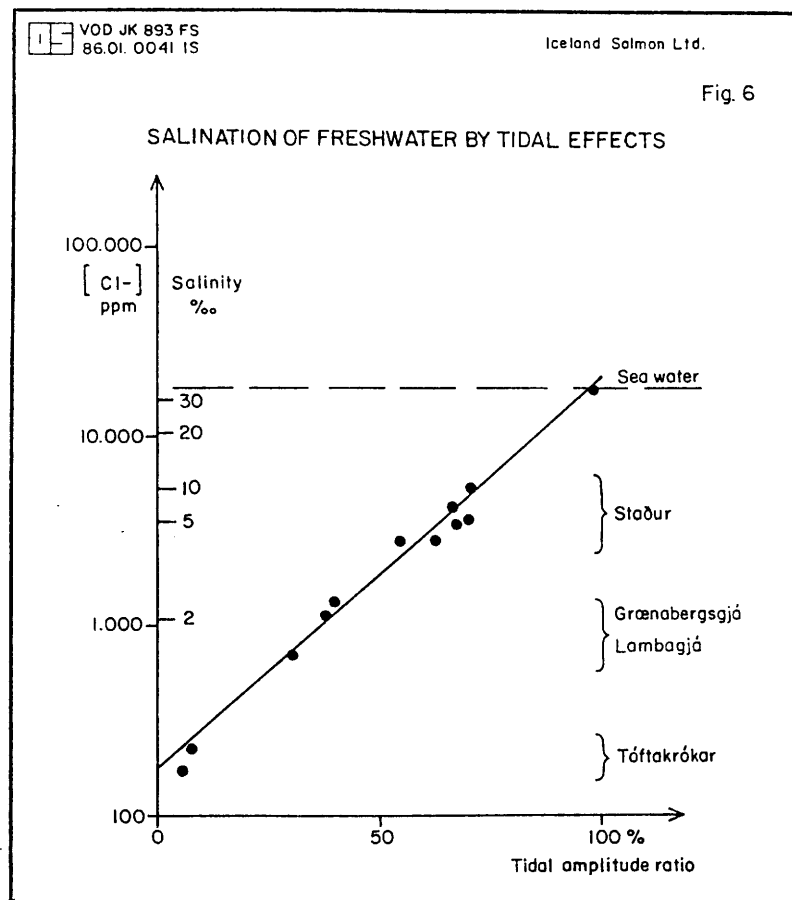


FIGURE 6 Salination of freshwater by tidal effects

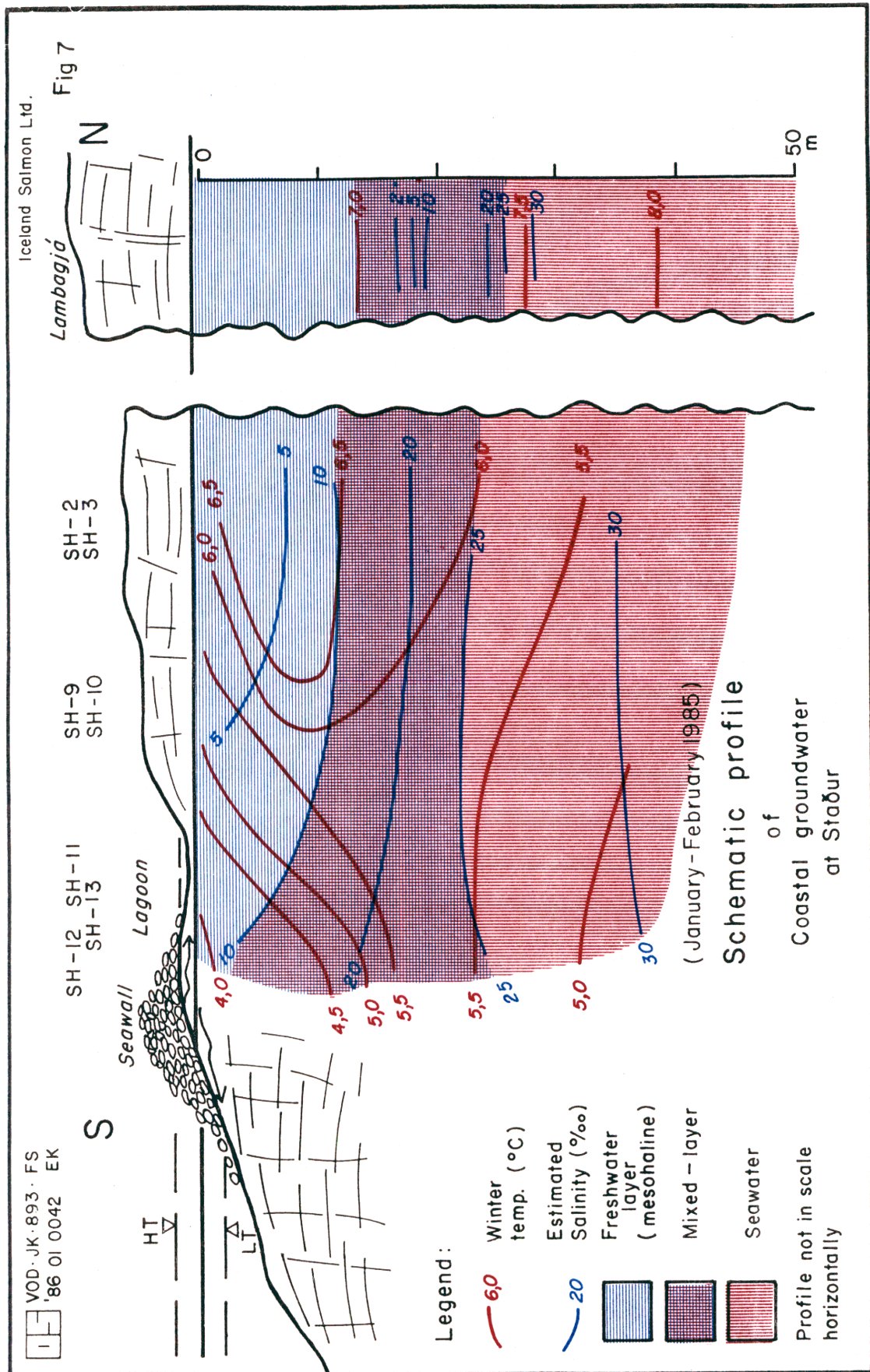


FIGURE 7 Schematic profile of coastal groundwater at Staður

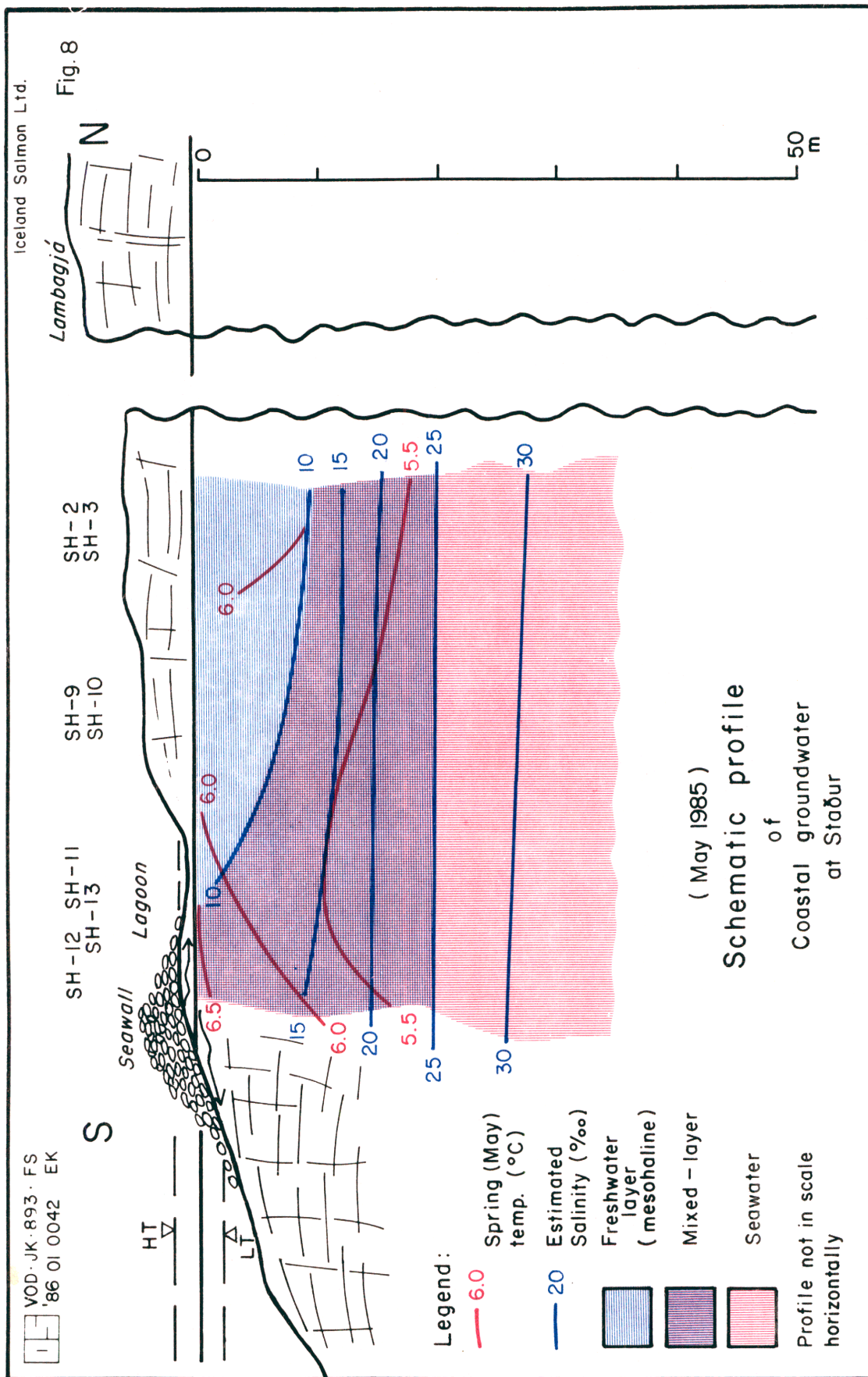


FIGURE 8 Schematic profile of coastal groundwater at Staður

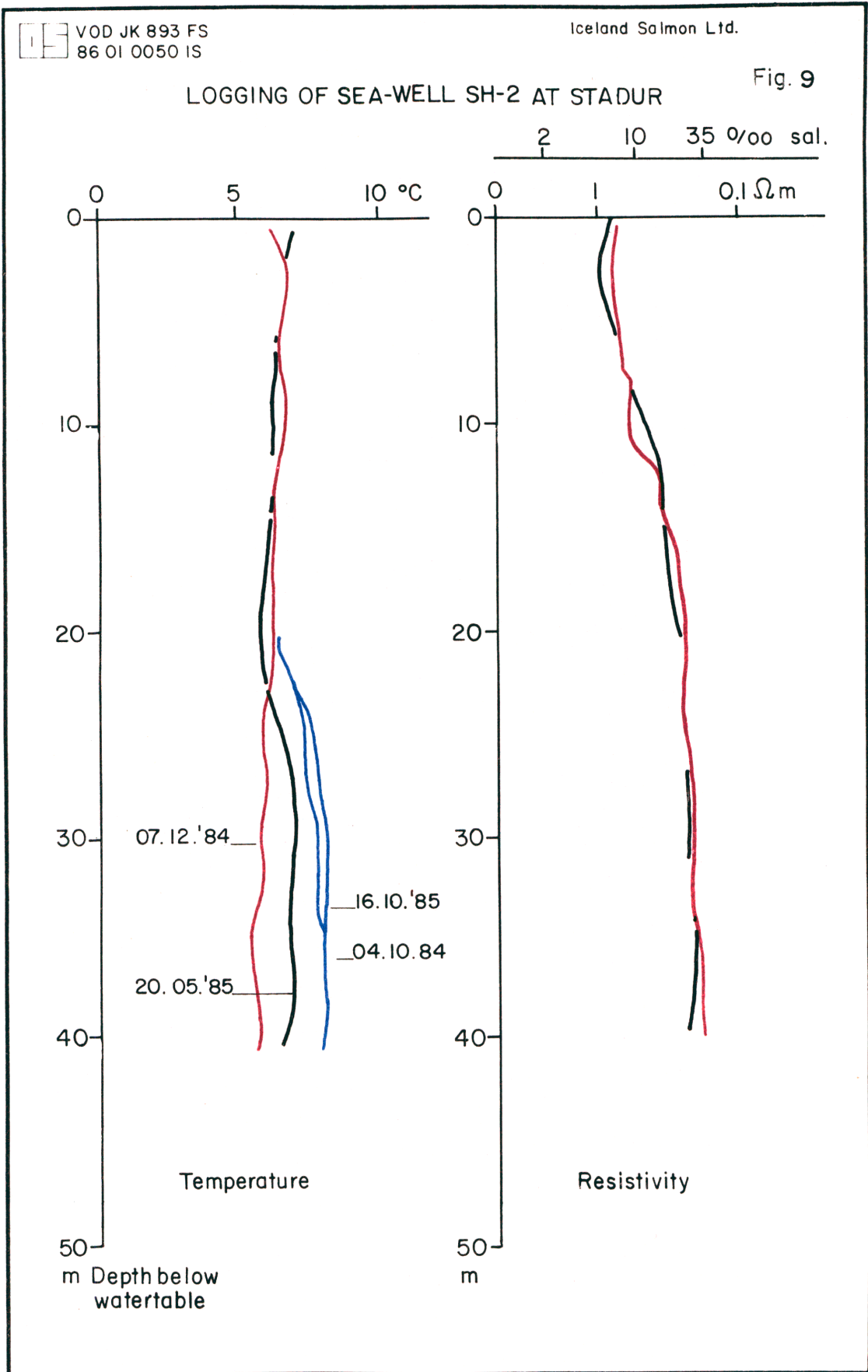


FIGURE 9 Logging of sea-well SH-2 at Staður

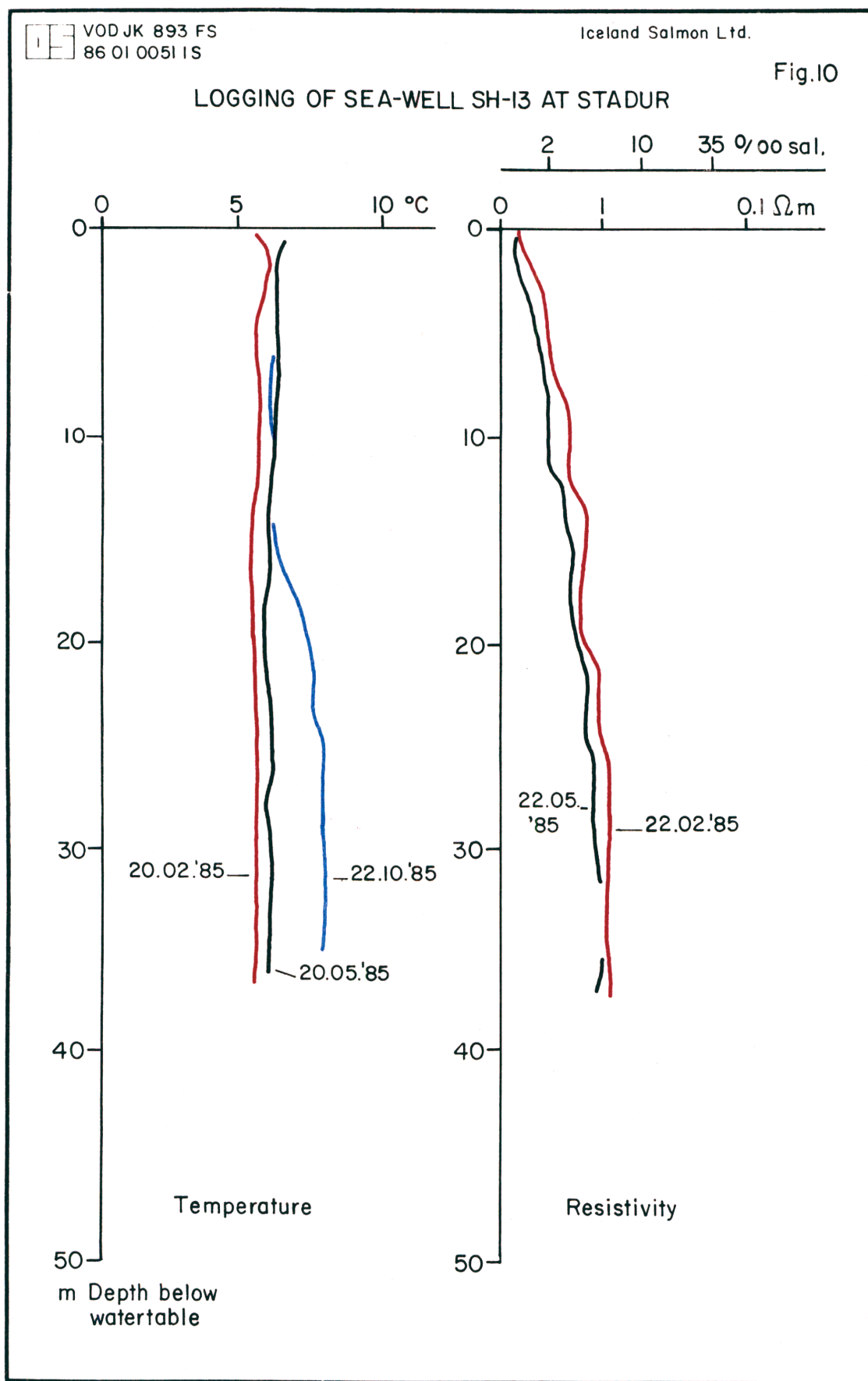


FIGURE 10 Logging of sea-well SH-13 at Staður

3 CHEMICAL ANALYSES

The results of all chemical analyses made for Islandslox as part of the seawater investigations are presented in this chapter. A short description of the analytical methods used is given in Appendix II.

Table 1 lists results of measurements of chloride and sulfate in water samples taken during the pumping tests in Staðargjá at sites A and B.

Table 2 lists the results of measurements of oxygen, iron concentration and conductivity in down-hole samples from observation wells SH 9, 11, 12 and 13 and the oxygen and iron concentrations in a sample taken late during the pumping test of Staðargjá. The oxygen concentration is measured by a Chemet test kit. For the saline water this method was shown to give too low readings in the 5-12 ppm concentration range compared to the Winkler and electrode methods. Several concurrent measurements by the Chemet method and the Winkler standard method (Standard Methods, 1980) were made. The maximum difference found in the 5-12 ppm concentration range was 1.5 ppm.

Table 3 lists total analyses of several samples from Staðarbergsgjá, Staðargjá sites A and B and a sample from a well (SH-16) by Brúargjá. For comparison the following chemical analyses are listed: analyses of seawater off shore at Staður, standard seawater composition (Iurekian, 1969) and of luke warm water from a 1047,5 m deep geothermal well SIG-1 at Staður (Lúðvíksson et.al 1985).

Table 4 lists analyses of water from production well SH-14: samples collected by a down-hole sampler before pumping, samples of pumped water, and down-hole samples taken during the pumptest.

Table 5 lists analyses of water samples from production well SH-15: down-hole samples, samples from the pumptest just before Christmas, and samples of pumped water taken Jan. 8, 1986 for complete analyses.

As can be seen from tables 3, 4 and 5 the water has a maximum salinity of 33.2 o/oo. The concentration of iron is below 0.1 mg/kg in the production wells and concentrations of cadmium, lead and copper are below 1 ppb. The concentration of zinc does not exceed 30 ppb. The pumped water from the production wells contains 8-9 ppm of oxygen which is at or above saturation.

For confirmation of pure seawater origin of the production water the ratio of oxygen isotopes for several samples was measured. The value recorded (δO^{18}) is a figure relative to standard oceanwater and should

be near to zero for seawater and be lower as the freshwater component increases. The only analysed sample of seawater off shore at Staður had a δO^{18} value of -0.91. All the samples of water pumped from production wells had δO^{18} values of -0.92 to -0.19. The results indicate a stronger groundwater influence in SH-15 than in SH-14.

Silica concentration in water from production wells is comparable with seawater concentration. In Staðarbergsgjá and Staðargjá the concentration is much higher.

The salinity in the shallow observation wells and sea-water production wells does not exceed 33.2 o/oo. Only one sample was collected and analysed of the seawater off shore at Staður. No other data exists of seawater from this location making interpretation of the well data difficult. For this purpose frequent sampling during at least one year would have been desired to record the seasonal variation and give a mean annual value. Measurements from nearby sites (Reykjanes, Krísuvíkurbjarg) show highly varying salinity from 23.5-35.0 o/oo (Stefánsson et al., 1961), but it is mostly less saline than standard seawater.

Where the temperature of the regional saline groundwater of the Reykjanes Peninsula is high it reacts with the underground rocks and its composition changes (see Kristmannsdóttir, 1984, Tómasson et al, 1977, Lúdvíksson et al, 1985). The oxygen concentration is very low in places and the concentration of iron is rather high. This makes the water unsuitable for direct aquacultural use. In the seawater wells at Staður the decrease of oxygen by depth has been measured in down-hole samples collected before pumping. Rather high concentrations of iron are also detected at depth in wells SH-12 and SH-13. The salinity of the luke warm water from the geothermal drillhole SIG-1 is even higher than of standard sea water. Groundwater in deep drillholes elsewhere on the peninsula has also been found to be fully saline (see Tómasson et al, 1977). The reason for the difference between them and the shallower production drillholes at Staður is that there the sea is drawn in from coastal areas and the transfer time is relatively short as demonstrated in chapter 6. In the deeper levels the recharge is probably from deeper levels out on the Reykjanes Ridge. The geothermal drillhole SIG-1 also shows significant compositional changes due to water-rock reaction at low and moderate temperatures.

TABLE 1 Staðargjá Pumping test at site A,
chloride and sulfate determinations

Date	Time	mg/kg	
		S04	Cl
85.01.24	17:07	491,9	3724,8
85.01.24	17:50	504,1	3798,3
85.01.25	10:50	590,7	4391,5
85.01.25	11:30	567,9	4205,2
85.01.26	11:45	564,8	4215,4
85.01.26	19:45	610,4	4538,5
85.01.27	14:00	534,5	4008,6
85.01.28	13:30	567,9	4302,6

Staðargjá pumping test at site B

85.02.01	15:40	842,2	6229,4
85.02.05	16:45	1172,0	8682,8

TABLE 2 Determinations of oxygen, iron and conductivity

			mg/l		Conduct.
Location		Date	O2	Fe	Ohmm/°C
Staðargjá					
Site A		85.01.25	9,0	< 0,1	-
SH-13, 38 m depth		85.03.01	5,0	0,2	0,25/20,5
SH-12 6 m "		85.03.01	7,0	< 0,1	0,42/20,5
SH-12 14 m "		85.03.01	7,0	0,15	0,34/20,5
SH-12 25 m "		85.03.01	7,0	0,15	0,29/20,5
SH-12 38 m "		85.03.01	5,0	0,20	0,26/20,5
SH-11 5 m "		85.03.01	8,0	< 0,1	0,70/20,5
SH-11 15 m "		85.03.01	6,0	0,1	0,34/20,5
SH-11 25 m "		85.03.01	7,0	< 0,1	0,29/20,5
SH-11 30 m "		85.03.01	4,5	< 0,1	0,28/20,5
SH-9 29 m "		85.03.01	4,5	0,1	0,28/20,5

Table 3 Concentration in mg/kg (ppm)

Loc.	Staðarb.- gja 9 m.d.	Staðarb.- gja 5 m.d.	Staðargjá pumpt.A	Staðargjá pumpt.A	Staðargjá pumpt.B	Staðargjá pumpt.B	Drillh.at Brúargjá Grindav.	Seawater of shore Staður	Standard sea water *	SIG-1 geothermal well
Date	16.01.85	16.01.85	25.01.85	28.01.85	06.02.85	06.02.85	16.11.85	25.11.84	-	04.09.85
No	0014	0015	0022	0023	0026	0027	0242	0102	-	0245
t°C	6.6	6.0	-	6.5	4.4	10.2	10.0	-	-	38.0
pH/°C	7.72/28.6	7.68/22	7.82/21	7.80/21.1	7.90/21.8	7.96/21.8	7.61/19.6	7.96/21.5	8.0/25.0	7.49/23
SiO2	14.5	14.4	13.2	13.0	8.6	2.6	16.9	1.5	2.9	25.0
Na	1215	1117	2107	2263	5074	9013	252.3	9717	10760	10472
K	50.5	46.0	88.2	92.7	215.4	380.4	9.7	415.1	387.0	285.3
Ca	68.4	63.2	98.5	104.6	217.5	359.4	32.0	380.8	413.0	1755.0
Mg	145.9	133.6	260.7	277.0	605.0	1062.1	30.2	1222.8	1294.0	543.8
CO2	33.3	30.5	40.8	40.4	63.3	97.6	23.6	103.0	103.0	36.7
SO4	289.0	266.4	514.1	552.6	1278.4	2282.3	57.8	2531	2712	2516
Cl	2220	2065	3865	4173	9370	16776	478.5	18037	19353	19936
F	0.20	0.19	0.26	0.26	0.43	0.56	0.16	0.57	1.30	0.06
tot.diss.	4396	4110	7495	8043	18221	33318	1001	35903	0.003	37627
Fe	0	0	0	<0.1	0.100	0.160	<0.1	0.010	0.003	0.7
Li	0.02	0.02	0.03	0.04	0.08	0.14	9"	-	-	0.005
02	-	-	9	-	-	7	-	67.9	67.0	69.2
Br	-	-	-	-	-	-	-	-	-	-
I	-	-	-	-	-	-	-	-	-	-
g/kg	-	-	-	-	-	-	-	-	-	-
(ppb)	-	-	-	-	-	-	-	-	-	-
80 ¹⁸	0	-	-	-6.29	-4.17	2.8	-	18.4	64.0	-0.11
Cond.ms	7.1	6.3	11	12	25	42	0.2	-0.91	0	53
Sal.o/oo + 4.0	3.8	3.8	7.0	7.6	16.9	30.3	0.9	32.6	35.0	36.0

* Turekian, 1969

- not measured

+ calculated from chloride concentration according to Standard Methods 1980.

" Measured by Winkler method

Table 4 Staður SH-14 Production well, concentration in mg/kg (ppm)

Loc.	35 m.d.	42 m.d.	47.5 m.d.	Pump test	Pump	45 m.d. pumping	Pumping	Pumping	Pump test surface	Pump test 35 m.d.	Pump test 42 m.d.	Pump test 47 m.d.	Pumping	Seawater off shore Staður	Standard	SIG-1 geoth.well
Date	14.08.85	14.08.85	14.08.85	19.08.85	21.08.85	27.08.85	30.08.85	30.08.85	04.09.85	04.09.85	04.09.85	04.09.85	04.09.85	25.11.84	*	04.09.85
No.	0168	0169	0170	0171	0172	0173	0174	0176	0181	0182	0183	0184	0203	0102		0245
t°C	-	-	-	6.5	7.0	7.0	7.0	7.5	6.5	-	-	-	-	6.6		38.0
pH/°C	8.40/21.9	8.37/20.7	8.16/20.6	8.00/22.7	8.02/21.9	7.90/23.0	7.99/22.6	8.00/19.6	7.97/22.6	7.89/22.6	7.91/22.4	7.91/22.5	8.00/21.5	7.96/21.5	8.00/25.0	7.49/23.0
SiO2	2.5	3.9	3.5	3.3	3.2	2.5	2.7	2.8	2.9	2.7	2.6	2.6	2.6	1.5	2.9	25.0
Na	8997	9390	9521	9774	9826	10174	9804	9847	9716.6	9760.2	9825.6	9825.6	9564.1	9717.1	10760.0	10472.0
K	400.0	410.6	421.3	419.9	423.4	432.0	420.8	431.3	422.2	418.7	421.8	426.7	397.8	415.4	387.0	285.3
Ca	427.3	424.6	409.4	373.9	375.7	387.5	372.4	376.0	374.2	378.7	383.5	388.0	380.8	380.8	413.0	1755.0
Mg	1082.6	1175.5	1204.7	1233.9	1220.9	1222.2	1181.8	1188.6	1208.7	1212.1	1275.9	1275.9	1225.5	1222.8	1294.0	543.8
CO2	82.7	96.8	100.7	101.2	99.4	105.5	104.6	104.3	98.5	101.6	102.9	104.2	98.5	103.0	103.0	36.7
SO4	2258	2348	2401	2448	2443	2539	2491	2480	2468	2438	2452	2480	2445	2531	2712	2516
Cl	16138	16772	16937	17486	17565	18290	18366	17988	17755	17905	17973	18169	17981	18037	19353	19936
F	0.45	0.61	0.70	0.71	0.74	0.77	0.80	0.78	0.78	0.78	0.79	0.80	0.86	0.57	1.3	0.06
Tot.diss.	32421	34088	37681	35327	34903	34629	35131	34464	34612	34457	35978	36239	35569	35903	-	37627
Fe	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	0.010	0.003	0.7
O2	0.15	1.5	3.5	2.0	1.5	2.0	2.0	7.7"	8.5"	11"	9"	9"	8.4"		67.0	0.005
Br	56.3	59.0	59.0	61.7	61.7	63.2	61.5	60.0	60.5							69.2
I g/kg																
ppb																
8018	-1.03	-0.91		-0.47	-0.46	-0.19	-0.40	-0.49	-0.53		-0.45	-0.32	-0.26	-0.91	64.0	-0.11
Cd ppb									<1				<1		0	<1
Pb ppb									<1				<1			<1
Cu ppb									<1				<1			<1
Zn ppb									30				17			19.5
Cond.ms	43.7	45.5	46.5	46.7	46.9	49.0	48.1	47.9	47.9	48.2	48.5	48.9	48.7	45.0	-	53.0
Sal.o/oo+	29.2	30.3	30.6	31.6	31.7	33.0	33.2	32.5	32.1	32.3	32.5	32.8	32.5	32.6	35.0	36.0

* Turekian, 1969

+ Calculated from chloride concentration according to standard methods, 1980

" Measured by Winkler method

- not measured

Table 5 Staður SH-15 Production well concentration in mg/kg (ppm)

Loc.	38 m.d.	64 m.d.	Pump test hrs.10:35	Pump test hrs.12:10	Pump test hrs.12:10	Pumping hrs.11:30	Pumping hrs.13:30	Pumping hrs.15:50	Seawater off shore	Standard sea water
Date	17.12.85	17.12.85	20.12.85	20.12.85	20.12.85	08.01.86	08.01.86	08.01.86	25.11.84	Iurekian.1969
No.	0267	0268	0269	0270	0271	0003	0004	0005	0102	
t°C						6.5	6.5	6.5		
pH/°C	7.93/24.9	8.04/24.8				8.00/20.6	8.00/20.6	8.00/20.5	7.96/21.5	8.00/25.0
SiO2	3.4	2.7				3.5	3.5	3.5	1.5	2.9
Na	9114	9258				9340	9269	9363	9717	10760
K	388.5	394.9				377.6	379.4	384.9	415.4	387.0
Ca	359.4	368.3				360.6	363.3	364.2	380.8	413.0
Mg	1161.2	1155.1				1136.6	1124.4	1127.4	1222.8	1294.0
CO2	104.7	108.2				94.1	93.2	94.6	103.0	103.0
SO4	2377	2425	2350	2350	2318	2305	2297	2333	2531	2712
Cl	16940	17275	16515	16560	16395	16631	16584	16767	18037	19353
F	0.76	0.83				0.83	0.83	0.83	0.57	1.3
Tot.diss.	33430	33886				33112	33049	33219	35903	
Fe	<0.1	<0.1				<0.1	<0.1	<0.1	0.010	0.003
02	5.5	5.2				8.4"	8.4"	8.4"		
Br	63.1	63.5				61.6	61.2	61.3	67.9	67.0
I g/kg										
ppb										
δ018									18.4	64.0
Cond.ms	46.6	47.6	46.3	46.3	45.9	-0.87	-0.86	-0.92	-0.91	0
Sal o/oo+	30.6	31.2	29.8	29.9	29.6	30.1	30.0	30.3	45.0	-
									32.6	35.0

- not measured
 " Measured by Winkler method
 + Calculated from chloride concentration

4 TIDAL RESPONSE

Tidal response has been recorded in all the wells and fissures in the area, see fig. 1 for their location. The response in production wells SH-14 and SH-15 is shown as an example, figs. 11 and 12. Amplitude ratios and timelags are given in table 6 and fig. 13. Table 6 also shows the diffusivity values I/S obtained from the amplitude ratio and time delay respectively.

It is worth mentioning that SH-14 is spaced 28 m from SH-1, which is 18 m deep but SH-14 is 62 m deep and is cased off down to 42 m. The time delay is less and the ratio higher in the deeper well. This indicates high transmissivities down to the 60 m depth.

It is clear from fig. 13 that the amplitude ratio decreases with distance from the shore, and the timelag increases. Fig. 14 shows the amplitude ratio plotted versus the shortest distance from the shore. The values are rather scattered, but the amplitude ratio plotted versus the distance in the direction of the tectonic swarms on fig. 15 shows a consistent relationship. Similarly, it is easier to establish a consistent relationship of timelag versus distance from the shore if the distance is measured in the direction of the tectonic swarms, figs. 16 and 17. This leads to the conclusion that the tidal response inland is governed by the faults, and that there is relatively little interconnection across fault systems. The diffusivity values I/S obtained from figs. 15 and 17 are :

From amplitude ratio	138 m ² /s
From time lag	230 m ² /s

These values, which can be looked upon as an indication of regional diffusivity, are higher than shown in table 6. The reason is that, by this method, the time lag and the damping effect at the shore are found and compensated for before the regional diffusivity values are calculated.

These regional values are higher than anticipated. However, they are consistent and take into account almost every measurement.

The main conclusion as regards the seawater wells is that the tidal wave has 45 min delay at the shore and the amplitude has damped down to about 70% of its initial value.

TABLE 6 Results from tidal analyses

Observation well	Amplitude ratio %	Timelag hours	I/S from amplitude ratio m2/s	I/S from timelag m2/s
SH-13	67.4	0.53	5	10
SH-12	71.6	0.52	9	14
SH-11	70.1	0.75	13	11
SH-10	68.2	0.80	11	10
SH-9	62.7		13	
Staðargjá, A	70.0		22	
Staðargjá, B	55.9	0.83	19	35
SH-1	63.1	1.32	21	10
SH-2	58.9	0.95	33	39
SH-3	50.6	1.43	20	17
SH-5	24.7	2.67	2	2
SH-6	37.5	1.65	19	25
Staðarbergsgjá	49.7	1.23	36	45
Grænabergsgjá	40.8	1.90	107	91
SH-4	37.5	2.08	98	83
SH-7	29.2	2.03	85	120
Lambagjá	30.8	2.28	94	95
Hrafnagjá	8.0	4.38	104	138
Miðgjá	6.0	4.61	141	202
Baðstofugjá	3.0			35
Golfv.	18.0	2.08	2.2	5.4
SH-14	71.0	1.08	38	15
SH-15	72.0	0.55	14.4	20.1
Hole at SH-16	16.4	3.05	87	29

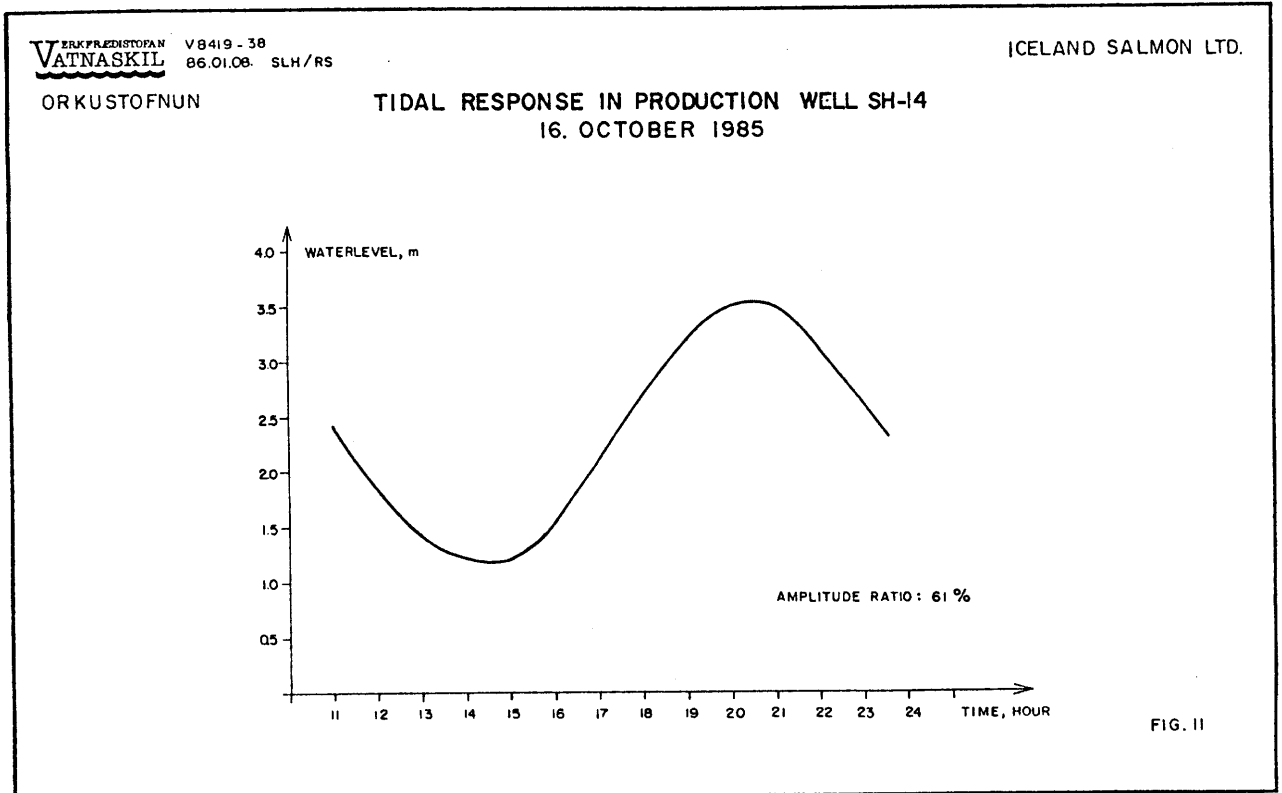


FIGURE 11 Tidal response in production well SH-14

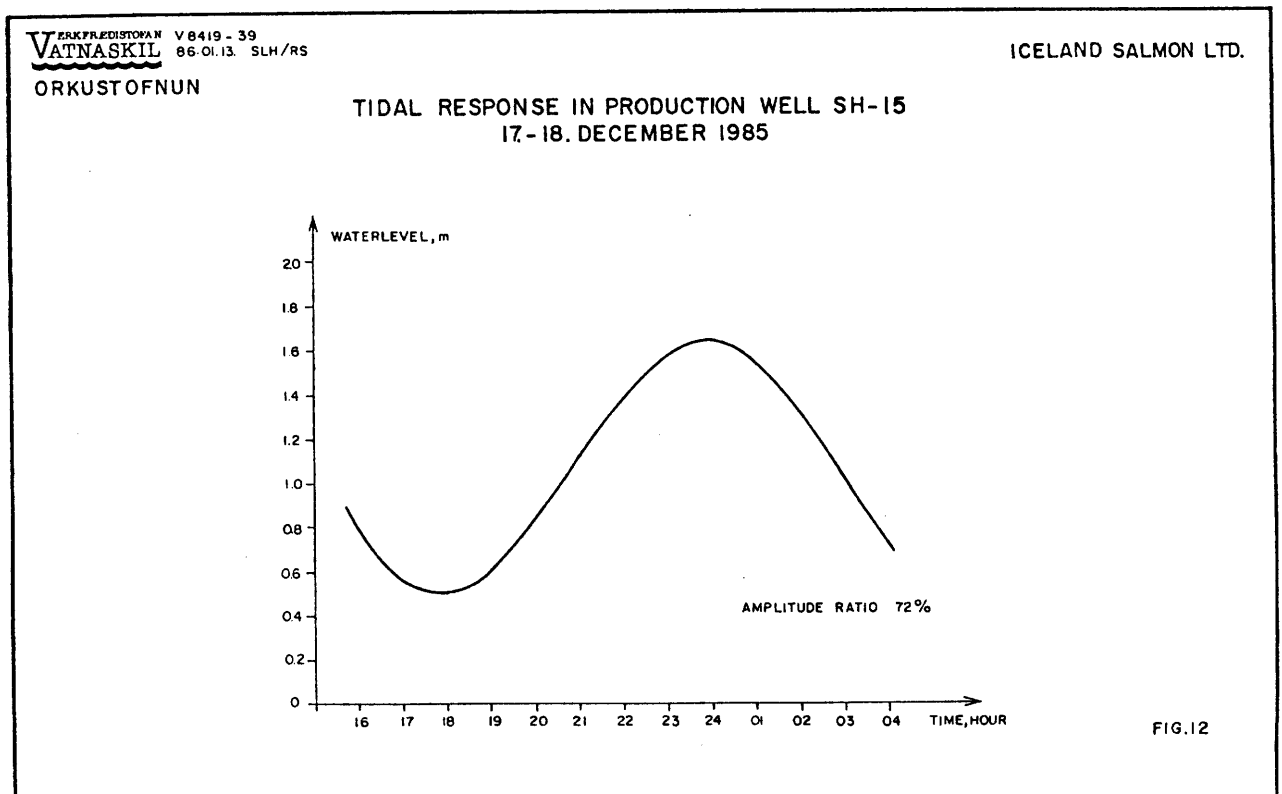


FIGURE 12 Response in production well SH-15

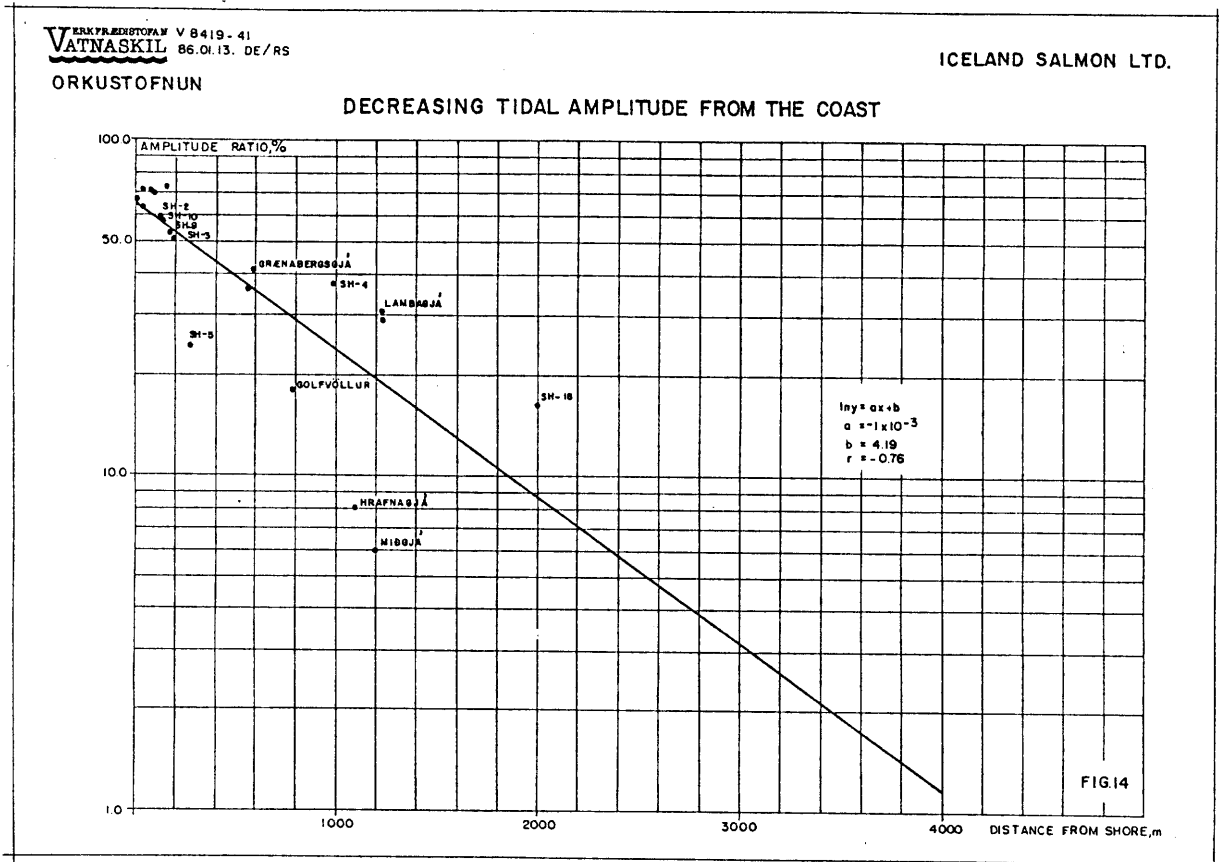


FIGURE 14 Decreasing tidal amplitude from the coast

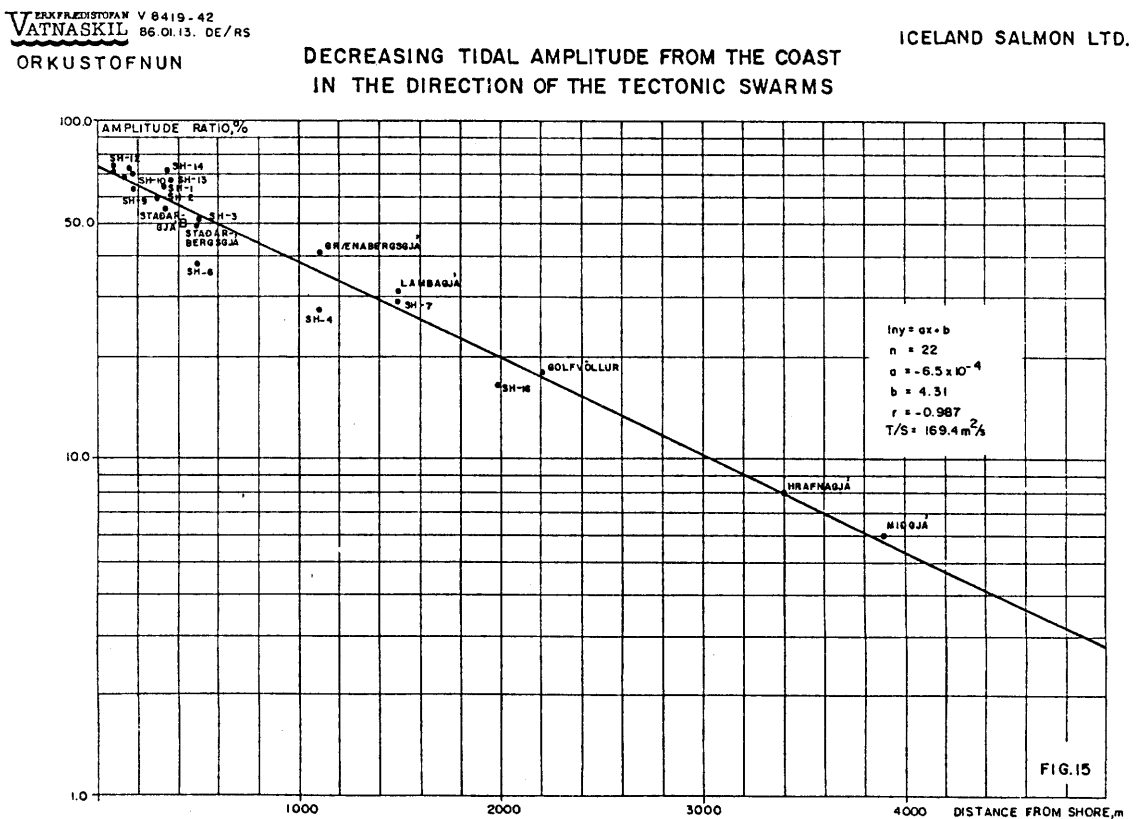


FIGURE 15 Decreasing tidal amplitude from the coast in the direction of the tectonic swarms

TIDAL RESPONSE
TIME LAG VS THE SHORTEST DISTANCE FROM THE SHORE

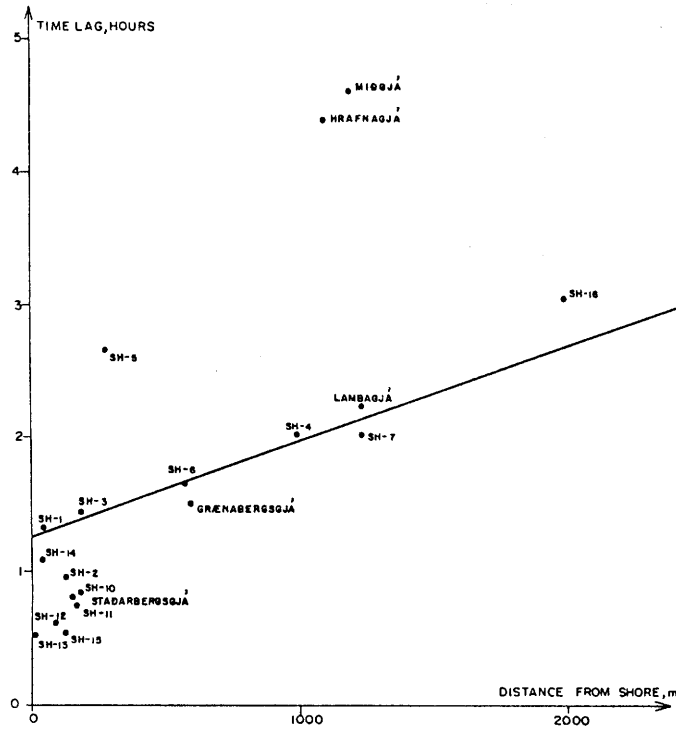


FIGURE 16 Time lag vs. the shortest distance from the shore

TIDAL RESPONSE
TIME LAG VS DISTANCE FROM THE SHORE
IN THE DIRECTION OF THE TECTONIC SWARMS

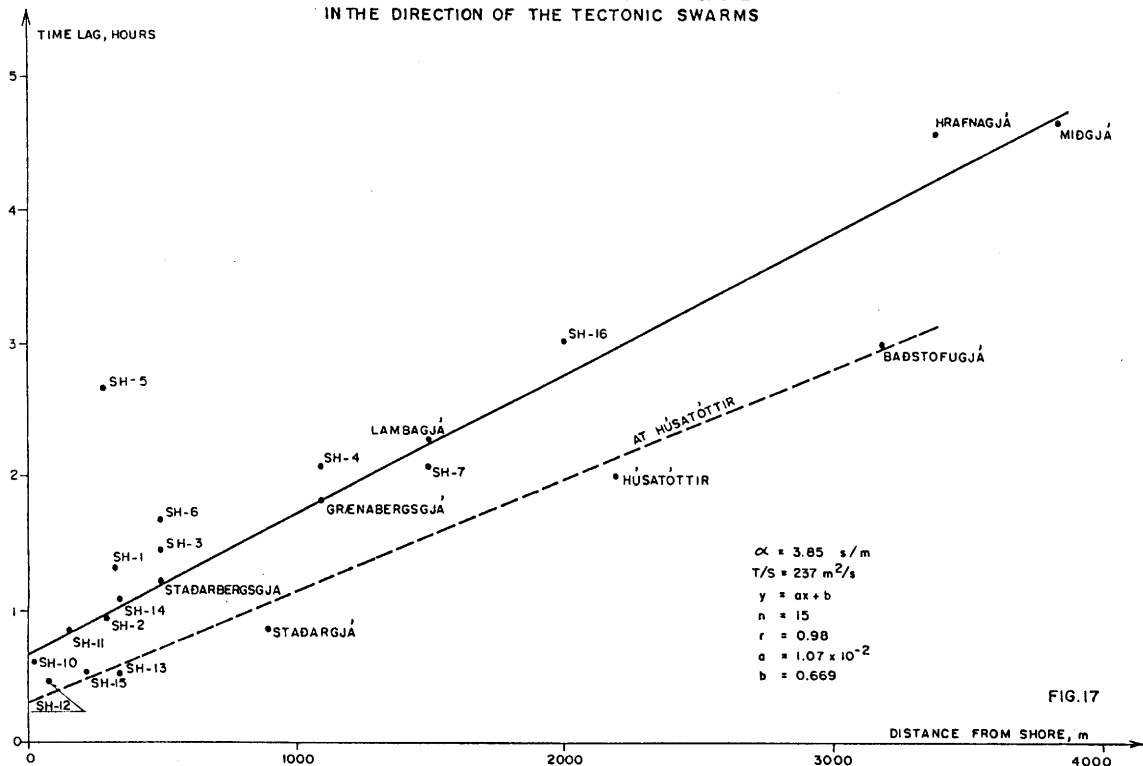


FIGURE 17 Time lag vs. distance from the shore in the direction of the tectonic swarms

5 TESTING OF STAÐARGJÁ FISSURE

In order to investigate seawater supply from fissures, two pump tests were conducted at Staðargjá. In both pump tests a submersible pump was used. With the help of a datalogger flowrate, waterlevel (draw-down) at pumping site and observation site, air, and water temperature were measured and stored directly in a computer.

5.1 Location A

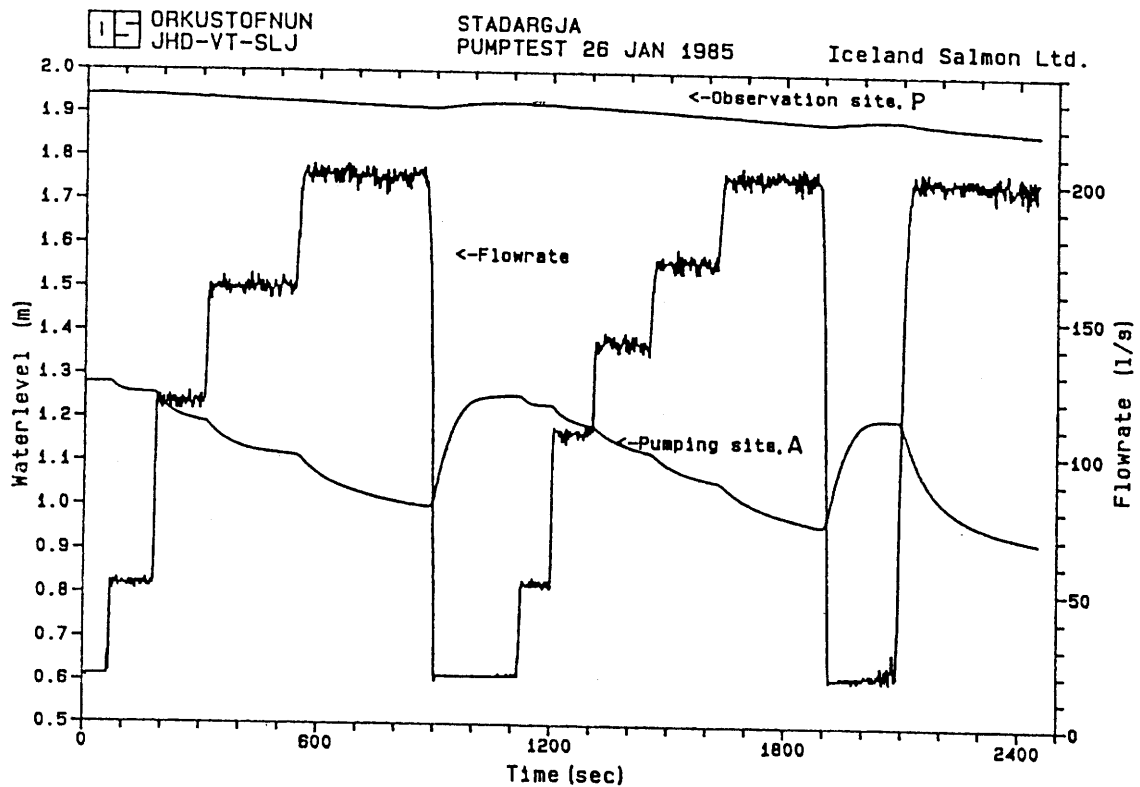
The first pump test was made on January 24 to 28, 1985, at an excavation in the Staðargjá fissure, marked site A in figure 2. The pumping test was conducted at both high and low tide. During pumping, groundwater level (drawdown) was measured at three locations: the pumping site, in SH-3 and at observation site P (see fig. 2). Figure 18 shows an example of the measured drawdown and pumping rate. Measured drawdown was 28-30 cm at pumping site and 2.5-3.0 cm at observation site P for 200 l/s pumping rate. None or very little drawdown was measured in SH-3. Turbulent drawdown, which is about 90% of the drawdown at the pumping site, can be avoided by deeper wells.

Results from calculations are that porosity, S , lies in the interval 6-9% and transmissivity, T , in the interval 1.5-2.5 m²/s and permeability 0.09-0.15 m/s. In table 7 transmissivity from tidal response is shown for site P and B and wells close to Staðargjá, using porosity, $S = 7.5\%$. By using the mean groundwater level to estimate the thickness of the "freshwater" lens, the permeability is calculated, and also given in the table.

As can be seen in table 7, transmissivity calculated from tidal response in Staðargjá is in good agreement with the transmissivity calculated from pumping tests. Table 7 shows clearly that the transmissivity at the "seawall" is somewhat lower than in the Staðargjá area, but on the whole very high. The salinity and chloride content of the pumped water are listed in table 8. The temperature remained fairly constant, about 6.5°C.

TABLE 7 Transmissivity and permeability from tidal response and well testing

Observation well	Transmissivity m ² /s	Permeability m/s
Staðargjá, A	1.7	0.10
Staðargjá, P	2.0	0.11
SH-3	1.4	0.08
SH-9	1.0	0.06
SH-10	0.8	0.05
SH-2	2.7	0.15
SH-1	1.2	0.08
SH-13	0.6	0.04
SH-12	0.9	0.06
SH-11	0.9	0.06



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FIG. 18

FIGURE 18 Staðargjá pumptest

TABLE 8 Salinity and chloride content of pumped water
at pumping site A

Date	Time	Chloride content ppm	Salinity by conductivity o/oo
85.01.24	11.15		6.0
"	13.14		6.2
"	14.00		6.3
"	14.30		6.2
"	16.00		6.2
"	17.05	3725	6.9
"	17.50	3798	6.9
85.01.25	10.14	4392	7.7
"	11.30	4205	7.4
"	14.55		6.9
"	16.40		6.8
85.01.26	9.45		8.1
"	11.00		7.6
"	12.25		7.5
"	14.45		
"	16.00		7.3
85.01.27	14.00	4009	7.2
"	16.30		7.0
85.01.28	13.30	4303	7.3

The small variations in salinity are due to tidal effects

As can be seen from table 8, the salinity of the pumped water was far less than that of seawater, therefore water taken from this spot cannot be used to supply seawater to the aquaculture complex. Therefore another site in the fissure closer to the shore was selected for pump testing. This new site is marked B on fig. 2.

5.2 Location B

The second pumping test that was conducted at Staðargjá from February 1 to February 6, 1985 was at a site marked B on figure 2. Very little drawdown was observed. Measured salinity and temperature of pumped water is listed in table 9.

TABLE 9 Salinity and temperature of pumped water at pumping site B

Date	Time	Salinity by conductivity o/oo	Temperature °C
85.02.01	14.00	7.0	
"	14.35	9.0	
"	15.00	9.6	4.9
"	15.40	10.0	2.9
"	16.10	25.0	0.1
"	16.15	26.2	
85.02.05	15.10	15.4	5.0
"	15.35	14.3	5.0
"	16.45	14.9	
"	22.00	25.5	
"	22.30	24.2	3.9
"	23.30	20.3	4.2
"	24.00	18.9	4.4
85.02.06	00.30	17.5	4.5
"	01.00	15.9	4.6
"	01.30	15.6	4.7
"	10.30	31.3	3.6
"	11.00	27.5	3.6
"	11.55	23.9	4.3
"	12.40	22.0	4.5
"	13.00	21.2	4.2
"	13.30	19.0	4.6
"	14.00	18.0	4.7
"	14.15	16.0	4.7
"	14.30	17.1	4.7
"	14.45	16.0	4.9
"	15.00	16.2	4.9
"	15.15	16.0	4.9
"	15.30	17.0	4.9
"	16.00	16.4	4.9

Table 9 shows that there is a great variation in the salinity. From figure 19 we can see that the variation is due to tidal effects. Fig. 2 shows that surface runoff from a pond in direct contact with the sea at high tide flows into Staðargjá at the pumping site. This causes more salinity of the pumped water at high tide. For higher pumping rates than in the pump test the surface runoff would not be sufficient to maintain the high salinity, and therefore water from this spot cannot be used to supply seawater to the aquaculture complex.

The main conclusions from these two pump tests at Staðargjá were that seawater cannot be provided without casing off the freshwater lens. This is in accordance with paragraph 2.5 in our original proposal for this investigation. At this stage, it was therefore recommended to proceed to drill well SH-14.

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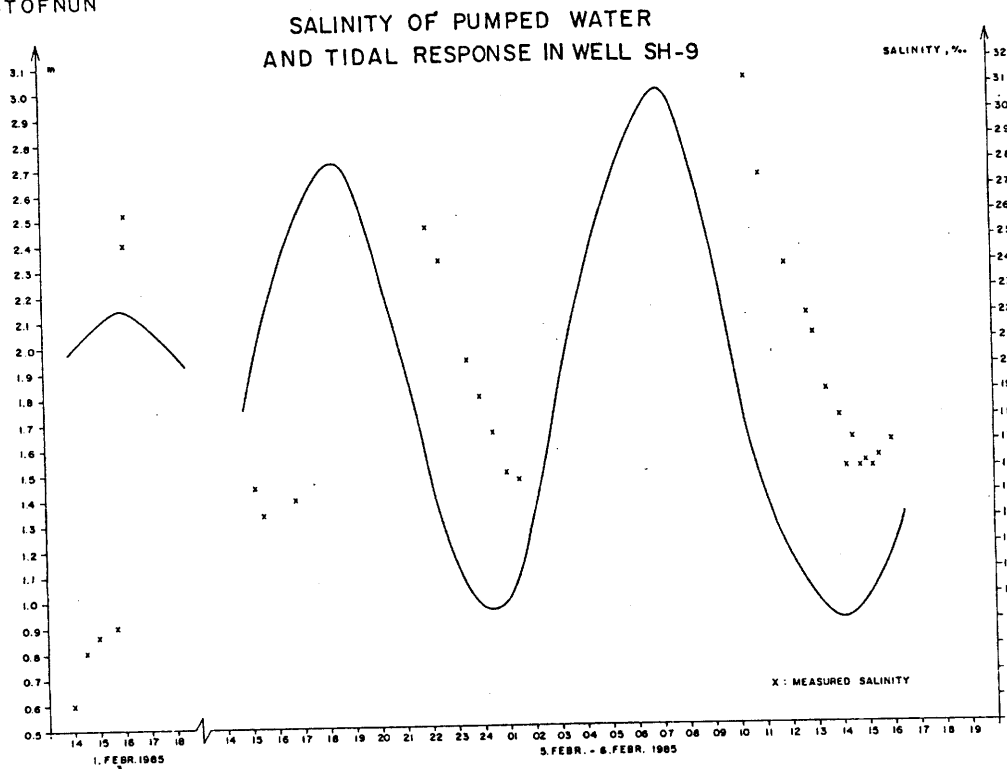


FIG.19

FIGURE 19 Salinity of pumped water and tidal response in well SH-9

6 SEAWATER WELLS

6.1 Testing of production well SH-14

The well was drilled from April 12 to August 7 1985 to the depth of 48 m. It was cased with solid steel 18 5/8" outside diameter casing to a depth of 36 m, in order to prevent inflow of fresh water. The well, however, only had a productive interval of 6-8 m, from 42 to 48 m, as no openings were detected from 36 m to 42 m.

After the pump testing the well was deepened down to 65 m. The deepening was carried out from September 12 to September 20, 1985.

6.1.1 Pumping test before deepening

The aim of this test was:

- a) To estimate the yield of the well.
- b) To measure changes in temperature and chemistry during the pumping.

In this chapter part a) will be considered. Part b) is described in chapter 3 and in section 6.2.

The test started on August 14 and lasted for 22 days. The pump was a suction pump, and due to tidal variations the pumprate was variable as the pump was operating close to maximum suction head. The mean flowrate was 80 l/s.

The step drawdown test was carried out on September 6, 1985. Maximum flowrate obtained was 98 l/s. The test produced the following drawdown-discharge relationship (see also table 9) :

$$s = 8.54 Q + 101.39 Q^2$$

where s is the drawdown in m and Q pumping in m³/s.

The water level was recorded in observation well SH-1 during the test.

The results were:

	Amplitude Ratio	Time lag
Before pumping	63%	1hr 18min
During pumping	61%	1hr 3min

The timelag in the tidal waves seems to be about 15 minutes shorter during pumping (see table 6). The effect on the amplitude ratio is insignificant. That means that it was not possible to distinguish the drawdown in SH-1 from the tidal waves.

6.1.2 The test after deepening

The main aim of this test was to measure the improvement of the yield of the well after deepening it. The test was carried out on September 25, 1985. Maximum pumping rate was 170 l/s (fig. 20). The test gave the following relationship (see table 9):

$$s = 288.0 Q + 34.11 Q^2$$

Water level at SH-1, which is 28 m away, was recorded continuously during the test. The maximum regional drawdown was about 1 cm.

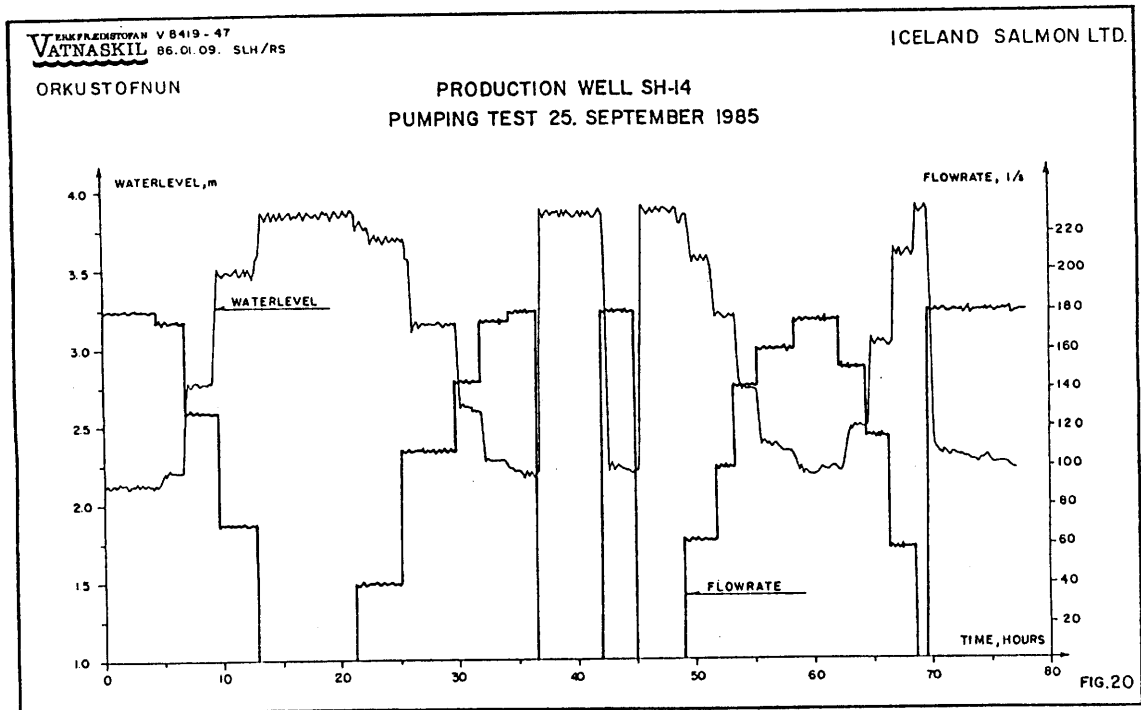


FIGURE 20 Production well SH-14

6.1.3 Results of the tests

Table 10 summarizes the results of the step drawdown tests in well SH-14.

TABLE 10 Step drawdown tests in well SH-14

Pumprate l/s	Drawdown before deepening m	Drawdown after deepening m
50	0.7	0.2
100	1.9	0.6
150	3.6	1.2
200	5.8	1.9
250	8.5	2.9
300	11.7	3.9
350		5.2
400		6.6

Transmissivity estimated from pump test was 0.35 m²/s

The yield rose significantly by deepening the well.

6.2 Mass transport calculations

Results of the chemical analysis of samples taken during the pumptest of SH-14 are given in section 3. In order to estimate the changes in chemistry of the pumped water, SO_4^{--} and Cl^- were chosen as suitable elements. The concentration of these elements during the pumptest is given in table 11 and on fig. 21. See table 4 in chapter 3 for reference.

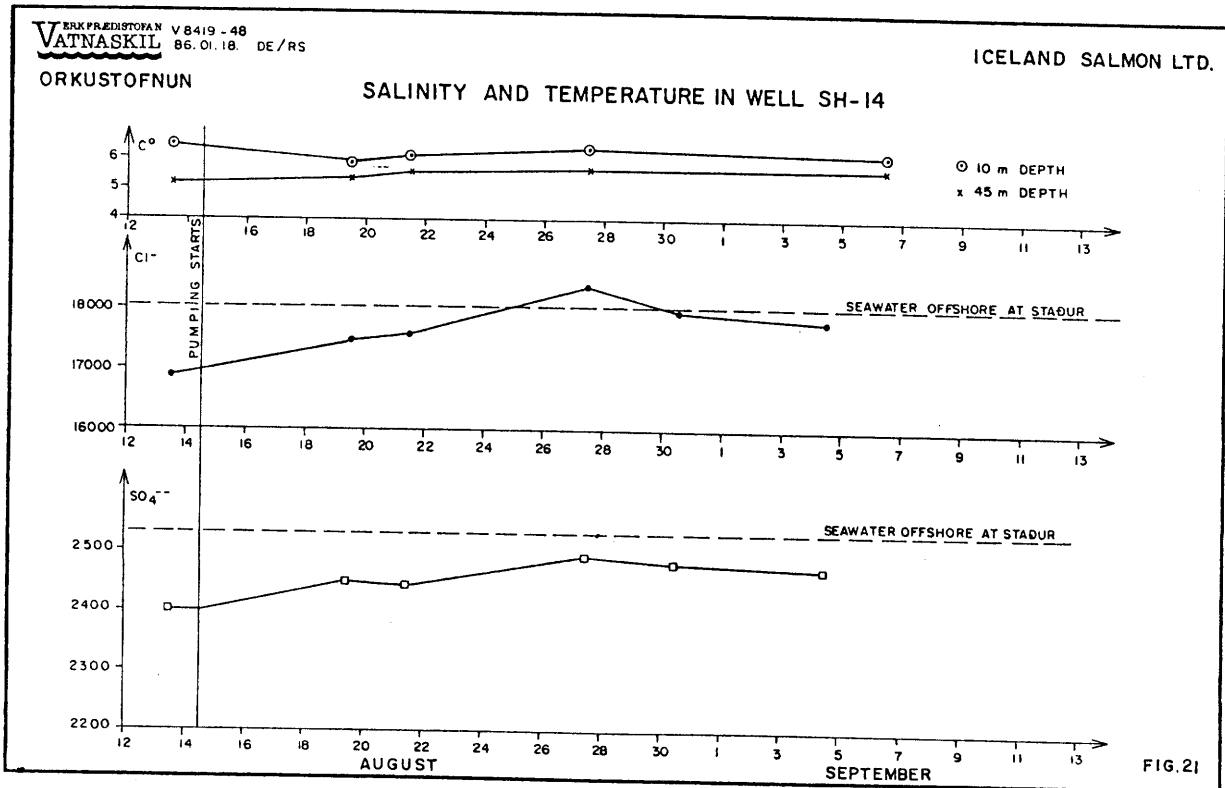


FIGURE 21 Salinity and temperature in well SH-14

TABLE 11 Concentration in ppm during pumptest

Date	SO4--	Cl-	Salinity o/oo
85.08.14	2400	16931	30.5
85.08.19	2448	17486	31.5
85.08.21	2443	17565	31.6
85.08.27	2491	18366	33.1
85.08.30	2480	17988	32.4
85.09.04	2468	17755	32.0
85.09.27	2445	17981	32.4

The initial concentration was 2400 ppm and 16931 ppm respectively for SO4-- and Cl-. The seawater concentration was measured 2531 ppm SO4-- and 18037 ppm Cl- on the November 25, 1985. It is not likely that these values are representative for the offshore concentration during the pump test in August and September 1985, see chapter 3. According to many measurements at Krísuvíkurborg in 1958 and 1959 the annual average value of chloride concentration is approximately 18500 ppm with standard deviation equal to around 900 ppm. Because of this high value of the standard deviation, more measurements of the chloride concentration offshore at Staður would have been valuable for the calibration of the transport parameters.

The relative concentration is given in table 12. Relative concentration means that zero value corresponds to the initial concentration, and unity equals the seawater concentration.

TABLE 12 Relative concentration during pump test of SH-14

Days from the start of pumping	SO4	Cl-
6	0.37	0.50
8	0.33	0.57
14	0.69	1.30
17	0.61	0.96
22	0.52	0.75
45	0.34	0.95

Fig. 21 shows that there were no significant changes in temperature during the pump test. As the final temperature of the pumped water is of vital importance, heat transport calculations had to be performed. In order to determine the necessary parameters, the data collected during the pump test was used for calibration purposes. It was necessary to proceed in the following way:

- a) Transmissivity values were determined by using the observed draw-down and the results from the tidal response analysis.
- b) The dispersion parameters were found by matching the data in table 12 and mass transport calculations done with Galerkin finite element model.

The finite element net is shown on a map in the envelope inside the back cover of this report. The results of calculations of drawdown and velocity field for pumping rate 80 l/s from well SH-14 and 1500 l/s from well SH-15 are shown on two separate maps which are also inside the back cover. The regional drawdown for 80 l/s pumping rate is about 1 cm which is in accordance with the pump test (see 6.1.2). The comparison of measured and calculated tidal response is shown on fig. 22. The agreement seems to be good. The mass transport calculations are performed by using the velocity field and transmissivity distribution. The results are shown on fig. 23. They are:

- 1) For a flowrate of 80 l/s the final concentration would be about 75% offshore seawater and 25% inland groundwater.
- 2) For a flowrate of 1500 l/s from a well closer to the shore, SH-15, the final concentration would be 90% offshore seawater and 10% inland groundwater.
- 3) It takes about 16 days to reach the equilibrium value in the pumping test, but about 5 days for the 1500 l/s flowrate from SH-15.

The dispersion parameters determined in these calculations can now be used to perform heat transport calculations.

Measured and calculated tidal
response in well SH-14

Blue : Measured tidal response
Red : Calculated tidal response

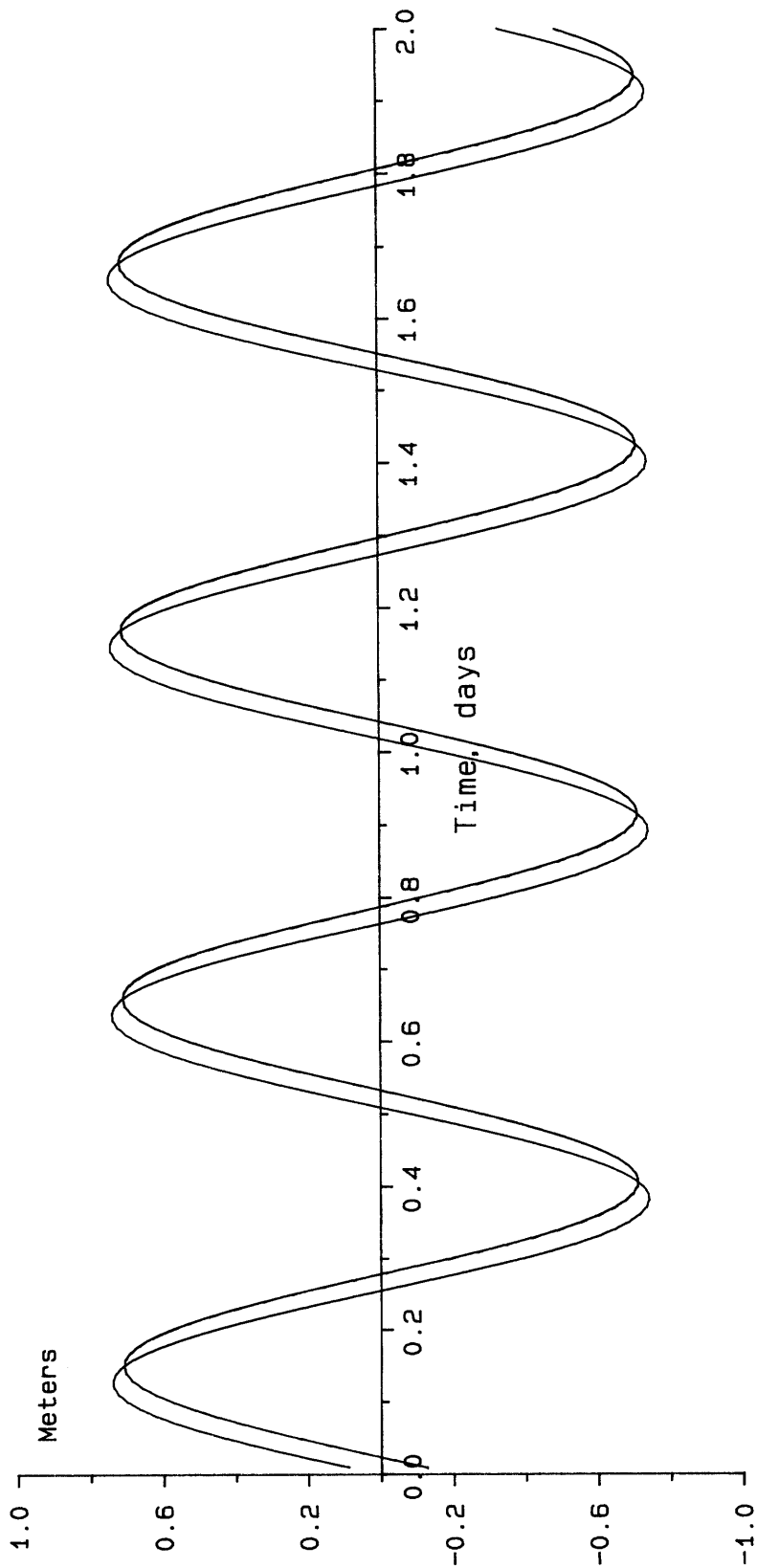


Figure 22

Response function for mass transport

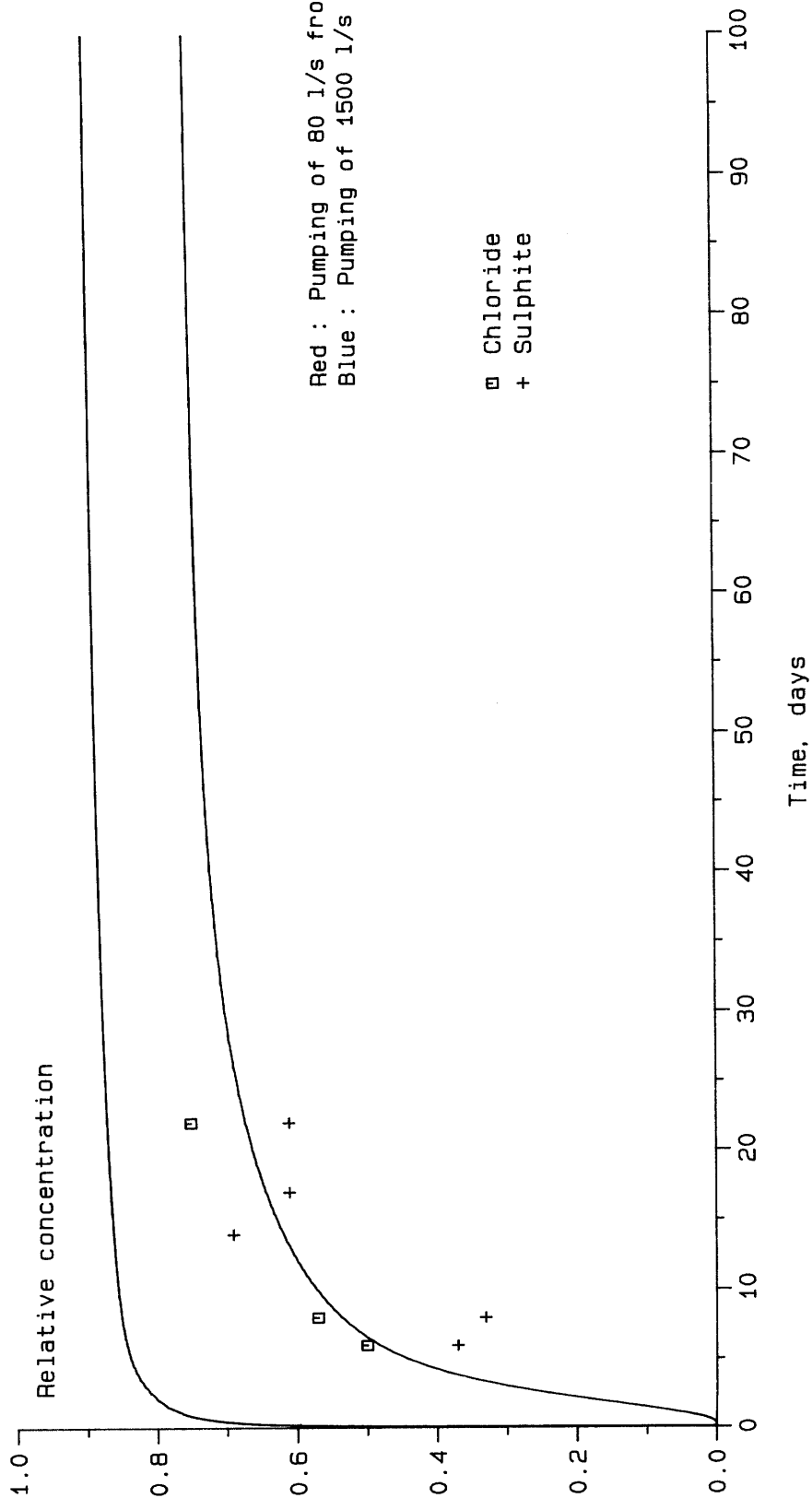


Figure 23

6.3 Heat transport calculations

The temperature of the pumped water in SH-14 was 6.0°C in September 1985. This can be compared with seawater temperature in Grindavík given in table 13.

TABLE 13 Average seawater temperature in Grindavík 1931 - 1960

Month	Temperature $^{\circ}\text{C}$
January	5.1
February	5.0
March	5.4
April	6.1
May	7.9
June	9.6
July	10.8
August	11.0
September	9.8
October	8.0
November	6.5
December	5.2

The temperature in the well in its natural state is thus very different from the offshore value. Fig. 24 shows calculated temperature in well SH-14 with flowrate equal to 80 l/s. It is clear from the figure that it will take a very long time for any changes in temperature to occur in the well, and it is thus practically impossible to detect these changes during a relatively short pumping test. It was therefore necessary to perform heat transport calculations in order to predict the temperature for higher flowrates. Fig. 25 and 26 show the results of these calculations. The results can be summarized as follows:

- 1) If 200 l/s were pumped from SH-14, then the average temperature of the pumped water would be 7.2°C and fluctuating from $6.7 - 7.8^{\circ}\text{C}$ with a phase lag of approximately 115 days. If 200 l/s were pumped from SH-15 then the average temperature of the pumped water would be 7.5°C , fluctuating from $6.2 - 8.7^{\circ}\text{C}$ with a phase lag of approximately 60 days.
- 2) If the seawater were pumped from SH-14 at a rate of 1500 l/s, (and the regional bedrock temperature assumed to be 6°C) the temperature could fluctuate from $5.8 - 9.0^{\circ}\text{C}$, with an average of

7.4°C. With pumping from well SH-15, closer to the shore, the temperature was calculated to fluctuate slightly more, or from 5.6-9.6°C, with an average temperature of 7.6°C. The time lag for temperature changes was calculated to be approximately 20 days in the latter case.

- 3) Items 1 and 2 can be summarized as follows:

TABLE 14 Results of heat transport calculations

Site	Pumping rate 200 l/s		Pumping rate 1500 l/s	
	Temperature range °C	Timelag in days	Temperature range °C	Timelag in days
SH-14				
300 m from the coast	6.7 - 7.8	115	5.8 - 9.0	30
SH-15				
100 m from the coast	6.2 - 8.7	60	5.6 - 9.6	20

- 4) The influence on pumped seawater from water coming from inland was simulated. Logs from observation wells inland showed the groundwater temperature to be in the range of 6°C to 8°C, and thus calculations were made for the extremes. The following shows the results of the calculations (average annual temperature).

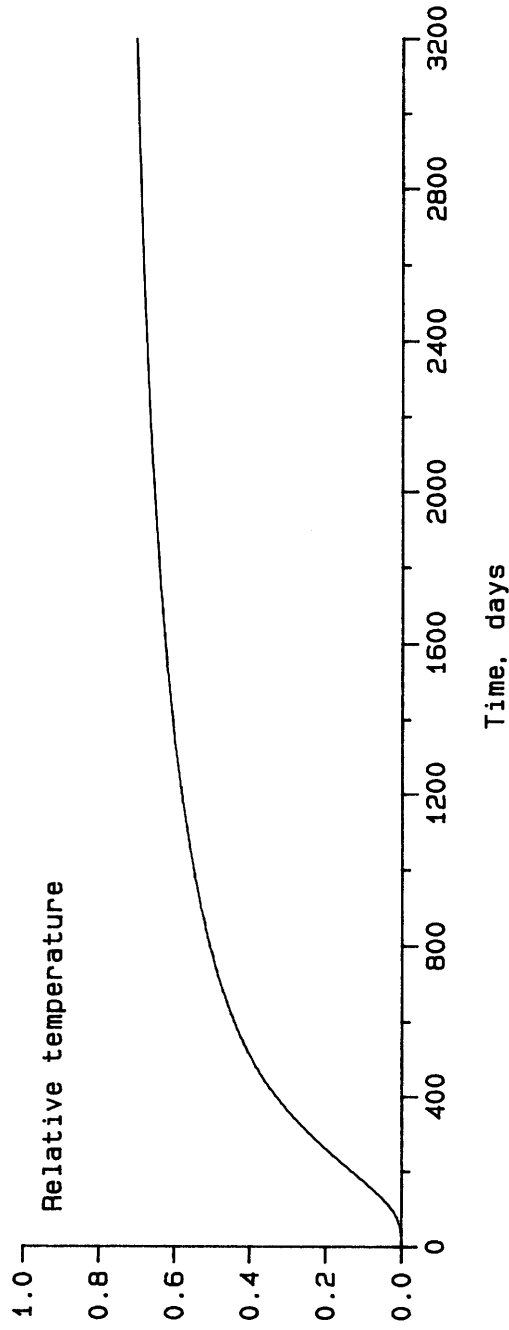
	SH-14		SH-15	
	200 l/s	1500 l/s	200 l/s	1500 l/s
Temp. 6°C	7.2°C	7.8°C	7.4°C	7.6°C
Temp. 8°C	8.0°C	8.0°C	8.0°C	8.0°C

This means that the average temperature of water pumped at 1500 l/s is unaffected by small changes in inland groundwater temperatures.

- 5) For a pumping rate of 1500 l/s the mass transport time lag is roughly one day irrespective of the site. During a cold period the same seawater will at most be heated by 3.0°C at most for wells away from the shore, and by 2.0°C for wells close to the shore line.

In the light of these results, drilling of well SH-15 near the shore was recommended.

Calculated temperature in production
well SH-14 for pumping rate 80 l/s



Blue : Temperature of seawater off shore
Red : Temperature of pumped seawater,
areal temperature 6 °C
Green : Temperature of pumped seawater,
areal temperature 8 °C

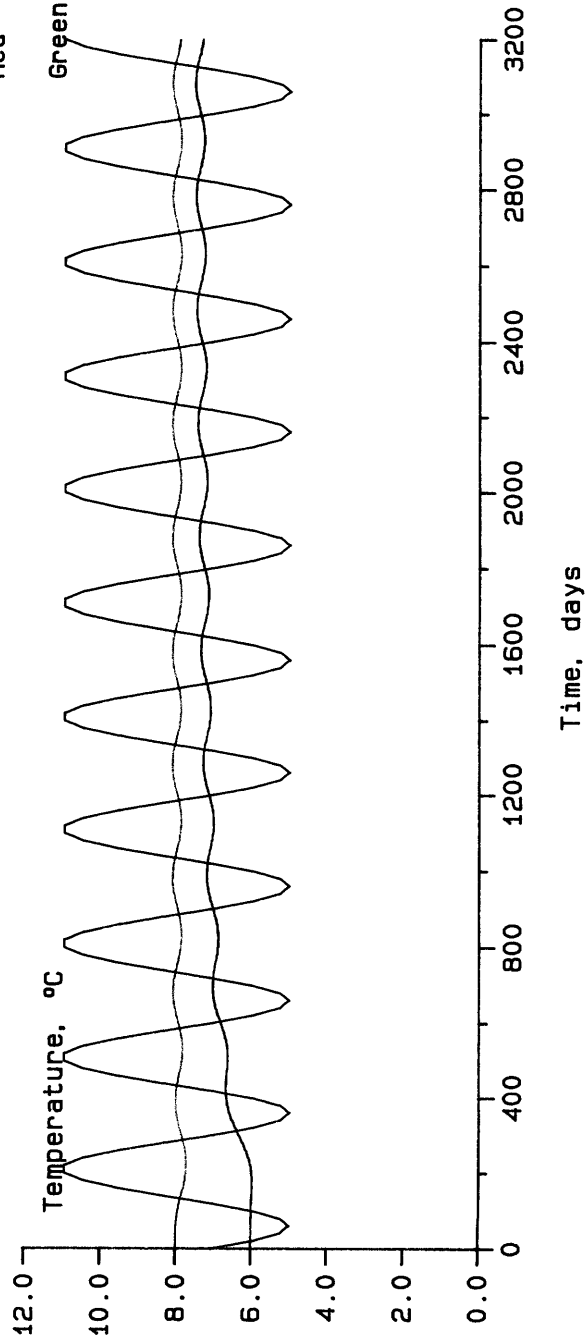


Figure 24

Calculated temperature in production wells
SH-14 and SH-15 for pumping rate 200 l/s

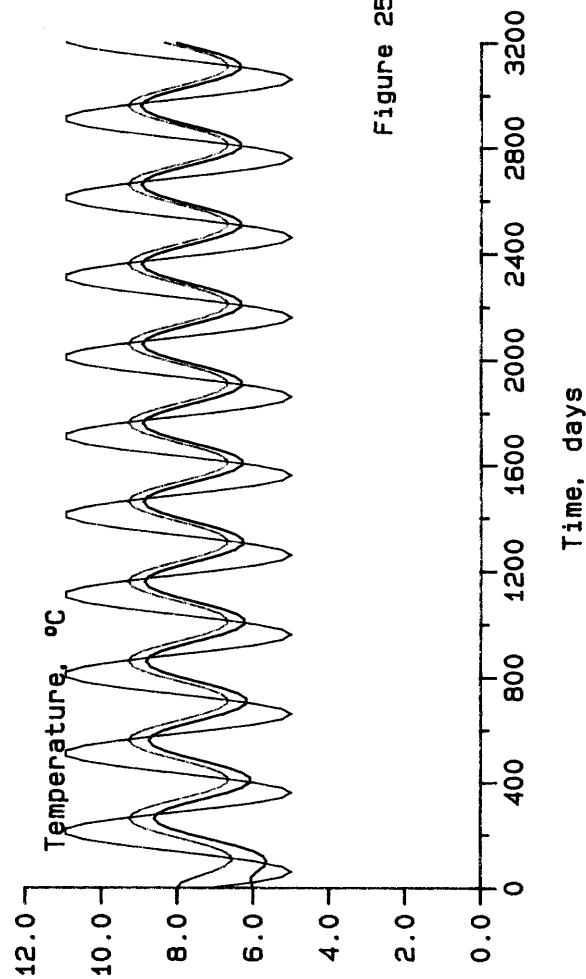
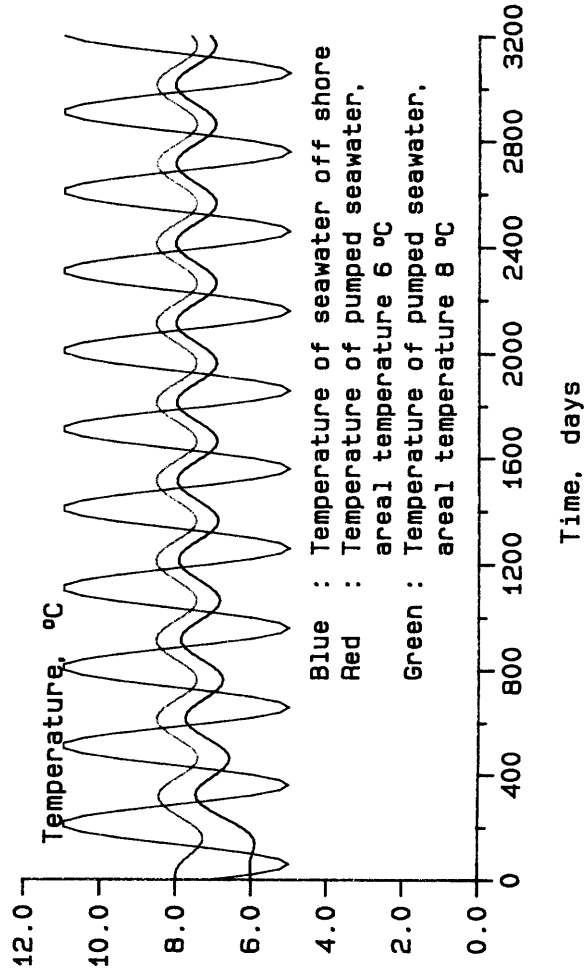
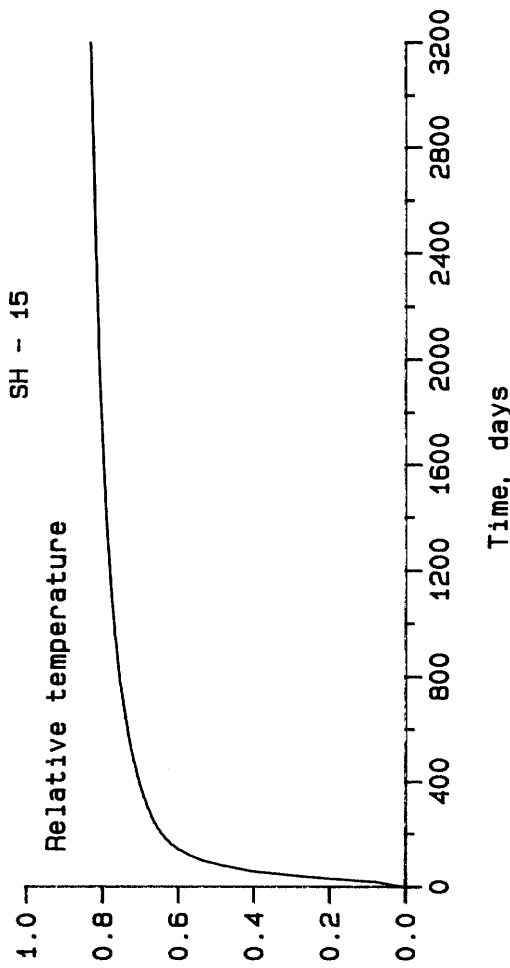
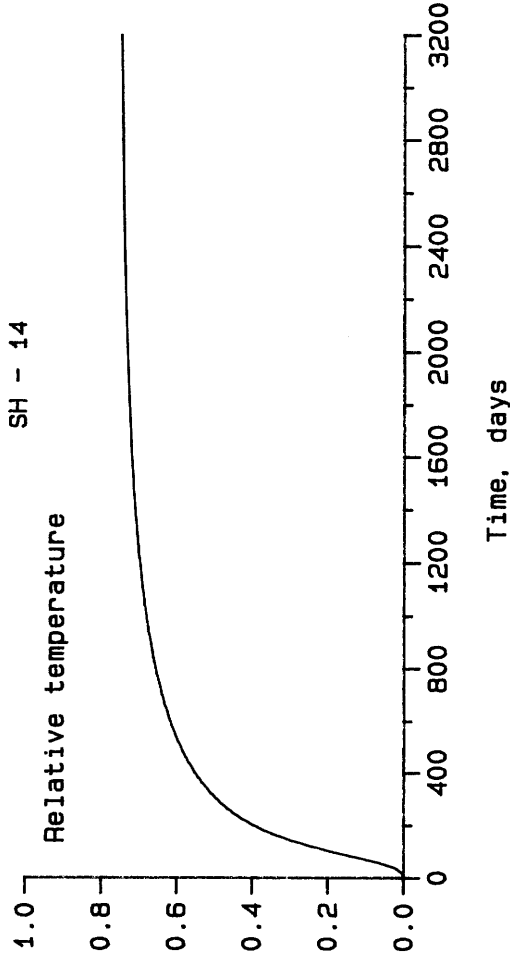


Figure 25

Calculated temperature in production wells
SH-14 and SH-15 for pumping rate 1500 l/s

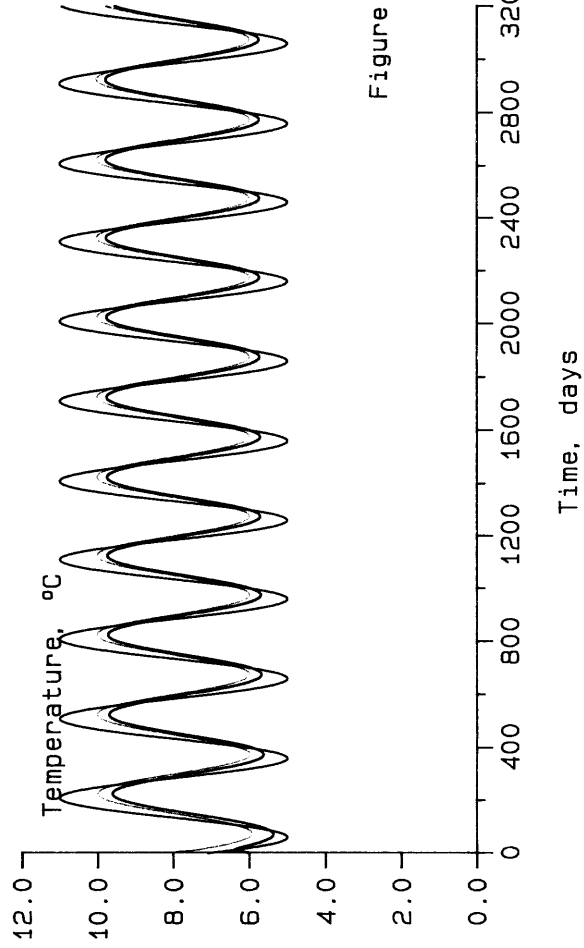
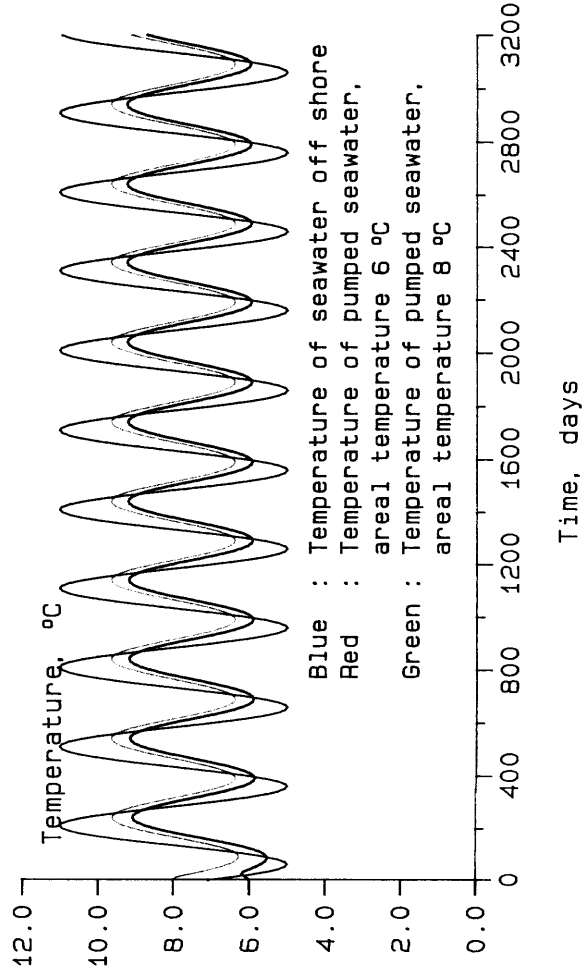
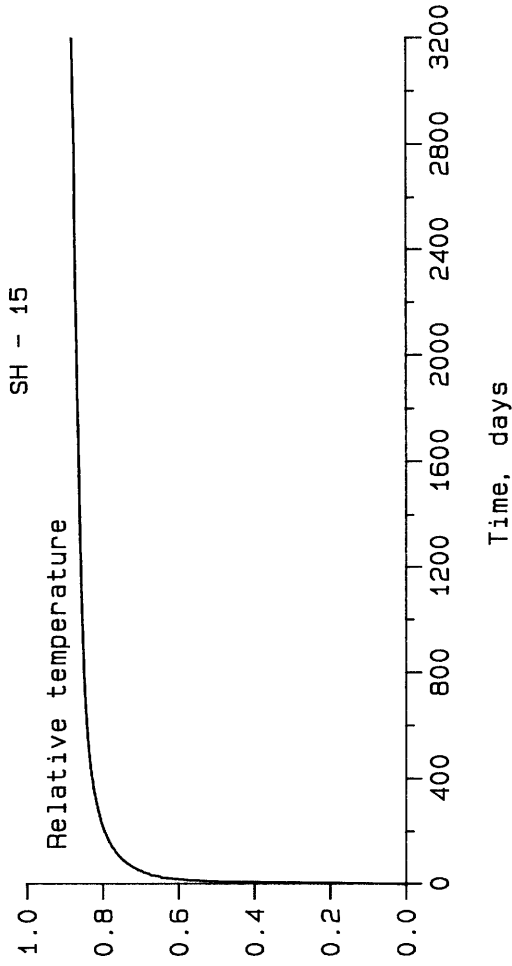
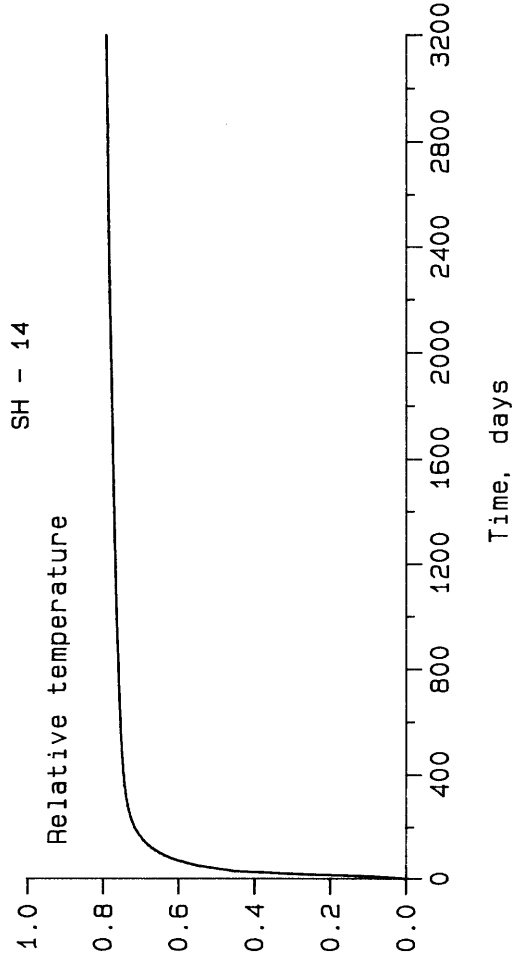


Figure 26

6.4 Testing of production well SH-15

Approximate location of well SH-15 is shown on figure 2. The well was drilled during November 11 to December 13, 1985. It is 67 m deep, and it is cased down to 37 m depth with a 22" outside diameter casing. A shortterm pump test was conducted from Thursday afternoon December 19 to Friday noon December 20.. On Friday a step-drawdown test was conducted. The pump was a suction pump, the same one that was used in testing of well SH-14. The pumping rate was 175 l/s and measured drawdown 10-15 cm, see fig 27. Table 15 shows how calculated drawdown varies with pumping rate.

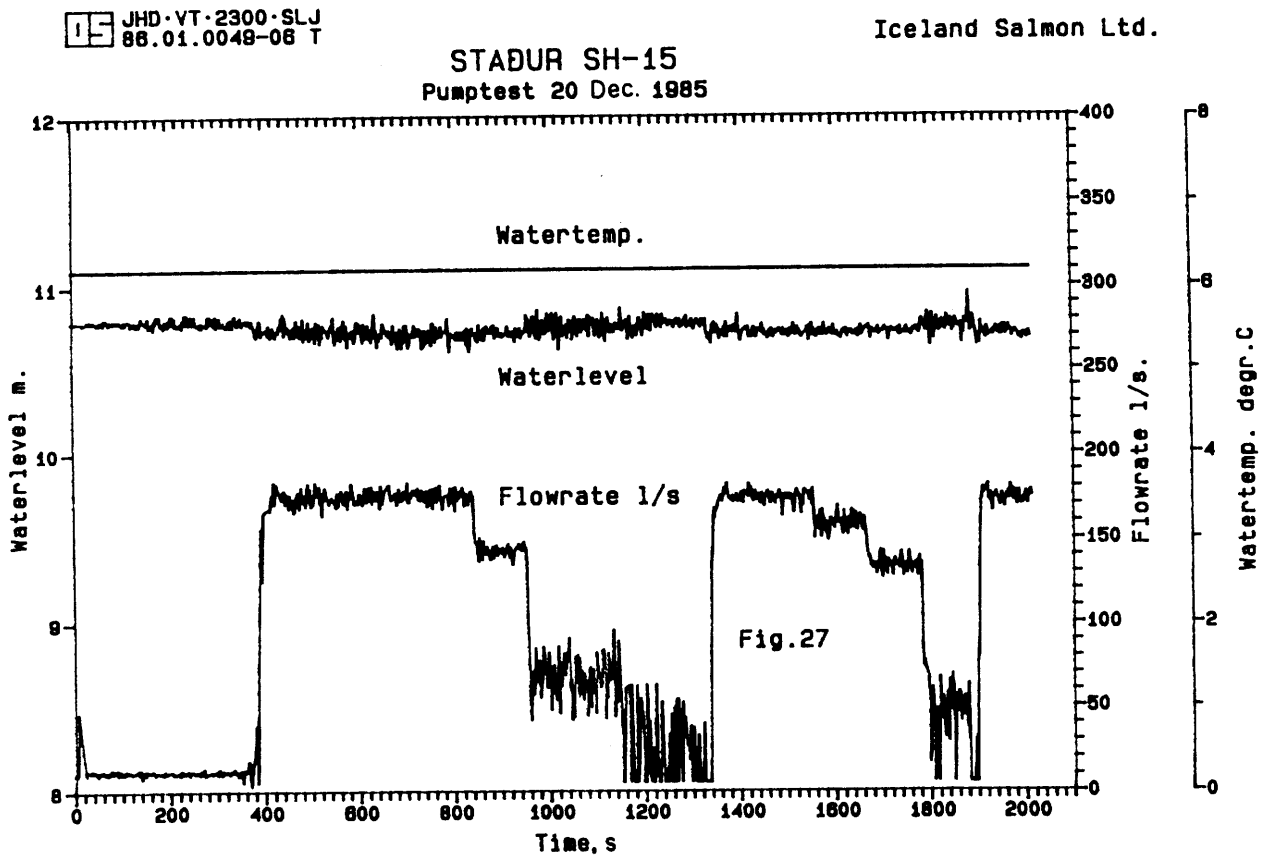


FIGURE 27 Pump test, 20 Dec. 1985 in well SH-15

TABLE 15 Drawdown in well SH-15

Pumping rate l/s	Drawdown m
100	0,05
150	0.1
200	0.2
250	0.3
300	0.4
350	0.5
400	0.7

Transmissivity estimated from pumping test is 1 - 1.5 m²/s. The yield is much better for SH-15 than for SH-14. As reported in chapter 3, the chloride analysis from well SH-15 gave the following results:

TABLE 16 Chloride analysis in well SH-15

Date	Cl- ppm	Salinity o/oo
At 38 m depth:		
1985.12.17	16940	30.5
At 64 m depth:		
1985.12.17	17275	31.1
First pumptest:		
1985.12.19 at 19:15	16395	29.5
1985.12.20 at 10:35	16515	29.8
1985.12.20 at 12:10	16560	29.8
Second pumptest:		
1986.01.08 at 11:25	16631	30.0
1986.01.08 at 13:30	16584	29.9
1986.01.08 at 15:50	16767	30.2

Oxygen concentration was measured in six samples collected during the second pumptest of 1986.01.08 and was measured to be 8.4 ppm O₂ (Table 5). The seawater is thus nearly saturated with oxygen. The temperature of the seawater was measured to be 6.5°C. It is clear from these tests that the pumped seawater has not reached an equilibrium, and that chloride concentration can be expected to increase with prolonged

pumping, but the results do not eliminate the possibility that some leakage could occur from the freshwater layer above. In this context it is worth mentioning that the casing in well SH-15, which is to screen off the freshwater is uncemented. Therefore it cannot be regarded as secure sealing against fluid migration.

APPENDIX 1

SCOPE OF WORK

PROPOSAL FOR THE INVESTIGATION OF THE
FRESHWATER AND SEAWATER SUPPLY FOR A
PROPOSED AQUACULTURE COMPLEX AT STAÐUR

30.8.84 Sb

SCOPE OF WORK

This project is undertaken to investigate the feasibility of supplying water, both fresh and seawater, to a proposed salmon farm as outlined in your letter of August 16, 1984. In short, the freshwater requirements are 700 l/s, and the seawater requirements 20 m³/s. The National Energy Authority and Vatnaskil, a consulting engineering company engaged in hydrological investigations, have decided to collaborate on this project to meet the tight schedule outlined in your letter. The work involves geohydrological investigations and hydrological modeling to estimate the effect of pumping. To collect the required data, pump tests, and other investigations are proposed, as outlined in this document. In addition to the scientific investigations, the project calls for drilling of separate wells for observation and production, cleaning of rock debris from fissures, and procuring of pumps for well testing. The investigation is not limited to the immediate area surrounding the wells, as the capacity of the whole basin is believed to be the determining factor.

1. INVESTIGATION OF FRESHWATER

1.1 SURVEYING. The elevation of the various water-level stations has to be measured. A leveling network was laid out by the National Energy Authority in 1983, alongside the road from Grindavik to the tip of the Reykjanes peninsula. Elevation measurements have to be made at observation points throughout the area.

1.2 TIDAL RESPONSE. The permeability of the surrounding area will be calculated from continuous recording of the tidal response in the fissure and the observation wells. In previous investigations on the Reykjanes peninsula, this method has proved useful and inexpensive.

1.3. LOGGING AND SAMPLING. The water basin of the Reykjanes peninsula is characterized by a thin freshwater lens (20-40 m) floating on seawater. It is proposed to drill at least one observation well into the seawater layer. This well, located close to the fissure, will reach to approximately 40 m depth. The observation well and fissure will be logged for salinity and temperature to determine the exact thickness of the freshwater lens. Furthermore, water samples will be collected

and analysed for salinity.

1.4 HYDROGEOLOGICAL MAP. Existing maps and field investigations of the Staður area will be improved, with special emphasis on the tectonics and geological structure as required for the hydrological modelling. Better mapping may also influence the siting of additional wells.

1.5 EVALUATION OF METEOROLOGICAL DATA. Because of the limited storage capacity of the field, it is important to analyse the effect of extreme drought on the water balance. Precipitation data will be analysed and compared with water-level data from observation wells on the Reykjanes peninsula to find the key for the Staður area.

1.6 PREFEASIBILITY REPORT. The information collected in items 1.1 to 1.5 is sufficient to make a prefeasibility report for the area as a whole. Unfortunately, a final report cannot be written within the allotted time of two months.

1.7 SITING OF OBSERVATION WELLS. Two wells are to be sited close to the fissure to be tested, and the others at the coast.

1.8 DRILLING OF OBSERVATION WELLS. A total of four to six observation wells may have to be drilled for logging of the freshwater table. At least one well has to be deep enough for exact measurement of the thickness of the freshwater lens. This well and another shallow well, to allow continuous watertable measurements, should be located close to the fissure. The other wells are to be drilled close to the coast. The wells should have a diameter of 80 mm, with 1-2 m of casing cemented at the top. Each well will have an elevation mark at the top of the casing, and a cap.

1.9 WELL TESTING OF FISSURE. One of the fissures in the lava field at Staður is open down to the freshwatertable, and is wide enough to allow pump testing. For that purpose submersible electric pumps will be used, or sump pumps with a capacity of 200-300 l/s. For the duration of the testing, about a week, flow measurements, and drawdown measurements in the fissure and observation wells, have to be made. Water samples will be collected for determination of salinity. The pumped water should be piped to another fissure for disposal, approx. 500 m away.

1.10 HYDROLOGICAL EVALUATION-GROUNDWATER MODELLING. Upon completion of the pump test and prefeasibility report, a detailed hydrological model will be made of the area. Effects of pumping at Staður and of the surface disposal of the geothermal brine at Svartsengi will be

evaluated. A map showing the flow vectors and contour map of the watertable will be made.

1.11 FINAL REPORT. A final report will be submitted, summarizing the results of the investigations. Recommendations on the maximum sustainable yield of the freshwater lens and on the development of this sensitive resource will be made.

2. SEAWATER INVESTIGATIONS.

2.1 OBSERVATION WELLS. Two observation wells should be drilled near the coast. This will make it possible to determine the salinity of the seawater and the and any presence of a freshwater lens that may have to be cased off in pumped wells. The well diameter should be 80 mm, and the depth 25 m.

2.2 FISSURE. A fissure, partly filled with rock debris, at the proposed investigation site for the seawater intake. It is proposed to clean the fissure to allow sampling of the water, tidal response measurements, and possibly pump testing.

2.3 LOGGING. The observation wells will be logged for tidal response, temperature and salinity.

2.4 WELL TEST ON FISSURE. It is proposed to place a pump in the fissure for establishing the quality of the seawater/freshwater.

2.5 TEST WELLS. One or two wells with a diameter of 24" may be drilled, and pump tested to determine permeability. In all probability the wells will have to be cased off down to 20-30 m and drilled to 50-60 m depth. These wells have to be drilled with a cable-tool rig, but the immediate availability of that equipment is uncertain at the present time. The required capacity of a pump for the well testing is 100 l/s.

2.6 REPORT. The report to be submitted will outline the results of the investigations. The permeability and water quality are crucial factors in the plan to pump exclusively from wells in the lava field, rather than making a channel to the coast.

APPENDIX 2

ANALYTICAL METHODS

ANALYTICAL METHODS USED FOR
ANALYSES OF SAMPLES OF THE
FRESH AND SALINE WATERS AT STADUR:

pH is measured by a pH-meter with a glass electrode.

Dissolved O_2 is measured with a Chemét test kit, based on reaction with rhodazine D for concentration of $O_2 = 1\text{ppm}$ and based on reaction with indigocarmin for concentration of $O_2 > 1\text{ppm}$. At concentration of $O_2 > 6\text{ppm}$ the Chemét test method has often been complemented by a Winkler titration method (Grasshof, Klaus (ed), 1983).

Total carbonate as CO_2 is measured by titration with 0.1N HCl using a pH-meter (from pH 8.2 to pH 3.8).

Conductivity is measured by a conductivity meter.

Salinity is calculated from measured chloride concentration according to Standard Methods 1980 ($\text{Salinity } ^\circ/\text{oo} = 0.03 + 1.805 \times (\text{chlorinity } ^\circ/\text{oo})$).

Na is measured by atomic absorption spectrophotometric methods.

K is measured by atomic absorption spectrophotometric methods.

Ca is measured by atomic absorption spectrophotometric methods.

Mg is measured by atomic absorption spectrophotometric methods.

Cl is measured by ion chromatography.

SO_4 is measured by ion chromatography.

F is measured by an ion sensitive electrode.

SiO_4 is measured spectrophotometrically as yellow silicomolybdate complex or reduced to molybdenum blue complex (Standard Methods, 1980).

Fe is measured by atomic absorption spectrophotometry.

Cu is extracted by dithizone in chloroform (Ármanncsson, H., 1979) and measured by atomic absorption spectrophotometry.

Zn is extracted by dithizone in chloroform (Ármannsson, H., 1979)
and measured by atomic absorption spectrophotometry.

Cd is extracted by dithizone in chloroform (Ármannsson, H., 1979)
and measured by atomic absorption spectrophotometry.

Pb is extracted by dithizone in chloroform (Ármannsson, H., 1979)
and measured by atomic absorption spectrophotometry.

APPENDIX 3

LAND SURVEYING AT STADUR

ORKUSTOFNUN

Vatnsorkudeild

320/893 86.01.20 GP

Landmálinsar í Stadarhverfi 1984/85

Í september 1984 fengu landmálinsmenn OS það verkefni að mæla inn nokkra rannsóknarstæði í Stadarhverfi. Það voru loftborholur (nefndar SH-1 til SH-8) og nokkur elaströr (hér nefnd písarör), sem komið hafði verið fyrir í sjám, þar sem mæla átti hæð jarðvatns (piezometric surface). Borholur SH9 til SH13 báttust við í febrúar 1985.

Í fyrstu var aðeins beðið um hæðarmálinsar, og voru þá settir nokkrir (ómerktilir) boltar við rannsóknarstæðina og mælt á þá frá fastmerkjalínu Orkustofnunar með Þjóðvesi í Stadarhverfi. Einnis var mælt frá boltunum á rör í loftborholu, Jörd við loftborholu og á ákvedna viðmidunarstæði á písarörum.

Rannsóknarmenn notuðu kort, sem Landmálinsar Íslands höfðu serti af Stadarhverfi í Júní 1984, og voru mælistöðvar kortsins finnanlegar sem hælir á foldinni. Hnitalisti er í töflu 1 (hnit frá LMI, hæðir frá OS). Því var ákveðið að mæla inn lesu rannsóknarstæðanna til að hæst væri að setja þá inn á kortið.

Tafla 1		Mælistöðvar 1984/85		Gauss-hnit	
X-nordur	Y-austur	Hæð	Nafn		
7079792.81	2423562.52	13.5	1093	(LMI)	
7082671.22	2429195.61	6.65	3018	(LMI)	
7081473.99	2430741.10	16.	3031	(LMI)	
7080987.16	2424980.70	14.78	1000	(LMI)	
7080628.12	2424121.81	12.88	1001	(LMI;12.91)	
7080099.90	2424192.31	11.69	1003	(LMI)	

Í töflu 2 eru gefin hnit og hæðir fyrir bolta (FM), loftborholur og písarör. Hæðir loftborhola mældar við fóðurrör eftir að lok hefur verið skrúfað af. Hnit eru í Gauss-kerfi, sem notað er á korti Landmálins Íslands, og hæðir eru í Njardvíkurkerfi, sem einnis er notað á því korti. Fyrsti stafur Y-hnits (2) er númer á Gauss-belti, sem hefur 21-gráðu háðesishausinn fyrir snertibaus (þar er Y = 2500000).

Hæðir í Grindavíkurkerfi fást með því að draga 0,121 m frá hæðum, sem gefnar eru upp í Njardvíkurkerfi. Hnit í UTM-kerfi, sem notað er á kortum LMI í mælikvarða 1:50.000 af Reykjanesskaga, er hæst að reikna út frá Gauss-hnitum. Sama máli sildir um Lambert-hnit, sem notuð eru á kortum hárfélaga á Sudurnesjum. UTM-hnit eru gefin í töflu 3.

Tafla 2 Borholur í Stadarhverfi 1984/85 Gauss-hnit

X-nordur	Y-austur	Hæð	Nafn	Jörd
		8.092	7176	
7080688.7	2424223.4	2.603	PISA	
7080690.2	2424217.5	8.728	Bolti	
7080496.9	2424875.7	4.888	SH-1	3.95
7080496.7	2424876.2	4.015	SH-1/FM	
7080472.5	2424789.0	6.418	SH-2	5.31
7080472.5	2424789.0	5.311	SH-2/FM	
7080475.2	2424732.4	6.308	SH-3	5.27
7080473.7	2424734.2	5.230	SH-3/FM	
7080470.2	2424735.2	4.798	PISA	
7080812.2	2423901.5	8.756	SH-4	7.56
7080812.1	2423902.1	7.596	SH-4/FM	
7080804.5	2423904.0	7.298	PISA	
7080877.6	2421480.2	8.620	SH-5	7.33
7080876.6	2421481.7	7.542	SH-5/FM	
7080506.8	2422941.7	19.786	SH-6	18.74
7080508.4	2422944.5	18.946	SH-6/FM	
7081026.5	2423703.9	1.619	PISA S	
7081027.0	2423703.9	3.317	FM/Lam	
7081100.5	2423752.7	6.373	PISA N	
7081091.4	2423749.8	9.674	SH-7/FM	
7081102.1	2423764.1	12.184	SH-7	11.22
7081099.2	2423765.3	12.052	SH-8	11.07
7080165.3	2424386.2	3.245	SH-9/FM	
7080170.6	2424390.2	4.099	SH-9/rör	
7080121.2	2424337.5	4.310	SH10/rör	3.48
7080090.6	2424376.9	3.648	SH11/rör	2.57
7080079.4	2424473.3	3.520	SH12/rör	2.30
7080477.8	2424967.9	3.840	SH13/rör	2.94

Gauss-hnit: Notud á korti LMI af Stadarhverfi (Júní 1984)
Hæðir eru í metrum yfir sjó í hækakerfi Njardvíkur.

Tafla 3 Borholur í Stáðarhverfi 1984/85 UTM-hnit

X-nordur	Y-austur	Hæð	Nafn	Jörð
7077856.4	7424253.7	8.092	7176	
7077857.9	7424247.8	2.603	PISA	
		8.728	Bolti	
7077664.7	7424905.7	4.888	SH-1	3.95
7077664.5	7424906.2	4.015	SH-1/FM	
7077640.3	7424819.1	6.418	SH-2	5.31
7077640.3	7424819.1	5.311	SH-2/FM	
7077643.0	7424762.5	6.308	SH-3	5.27
7077641.5	7424764.3	5.230	SH-3/FM	
7077638.0	7424765.3	4.798	PISA	
7077979.9	7423931.9	8.756	SH-4	7.56
7077979.8	7423932.5	7.596	SH-4/FM	
7077972.2	7423934.4	7.298	PISA	
7078045.2	7421511.6	8.620	SH-5	7.33
7078044.2	7421513.1	7.542	SH-5/FM	
7077674.6	7422972.5	19.786	SH-6	18.74
7077676.2	7422975.3	18.946	SH-6/FM	
7078194.1	7423734.4	1.619	PISA S	
7078194.6	7423734.4	3.317	FM/Lam	
7078268.1	7423783.2	6.373	PISA N	
7078259.0	7423780.3	9.674	SH-7/FM	
7078269.7	7423794.6	12.184	SH-7	11.22
7078266.8	7423795.8	12.052	SH-8	11.07
7077333.2	7424416.4	3.245	SH-9/FM	
7077338.5	7424420.4	4.099	SH-9/rör	
7077289.2	7424367.8	4.310	SH10/rör	3.48
7077258.6	7424407.1	3.648	SH11/rör	2.57
7077247.4	7424503.5	3.520	SH12/rör	2.30
7077645.6	7424997.9	3.840	SH13/rör	2.94
7078550	7420920	4.36	Vatnsstöði/FM	
7079700	7426030	14.93	Badstofusjá/FM	
7080300	7425600	25.15	Skothúsasjá/FM	
7079700	7424700	25.72	Hrafnasjá/FM	

UTM-hnit eru notuð á kortum LMI í málíkvarða 1:50.000.
Hnit bolta á 4 síðustu stöðunum voru lesin af kortunum.
Hæðir eru í metrum yfir sjó í hækakerfi Njardvíkur.

APPENDIX 4

TEMPERATURE AND SALINITY LOGS

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMÆLINGA

MÆLISTADUR : SH-2 SIAD Í STADARHVERFI
DAGS / MÆLT AF : 21 09 1984 / SPS FS
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
6.00	7.30	1.33	0.84
7.00	7.10	1.33	0.84
8.00	7.00	1.35	0.85
9.00	6.90	1.35	0.85
10.00	6.90	1.35	0.85
11.00	6.80	1.35	0.84
12.00	6.70	1.33	0.83
13.00	6.70	1.30	0.81
14.00	6.60	1.22	0.75
15.00	6.60	1.12	0.69
16.00	6.60	1.01	0.62
17.00	6.50	0.94	0.57
18.00	6.50	0.74	0.44
19.00	6.30	0.67	0.39
20.00	6.20	0.67	0.39
21.00	6.20	0.64	0.37
22.00	6.10	0.53	0.30
23.00	6.10	0.51	0.29
24.00	6.00	0.49	0.27
25.00	6.10	0.48	0.27
26.00	6.20	0.47	0.26
27.00	6.20	0.45	0.25
28.00	6.30	0.45	0.25
29.00	6.60	0.43	0.24
30.00	7.00	0.41	0.23
31.00	6.90	0.39	0.22
32.00	6.90	0.39	0.22
33.00	7.10	0.39	0.22
34.00	7.20	0.38	0.21
35.00	7.30	0.37	0.21
36.00	7.30	0.37	0.21
37.00	7.40	0.37	0.21
38.00	7.50	0.36	0.20
39.00	7.50	0.36	0.20
40.00	7.50	0.36	0.20
41.00	7.50	0.35	0.19
42.00	7.50	0.35	0.19
43.00	7.50	0.35	0.19
44.00	7.50	0.35	0.19
45.00	7.30	0.35	0.19
46.00	7.20	0.35	0.19

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMÆLINGA

MÆLISTADUR : SH-2 SIAD STADARHVERFI
DAGS / MÆLT AF : 04 10 1984 / SPS BAH
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
6.00	7.30	1.33	0.84
7.00	6.90	1.35	0.85
8.00	6.80	1.36	0.85
9.00	6.80	1.36	0.85
10.00	6.80	1.35	0.84
11.00	6.70	1.32	0.82
12.00	6.70	1.29	0.80
13.00	6.60	1.15	0.71
14.00	6.60	1.14	0.70
15.00	6.60	1.04	0.64
16.00	6.50	0.92	0.56
17.00	6.40	0.85	0.51
18.00	6.40	0.75	0.44
19.00	6.30	0.68	0.40
20.00	6.20	0.63	0.36
21.00	6.20	0.56	0.32
22.00	6.10	0.54	0.31
23.00	6.00	0.52	0.29
24.00	6.00	0.49	0.27
25.00	6.00	0.47	0.26
26.00	6.10	0.46	0.25
27.00	6.40	0.44	0.24
28.00	6.50	0.43	0.24
29.00	6.70	0.42	0.23
30.00	6.90	0.41	0.23
31.00	7.00	0.39	0.22
32.00	6.90	0.38	0.21
33.00	7.10	0.38	0.21
34.00	7.20	0.38	0.21
35.00	7.30	0.37	0.21
36.00	7.40	0.37	0.21
37.00	7.40	0.37	0.21
38.00	7.40	0.36	0.20
39.00	7.40	0.36	0.20
40.00	7.50	0.36	0.20
41.00	7.50	0.35	0.19
42.00	7.50	0.35	0.19
43.00	7.50	0.35	0.19
44.00	7.50	0.34	0.19
45.00	7.60	0.34	0.19
46.00	7.60	0.34	0.19

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMÆLINGA

MÆLISTADUR : SH-2 SIAD STADARHVERFI KL: 13 25
DAGS / MÆLT AF : 07 12 1984 / SPS BA
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
6.00	6.30	1.19	0.73
7.00	6.50	1.17	0.72
8.00	6.50	1.17	0.72
9.00	6.50	1.16	0.71
10.00	6.50	1.16	0.71
11.00	6.50	1.15	0.71
12.00	6.60	1.12	0.69
13.00	6.60	1.07	0.66
14.00	6.60	1.02	0.62
15.00	6.60	1.00	0.61
16.00	6.50	0.93	0.56
17.00	6.50	0.84	0.50
18.00	6.40	0.65	0.38
19.00	6.40	0.63	0.37
20.00	6.30	0.61	0.35
21.00	6.30	0.52	0.30
22.00	6.30	0.51	0.29
23.00	6.20	0.50	0.28
24.00	6.20	0.48	0.27
25.00	6.20	0.47	0.26
26.00	6.20	0.45	0.25
27.00	6.20	0.45	0.25
28.00	6.10	0.44	0.24
29.00	5.90	0.44	0.24
30.00	5.70	0.43	0.23
31.00	5.60	0.42	0.23
32.00	5.70	0.41	0.22
33.00	5.80	0.40	0.21
34.00	5.80	0.40	0.21
35.00	5.60	0.40	0.21
36.00	5.60	0.40	0.21
37.00	5.50	0.40	0.21
38.00	5.50	0.39	0.21
39.00	5.50	0.39	0.21
40.00	5.40	0.39	0.20
41.00	5.30	0.38	0.20
42.00	5.40	0.38	0.20
43.00	5.40	0.38	0.20
44.00	5.40	0.38	0.20
45.00	5.40	0.38	0.20
46.00	5.40	0.37	0.19

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMÆLINGA

MÆLISTADUR : SH-2 STADARHVERFI, kl. 14:45
DAGS / MÆLT AF : 20 05 1985 / BA SIG
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
7.00	6.20	1.43	0.88
8.00	6.00	1.44	0.88
9.00	5.90	1.45	0.88
10.00	5.90	1.44	0.88
11.00	5.90	1.39	0.85
12.00	6.00	1.32	0.80
13.00	6.00	1.28	0.78
14.00	6.10	1.22	0.74
15.00	6.10	1.14	0.69
16.00	6.00	1.02	0.61
17.00	6.00	0.93	0.55
18.00	5.90	0.73	0.43
19.00	5.80	0.69	0.40
20.00	5.80	0.67	0.39
21.00	5.70	0.60	0.34
22.00	5.60	0.58	0.33
23.00	5.50	0.56	0.31
24.00	5.50	0.53	0.29
25.00	5.40	0.51	0.28
26.00	5.40	0.50	0.27
27.00	5.40	0.49	0.27
28.00	5.30	0.48	0.26
29.00	5.30	0.48	0.26
30.00	5.30	0.47	0.25
31.00	5.30	0.45	0.24
32.00	5.30	0.44	0.24
33.00	5.40	0.44	0.24
34.00	5.40	0.44	0.24
35.00	5.40	0.43	0.23
36.00	5.40	0.43	0.23
37.00	5.40	0.42	0.22
38.00	5.40	0.42	0.22
39.00	5.40	0.42	0.22
40.00	5.40	0.41	0.22
41.00	5.40	0.41	0.22
42.00	5.40	0.41	0.22
43.00	5.40	0.41	0.22
44.00	5.40	0.41	0.22
45.00	5.40	0.40	0.21
46.00	5.40	0.40	0.21

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMÆLINGA

MÆLISTADUR : SH-2 STADARHVERFI
DAGS / MÆLI AF : 13 08 1985 / DE
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
6.00	6.90	1.37	0.86
7.00	6.60	1.39	0.86
8.00	6.50	1.39	0.86
9.00	6.50	1.35	0.84
10.00	6.40	1.32	0.81
11.00	6.40	1.18	0.72
12.00	6.30	1.11	0.68
13.00	6.30	1.04	0.63
14.00	6.20	0.95	0.57
15.00	6.20	0.86	0.51
16.00	6.10	0.76	0.45
17.00	6.10	0.70	0.41
18.00	6.00	0.66	0.38
19.00	6.00	0.61	0.35
20.00	5.90	0.59	0.34
21.00	5.90	0.56	0.32
22.00	5.80	0.57	0.32
23.00	5.70	0.53	0.30
24.00	5.70	0.51	0.28
25.00	5.70	0.51	0.28
26.00	5.60	0.50	0.28
27.00	5.70	0.45	0.24
28.00	5.80	0.48	0.26
29.00	5.90	0.47	0.26
30.00	6.10	0.45	0.25
31.00	6.40	0.44	0.24
32.00	6.40	0.43	0.24
33.00	6.40	0.43	0.24
34.00	6.50	0.43	0.24
35.00	6.60	0.43	0.24
36.00	6.60	0.42	0.23
37.00	6.50	0.42	0.23
38.00	6.50	0.42	0.23
39.00	6.60	0.41	0.23
40.00	6.40	0.41	0.23
41.00	6.60	0.41	0.23
42.00	6.60	0.41	0.23
43.00	6.60	0.41	0.23
44.00	6.60	0.41	0.23
45.00	6.40	0.41	0.23
46.00	6.10	0.40	0.22

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMÆLINGA

MÆLISTADUR : SH-2 kl. 11:07 (ekki sellumæll)
DAGS / MÆLI AF : 16 10 1985 / DE
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
7.00	6.80	1.00	0.61
10.00	6.60	1.00	0.61
15.00	6.20	1.00	0.60
20.00	6.10	1.00	0.60
25.00	6.10	1.00	0.60
28.00	6.30	1.00	0.60
30.00	7.00	1.00	0.62
32.00	7.40	1.00	0.63
34.00	7.40	1.00	0.63
36.00	7.50	1.00	0.63
38.00	7.50	1.00	0.63
40.00	7.60	1.00	0.63
42.00	7.60	1.00	0.63
44.00	7.60	1.00	0.63
45.00	7.60	1.00	0.63
46.00	7.70	1.00	0.63

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMÆLINGA

MÆLISTADUR : SH-8 VID LAMBAGJÁ
DAGS / MÆLI AF : 04 10 1984 / SPS BAH
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
12.00	7.20	5.60	3.67
13.00	7.10	5.70	3.72
14.00	7.10	5.70	3.72
15.00	7.20	5.70	3.73
16.00	7.20	5.60	3.67
17.00	7.20	5.50	3.60
18.00	7.20	5.50	3.60
19.00	7.20	5.40	3.53
20.00	7.20	5.30	3.47
21.00	7.20	5.30	3.47
22.00	7.20	5.20	3.40
23.00	7.20	5.00	3.27
24.00	7.20	4.90	3.20
25.00	7.20	4.70	3.07
26.00	7.20	4.50	2.94
27.00	7.20	2.40	1.55
28.00	7.30	1.61	1.03
29.00	7.30	1.05	0.66
30.00	7.30	0.93	0.58
31.00	7.40	0.86	0.53
32.00	7.40	0.81	0.50
33.00	7.40	0.76	0.47
34.00	7.50	0.64	0.39
35.00	7.50	0.59	0.35
36.00	7.60	0.51	0.30
37.00	7.60	0.48	0.28
38.00	7.60	0.47	0.27
39.00	7.70	0.46	0.27
41.00	8.00	0.37	0.21
42.00	8.20	0.34	0.19
43.00	8.20	0.34	0.19
44.00	8.20	0.34	0.19
45.00	8.20	0.34	0.19
46.00	8.20	0.34	0.19
47.00	8.20	0.34	0.19
48.00	8.20	0.34	0.19
49.00	8.20	0.34	0.19
50.00	8.20	0.34	0.19
51.00	8.20	0.34	0.19
52.00	8.20	0.34	0.19
53.00	8.20	0.34	0.19
54.00	8.20	0.34	0.19
55.00	8.20	0.34	0.19
56.00	8.20	0.34	0.19
57.00	8.20	0.34	0.19
58.00	8.20	0.34	0.19
59.00	8.20	0.34	0.19
60.00	8.20	0.34	0.19
61.00	8.20	0.34	0.19
62.00	8.20	0.34	0.19

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMÆLINGA

MÆLISTADUR : SH-8 VID LAMBAGJÁ
DAGS / MÆLI AF : 10 10 1984 / SPS FS
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
14.00	7.00	6.30	4.11
15.00	7.00	6.10	3.97
16.00	7.00	5.80	3.78
17.00	7.00	5.80	3.78
18.00	7.00	5.80	3.78
19.00	7.00	5.70	3.71
20.00	7.00	5.60	3.64
21.00	7.00	5.50	3.58
22.00	7.00	5.40	3.51
23.00	7.00	5.30	3.45
24.00	7.00	5.20	3.38
25.00	7.00	5.10	3.32
26.00	7.00	5.00	3.25
27.00	7.10	5.00	3.26
28.00	7.10	4.80	3.13
29.00	7.10	4.60	3.00
30.00	7.20	1.92	1.23
31.00	7.20	0.89	0.55
32.00	7.30	0.77	0.47
33.00	7.30	0.75	0.46
34.00	7.30	0.70	0.42
35.00	7.30	0.64	0.38
36.00	7.40	0.56	0.33
37.00	7.40	0.48	0.28
38.00	7.40	0.46	0.27
39.00	7.40	0.45	0.26
40.00	7.50	0.36	0.20
41.00	7.50	0.36	0.20
42.00	7.80	0.36	0.20
43.00	7.90	0.35	0.19
44.00	7.90	0.34	0.19
45.00	7.90	0.34	0.19
46.00	7.90	0.34	0.19
47.00	7.90	0.34	0.19
48.00	7.90	0.34	0.19
49.00	7.90	0.34	0.19
50.00	7.90	0.34	0.19
51.00	8.00	0.34	0.19
52.00	8.00	0.34	0.19
53.00	8.00	0.34	0.19
54.00	8.00	0.34	0.19
55.00	8.00	0.34	0.19
56.00	8.00	0.34	0.19
57.00	8.00	0.34	0.19
58.00	8.00	0.34	0.19
59.00	8.00	0.34	0.19
60.00	8.00	0.34	0.19
61.00	8.00	0.34	0.19
62.00	8.00	0.34	0.19

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITÁ- OG SELTUMÆLINGA

MÁLSTADUR : HOLA SH-9 STAD
DAGS / MÆLT AF : 31 01 1985 / SPS
TAKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
3.00	5.50	1.69	1.02
4.00	5.90	1.58	0.97
5.00	6.00	1.51	0.92
6.00	6.10	1.49	0.91
7.00	6.10	1.28	0.78
8.00	6.10	1.24	0.75
9.00	6.10	1.20	0.73
10.00	6.10	1.15	0.70
11.00	6.10	1.06	0.64
12.00	6.10	1.04	0.63
13.00	6.00	0.83	0.49
14.00	6.00	0.78	0.46
15.00	5.80	0.68	0.39
16.00	5.70	0.63	0.36
17.00	5.70	0.61	0.35
18.00	5.70	0.58	0.33
19.00	5.60	0.53	0.29
20.00	5.60	0.52	0.29
21.00	5.50	0.50	0.27
22.00	5.40	0.50	0.27
23.00	5.40	0.49	0.27
24.00	5.30	0.49	0.27
25.00	5.20	0.47	0.25
26.00	5.30	0.47	0.25
27.00	5.50	0.46	0.25
28.00	5.40	0.45	0.24
29.00	5.30	0.45	0.24
30.00	5.30	0.45	0.24
31.00	5.30	0.45	0.24

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITÁ- OG SELTUMÆLINGA

MÁLSTADUR : STADUR HOLA SH-9 KL 12:05
DAGS / MÆLT AF : 20 02 1985 / BA ÁG
TAKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
5.00	5.50	1.36	0.82
6.00	5.60	1.30	0.78
7.00	5.70	1.30	0.78
8.00	5.80	1.25	0.75
9.00	5.80	1.20	0.72
10.00	5.80	1.16	0.70
11.00	5.70	1.00	0.59
12.00	5.70	1.00	0.59
13.00	5.60	0.95	0.56
14.00	5.60	0.90	0.53
15.00	5.60	0.85	0.50
16.00	5.50	0.84	0.49
17.00	5.50	0.84	0.49
18.00	5.30	0.82	0.47
19.00	5.20	0.68	0.38
20.00	5.10	0.66	0.37
21.00	5.10	0.62	0.35
22.00	5.10	0.60	0.33
23.00	5.10	0.57	0.31
24.00	5.00	0.56	0.31
25.00	5.00	0.55	0.30
26.00	5.00	0.51	0.28
27.00	4.90	0.48	0.26
28.00	4.80	0.48	0.26
29.00	4.80	0.47	0.25
30.00	4.80	0.45	0.24
31.00	4.80	0.45	0.24

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITÁ- OG SELTUMÆLINGA

MÁLSTADUR : STADUR, HOLA SH-9 kl. 20:46
DAGS / MÆLT AF : 20 05 1985 / BA SjG
TAKI NR : 4

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
5.00	5.90	1.19	0.72
6.00	5.80	1.13	0.68
7.00	5.80	1.11	0.67
8.00	5.80	1.07	0.64
9.00	5.80	1.07	0.64
10.00	5.80	1.00	0.60
11.00	5.80	0.93	0.55
12.00	5.80	0.91	0.54
13.00	5.80	0.88	0.52
14.00	5.80	0.84	0.49
15.00	5.80	0.82	0.48
16.00	5.80	0.68	0.39
17.00	5.80	0.64	0.37
18.00	5.70	0.61	0.35
19.00	5.70	0.58	0.33
20.00	5.70	0.55	0.31
21.00	5.60	0.53	0.29
22.00	5.60	0.51	0.28
23.00	5.60	0.51	0.28
24.00	5.60	0.52	0.29
25.00	5.60	0.48	0.26
26.00	5.60	0.48	0.26
27.00	5.50	0.47	0.26
28.00	5.50	0.47	0.26
29.00	5.50	0.46	0.25
30.00	5.40	0.46	0.25
31.00	5.30	0.45	0.24

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITÁ- OG SELTUMÆLINGA

MÁLSTADUR : STADUR HOLA SH-10 KL 14:35
DAGS / MÆLT AF : 20 02 1985 / BA ÁG
TAKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
5.00	5.50	1.11	0.66
6.00	5.50	1.10	0.65
7.00	5.60	1.08	0.64
8.00	5.60	1.04	0.62
9.00	5.60	0.98	0.58
10.00	5.50	0.91	0.53
11.00	5.40	0.88	0.51
12.00	5.40	0.84	0.49
13.00	5.40	0.82	0.47
14.00	5.40	0.80	0.46
15.00	5.40	0.77	0.44
16.00	5.20	0.66	0.37
17.00	4.90	0.56	0.31
18.00	5.10	0.55	0.30
19.00	5.00	0.55	0.30
20.00	5.00	0.55	0.30
21.00	4.90	0.55	0.30
22.00	4.80	0.54	0.29
23.00	4.70	0.52	0.28

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMÆLINGA

MÆLISTADUR : STADUR, HOLA SH-10 KL. 10:55
DAGS / MÆLT AF : 23 05 1985 / BA FS
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
4.00	6.20	1.08	0.65
5.00	5.80	1.06	0.63
6.00	5.80	1.04	0.62
7.00	5.80	1.03	0.61
8.00	5.80	1.02	0.61
9.00	5.80	0.99	0.59
10.00	5.80	0.94	0.56
11.00	5.90	0.89	0.53
12.00	5.90	0.80	0.47
13.00	5.90	0.77	0.45
14.00	5.90	0.75	0.44
15.00	5.80	0.73	0.42
16.00	5.80	0.66	0.38
17.00	5.70	0.57	0.32
18.00	5.70	0.55	0.31
19.00	5.60	0.53	0.29
20.00	5.60	0.53	0.29
21.00	5.60	0.52	0.29
22.00	5.60	0.51	0.28
23.00	5.50	0.50	0.27

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMÆLINGA

MÆLISTADUR : STADUR HOLA SH-11 KL 13:05
DAGS / MÆLT AF : 20 02 1985 / BA AG
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
4.00	5.30	1.02	0.60
5.00	5.40	1.02	0.60
6.00	5.40	1.02	0.60
7.00	5.40	1.02	0.60
8.00	5.40	1.02	0.60
9.00	5.40	0.93	0.54
10.00	5.40	0.86	0.50
11.00	5.40	0.76	0.44
12.00	5.40	0.75	0.43
13.00	5.40	0.73	0.42
14.00	5.30	0.67	0.38
15.00	5.20	0.65	0.37
16.00	5.20	0.63	0.35
17.00	5.30	0.54	0.30
18.00	5.30	0.50	0.27
19.00	5.30	0.49	0.27
20.00	5.30	0.49	0.27
21.00	5.30	0.49	0.27
22.00	5.30	0.49	0.27
23.00	5.30	0.49	0.27
24.00	5.20	0.46	0.25
25.00	5.10	0.45	0.24
26.00	4.90	0.45	0.24
27.00	4.80	0.45	0.24
28.00	4.80	0.45	0.24
29.00	4.90	0.45	0.24
30.00	5.00	0.45	0.24
31.00	5.20	0.44	0.23
32.00	5.20	0.43	0.23
33.00	5.20	0.43	0.23

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMÆLINGA

MÆLISTADUR : STADUR, HOLA SH-11 KL. 09:50
DAGS / MÆLT AF : 23 05 1985 / BA FS
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
3.00	6.50	0.93	0.56
4.00	5.90	0.94	0.56
5.00	5.80	0.94	0.56
6.00	5.70	0.94	0.56
7.00	5.70	0.93	0.55
8.00	5.70	0.90	0.53
9.00	5.70	0.85	0.50
10.00	5.60	0.82	0.48
11.00	5.60	0.82	0.48
12.00	5.60	0.81	0.47
13.00	5.50	0.77	0.44
14.00	5.50	0.70	0.40
15.00	5.50	0.63	0.36
16.00	5.40	0.60	0.34
17.00	5.30	0.58	0.32
18.00	5.30	0.51	0.28
19.00	5.20	0.51	0.28
20.00	5.20	0.50	0.27
21.00	5.20	0.50	0.27
22.00	5.20	0.49	0.27
23.00	5.20	0.48	0.26
24.00	5.20	0.47	0.25
25.00	5.20	0.46	0.25
26.00	5.10	0.45	0.24
27.00	5.10	0.45	0.24
28.00	5.10	0.45	0.24
29.00	5.10	0.45	0.24
30.00	5.10	0.44	0.23
31.00	5.10	0.43	0.23
32.00	5.10	0.43	0.23
33.00	5.10	0.43	0.23

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMÆLINGA

MÆLISTADUR : STADUR HOLA SH-12 KL 13:45
DAGS / MÆLT AF : 20 02 1985 / BA AG
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
4.00	3.90	0.68	0.37
5.00	4.30	0.69	0.38
6.00	4.30	0.68	0.37
7.00	4.30	0.66	0.36
8.00	4.30	0.66	0.36
9.00	4.30	0.66	0.36
10.00	4.30	0.66	0.36
11.00	4.30	0.66	0.36
12.00	4.30	0.66	0.36
13.00	4.30	0.65	0.35
14.00	4.40	0.65	0.36
15.00	4.50	0.65	0.36
16.00	4.60	0.59	0.32
17.00	5.00	0.56	0.31
18.00	5.20	0.54	0.30
19.00	5.40	0.51	0.28
20.00	5.60	0.50	0.28
21.00	5.70	0.50	0.28
22.00	5.70	0.49	0.27
23.00	5.60	0.48	0.26
24.00	5.60	0.48	0.26
25.00	5.60	0.47	0.26
26.00	5.60	0.47	0.26
27.00	5.60	0.47	0.26
28.00	5.60	0.44	0.24
29.00	5.60	0.44	0.24
30.00	5.60	0.44	0.24
31.00	5.60	0.43	0.23
32.00	5.60	0.43	0.23
33.00	5.60	0.43	0.23
34.00	5.60	0.43	0.23
35.00	5.50	0.43	0.23
36.00	5.50	0.43	0.23
37.00	5.40	0.42	0.22
38.00	5.40	0.42	0.22
39.00	5.40	0.42	0.22
40.00	5.40	0.41	0.22
41.00	5.30	0.41	0.22

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMKLINGA

MÆLISTIÐUR : STADUR, HOLA SH-12 kl. 21:20
DAGS / MÆLI AF : 20 05 1985 / BA SIG
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
4.00	5.20	0.77	0.44
5.00	5.00	0.78	0.44
6.00	5.00	0.77	0.44
7.00	5.00	0.76	0.43
8.00	5.00	0.76	0.43
9.00	5.00	0.76	0.43
10.00	5.00	0.75	0.43
11.00	5.00	0.67	0.38
12.00	4.90	0.70	0.39
13.00	4.90	0.69	0.39
14.00	4.90	0.69	0.39
15.00	4.90	0.66	0.37
16.00	4.80	0.61	0.34
17.00	4.80	0.60	0.33
18.00	4.80	0.57	0.31
19.00	4.80	0.54	0.29
20.00	4.90	0.52	0.28
21.00	5.00	0.52	0.28
22.00	5.00	0.50	0.27
23.00	5.10	0.49	0.26
24.00	5.10	0.49	0.26
25.00	5.10	0.48	0.26
26.00	5.20	0.48	0.26
27.00	5.20	0.47	0.25
28.00	5.20	0.46	0.25
29.00	5.20	0.44	0.23
30.00	5.20	0.44	0.23
31.00	5.20	0.44	0.23
32.00	5.20	0.43	0.23
33.00	5.20	0.43	0.23
34.00	5.20	0.43	0.23
35.00	5.20	0.43	0.23
36.00	5.20	0.42	0.22
37.00	5.30	0.42	0.22
38.00	5.30	0.42	0.22
39.00	5.30	0.42	0.22
40.00	5.30	0.41	0.22
41.00	5.30	0.41	0.22
31.00	5.20	0.44	0.23

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMKLINGA

MÆLISTIÐUR : STADUR HOLA SH-13 KL 15:55
DAGS / MÆLI AF : 20 02 1985 / BA AG
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
4.00	5.70	1.29	0.78
5.00	6.00	1.07	0.64
6.00	5.90	1.01	0.60
7.00	5.90	0.91	0.54
8.00	5.70	0.87	0.51
9.00	5.70	0.82	0.48
10.00	5.60	0.78	0.45
11.00	5.50	0.75	0.43
12.00	5.50	0.67	0.38
13.00	5.50	0.65	0.37
14.00	5.50	0.65	0.37
15.00	5.50	0.65	0.37
16.00	5.50	0.65	0.37
17.00	5.40	0.54	0.30
18.00	5.40	0.53	0.29
19.00	5.30	0.52	0.29
20.00	5.30	0.52	0.29
21.00	5.30	0.52	0.29
22.00	5.30	0.52	0.29
23.00	5.30	0.52	0.29
24.00	5.30	0.52	0.29
25.00	5.30	0.46	0.25
26.00	5.30	0.45	0.24
27.00	5.30	0.44	0.24
28.00	5.30	0.43	0.23
29.00	5.30	0.42	0.22
30.00	5.30	0.42	0.22
31.00	5.30	0.42	0.22
32.00	5.30	0.42	0.22
33.00	5.30	0.42	0.22
34.00	5.30	0.42	0.22
35.00	5.30	0.41	0.22
36.00	5.30	0.41	0.22
37.00	5.30	0.41	0.22
38.00	5.30	0.40	0.21
39.00	5.30	0.40	0.21
40.00	5.30	0.40	0.21
41.00	5.40	0.39	0.20

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMKLINGA

MÆLISTIÐUR : STADUR, HOLA SH-13 KL 13:15 (hárfjara ca.)
DAGS / MÆLI AF : 20 05 1985 / BA SIG
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
5.00	6.60	1.19	0.73
6.00	6.40	1.16	0.71
7.00	6.30	1.07	0.65
8.00	6.30	0.96	0.58
9.00	6.30	0.95	0.57
10.00	6.30	0.93	0.56
11.00	6.30	0.84	0.50
12.00	6.30	0.78	0.46
13.00	6.30	0.77	0.46
14.00	6.30	0.77	0.46
15.00	6.20	0.77	0.45
16.00	6.20	0.77	0.45
17.00	6.20	0.68	0.40
18.00	6.20	0.67	0.39
19.00	6.10	0.67	0.39
20.00	6.00	0.60	0.34
21.00	6.00	0.59	0.34
22.00	5.90	0.57	0.32
23.00	5.90	0.56	0.32
24.00	5.90	0.53	0.30
25.00	5.80	0.51	0.28
26.00	5.80	0.48	0.26
27.00	5.80	0.46	0.25
28.00	5.80	0.46	0.25
29.00	5.80	0.46	0.25
30.00	5.80	0.44	0.24
31.00	5.80	0.44	0.24
32.00	5.80	0.43	0.23
33.00	5.70	0.43	0.23
34.00	5.80	0.43	0.23
35.00	5.80	0.42	0.23
36.00	5.80	0.42	0.23
37.00	5.80	0.41	0.22
38.00	5.80	0.41	0.22
39.00	5.80	0.41	0.22
40.00	5.80	0.40	0.21
41.00	5.90	0.40	0.21

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITA- OG SELTUMKLINGA

MÆLISTIÐUR : SH-13
DAGS / MÆLI AF : 13 08 1985 / DE
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
4.00	6.90	1.05	0.65
5.00	6.50	1.02	0.62
6.00	6.40	1.00	0.61
7.00	6.40	0.95	0.57
8.00	6.50	0.85	0.51
9.00	6.60	0.75	0.45
10.00	6.80	0.72	0.43
11.00	6.90	0.70	0.42
12.00	6.90	0.68	0.41
13.00	6.90	0.65	0.39
14.00	7.00	0.61	0.36
15.00	7.00	0.59	0.35
16.00	7.10	0.58	0.34
17.00	7.10	0.55	0.32
18.00	7.10	0.53	0.31
19.00	7.10	0.51	0.30
20.00	7.00	0.51	0.30
21.00	6.40	0.49	0.28
22.00	6.40	0.49	0.28
23.00	6.40	0.48	0.27
24.00	6.40	0.48	0.27
25.00	6.00	0.46	0.25
26.00	5.70	0.44	0.24
27.00	5.60	0.43	0.23
28.00	5.60	0.43	0.23
29.00	5.60	0.43	0.23
30.00	5.60	0.43	0.23
31.00	5.50	0.43	0.23
32.00	5.50	0.43	0.23
33.00	5.50	0.42	0.22
34.00	5.50	0.42	0.22
35.00	5.50	0.42	0.22
36.00	5.50	0.42	0.22
37.00	5.50	0.41	0.22
38.00	5.60	0.41	0.22
39.00	5.60	0.41	0.22
40.00	5.70	0.41	0.22
41.00	5.70	0.40	0.21

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITÁ- OG SELTUMÆLINGA

MÆLISTADUR : SH-13
DAGS / MÆLT AF : 22 10 1985 / DE
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
10.00	6.50	1.00	0.61
15.00	6.30	1.00	0.60
20.00	6.10	1.00	0.60
25.00	6.10	1.00	0.60
26.00	6.40	1.00	0.61
28.00	7.00	1.00	0.62
30.00	7.10	1.00	0.62
31.00	7.30	1.00	0.62
32.00	7.30	1.00	0.62
34.00	7.50	1.00	0.63
35.00	7.50	1.00	0.63
40.00	7.50	1.00	0.63
45.00	7.70	1.00	0.63

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITÁ- OG SELTUMÆLINGA

MÆLISTADUR : SH-14 Höggborshola í dælingu.
DAGS / MÆLT AF : 13 08 1985 / DE
TÆKI NR : 5

Dýpi	°C	Ohmm mælt	Ohmm leiðr.
7.00	7.10	0.48	0.28
8.00	6.60	0.50	0.29
9.00	6.50	0.50	0.28
10.00	6.40	0.50	0.28
11.00	6.30	0.50	0.28
12.00	6.30	0.50	0.28
13.00	6.30	0.49	0.28
14.00	6.30	0.49	0.28
15.00	6.30	0.49	0.28
16.00	6.40	0.48	0.27
17.00	6.30	0.48	0.27
18.00	6.30	0.47	0.26
19.00	6.30	0.47	0.26
20.00	6.40	0.46	0.26
21.00	6.40	0.45	0.25
22.00	6.40	0.45	0.25
23.00	6.40	0.44	0.24
24.00	6.40	0.44	0.24
25.00	6.40	0.43	0.24
26.00	6.30	0.43	0.24
27.00	6.20	0.43	0.24
28.00	6.10	0.43	0.24
29.00	6.10	0.43	0.24
30.00	6.10	0.43	0.24
31.00	6.00	0.43	0.23
32.00	6.00	0.42	0.23
33.00	5.90	0.42	0.23
34.00	5.90	0.42	0.23
35.00	5.80	0.42	0.23
36.00	5.80	0.42	0.23
37.00	5.70	0.41	0.22
38.00	5.70	0.41	0.22
39.00	5.60	0.41	0.22
40.00	5.70	0.41	0.22
41.00	5.70	0.41	0.22
42.00	5.60	0.41	0.22
43.00	5.40	0.41	0.22
44.00	5.40	0.41	0.22
45.00	5.30	0.41	0.22
46.00	5.30	0.41	0.22
47.00	5.30	0.41	0.22
48.00	5.20	0.41	0.22

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITÁ- OG SELTUMÆLINGA

MÆLISTADUR : STADUR, HOLA SH-15 (?) kl.12:20. Höggborshola.
DAGS / MÆLT AF : 16 12 1985 / BA
TÆKI NR : 5

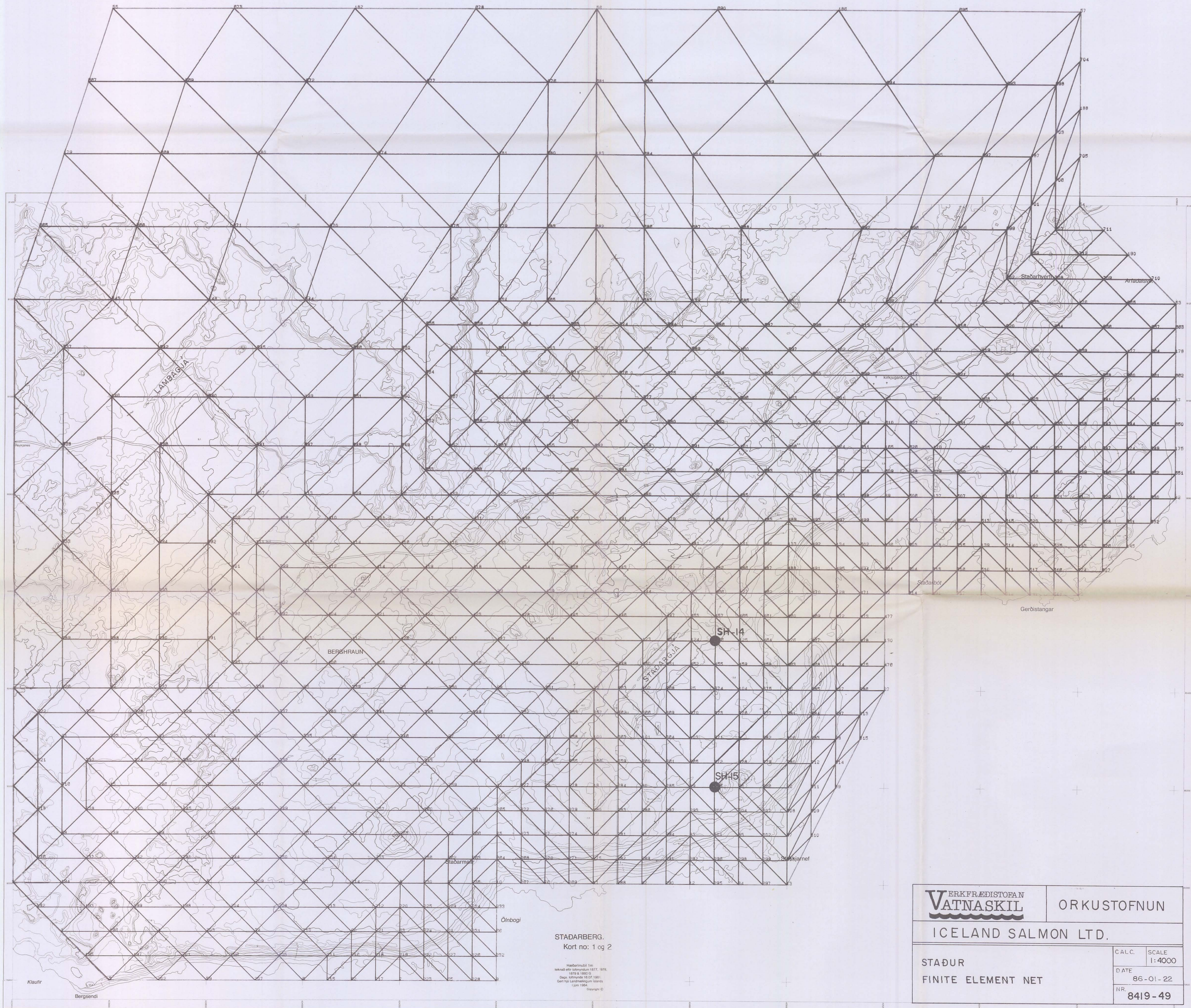
Dýpi	°C	Ohmm mælt	Ohmm leiðr.
36.00	4.60	0.44	0.23
37.00	4.60	0.44	0.23
38.00	4.70	0.44	0.23
39.00	4.70	0.44	0.23
40.00	4.70	0.44	0.23
41.00	4.60	0.43	0.22
42.00	4.60	0.43	0.22
43.00	4.60	0.43	0.22
44.00	4.60	0.43	0.22
45.00	4.60	0.43	0.22
46.00	4.60	0.43	0.22
47.00	4.60	0.42	0.22
48.00	4.60	0.42	0.22
50.00	4.60	0.42	0.22
52.00	4.60	0.42	0.22
54.00	4.60	0.42	0.22
56.00	4.60	0.42	0.22
58.00	4.60	0.42	0.22
60.00	4.60	0.41	0.21
62.00	4.80	0.41	0.21
64.00	5.00	0.41	0.21
66.00	5.10	0.41	0.21

ORKUSTOFNUN VOD
86-01-21 BA

ÚRVINNSLA HITÁ- OG SELTUMÆLINGA

MÆLISTADUR : SH-16
DAGS / MÆLT AF : 22 10 1985 / DE
TÆKI NR : 5

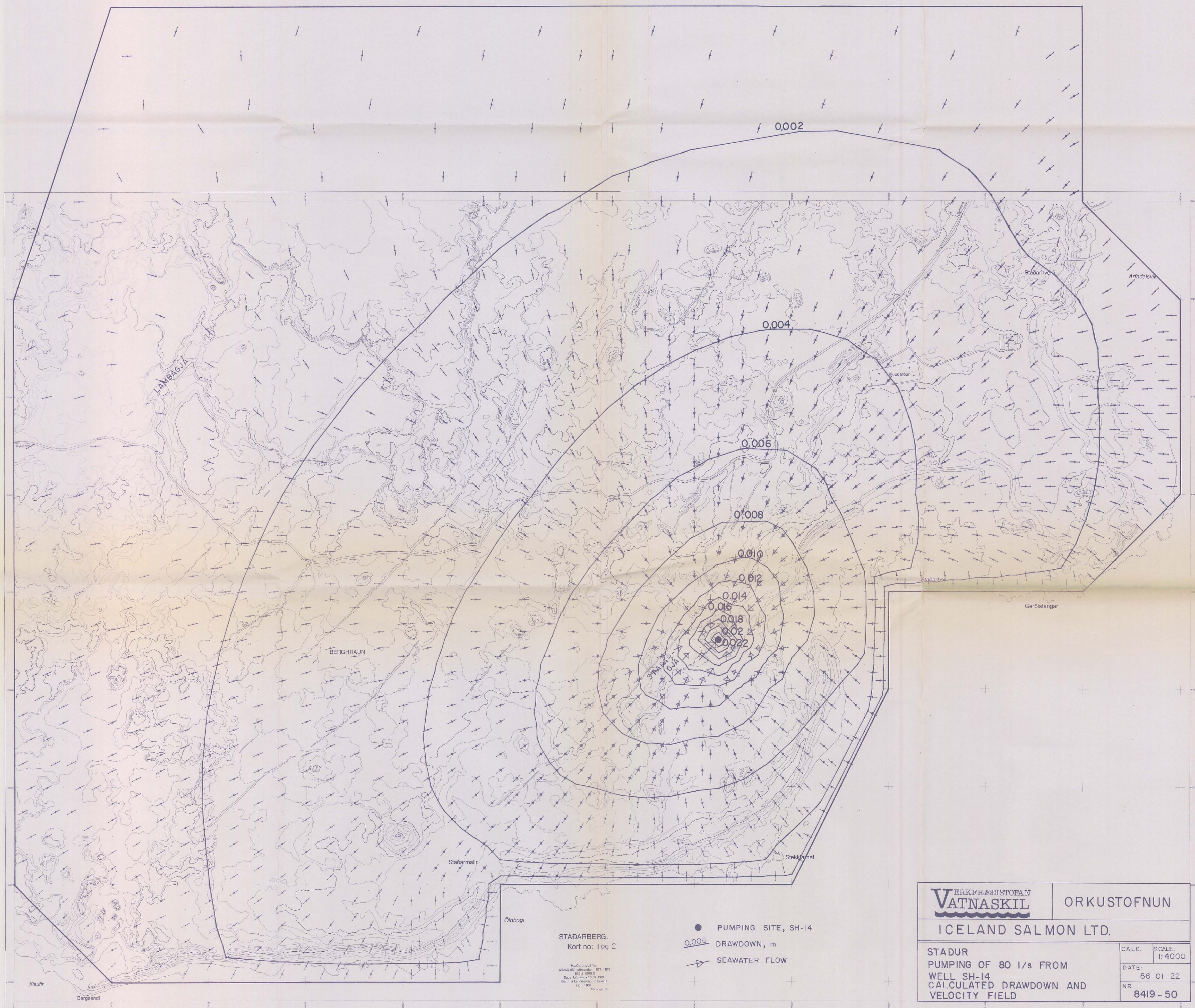
Dýpi	°C	Ohmm mælt	Ohmm leiðr.
22.00	9.30	1.00	0.66
23.00	9.30	1.00	0.66
24.00	9.30	1.00	0.66
25.00	9.30	1.00	0.66
26.00	9.30	1.00	0.66
27.00	9.30	1.00	0.66
28.00	9.30	1.00	0.66
29.00	9.30	1.00	0.66
30.00	9.30	1.00	0.66



STADARBERG.
Kort no: 1 og 2

Neðanfarndi 1:1
teknað eftir Gíslasýslu 1877, 1878,
1879 & 1880 G.
Daga: Vatnaskil 16.07.1981
Gert hjá Landmælingum Íslands
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VERKFRÆÐISTOFAN VATNASKIL		ORKUSTOFNUN	
ICELAND SALMON LTD.			
STADUR		CALC.	SCALE 1:4000
FINITE ELEMENT NET		DATE	86-01-22
		NR.	8419-49



VERKFRÆÐISTOFAN VATNASKIL		ORKUSTOFNUN	
ICELAND SALMON LTD.			
STADUR PUMPING OF 80 l/s FROM WELL SH-14 CALCULATED DRAWDOWN AND VELOCITY FIELD		CALC.	SCALE: 1:4000
		DATE:	86-01-22
		NR.	8419-50

