SUSTAINABLE GROUNDWATER MONITORING SYSTEM OF EAST-VIRU COUNTY, ESTONIA

Norwegian Financial Mechanism project 52/2006-EE0010
1.01.2008 – 30.04.2011

Coordinator: Ministry of Environment, Estonia
Partners:
University of Tartu, Estonia
Tallinn Technical University, Estonia
Geological Survey of Estonia

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Automation of the groundwater monitoring network – installation of automatic divers

2011

Automation of the existing groundwater monitoring network and new monitoring wells was one of the main task of the project.

There are various types of automatic monitoring devices available of measuring the water level, water temperature and conductivity. In the frame of this project for automation of East-Viru groundwater monitoring network has been used Solinst Levelogger Gold and Schlumberger Water Services CTD Divers types. Using the loggers we can measure and monitor the groundwater level, temperature and conductivity in an economic and efficient way. Loggers have a diameter of 22 mm. The detail characterization of installation of loggers is presented in the report of Maves Ltd. "The final report of installation and setting of loggers in monitoring wells of East-Viru County financed by Norwegian project EE 0010 "Sustainable groundwater monitoring system of East-Viru County, Estonia"" (Appendix 1). The location of automatic monitoring wells is presented in Figure 1, the distribution of monitoring wells by observed aquifers is presented in Figure 1A.

Measuring level

All loggers determine the height of a water column by measuring the water pressure with the built-in pressure sensor. When the logger is above water, the atmospheric pressure is measured, in the same way as a barometer. Below the water surface the pressure of the water is added: the higher the water column, the higher the pressure. Based on the measured pressure, the height of the water column above the logger's pressure sensor can be determined.

Measuring temperature

All loggers measure the groundwater temperature. This can provide information about the groundwater flow, so that the spread of (contaminated) water can be detected.

The temperature is measured using a semi-conductor sensor. The temperature is not only recorded, but also used to simultaneously compensate the pressure sensor for temperature influences.

In addition to the normal loggers for each measurement area a Baro-Diver is also installed, which records as a barometer the atmospheric pressure. Air pressure measurements are used to compensate the level measurements for variations in air pressure. The compensation values are related to a reference point what for was taken surface of the earth. In principle, one Baro-Diver is sufficient for an area with a radius of 30 kilometers Figure 1B).

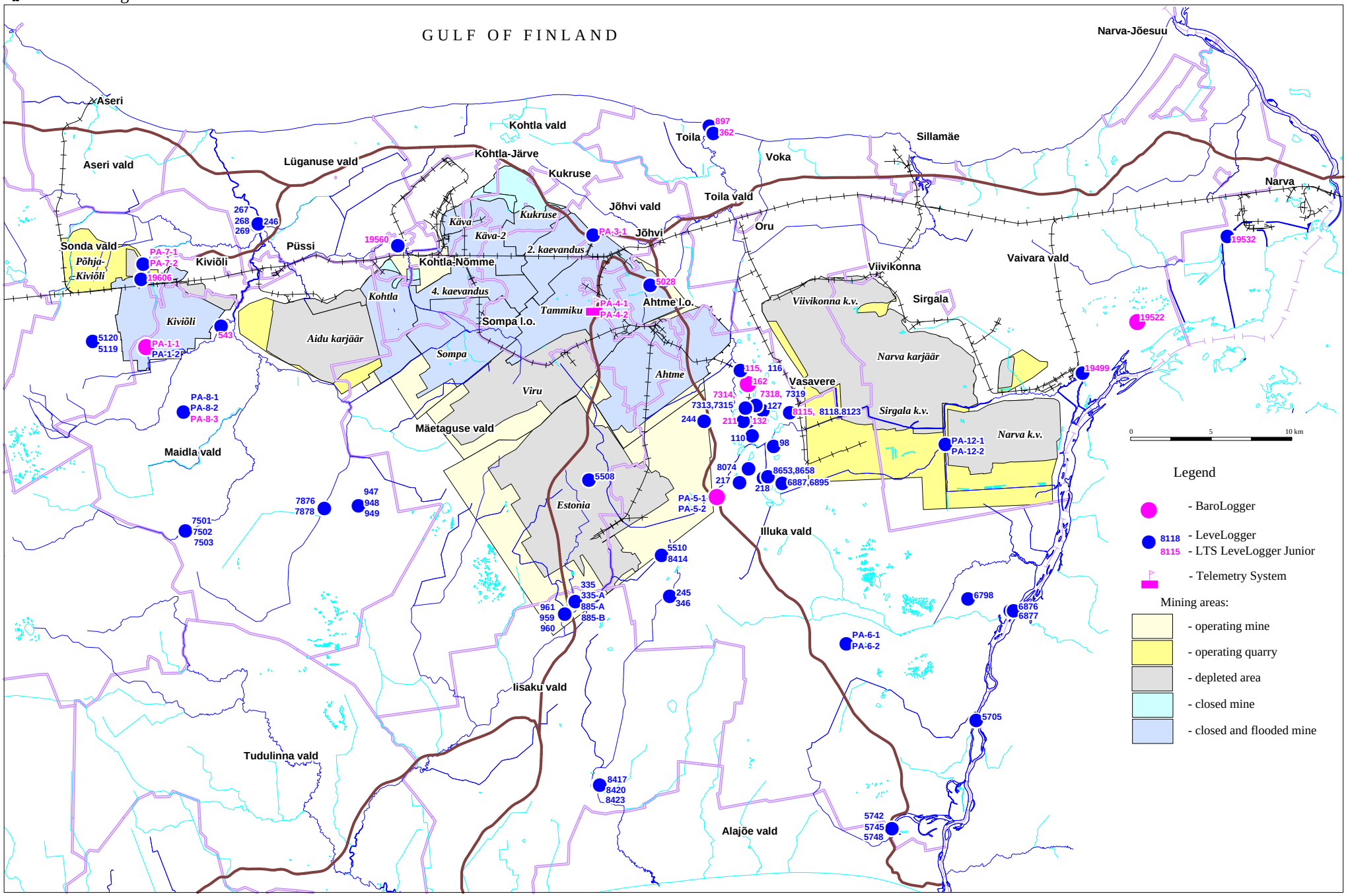

Figure 1. Location of installed loggers.

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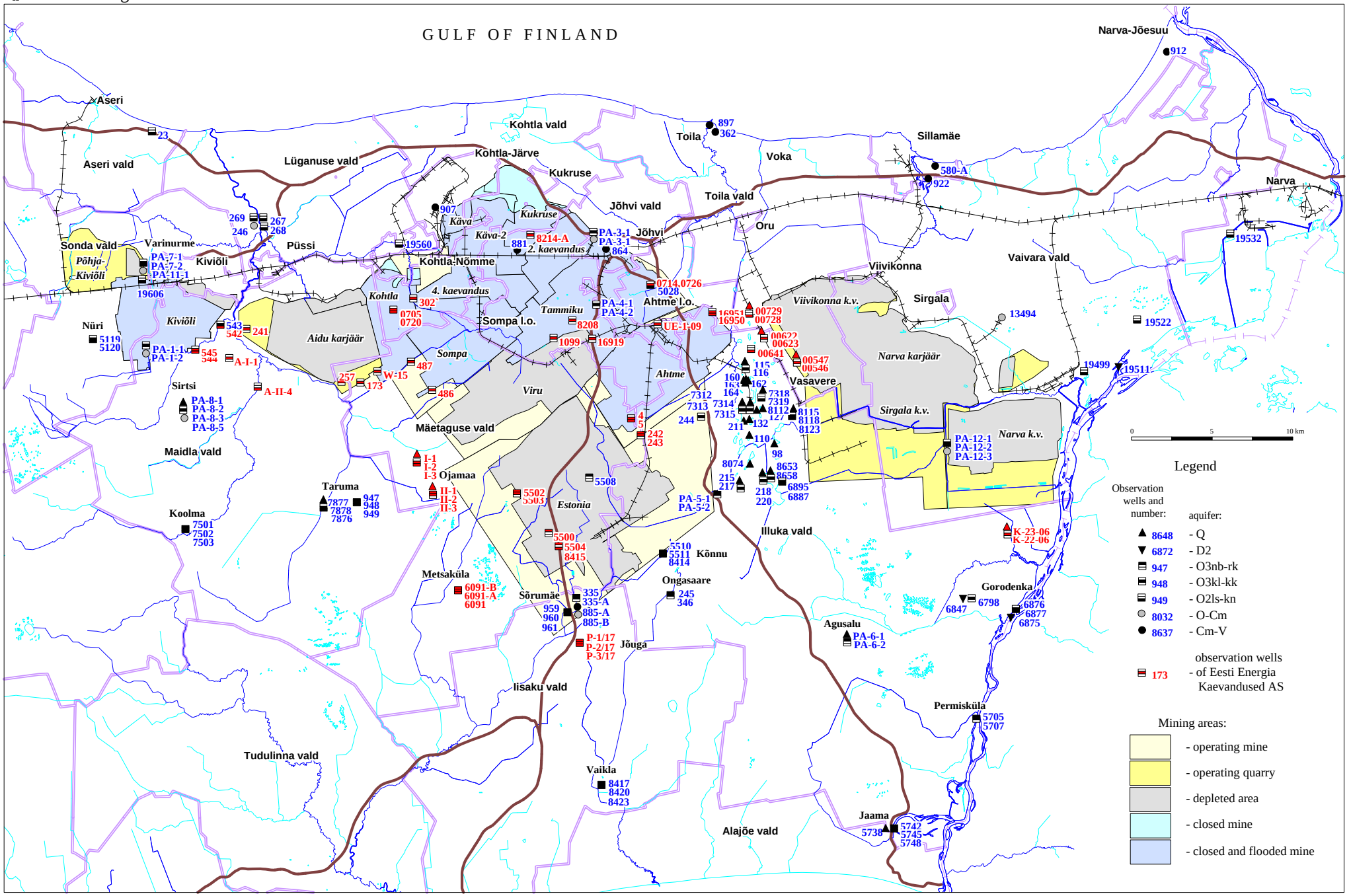

Figure 1A. Distribution of monitoring wells of East-Viru county by observed aquifers.

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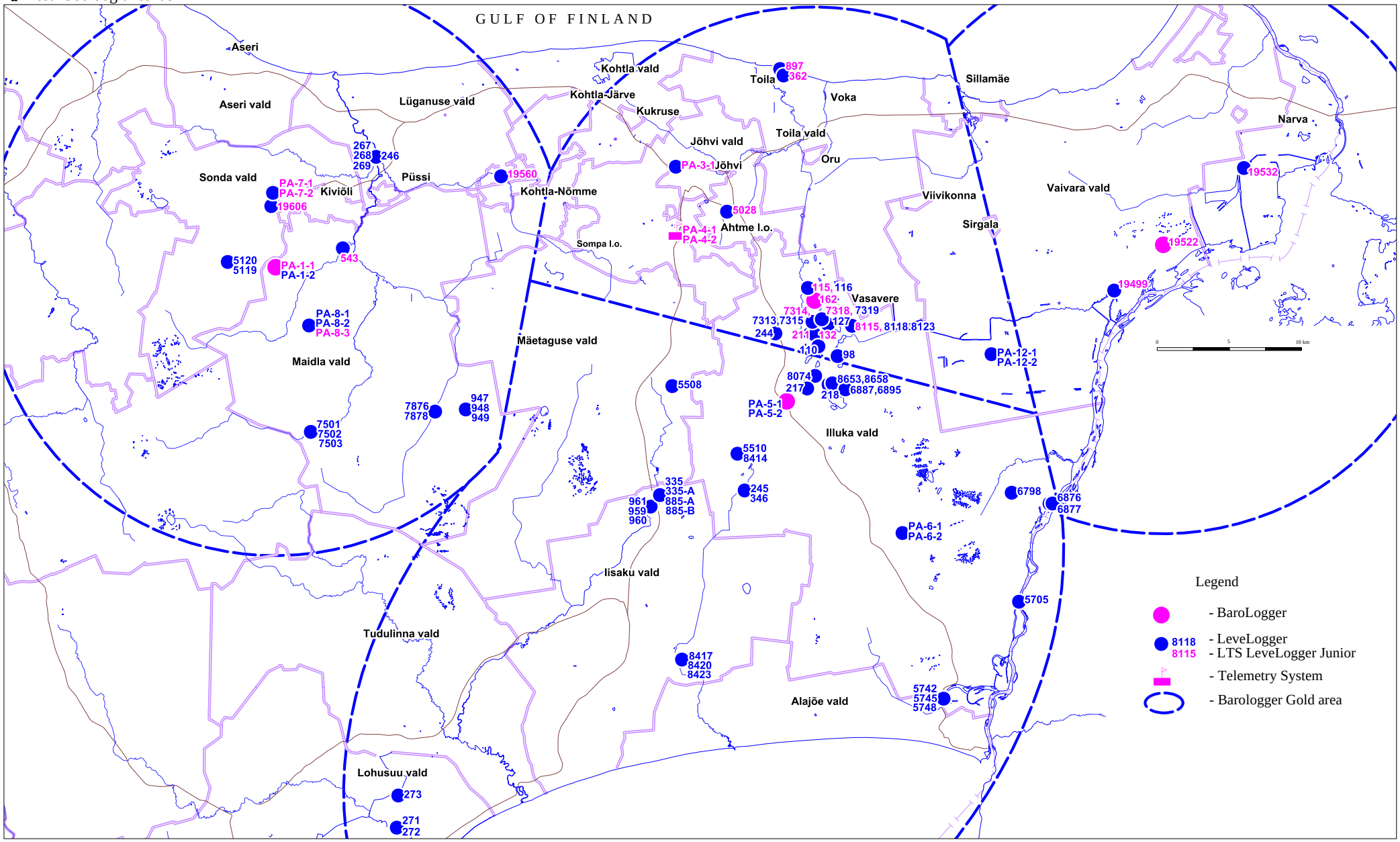

Figure 1B. Distribution of Barologger Gold areas.

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Measuring conductivity

The LTC Levelogger Junior provides a convenient method to measure level, temperature and conductivity in one probe.

Loggers are normally installed in monitoring wells below the water surface. The depth at which the logger was suspended depends on the measurement range of the instrument. The characterizations of Levelogger Gold, Barologger Gold and LTC Levelogger Junior are presented in Appendices 2, 3, 4.

Into 7 monitoring wells are installed by Est-Doma Ltd. the Schlumberger Water Services CTD-Divers (Appendix 5).

The CTD-Diver

The CTD-Diver is designed to take and record measurements in (ground) water. The CTD-Diver measures water level, level temperature and conductivity. The CTD-Diver consists of a pressure sensor for measuring the water level, a temperature sensor, a four-electrode conductivity cell, a non-volatile memory to store the measurements and a battery.

In addition to level and temperature, the CTD-Diver also measures the electrical conductivity of water in milliSiemens per centimeter (mS/cm). A change in conductivity can indicate, for instance, a change in flow or increasing or decreasing contamination or salination.

Based on the measured conductivity and temperature, the CTD-Diver calculates the specific conductivity at 25 °C.

The conductivity is measured using a four-electrode measuring cell. This type of measuring cell is extremely for measuring high or low conductivity values. The characterization of CTD-Diver is presented in Appendix 6.

All together within the framework of state procurement by company Labochema Estonia Ltd. were bought 64 loggers of groundwater level and temperature (3001 LT Levelogger Gold, type A in project documents), 24 loggers of groundwater level and conductivity (3001 LTC Junior, type C) and 4 loggers of atmospheric pressure (3001 LT Barologger Gold, type B). According to contract between the Ministry of Environment and Maves Ltd. the loggers were set in observation wells in summer and autumn 2010. All three types of loggers were installed before setting. Loggers A and C determine the height of water column by measuring the water pressure with pressure sensor (installed unit – cm) and groundwater temperature (installed unit – °C). Logger C determines additionally groundwater conductivity (specific conductivity unit – µS/cm). As a measuring unit of logger B was installed the correction of groundwater level in cm depending on fluctuation of

atmospheric pressure. The measuring frequency was installed of 3 hours while all three types of loggers take measurements synchronically at the same time.

The logger of groundwater conductivity (type C) was calibrated before setting, using calibration solution HI 7031 with conductivity of 1413 µS/cm. For installation of loggers the Solinst software 3. 4. 0. was used (www.solinst.com/downloads). At the setting of loggers the allowed diving depth was taken into consideration: maximum 10 m for type A and 30 m for type C below water level. If possible, the loggers were set at the open part of the well or at filter.

The loggers were hanged in wells at stainless thick.

Establishment of the Solinst Telemetry System for monitoring wells PA-4-1 (26253) and PA-4-2 (26254)

In recent years the Keila–Kukruse aquifer in Viru mine is drained by lowering of groundwater level from 70.0 m a.s.l. up to 14–17 m a.s.l. It is estimated that 40–50% of inflow into Viru mine comes from Sompa and Tammiku mine. It is decided that in 2013 the Viru mine will be closed and flooded. Besides is presumed that water level in Viru mine will be arises up to 60 m a.s.l. Such situation represents the risk for unexpected floods in residential areas. So it would be necessary to nearby Viru mine establish the automatic groundwater monitoring system station for fast reliable data transfer direct to computer in Geological Survey of Estonia.

In February 2011 the Labochema Estonia Ltd. set near by monitoring wells PA-4-1 and PA-4-2 where has been installed Solinst LTC Levelogger Junior dataloggers new Solinst Telemetry System to offer two-way communication and control from our own computer in Geological Survey. The STS Remote Station consists of an STS controller, Distribution Box, Battery and Modem with a connected Antenna, protected within a weatherproof Nema 4×case. The STS Distribution Box allows the connection of up to 4 data loggers. Today are used 2 connections with LTC Levelogger Junior dataloggers.

The characterization of Solinst Telemetry System is presented in Appendix 7.

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Tellija: Keskkonnaministeerium Töö nr: 10032

Norra finantsmehhanismidest rahastatava projekti EE0010 „SUSTAINABLE GROUNDWATER MONITORING SYSTEM OF EAST- VIRU COUNTRI; ESTONIA“ raames Ida-Virumaa puurkaevudesse automaatseadmete paigaldamise ja töökorda seadmise lõpparuanne

Vastutav täitja: Eik Eller

Juhatuse liige: Indrek Tamm

Tallinn

oktoober 2010

SISUKORD

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1 ÜLDOSA

Käesoleva töö tellis Keskkonnaministeeriumi veeosakond (leping nr 4-1.1/59 12.04.2010).

Töö eesmärgiks oli paigaldada ja seada töökorda automaatmõõteseadmed põhjaveeseire puurkaevudesse Ida-Virumaal (vastavalt lepingu lisa 1 kohasest töö tehnilisest kirjeldusest, lisade 2 ja 3 kohasest põhjavee seirepuurkaevude nimekirjadest ja automaatmõõteseadmete paigaldamise juhenditest). Käesolev töö tehti Norra finantsmehhanismidest rahastatava projekti EE0010 „Sustainable groundwater monitoring system of East-Viru county, Estonia“ raames.

Seireseadmed paigaldasid AS Maves geoloogid E. Eller ja M. Osjamets ajavahemikel 7.06-18.06.2010 (29 seadet), 5.07-09.07.2010 (30 seadet) ja 7.09-10.09.2010 (32 seadet).

Tööülesandeks olnud seirepuurkaevude valikus tehti Tellija poolt kaks korda muudatusi. Algselt kavas olnud kohtadest jäid seadmed paigaldamata AS Sillamäe Veevärgi puurkaevudesse 2207 ja 2198 vastava leppe puudumise tõttu Tellija ja vee-ettevõtte vahel.

Seadmete paigaldamise käigus selgus kohapeal, et seirepuurkaevud 19028; 3875; 3988; 4012 olid avariilised ning neisse polnud mõtet seireseadmeid paigaldada.

Seirepuurkaevudesse 2088; PA-1-2; PA-3-2; PA-8-5; PA-9-3 ja PA-11-2 ei võimaldanud seadmete tehnilise kirjelduse järgne[1] lubatud sukeldussügavus seadmeid vajalikule (puurkaevu töötava osa või filtri sügavusele) sügavusele paigaldada. Probleemi lahendamiseks otsustas Tellija nende puuraukude jaoks uued seadmed muretseda.

Paigaldamata jäänud 12 seadme kasutuselevõtuks pakkus Tellija täiendavaks valikuks 22 puurauku milledest kontrollimisel osutusid sobivaks puuraugud katastri numbritega 3279; 3282; 3385; 3400; 3662; 3861; 3876; 5070; 13733; 19522; 19560 ja 19606.

Kokku paigaldati käesoleva töö käigus 88 seirepuurkaevu 91 automaatmõõteseadet (lepingus olnud 89 seadmele lisas tellija 3 seadet, üks põhjaveetaseme ja vee elektrijuhtivuse mõõteandur 3001 LTC Junior ei olnud töökorras ja anti 24.09.2010 LaboChema esindajale üle, kviitung on lisatud aruandele).

Seadmete paigaldamisel ilmnenud vajadus täiendavate seirepuurkaevude järele ning vajadus asenduskaevude kasutamiseks ei võimaldanud töid algse kava kohaselt teostada ja tingisid täiendavaid kulutusi sõiduks ja seadmete paigaldamiseks.

Andmed seireseadmete ja seirepuurkaevude kohta on esitatud tabelis 1. Jõhvi Ilmajaama juures asuvate seirepuurkaevudesse PA-4-1 ja PA-4-2 paigaldatud seireseadmetest lähtuvad kaablid andmete automaatseks mahalaadimiseks toodi maasse kaevatult ilmajaama meteoväljakule. Eesti Meteoroloogia ja Hüdroloogia

[1] (User Guide – software version 3.4.0 lk 5)

Instituudi spetsialistid tuleb need ühendada oma infovõrku andmete automaatseks mahalaadimiseks.

2 SEIRESEADMED JA NENDE PAIGALDAMISE METOODIKA

Põhjavee seirepuurkaevudesse paigaldati järgmised automaatmõõteseadmed:

A. põhjaveetaseme ja temperatuuri mõõteandur 3001 LT Levellogger Gold (seade A) 64 tk;

B. õhurõhu automaatne registreerija 3001 LT Barologger Gold (seade B) 4 tk;

C. põhjaveetaseme ja vee elektrijuhtivuse mõõteandur 3001 LTC Junior (seade C) 23 tk

Kõik kolm anduritüüpi seadistati enne puurkaevu sukeldamist:

1. Project ID väljale anti väärtuseks Ida-Viru pv seire
2. Location väljale anti väärtuseks Seirepuurkaevu katastri nr (uute seirepuurkaevude puhul puurkaevu nr)
3. Andurid A ja C mõõdavad peale puurkaevu sukeldamist enda peale jääva veesamba kõrgust (seadistatud mõõtühikuteks cm) ja põhjavee temperatuuri (seadistatud mõõtühikuks ^{o}C), C tüüpi andur mõõdab lisaks põhjavee elektrijuhtivust (Specific Conductance, mõõtühikuks µS/cm). Andur B mõõtühikuks on seadistatud veetaseme parandus sentimeetrites johtuvalt õhurõhust.
4. Andurite A B C mõõtmissageduseks määrati kord iga 3 h tagant. Selleks, et tagada veesamba mõõtmistulemuste õhurõhu parandus määrati anduri esimene mõõtmispunkt ajaliselt toimuma kell 16.00 peale paigaldamist.
5. Põhjaveetaseme ja vee elektrijuhtivuse mõõteandurid (seadmed C) kalibreeriti enne paigaldamist kasutades juhtivuse kalibreerimislahust HI 7031 elektrijuhtivusega 1413 µS/cm. Seadmete seadistamiseks kasutati Solinst tarkvara 3.4.0 (www.solinst.com/downloads).

Seireseadmete paigaldamisel arvestati seadmete lubatud sukeldumissügavusega seadmel A 10 m ja seadmel C 30 m allpool veetaset, paigaldades need võimalusel seirepuurkaevude avatud ossa või filtri sisse.

Seadmed riputati puurauku roostevaba trossiga, mis algab 5 cm sügavusel maapinnast läbi puurkaevu manteltoru puuritud august. Erandjuhud on loetletud alljärgneva tabeli 1 märkuste ja tähelepanekute veerus.

Seireseadmete paigaldamisega seotud andmed on toodud tabelis 1.

Tabel 1 Seireseadmete paigaldamise andmed

jrk nr	katastri nr	seire nr	veekiht	koordinaadid		seade	puurkaevu sügavus, m	veetase paigaldamisel		seadme sügavus maapinnast, m	märkused ja tähelepanekud
				X	Y			maa-pinnast, m	toru otsast, m		
1	2464	897	V2gd	700451	6592851	C	201,0	6,00	6,00	42,50	seade on paigaldatud kaabliga, millel on teibiga tähistatud 0 sügavuse märk, mis peab jääma puuraugu toru otsa kõrgusele
2	4018	885-A	V2vr	692174	6563477	A	216,3	53,83	54,82	63,05	
3	2478	362	V2vr	700692	6592403	C	160,0	44,42	44,72	69,70	seadme kättesaamiseks tuleb tõsta pumpa hoidvat flanssi puurkaevu suudmel
4	4019	885-B	O-Cm	692175	6563459	A	125,4	31,63	32,20	36,14	
5	19016	246	O-Cm	672599	6586799	A	50,0	0,18	1,43	8,17	
6	3971	8423	O2ls-O2-1kn	693654	6552208	A	117,0	2,05	3,35	7,40	
7	3974	8417	O3nb-rk	693654	6552208	A	38,5	1,85	2,18	10,90	
8	3972	8420	O2kl-kk	693687	6552152	A	89,1	1,80	2,24	10,13	
9	3277	7313	O2id-kk	702645	6575417	A	39,9	3,38	4,59	9,86	Tross on kinnitatud toru otsast (toru 1,21 m üle maapinna)
10	3280	7315	O2id-kk	702796	6575438	A	38,9	3,00	3,45	11,19	
11	3281	7319	O2ls-O2-1kn	703325	6575612	A	76,2	13,03	13,45	20,12	
12	3538	6877	O2ls-O2-1kn	719223	6562921	A	86,9	12,22	13,42	16,61	trossi kinnitus 70 cm toru otsast (toru 1,20 m üle maapinna)
13	3525	6798	O2kk	716417	6563643	A	62,9	5,23	4,12	12,08	
14	3979	5748	O2ls-O2-1kn	711719	6549451	A	128,0	4,13	4,90	11,11	
15	3981	5742	O3nb-rk	711717	6549452	A	43,8	0,42	0,82	8,60	
16	3980	5745	O2kl-kk	711717	6549452	A	94,5	+0,01	0,66	8,67	
17	3289	6887	O2ls-O2-1kn	704956	6570785	A	72,5	8,18	9,73	0,00	tross on kinnitatud puurkaevu päise alt (toru 1,55 m üle maapinna)
18	3537	6876	O2kl-kk	719229	6562903	A	57,6	3,06	4,04	11,13	
19	3862	8658	O2id-kk	704067	6571176	A	37,8	+0,60	0,65	8,05	
20	3872	217	O2id-kk	702320	6570830	A	45,4	1,48	1,85	9,15	
21	13701	6895	O2id-kk	704957	6570776	A	44,2	+0,64	0,86	3,60	trossi kinnitus 27 cm toru otsast (toru 1,5 m üle maapinna)
22	4014	5705	O3nb-rk	716923	6556131	A	25,2	2,10	2,73	10,09	

jrk nr	katastri nr	seire nr	veekiht	koordinaadid		seade	puurkaevu sügavus, m	veetase paigaldamisel		seadme sügavus maapinnast, m	märkused ja tähelepanekud
				X	Y			maa-pinnast, m	toru otsast, m		
23	5069	116	O2id-kk	702375	6577771	A	32,0	1,03	1,87	10,71	
24	3398	8118	O2kk	705409	6575146	A	28,0	1,47	1,96	9,63	
25	3396	8123	O2ls-O2-1kn	705403	6575153	A	61,7	4,93	5,31	11,78	
26	19026	273	O3prg	674133	6542779	A	19,5	2,05	3,06	10,55	
27	3651	271	O3prg	673964	6540517	A	22,0	0,43	1,45	8,54	
28	3650	272	O3prg	674026	6540565	A	24,0	1,51	2,51	9,60	
29	3646	268	O2ls-O2-1kn	672543	6586770	A	15,0	3,50	4,32	6,38	
30	3643	269	O2ls-O2-1kn	672484	6586742	A	19,0	4,80	5,69	10,95	
31	3648	267	O2ls-O2-1kn	672603	6586797	A	23,0	0,36	1,62	8,50	
32	2581	7878	O2id-kk	676668	6569232	A	40,0	0,50	1,16	8,14	
33	2582	7876	O2ls-O2-1kn	676671	6569239	A	75,0	0,55	1,35	8,28	
34	4021	7501	O3nb-rk	668105	6567832	A	37,6	1,85	2,62	8,22	
35	4023	7503	O2id-kk	668101	6567832	A	78,4	3,32	4,04	8,15	
36	4022	7502	O2ls-O2-1kn	668102	6567836	A	109,9	3,50	4,16	8,07	
37	4016	335	O3nb-rk	692169	6563498	A	19,3	2,72	3,50	8,14	
38	3198	961	O2ls-O2-1kn	691519	6562698	A	100,4	12,28	12,79	16,09	
39	3197	960	O2kl-kk	691520	6562689	A	64,0	0,25	0,72	7,53	
40	3196	959	O3nb-rk	691524	6562693	A	18,0	0,20	0,90	7,08	
41	4017	335-A	O2kl-kk	692170	6563486	A	56,7	4,04	4,77	8,07	
42	3969	8414	O2ls-O2-1kn	697509	6566338	A	102,0	27,05	27,12	33,15	toru maapealne osa on ära võetud
43	3008	5510	O2id-kk	697503	6566337	A	71,6	14,80	15,31	20,51	puurkaevu manteltoru ümber on kaevatud auk, seadme sügavus antud vanast maapinnas, trossi kinnitus 0,87 m toru otsast
44	3963	244	O2id-kk	700129	6574625	A	38,0	1,80	2,53	7,08	
45	3964	245	O3nb-rk	697996	6563807	A	18,2	0,65	1,45	9,12	
46	3966	346	O2kl-kk	698005	6563800	A	57,4	0,82	1,53	6,56	
47	2595	949	O2ls-O2-1kn	678803	6569381	A	91,8	7,08	7,78	13,18	
48	2593	948	O2kl-kk	678792	6569379	A	55,0	6,12	6,70	13,04	
49	2594	947	O2rk	678780	6569386	A	8,4	0,37	0,92	5,17	

jrk nr	katastri nr	seire nr	veekiht	koordinaadid		seade	puurkaevu sügavus, m	veetase paigaldamisel		seadme sügavus maapinnast, m	märkused ja tähelepanekud
				X	Y			maa-pinnast, m	toru otsast, m		
50	4015	5508	O2rk	693019	6570994	A	15,8	8,02	8,95	12,11	
51	19532	19532	O	732430	6586026	C	26,5	1,13	1,50	21,90	Kaev on looduses tähistatud passi numbriga nr 45/5, trossi kinnitus plasttoru otsast (metallist manteltoru sees)
52	4010	5120	O2ls-O2-1kn	662369	6579549	A	68,6	13,70	14,24	22,80	
53	4009	5119	O2id-kk	662373	6579553	A	38,0	1,60	2,15	10,57	
54	19499	19499	O2-1	723483	6577582	C	50,0	4,70	4,97	40,15	kaev on looduses tähistatud passi numbriga 48-7
55	3367	98	fQIII	704414	6573059	A	7,2	0,24	1,84	5,00	tross on kinnitatud toru otsast
56	3263	160	fQIII	702786	6576976	C;B	17,0	4,06	5,12	7,17	
57	3873	218	fQIII	703797	6571098	A	20,0	+0,13	0,35	8,79	
58	3733	543	O2kl-kk	670307	6580493	C	14,5	0,48	1,08	6,10	
59	19606	19606	O	665372	6583405	C	40,1	7,79	8,35	20,15	Kaev on looduses tähistatud numbriga N5
60	19522	19522	O	726863	6580741	C;B	37,5	1,25	1,65	25,05	
61	13733	132	Q	702799	6574573	C	28,5	13,72	14,63	23,09	
62	3400	8115	Q	705408	6575155	C	16,3	2,13	3,00	14,20	
63	3876		Q	702533	6574607	C	4,0	0,87	1,09	1,88	muda põhjas sügavus 2 m
64	3662	5028	O	696794	6583016	C	49,7	9,90	10,62	20,15	
65	19560	19560	O	681223	6585454	C	38,0	1,23	1,61	30,32	
66	3372	110	Q	703090	6573737	A	11,0	3,05	3,39	6,68	kaev kinni ca 8 m toru otsast
67	5077	127	Q	703752	6575250	A	35,5	6,02	6,68	15,13	
68	3385	8074	Q	702868	6571699	A	20,3	1,60	1,97	5,57	
69	3861	8653	Q	704064	6571187	A	18,5	+0,18	1,40	7,51	tross kinnitatud toru otsast (toru 1,58 m üle maapinna)
70	3279	7314	Q	702682	6575423	C	13,4	4,15	4,55	10,15	
71	3282	7318	Q	703327	6575602	C	39,7	13,18	13,70	30,23	
72	5070	115	Q	702371	6577762	C	11,0	0,62	1,75	8,20	
73		PA-1-1	O3id-kk	665672	6579195	C	40,0	14,27	14,83	35,31	
74		PA-1-2	O-Cm	665674	6579185	B	104,0				
75		PA-3-1	O3id-kk	693269	6586115	C	25,0	6,30	7,25	19,50	

jrk nr	katastri nr	seire nr	veekiht	koordinaadid		seade	puurkaevu sügavus, m	veetase paigaldamisel		seadme sügavus maapinnast, m	märkused ja tähelepanekud
				X	Y			maa-pinnast, m	toru otsast, m		
76		PA-4-1	O3kl-jh	693347	6581659	C	20,0	17,92	18,57	20,00	seade on riputatud puurauku andmeside kaabliga, mis on toodud 0,3 m sügavusel maasse kaevatult meteoväljaku tuulemastini
77		PA-4-2	O3id-kk	693347	6581670	C	50,0	27,00	27,60	40,00	seade on riputatud puurauku andmeside kaabliga, mis on toodud 0,3 m sügavusel maasse kaevatult meteoväljaku tuulemastini
78		PA-5-1	O3nb-rk	700908	6569954	A	20,0	2,32	2,84	10,14	
79		PA-5-2	O3id-kk	700908	6569947	A;B	70,0	2,97	3,82	11,07	
80		PA-6-1	Q	708902	6560877	A	5,0	1,30	2,16	4,03	
81		PA-6-2	O2ls-O2-1kn	708892	6560866	A	25,0	1,07	1,88	10,10	
82		PA-7-1	O3kl-kk	665497	6584308	C	15,0	3,04	3,94	11,17	
83		PA-7-2	O3ls-O1-2kn	665494	6584219	C	44,0	2,80	3,80	30,12	
84		PA-8-1	Q	667981	6575193	A	5,0	0,70	1,60	3,15	
85		PA-8-2	O3nb-rk	667979	6575204	A	30,0	1,95	2,80	10,10	
86		PA-8-3	O3id-kk	667983	6575171	C	55,0	2,46	3,46	30,22	
87		PA-12-1	O3nr-kk	715034	6573193	A	20,0	7,09	7,40	15,17	
88		PA-12-1	O2ls-kn	715143	6574050	A	50,0	22,14	23,19	30,14	
	2207	922	V2gd	714083	6589404		220,0				kaevu omanik ei luba seadet paigaldada
	2088	912	V2vr	728629	6597265		120,0				seade ei sobi sellesse kaevu sügavuse tõttu
	2198	580-A	V2vr	714321	6590251		150,0				kaevu omanik ei luba seadet paigaldada
	19028	23	O2ls-O2-1kn	666077	6592330		3,4				lagunenud rakkega salvkaev, milles vähe vett
	3875	220	O2kl-kk	703791	6571098		36,0				kaev avariis, praht sees
	3988	5707	O2id-kk	716928	6556140		77,4				kaev avariis, kivi ees
	4012	5511	O3nb-rk	697507	6566344		18,8				pump sees, ei saanud seadet paigaldada

Note:
This version of software is not compatible with older models of the Levelogger (Silver LT and LTC, Black LTC and old Rain Loggers). To program and use the old versions, Levelogger 3.1.1 Software and User Guides can still be accessed at: www.solinst.com/Downloads/
For Software version 2.0.3, contact Solinst.

Note:
Let Solinst keep you up-to-date with each new software and firmware release. Register your software at: www.solinst.com/Registration/ to receive these updates automatically.

1 Introduction to Solinst Levelogger Series and Software

Levelogger Gold Software Version 3.4.0 is intuitive and easy-to-use. It is designed to support the Levelogger Gold Series of products.

Levelogger Gold

The Levelogger Gold is an absolute (non-vented) datalogger, which measures groundwater and surface water levels and temperature. Water levels are displayed as temperature compensated pressure readings, and can be barometrically compensated with the aid of a Barologger Gold. Solinst recommends customers use Version 3.4.0 Software using with V2.006 firmware or higher.

Levelogger Gold Technical Specifications	
Level Sensor:	Piezoresistive Silicon in 316L Stainless Steel
Accuracy (Typical):	0.05% FS
Stability of Readings:	Superior, low noise, 6 times better than previous versions
Resolution:	0.002 to 0.0006% FS
Normalization:	Automatic Temp Compensation
Temperature Sensor:	Platinum Resistance Temperature Detector
Temp. Sensor Accuracy:	± 0.05°C
Temp. Sensor Resolution:	0.003°C
Temp. Comp. Range:	-10 to +40°C
Battery Life:	10 Years - based on one reading/min
Clock Accuracy:	± 1 minute/year
Operating Temperature:	-20°C to 80°C
Maximum # Readings:	40,000 of level and temperature
Memory:	Superior reliability EEPROM Slate, rollover and redundant backup of last 1200 readings
Communication:	Optical Infra-Red Interface, Serial at 9600 Baud, Conversion to RS232 or USB Computer Connection
Size:	7/8" x 6" (22 mm x 154 mm)
Weight:	6.3 oz (179 grams)
Backwards Compatibility:	Full
Corrosion Resistance:	Zirconium Nitride (ZrN) Coating
Other Wetted Materials:	316-L Stainless Steel, Delrin, Viton
Sampling Modes:	Linear, Event and User-Selectable with 30 separate line items
Measurement Rates:	0.5 sec to 99 hrs
Barometric Compensation:	Software Wizard and one Barologger in local area (approx. 20 miles/30 km radius and or per 1000 ft/300 m change in elevation)

LT Models	Full Scale (FS)	Accuracy (Typical)	Resolution
F15, M5	16.4 ft., 5 m	± 0.010 ft., 0.3 cm	0.001% FS
F30, M10	32.8 ft., 10 m	± 0.016 ft., 0.5 cm	0.0006% FS
F65, M20	65.6 ft., 20 m	± 0.032 ft., 1 cm	0.0006% FS
F100, M30	98.4 ft., 30 m	± 0.064 ft., 1.5 cm	0.0006% FS
F300, M100	328.1 ft., 100 m	± 0.164 ft., 5 cm	0.0006% FS

LTC Levelogger Junior

The LTC Levelogger Junior provides an inexpensive and convenient method to measure level, temperature and conductivity all in one probe. The LTC Levelogger Junior is compatible with all Levelogger Gold accessories. Solinst recommends customers use Version 3.4.0 Software with V2.001 firmware or higher.

LTC Levelogger Junior Technical Specifications	
Level Sensor:	Piezoresistive Silicon in 316L SS
Ranges:	F30/M10, F100/M30
Accuracy (typical):	0.1% FS
Resolution:	0.08" (0.2 cm), 0.24" (0.6 cm)
Normalization:	Automatic Temp Compensation
Temperature Sensor:	Platinum RTD
Accuracy:	± 0.1˚C
Resolution:	0.1˚C
Temp Compensation Range:	-10˚C to 40˚C
Conductivity Sensor:	4-Electrode Platinum
Full Range:	0 - 80,000 µS/cm
Calibrated Range:	500 - 50,000 µS/cm
Accuracy:	2% of reading or 20 µS/cm
Resolution:	1 mS
Temp. Compensation Range:	0˚C to 40˚C
Normalization:	Specific Conductance @ 25˚C
General:	
Battery Life:	5 Years (5 minute sampling rate)
Clock Accuracy:	± 1 minute/year from 0 to 40˚C
Operating Temperature:	- 20˚C to 80˚C
Memory:	Non-volatile EEPROM, FRAM back-up
Maximum Readings:	16,000 sets of readings
Communication:	Optical Infra-Red to USB or RS232
Size:	7/8" x 7.5" (22 mm x 190 mm)
Wetted Materials:	Platinum, 316 Stainless Steel, Delrin®, Viton®
Sampling Mode:	Linear, (5 sec to 99 hrs) SDI-12, Real Time View
Barometric Compensation:	Software Wizard and Barologger Gold

LT Models	Full Scale (FS)	Accuracy (Typical)	Resolution
F30, M10	32.8 ft., 10 m	± 0.032 ft., 1.0 cm	0.021% FS
F100, M30	98.4 ft., 30 m	± 0.128 ft., 1.5 cm	0.021% FS

Barologger Gold

The Barologger Gold uses algorithms based on air pressure only. It measures and logs changes in atmospheric pressure, which are then used to compensate water level readings recorded by a Levelogger Gold, or a Levelogger Junior.

LT Models	Full Scale (FS)	Accuracy (Typical)	Resolution
Barologger	0.05%	± 0.003 ft., 0.1 cm	0.002% FS

Tellija: Keskkonnaministeerium Töö nr: 20110216

Ida-Virumaa põhjaveeseire tugivõrgustiku automatiseerimiseks seireseadmete puurkaevudesse paigaldamise ja töökorda seadmise lõpparuanne

Vastutav täitja: Andrus Randver

Lauri Kann

Rainer Sults

Juhatuse liige: Jaanus Vahtra

Tartu 2011

TAUST

Veepoliitika raamdirektiivi 2000/60/EÜ lisa V punkti 2 alusel on liikmesriigid kohustatud läbi viima nii põhjavee koguselise kui keemilise seisundi seiret. Põhjavee koguselise seisundi peamine näitaja on põhjavee tase ja põhjavee keemilise seisundi peamised näitajad on elektrijuhtivus ja saasteainete sisaldus põhjavees. Norra finantsmehhanismi projekti 52/2006-EE0010 raames luuakse Ida–Viru maakonnas kompleksne põhjavee koguselise ja keemilise seisundi seire- ja modelleerimis-süsteem. Nimetatud seire- ja modelleerimissüsteem on Eesti rahvuslik pilootprojekt, mida hakatakse rakendama veepoliitika raamdirektiivi 2000/60/EÜ, põhjavee-direktiivi 2006/118/EÜ ja keskkonnaseire seaduse nõuete täitmiseks.

TÖÖ EESMÄRK

Käesoleva töö tellis Keskkonnaministeerium ning töid teostati vastavalt 7. detsembril 2010.a sõlmitud töövõtulepingule nr 4-1.1/302.

Töö eesmärgiks oli Norra finantsmehhanismidest rahastatava projekti 52/2006-EE0010 „Sustainable Groundwater Monitoring System of East-Viru County, Estonia“ raames **automaatmõõte seadmete töökorda seadmine ja paigaldamine põhjavee-seire Ida-Virumaa põhjaveeseire puurkaevudesse** .

Andureid paigaldasid OÜ Est-Doma töötajad: Andrus Randver, Lauri Kann ja Rainer Sults. Tööde teostamine toimus plaanitust hiljem, kuna ilmastik (lumi) segas ja muutis võimatuks seirekaevudele lähenemise.

SEIRESEADMED JA PAIGALDAMISE METOODIKA

Paigaldatavaid automaatseadmeid oli kahte tüüpi:

1) põhjaveetaset ja vee elektrijuhtivust mõõtev andur Ceramic CTD DI 273 (tootja Schlumberger Water Services) 7 tk; maksimaalne rõhk, mida andur kannatab on 150m veesammast.
2) põhjaveetaset ja vee elektrijuhtivust mõõtev andur LTC Junior (tootja Solinst Canada) 1 tk;

Kõik andurid said programmeeritud salvestama iga 3 tunni tagant.
Andurite elektrijuhtivuse justeerimist ei pidanud vajalikuks, kuna justeerimine oli tehtud tootjate poolt ja kontrollmõõtmised kinnitasid vastavust.
All olevas tabeli märkuste lahtris on kirjas, millised väärtused anti andurite „Measuring point“(diverite märgis) väljadele.

Seirekaevud, mille torud olid tehtud plastikust, paigaldati andurid järgnevalt:

toru seina puuriti auk, millest aeti läbi andur koos vajaliku pikkusega DDU kaabliga. Kaabli otsas olev „seen“ jäi toru välispinnale, et saaks mugavamalt andurilt andmeid mahalaadida. Eelpool kirjeldatu järgi paigaldati andurid järgnevatesse seire-kaevudesse: PA-1-2, PA-8-5, PA-3-2, PA-12-3, PA-11-1.

Raudtorudega seirekaevudes Konsu külas (Ahtme metskonnas), Sompa külas ja Narva- Jõesuus paigaldati andurid pika poldi külge, mis oli puuritud läbi kaevuseina. Andur riputati trossiga kaevu ja ülevalt kinnitati läbi kaevuseina puuritud poldi külge. Narva-Jõesuus paigaldati andur DDU kaabliga, mis kinnitati samuti kaevu seinas oleva poldi külge.

Seireseadmete paigaldamise andmed

Jrk nr	Katastri nr	Seire nr	Koordi-naadid X ja Y	Veekiht	Kaevu sügavus, m	Seade	Veetase paigaldamisel		Seadme sügavus maapinnast, m	Märkused
							maa-pinnast, m	toru otsast, m		
01	2438	881	X=6585093; Y=688495	V_2gd	220	DI 273			220	Vaatluskaevu paigaldatud 17.02.2011 (trossiga) diver märgisega „kase kinnistu, sompa „ sn: J8964. Diveri andmete automaat salvestamise alguse aeg: 17.02.2011 kell 16.00
02	2088	912	X=6597275; Y=728644	V_2vr	90	DI 273			90	Vaatluskaevu paigaldatud 09.02.2011 diver märgisega „narva-joesuu“ sn: J8979. Diveri andmete automaat salvestamise alguse aeg: 10.02.2011 kell 16.00. Andurit ei olnud võimalik seirekaevu paigaldada soovitud sügavusele, kuna kaev oli ca 60 m sügav. Andur paigaldati põhjast 0,5 m kõrgemale DDU kaabliga.
03	26250	PA-1-2	X=6579185; Y=665674	O-Cm	80	DI 273			80	Vaatluskaevu paigaldatud 09.02.2011 diver märgisega „PA-1-2“ sn: J8966 DDU kaabliga. Diveri andmete automaatsalvestamise alguse aeg: 10.02.2011 kell 16.00
04	26262	PA-8-5	X=6575182; Y=667982	O-Cm	80	DI 273			80	Vaatluskaevu paigaldatud 09.02.2011 diver märgisega „PA-8-5“ sn: J9019. DDU kaabliga. Diveri andmete automaatsalvestamise

										alguse aeg: 10.02.2011 16.00
05	26252	PA-3-2	X=6586111; Y=693261	O-Cm	70	DI 273			70	Vaatluskaevu paigaldatud 09.02.2011 diver märgisega „PA-3-2“ sn: J9009. DDU kaabliga. Diveri andmete automaatsalvestamise alguse aeg: 10.02.2011 kell 16.00
06	26265	PA-12-3	X=6573203; Y=715037	O-Cm	60	DI 273			60	Vaatluskaevu paigaldatud 09.02.2011 diver märgisega „PA-12-3“ sn: J8976. DDU kaabliga. Diveri andmete automaatsalvestamise alguse aeg: 10.02.2011 kell 16.00
07	26268	PA-11-1	X=6584298; Y=665500	O-Cm	55	DI 273			55	Vaatluskaevu paigaldatud 09.02.2011 diver märgisega „PA-11-1 „ sn: J9024 DDU kaabliga. Diveri andmete automaatsalvestamise alguse aeg: 10.02.2011 kell 16.00
08	3870	215	X=6570835; Y=702323	Q	23	LTC Junior			23	Vaatluskaevu paigaldatud 09.02.2011 diver 3001 LTC Junior (trossiga), märgisega „ Illuka„ Diveri andmete automaatsalvestamise alguse aeg: 10.02.2011 16.00

AUTOMAATMÕÕTESEADMETE PAIGALDAMINE PÕHJAVEE SEIREPUURKAEVUDESSE IDA–VIRUMAAL NORRA FINANTSMEHHANISMI PROJEKTI 52/2006-EE0010 RAAMES

LÄHTEÜLESANNE

1. TAUST

Veepoliitika raamdirektiivi 2000/60/EÜ lisa V punkti 2 alusel on liikmesriigid kohustatud läbi viima nii põhjavee koguselise kui keemilise seisundi seiret. Põhjavee koguselise seisundi peamine näitaja on põhjaveetase ning põhjavee keemilise seisundi peamised näitajad on elektrijuhtivus ja saasteainete sisaldus põhjavees.

Norra finantsmehhanismi projekti 52/2006-EE0010 raames luuakse Ida–Viru maakonnas
kompleksne põhjavee koguselise ja keemilise seisundi seire- ja modelleerimissüsteem. Nimetatud seire- ja modelleerimissüsteem on Eestis rahvuslik pilootprojekt, mida hakatakse rakendama veepoliitika raamdirektiivi 2000/60/EÜ, põhjaveedirektiivi 2006/118/EÜ ja keskkonnaseire seaduse nõuete täitmiseks.

2. TÖÖ EESMÄRK

Töö eesmärk on automaatmõõteseadmete paigaldamine põhjavee seirepuurkaevudesse vastavalt lisa 1 nimekirjale Ida-Viru maakonnas Norra finantsmehhanismidest rahastatava projekti 52/2006-EE0010 „Sustainable Groundwater Monitoring System of East-Viru County, Estonia“ raames.

3. TEGEVUSED LÄHTEÜLESANDE LAHENDAMISEKS

Töö lahendamiseks peab pakkuja vastavalt lisas 1 olevale nimekirjadele:
3.1. valmistama põhjavee seirepuurkaevudesse paigaldatavad automaatseadmed ette selliselt, et need saab põhjavee seirepuurkaevudesse paigaldada;
3.2. paigaldama punktis 8.1. nimetatud põhjaveeseire automaatseadmed põhjavee seirepuurkaevudesse selliselt, et nendega oleks võimalik määrata seirepuurkaevuga avatava põhjaveekihi näitajate andmed lähtudes lisa 1 tabeli andmetest;
3.3. seirepuurkaevudesse paigaldatud automaatseadmed programmeerima, töökorda seadma ja tööle panema.

4. TÖÖ TEOSTAMISEKS VAJALIKUD MATERJALID

4.1. põhjavee seirepuurkaevude nimekiri koos vastavate asukohtade ja seirepuurkaevu paigaldatavate automaatseadmete loeteluga (lisa 1);
4.2. põhjavee seirepuurkaevude automaatseadmete ja lisatarvikute nimekiri (punkt 8.1);
4.3. veeseadus.

5. TÖÖDE TÄHTAEG

Kaks kuud, käesoleva lepingu sõlmimise kuupäevast arvates

6. HINNAPAKKUMISE KEHTIVUS

Pakkumus peab olema jõus 90 päeva pakkumiste esitamise tähtpäevast arvates.

7. TÖÖDE PERIOOD

Kaks kuud, pakkumiste esitamise lõpptähtajast (05.11.2010.a.) arvates.

8. TÖÖDE SPETSIFIKATSIOON

8.1. Põhjavee seirepuurkaevudesse paigaldatakse järgmised automaatmõõteseadmed koos
vajalike lisatarvikutega:
8.1.1. põhjaveetaseme, vee temperatuuri ning vee elektrijuhtivuse mõõteandur Ceramic CTD-Diver (C) (7 tk);
8.1.2. põhjaveetaseme ja vee elektrijuhtivuse mõõteandur 3001 LTC Junior (C) (1 tk);
8.1.3. Seade diveri programmeerimiseks ning salvestatud andmete mahalaadimiseks arvutisse (1 tk) ;
8.1.4. Diveri ja arvuti ühenduskaabel (1 tk);
8.1.5. Diveri andmesidekaabel (DDC) CTD-diveri jaoks (60 m) (2 tk);
8.1.6. Diveri andmesidekaabel (DDC) CTD-diveri jaoks (80 m) (3 tk);
8.1.7. Diveri andmesidekaabel (DDC) CTD-diveri jaoks (100 m) (1 tk);
8.1.8. Diveri andmesidekaabel (DDC) CTD-diveri jaoks (200 m) (1 tk);
8.1.9. Kaabli jätkud (10 tk, 2 pakki);
8.1.10. Elektrijuhtivuse kalibreerimislahus 1,4 mS/cm (460 ml, 1 tk);
8.1.11. Elektrijuhtivuse kalibreerimislahus 5 mS/cm (460 ml, 1 tk);
8.1.12. Elektrijuhtivuse kalibreerimislahus 12,88 mS/cm (460 ml, 1 tk);
8.1.13. Elektrijuhtivuse kalibreerimislahus 80 mS/cm (460 ml,1 tk);
8.1.14. Diveri tross (650 m);
8.1.15. Vasest torukesed trossi kinnituseks (50 tk, 1 pakk);
8.1.17. Andmete mahalaadija Levelloader Gold andurilt 3001 LTC Junior andmete mahalaadimiseks (1 tk);
8.1.18. Andmete mahalaadija ühendusjuhtmed (1 kompl.);
8.1.19. Andmeside kaabel andurile 3001 LTC Junior (25 m);
8.1.20. Terastross anduri sukeldamiseks kaevu (25 m);
8.1.21. Andmeside kaabli riputuskonksud (81 tk);
8.1.22. Anduri 3001 LTC Junior elektrijuhtivuse kalibreerimiseks lahused 5, 12, 80 S/cm (500 ml, kokku 3 tk);

8.2. Automaatmõõteseadmed tuleb paigaldada lisas 1 toodud seirepuurkaevude avatud osa või filtri sisse.

Lisa 1. Täiendavate seireseadmete paigaldamine puurkaevudesse põhjaveeseire tugivõrgu automatiseerimiseks Ida-Virumaal

Katastri number	Vaatluskaevu asukoht	Veekihi indeks	Anduri paigaldus-sügavus, m	Anduri paigaldus-sügavus alla veetaset, m	Andur
01 Kambriumi–Vendi Gdovi põhjaveekogum					
2438	Ida-Virumaa, Jõhvi vald, Sompa küla, Kase kinnistu, kat. nr. 25201:002:0139; X=6585093; Y=688495	V_2gd	220	140	C
02 Kambriumi–Vendi Voronka põhjaveekogum					
2088	Ida-Virumaa, Narva-Jõesuu, Narva metskond 30, kat. nr.51301:007:0020; X=6597275; Y=728644	V_2vr	90	70	C
03 Ordoviitsiumi– Kambriumi põhjaveekogum					
26250	PA-1-2; Ida-Virumaa, Maidla vald, Sirtsi küla, Sonda metskond 6, kat. nr. 44901:001:0610; X=6579185; Y=665674	O-Cm	80	60	C
26262	PA-8-5; Ida-Virumaa, Maidla vald, Sirtsi küla, Maidla metskond 14, kat. nr. 44901:001:0540; X= 6575182; Y=667982	O-Cm	80	70	C
26252	PA-3-2; Ida-Virumaa, Jõhvi vald, Edise küla, EHAK kood 1524; X=6586111; Y=693261	O-Cm	70	55	C

Katastri number	Vaatluskaevu asukoht	Veekihi indeks	Anduri paigaldus-sügavus, m	Anduri paigaldus-sügavus alla veetaset, m	Andur
26265	PA-12-3, Ida-Virumaa, Vaivara vald, Mustanina küla, Narva karjäär maatükk 3, kat. nr. 85101:011:0034; X=6573203; Y=715037	O-Cm	60	45	C
26268	PA-11-1; Ida-Virumaa, Sonda vald, Varinurme küla, Sonda metskond 6, kat. nr. 75101:003:0297; X=6584298; Y=665500	O-Cm	55	40	C
04 Kvaternaari põhjaveekogum					
3870	Ida-Virumaa, Illuka vald, Konsu küla, Ahtme metskond 30, kat. nr. 22901:003:0082; X=6570835; Y=702323	Q	23	10	C

The long openings at the point of the CTD-Diver provide for good liquid flow.

All versions meet the following specifications:

Outside diameter	Ø22 mm
Length	183 mm including suspension eye
Weight	App. 150 grams
Protection class	IP68
Storage/ transport temperature	-20 ℃ to 80 ℃ (influences battery life)
Material	
- *housing*	Zirconia(ZrO_2)
- *pressure sensor*	Alumina (Al_2O_3)
- *suspension eye*	Akulon (glass fibre reinforced)
- *nose cone*	Akulon (glass fibre reinforced)
Communication	RS232 (optically separated)
Memory capacity	16,000 measurements (non-volatile memory) A measurement consists of date, time, level, temperature and conductivity
Sampling rate	1 second to 99 hours
Sampling method	Both fixed sampling rate or variation dependent (conductivity channel)
*Expected life of battery**	8 years, dependent on use
- theoretical	2.000.000 measurements 500 times the entire memory readout 500 times programming
*Clock accuracy***	better than two seconds per day at 25 ℃

CE marking	in accordance with directive 89/336/EEC
- *Interference proof (ESD)*	against electrostatic discharge according to EN 61000-4-2 (1995)+A1 (1998)+A2 (2001)
- *Interference proof (EMC)*	against electromagnetic fields according to EN 6100-4-3(2001)+A1 (2002)
- *Test report number*	04C00491RPT01

The following applies to the temperature measurements of the CTD-Divers:

Measurement range	-20 ℃ to 80 ℃ 0 ℃ to 40 ℃ (Operating Temperature (OT))
Accuracy	± 0.1 ℃ (OT)
Resolution	0.01 ℃

The specifications for the water pressure measurements differ for each type of CTD-Diver:

	DI261	**DI263**	**DI265**
Pressure range			
Range	950-1.950 cmH_2O	950-3.950 cmH_2O	950-10.950 cmH_2O
Usable range (FS) (FS = full scale)	900 cmH_2O	2.900 cm H_2O	9.900 cmH_2O
Zero point pressure range	650 cmH_2O		
Accuracy	±0.1% FS typ.@ operating temperature (OT)		
Resolution	0.2 cmH_2O	0.6 cmH_2O	2 cmH_2O
Maximum pressure (MD)	2,000 cmH_2O	3,500 cm H_2O	15,000 cmH_2O
Long-term stability	± 2 cmH_2O	± 3 cmH_2O	± 10 cmH_2O

Note! Because the Diver also measures the air pressure variations, and these can vary between 950 and 1050 mbar, there is a difference between the calibrated range and the usable range. The usable range is the calibrated range minus the total possible air pressure variation (app. 100 cm wc).

Conductivity

Housing of measuring cell	Alumina (Al_2O_3)
Range (FS)	20 µS/cm to 80 mS/cm (auto ranging)
(FS = full scale)	
*Accuracy***	Typ. ±1% of measured value or 10 µS/cm, whatever the largest
Resolution	0.1% of measured value or 0.1 µS/cm, whatever the largest
Calibration by the user	At 1.413 mS/cm; 5.00 mS/cm; 12.88 mS/cm and 80.0 mS/cm

General

Transport	Suitable for transport in vehicles, ships and aeroplanes, in supplied tube.
Vibration proof	In accordance with MIL-810
Mechanical shock test	In accordance with MIL-810, light-weight equipment.

Chemical resistance

Contamination	Insensitive to Hydrogen sulphide (H_2S) and Na, Cl and Fe ions. Stable in Ethanol, BTEX components and chlorinated hydrocarbons. This applies for concentrations normally found in ground water
Corrosion resistance	The materials used for the housing, the suspension eye and the nose cone are, within the specified temperature range, suitable for use in fresh and brackish water and seawater.

Telemetry Systems

Model 9100 and 9200 Data Sheet

Solinst Telemetry Systems

Solinst Telemetry Systems are designed for use with the Solinst Levelogger Series of dataloggers. They offer two-way communication and control from your own desktop. You choose the Levelogger, the best communication method to suit your site, access the intuitive software to create sampling and reporting schedules, then view and manage data on your Home Station computer in any way you choose.

STS Systems can be set up using landline, radio, digital cellular, or satellite wireless communications. They are powered by a sealed lead-acid 12V battery, with optional solar trickle charging or direct AC power. RRL Radio Stations use six replaceable lithium batteries, and also have the option of a back-up power source.

STS Telemetry Systems are ideal for large networks. Hundreds of remote stations can report to a single Home Station computer. RRL Radio Telemetry is ideal for small closed loop networks.

Advantages

- Time and cost savings
- Reliable data transfer direct to your desktop
- Manage the data yourself
- Flexible options to suit site/application conditions
- Low maintenance
- Enhanced power management
- Faster, easier access to data

Applications

Water level, conductivity and/or rainfall monitoring for:

- Remote or difficult-to-access locations
- Hazardous or critically important sites
- Long-term groundwater monitoring applications
- Longer term pump tests
- Drought and water taking management
- Watershed management
- Landfill and mine water supervision
- Flood and stormwater management

Benefits of Using Solinst Telemetry

Solinst has created simplified systems with standardized hardware, flexible communication options, and intuitive software that make the system easy to set-up, operate and manage the data.

Solinst Telemetry provides an economical and efficient method to access remote data instantly, saving time and costs by eliminating manual data collection, time spent traveling and costly data hosting.

STS Systems have added features such as alarm notification, remote diagnostic reporting and firmware updating, which makes it easy to maintain your system, while simplifying data collection.

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Communication Options

With the choice of radio, cellular, landline (Ethernet) or satellite, STS Systems provide communication options to suit your site and application. To determine the best method to meet your requirements you need to evaluate the options available in your area i.e. cellular carriers, and the physical conditions of your site, including topography, nearby buildings, trees, etc.

Radio

If you have no cellular service available, or you are setting up a local network, then radio may be your option. It has the advantage of free airtime and no long distance fees.

Cellular

If your telemetry network is within an area of good cellular coverage, then GSM or CDMA wireless communication may be your method of choice. Because data is 'pushed' through the system, power requirements to send data are low.

Landline (Ethernet)

This option is ideal for monitoring water levels on large properties, where Ethernet connections are available at each monitoring well and the Home Station Computer.

Satellite

Satellite is an option in very remote areas where there is no cellular service available and radio transmission is not possible.

Internet Connectivity

Choosing to communicate using digital cellular or satellite gives the advantage of IP addressability. IP (Internet Protocol) allows a reliable method of data transfer using an internet connection, which saves you time and money. An IP Network allows all Remote Stations to send data to the Home Station at the same time, without disruptions or time scheduling issues.

Data Self-Management

STS/RRL Software allows you to always be in control of your own data. Data retrieved from each Levelogger is placed in a Microsoft® Access® database on the Home Station computer. New data is added to the existing database. The STS Software can be used for a convenient quick check of the latest readings. You can export your data as .lev or .csv files for use in your preferred database or modeling package. You can display formatted data on web pages by accessing the database directly with your own software. Data self-management provides flexible options, and ongoing cost savings, without being tied to a proprietary data hosting service.

TELEMETRY SELECTION CHART	RRL Remote Radio Link	STS Telemetry System			
Specifications	**RRL Gold Radio**	**STS Gold Radio**	**Digital Cellular (CDMA & GSM)**	**Landline (Ethernet)**	**Satellite**
Why Use?	• smaller applications • closed loop network at any location • compact, all-in-one units fit in 4.5" (115 mm) wells	• smaller applications • closed loop network at any location	• cellular coverage available • topography not suitable for radio • send data over the Internet	• on-site facility monitoring	• too remote for cellular • send data over the Internet
System Differences	• free airtime, no long distance fees • you control the network • scheduled data transmission times • low power needs • relay station option	• free airtime, no long distance fees • you control the network • scheduled data transmission times • medium power needs	• monthly carrier fees • no scheduling conflicts for data transmission • low power needs	• uses LAN • no scheduling conflicts • direct power/AC	• satellite service available anywhere • no scheduling conflicts for data transmission • larger power needs
Suggested Applications	• monitoring mine sites • agricultural studies • landfill supervision • golf course management	• monitoring mine sites • agricultural studies • landfill supervision • golf course management	• flood and stormwater management • watershed management • drought monitoring	• on-site water level monitoring • run-off monitoring	• glacial melt monitoring • hard-to-reach, isolated areas
Remote Station Support	• 2.4 GHz or 900 MHz radio • 20 mile (30 km) line of site • 9600 bits/sec	• 900 MHz radio • 20 mile (30 km) line of site • 9600 or 115200 bits/sec	• CDMA or GSM IP enabled modem • dynamic IP Address • 115200 bits/sec	• Ethernet modem • dynamic IP Address • 115200 bits/sec	• IP enabled modem • dynamic IP Address • 115200 bits/sec
Home Station Support	• RRL Home Station with power source • STS/RRL Software	• 2nd Radio required with RS232 connection • STS/RRL Software	• static IP Address • no extra hardware • STS/RRL Software	• static IP Address • no extra hardware • STS/RRL Software	• static IP Address • no extra hardware • STS/RRL Software
Antenna	6" (15 cm) half wave, (2.1dBi) non-articulating	6" (15 cm) half wave, (2.1dBi) non-articulating	Dual Band Dipole	N/A	Included
Optional Antenna	5 dBi Omni Directional	5 dBi Omni Directional	3 dBi, Dual Band, Omni Directional	N/A	N/A
No Data Hosting Fees	√	√	√	√	√
Remote Firmware Upgrades		√	√	√	√
Remote Diagnostic Reporting	√ (limited)	√	√	√	√
Power	6 AA lithium batteries	12V sealed lead-acid battery			
External Power and Charge Accessories	• Solar power connection package (for user supplied solar panel) • AC power/battery charger assembly				

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STS Remote Telemetry Unit Setup

STS Gold Systems come with standardized equipment configurations, including your choice of communication device to meet the needs of your application. The STS Remote Station consists of an STS Controller, Distribution Box, Battery, and Modem with a connected Antenna, protected within a weatherproof Nema 4X case.

STS NEMA 4X Enclosure

The STS Distribution Box allows the connection of up to 4 data loggers. It controls the modem and manages the power supply.

The STS Controller powers-up the Remote Station for initial set-up and testing. It collects, stores, and sends data from the remote dataloggers to the Home Station.

As the data is 'pushed' from the Remote Station to the Home Station, there are no dial-up or timing issues. Data cannot be lost due to cellular or satellite signal issues, as the STS Controller stores the data in its memory until it has been successfully uploaded by the Home Station. With each communication, system information on battery level, Levelogger status, modem signal strength and status are sent to the Home Station, providing remote diagnostics.

STS/RRL Gold Software

STS/RRL Gold Software controls both systems, allowing users to manage a project with multiple STS and RRL sites with one program. It is easy to set up the Software with site information, sampling and reporting schedules, and alarm notifications.

A linear 'Sample Rate' is set at which the STS Controller records a real-time reading from each attached datalogger. A 'Report Rate' is set to establish the frequency that the data is sent from the STS Controller to the Home Station.

Each RRL Station is programmed and scheduled using a convenient software wizard.

Leveloggers can be set to record independently of the Telemetry Systems and store the data in their own internal memory, providing a reliable backup, if circumstances require it.

RRL Systems

The Solinst RRL Gold Remote Radio Link System offers a very simple and inexpensive method of local telemetry. Data is sent from the field via short-distance radio to your PC. The RRL is excellent for small, closed loop networks such as mine sites, golf courses, and landfill monitoring networks. By using free unlicensed radio bands (ISM), the RRL Gold has the advantage of being a lower cost option than cellular or satellite telemetry systems.

RRL Stations

RRL Stations work with omni-directional antenna line-of-sight transmission, therefore, can communicate over distances of 20 miles (30 km), or more, using some stations as repeaters.

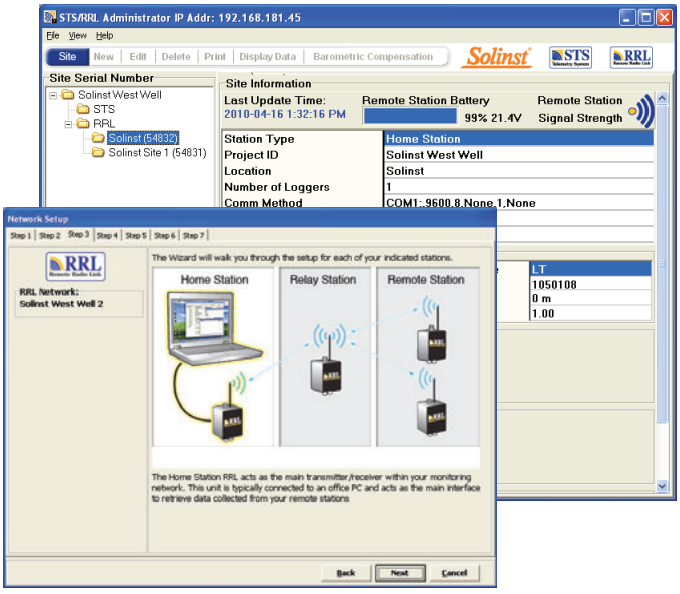
RRL Stations use the same hardware, and are programmed using a wizard in the STS/RRL Gold Software as a Home Station, Remote Station or Relay Station. As such, RRL Stations are interchangeable as required.

RRL Gold Station

There is the option of a 900 MHz (North American) or 2.4 GHz (Worldwide) radio module for RRL Gold Stations. Stations come standard with six AA replaceable lithium batteries and antenna.

Up to 4 Solinst Leveloggers (using two 'splitters') can be attached to one RRL Station. Stations are designed to fit into 4.5" (115 mm) diameter wells for discrete placement. The case is rugged and waterproof with an IP66 rating.

RRL Stations have a non-volatile internal memory; a Remote Station stores collected data in its memory until the Home Station has been successfully contacted.

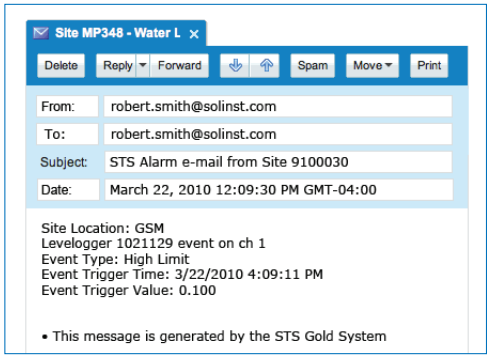


STS/RRL Software Set-up Screens

Alarm Settings

An e-mail alarm notification will be sent automatically to the Home Station, if a non-communication or low battery condition is detected at an STS Remote Station, when a reading is taken. The Home Station then sends out email alerts, as set up in the software.

High, low and percent change alarms can also be set for any monitored parameter (e.g. water level, temperature, rainfall, or conductivity).



System Diagnostics

The STS and RRL are very reliable systems, which require minimal maintenance.

To help simplify system diagnostics, each data report to the Home Station includes System information. This information can help prevent data disruptions by providing the battery level, modem operation, signal strength and Levelogger status. A communication test can also be performed between the Home Station and a Remote Station, and Leveloggers.

Automatically receive remote system diagnostics at your Home Station PC.

Power Supply

Solinst Telemetry Systems are designed to avoid power issues. Each STS comes with a 12V battery that can last up to 12 months before replacing or recharging, depending on reporting frequency. The low power electronics of an STS are designed to only use power when there is a scheduled transmission of data, and very little power when it is in standby mode. Power requirements at RRL Remote Stations are also kept to a minimum. Each RRL Station is powered by 6 replaceable lithium batteries. Solinst provides optional cables that enable solar power or direct AC mains connection as a power source, as well as a battery charging kit.

STS Remote Firmware Updates

If new firmware becomes available, a firmware update can be performed from the Home Station using the update utilities supplied with the STS Software. New firmware is made available free via the Solinst website (http://www.solinst.com/Downloads/).

STS Systems also allow modem parameters to be reset remotely from the Home Station and changes made to the report and sampling rates.

Levelogger Series

STS Telemetry Systems are dedicated to the Levelogger Series of data loggers. This provides the advantage of combining a user-friendly telemetry system with high quality data loggers.

Up to 4 Solinst data loggers can be attached to each remote station, in any combination of the Levelogger Gold, Barologger, Levelogger Junior, LTC Levelogger Junior, or Rainlogger. (See Model 3001 Gold, Junior, LTC Junior and 3002 Data Sheets).

Solinst Leveloggers are ideal for remote monitoring, with independent user-defined logging schedules as a back-up. They have long battery life, power surge protection and a non-volatile memory. If programmed separately, Leveloggers record regardless of the status of the STS System.

Leveloggers are low maintenance, absolute data loggers. There is no need to deal with vent tubes or cumbersome equipment. One Barologger can typically provide accurate barometric data for a 20 mile (30 km) radius and/or with every 1000 ft (300 m) of change in elevation.

These reliable, durable data loggers have intuitive software with many useful features, such as self-tests and firmware upgrade and diagnostic utilities.

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