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Oskarshamn site investigation

Hydrochemical logging in KAV01

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Contents

1 Introduction

The following document reports performance of and results from the activity "Hydrochemical logging in KAV01". KAV01 is a 743.6 metres deep core drilled borehole, within the site investigation in Simpevarp, Oskarshamn. The work was conducted according to the activity plan AP PS 400-03-035 (SKB internal controlling document). Before the logging was performed, it was noticed that the borehole had been polluted with a greasy substance. Moreover, the casing was corroded. The data is reported to SICADA in field note no. Simpevarp 104.

2 Objective and scope

Hydrochemical logging was performed in order to obtain an overview of the chemical composition of the water along the borehole KAV01. The analysis program was carried out according to SKB chemistry class 3, with the exception of isotope analyses.

Due to low electric conductivity values throughout the water column in the borehole, no samples were analysed for major components.

3 Equipment

3.1 Description of equipment

For the hydrochemichal logging an approximately 750 metres long polyamide tube, divided into units of 50 metres, was used. The equipment is described in the method description SKB MD 422.001, “Metodbeskrivning för hydrokemisk loggning” (SKB internal controlling document).

The tube units are connected with couplings. The exact length of each tube unit is given in Table 3-1. The water content in each tube unit constitutes one sample and the volume of each sample is approximately two litres. At the lower end of the tube array, a weight is added to keep it straight and to prevent fastening. The first tube lowered down the borehole has a non return valve at the bottom to prevent water outflow. A schematic picture of the equipment used for the hydrochemichal logging is shown in Figure 3-1.

Table 3-1. Length of tube units used at the hydrochemical logging in KAV01.

Unit	Length [m]
1	49.3
2	49.2
3	49.2
4	49.9
5	50.0
6	49.8
7	50.6
8	50.3
9	49.7
10	50.0
11	49.9
12	49.3
13	50.1
14	49.9
15	49.7
Sum:	746.7
Coupling	2.8
Weight	0.82
Total tube length:	750.3

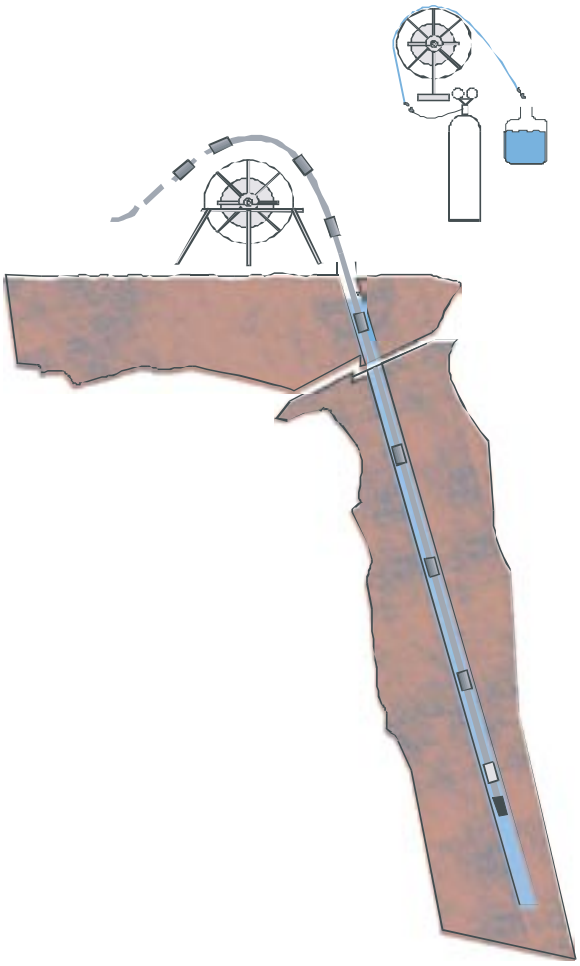

Figure 3-1. *Equipment for hydrochemical logging in boreholes. At the lower end of the tube array there is a non return valve and a weight connected. Each tube unit is approximately 50 metres long.*

4 Performance

The hydrochemichal logging in KAV01 was performed June 16, 2003, according to the activity plan and following the method description. The equipment was lowered to a depth of 733 metres, i.e. the length of the borehole subtracted with 10 metres, to avoid fastening of the equipment. The lowering of the equipment started at 16:03 and the last unit was lowered at 19:17. The tubes were lowered down the borehole five metres/minute. Due to the contamination risk from the greasy substance observed in the borehole, the first tube unit was not opened until it had been lowered to 50 metres. In addition, a moderate nitrogen gas pressure was applied while lowering this unit. The retrieval of the tubes started at 19:22 and all tube units had been lifted up at 20:32. The uptake was performed as fast as possible due to a leak in the non return valve. The tube units were emptied the same evening using pressurized nitrogen gas and the water samples portioned into sample bottles. Each tube unit represents one sample. Sample preparation and consulted laboratories are listed in the activity plan.

An overview showing the samples obtained at the logging occasion is given in Table 4-1. The hydrochemical data from the logging are stored in the database SICADA in field note no. Simpevarp 104. The SKB sample numbers are 5637–5650.

When a tube is fully filled it contains about 2.5 litres of water. Estimates of the amount of water in each tube unit are given in Table 4-2. During the lifting of the tube units, it was noticed that the non return valve had not closed properly. This caused water to leak out from the bottom of the tube array. To minimise the loss of water the tubes were retrieved as quickly as possible. The leakage from the non return valve was probably caused by small gravel. Samples taken for analysis of major components were obtained but not analysed due to the low electric conductivity values.

Table 4-1. Overview of samples collected at hydrochemical logging in KAV01. Filled cells represent collected samples.

Tubes			Samples taken out				Archives	
Tube unit	[m]	SKB:nr	pH, alk., cond.	Major components	Anions	Uranine		
			250 ml	125 ml	250 ml	100 ml	2x250 ml	2x100 ml
1	0 33		not used					
2	33 83	5650						
3	83 133	5649						
4	133 183	5648						
5	183 233	5647						
6	233 283	5646					one bottle	
7	283 333	5645						
8	333 383	5644						
9	383 433	5643						
10	433 483	5642						
11	483 533	5641						
12	533 583	5640						
13	583 633	5639						
14	633 683	5638						
15	683 733	5637						

No samples were taken from the upper tube unit, i.e. unit no. 1.

Table 4-2. Estimates of water amount in tube units.

Tube unit	Volume in tube unit [ml]
1	-
2	775
3	775
4	875
5	1120
6	1370
7	1480
8	2050
9	2220
10	2170
11	2280
12	2220
13	2120
14	2110
15	1770

5 Results

5.1 Analysis results

Results from the different analysis are shown in Figure 5-1 to 5-8 below. The results are plotted for the mid-point of each tube, counted from the top of the borehole. Fore example, borehole length 33–83 metres is plotted at 58 metres and so on.

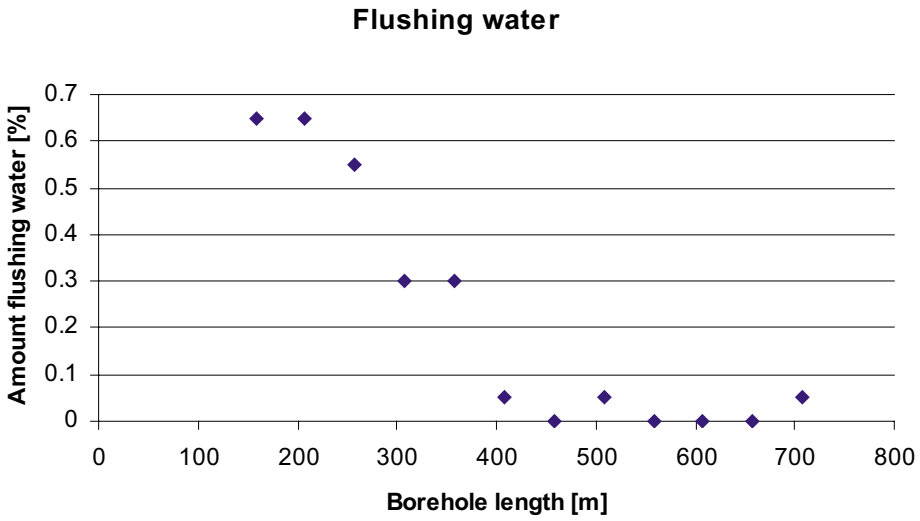

Figure 5-1. *Amount of flushing remaining in KAV01 at different depths at the time of the hydrochemical logging.*

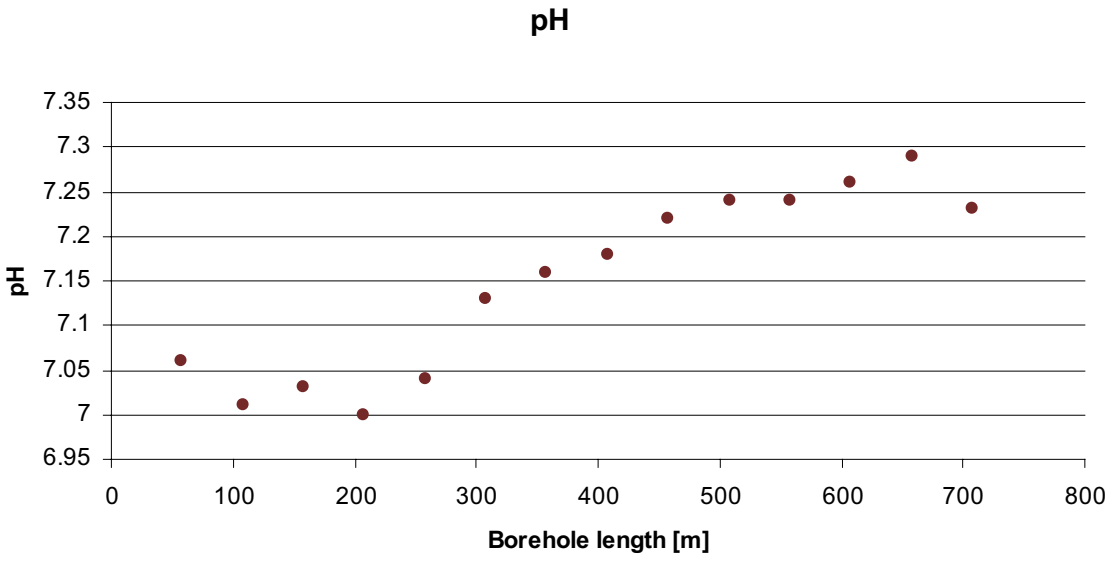

Figure 5-2. *Measurements of pH obtained from the hydrochemical logging in KAV01.*

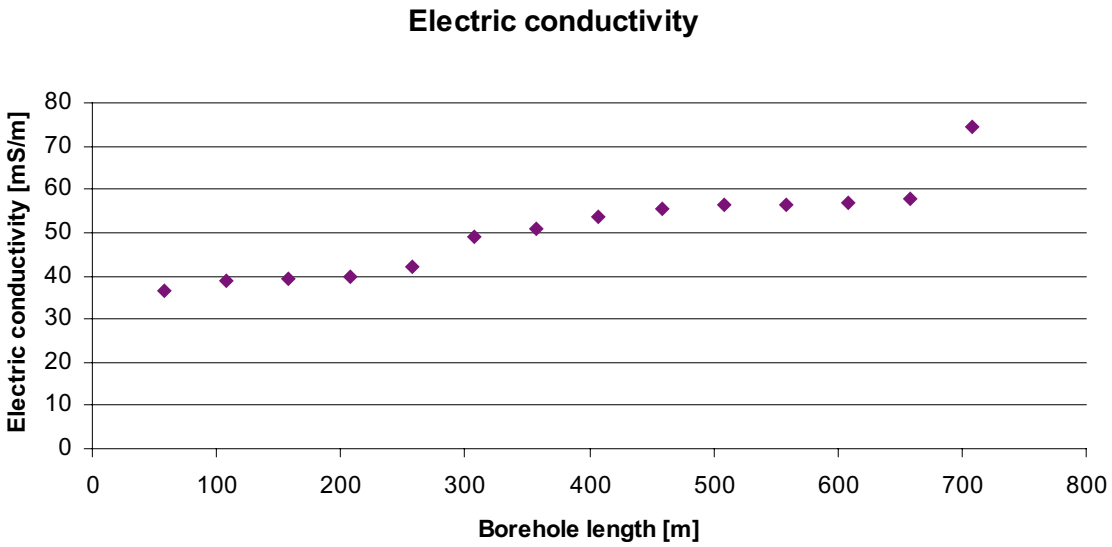

Figure 5-3. *The electric conductivity values are low and increase only slightly down KAV01.*

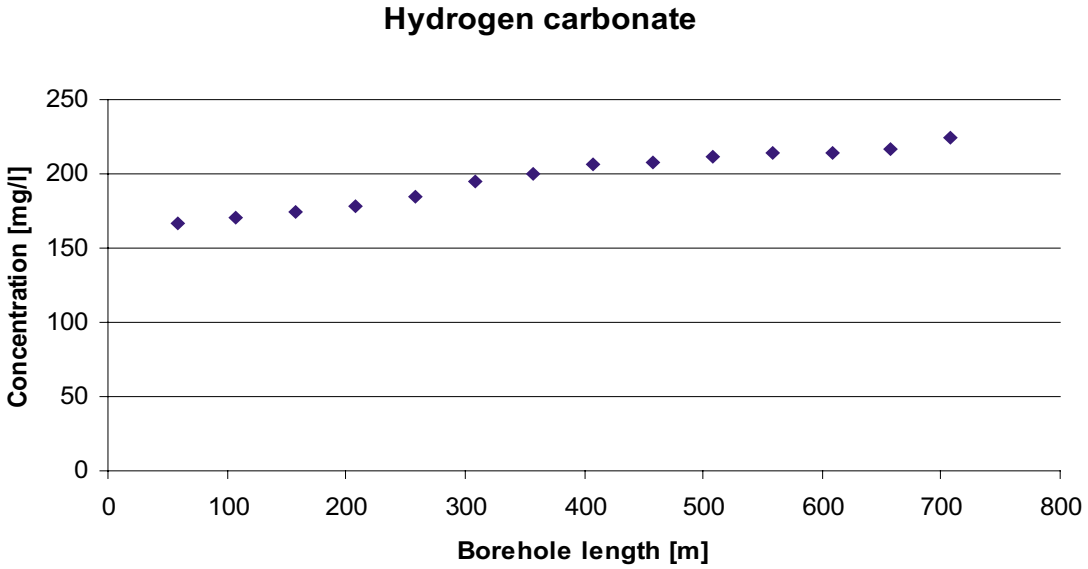

Figure 5-4. *Results from analysis of hydrogen carbonate obtained from water samples taken at the hydrochemical logging in KAV01.*

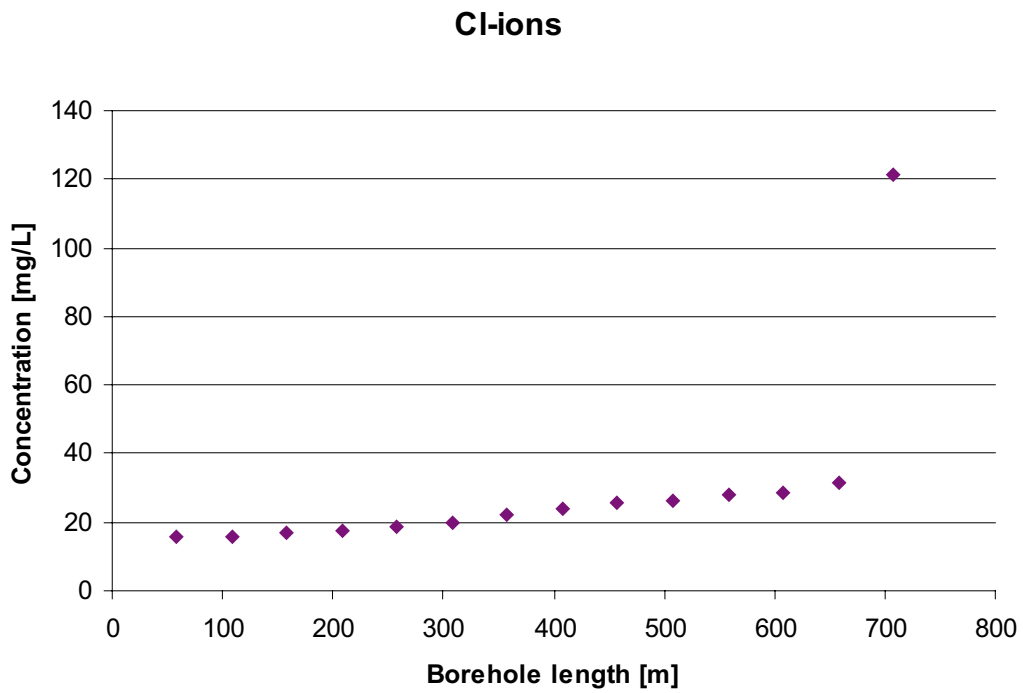

Figure 5-5. *Analysis results of chloride from samples taken at different depths in KAV01.*

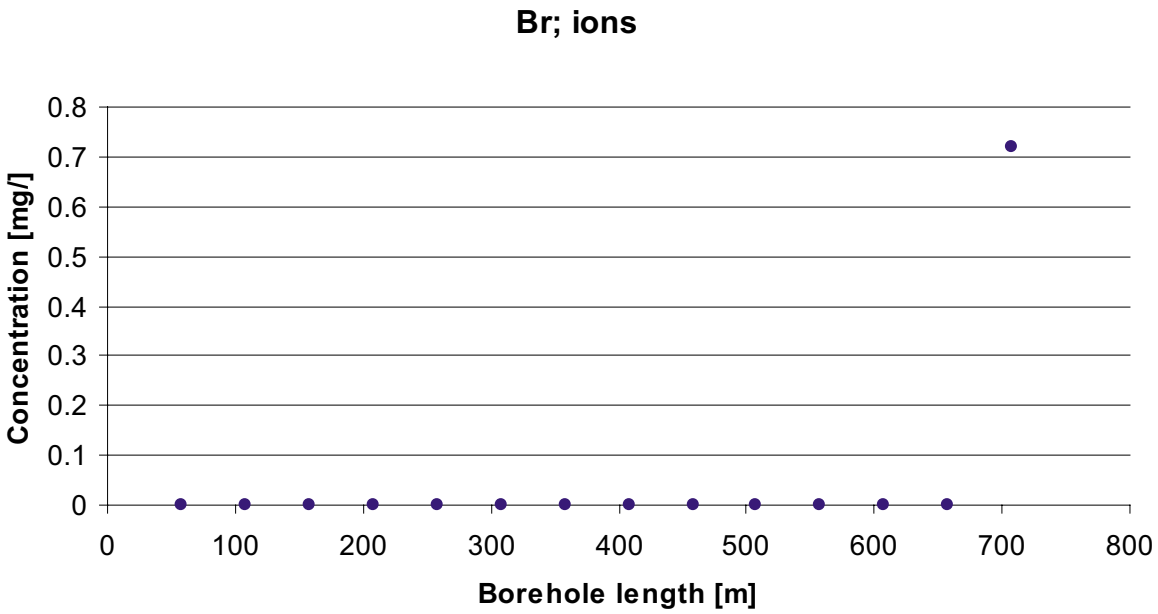

Figure 5-6. *Results of brimide analysis. All values except for the borehole section 683–733 metres were below detection level, <0,2 mg/L.*

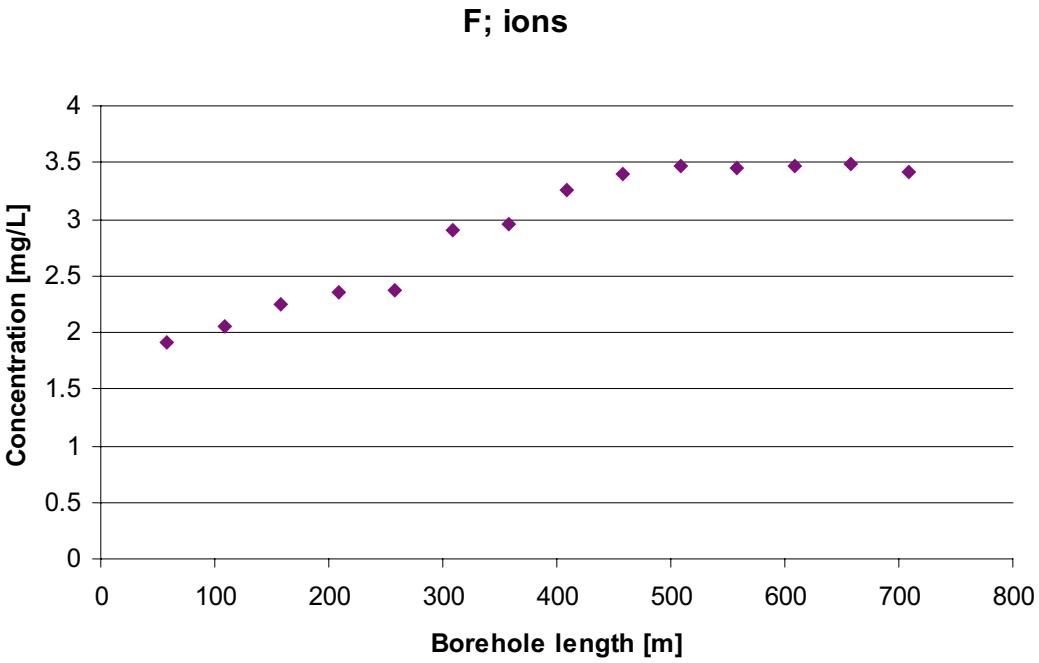

Figure 5-7. *Concentrations of fluoride in water samples taken June 18, 2003, in KSH02.*

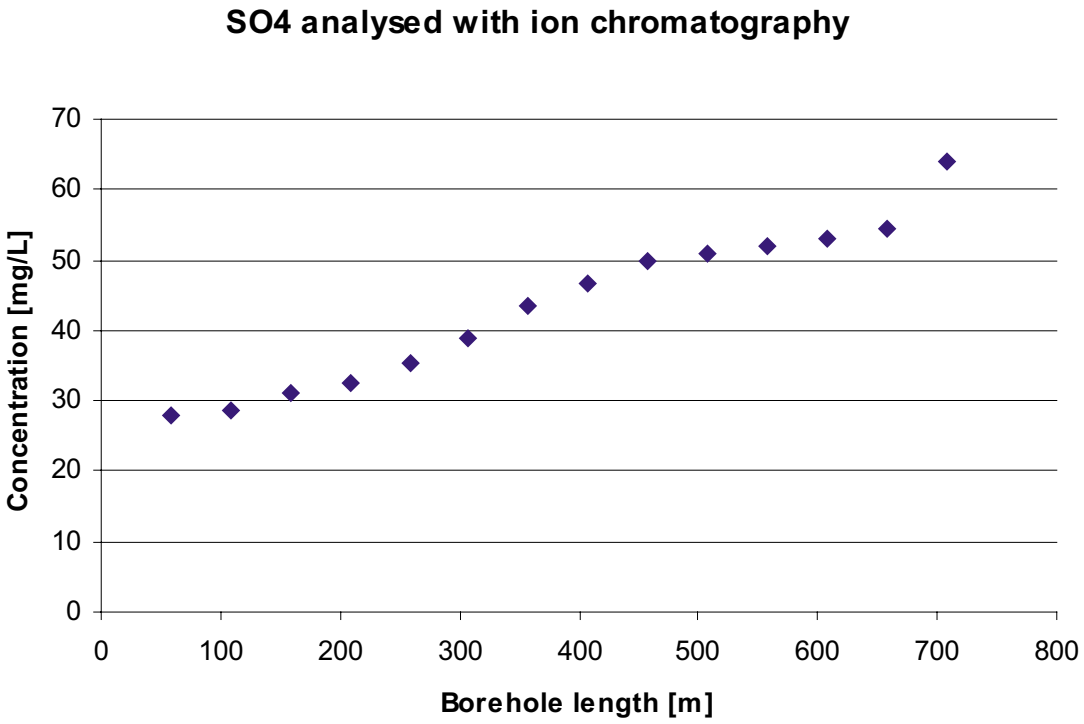

Figure 5-8. *Sulphate concentrations obtained from samples taken during the hydro-chemical logging in KAV01. Sulphate is measured by ion chromatography.*

6 Conclusions

Analyses of uranine, giving flushing water content in the water, show that almost no flushing water remains in KAV01.

The values for electric conductivity are unexpectedly low, increasing only slightly in KAV01. The results from the electric conductivity analysis caused analysis for major components to be cancelled. Therefore ion balances have not been calculated.

Appendix 1

Water composition

IDCODE	Sample no.	HCO_3 mg/L	Cl mg/L	SO_4 mg/L	Br mg/l	F mg/L	pH	ElCond mS/m	Flushing water %
KAV01	5650	167	15.5	27.97	<0.2	1.91	7.06	36.4	-
KAV01	5649	171	15.9	28.70	<0.2	2.06	7.01	38.9	-
KAV01	5648	175	16.8	31.27	<0.2	2.24	7.03	39.1	0.65
KAV01	5647	178	17.7	32.59	<0.2	2.36	7.00	39.7	0.65
KAV01	5646	184	18.8	35.19	<0.2	2.37	7.04	41.9	0.55
KAV01	5645	195	19.8	38.87	<0.2	2.90	7.13	49.0	0.3
KAV01	5644	200	22.3	43.57	<0.2	2.96	7.16	50.9	0.3
KAV01	5643	206	24.2	46.60	<0.2	3.26	7.18	53.6	0.05
KAV01	5642	208	25.9	49.85	<0.2	3.39	7.22	55.4	0
KAV01	5641	212	26.4	51.03	<0.2	3.47	7.24	56.2	0.05
KAV01	5640	214	28.2	52.03	<0.2	3.46	7.24	56.6	0
KAV01	5639	214	28.7	53.10	<0.2	3.47	7.26	56.9	0
KAV01	5638	217	31.6	54.62	<0.2	3.49	7.29	57.9	0
KAV01	5637	224	121.4	63.91	0.72	3.42	7.23	74.3	0.05