COLORADO GEOLOGICAL SURVEY

1801 19th Street
Golden, Colorado 80401
Phone: 303.384.2655

Serving the people of Colorado
Director, Karen Berry

TECHNICAL MEMORANDUM

Date: **October 3, 2017**

To: **Andy Moore, Senior Water Resource Specialist**
Colorado Water Conservation Board (CWCB)

From: **Lesley A. Sebol, PhD, Hydrogeologist**
Peter E. Barkmann, Supervisor Hydrogeologist
Colorado Geological Survey (CGS)

Re: 2017 Addendum to the Gilcrest/LaSalle Pilot Project Hydrogeologic Characterization Report

This technical memorandum presents the 2017 addendum for the Gilcrest/LaSalle Pilot Project Hydrogeologic Characterization Report. Specifically, it includes a brief description of activities undertaken to generate additional spring and fall groundwater maps using new 2015, 2016 and 2017 (spring only) water level data, and the findings. Water level data were provided by Erik Skeie of CWCB and Kevin Donegan of Colorado Division of Water Resources (DWR) in July and August of 2017. This addendum is a follow up to the prior 2015 Addendum to the Gilcrest/LaSalle Pilot Project Hydrogeologic Characterization Report (hereafter referred to as the 2015 Addendum). Incorporated herein are previously presented 2014 water level data which were used to calculate differences with the new 2015 data, as shown in Table 2017TM-1.

Methods

Similar to the prior 2015 Technical Memorandum Addendum, water levels were mapped in the same study area limits as in the Gilcrest/LaSalle Pilot Project Hydrogeologic Characterization Report, excluding wells in Beebe Draw (in the southeastern section of the study area). Beebe Draw was again excluded from this addendum as it is not the current focus of interest, which remains water level changes near the towns of Gilcrest and LaSalle. For consistency, contour process and generation of the depth-to-groundwater rasters followed the same general steps as the original report and 2015 Addendum. Using 2015 Lidar, the South Platte River shown on the figures was adjusted to follow the center of the apparent main channel, showing its current post-September 2013 flood pattern. The study area boundary was slightly adjusted to follow the outside of this new river line.

A maximum of 59 wells were used for generating groundwater contours (Figure TM2017-1). This total includes data for 20 new wells in the Gilcrest area whose data was sourced from the Town of Gilcrest, DWR and Colorado State University (CSU). The date these new wells began to be monitored is variable (Table 2017TM-1). As a result, the fall 2015 mapping is the first to incorporate some of the wells but all 20 were available by the fall 2016 mapping. Four wells (28-1, 28-3, WL-M-040, and WL-M-60) which had data in the 2015 Addendum were removed because data were no longer available beginning in 2015.

Ground surface elevations were obtained for the 20 new wells and updated for the remaining wells using the most recent (June 2015) Lidar elevations (preferentially in areas having Lidar coverage) or alternatively the 10-meter surface elevation digital elevation model (DEM) updated to 2015. Previously, the 2013 10-meter DEM had been used for the whole study area. Table TM2017-2 provides a comparison of the previous and current well elevations and identifies by color coding whether the Lidar or 10-meter DEM elevation was used at each well.

Groundwater elevation contours were generated for the spring and fall of 2015 and 2016 and the spring of 2017 (Figures TM2017-2 through TM2017-6). Water level data were chosen from the spring and fall months having the greatest number of wells exhibiting minimum and maximum levels, respectively. Thus, low water levels were mapped using data from March 23, 2015, March 25, 2016, and March 30, 2017, and high water levels from September 22, 2015 and September 23, 2016 (Table 2017TM-1). Data measurement frequency at the wells varied between daily and monthly. Some wells were instrumented with data loggers, but others had manual measurements. However, there were data available at all the wells either on or within two to three days of the above chosen dates.

Although not shown on the maps, lidar elevations were obtained for 15 points evenly spaced along the newly adjusted South Platte River line. These elevations were incorporated into the groundwater contours to adjust the contours between the wells with data and the river. Contours were manually adjusted around the edge of Lower Latham Reservoir, which has a recorded elevation of 4,664 feet on the topographic map. This elevation fit nicely with groundwater elevation data from the nearest well WL-M-401. Elsewhere, contours were not adjusted to account for specific recharge ponds or drainage ditches because this would require detailed analysis of water levels, flow rates and timing, which was beyond the scope of this effort.

Groundwater data were used to generate depth-to-groundwater and water level change maps between Spring 2014 to 2015, Fall 2014 to 2015, Spring 2015 to 2016, Fall 2015 to 2016, and Spring 2016 to 2017 (Figures TM2017-7 through TM2017-11). Depth-to-groundwater maps were prepared by subtracting ArcGIS raster images of the 2015, 2016 and spring 2017 water table elevation maps from the 2015 surface 10-meter DEM. The depth-to-groundwater raster images are classified using colors that only display areas where depth to water is 15 feet or less and presented by different colors representing groundwater depths of <0.5 feet, 0.5 – 5 feet, 5 – 10 feet, and 10 – 15 feet below ground surface (bgs). The depth-to-groundwater raster images were also clipped to follow the river line. Additionally, water level changes at the wells on these maps, are symbolized by direction of change and magnitude. Purple circles show rising water levels and green circles show falling water levels at the wells, with larger circles indicating greater rising or falling values at the wells.

Observations

1. The 20 new wells which began to be added in late 2015 were clustered around Gilcrest and groundwater elevations in these wells generally agreed with each other and others nearby, except two which had anomalously higher groundwater elevations for each measuring event (RE1 and MW3). Both of these wells had groundwater elevations that averaged about 4 feet higher than nearby wells. Their ground surface elevation used in the calculations did not appear anomalous. Therefore, groundwater contours were manually adjusted near these wells to reduce the impact of these anomalies.

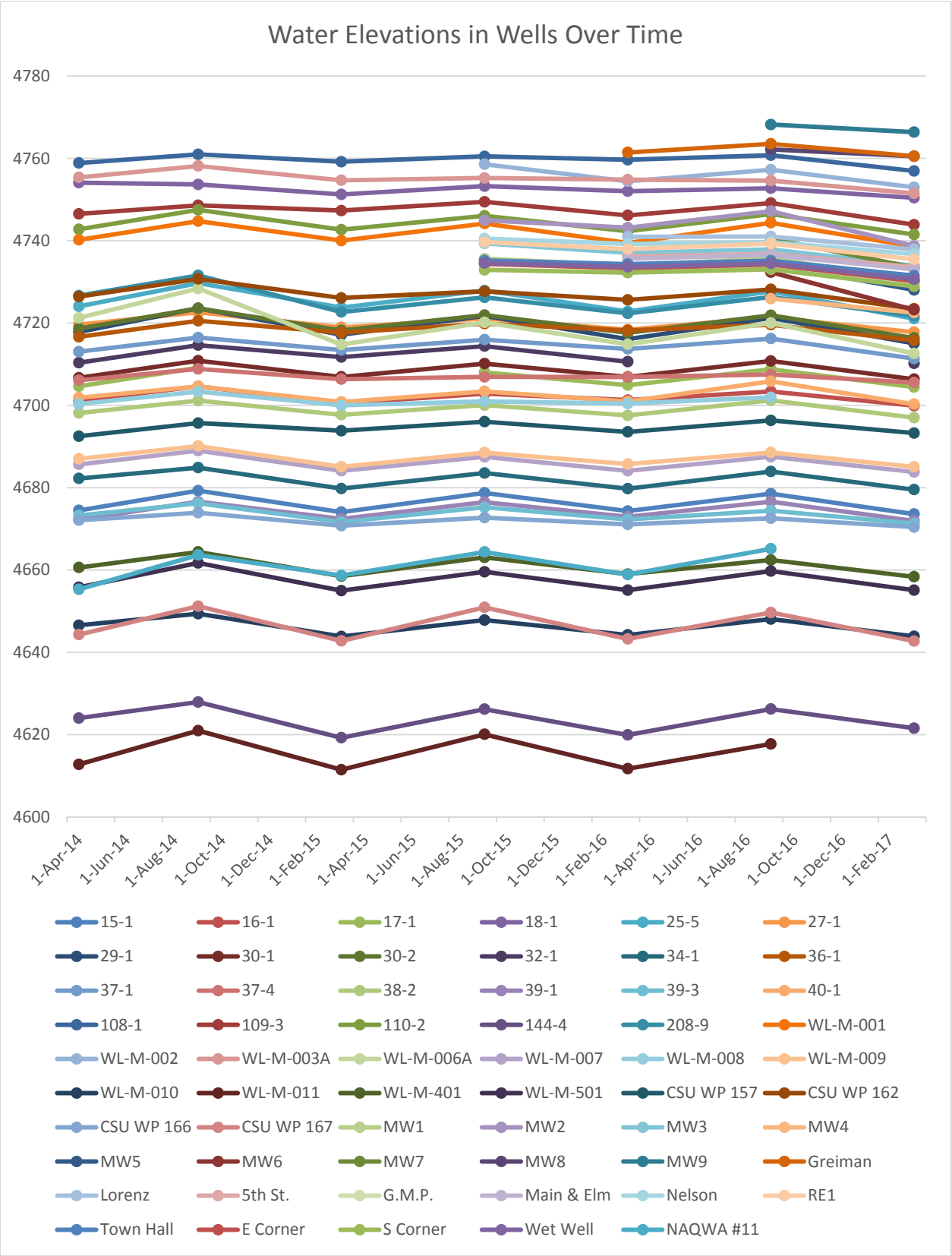
2. Similar to the 2013 and 2014 data, the depth to groundwater east/northeast of Gilcrest is either less than 0.5 feet or is in the range of 0.5 to 5 feet. Possible recharge sources located in this area include the Bolander Seep (aka Big Bend Drain) and Schmidt recharge ponds #1, #2, and #3 (Figure TM2017-1). The area with less than 0.5 foot groundwater depths was centered over the boundary of Sections 23 and 26 of 4N 66W, and exhibited expansions each fall relative to spring. Additionally, the areal limits for water depths of less than five feet appeared largest in the fall of 2016. Within Gilcrest, the depth to groundwater remains in the 5 – 10 and 10 – 15 feet ranges.

3. The Haren Recharge Facility located in Section 16 of 4N 66W, which started diverting in summer of 2013, remains the largest recharge facility in the study area (Figure TM2017-1). Groundwater levels just west of the Haren Recharge Facility in the area below the river bluff/terrace remain less than 0.5 feet year round. Similarly, west/southwest of LaSalle also below the river bluff/terrace groundwater levels remain less than 0.5 feet year round although the extent expands slightly in the fall versus spring. Possible recharge sources here include the Loeffler and Miller recharge ponds and the Union Ditch.

4. Annual water level changes between spring 2015 and spring 2014 predominately dropped and where they rose the amount was less than 1.4 feet (except one well east of LaSalle at 3.37 feet). Also, between fall 2015 and fall 2014 water levels dropped at all wells except for two with nominal rises of less than one foot. Water levels between spring 2016 and spring 2015 predominantly rose (n=23 versus n=14) although the maximum rise was only 0.81 feet. Between fall 2016 and fall 2015 water level differences were mixed (n=26 versus n=21) and the maximum water level rise versus drop was 2.45 versus 2.36 feet, respectively. Water levels between spring 2017 and spring 2016 predominantly dropped at all but two wells, and the maximum drop in levels was 4.45 feet. Summary statistics of the rise and fall of water levels in the wells are provided in the table below, where (n) is the number of wells with measurements.

Water Levels in Wells Statistics							
Annual Difference		**Max. Rise**	**Avg. Rise**	**(n)**	**Max. Fall**	**Avg. Fall**	**(n)**
2015 to 2014	**Spring**	3.37	0.93	10	-6.48	-1.55	27
	Fall	0.83	0.63	3	-8.23	-1.60	35
2016 to 2015	**Spring**	0.81	0.39	23	-1.16	-0.55	14
	Fall	2.45	0.52	26	-2.36	-0.59	21
2017 to 2016	**Spring**	1.64	0.82	2	-4.45	-1.65	48

5. Regional water elevations for all the wells during the 2015 through 2017 study period (and including 2014) are shown in the graph below. The overall trend in the majority of wells is nearly flat other than the Spring low and Fall high level fluctuations, indicating that the regional pattern dominates.


Water Elevations in Wells Over Time
4780
4760
4740
4720
4700
4680
4660
4640
4620
4600
1-Apr-14
1-Jun-14
1-Aug-14
1-Oct-14
1-Dec-14
1-Feb-15
1-Apr-15
1-Jun-15
1-Aug-15
1-Oct-15
1-Dec-15
1-Feb-16
1-Apr-16
1-Jun-16
1-Aug-16
1-Oct-16
1-Dec-16
1-Feb-17
15-1
16-1
17-1
18-1
25-5
27-1
29-1
30-1
30-2
32-1
34-1
36-1
37-1
37-4
38-2
39-1
39-3
40-1
108-1
109-3
110-2
144-4
208-9
WL-M-001
WL-M-002
WL-M-003A
WL-M-006A
WL-M-007
WL-M-008
WL-M-009
WL-M-010
WL-M-011
WL-M-401
WL-M-501
CSU WP 157
CSU WP 162
CSU WP 166
CSU WP 167
MW1
MW2
MW3
MW4
MW5
MW6
MW7
MW8
MW9
Greiman
Lorenz
5th St.
G.M.P.
Main & Elm
Nelson
RE1
Town Hall
E Corner
S Corner
Wet Well
NAQWA #11

Attachments:

Table TM2017-1	Summary of 2015, 2016 and Spring 2017 Groundwater Data
Table TM2017-2	Comparison of Ground Surface Elevations
Figure TM2017-1	Groundwater Level Monitoring Wells
Figure TM2017-2	Groundwater Elevation Contour Map 2015 Spring
Figure TM2017-3	Groundwater Elevation Contour Map 2015 Fall
Figure TM2017-4	Groundwater Elevation Contour Map 2016 Spring
Figure TM2017-5	Groundwater Elevation Contour Map 2016 Fall
Figure TM2017-6	Groundwater Elevation Contour Map 2017 Spring
Figure TM2017-7	Groundwater Depth Map 2015 Spring, With 2014 to 2015 Change
Figure TM2017-8	Groundwater Depth Map 2015 Fall, With 2014 to 2015 Change
Figure TM2017-9	Groundwater Depth Map 2016 Spring, With 2015 to 2016 Change
Figure TM2017-10	Groundwater Depth Map 2016 Fall, With 2015 to 2016 Change
Figure TM2017-11	Groundwater Depth Map 2017 Spring, With 2016 to 2017 Change

GIS Database:

Well point data,
Water level elevation contours (5), and
Depth-to-groundwater raster images (5)

Table 2017TM-1. Summary of 2015, 2016 and Spring 2017 Groundwater Data

Well Name	Source	Township & Range	Latitude	Longitude	UTM-x	UTM-y	2017 Ground Surface Elevation*	Depth to Water							Water Elevation							Difference				
								2014 Spring	2014 Fall	2015 Spring	2015 Fall	2016 Spring	2016 Fall	2017 Spring	2014 Spring	2014 Fall	2015 Spring	2015 Fall	2016 Spring	2016 Fall	2017 Spring	2014 to 2015		2015 to 2016		2016 to 2017
								15-Apr-14	17-Sep-14	23-Mar-15	22-Sep-15	25-Mar-16	23-Sep-16	30-Mar-17	15-Apr-14	17-Sep-14	23-Mar-15	22-Sep-15	25-Mar-16	23-Sep-16	30-Mar-17	Spring	Fall	Spring	Fall	Spring
15-1	CCWCD	T4N R66W	40.33838	-104.69683	525750	4465360	4688.59	14.11	9.32	14.53	9.87	14.28	10.05	15.00	4674.48	4679.27	4674.06	4678.72	4674.31	4678.54	4673.59	-0.42	-0.55	0.25	-0.18	-0.72
16-1	CCWCD	T4N R66W	40.31478	-104.69717	525730	4462740	4709.65	8.49	5.06	9.20	6.81	8.39	6.28	9.75	4701.16	4704.59	4700.45	4702.84	4701.26	4703.37	4699.90	-0.71	-1.75	0.81	0.53	-1.36
17-1	CCWCD	T4N R66W	40.31908	-104.74815	521397	4463200	4727.76	23.14	18.61	n/a	19.75	22.85	19.00	23.32	4704.62	4709.15	n/a	4708.01	4704.91	4708.76	4704.44	n/a	-1.14	n/a	0.75	-0.47
18-1	CCWCD	T4N R66W	40.28344	-104.75476	520847	4459250	4756.93	2.85	3.28	5.70	3.69	4.91	4.21	6.50	4754.08	4753.65	4751.23	4753.24	4752.02	4752.72	4750.43	-2.85	-0.41	0.79	-0.52	-1.59
25-5	CCWCD	T4N R66W	40.30413	-104.77302	519289	4461540	4746.85	22.80	17.15	23.10	18.96	24.04	19.15	25.80	4724.05	4729.70	4723.75	4727.89	4722.81	4727.70	4721.05	-0.30	-1.81	-0.94	-0.19	-1.76
27-1	CCWCD	T4N R66W	40.30454	-104.80011	516986	4461580	4746.13	26.54	23.52	27.20	25.04	27.73	24.76	28.36	4719.59	4722.61	4718.93	4721.09	4718.40	4721.37	4717.77	-0.66	-1.52	-0.53	0.28	-0.63
29-1	CCWCD	T4N R66W	40.31177	-104.77239	519340	4462390	4743.54	25.70	19.96	26.40	21.82	27.44	22.31	28.50	4717.84	4723.58	4717.14	4721.72	4716.10	4721.23	4715.04	-0.70	-1.86	-1.04	-0.49	-1.06
30-1	CCWCD	T4N R66W	40.31922	-104.75513	520804	4463220	4727.96	21.26	17.12	21.05	17.83	21.04	17.20	21.60	4706.70	4710.84	4706.91	4710.13	4706.92	4710.76	4706.36	0.21	-0.71	0.01	0.63	-0.56
30-2	CCWCD	T4N R66W	40.30716	-104.76356	520092	4461880	4739.86	21.20	16.30	21.65	17.93	22.25	18.00	23.50	4718.66	4723.56	4718.21	4721.93	4717.61	4721.86	4716.36	-0.45	-1.63	-0.60	-0.07	-1.25
32-1	CCWCD	T4N R66W	40.32012	-104.76840	519677	4463310	4728.03	17.68	13.41	16.30	13.65	17.43	n/a	17.82	4710.35	4714.62	4711.73	4714.38	4710.60	n/a	4710.21	1.38	-0.24	-1.13	n/a	-0.39
34-1	CCWCD	T4N R65W	40.34041	-104.75400	520894	4465570	4689.42	7.18	4.55	9.65	5.87	9.67	5.50	9.90	4682.24	4684.87	4679.77	4683.55	4679.75	4683.92	4679.52	-2.47	-1.32	-0.02	0.37	-0.23
36-1	CCWCD	T4N R65W	40.29741	-104.73716	522338	4460800	4730.13	13.49	9.60	12.49	10.28	11.96	10.56	14.37	4716.64	4720.53	4717.64	4719.85	4718.17	4719.57	4715.76	1.00	-0.68	0.53	-0.28	-2.41
37-1	CCWCD	T4N R66W	40.30474	-104.74491	521677	4461610	4724.91	11.87	8.44	11.47	8.97	11.20	8.70	13.55	4713.04	4716.47	4713.44	4715.94	4713.71	4716.21	4711.36	0.40	-0.53	0.27	0.27	-2.35
37-4	CCWCD	T4N R66W	40.30544	-104.71739	524016	4461700	4723.53	17.44	14.68	17.17	16.63	16.65	16.05	18.00	4706.09	4708.85	4706.36	4706.90	4706.88	4707.48	4705.53	0.27	-1.95	0.52	0.58	-1.35
38-2	CCWCD	T4N R66W	40.32084	-104.72462	523396	4463400	4715.31	17.17	14.17	17.60	15.26	17.77	14.10	18.30	4698.14	4701.14	4697.71	4700.05	4697.54	4701.21	4697.01	-0.43	-1.09	-0.17	1.16	-0.53
39-1	CCWCD	T4N R66W	40.33449	-104.67757	527388	4464930	4689.88	17.65	13.29	17.45	13.42	16.94	13.30	17.95	4672.23	4676.59	4672.43	4676.46	4672.94	4676.58	4671.93	0.20	-0.13	0.51	0.12	-1.01
39-3	CCWCD	T5N R65W	40.33057	-104.66021	528864	4464500	4688.87	15.62	12.66	17.20	13.64	16.60	14.46	17.60	4673.25	4676.21	4671.67	4675.23	4672.27	4674.41	4671.27	-1.58	-0.98	0.60	-0.82	-1.00
40-1	CCWCD	T4N R66W	40.31766	-104.72861	523058	4463050	4717.83	15.97	13.23	16.99	14.43	16.90	11.98	17.55	4701.86	4704.60	4700.84	4703.40	4700.93	4705.85	4700.28	-1.02	-1.20	0.09	2.45	-0.65
108-1	CCWCD	T4N R65W	40.27549	-104.77104	519465	4458360	4764.18	5.32	3.20	5.00	3.71	4.53	3.42	7.25	4758.86	4760.98	4759.18	4760.47	4759.65	4760.76	4756.93	0.32	-0.51	0.47	0.29	-2.72
109-3	CCWCD	T4N R65W	40.27807	-104.80025	516981	4458640	4773.93	27.42	25.33	26.62	24.50	27.78	24.78	30.05	4746.51	4748.60	4747.31	4749.43	4746.15	4749.15	4743.88	0.80	0.83	-1.16	-0.28	-2.27
110-2	CCWCD	T4N R66W	40.28272	-104.82911	514527	4459150	4759.83	17.06	12.35	17.15	13.79	17.54	13.37	18.34	4742.77	4747.48	4742.68	4746.04	4742.29	4746.46	4741.49	-0.09	-1.44	-0.39	0.42	-0.80
144-4	CCWCD	T4N R66W	40.38838	-104.63177	531253	4470930	4635.96	11.95	8.05	16.71	9.77	16.04	9.75	14.40	4624.01	4627.91	4619.25	4626.19	4619.92	4626.21	4621.56	-4.76	-1.72	0.67	0.02	1.64
208-9	CCWCD	T4N R66W	40.30478	-104.77916	518767	4461610	4751.52	24.88	19.96	28.84	25.28	29.19	25.20	29.79	4726.64	4731.56	4722.68	4726.24	4722.33	4726.32	4721.73	-3.96	-5.32	-0.35	0.08	-0.60
WL-M-001	CDA	T4N R66W	40.28657	-104.81403	515808	4459580	4759.25	19.04	14.50	19.23	15.09	19.77	14.91	20.64	4740.21	4744.75	4740.02	4744.16	4739.48	4744.34	4738.61	-0.18	-0.58	-0.55	0.18	-0.87
WL-M-002	CDA	T4N R66W	40.26922	-104.80188	516845	4457660	4772.93	Error	Error	Error	14.37	18.50	15.68	19.95	Error	Error	Error	4758.56	4754.43	4757.25	4752.98	n/a	n/a	n/a	-1.32	-1.45
WL-M-003A	CDA	T4N R66W	40.27503	-104.77450	519171	4458310	4763.15	7.77	4.99	8.48	7.93	8.32	8.57	11.65	4755.38	4758.16	4754.67	4755.22	4754.83	4754.58	4751.50	-0.70	-2.94	0.15	-0.63	-3.33
WL-M-006A	CDA	T4N R66W	40.31180	-104.78103	518606	4462390	4736.13	14.89	7.74	21.37	15.98	21.30	16.12	23.54	4721.24	4728.39	4714.76	4720.15	4714.83	4720.01	4712.59	-6.48	-8.23	0.07	-0.14	-2.23
WL-M-007	CDA	T4N R66W	40.33800	-104.75438	520862	4465300	4707.26	21.60	18.28	23.16	19.78	23.16	19.75	23.44	4685.66	4688.98	4684.10	4687.48	4684.10	4687.51	4683.82	-1.56	-1.50	-0.01	0.03	-0.28
WL-M-008	CDA	T4N R66W	40.31125	-104.72288	523547	4462340	4715.78	15.47	12.46	15.79	14.84	15.36	13.84	n/a	4700.31	4703.32	4699.99	4700.94	4700.42	4701.94	n/a	-0.32	-2.39	0.43	1.00	n/a
WL-M-009	CDA	T4N R65W	40.32697	-104.70010	525477	4464090	4701.61	14.59	11.49	16.56	13.09	15.88	13.06	16.53	4687.02	4690.12	4685.05	4688.52	4685.73	4688.55	4685.08	-1.97	-1.60	0.68	0.03	-0.66
WL-M-010	CDA	T5N R65W	40.36317	-104.66840	528155	4468120	4663.62	17.06	14.25	19.77	15.78	19.40	15.54	19.74	4646.56	4649.37	4643.85	4647.84	4644.22	4648.08	4643.88	-2.71	-1.53	0.36	0.24	-0.34
WL-M-011	CDA	T5N R65W	40.39538	-104.60798	533269	4471720	4630.26	17.49	9.29	18.80	10.18	18.54	12.54	n/a	4612.77	4620.97	4611.46	4620.08	4611.72	4617.72	n/a	-1.31	-0.89	0.26	-2.36	n/a
WL-M-401	CDA	T5N R65W	40.35020	-104.65658	529164	4466680	4671.26	10.67	6.88	12.77	8.19	12.27	8.85	12.90	4660.59	4664.38	4658.49	4663.07	4658.99	4662.41	4658.36	-2.10	-1.31	0.50	-0.65	-0.63
WL-M-501	CDA	T5N R65W	40.35112	-104.68045	527137	4466780	4670.15	14.37	8.44	15.17	10.59	15.05	10.42	15.05	4655.78	4661.71	4654.98	4659.56	4655.10	4659.73	4655.10	-0.81	-2.16	0.12	0.17	0.00
CSU WP 157	CSU	T5N R65W	40.33378	-104.75380	520913	4464830	4713.23	20.74	17.54	19.40	17.21	19.68	16.90	19.97	4692.49	4695.69	4693.83	4696.02	4693.55	4696.33	4693.26	1.34	0.33	-0.28	0.31	-0.29
CSU WP 162	CSU	T5N R65W	40.29226	-104.77093	519470	4460220	4744.26	17.85	13.56	18.17	16.57	18.65	16.10	20.80	4726.41	4730.70	4726.09	4727.69	4725.61	4728.16	4723.46	-0.32	-3.01	-0.48	0.47	-2.15
CSU WP 166	CSU	T4N R65W	40.33449	-104.65840	529016	4464940	4681.91	9.83	8.00	11.15	9.20	10.85	9.35	11.50	4672.08	4673.91	4670.76	4672.71	4671.06	4672.56	4670.41	-1.32	-1.20	0.30	-0.15	-0.65
CSU WP 167	CSU	T4N R66W	40.36596	-104.65863	528983	4468430	4659.26	14.95	8.06	16.49	8.34	16.02	9.60	16.53	4644.31	4651.20	4642.77	4650.92	4643.24	4649.66	4642.73	-1.54	-0.28	0.47	-1.26	-0.51
MW1	CSU	T4N R66W	40.28800	-104.76800	519720	4459750	4741.93	n/a	n/a	n/a	6.31	7.94	6.23	11.34	n/a	n/a	n/a	4735.62	4733.99	4735.70	4730.59	n/a	n/a	n/a	0.08	-3.40
MW2	CSU	T4N R66W	40.28290	-104.76800	519722	4459180	4749.13	n/a	n/a	n/a	4.19	5.97	1.96	10.41	n/a	n/a	n/a	4744.94	4743.16	4747.17	4738.72	n/a	n/a	n/a	2.23	-4.45
MW3	CSU	T4N R66W	40.28970	-104.76600	519890	4459940	4742.92	n/a	n/a	n/a	3.56	5.88	5.04	9.01	n/a	n/a	n/a	4739.36	4737.04	4737.88	4733.91	n/a	n/a	n/a	-1.48	-3.13
MW4	CSU	T4N R66W	40.30263	-104.75642	520700	4461380	4731.93	n/a	n/a	n/a	n/a	n/a	6.02	9.39	n/a	n/a	n/a	n/a	n/a	4725.91	4722.54	n/a	n/a	n/a	n/a	n/a
MW5	CSU	T4N R66W	40.30152	-104.76388	520066	4461250	4738.93	n/a	n/a	n/a	n/a	n/a	4.64	10.89	n/a	n/a	n/a	n/a	n/a	4734.29	4728.04	n/a	n/a	n/a	n/a	n/a
MW6	CSU	T4N R66W	40.30075	-104.77158	519412	4461160	4742.93	n/a	n/a	n/a	n/a	n/a	10.58	19.72	n/a	n/a	n/a	n/a	n/a	4732.35	4723.21	n/a	n/a	n/a	n/a	n/a
MW7	CSU	T4N R66W	40.28976	-104.78735	518075	4459940	4759.93	n/a	n/a	n/a	n/a	n/a	19.41	26.46	n/a	n/a	n/a	n/a	n/a	4740.52	4733.47	n/a	n/a	n/a	n/a	n/a
MW8	CSU	T4N R66W	40.27767	-104.75866	520517	4458600	4767.66	n/a	n/a	n/a	n/a	n/a	5.48	7.15	n/a	n/a	n/a	n/a	n/a	4762.18	4760.51	n/a	n/a	n/a	n/a	n/a
MW9	CSU	T4N R66W	40.27846	-104.75405	520909	4458690	4770.88	n/a	n/a	n/a	n/a	n/a	2.68	4.52	n/a	n/a	n/a	n/a	n/a	4768.20	4766.36	n/a	n/a	n/a	n/a	n/a
Greiman	DWR	T4N R66W	40.27651	-104.76466	520007	4458470	4766.83	n/a	n/a	n/a	n/a	5.40	3.30	6.30	n/a	n/a	n/a	n/a	4761.43	4763.53	4760.53	n/a	n/a	n/a	n/a	-0.90
Lorenz	DWR	T4N R66W	40.28658	-104.76061	520349	4459590	4744.00	n/a	n/a	n/a	n/a	3.05	3.00	6.10	n/a	n/a	n/a	n/a	4740.95	4741.00	4737.90	n/a	n/a	n/a	n/a	-3.05
5th St.	Gilcrest	T4N R66W	40.28067	-104.78066	518646	4458933	4753.93	n/a	n/a	n/a	n/a	17.80	17.14	20.35	n/a	n/a	n/a	n/a	4736.13	4736.79	4733.58	n/a	n/a	n/a	n/a	-2.55
G.M.P.	Gilcrest	T4N R66W	40.28754	-104.77331	519269	4459700	4742.93	n/a	n/a	n/a	n/a	10.36	8.81	13.13	n/a	n/a	n/a	n/a	4732.57	4734.12	4729.80	n/a	n/a	n/a	n/a	-2.77
Main & Elm	Gilcrest	T4N R66W	40.28266	-104.77968	518729	4459150	4750.93	n/a	n/a	n/a	n/a	15.32	14.43	17.89	n/a	n/a	n/a	n/a	4735.61	4736.50	4733.04	n/a	n/a	n/a	n/a	-2.57
Nelson	Gilcrest	T4N R66W	40.28017	-104.78260	518481	4458877	4754.93	n/a	n/a	n/a	14.42	15.72	15.28	18.19	n/a	n/a	n/a	4740.51	4739.21	4739.65	4736.74	n/a	n/a	n/a	n/a	-2.47
RE1	Gilcrest	T4N R66W	40.29118	-104.77722	518935	4460100	4746.93	n/a	n/a	n/a	7.28	9.00	7.65	11.44	n/a	n/a	n/a	4739.65	4737.93	4739.28	4735.49	n/a	n/a	n/a	n/a	-2.44
Town Hall	Gilcrest	T4N R66W	40.28381	-104.77693	518962	4459280	4749.11	n/a	n/a	n/a	13.93	14.81	13.98	17.59	n/a	n/a	n/a	4735.18	4734.30	4735.13	4731.52	n/a	n/a	n/a	n/a	-2.78
E Corner	Gilcrest	T4N R66W	40.28967	-104.76826	519698	4459930	4741.93	n/a	n/a	n/a	7.57	8.62	7.72	11.75	n/a	n/a	n/a	4734.36	4733.31	4734.21	4730.18	n/a	n/a	n/a	n/a	-3.13
S Corner	Gilcrest	T4N R66W	40.28790	-104.77012	519540	4459740	4742.92	n/a	n/a	n/a	10.02	10.70	9.89	14.01	n/a	n/a	n/a	4732.90	4732.22	4733.03	4728.91	n/a	n/a	n/a	n/a	-3.31
Wet Well	Gilcrest	T4N R66W	40.28965	-104.77095	519469	4459930	4741.93	n/a	n/a	n/a	7.36	8.30	7.45	11.31	n/a	n/a	n/a	4734.57	4733.63	4734.48	4730.62	n/a	n/a	n/a	n/a	-3.01
NAQWA #11	USGS	T4N R66W	40.35061	-104.67831	527318	4466720	4667.70	12.40	4.06	9.03	3.32	8.82	2.55	n/a	4655.30	4663.64	4658.67	4664.38	4658.88	4665.15	n/a	3.37	0.74	0.21	0.77	n/a

Notes: * Ground surface elevation in feet, revised in 2017 using 2015 Lidar (where available) and 2015 digital elevation model (DEM).

N/A = well not installed or no data (not measured) at the time of the sampling event; Error = no data due to data logger malfunctioning.

Table 2017TM-2. Comparison of Ground Surface Elevations.

Source	Well ID	UTM_x	UTM_y	previous GS Elev. 2013 DEM in TM2015	new Lidar 2015 GS Elev.	new DEM 10m 2015 GS Elev.	selected GS Elev. Revised 2017	calculated 2015-2013 DEM difference	calculated 2015 DEM -2015 Lidar difference	NOT USE from CDA GS Elev.	calculated CDA-2017 Elev. difference
CCWCD	15-1	525750	4465360	4688.91	4688.59	4689.04	4688.59	0.13	0.45		
CCWCD	16-1	525730	4462740	4708.91	n/c	4709.65	4709.65	0.74			
CCWCD	17-1	521397	4463200	4723.90	4727.76	4728.68	4727.76	4.78	0.92		
CCWCD	18-1	520847	4459250	4756.89	n/c	4756.93	4756.93	0.04			
CCWCD	25-5	519289	4461540	4744.93	4746.85	4745.44	4746.85	0.51	-1.41		
CCWCD	27-1	516986	4461580	4744.93	4746.13	4746.23	4746.13	1.30	0.10		
CCWCD	29-1	519340	4462390	4742.93	4743.54	4742.62	4743.54	-0.31	-0.92		
CCWCD	30-1	520804	4463220	4724.90	4727.96	4728.03	4727.96	3.13	0.07		
CCWCD	30-2	520092	4461880	4740.93	4739.86	4739.56	4739.86	-1.37	-0.30		
CCWCD	32-1	519677	4463310	4726.93	4728.03	4728.61	4728.03	1.68	0.58		
CCWCD	34-1	520894	4465570	4692.12	4689.42	4689.83	4689.42	-2.29	0.41		
CCWCD	36-1	522338	4460800	4730.19	n/c	4730.13	4730.13	-0.06			
CCWCD	37-1	521677	4461610	4724.92	n/c	4724.91	4724.91	-0.01			
CCWCD	37-4	524016	4461700	4723.91	n/c	4723.53	4723.53	-0.38			
CCWCD	38-2	523396	4463400	4713.22	4715.31	4714.82	4715.31	1.60	-0.49		
CCWCD	39-1	527388	4464930	4691.91	4689.88	4690.47	4689.88	-1.44	0.59		
CCWCD	39-3	528864	4464500	4687.98	n/c	4688.87	4688.87	0.89			
CCWCD	40-1	523058	4463050	4714.91	4717.83	4718.25	4717.83	3.34	0.42		
CCWCD	108-1	519465	4458360	4764.65	n/c	4764.18	4764.18	-0.47			
CCWCD	109-3	516981	4458640	4773.93	n/c	4773.93	4773.93	0.00			
CCWCD	110-2	514527	4459150	4760.93	4759.83	4760.16	4759.83	-0.77	0.33		
CCWCD	144-4	531253	4470930	4638.91	4635.96	4636.43	4635.96	-2.48	0.47		
CCWCD	208-9	518767	4461610	4750.93	4751.52	4751.73	4751.52	0.80	0.21		
CDA	WL-M-001	515808	4459580	4756.93	4759.25	4756.62	4759.25	-0.31	-2.63	4771.18	11.93
CDA	WL-M-002	516845	4457660	4772.93	n/c	4772.93	4772.93	0.00		4786.02	13.09
CDA	WL-M-003A	519171	4458310	4763.93	n/c	4763.15	4763.15	-0.78		4776.81	13.66
CDA	WL-M-006A	518606	4462390	4738.93	4736.13	4736.12	4736.13	-2.81	-0.01	4738.94	2.81
CDA	WL-M-007	520862	4465300	4707.56	4707.26	4707.29	4707.26	-0.27	0.03	4716.10	8.84
CDA	WL-M-008	523547	4462340	4715.72	n/c	4715.78	4715.78	0.06		4733.27	17.49
CDA	WL-M-009	525477	4464090	4695.91	4701.61	4700.9	4701.61	4.99	-0.71	4711.72	10.11
CDA	WL-M-010	528155	4468120	4663.91	4663.62	4664.21	4663.62	0.30	0.59	4673.14	9.52
CDA	WL-M-011	533269	4471720	4632.08	4630.26	4630.25	4630.26	-1.83	-0.01	4643.82	13.56
CDA	WL-M-401	529164	4466680	4667.91	4671.26	4672.1	4671.26	4.19	0.84	4684.39	13.13
CDA	WL-M-501	527137	4466780	4670.91	4670.15	4669.64	4670.15	-1.27	-0.51	4679.65	9.50
CSU	CSU WP 157	520913	4464830	4712.91	4713.23	4713.02	4713.23	0.11	-0.21		
CSU	CSU WP 162	519470	4460220	4744.93	n/c	4744.26	4744.26	-0.67			
CSU	CSU WP 166	529016	4464940	4681.91	n/c	4681.91	4681.91	0.00			
CSU	CSU WP 167	528983	4468430	4659.91	4659.26	4659.33	4659.26	-0.58	0.07		
USGS	NAQWA #11	527318	4466720	4670.33	4667.70	4667.76	4667.70		0.06		
CSU	MW1	519720	4459750	n/a	n/c	4741.93	4741.93				
CSU	MW2	519722	4459180	n/a	n/c	4749.13	4749.13				
CSU	MW3	519890	4459940	n/a	n/c	4742.92	4742.92				
CSU	MW4	520700	4461380	n/a	n/c	4731.93	4731.93				
CSU	MW5	520066	4461250	n/a	n/c	4738.93	4738.93				
CSU	MW6	519412	4461160	n/a	n/c	4742.93	4742.93				
CSU	MW7	518075	4459940	n/a	n/c	4759.93	4759.93				
CSU	MW8	520517	4458600	n/a	n/c	4767.66	4767.66				
CSU	MW9	520909	4458690	n/a	n/c	4770.88	4770.88				
DWR	Greiman	520007	4458470	n/a	n/c	4766.83	4766.83				
DWR	Lorenz	520349	4459590	n/a	n/c	4744.00	4744.00				
Gilcrest	5th St.	518646	4458933	n/a	n/c	4753.93	4753.93				
Gilcrest	G.M.P.	519269	4459700	n/a	n/c	4742.93	4742.93				
Gilcrest	Main & Elm	518729	4459150	n/a	n/c	4750.93	4750.93				
Gilcrest	Nelson	518481	4458877	n/a	n/c	4754.93	4754.93				
Gilcrest	RE1	518935	4460100	n/a	n/c	4746.93	4746.93				
Gilcrest	Town Hall	518962	4459280	n/a	n/c	4749.11	4749.11				
Gilcrest	E Corner	519698	4459930	n/a	n/c	4741.93	4741.93				
Gilcrest	S Corner	519540	4459740	n/a	n/c	4742.92	4742.92				
Gilcrest	Wet Well	519469	4459930	n/a	n/c	4741.93	4741.93				

NOTES:

n/c = Lidar does not cover area of the well; n/a =not applicable due to being new well.

Red font is new well for 2015-2017.

NAQWA #11 elevation from USGS NWIS website = 4670.33; was 4671.38 in TM2015 from 2013 10m DEM, but the shape file from DNR had 4667.67.