

MEMORANDUM

Project No.: 090045-017A

June 29, 2015

To: Jacob Anderson and Dave McClure and, Klickitat County Natural Resources Department

cc:

Jared Bean, Senior Staff Hydrogeologist

From: Steve Germiot, LHG, CGWP, Principal Hydrogeologist

Re: White Salmon Basin (WRIA 29B) Well Monitoring Network Setup

Project Objectives

In 2014, the Klickitat County Board of County Commissioners allocated funding to establish a groundwater level monitoring network for the White Salmon River Basin (the Basin; aka WRIA 29B), collect a round of water level measurements from the well network, and present the information in a memorandum. The primary objective of water level monitoring over time is to support effective management, planning, and use of groundwater supplies. This type of monitoring program has been underway in portions of the adjacent Klickitat River Basin (WRIA 30) since 2007. The Basin water level monitoring program was conducted in accordance with the project-specific Quality Assurance Project Plan (QAPP), which was approved in 2014 prior to start of work, and was amended in 2015 (Aspect, 2015).

Water Level Monitoring Network

After receiving focus area guidance from the Klickitat County Natural Resources Department (KCNRD), establishment of the well water level monitoring network for the Basin consisted of the following general steps:

- Download all well logs in the focus areas of the Basin from the Washington Department of Ecology (Ecology) online well log database;
- Plot the total depths of all well logs per target area to illustrate shallow and deep well completion clusters in inferred primary aquifer units of each target area;
- Within the shallow and deep well completion cluster zones of each target area, review stratigraphic quality of logs and select target wells for representative aquifer water level monitoring;
- In coordination with the KCNRD, contact well owners by phone and in person to obtain permission to conduct water level monitoring in their well; and
- Perform an initial field visit and water level measurement event to document well location using Global Position System (GPS), wellhead access instructions, and most appropriate water level monitoring procedure (equipment) for future monitoring events.

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Aspect Consulting (Aspect) staff performed the initial field visit and water level measurements in October of 2014. Most wells incorporated in the network were previously identified target wells, as described above. However, several additional wells were added to the network during the initial field visit as a result of on-the-ground conversations and coordination with Basin residents and well owners. For consenting well owners, Klickitat County Public Works staff performed wellhead elevation surveys in spring 2015. Wellhead location and elevation information are used to convert depth-to-water measurement data to water level elevations, and thereby enable comparison and evaluation of water level trends between wells and within aquifers.

Because budget remained, Aspect, KCNRD, and Central Klickitat County Conservation District (CKCD) staff performed a second round of water level measurements in April 2015, after agreement from KCNRD. As of June 2015, the Basin water level monitoring network consists of 37 wells. Figure 1 shows the Basin and the locations of wells in the monitoring network. Table 1 presents summary well completion information for the wells included in the monitoring network. Table 2 presents the two rounds of water level measurements to date.

Water Level Measurement Procedures

The depth-to-water measurements were made relative to the top of well casing or other defined measuring point at the wellhead. Other pertinent information regarding the well or the measuring of water levels was also recorded in the field notes.

Depth-to-water measurements were conducted using either an electric water level indicator (e-tape) or a sonic water level indicator (sonic) as described in the QAPP (Aspect, 2015). Where possible, sonic water level monitoring is preferred because it requires no cleaning between wells, and it carries no risk of entanglement with wires or other objects in the well casing. Granted, sonic water level measurements are less precise than e-tape measurements, but the data resolution from either instrument is adequate for the purposes of water level trend monitoring. The QAPP provides a quality control evaluation between the e-tape and sonic measurements. The evaluation documents reliability of sonic measurements for depths-to-water less than approximately 250 feet below the top of well casing (Aspect, 2015). If an e-tape was used for the depth-to-water measurement, the bottom several feet of e-tape were rinsed and wiped with a clean paper towel.

For wells equipped with airlines, the height of water over the airline outlet was measured in pounds per square inch (psi) and converted to feet of water (1 psi = 2.31 feet of water). If the airline outlet depth was known, water elevation was estimated as the top of casing elevation minus depth to airline outlet plus feet of water over airline (Table 2).

Attachments

- Table 1 – White Salmon Basin Water Level Monitoring Network
- Table 2 – White Salmon Basin Monitoring Network Water Level Data
- Figure 1 – White Salmon Basin Water Level Monitoring Network

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References

Aspect, 2015, Quality Assurance Project Plan Update for Water Level Monitoring – WRIA 30/31/29B, March 11, 2014 and amended April 24, 2015.

Limitations

Work for this project was performed for the Klickitat County Natural Resources Department (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

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Table 1 - White Salmon Basin Water Level Monitoring Network

White Salmon Basin Well Monitoring Network
 WRIA 29B, Washington

Ecology Well Log Data					Well Top of Casing Location Information					
					Surveyor Data			GPS data		Google Earth data
					NAD 83 State Plane South		NAVD88	NAD 83 State Plane South		WGS84
Subarea	TRS Label	Ecology Well Log ID	Depth (ft)	Diam. (in)	X (feet)	Y (feet)	Elevation (feet)	X (feet)	Y (feet)	Elevation (feet)
Trout Lake	T6R10-14M1	134861	398	6	-	-	-	1379153.62	247177.10	1924
Trout Lake	T6R10-27H15	133047	325	6	237159.36	1377902.20	1980.39 ¹	1377907.44	237156.00	-
Trout Lake	T6R10-27A2	129821	370	6	238569.96	1378294.15	1946.91 ¹	1378304.11	238515.34	-
South Trout Lake	T5R10-12L3	467907	160	6	219629.38	1385170.06	1440.51 ¹	1385245.01	219913.44	-
South Trout Lake	T5R10-12P1		190		218444.68	1386568.31	1427.76 ¹	1386630.48	218758.66	-
South Trout Lake	T5R10-12P2	380078	168	6	218806.91	1386143.25	1428.05 ¹	1386200.73	219057.26	-
BZ Corner	T4R10-2B4	341508	220	6	195698.71	1382590.99	850.94 ¹	-	-	-
Husum 2	T4R10-11J5	317873	117	6	188840.16	1382624.67	726.78 ¹	1382628.90	188842.11	-
Husum 2	T4R10-11J6	352381	148	6	188221.04	1382969.68	707.37 ¹	1383016.65	188170.12	-
Husum 3	T3R10-2A1	416976	280	8	-	-	-	1382324.15	164338.75	454
Husum 3	T3R10-2A2	139796	145	8	-	-	-	1382329.43	164374.08	454
Husum 2	T4R11-17N1	499075	176	8	182275.98	1395221.30	826.93 ¹	1395030.36	182295.92	-
Husum 2	T4R11-20P2	145947	425	6	176612.40	1396037.20	866.15 ¹	1395875.75	176562.61	-
Husum 2	T4R11-29D1	465596	480	6	175903.40	1394375.51	855.85 ¹	1394199.26	175845.17	-
Husum 2	T4R11-31D1	341511	100	6	169776.95	1388930.13	432.36 ¹	1388743.83	169715.42	-
Husum 2	T4R10-36A1	355990	160	10	169227.51	1388591.42	494.28 ¹	1388400.40	169169.30	-
Husum 2	T4R10-36H1	380957	85	8	169133.94	1387857.37	491.19 ¹	1387676.34	169078.08	-
Snowden 1	T3R11-8L2	142099	410	6	156898.65	1396446.81	1649.78 ¹	1396426.40	156856.09	-
Snowden 1	T3R11-8A1	826421	150	6	159429.61	1398371.89	1661.28 ¹	1398383.94	159428.84	-
Snowden 2	T4R11-34C1	556407	650	6	169276.91	1406105.93	1950.30 ¹	1406129.14	169243.48	-
Snowden 1	T3R11-7Q2	368386	345	6	155567.19	1392670.46	1016.51 ¹	1392681.65	155572.19	-
Snowden	T3R11-21E1	-	240	-	-	-	2134 ²	-	-	-
Snowden	T3R11-21L1	-	320	-	-	-	2140 ²	-	-	-
Bill Moore Rd	T4R12-9R2	369681	825	6	-	-	-	1435808.46	188590.67	
Bill Moore Rd	T4R12-20D1		98	6	180066.239	1425971.216	2176.422 ¹	1425952.40	180099.57	-
Bill Moore Rd	T4R12-11E1			6	190015.712	1441493.66	2284.257 ¹	1441502.18	189976.16	-
Bill Moore Rd	T4R12-11E2			6	189908.662	1442117.605	2271.919 ¹	1442155.79	189921.03	-
Bill Moore Rd	T4R12-10R1		410	6	186332.7	1441016.402	2417.803 ¹	1441024.82	186319.14	-
Bill Moore Rd	T4R12-15C1		318	6	185782.196	1438206.143	2534.789 ¹	1438165.67	185825.56	-
White Salmon	T3R10-10B1	-	755	-	-	-	-	-	-	461
White Salmon	T3R10-3Q1	-	1242	-	-	-	-	-	-	482
White Salmon	T3R10-3Q2	-	360	-	-	-	-	-	-	471
White Salmon	T3R10-3Q3	-	500	-	-	-	-	-	-	490
White Salmon	T3R10-3Q4	-	1010	-	-	-	-	-	-	484
Bingen	T3R11-30I	-	330	-	-	-	165 ²	-	-	-
Bingen	T3R11-30Jl	-	510	-	-	-	144 ²	-	-	-
Bingen	T3R11-29El	-	440	-	-	-	263 ²	-	-	-

¹ From Klickitat County Public Works Department's survey.

² From well owner's survey.

Table 2 - White Salmon Basin Monitoring Network Water Level Data

White Salmon Basin Well Monitoring Network
WRIA 29B, Washington

Ecology Well Log Data					Well Top of Casing Location Information		October 2014				April 2015			
					Surveyor Data ¹	Google Earth data								
					NAVD88	WGS84								
Subarea	TRS Label	Ecology Well Log ID	Depth (ft)	Diam. (in)	Elevation (feet)	Elevation (feet)	Depth to water (ft btoc)	Water over airline or transducer (ft)	Water elevation (ft)	Comments	Depth to water (ft btoc)	Water over airline or transducer (ft)	Water elevation (ft)	Comments
Trout Lake	T6R10-14M1	134861	398	6	#N/A	1924	127.0	-	1797.0		120.0	-	1804.0	Well owner measured on 4/17/15
Trout Lake	T6R10-27H15	133047	325	6	1980.39 ¹	-	270.2	-	1710.2		228.6	-	1751.8	
Trout Lake	T6R10-27A2	129821	370	6	1946.91 ¹	-	238.4	-	1708.5		197.4	-	1749.5	
South Trout Lake	T5R10-12L3	467907	160	6	1440.51 ¹	-	80.6	-	1360.0		45.6	-	1394.9	
South Trout Lake	T5R10-12P1		190		1427.76 ¹	-	-	-	-	Not measured	(Airline)	76.2	-	Airline 33 psi
South Trout Lake	T5R10-12P2	380078	168	6	1428.05 ¹	-	78.7	-	1349.3		50.4	-	1377.7	
BZ Corner	T4R10-2B4	341508	220	6	850.94 ¹	-	122.0	-	728.9		121.2	-	729.7	
Husum 2	T4R10-11J5	317873	117	6	726.78 ¹	-	83.8	-	643.0	Access port installed Oct 2014	80.8	-	646.0	
Husum 2	T4R10-11J6	352381	148	6	707.37 ¹	-	87.0	-	620.3	Access port installed Oct 2014	87.5	-	619.9	
Husum 2	T4R11-17N1	499075	176	8	826.93 ¹	-	123.1	-	703.8		118.0	-	709.0	
Husum 2	T4R11-20P2	145947	425	6	866.15 ¹	-	263.6	-	602.5		248.4	-	617.7	
Husum 2	T4R11-29D1	465596	480	6	855.85 ¹	-	274.7	-	581.1		262.3	-	593.5	
Husum 2	T4R11-31D1	341511	100	6	432.36 ¹	-	34.6	-	397.8		32.6	-	399.8	
Husum 2	T4R10-36A1	355990	160	10	494.28 ¹	-	96.43 non-static	-	-	Non-static	93.5	-	400.8	
Husum 2	T4R10-36H1	380957	85	8	491.19 ¹	-	26.8	-	464.4		23.4	-	467.8	
Husum 3	T3R10-2A1	416976	280	8	#N/A	454	67 psi	154.8	-	Pump depth: 210'	(Airline)	147.8	-	Airline 64 psi
Husum 3	T3R10-2A2	139796	145	8	#N/A	454	27 psi	62.4	-	Pump depth: 105; no WLI access	(Airline)	64.7	-	Airline 28 psi
Snowden 1	T3R11-8L2	142099	410	6	1649.78 ¹	-	295.4	-	1354.4		292.8	-	1357.0	
Snowden 1	T3R11-8A1	826421	150	6	1661.28 ¹	-	56.7	-	1604.6		56.6	-	1604.7	
Snowden 1	T3R11-7Q2	368386	345	6	1016.51 ¹	-	27.8	-	988.7		26.0	-	990.5	

Notes:

¹ From Klickitat County Public Works Department's survey.

² From well owner's survey.

Table 2 - White Salmon Basin Monitoring Network Water Level Data

White Salmon Basin Well Monitoring Network
WRIA 29B, Washington

Ecology Well Log Data					Well Top of Casing Location Information		October 2014				April 2015			
					Surveyor Data ¹	Google Earth data								
					NAVD88	WGS84								
Subarea	TRS Label	Ecology Well Log ID	Depth (ft)	Diam. (in)	Elevation (feet)	Elevation (feet)	Depth to water (ft btoc)	Water over airline or transducer (ft)	Water elevation (ft)	Comments	Depth to water (ft btoc)	Water over airline or transducer (ft)	Water elevation (ft)	Comments
Snowden 2	T4R11-34C1	556407	650	6	1950.30 ¹	-	41 psi	94.7	-		(Airline)	110.4	-	Airline 47.8 psi
Snowden	T3R11-21E1	-	240	-	2134.00 ²	-	125.4	95.0	2008.6	Data provided by water system managers - current measurement; water over pump 95 ft; depth to water 125.4 ft; SCADA water elevation 2008.6;	-	-	-	Data unavailable - SCADA system being redesigned
Snowden	T3R11-21L1	-	320	-	2140.00 ²	-	75.5	247.2	2064.5	Data provided by water system managers - June 2014 measurement ; water over pump 107 ft; depth to water 75.5 ft; water elevation 2064 ft	-	-	-	Data unavailable - SCADA system being redesigned
Bill Moore Rd	T4R12-9R1	369681	825	6	2421.49	-	360.7	-	2060.8	Well also in Appleton monitoring network	361.6	-	2059.9	Water leak in spigot
Bill Moore Rd	T4R12-20D1		98	6	2176.42 ¹	-	17.9	-	2158.5	-	17.5	-	2158.9	
Bill Moore Rd	T4R12-11E1			6	2284.26 ¹	-	12.1	-	2272.2	-	-	-	-	Permission granted but not measured
Bill Moore Rd	T4R12-11E2			6	2271.92 ¹	-	11.5	-	2260.4	Tape sticks at 20.5'	19.7	-	2252.2	
Bill Moore Rd	T4R12-10R1		410	6	2417.80 ¹	-	302.3	-	2115.6		269.2	-	2148.6	
Bill Moore Rd	T4R12-15C1		318	6	2534.79 ¹	-	46.3	-	2488.5		32.0	-	2502.8	
White Salmon	T3R10-10B1	-	755	-	-	461		205.0	356.0	Datalogger measurement - erroneous.		205.0	356.0	Datalogger measurement - erroneous.
White Salmon	T3R10-3Q1	-	1242	-	-	482	-	-	-	ASR pilot test - Well No. 2 injection phase; non-static shut-in pressure = 43.94 psi	-	-	-	ASR pilot test - Well No. 2 recovery phase; Non-static shut-in pressure = 11.21 psi
White Salmon	T3R10-3Q2	-	360	-	-	471	198.1	-	272.9		197.7	-	273.3	
White Salmon	T3R10-3Q3	-	500	-	-	490	218.2	-	271.8		211.2	-	278.8	
White Salmon	T3R10-3Q4	-	1010	-	-	484	-	-	-	ASR pilot test - Well No. 2 injection phase; non-static shut-in pressure = 83 psi	-	-	-	ASR pilot test - Well No. 2 recovery phase; non-static shut-in pressure = 50 psi
Bingen	T3R11-30I	-	330	-	165.00 ²	-		165.6	55.6	Data provided by well owner. Bottom of pump 279.75 ft btoc. Transducer 275 ft btoc.	-	181.9	71.9	
Bingen	T3R11-30J	-	510	-	144.00 ²	-		313.8	57.8	Data provided by well owner. Bottom of pump 460 ft btoc. Transducer 400 ft btoc.	-	345.7	89.7	
Bingen	T3R11-29E	-	440	-	263.00 ²	-		55.4	-76.6	Data provided by well owner. Bottom of pump 400 ft btoc. Airline outlet 395 ft btoc.	-	102.0	-30.0	

Notes:

¹ From Klickitat County Public Works Department's survey.

² From well owner's survey.



Wells in Monitoring Network

White Salmon River Watershed

Rivers/Streams

Roads

City

Township and Range

Section

County Boundary

Klickitat County

White Salmon Basin

Water Level Monitoring Network

WRIA 29 White Salmon Basin Well Monitoring Network Setup Memo
White Salmon River Watershed
Klickitat County, Washington

JUN-2015

PROJECT NO.
090045

BY:
JB / RAP

REVISED BY:
JB / RAP

FIGURE NO.

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Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community