

Great West Engineering, Inc.

***Well Construction Report
Production Well CMRWA #3***

Central Montana Regional Water Authority

February 2020



Western Groundwater Services, LLC

6595 Bear Claw Lane

Bozeman, MT 59715

(406) 585-5947

www.westerngroundwaterservices.com



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1. INTRODUCTION

The Central Montana Regional Water Authority (Authority) is developing a groundwater supply for the Musselshell-Judith Regional Water System. The first well, CMRWA #1, was constructed in 2004 near Utica and is not presently planned for use in the water system. In 2012, the second well, CMRWA #2, was constructed at a new wellfield location on U Bet Road and referred to as the U Bet Wellfield. The third well, CMRWA #3, was constructed in 2019, also at the U Bet Wellfield (**Figure 1**). This report is documenting the construction and testing of the CMRWA #3 well.

The Engineer Report and Technical Specifications for well construction and testing was submitted to DEQ and assigned Department EQ#19-1324. DEQ approved the project for construction in October 2018.

The Authority has retained Great West Engineering, Inc. to provide consulting engineering services for the Musselshell-Judith Regional Water System. Western Groundwater Services, LLC provided hydrogeology services for the CMRWA #3 project working as a subconsultant to Great West Engineering, Inc.

2. WELL CONSTRUCTION

2.1 Bidding and Costs

The CMRWA #3 project was publicly advertised for bidding during July and August, 2019, with a bid opening on August 6, 2019. Hydro Resources – Rocky Mountain, Inc. of Fort Lupton, CO was the low bidder and awarded the project. The bid and actual fees for the project are provided in **Table 1**. Contractor work began on September 10, 2019 and was completed, except for reclamation, on November 7, 2019, a total work period of 59 days. A history report for the project is provided in **Appendix A**.

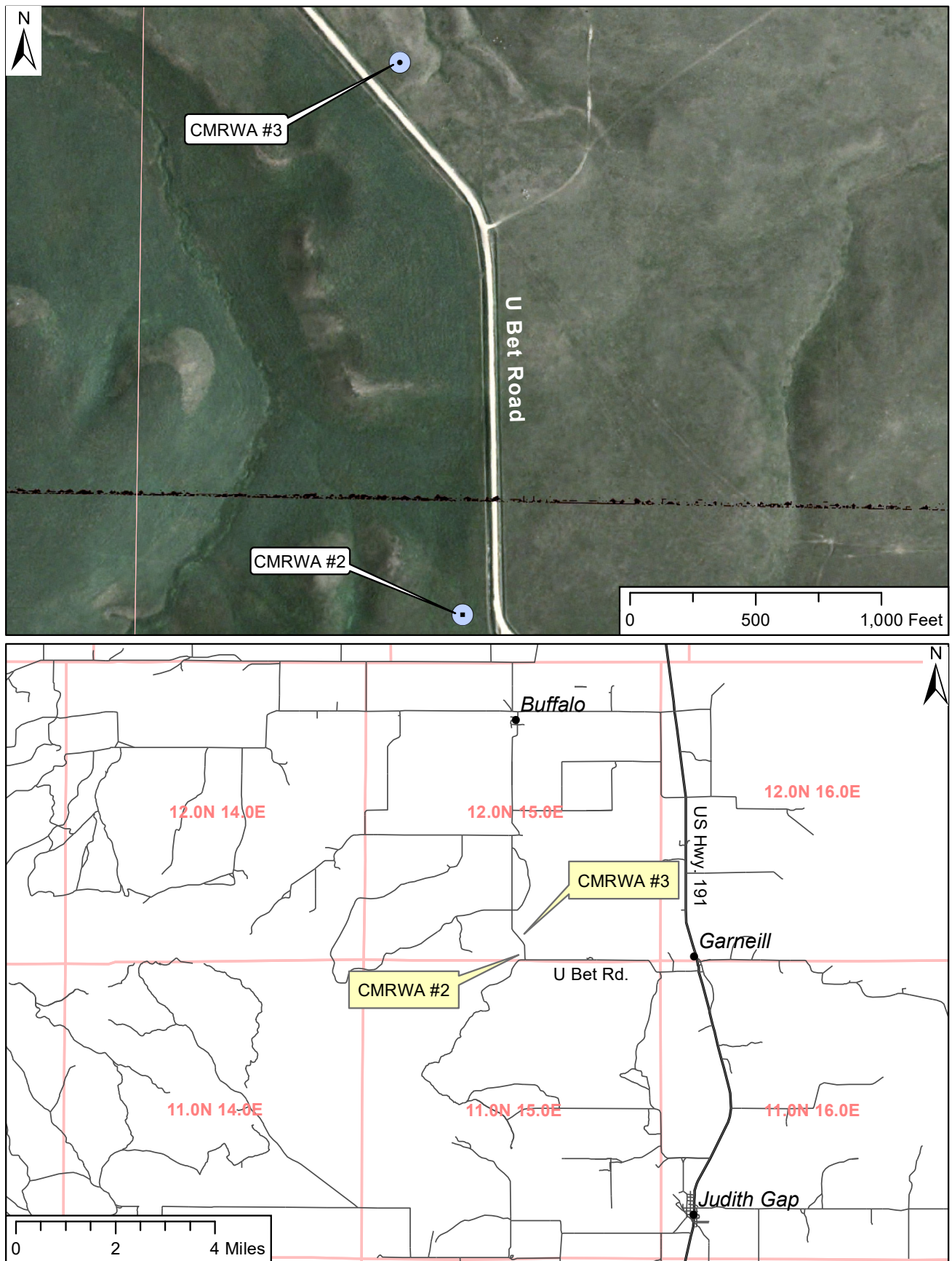


Figure 1. Location Map

Table 1. CMRWA #3 Bid and Actual Contractor Fees

ITEM NO.	DESCRIPTION	QUANT.	UNITS	UNIT RATES	BID TOTAL	ACTUAL QUANT.	ACTUAL TOTAL
1	Mobilization / Demobilization	1	LS	\$ 349,935	\$ 349,935	1	\$ 349,935
2	17-1/2 inch Borehole Drilling	1000	LF	\$ 205	\$ 205,000	1005	\$ 206,025
3	14.00 inch Intermediate Casing Installed	1000	LF	\$ 171	\$ 171,000	1000	\$ 171,000
4	12-1/4 inch Borehole Drilling	1140	LF	\$ 122	\$ 139,080	1160	\$ 141,520
5	9-5/8 inch Liner Casing Installed	1190	LF	\$ 124	\$ 147,560	1209	\$ 149,916
6	Liner Hanger Installed	1	EA	\$ 86,690	\$ 86,690	1	\$ 86,690
7	8-3/4 inch Open Hole Drilling (Mud)	660	LF	\$ 89	\$ 58,740	0	\$ -
8	Air Drilling System Mobilization	1	LS	\$ 53,051	\$ 53,051	1	\$ 53,051
9	8-3/4 inch Open Hole Drilling (Air)	660	LF	\$ 66	\$ 43,560	685	\$ 45,210
10	Development	24	HR	\$ 1,300	\$ 31,200	28.5	\$ 37,050
					\$ 1,285,816		\$ 1,240,397
A1-1	Temporary Pumping System	1	EA	\$ 90,117	\$ 90,117	1	\$ 90,117
A1-2	Pumping Test Hourly Work	174	HR	\$ 477	\$ 82,998	78	\$ 13,572
					\$ 173,115		\$ 103,689
A2-1	Acid-Fracture Stimulation	1	EA	\$ 152,030	\$ 152,030	1	\$ 152,030
A2-2	Flow Back Water Disposal	30	TRIPS	\$ 400	\$ 12,000	35	\$ 14,000
					\$ 164,030		\$ 166,030
A3-1	Open Hole Wireline Logging	1	EA	\$ 20,474	\$ 20,474	1	\$ 20,474
A3-2	Cased Hole Wireline Logging	1	EA	\$ 42,769	\$ 42,769	0	
					\$ 63,243		\$ 20,474
C-1	8-3/4 inch Open Hole Drilling (Air) > 2822 FT	28	LF	\$ 16	\$ 448	28	\$ 448
					\$ 448		\$ 448
				TOTAL	\$ 1,686,652		\$ 1,531,038

2.2 As-Built Well Construction, Acid Treatment, and Development

The as-built log for the CMRWA #3 well is provided on **Figure 2**. CMRWA #3 was constructed with a 20-inch diameter steel conductor casing set and cemented into a 36-inch diameter borehole to a depth of 40-ft below ground. Intermediate casing at 14-inch diameter was set and cemented into a 17-1/2 inch diameter borehole to a depth of 1,000 ft below ground. The 14-inch casing terminates 2-ft above ground and is presently covered with a welded steel plate. Below the intermediate casing a 9-5/8 inch liner casing was set and cemented into a 12-1/4 inch diameter borehole to a depth of 2,163 ft below ground. This casing was secured onto the 14-inch diameter casing using a mechanical liner hanger set at 947 ft below ground. The well completion was an open hole from below the liner casing to the total depth at 2,850 ft.

The cased hole sections of the well were drilled using the mud rotary method. The 17-1/2 inch borehole was drilled with reverse circulation. The liner casing borehole was drilled direct. The open hole section of the well was drilled direct rotary with air. Drilling was terminated at 2,850 ft due to drill cuttings settling onto the drill string during connections, creating a possible stuck tool condition.

Well development was conducted for a period of 8-hours after total depth was achieved. Four hours of development was conducted with the tools at total depth, and four hours with the drill tools set at 900 ft below ground. The discharge rate from the well when air-lift pumping from 900 ft was measured at 485 gpm. Based on this air-lift rate being substantially below the well target rate of 1,200 gpm, the contractor was authorized to proceed with acid stimulation treatment of the well.

Acid stimulation treatment was completed by injecting 16,000 gallons of 20% hydrochloric acid into the open hole section of the well. The well was then shut-in for approximately 18 hours, at which time development of the spent acid solution was developed from the well by air-lift pumping into storage tanks on-site. Approximately 186,000 gallons of spent acid solution was hauled to a disposal facility in Moore, MT owned and operated by Kodiak Concrete of Lewistown, MT. Off-site discharge from the well was initiated when the discharge specific conductance had achieved 800 $\mu\text{S}/\text{cm}$.¹

Development work that followed the acid treatment included air-lift pumping with the drill tools set at 900 ft below ground, where the discharge was measured at 1,200 gpm. With the drill tools relocated to a depth of 1300 ft below ground, the discharge rate was measured at 1,330 gpm. Based on the air-lift discharge at 900 ft, the improvement in capacity by the acid treatment was approximately 2.5 times.

Disinfection of the well was completed after pump testing. All equipment had been removed from the well prior to disinfection. The disinfection treatment consisted of pouring from surface into the well approximately 22,000 gallons of a sodium hypochlorite solution. The solution was made from 10% NSF Standard 60 sodium hypochlorite mixed with water obtained from the Judith Gap public water system to achieve a free chlorine concentration of about 130 mg/L. Immediately following the injection of the disinfection solution into the well, a steel plate was welded onto the top of the 14-inch well casing.

2.3 Borehole Geology

The CMRWA #3 borehole started in Cretaceous age (~70 million years before present (Ma)) rocks of the Thermopolis Shale and was completed in Mississippian age (~315 Ma) rocks of the Madison Group. The formations encountered corresponded closely to the CMRWA #2 well and were generally as anticipated with respect to lithology, thickness, and elevation. However, the formation contacts were not as well defined.

1 Water discharged from the well during air-drilling before acid treatment was measured at 710 $\mu\text{S}/\text{cm}$.

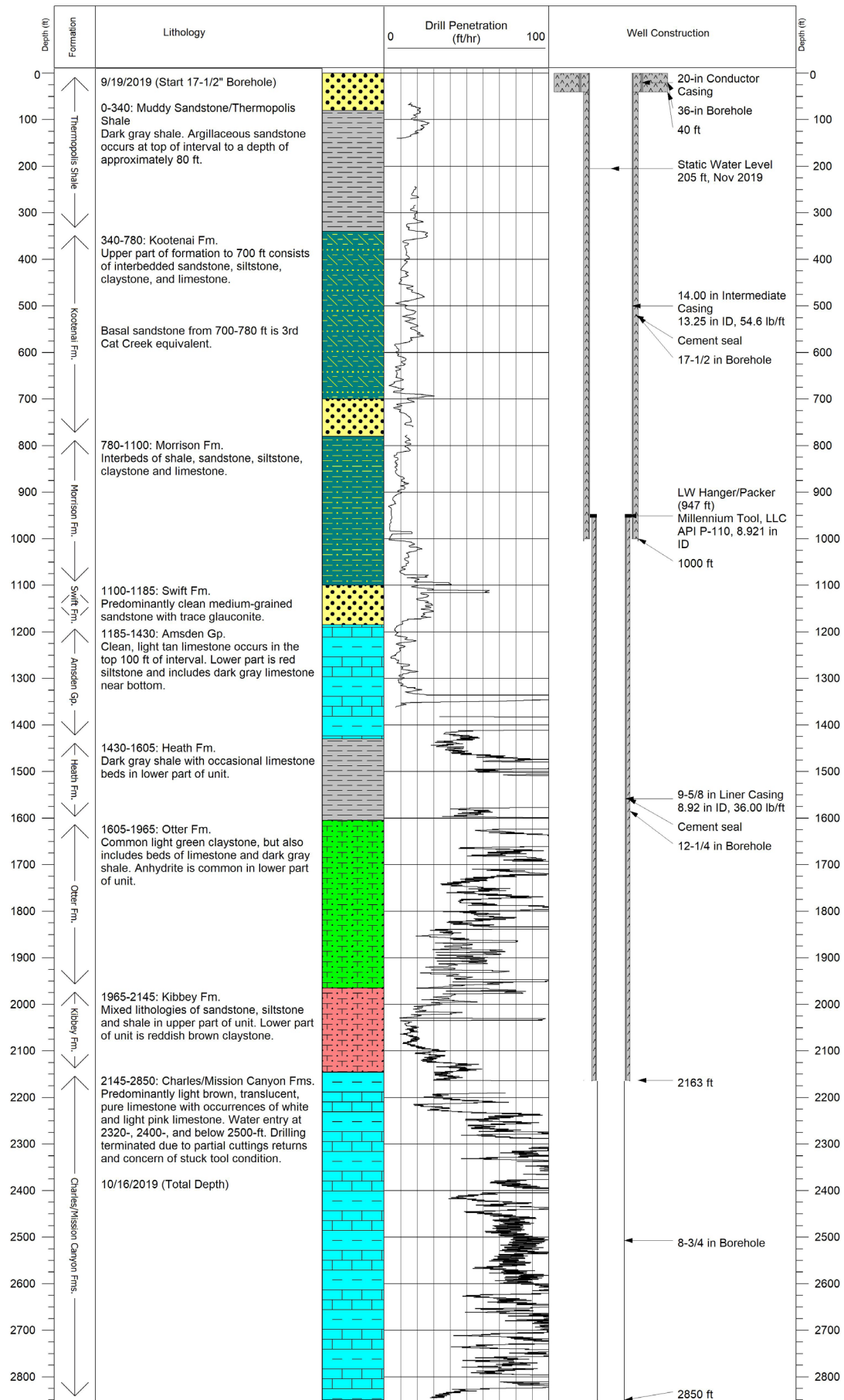


Figure 2. CMRWA #3 As-Built Log

Samples obtained while drilling were examined on-site after rinsing, drying and archive into storage vials. Samples were examined using a 6-40X Zeiss stereo microscope and logged into a borehole logging program. The field log for the samples is provide in **Appendix A**. Samples were collected from the shale shaker as grabs labeled with the bit depth at time of collection. Logging and archiving was completed at 30 ft intervals. Because there is a lag time for up-hole transport of the cuttings, the samples are not correctly located with respect to depth on the log. Generally, the actual sample depth may be 5- to 10-ft shallower than shown on the log to a depth of 2,165 ft. Samples collected below 2,165 ft have very little lag offset due to the rapid up-hole transport of the air-rotary method.

Identification of formations encountered during drilling was made based on the borehole samples. These distinctions were generally poorly defined, except for the upper contact of the Amsden Group, and generally the top of the Madison Group. The top of the Kootenai also appears to be reasonably well defined, however, the basal sandstone of the Kootenai was poorly sampled. The Big Snowy Group formations (Heath, Otter, Kibbey) were also poorly distinguished. One explanation for the inability to better define contacts may be the mixing of drill cuttings during upflow in the wellbore, as many of the samples were mixtures of differing lithologies.

Geophysical logging of the liner casing borehole section (1000 – 2165 ft) was conducted to better define the formations (the natural-gamma and caliper logs were also run to surface in the cased borehole). The suite of logs run is common for delineating borehole lithology. The log data are plotted on the field log provided in **Appendix A** and are also provided electronically on CD included with this report. These data provide some delineation of the formations, such as the top of the Swift, however, generally they do not provide additional clarity to many of the formation contacts.

The top of the Madison Group was estimated at 2,120 ft below ground, primarily by an increase in penetration rate, however, this increase was poorly captured by the EDR system being used to monitor drilling.² It was primarily identified by the drilling staff and was verified by the carbonate lithology of borehole samples. The top of the Madison Group corresponded to the occurrence of white or light gray limestone.

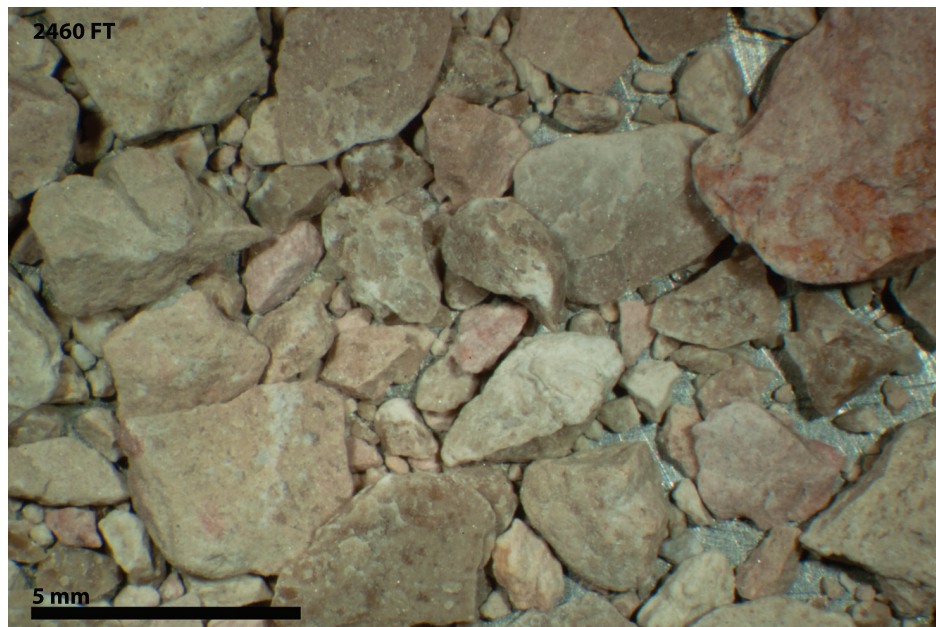
The Madison Group includes from bottom up the Lodgepole, Mission Canyon and Charles formations, each with a thickness of about 500 ft. These rocks are comprised of carbonate minerals and in the CMRWA #3 borehole, appear to be entirely calcite (calcium carbonate) with minor occurrences of rhodocrosite (manganese carbonate). Dolomite was not observed in the samples. The Lodgepole, which was not drilled, is known to include shale interbeds with limestone.

The CMRWA #3 well is producing groundwater from the Charles and Mission Canyon formations. Both formations have similar carbonate lithology. Based on an approximately 500 ft thickness, the contact between the formations, which is gradational, may occur at about 2550 ft, where the drill cuttings became much smaller. This contact would result in a Charles thickness of 430 feet, which is reasonable. Selected photos of drill cuttings are provided on **Figure 3** and **Figure 4**.

² The drilling rig was equipped with an electronic drilling recorder (EDR) rented from M/D Totco that provided real-time measurement of several drilling parameters including penetration rate.



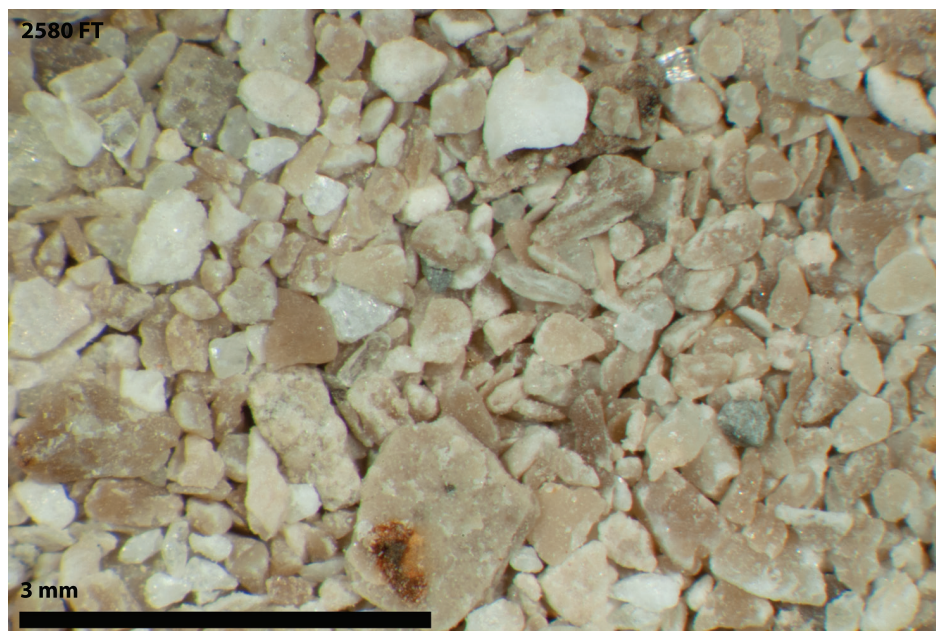
A.



B.



C.



D.

Figure 3. Borehole Sample Photos 2370-2580



A.



B.

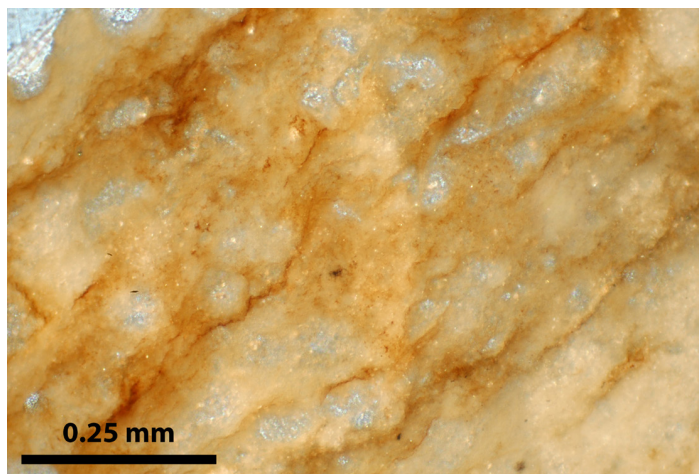


C.

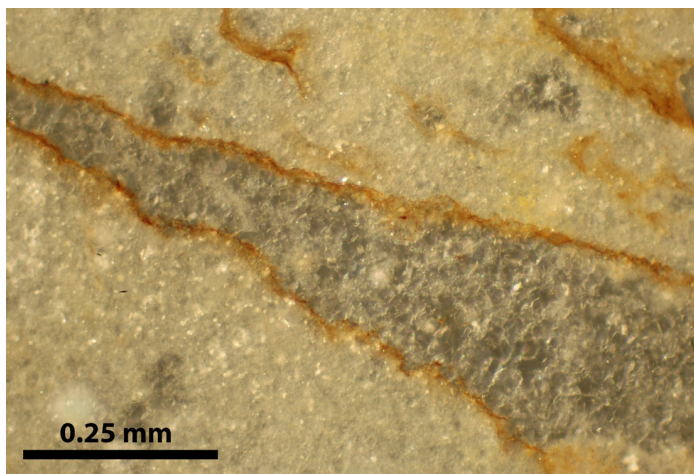
Figure 4. Borehole Sample Photos 2670-2850

Thin section slides of selected samples show predominantly very fine grain calcite crystals forming a limestone mud called micrite (**Figure 5**). There is an abundance of iron staining and less commonly hematite crystals. The iron that occurs is in the +3 oxidation state and will remain in solid form unless reduced to the +2 oxidation state. As the groundwater being produced has a dissolved oxygen content of 3- to 4-milligrams per liter (mg/L, see below), iron should remain mineralized rather than dissolved. Fossil fragments, and non-fossilized grains (peloids, ooids) also occur (**Figure 5d**), but are not well preserved. Rare dolomite rhombohedrons (~diamond shapes) occur as secondary minerals formed within micrite (**Figure 5f**).

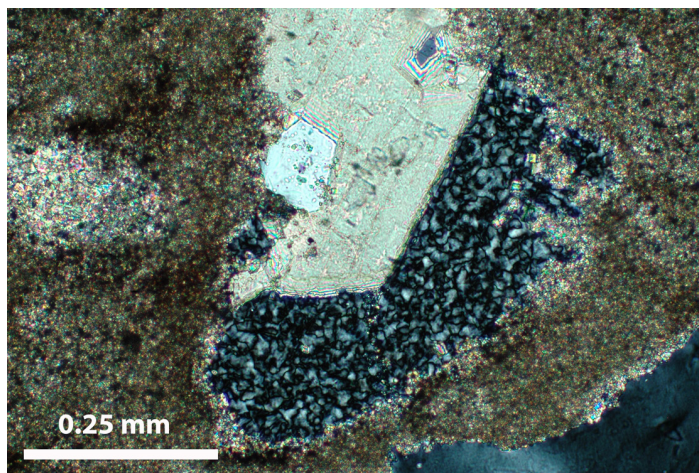
Although the Charles is known to include thick evaporite beds of anhydrite, up to 50 ft thick, these beds are absent in the CMRWA #3 borehole. It appears likely that the evaporite beds have been dissolved out of the formation, leaving only the carbonate rocks. The thicker evaporite beds, that may have an extent of 10s of square miles, could now be the high permeability features encountered at 2,320 and 2,400 ft. In the lower part of the well, below 2550 ft, additional inflow is believed to occur through more pervasive rock fractures. In this part of the well during drilling, cuttings were apparently being discharged into fractures, and then sloughing back into the borehole when drilling was stopped to make a drill pipe connection. This condition has a stuck tool risk, and ultimately resulted in the termination of drilling at 2,850 ft. Drill tools were at no time actually stuck in the borehole, however. In future wells, if possible, it is recommended that drilling proceed into the Lodgepole formation. In the CMRWA #3 well, this contact is estimated at about 2,930 ft below ground.



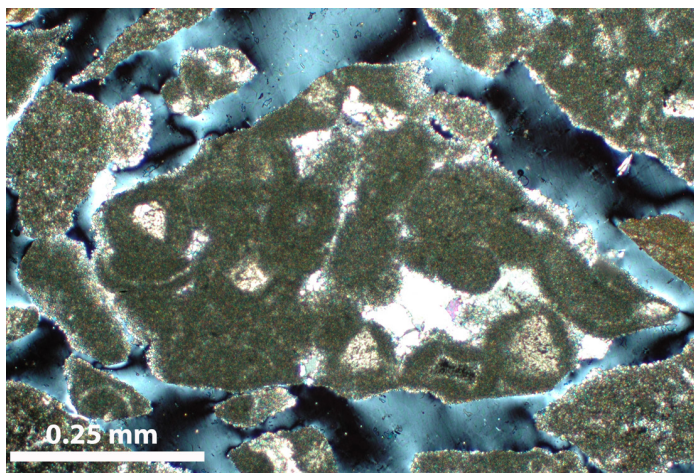
A. 2370ft, Iron minerals occurring as fracture fill or in stylolites within limestone. (100X, reflected light).



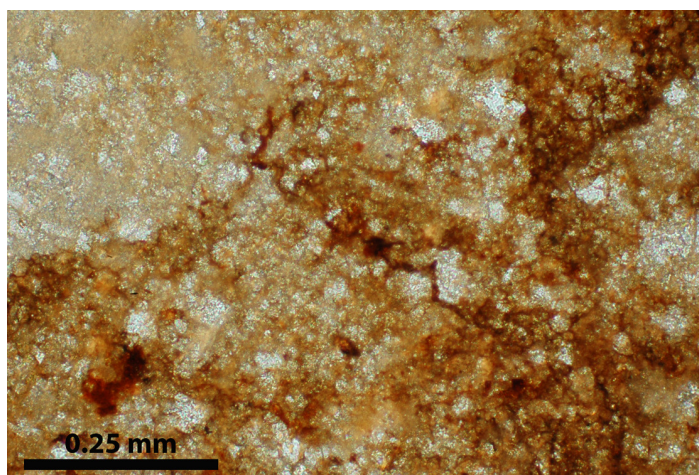
B. 2370 ft, Calcite fills a fracture with with iron coatings in limestone. (100X, reflected light).



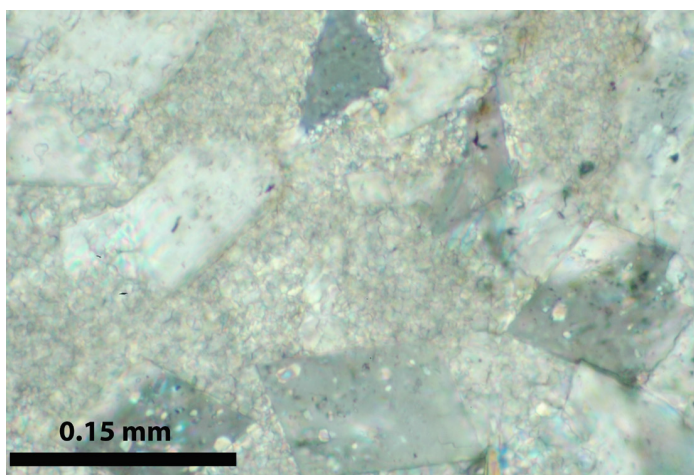
C. 2370 ft, Silica (chert) occurs as fine-grained micro-crystals adjacent to a large calcite crystal in limestone. (100X, cross-polarized light).



D. 2460 ft, Peloids and ooids with larger calcite crystals forming limestone. (100X, cross-polarized light).



E. 2760 ft, Concentrated iron deposits within limestone. (100X, reflected light).



F. 2760 ft, Large dolomite(?) crystals formed as secondary minerals in micrite (200X, cross-polarized light).

Figure 5. Thin Section Photos

3. HYDRAULIC TESTING

Pump testing of the CMRWA #3 well included a step rate test followed on the next day by a constant rate test (**Table 2**). A temporary pumping system was set into the well and operated during testing by the contractor. The testing plan and test instruments were provided by Western Groundwater Services. Discharge from the well was measured using a Siemens FUP1010 computer logging ultra-sonic flow meter. Pumping water level was measured using an In-Situ LevelTROLL 700 pressure transducer and data logger rated to 500 psig. The CMRWA #2 well was also monitored during the test. It is equipped with an In-Situ LevelTROLL 500 pressure transducer and data logger rated to 300 psig owned by the Authority. The logging frequency of the test instruments was set to 1-minute for the duration of testing.

Table 2. Pumping Test Schedule

Type	Start	End	Duration (hrs)
Step Rate	11/1/19 11:45 AM	11/1/19 5:46 PM	6.0
Constant Rate	11/2/19 9:59 AM	11/5/19 10:00 AM	72.0

3.1 Step Rate Pumping Test

Four sequential steps each with a 1.5 hour duration were completed for the step rate pumping test (**Figure 6**). Test rates ranged from 445- to 1562-gpm. The initial static water level was 205 feet below ground (ft bGL). At the end of testing, the well recovered to a slightly shallower static level of about 203 ft bGL.

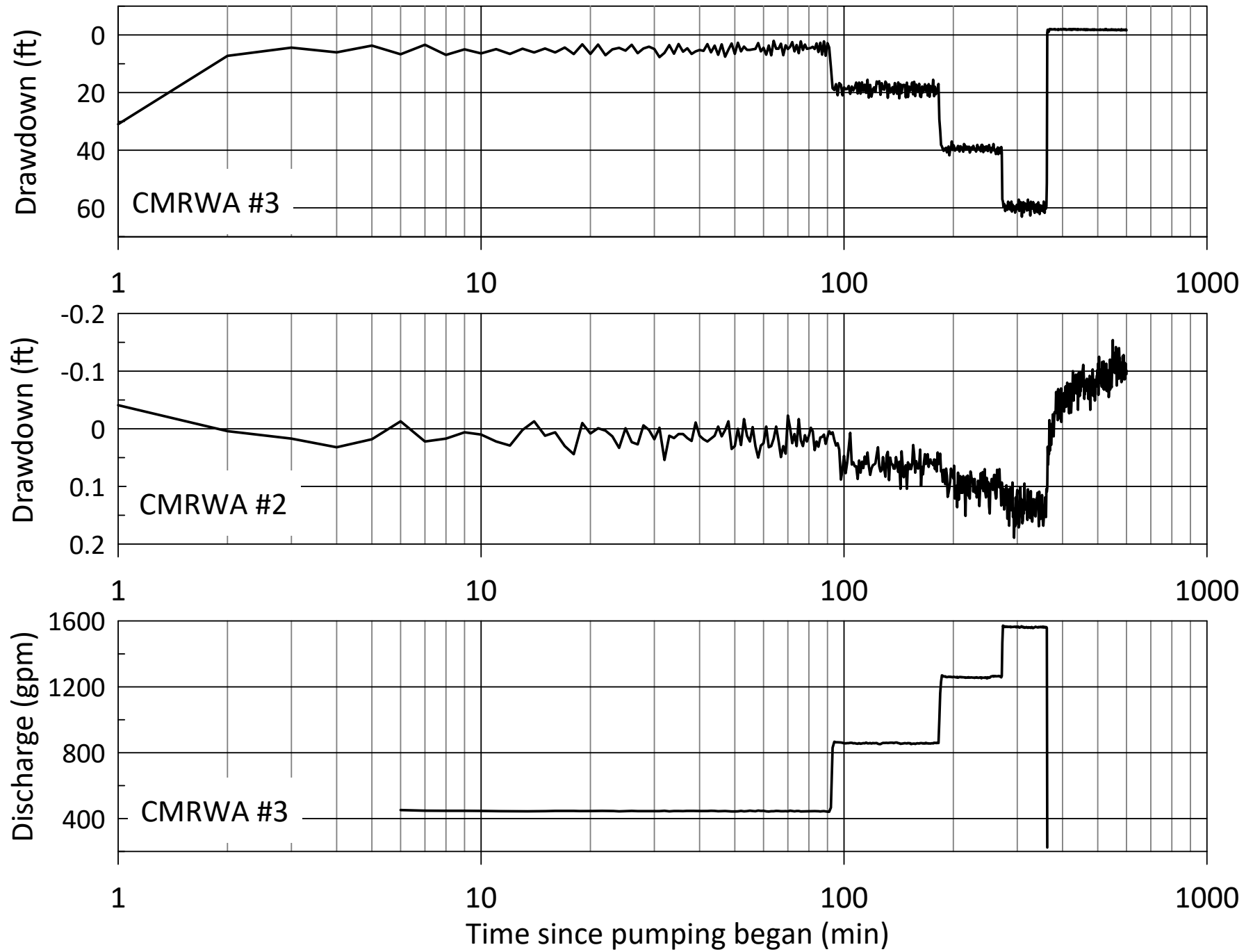
Test data were analyzed using the Hantush-Bierschenk method (**Figure 7** and **Figure 8**). Within the sensitivity of the test instruments, each step achieved a steady-state condition. There is consistent fluctuation of the drawdown data throughout the testing. At least some of this appears to be actual movement of the pumping water level. There is also a possibility that some of the fluctuation is related to electronic noise.

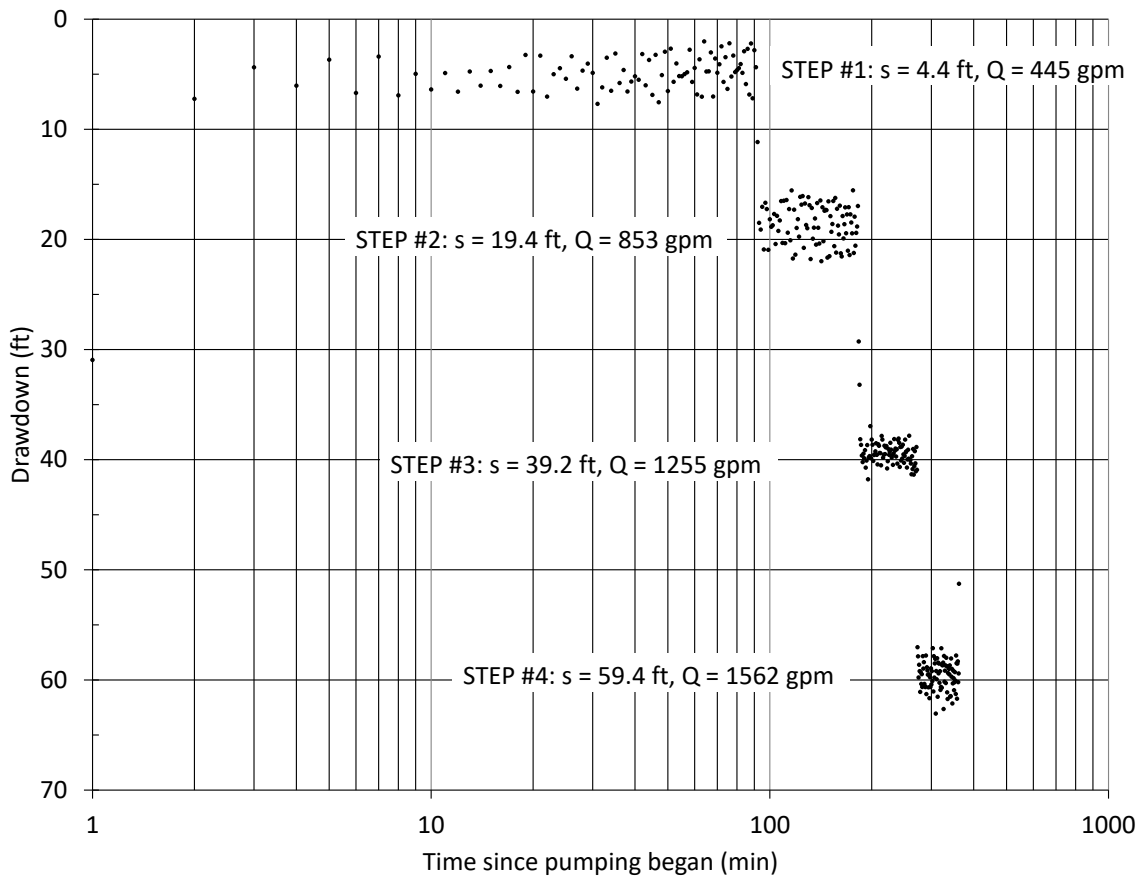
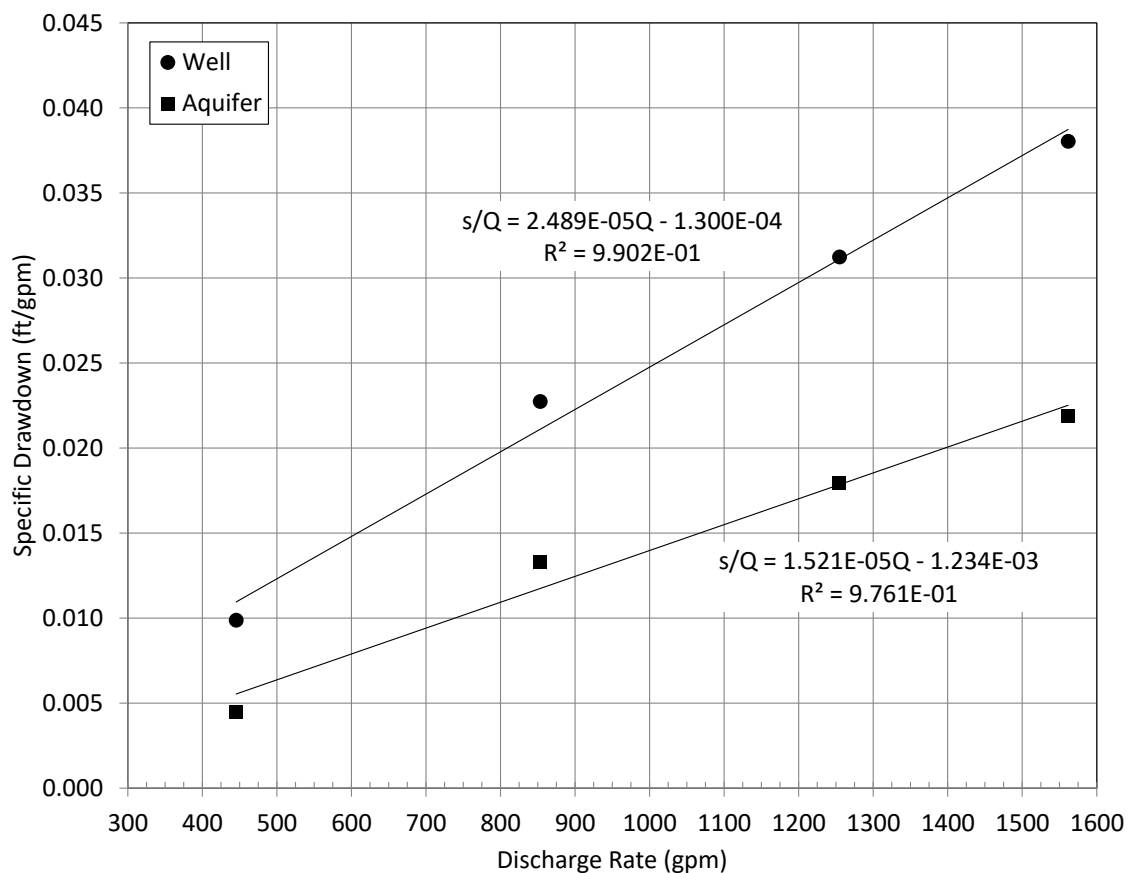
Observed drawdown in each step was dominated by turbulent head losses. About 40% to 55% of the head loss occurs during flow in the liner casing and intermediate casing below the pump.³ About 45% to 60% of the head loss is occurring due to fracture flow in the aquifer formation, and upflow in the open borehole.

A semi-logarithmic plot for the step rate test also illustrates the response to pumping in the CMRWA #2 well (**Figure 6**). The CMRWA #2 data also exhibit fluctuation, indicating that actual fluctuation in the aquifer was occurring during the test and is caused by the pumping well. Maximum drawdown in the CMRWA #2 well was about 0.2 ft at the end of the step rate test.

CRMWA #2 is open to one zone, which appears to correlate to the upper permeable zone in CMRWA #3 at 2,320 ft bGL. In CMRWA #2 this zone occurs at 2,241 ft bGL. The test data are showing there is a connection, but that the interference drawdown impact from the step rate test was negligible.

3 Pipe flow head losses were calculated using the Darcy-Weisbach and Colebrook formulas.

**Figure 6.** Step Rate Test Semi-Log Plots

**Figure 7.** Step Rate Test Analysis Plot**Figure 8.** Step Rate Test Regression Plot

3.2 Constant Rate Pumping Test

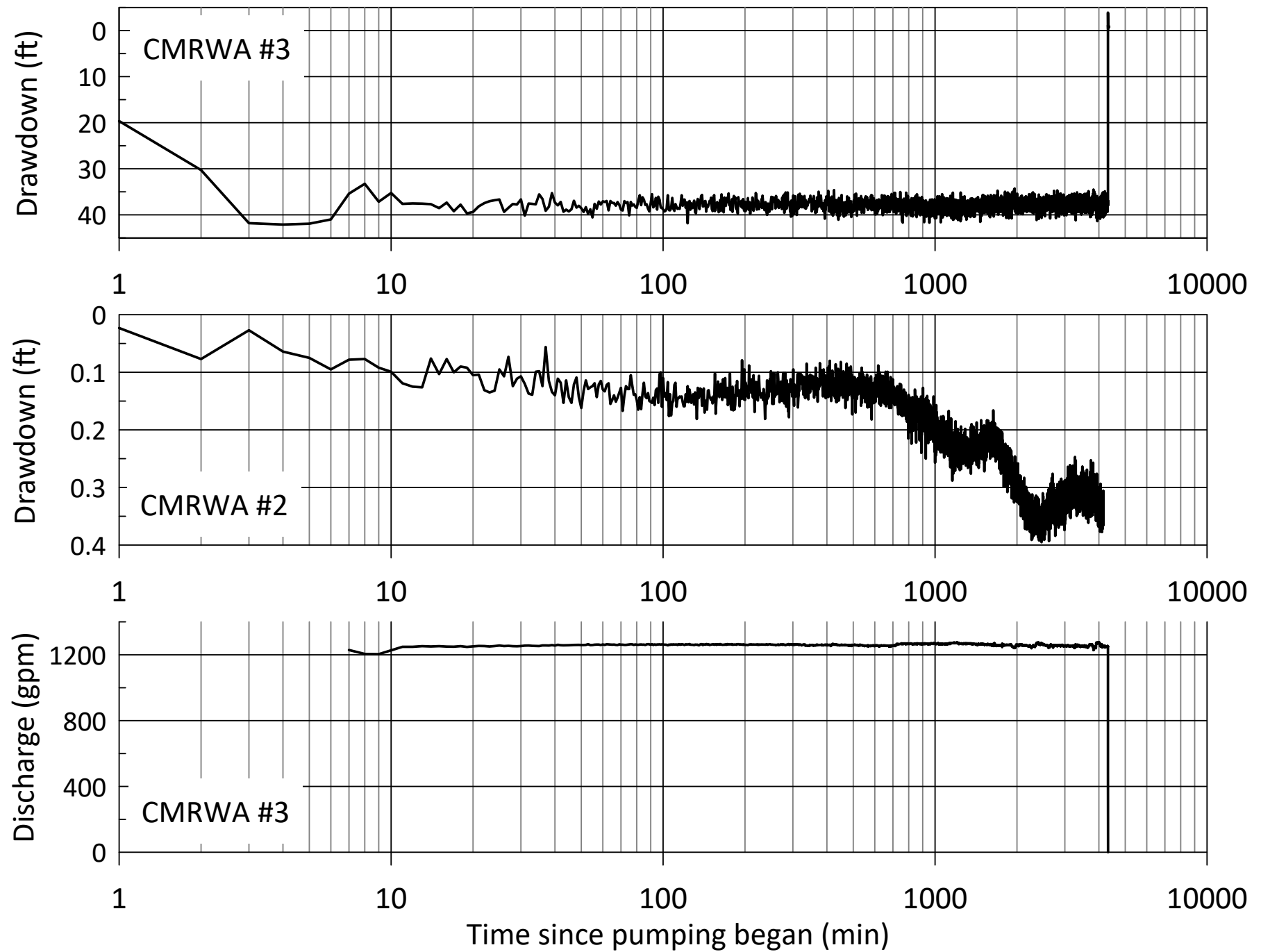
A 72-hour constant rate pumping test was run at an average rate of 1258 gpm (**Figure 9**).⁴ Maximum drawdown of about 37- to 39-ft was achieved immediately after starting the pump, resulting in a pumping water level of 240 to 245 ft bGL. This test meets the Circular DEQ-1 Standard for approval of a source capacity equal to the test rate (DEQ-1 3.4.2.1(d)(2)). The test data could support a greater capacity with a deviation request to DEQ. There is no technical basis to refute a rate less than 1,562 gpm.

Semi-logarithmic plots for the constant rate test illustrate the response to pumping at the CMRWA #2 well (**Figure 9**). Drawdown in CMRWA #2 is initiated within 1-minute after the pump was started in CMRWA #3. CMRWA #2 drawdown follows a generally linear pattern to a time of about 100 minutes. After about 500 minutes, CMRWA #2 drawdown increases sharply, as if a flow limiting boundary was impacting the response. This trend continues to about 2,500 minutes when the maximum interference drawdown of about 0.35 ft occurred. The response after this time reflects recharge, or possibly that the connection to the pumping well is being modified by the pump test (or possibly barometric effects). Overall, the data are indicating negligible interference drawdown at CMRWA #2 due to pumping in CMRWA #3 for the 72-hour test.

Hydraulically, it can be said the test results are remarkable. Whereas a typical confined aquifer well would exhibit continued drawdown until boundary features are intercepted, the CMRWA #3 well shows no such response. The zero slope of the data collected from CMRWA #3 suggests infinite transmissivity, which supports an interpretation of highly permeable fracture flow to the well bore. The rapid response of pumping at the CMRWA #2 well is indicating a storativity of close to zero, also a characteristic of fracture flow systems.

It is expected that after some duration of pumping, the aquifer drawdown will increase, perhaps rapidly, as flow limiting boundary conditions are realized. New data collected during use of the well may be more insightful as to the aquifer properties and boundaries.

⁴ A 7-day test was included in the project but was terminated early due to the steady-state response to pumping.

**Figure 9.** Constant Rate Test Semi-Log Plots

3.3 Design Capacity and Pumping Water Level

The CMRWA #3 well meets the DEQ standards for a pumping capacity of 1,258 gpm. Pumping water level at this rate is estimated from the step rate pumping test analysis and with consideration of seasonal fluctuation in the aquifer water level. Water level in the CMRWA #2 well has shown up to 36 ft of seasonal fluctuation over the past three years, with the seasonal high occurring from October to December. It is likely that static water level in CMRWA #3 is near to the seasonal high, assuming it responds similarly to CMRWA #2.

It follows from the step rate pumping test that drawdown for a given pumping rate in CMRWA #3 can be calculated from the following:

$$s = 2.5E-5*Q^2 - 1.3E-4*Q \quad \text{Eq. 1}$$

where,

s is drawdown (ft)
Q is pumping rate (gpm)

Static water level measured during November 2019, ranged from 203- to 205-ft bGL. Taking these values as the seasonal high, the low static water level may range from 239- to 241-ft bGL, or using a conservatively rounded value 250 ft. Pumping water level for CMRWA #3 at a given pumping rate, Q, may be conservatively estimated as:

$$PWL = 250 + s \quad \text{Eq. 2}$$

where,

s is the drawdown (ft) from Eq. 1

If a pump were to be selected to produce 1,200 gpm, as planned for the CMRWA #3 well, the drawdown is estimated from Eq. 1 as 36 ft. The pumping water level from Eq. 2 is estimated as 286 ft bGL. If a VFD is used, a total pump head of 300-ft may be feasible and would preserve the ability to produce at the target rate in the event greater drawdown is realized during sustained pumping.

4. WATER QUALITY

Field water quality data were collected during the step-rate and constant-rate pumping tests as grab samples using an Horiba U-52 multi-sensor. A comprehensive lab sample was collected at the end of the constant rate test for analysis of Safe Drinking Water Act and other general parameters (**Appendix B**).

Laboratory analysis for acute contaminants was completed by Bridger Analytical Lab, Bozeman, MT. Samples were delivered to the lab within 24-hours of sample collection. All other lab analyses were completed by Pace Analytical, Sheridan, WY (formerly Inter-Mountain Labs). Synthetic organics analyses were completed by Eurofins Eaton Analytical LLC under a subcontractor agreement with Pace. These labs are state certified for the analyses completed.

4.1 Field Parameters

Final values at the end of the constant rate test for field parameters indicate a slightly alkaline, oxidizing

groundwater of moderate mineral content (**Table 3**). There is a substantial difference in water temperature between the CMRWA #2 and CMRWA #3 groundwater. The mineral content of CMRWA #3 also is moderately greater than CMRWA #2. These differences are likely related to the greater depth and longer open borehole of CMRWA #3. Particulate content was negligible. Degassing of carbon dioxide initially clouded the grab samples, which cleared within a few minutes.

Table 3. Field Parameter Data

Well	Temp (° F) ^A	pH	ORP (V Eh)	SC (µS/cm)	Turb (NTU)	DO (mg/L)
CMRWA #3	59.2	7.2	0.211	732	0	4.43
CMRWA #2 ^B	49.2	7.5	0.297	598	0.5	4.45
^A From downhole pressure/temperature sensor; ^B From constant rate test Oct. 19, 2016. ORP – oxidation reduction potential; SC – specific conductance; Turb – turbidity; DO – dissolved oxygen.						

4.2 Lab Parameters

A summary of selected lab parameters follows:

- Total coliform and *E. Coli* were non-detect. Nitrate plus nitrite was measured at 0.148 mg/L as nitrogen. Both measurements are indicating pristine groundwater quality.
- Hardness was measured at 375 mg/L as calcium carbonate, which falls under the category of Very Hard. Total dissolved solids was measured at 500 mg/L, the secondary limit for this parameter. Alkalinity was 172 mg/L as calcium carbonate. The lab pH was 8.1.
- Iron and manganese were measured at 0.29 and 0.01 mg/L, respectively. These concentrations may have been derived from colloid particles eroding from downhole equipment or formation material, as both iron and manganese require anoxic conditions to exist dissolved in water. The lab process would have dissolved the iron and manganese from particulate in the samples.
- Fluoride and arsenic both occur in the Madison aquifer at other locations and can exceed drinking water standards (maximum contaminant level – MCL). Fluoride was detected at 1.1 mg/L, well below the MCL of 4.0 mg/L.⁵ Arsenic was non-detectable at a detection limit of 5 µg/L.
- Radium-226 was detectable at 0.5 pCi/L. Radium-228 was non-detect, resulting in a combined total of 0.5 pCi/L, well below the MCL of 5.0 pCi/L. Gross Alpha was non-detect.
- Analysis for volatile and synthetic compounds were non-detect for all parameters.

Table 4 provides a comparison of selected parameters for CMRWA #2 and CMRWA #3. As stated above, differences between the wells are most likely attributed to the greater depth and multiple water bearing zones occurring in CMRWA #3. The single producing zone of CMRWA #2 also occurs in CMRWA #3.

⁵ A concentration of 2.0 mg/L is a secondary standard for Fluoride.

Table 4. Water Quality Comparison

Parameter	Units	CMRWA #3	CMRWA #2
Sample Date	--	11/5/2019	10/19/2016
pH	s.u.	8.1	8.3
Specific Conductance	µS/cm	753	589
Total Dissolved Solids	mg/L	500	360
Total Alkalinity	mg/L as CaCO ₃	172	166
Hardness	mg/L as CaCO ₃	375	302
Chloride	mg/L	35	<1
Fluoride	mg/L	1.1	0.7
Sulfate	mg/L	162	146
Calcium	mg/L	104	81
Magnesium	mg/L	28	25
Potassium	mg/L	1	1
Sodium	mg/L	3	3

4.3 Stable Isotopes and Tritium

Stable isotopes were measured in several Madison aquifer discharges in Judith Basin in 2016 as part of a spring study. CMRWA #3 groundwater was evaluated for the same isotopes for comparison. The analysis was completed at the University of Arizona Environmental Isotope Laboratory, Tucson, AZ. This lab also completed the analyses for the spring study.

Stable isotope analysis results show similarity to CMRWA #2 (**Table 5**). Detectable tritium is indicating a groundwater that was recharged from the atmosphere less than approximately 70-years ago.

Table 5. Isotope Comparison

Parameter	CMRWA #3	CMRWA #2
Sample Date	11/5/2020	10/19/2016
δO(18/16) (‰) (VSMOW)	-18.2	-18
δH(2/1) (‰) (VSMOW)	-139.5	-138.2
δC(13/12) (‰) (VPDB)	-2.4	-3.4
δS(34/32) (‰) (CDT)	20.7	18.9
Tritium (TU) (Error)	3.0 (0.40)	5.9 (0.28)

4.4 PHREEQC Modeling

The U.S. Geological Survey geochemical modeling software was used to evaluate speciation and solubility indices for the CMRWA #3 water sample collected on 11/5/2019 (**Appendix B**). The ion balance error was -1.1% indicating a sufficiently accurate analysis. Modeling results indicate a carbon dioxide gas partial pressure of 0.01 atm, or 40 times greater than atmospheric. Calcite and quartz both were calculated to have saturation indices of 0.0, indicating equilibrium with limestone and silica (quartz was undersaturated in CMRWA #2 groundwater). Gypsum and anhydrite were undersaturated, indicating these minerals likely are not present in the formation contributing groundwater to the well.

5. CONCLUSIONS AND RECOMMENDATIONS

- CMRWA #3 was drilled to a depth of 2,850 ft below ground and is producing groundwater from the Madison aquifer. A 14-inch diameter casing with inside diameter of 13.25 inches extends from surface to a depth of 1,000 ft. A liner casing at 9.625-inch diameter extends from 947- to 2,163-ft. Acid stimulation of the well used 16,000 gallons of 20% hydrochloric acid and is estimated to have improved well capacity by a factor of 2.5.
- Static water level in the well in November 2019 was 203 ft below ground and is estimated to be near to the seasonal high. Static water level may decline by about 35 ft, as occurs in the CMRWA #2 well. Monitoring data will be needed to verify seasonal fluctuation, as CMRWA #3 is open to more water bearing zones than CMRWA #2.
- The well was pump tested at up to 1,563 gpm during the step rate test with 60-ft of drawdown. A 72-hour constant rate test was run at an average rate of 1,258 gpm with 37- to 39-ft of drawdown. The well meets the DEQ design standard for the rate of 1,258 gpm.
- Maximum drawdown occurred immediately after pumping was started and full recovery occurred immediately after pumping had stopped. This response to pumping is indicating high permeability fractures were intercepted by the well bore. It is likely that with prolonged use additional drawdown will be realized as boundaries are intercepted by the cone of depression.
- Interference drawdown at CMRWA #2 was measured at less than 0.2 ft during the step rate pumping test and 0.4 ft during the constant rate pumping test. The common zone of these wells was found to be less permeable in CMRWA #3. CMRWA #3 is also producing groundwater from multiple zones. The wells are offset 2,200 ft.
- Water quality testing of well discharge indicates compliance with primary and secondary drinking water standards. There is no water treatment required to use the well water in a public water system. The well water is classified as Very Hard. Consumers will likely desire to install softeners. There is a likelihood also for calcium carbonate precipitation in hot water heaters and water system piping.
- At the target rate for the CMRWA #3 well of 1,200 gpm, it is estimated the maximum pumping water level will be about 286 ft below ground. For pump selection, a pumping water level of 300 ft and a pump setting of 500 ft is recommended. If a VFD is used some additional margin can be gained by achieving the target rate at 50-55 Hertz, although impacts to motor horsepower should be considered.

- In the event CMRWA #2 experiences declining production, or greater production is desired, the well could be deepened to a similar depth as CMRWA #3. Increasing well depth would be expected to also increase hardness and temperature of the well water.
- The project requires two additional wells also with target rates of 1,200 gpm. These wells could be constructed similarly to CMRWA #3, using the same casing sizes and including acid stimulation treatment.
- Consideration can be given to locating future wells at closer spacing, although there may also be a possible benefit to maintaining the existing well field plan. A closer spacing saves costs on infrastructure and may reduce risk of an underperforming well. The approximately 2,000 ft offsets of the wellfield plan may provide some degree of protection from aquifer dewatering if future wells intercept new producing zones.

APPENDIX A – WELL DATA

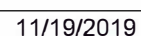
HISTORY OF HOLE
CMRWA #3

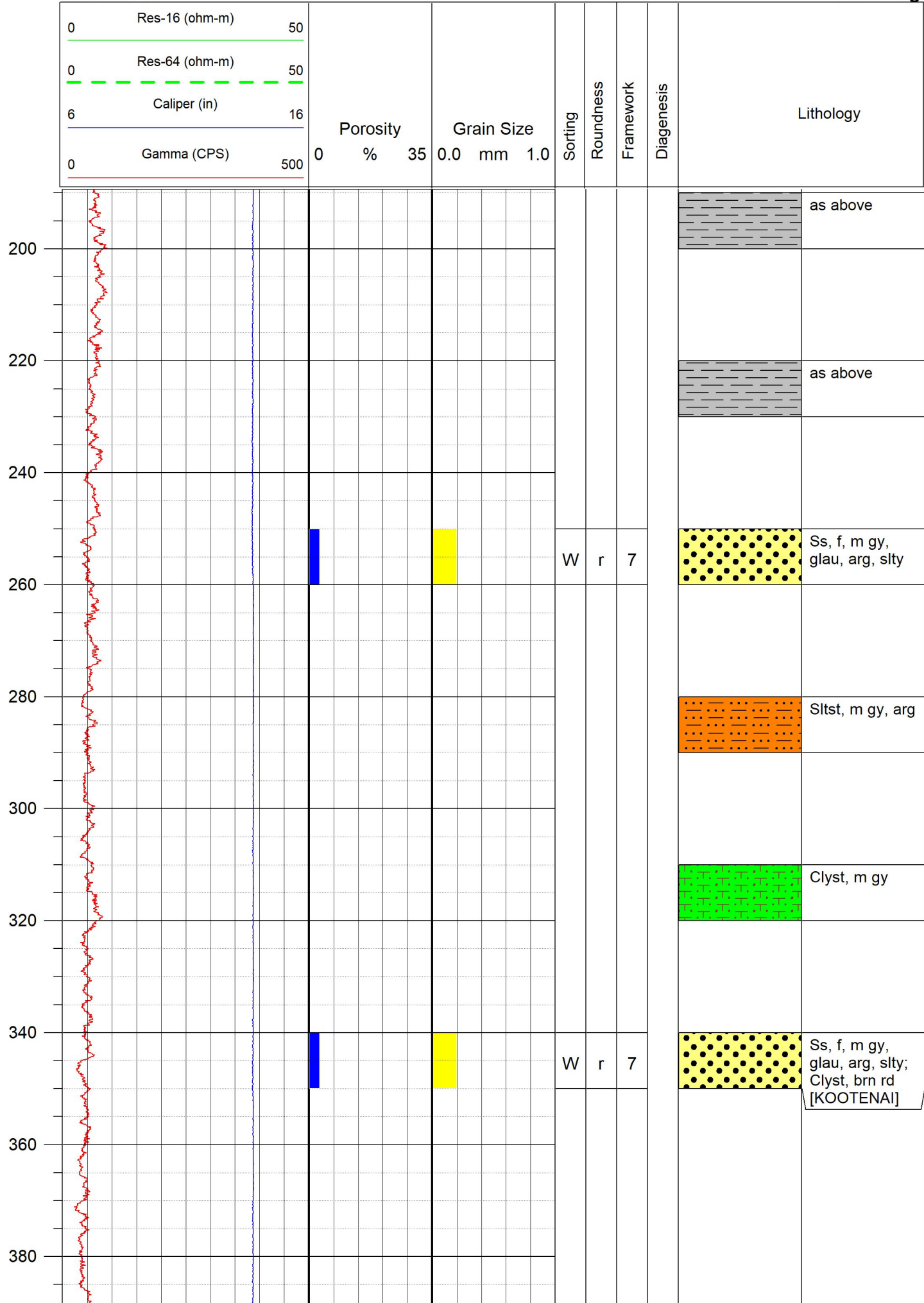
OWNER:	Central MT Regional Water Authority		
	Roundup, MT		
	Monty Sealey (406) 323-2755		
ENGINEER:	Great West Engineering, Inc.		
	Helena, MT (406) 449-8627		
	Bob Church (406) 495-6177		
HYDROGEOLOGIST:	Western Groundwater Services, LLC		
	Bozeman, MT (406) 585-5947		
	Mark Cunnane (406) 579-1493		
CONTRACTOR:	Hydro Resources		
	Fort Lupton, CO (303) 857-7540		
	Dallas Werner (lic. drill) (303) 917-5977		
	Tyler Curtis (site sup.) (775) 421-6536		
	Ryan Brooks (mud eng.) (303) 720-4775		
	Jim Hale (drill mgr) (775) 304-3809		
NOTICE TO PROCEED:	9/10/2019		Bold = payable quantity
CONTRACT TIME:	70		
TOTAL FEES TO-DATE:	\$ 1,531,038.00		
DATE	DAY	TIME	ACTIVITY
09/10/19	Tuesday	1	Mobilization (preparation of drilling site)
09/11/19	Wednesday	2	Mobilization (preparation of drilling site)
09/12/19	Thursday	3	Mobilization (preparation of drilling site)
09/13/19	Friday	4	Mobilization (preparation of drilling site)
09/14/19	Saturday	5	Mobilization (preparation of drilling site)
09/15/19	Sunday	6	Mobilization (preparation of drilling site)
09/16/19	Monday	7	Mobilization (drilled & set conductor casing, 20" in 36" borehole to 40 ft below ground)
09/17/19	Tuesday	8	Mobilization (rigging up to drill 17-1/2" borehole)
09/18/19	Wednesday	9	Mobilization (rigging up to drill 17-1/2" borehole)
09/19/19	Thursday	10	Mobilization 50%, 17-1/2" Drilling 123 LF (Total Depth 123 ft)
09/20/19	Friday	11	17-1/2" Drilling 308 LF (Total Depth 431 ft)
09/21/19	Saturday	12	17-1/2" Drilling 246 LF (Total Depth 677 ft)
09/22/19	Sunday	13	17-1/2" Drilling 210 LF (Total Depth 887 ft)
09/23/19	Monday	14	17-1/2" Drilling 100 LF (Total Depth 987 ft)
09/24/19	Tuesday	15	17-1/2" Drilling 18 LF (Total Depth 1005 ft)
09/25/19	Wednesday	16	14.00" Intermediate Casing Installed 1000 LF
09/26/19	Thursday	17	Waiting on cement
09/27/19	Friday	18	Waiting on cement
09/28/19	Saturday	19	Waiting on cement
09/29/19	Sunday	20	Rig down for generator/swivel repairs
09/30/19	Monday	21	Rig down for generator/swivel repairs
10/01/19	Tuesday	22	12-1/4" Drilling 155 LF (1005 to 1160 ft)
10/02/19	Wednesday	23	12-1/4" Drilling 132 LF (1160 to 1292 ft)
10/03/19	Thursday	24	12-1/4" Drilling 118 LF (1292 to 1410 ft)
10/04/19	Friday	25	12-1/4" Drilling 148 LF (1410 to 1558 ft)
10/05/19	Saturday	26	12-1/4" Drilling 431 LF (1558 to 1989 ft)
10/06/19	Sunday	27	12-1/4" Drilling 44 LF (1989 to 2033 ft)
10/07/19	Monday	28	12-1/4" Drilling 44 LF (2033 to 2165 ft)
10/08/19	Tuesday	29	Open Hole Wire Line Logging 1 EA
10/09/19	Wednesday	30	Setting liner casing
10/10/19	Thursday	31	Liner Casing Installed 1209 LF; LINER HANGER INSTALLED 1 EA.
10/11/19	Friday	32	Waiting on cement
10/12/19	Saturday	33	Waiting on cement
10/13/19	Sunday	34	Waiting on cement

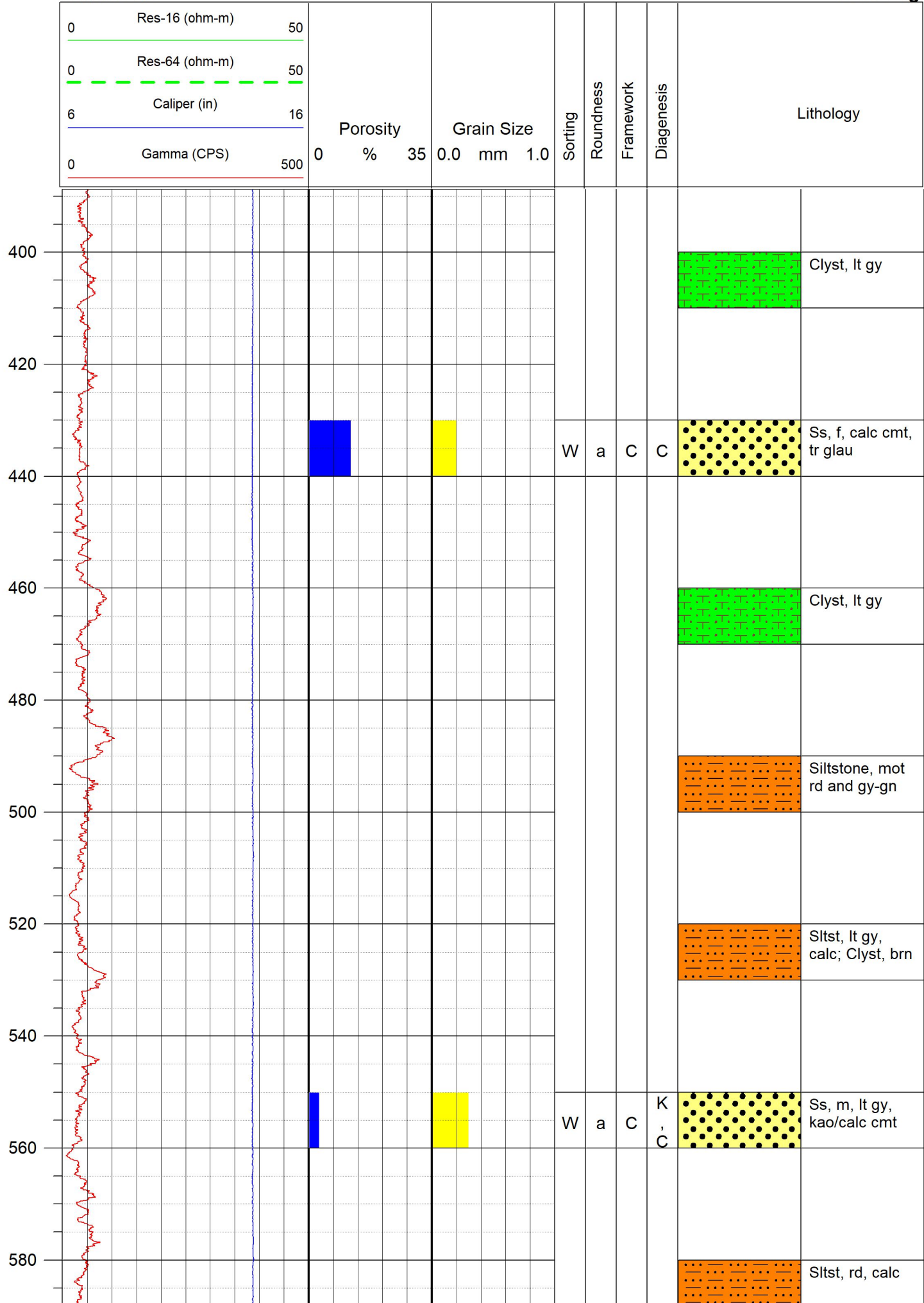
HISTORY OF HOLE
CMRWA #3

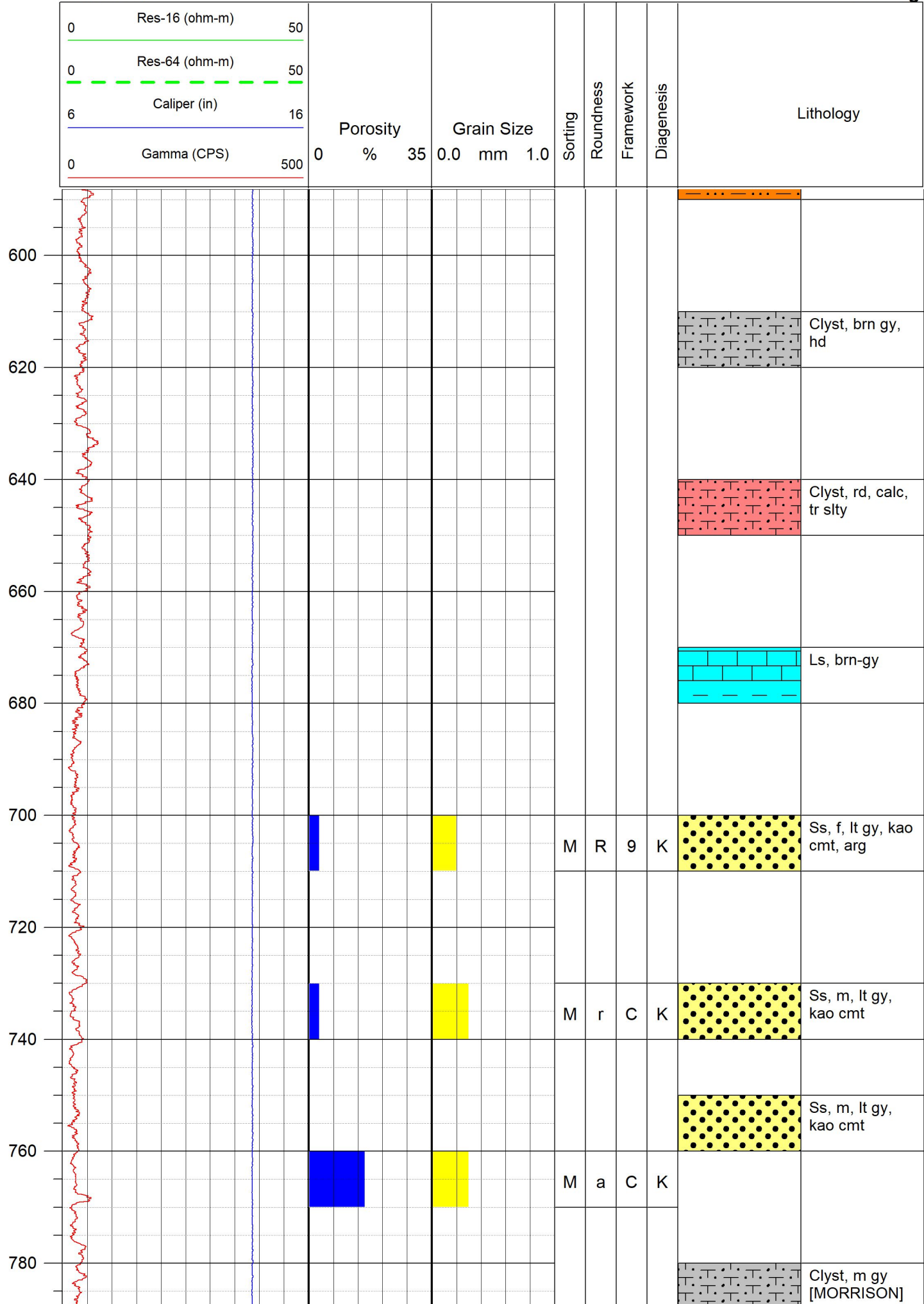
DATE	DAY	TIME	ACTIVITY
10/14/19	Monday	35	Air Drilling System Mobilization 1 LS; 8-3/4" Open Hole Drilling (AIR) 132 LF (Total Depth 2297 ft)
10/15/19	Tuesday	36	8-3/4" Open Hole Drilling (Air) 397 LF (Total Depth 2694 ft)
10/16/19	Wednesday	37	8-3/4" Open Hole Drilling (Air) 156 LF; C-1: 8-3/4" Open Hole Drilling Addition 28 LF (Total Depth 2850 ft); Development 8 HRS; Mobilization (50%)
10/17/19	Thursday	38	Preparing for acid treatment of well
10/18/19	Friday	39	Preparing for acid treatment of well
10/19/19	Saturday	40	Preparing for acid treatment of well
10/20/19	Sunday	41	Preparing for acid treatment of well
10/21/19	Monday	42	Acid-Fracture Stimulation 1 EA
10/22/19	Tuesday	43	Flow Back Water Disposal 17 Trips; Development 3 HRS (Total 11 HRS)
10/23/19	Wednesday	44	Flow Back Water Disposal 10 Trips; Development 10.5 HRS (Total 21.5 HRS)
10/24/19	Thursday	45	Flow Back Water Disposal 8 Trips; Development 7 HRS (Total 28.5 HRS); Demobilizing drilling equipment
10/25/19	Friday	46	Demobilizing drilling equipment
10/26/19	Saturday	47	Demobilizing drilling equipment
10/27/19	Sunday	48	Demobilizing drilling equipment
10/28/19	Monday	49	Mobilizing for pump testing
10/29/19	Tuesday	50	Mobilizing for pump testing
10/30/19	Wednesday	51	Mobilizing for pump testing
10/31/19	Thursday	52	Mobilizing for pump testing
11/01/19	Friday	53	Step rate pumping test. Pumping Test Hourly 6 HRS
11/02/19	Saturday	54	Constant rate pumping test. Pumping Test Hourly 14 HRS (Total 20 hrs)
11/03/19	Sunday	55	Constant rate pumping test. Pumping Test Hourly 24 HRS (Total 44 hrs)
11/04/19	Monday	56	Constant rate pumping test. Pumping Test Hourly 24 HRS (Total 68 hrs)
11/05/19	Tuesday	57	Constant rate pumping test. Pumping Test Hourly 10 HRS (Total 78 hrs); Temporary Pumping System 1 EA
11/06/19	Wednesday	58	Demobilizing pumping system
11/07/19	Thursday	59	Disinfection; weld cap onto top of casing
END HISTORY REPORT			

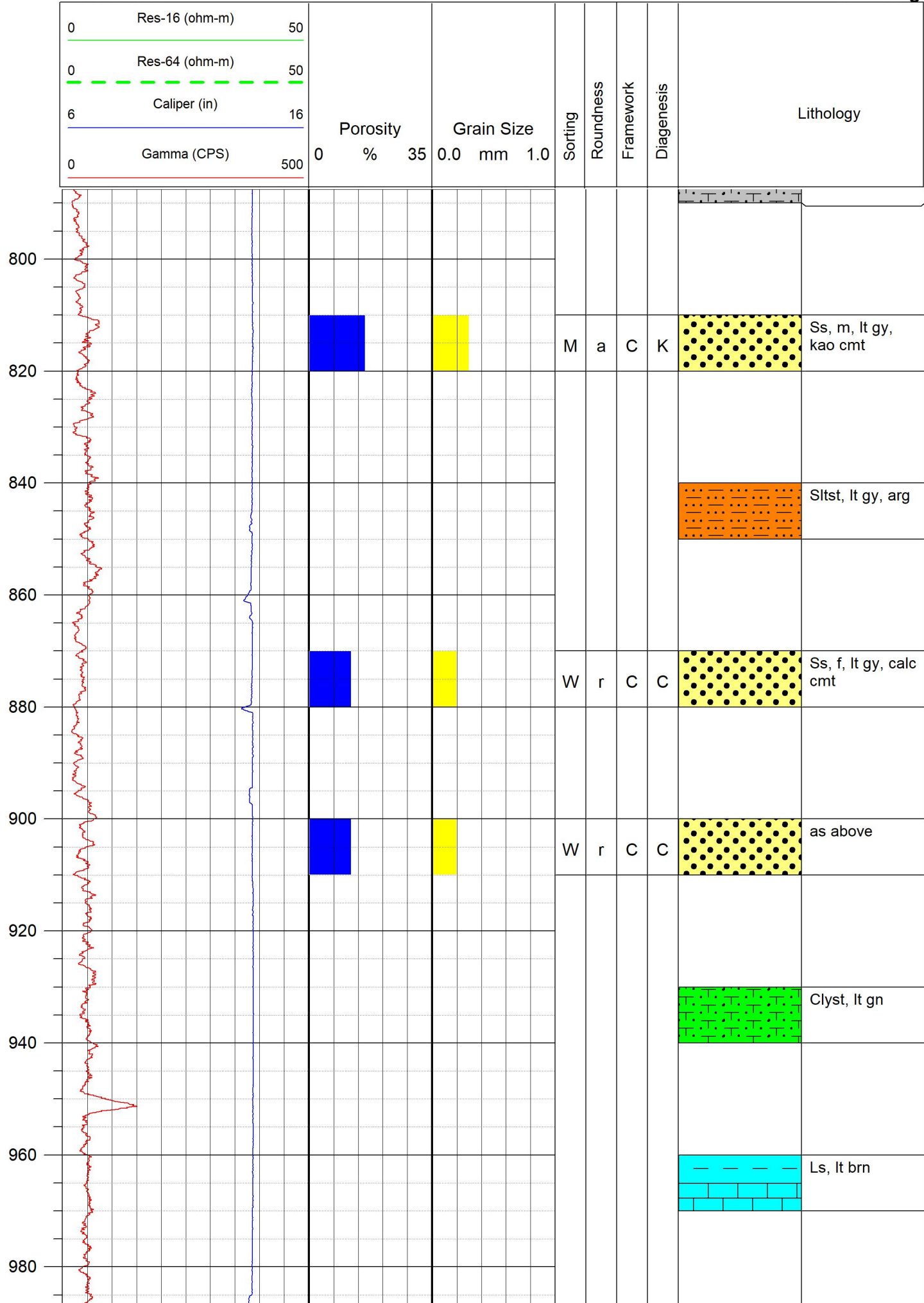
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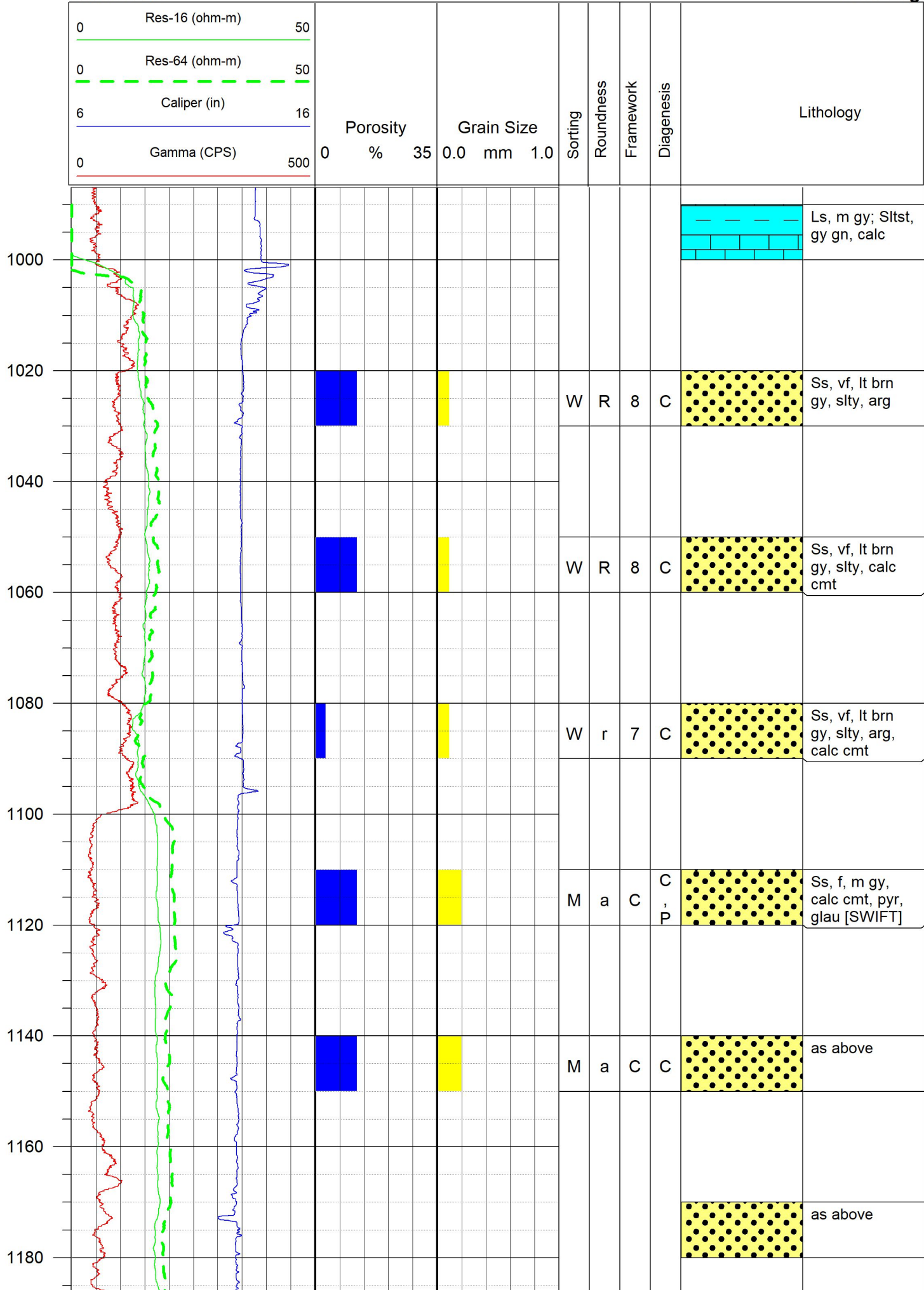


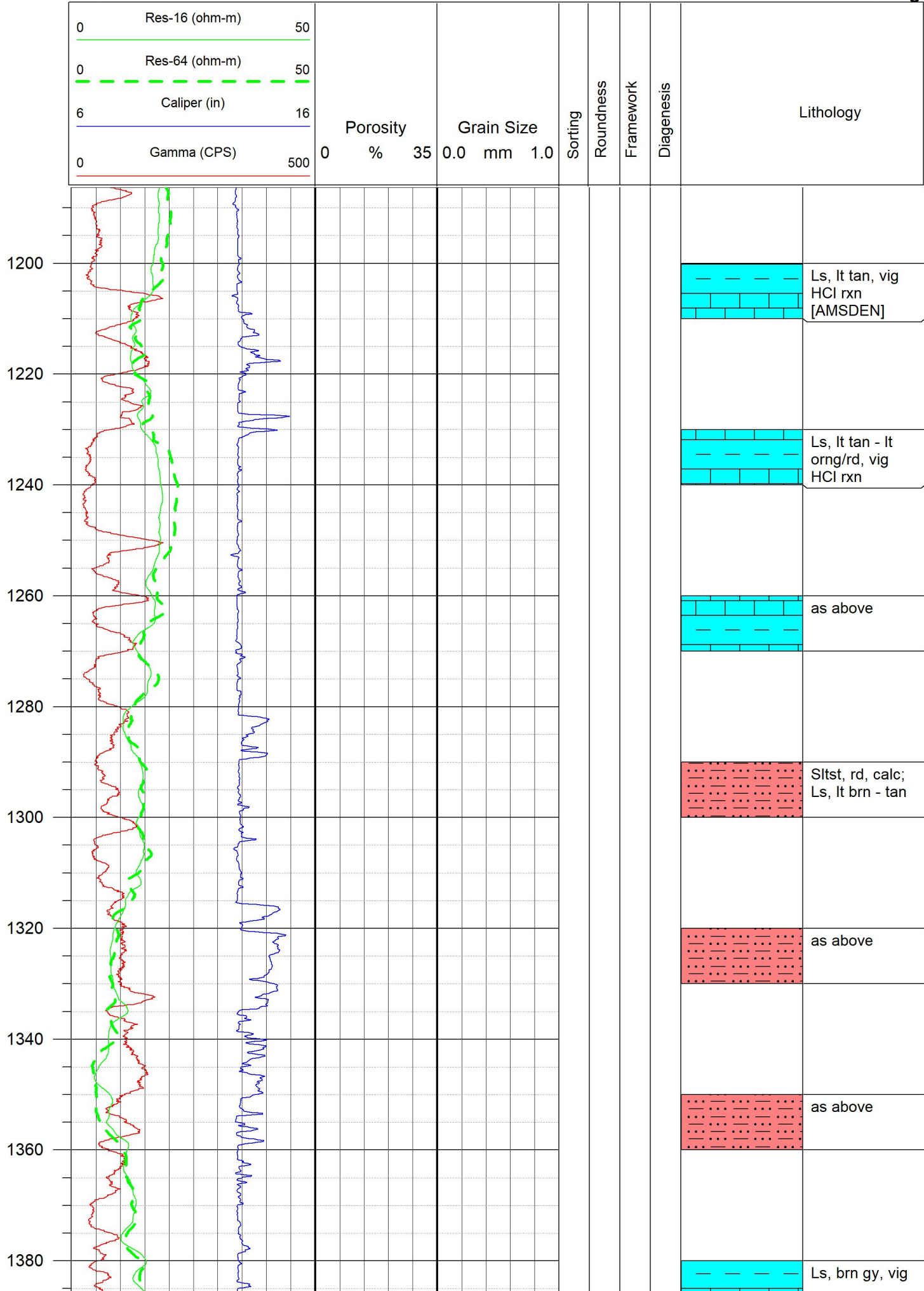
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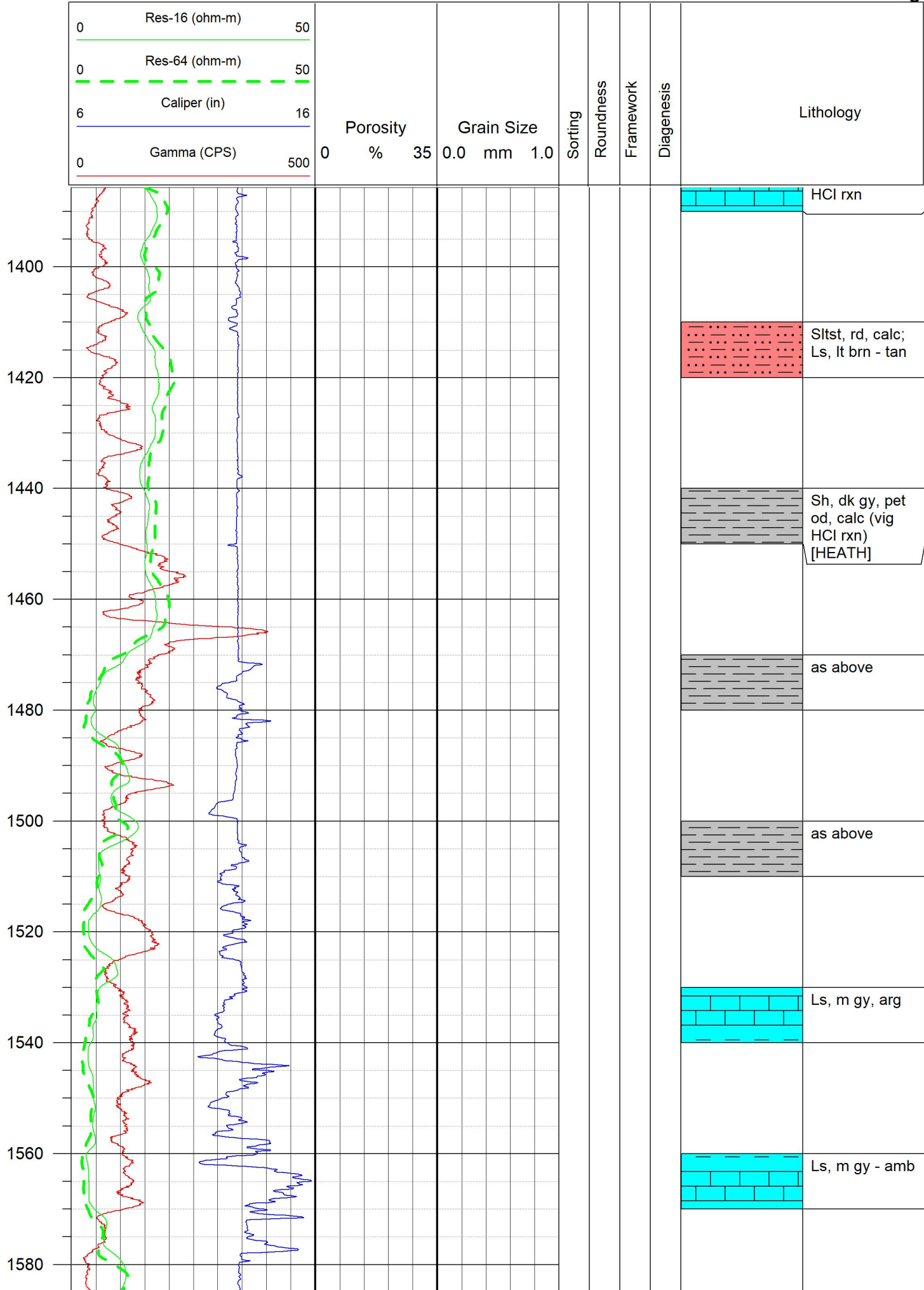
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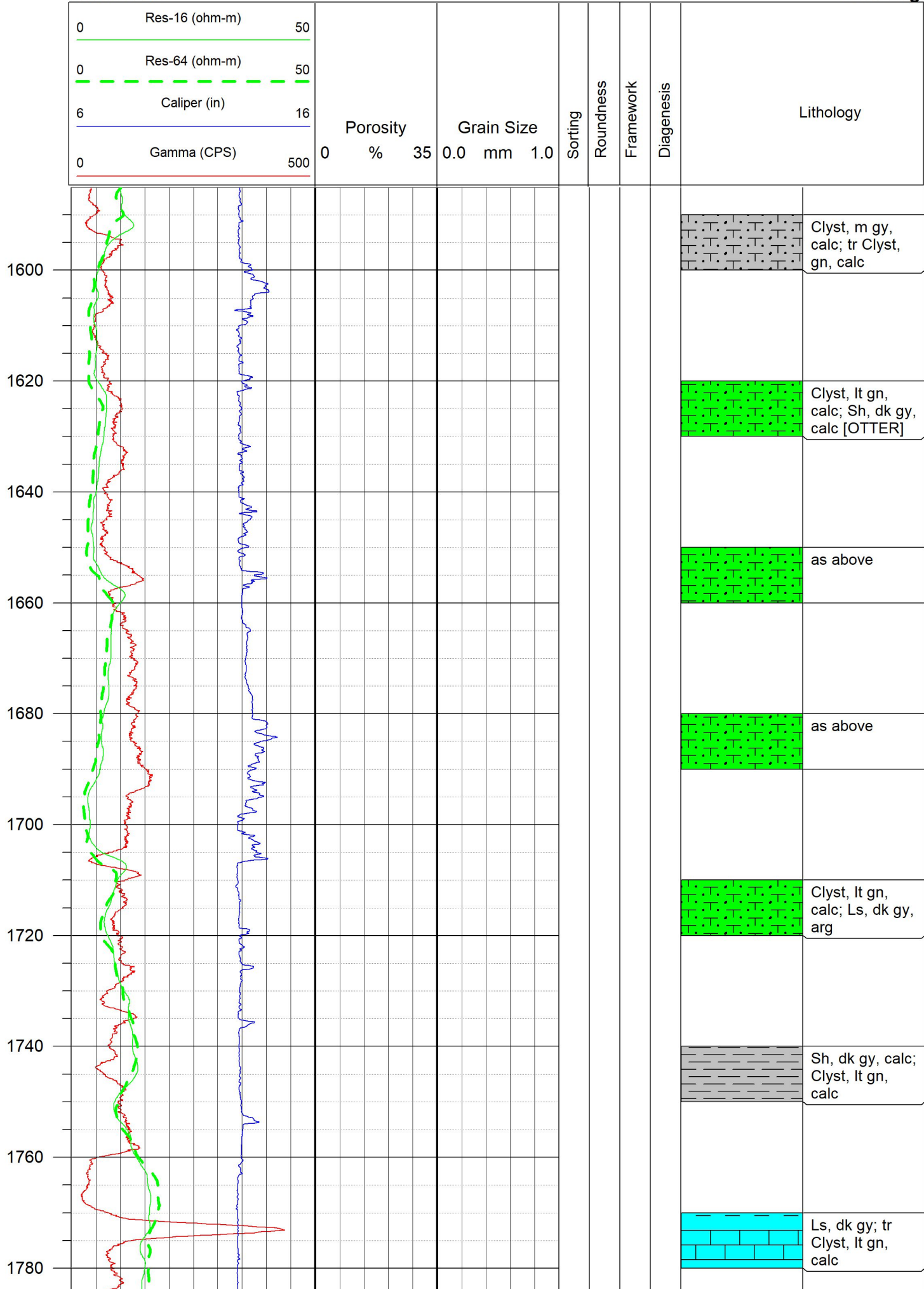
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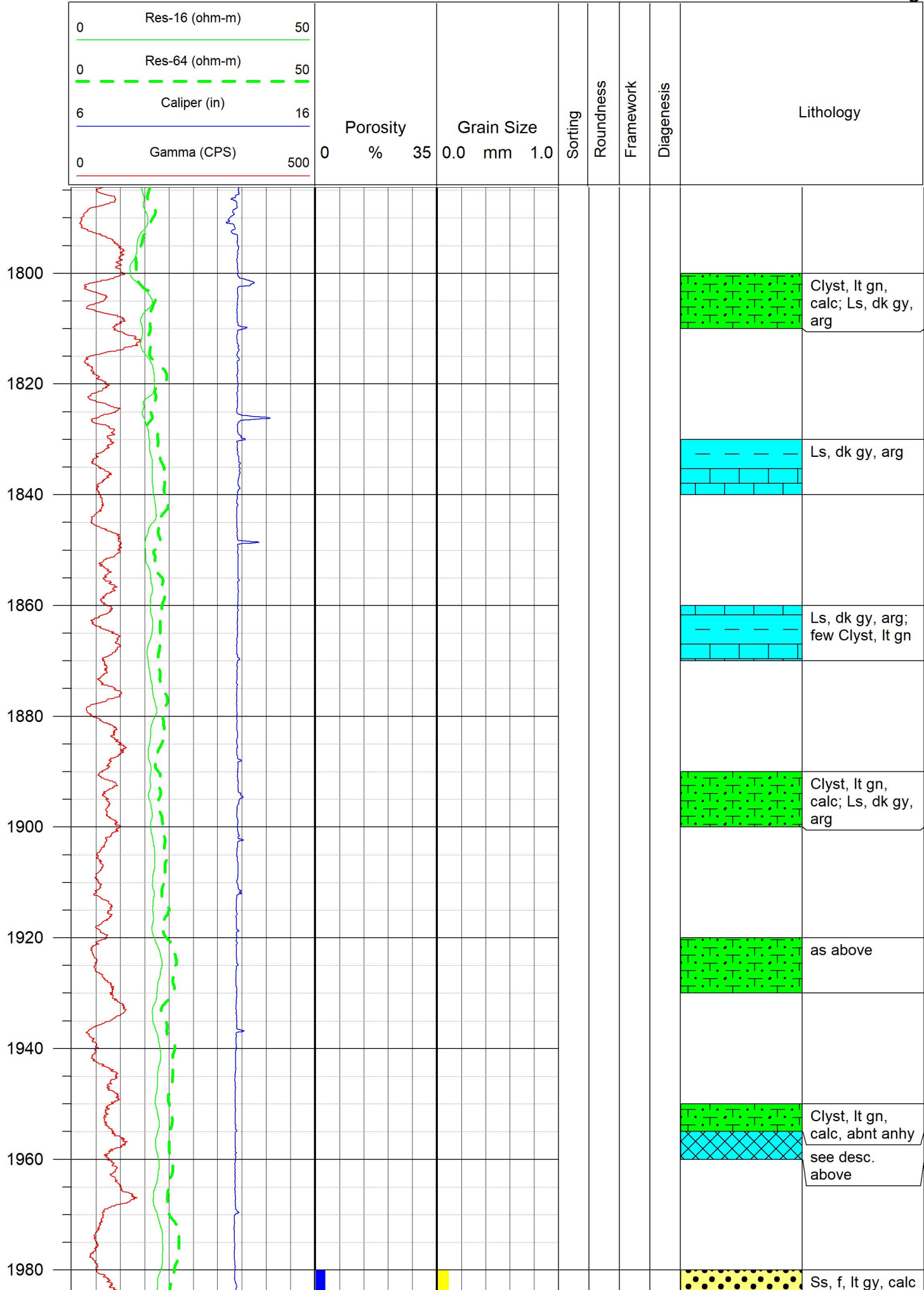
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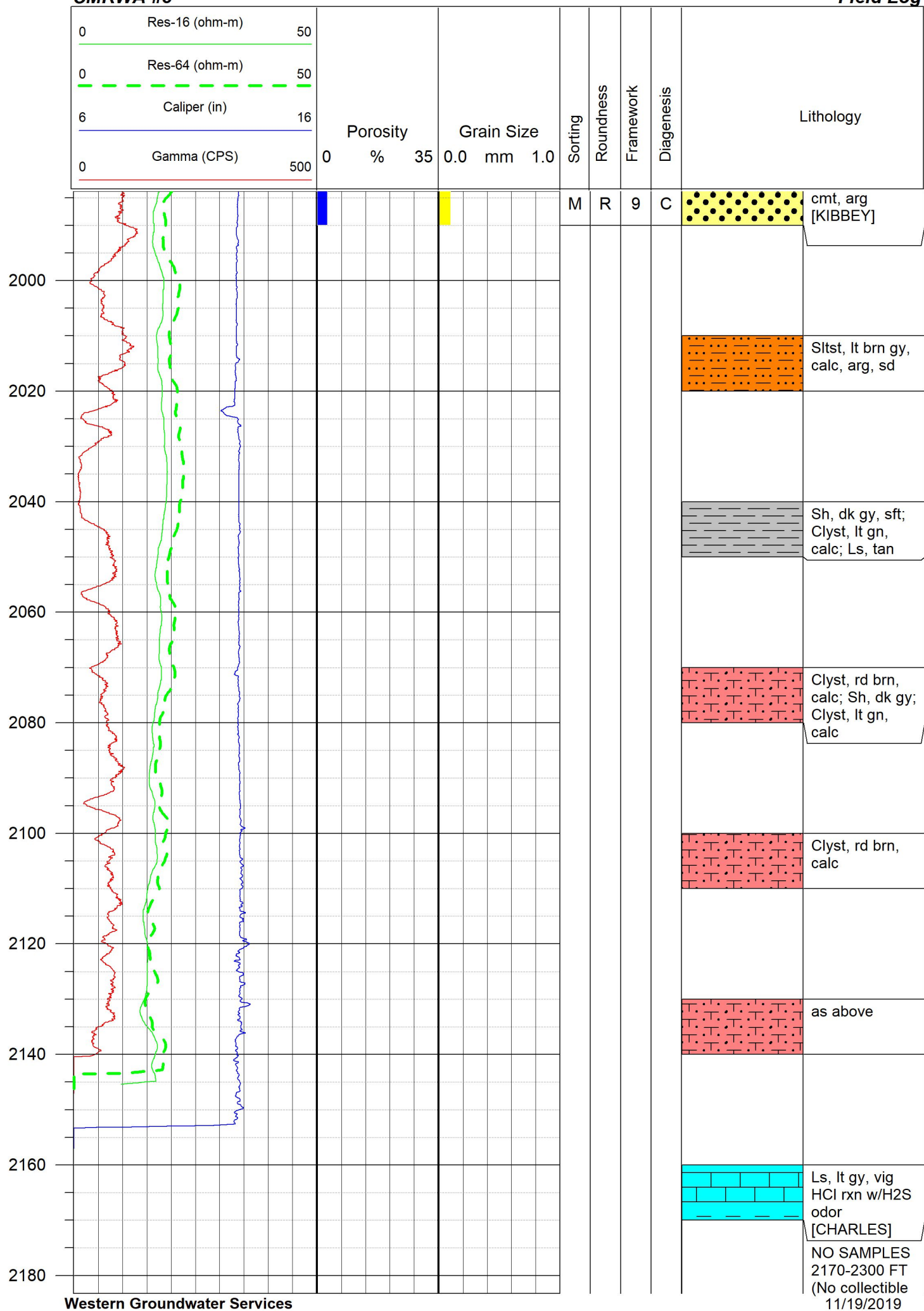
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CMRWA #3
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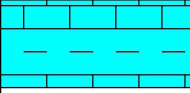
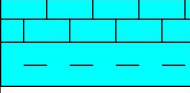
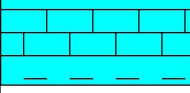
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Field Log


CMRWA #3
Field Log


Field Log



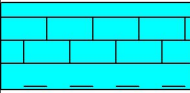
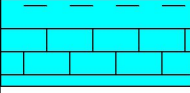
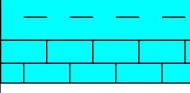
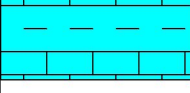
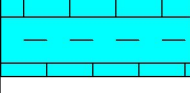
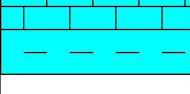
CMRWA #3
Field Log

0 Res-16 (ohm-m) 50 0 Res-64 (ohm-m) 50 6 Caliper (in) 16 0 Gamma (CPS) 500	0 Porosity % 35 0.0 Grain Size mm 1.0			Sorting	Roundness	Framework	Diagenesis	Lithology	
2200									
2220									
2240									
2260									
2280									
2300									
2320								 Ls, wh-lt tan, mic chps, vig HCl rxn w/H2S odor	
2340								 Ls, lt brn - pk - wh - lt gy, vig HCl rxn, w/H2S odor	
2360									
2380								 Ls, wh, suc, vig HCl rxn, no odor; Ls, lt brn; Ls, lt gy	

CMRWA #3
Field Log

0 Res-16 (ohm-m) 50 0 Res-64 (ohm-m) 50 6 Caliper (in) 16 0 Gamma (CPS) 500	0 Porosity % 35 0.0 Grain Size mm 1.0			Sorting	Roundness	Framework	Diagenesis	Lithology	
2400									
2420									Ls, lt brn - wh, mas, suc, vig HCl rxn, w/H₂S odor WATER ZONE #2 (~600 GPM)
2440									Ls, lt brn, suc, mod HCl rxn, no odor
2460									Ls, lt brn - pk - lt gy, vig HCl rxn, mod H₂S odor
2480									
2500									Ls, lt brn - pk - wh, vig HCl rxn, w/H₂S odor
2520									Ls, lt brn, lt pk brn, vig HCl rxn, w/H₂S odor
2540									
2560									Ls, lt brn, vig HCl rxn (pinhead chips from this sample on, except 2760ft)
2580									

CMRWA #3
Field Log

0 Res-16 (ohm-m) 50 0 Res-64 (ohm-m) 50 6 Caliper (in) 16 0 Gamma (CPS) 500	0 Porosity % 35	0.0 Grain Size mm 1.0	Sorting	Roundness	Framework	Diagenesis	Lithology	
								Ls, lt brn - wh, vig HCl rxn
2600								
								Ls, vcol (lt brn, wh, yel, pk), vig HCl rxn
2620								
								Ls, vcol (lt brn, lt gy, wh, yel, pk), vig HCl rxn
2640								
								Ls, lt brn - wh, suc, vig HCl rxn
2660								
								Ls, lt brn - wh, suc, vig HCl rxn
2680								
								Ls, lt brn - wh, suc, vig HCl rxn, rr dk brn frac ctngs; rr spar calc
2700								
								Ls, lt brn, vig HCl rxn, rr dk brn frac ctngs
2720								
2740								
2760								
2780								

CMRWA #3
Field Log

0 Res-16 (ohm-m) 50 0 Res-64 (ohm-m) 50 6 Caliper (in) 16 0 Gamma (CPS) 500										0 Porosity % 35 0.0 Grain Size mm 1.0 Sorting Roundness Framework Diagenesis Lithology									
2800										Ls, lt brn - wh, suc, vig HCl rxn									
2820										Ls, lt brn - wh, suc, vig HCl rxn									
2840																			
2860										Ls, lt brn - wh, suc, vig HCl rxn BOTTOM OF BOREHOLE, 10/16/2019 10:30 AM									

APPENDIX B – WATER QUALITY DATA



BRIDGER ANALYTICAL LAB

7539 Pioneer Way Suite B, Bozeman, MT 59718 Phone: (406) 582-0822
US EPA ID# MT00953 MT Certification Number CERT0094

Western Groundwater Services
6595 Bear Claw Ln
Bozeman, MT 59715

Reported:

11/07/2019 13:06

Project Name: CMRWA #3

Client Sample ID: C3 110519 0830 MC

Collection Date: 11/05/2019 8:30

Lab Sample ID: 1911079-01

Collected By: Mark Cunnane

Date Received: 11/06/2019

Analyte	Result	Units	RL	Qual	MCL	Method	Analysis Date/By
---------	--------	-------	----	------	-----	--------	------------------

Inorganic

Nitrate + Nitrite as N	0.148	mg/L	0.05		10	EPA 300.1	11/06/19 23:35/FAF
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Microbiological

Total Coliform	Absent		1.00			SM 9223B	11/07/19 11:44/DSL
E. coli	Absent		1.00			SM 9223B	11/07/19 11:44/DSL



BRIDGER ANALYTICAL LAB

7539 Pioneer Way Suite B, Bozeman, MT 59718 Phone: (406) 582-0822
US EPA ID# MT00953 MT Certification Number CERT0094

Western Groundwater Services
6595 Bear Claw Ln
Bozeman, MT 59715

Reported:
11/07/2019 13:06

Notes and Definitions

Item	Definition
cfu	Colony Forming Unit
MCL	Maximum Contaminant Level
mg/L	milligrams per liter (ppm)
mL	milliliter
MPN	Most Probable Number
ND	Not Detected
NTU	Nephelometric Turbidity Units
ppb	parts per billion ($\mu\text{g/L}$)
ppm	parts per million (mg/L)
RL	Reporting Limit
S.U.	Standard Units
$\mu\text{g/L}$	micrograms per liter (ppb)
$\mu\text{S/cm}$	microsiemens per centimeter



Date: 1/8/2020

CLIENT: Western Groundwater Services
Project: CMRWA Well #3
Lab Order: S1911124

CASE NARRATIVE
Report ID: S1911124001

Samples C3 110519 0830 MC and Trip Blank were received on November 8, 2019.

All samples were received and analyzed within the EPA recommended holding times, except those noted below in this case narrative. Samples were analyzed using the methods outlined in the following references:

"Standard Methods For The Examination of Water and Wastewater", approved method versions
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition
40 CFR Parts 136 and 141
40 CFR Part 50, Appendices B, J, L, and O
Methods indicated in the Methods Update Rule published in the Federal Register Friday, May 18, 2012
ASTM approved and recognized standards

All Quality Control parameters met the acceptance criteria defined by EPA and Pace Analytical (Formerly Inter-Mountain Laboratories) except as indicated in this case narrative.

Reviewed by:

A handwritten signature in black ink, reading "John M. Jacobs".

John Jacobs, Project Manager



Sample Analysis Report

CLIENT: Western Groundwater Services
6595 Bear Claw Lane
Bozeman, MT 59715

Date Reported: 1/8/2020
Report ID: S1911124001

Project: CMRWA Well #3
Lab ID: S1911124-001
Client Sample ID: C3 110519 0830 MC

Work Order: S1911124
Collection Date: 11/5/2019 8:30:00 AM
Date Received: 11/8/2019 11:50:00 AM
Sampler: MC
Matrix: Drinking Water
COC: 184337

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
General Parameters						
pH	8.1	0.1		s.u.	11/09/2019 0748 AB	SM 4500 H B
Electrical Conductivity	753	5		µmhos/cm	11/09/2019 0748 AB	SM 2510B
Total Dissolved Solids (180)	500	10		mg/L	11/11/2019 0823 IJQ	SM 2540
Alkalinity, Total (As CaCO ₃)	172	5		mg/L	11/09/2019 0748 AB	SM 2320B
Hardness, Calcium/Magnesium (As CaCO ₃)	375	1		mg/L	12/31/2019 0945 JJ	SM 2340B
Silica as SiO ₂	7	1		mg/L	11/11/2019 1627 DG	EPA 200.7
Anions						
Alkalinity, Bicarbonate as HCO ₃	210	5		mg/L	11/09/2019 0748 AB	SM 2320B
Alkalinity, Carbonate as CO ₃	ND	5		mg/L	11/09/2019 0748 AB	SM 2320B
Alkalinity, Hydroxide as OH	ND	5		mg/L	11/09/2019 0748 AB	SM 2320B
Chloride	35	1		mg/L	11/16/2019 0720 AB	EPA 300.0
Fluoride	1.1	0.1		mg/L	11/09/2019 0748 AB	SM 4500FC
Sulfate	162	1		mg/L	11/16/2019 0720 AB	EPA 300.0
Cations						
Calcium	104	1		mg/L	11/11/2019 1627 DG	EPA 200.7
Magnesium	28	1		mg/L	11/11/2019 1627 DG	EPA 200.7
Potassium	1	1		mg/L	11/11/2019 1627 DG	EPA 200.7
Sodium	3	1		mg/L	11/11/2019 1627 DG	EPA 200.7
Radiochemistry (SDWA)						
Radium 226	0.5 ± 0.1	0.2		pCi/L	01/07/2020 0817 WN	SM 7500 RA_B
Radiochemistry						
Gross Alpha	ND	4		pCi/L	12/19/2019 1326 AEF	SM 7110B
Total Radium 228	ND	1		pCi/L	12/03/2019 0813 WN	Ga-Tech
Total Metals						
Iron	0.29	0.03		mg/L	11/14/2019 1916 DG	EPA 200.7
Manganese	0.01	0.01		mg/L	11/14/2019 1916 DG	EPA 200.7

These results apply only to the samples tested.

Qualifiers: B Analyte detected in the associated Method Blank
E Value above quantitation range
H Holding times for preparation or analysis exceeded
L Analyzed by another laboratory
ND Not Detected at the Reporting Limit
S Spike Recovery outside accepted recovery limits
X Matrix Effect

RL - Reporting Limit

C Calculated Value
G Analyzed at IML Gillette laboratory
J Analyte detected below quantitation limits
M Value exceeds Monthly Ave or MCL or is less than LCL
O Outside the Range of Dilutions
U Analysis reported under the reporting limit

Reviewed by:

John M. Jacobs
John Jacobs, Project Manager



Sample Analysis Report

CLIENT: Western Groundwater Services
6595 Bear Claw Lane
Bozeman, MT 59715

Date Reported: 1/8/2020
Report ID: S1911124001

Project: CMRWA Well #3
Lab ID: S1911124-001
Client Sample ID: C3 110519 0830 MC

Work Order: S1911124
Collection Date: 11/5/2019 8:30:00 AM
Date Received: 11/8/2019 11:50:00 AM
Sampler: MC
Matrix: Drinking Water
COC: 184337

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
Total Recoverable Metals						
Antimony	ND	0.005		mg/L	11/13/2019 2037 MS	EPA 200.8
Arsenic	ND	0.005		mg/L	11/13/2019 2037 MS	EPA 200.8
Barium	ND	0.5		mg/L	11/13/2019 2037 MS	EPA 200.8
Beryllium	ND	0.01		mg/L	11/14/2019 1916 DG	EPA 200.7
Cadmium	ND	0.002		mg/L	11/13/2019 2037 MS	EPA 200.8
Chromium	ND	0.01		mg/L	11/14/2019 1916 DG	EPA 200.7
Mercury	ND	0.001		mg/L	11/15/2019 1009 HCZ	EPA 245.1
Nickel	ND	0.01		mg/L	11/14/2019 1916 DG	EPA 200.7
Selenium	ND	0.005		mg/L	11/13/2019 2037 MS	EPA 200.8
Sodium	3.1	0.5		mg/L	11/14/2019 1916 DG	EPA 200.7
Thallium	ND	0.001		mg/L	11/13/2019 2037 MS	EPA 200.8

These results apply only to the samples tested.

Qualifiers: B Analyte detected in the associated Method Blank
E Value above quantitation range
H Holding times for preparation or analysis exceeded
L Analyzed by another laboratory
ND Not Detected at the Reporting Limit
S Spike Recovery outside accepted recovery limits
X Matrix Effect

RL - Reporting Limit

C Calculated Value
G Analyzed at IML Gillette laboratory
J Analyte detected below quantitation limits
M Value exceeds Monthly Ave or MCL or is less than LCL
O Outside the Range of Dilutions
U Analysis reported under the reporting limit

Reviewed by:

John M. Jacobs
John Jacobs, Project Manager



Sample Analysis Report

CLIENT: Western Groundwater Services
6595 Bear Claw Lane
Bozeman, MT 59715

Date Reported: 1/8/2020
Report ID: S1911124001

Project: CMRWA Well #3
Lab ID: S1911124-001
Client Sample ID: C3 110519 0830 MC

Work Order: S1911124
Collection Date: 11/5/2019 8:30:00 AM
Date Received: 11/8/2019 11:50:00 AM
Sampler: MC
Matrix: Drinking Water
COC: 184337

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
524.2 SDWA-Volatile Compounds in Drinking Water (Absaraka Lab)						
1,1,1,2-Tetrachloroethane	ND	1		µg/L	11/15/2019 1451 SFK	524.2
1,1,1-Trichloroethane	ND	1		µg/L	11/15/2019 1451 SFK	524.2
1,1,2,2-Tetrachloroethane	ND	1		µg/L	11/15/2019 1451 SFK	524.2
1,1,2-Trichloroethane	ND	1		µg/L	11/15/2019 1451 SFK	524.2
1,1-Dichloroethane	ND	1		µg/L	11/15/2019 1451 SFK	524.2
1,1-Dichloroethene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
1,1-Dichloropropene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
1,2,3-Trichloropropane	ND	2		µg/L	11/15/2019 1451 SFK	524.2
1,2,4-Trichlorobenzene	ND	2		µg/L	11/15/2019 1451 SFK	524.2
1,2-Dichlorobenzene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
1,2-Dichloroethane	ND	1		µg/L	11/15/2019 1451 SFK	524.2
1,2-Dichloropropane	ND	1		µg/L	11/15/2019 1451 SFK	524.2
1,3-Dichlorobenzene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
1,3-Dichloropropane	ND	1		µg/L	11/15/2019 1451 SFK	524.2
1,4-Dichlorobenzene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
2,2-Dichloropropane	ND	1		µg/L	11/15/2019 1451 SFK	524.2
2-Chlorotoluene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
4-Chlorotoluene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Benzene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Bromobenzene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Bromomethane	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Carbon tetrachloride	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Chlorobenzene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Chloroethane	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Chloromethane	ND	1		µg/L	11/15/2019 1451 SFK	524.2
cis-1,2-Dichloroethene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
cis-1,3-Dichloropropene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Ethylbenzene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
m,p-Xylenes	ND	2		µg/L	11/15/2019 1451 SFK	524.2
Methylene chloride	ND	2		µg/L	11/15/2019 1451 SFK	524.2
o-Xylene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Styrene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Tetrachloroethene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Toluene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
trans-1,2-Dichloroethene	ND	1		µg/L	11/15/2019 1451 SFK	524.2

These results apply only to the samples tested.

Qualifiers: B Analyte detected in the associated Method Blank
E Value above quantitation range
H Holding times for preparation or analysis exceeded
L Analyzed by another laboratory
ND Not Detected at the Reporting Limit
S Spike Recovery outside accepted recovery limits
X Matrix Effect

RL - Reporting Limit

C Calculated Value
G Analyzed at IML Gillette laboratory
J Analyte detected below quantitation limits
M Value exceeds Monthly Ave or MCL or is less than LCL
O Outside the Range of Dilutions
U Analysis reported under the reporting limit

Reviewed by:

John M. Jacobs
John Jacobs, Project Manager



Sample Analysis Report

CLIENT: Western Groundwater Services
6595 Bear Claw Lane
Bozeman, MT 59715

Date Reported: 1/8/2020
Report ID: S1911124001

Project: CMRWA Well #3
Lab ID: S1911124-001
Client Sample ID: C3 110519 0830 MC

Work Order: S1911124
Collection Date: 11/5/2019 8:30:00 AM
Date Received: 11/8/2019 11:50:00 AM
Sampler: MC
Matrix: Drinking Water
COC: 184337

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
524.2 SDWA-Volatile Compounds in Drinking Water (Absaraka Lab)						
trans-1,3-Dichloropropene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Trichloroethene	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Vinyl chloride	ND	1		µg/L	11/15/2019 1451 SFK	524.2
Surr: 4-Bromofluorobenzene	120	70-130		%REC	11/15/2019 1451 SFK	524.2
Surr: 1,2-Dichloroethane-d4	70	70-130		%REC	11/15/2019 1451 SFK	524.2

These results apply only to the samples tested.

Qualifiers: B Analyte detected in the associated Method Blank
E Value above quantitation range
H Holding times for preparation or analysis exceeded
L Analyzed by another laboratory
ND Not Detected at the Reporting Limit
S Spike Recovery outside accepted recovery limits
X Matrix Effect

RL - Reporting Limit

C Calculated Value
G Analyzed at IML Gillette laboratory
J Analyte detected below quantitation limits
M Value exceeds Monthly Ave or MCL or is less than LCL
O Outside the Range of Dilutions
U Analysis reported under the reporting limit

Reviewed by:

John M. Jacobs
John Jacobs, Project Manager



Sample Analysis Report

CLIENT: Western Groundwater Services
6595 Bear Claw Lane
Bozeman, MT 59715

Date Reported: 1/8/2020
Report ID: S1911124001

Project: CMRWA Well #3
Lab ID: S1911124-002
Client Sample ID: Trip Blank

Work Order: S1911124
Collection Date: 11/5/2019
Date Received: 11/8/2019 11:50:00 AM
Sampler: MC
Matrix: Drinking Water
COC: 184337

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
524.2 SDWA-Volatile Compounds in Drinking Water (Absaroka Lab)						
1,1,1,2-Tetrachloroethane	ND	1		µg/L	11/15/2019 1514 SFK	524.2
1,1,1-Trichloroethane	ND	1		µg/L	11/15/2019 1514 SFK	524.2
1,1,2,2-Tetrachloroethane	ND	1		µg/L	11/15/2019 1514 SFK	524.2
1,1,2-Trichloroethane	ND	1		µg/L	11/15/2019 1514 SFK	524.2
1,1-Dichloroethane	ND	1		µg/L	11/15/2019 1514 SFK	524.2
1,1-Dichloroethene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
1,1-Dichloropropene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
1,2,3-Trichloropropane	ND	2		µg/L	11/15/2019 1514 SFK	524.2
1,2,4-Trichlorobenzene	ND	2		µg/L	11/15/2019 1514 SFK	524.2
1,2-Dichlorobenzene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
1,2-Dichloroethane	ND	1		µg/L	11/15/2019 1514 SFK	524.2
1,2-Dichloropropane	ND	1		µg/L	11/15/2019 1514 SFK	524.2
1,3-Dichlorobenzene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
1,3-Dichloropropane	ND	1		µg/L	11/15/2019 1514 SFK	524.2
1,4-Dichlorobenzene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
2,2-Dichloropropane	ND	1		µg/L	11/15/2019 1514 SFK	524.2
2-Chlorotoluene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
4-Chlorotoluene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Benzene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Bromobenzene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Bromomethane	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Carbon tetrachloride	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Chlorobenzene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Chloroethane	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Chloromethane	ND	1		µg/L	11/15/2019 1514 SFK	524.2
cis-1,2-Dichloroethene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
cis-1,3-Dichloropropene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Ethylbenzene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
m,p-Xylenes	ND	2		µg/L	11/15/2019 1514 SFK	524.2
Methylene chloride	ND	2		µg/L	11/15/2019 1514 SFK	524.2
o-Xylene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Styrene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Tetrachloroethene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Toluene	ND	1		µg/L	11/15/2019 1514 SFK	524.2

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M Value exceeds Monthly Ave or MCL or is less than LCL
O Outside the Range of Dilutions
U Analysis reported under the reporting limit

Reviewed by:

John M. Jacobs
John Jacobs, Project Manager

**Sample Analysis Report**

CLIENT: Western Groundwater Services
6595 Bear Claw Lane
Bozeman, MT 59715

Date Reported: 1/8/2020
Report ID: S1911124001

Project: CMRWA Well #3
Lab ID: S1911124-002
Client Sample ID: Trip Blank

Work Order: S1911124
Collection Date: 11/5/2019
Date Received: 11/8/2019 11:50:00 AM
Sampler: MC
Matrix: Drinking Water
COC: 184337

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
524.2 SDWA-Volatile Compounds in Drinking Water (Absaraka Lab)						
trans-1,2-Dichloroethene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
trans-1,3-Dichloropropene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Trichloroethene	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Vinyl chloride	ND	1		µg/L	11/15/2019 1514 SFK	524.2
Surr: 4-Bromofluorobenzene	120	70-130		%REC	11/15/2019 1514 SFK	524.2
Surr: 1,2-Dichloroethane-d4	70	70-130		%REC	11/15/2019 1514 SFK	524.2

These results apply only to the samples tested.

Qualifiers: B Analyte detected in the associated Method Blank
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Reviewed by:

John M. Jacobs
John Jacobs, Project Manager



Inter-Mountain Labs
Sheridan, WY and Gillette, WY

- CHAIN OF CUSTODY RECORD -

Page of

All shaded fields must be completed.
This is a legal document; any misrepresentation may be construed as fraud.

184337

Client Name

Report Address

Project Identification

Sampler (Signature/Attestation of Authenticity)

Telephone #

Invoice Address

Contact Name

Email

Phone

Purchase Order #

Quote #

ANALYSES / PARAMETERS

REMARKS

LAB ID
(Lab Use Only)

DATE
SAMPLED

TIME

SAMPLE
IDENTIFICATION

Matrix

of
Containers

REMARKS

1 01911124-0011/5 0830 Q3 110519 0830 MC WT *

* One amber NO-head space bottle was broken
Trip B11C

LAB COMMENTS

Relinquished By (Signature/Printed)

DATE

TIME

Received By (Signature/Printed)

DATE

TIME

SHIPPING INFO

MATRIX CODES

TURNAROUND TIMES

COMPLIANCE INFORMATION

ADDITIONAL REMARKS

- ☒ UPS
☐ Fed Express
☐ US Mail
☐ Hand Carried
☐ Other

- Water WT
Soil SL
Solid SD
Filter FT
Other OT

- ☒ Check desired service
☐ Standard turnaround
☐ RUSH - 5 Working Days
☐ URGENT - < 2 Working Days

- Compliance Monitoring?
Program (SDWA, NPDES,...)
PWSID / Permit #
Chlorinated?

- Sample Disposal: Lab
Client

103°C

Kathy Boap

11.8.19

11:50



Survey Meter # Model 2241-2; SN 182115
pH strip lot # H0863463
Thermometer SN# 27130475

Condition Upon Receipt (Attach to COC)

Sample Receipt

1 Number of ice chests/packages received: 1 ROI? Yes No

Note as "OTC" if samples are received over the counter, unpackaged

2 Temperature of cooler/samples. (If more than 8 coolers, please write on back)

Temps Observed (°C): 6.3
Temps Corrected (°C): 6.9

Acceptable is: 0.1° to 10°C for Bacteria; and 0.1° to 6°C for most other water parameters. Samples may not have had adequate time to cool following collection. Indicate ROI (Received on Ice) for iced samples received on the same day as sampled, in addition to temperature at receipt.

Client contact for temperatures outside method criteria must be documented below.

3 Emission rate of samples for radiochemical analyses < 0.5mR/hr? Yes No N/A

4 COC Number (If applicable): 184337

5 Do the number of bottles agree with the COC? Yes No N/A

6 Were the samples received intact? (no broken bottles, leaks, etc.) Yes No N/A

7 Were the sample custody seals intact? Yes No N/A

8 Is the COC properly completed, legible, and signed? Yes No

Sample Verification, Labeling & Distribution

1 Were all requested analyses understood and appropriate? Yes No

2 Did the bottle labels correspond with the COC information? Yes No

3 Samples collected in method-prescribed containers? Yes No

4 Sample Preservation:

pH at Receipt:

Final pH (if added in lab):

Preservative/Lot#

Date/Time Added:

<u>2</u> Total Metals	_____ Total Metals	HNO ₃ _____	_____
_____ Diss Metals	_____ Diss Metals	Filtered and preserved in metals	Filtered and preserved in metals
_____ Nutrient	_____ Nutrient	H ₂ SO ₄ _____	
_____ Cyanide	_____ Cyanide	NaOH _____	
_____ Sulfide	_____ Sulfide	ZnAcet _____	
_____ Phenol	_____ Phenol	H ₂ SO ₄ _____	
_____ SDWA Rads	_____ SDWA Rads	HNO ₃ _____	

Preserved samples for Rad analysis accompanied by Field Blank? Yes No

5 VOA vials have <6mm headspace? Yes No N/A

6 Were all analyses within holding time at the time of receipt? Yes No

7 Specially requested detection limits (RLs) assigned? Yes No N/A

8 Have rush or project due dates been checked and accepted? Yes No N/A

9 Do samples require subcontracted analyses? Yes No

If "Yes", which type of subcontracting is required?

General

Customer-Specified

Certified

Sample Receipt, Verification, Login, Labeling & Distribution completed by (initials): KB

Set ID: 5191124

Discrepancy Documentation (use back of sheet for notes on discrepancies)

Any items listed above with a response of "No" or do not meet specifications must be resolved.

Person Contacted: _____ Method of Contact: _____ Phone: _____

Initiated By: _____ Date/Time: _____ Email: _____

Problem: _____

Resolution: _____

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (866) 988-3757
1 800 566 LABS (1 800 566 5227)



AT-1807

Laboratory Report

for

Inter-Mountain Labs - Sheridan
1673 Terra Avenue
Sheridan, WY 82801
Attention: Ian Scofield

Date of Issue
12/05/2019


EUROFINS EATON
ANALYTICAL, LLC



UTAH ELCP CA00006

SZN3: Ivana Velez
Project Manager

Report:838086
Project:DRINKING-SOC
Group:SOCs Regulated

* Accredited in accordance with TNI 2016 and ISO/IEC 17025:2017.

* Laboratory certifies that the test results meet all **TNI 2016 and ISO/IEC 17025:2017** requirements unless noted under the individual analysis.

* Following the cover page are State Certification List, ISO/IEC 17025:2017 Accredited Method List, Acknowledgement of Samples Received, Comments, Hits Report, Data Report, QC Summary, QC Report and Regulatory Forms, as applicable.

* Test results relate only to the sample(s) tested.

* Test results apply to the sample(s) as received, unless EEA-M collected and analyzed the sample(s) as noted in the COC and final report.

* This report shall not be reproduced except in full, without the written approval of the laboratory.

* This report includes ISO/IEC 17025:2017 and non-ISO/IEC 17025:2017 accredited methods.

STATE CERTIFICATION LIST

State	Certification Number	State	Certification Number
Alabama	41060	Montana	Cert 0035
Arizona	AZ0778	Nebraska	Certified
Arkansas	Certified	Nevada	CA000062018
California	2813	New Hampshire *	2959
Colorado	Certified	New Jersey *	CA 008
Connecticut	PH-0107	New Mexico	Certified
Delaware	CA 006	New York *	11320
Florida *	E871024	North Carolina	06701
Georgia	947	North Dakota	R-009
Guam	18-005R	Oregon *	CA200003-005
Hawaii	Certified	Pennsylvania *	68-565
Idaho	Certified	Puerto Rico	Certified
Illinois *	200033	Rhode Island	LAO00326
Indiana	C-CA-01	South Carolina	87016
Iowa - Asbestos	413	South Dakota	Certified
Kansas *	E-10268	Tennessee	TN02839
Kentucky	90107	Texas *	T104704230-18-15
Louisiana *	LA180000	Utah (Primary AB) *	CA00006
Maine	CA0006	Vermont	VT0114
Maryland	224	Virginia *	460260
Commonwealth of Northern Marianas Is.	MP0004	Washington	C838
Massachusetts	M-CA006	EPA Region 5	Certified
Michigan	9906	Los Angeles County Sanitation Districts	10264
Mississippi	Certified		

* NELAP/TNI Recognized Accreditation Bodies

ISO/IEC 17025 Accredited Method List

The tests listed below are accredited and meet the requirements of ISO/IEC 17025 as verified by the ANSI-ASQ National Accreditation Board/ANAB.
Refer to Certificate and scope of accreditation (AT 1807) found at: <https://www.eurofinsus.com/Eaton>

SPECIFIC TESTS	METHOD OR TECHNIQUE USED	Environ-mental (Drinking Water)	Environ-mental (Waste Water)	Water as a Component of Food and Bev/Bev/ Bottled Water
1,2,3-TCP (5 PPT & 0.5 PPT)	CA SRL 524M-TCP	x		x
1,4-Dioxane	EPA 522	x		x
2,3,7,8-TCDD	Modified EPA 1613B	x		x
Acrylamide	In House Method (2440)	x		x
Algal Toxins/Microcystin	In House Method (3570)			
Alkalinity	SM 2320B	x	x	x
Ammonia	EPA 350.1		x	x
Ammonia	SM 4500-NH3 H		x	x
Anions and DBPs by IC	EPA 300.0	x	x	x
Anions and DBPs by IC	EPA 300.1	x		x
Asbestos	EPA 100.2	x	x	
BOD / CBOD	SM 5210B		x	x
Bromate	In House Method (2447)	x		x
Carbamates	EPA 531.2	x		x
Carbonate as CO3	SM 2330B	x	x	x
Carbonyls	EPA 556	x		x
COD	EPA 410.4 / SM 5220D		x	
Chloramines	SM 4500-CL G	x	x	x
Chlorinated Acids	EPA 515.4	x		x
Chlorinated Acids	EPA 555	x		x
Chlorine Dioxide	SM 4500-CLO2 D Palin Test	x		x
Chlorine -Total/Free/ Combined Residual	SM 4500-Cl G	x	x	x
Conductivity	EPA 120.1		x	
Conductivity	SM 2510B	x	x	x
Corrosivity (Langelier Index)	SM 2330B	x		x
Cyanide, Amenable	SM 4500-CN G	x	x	
Cyanide, Free	SM 4500CN F	x	x	x
Cyanide, Total	EPA 335.4	x	x	x
Cyanogen Chloride (screen)	In House Method (2470)	x		x
Diquat and Paraquat	EPA 549.2	x		x
DBP/HAA	SM 6251B	x		x
Dissolved Oxygen	SM 4500-O G		x	x
DOC	SM 5310C	x		x
E. Coli	(MTF/EC+MUG)	x		x
E. Coli	CFR 141.21(f)(6)(i)	x		x
E. Coli	SM 9223		x	
E. Coli (Enumeration)	SM 9221B.1/ SM 9221F	x		x
E. Coli (Enumeration)	SM 9223B	x		x
EDB/DCBP	EPA 504.1	x		
EDB/DBCP and DBP	EPA 551.1	x		x
EDTA and NTA	In House Method (2454)	x		x
Endothall	EPA 548.1	x		x
Endothall	In-house Method (2445)	x		x
Enterococci	SM 9230B	x	x	
Fecal Coliform	SM 9221 E (MTF/EC)	x		
Fecal Coliform	SM 9221C, E (MTF/EC)		x	
Fecal Coliform (Enumeration)	SM 9221E (MTF/EC)	x		x
Fecal Coliform with Chlorine Present	SM 9221E		x	
Fecal Streptococci	SM 9230B	x	x	
Fluoride	SM 4500-F C	x	x	x
Glyphosate	EPA 547	x		x
Glyphosate + AMPA	In House Method (3618)	x		x
Gross Alpha/Beta	EPA 900.0	x	x	x
Gross Alpha Coprecipitation	SM 7110 C	x	x	x
Hardness	SM 2340B	x	x	x
Heterotrophic Bacteria	In House Method (2439)	x		x
Heterotrophic Bacteria	SM 9215 B	x		x
Hexavalent Chromium	EPA 218.6	x	x	x

SPECIFIC TESTS	METHOD OR TECHNIQUE USED	Environ-mental (Drinking Water)	Environ-mental (Waste Water)	Water as a Component of Food and Bev/Bev/ Bottled Water
Hexavalent Chromium	EPA 218.7	x		x
Hexavalent Chromium	SM 3500-Cr B		x	
Hormones	EPA 539	x		x
Hydroxide as OH Calc.	SM 2330B	x		x
Kjeldahl Nitrogen	EPA 351.2		x	
Legionella	Legiolert	x		x
Mercury	EPA 245.1	x	x	x
Metals	EPA 200.7 / 200.8	x	x	x
Microcystin LR	ELISA (2360)	x		x
Microcystin, Total	EPA 546	x		x
NDMA	EPA 521 In house method (2425)	x		x
Nitrate/Nitrite Nitrogen	EPA 353.2	x	x	x
OCL, Pesticides/PCB	EPA 505	x		x
Ortho Phosphate	EPA 365.1	x	x	x
Ortho Phosphorous	SM 4500P E	x		x
Oxyhalides Disinfection Byproducts	EPA 317.0	x		x
Perchlorate	EPA 331.0	x		x
Perchlorate (low and high)	EPA 314.0	x		x
Perfluorinated Alkyl Acids	EPA 537	x		x
Perfluorinated Pollutant	In house Method (2434)	x		x
pH	EPA 150.1	x		
pH	SM 4500-H+B	x	x	x
Phenylurea Pesticides/ Herbicides	In House Method, based on EPA 532 (2448)	x		x
Pseudomonas	IDEXX Pseudalert (2461)	x		x
Radium-226	GA Institute of Tech	x		x
Radium-228	GA Institute of Tech	x		x
Radon-222	SM 7500RN	x		x
Residue, Filterable	SM 2540C	x	x	x
Residue, Non-filterable	SM 2540D		x	
Residue, Total	SM 2540B		x	x
Residue, Volatile	EPA 160.4		x	
Semi-VOC	EPA 525.2	x		x
Silica	SM 4500-Si D	x	x	
Silica	SM 4500-SiO2 C	x	x	
Sulfide	SM 4500-S ⁻ D		x	
Sulfite	SM 4500-SO ³ B	x	x	x
Surfactants	SM 5540C	x	x	x
Taste and Odor Analytes	SM 6040E	x		x
Total Coliform (P/A)	SM 9221 A, B	x		x
Total Coliform (Enumeration)	SM 9221 A, B, C	x		x
Total Coliform / E. coli	Colisure SM 9223	x		x
Total Coliform	SM 9221B		x	
Total Coliform with Chlorine Present	SM 9221B		x	
Total Coliform / E.coli (P/A and Enumeration)	SM 9223	x		x
TOC	SM 5310C	x	x	x
TOX	SM 5320B		x	
Total Phenols	EPA 420.1		x	
Total Phenols	EPA 420.4	x	x	x
Total Phosphorous	SM 4500 P E		x	
Triazine Pesticides & Degradates	In House (3617)	x		x
Turbidity	EPA 180.1	x	x	x
Turbidity	SM 2130B	x	x	
Uranium by ICP/MS	EPA 200.8	x		x
UV 254	SM 5910B	x		
VOC	EPA 524.2	x		x
VOC	In House Method (2411)	x		x
Yeast and Mold	SM 9610	x		x
Field Sampling	N/A			

Acknowledgement of Samples Received

Addr: **Inter-Mountain Labs - Sheridan**
1673 Terra Avenue
Sheridan, WY 82801

Attn: Ian Scofield
Phone: 307-672-8945

Client ID: INTERMTNLABS-WY
Folder #: 838086
Project: DRINKING-SOC
Sample Group: SOC's Regulated

Project Manager: Ivana Velez
Phone: 626-386-1123
PO #: 247186

The following samples were received from you on **November 12, 2019 at 1040**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical, LLC.

Sample #	Sample ID	Sample Date												
201911120085	C3 110519 0830 MC	11/05/2019 0830												
Variable ID: S1911124-001														
<table border="1"> <tr> <td>@2378-TCDD_Dioxin C</td><td>@505-REG</td><td>@515_4-REG</td></tr> <tr> <td>@525_2-REG C</td><td>@531_2-REG</td><td>@551_EDB-DBCP</td></tr> <tr> <td>@DIQUATREG C</td><td>@EDB-DBC C</td><td>Endothall</td></tr> <tr> <td>Glyphosate</td><td></td><td></td></tr> </table>			@2378-TCDD_Dioxin C	@505-REG	@515_4-REG	@525_2-REG C	@531_2-REG	@551_EDB-DBCP	@DIQUATREG C	@EDB-DBC C	Endothall	Glyphosate		
@2378-TCDD_Dioxin C	@505-REG	@515_4-REG												
@525_2-REG C	@531_2-REG	@551_EDB-DBCP												
@DIQUATREG C	@EDB-DBC C	Endothall												
Glyphosate														

Test Description

@2378-TCDD_Dioxin C -- 2,3,7,8-TCDD_Dioxin

@505-REG -- Organochlorine Pesticides/PCBs

@515_4-REG -- Chlorophenoxy Herbicides

@525_2-REG C -- Semivolatiles by GCMS

@531_2-REG -- Aldicarbs

@551_EDB-DBCP -- EDB/DBCP/HAN by EPA 551.1

@DIQUATREG C -- Diquat and Paraquat

@EDB-DBC C -- EPA Method 504.1

CHAIN OF CUSTODY RECORD

838046

Inter-Mountain Laboratories, Inc.
1673 Terra Ave., Sheridan, WY 82801
Phone 800-828-1097
FAX 307-672-6053

Relinquished by: Kathy Bar

Date/Time: 11.11.19 14:35

Received by Lab: Cheryl Brecken EFA

Date/Time: 11.12.19 1040

Sent to: Eurofins 750 Royal Oaks Dr Ste 100

Monrovia CA 626 386 1100

P.O. 247186 KB 11.11.19
248186

Sample No.	Client ID	Sample Date	Sample Time	Number of Containers	Sample Matrix	Analyses/ Parameters	Remarks
S1911124-001	C3 110519 0830 MC	11/5/2019	8:30	20	DW	MT SOC 505,515,525,531,	
						551,547,548 549.2	
						See Attachment for	
						Complete Analysis	Due 12/20/19
							e-mail copy of results to:
							jjacobs@imlinc.com
							iscofield@imlinc.com

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
(626) 386-1100 FAX (866) 988-3757

Kit #: 247198 

Created By: Rachael Lucero - [BS2J]
Deliver By: 11/07/2019
STG: Bottle Orders
Ice Type: W

Note: Sampler Please return this paper with your samples

Cilent ID: INTERMTNLABS-WY
Project Code: DRINKING-SOC Bottle Orders
Group Name: SOCs Regulated
PO#JOB#:
Description: No Schedule

Ship Sample Kits to

Inter-Mountain Labs
555 Absaraka Avenue
Sheridan, WY 82801

Attr: Michella LaGory
Phone: 307-674-7506
Fax: 307-672-9845

Send Report to

Inter-Mountain Labs - Sheridan
1673 Terra Avenue
Sheridan, WY 82801

Attr: Ian Scofield
Phone: 307-672-8945

Billing Address

Inter-Mountain Labs - Sheridan
1673 Terra Avenue
Sheridan, WY 82801

Attr: Ian Scofield
Phone: 307-672-8945

# of Sample Tests	Bottle Qty - Type [preservative information]	Total	UN DOT #
3 GLYPHOS C	1 - 125ml amber glass [0.2 ml thio (8%)]	3	
3 @2378-TCDD_Dioxin C	2 - 1L amber glass [1 ml Thio 8%]	6	
3 @525_2-REG C	2 - 1L amber glass [45mg Sulfite xls+1 vial 2 ml 6N HCl]	6	UN1789
3 @DIQUATREG C	1 - 1L amber poly [1 ml Thio 8%]	3	
3 ENDOTHAL C	1 - 250ml amber glass [0.25 ml Thio (8%)]	3	
3 @531_2-REG	2 - 40ml amber glass vial [0.37g KH2Citrate+6mg ThioSO4]	6	
3 @505-REG	4 - 40ml amber glass vial [1 drop Thio (8%)]	12	
3 @EDB-DBC C	3 - 40ml amber glass vial [1 drop Thio (8%)]	9	
3 @515_4-REG	4 - 60ml amber glass [3 mg NaSulfite]	12	
3 @551_EDB-DBCP	3 - 60ml amber glass [EDB1g(1%NaP(99%KP))+0.6%NH4CL]	9	

Sum Bottles: 69

Sum Tests: 30

Comments

Tel: (626) 386-1100
Fax: (866) 988-3757
1 800 566 LABS (1 800 566 5227)

Laboratory Comments

Report: 838086
Project: DRINKING-SOC
Group: SOC's Regulated

Inter-Mountain Labs - Sheridan
Ian Scofield
1673 Terra Avenue
Sheridan, WY 82801

Flags Legend:

M2 - Matrix spike recovery was low; the associated blank spike recovery was acceptable.

Tel: (626) 386-1100
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Laboratory Data

Report: 838086
Project: DRINKING-SOC
Group: SOC's Regulated

Inter-Mountain Labs - Sheridan
Ian Scofield
1673 Terra Avenue
Sheridan, WY 82801

Samples Received on:
11/12/2019 1040

Prepped	Analyzed	Prep Batch	Analytical Batch	Method	Analyte	Result	Units	MRL	Dilution
C3 110519 0830 MC (201911120085)						Sampled on 11/05/2019 0830			
Variable ID: S1911124-001									
EPA 505 - Organochlorine Pesticides/PCBs									
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	Alachlor (Alanex)	ND	ug/L	0.10	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	Chlordane	ND	ug/L	0.10	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	Endrin	ND	ug/L	0.010	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	Heptachlor	ND	ug/L	0.010	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	Heptachlor Epoxide	ND	ug/L	0.010	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	Lindane (gamma-BHC)	ND	ug/L	0.010	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	Methoxychlor	ND	ug/L	0.050	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	PCB 1016 Aroclor	ND	ug/L	0.080	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	PCB 1221 Aroclor	ND	ug/L	0.10	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	PCB 1232 Aroclor	ND	ug/L	0.10	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	PCB 1242 Aroclor	ND	ug/L	0.10	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	PCB 1248 Aroclor	ND	ug/L	0.10	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	PCB 1254 Aroclor	ND	ug/L	0.10	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	PCB 1260 Aroclor	ND	ug/L	0.10	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	Total PCBs	ND	ug/L	0.10	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	Toxaphene	ND	ug/L	0.50	1
11/13/19	11/13/19 19:46	1209243	1211298	(EPA 505)	Tetrachlorometaxylene	102	%		1
EPA 515.4 - Chlorophenoxy Herbicides									
11/14/19	11/15/19 02:13	1209558	1210367	(EPA 515.4)	2,4,5-TP (Silvex)	ND	ug/L	0.20	1
11/14/19	11/15/19 02:13	1209558	1210367	(EPA 515.4)	2,4-D	ND	ug/L	0.10	1
11/14/19	11/15/19 02:13	1209558	1210367	(EPA 515.4)	Bentazon	ND	ug/L	0.50	1
11/14/19	11/15/19 02:13	1209558	1210367	(EPA 515.4)	Dalapon	ND	ug/L	1.0	1
11/14/19	11/15/19 02:13	1209558	1210367	(EPA 515.4)	Dinoseb	ND	ug/L	0.20	1
11/14/19	11/15/19 02:13	1209558	1210367	(EPA 515.4)	Pentachlorophenol	ND	ug/L	0.040	1
11/14/19	11/15/19 02:13	1209558	1210367	(EPA 515.4)	Picloram	ND	ug/L	0.10	1
11/14/19	11/15/19 02:13	1209558	1210367	(EPA 515.4)	2,4-Dichlorophenyl acetic acid	105	%		1
11/14/19	11/15/19 02:13	1209558	1210367	(EPA 515.4)	4,4-Dibromooctafluorobiphenyl	107	%		1
EPA 504.1 - EPA Method 504.1									
11/15/19	11/15/19 16:14	1208900	1210395	(EPA 504.1)	Dibromochloropropane (DBCP)	ND	ug/L	0.010	1
11/15/19	11/15/19 16:14	1208900	1210395	(EPA 504.1)	Ethylene Dibromide (EDB)	ND	ug/L	0.010	1
11/15/19	11/15/19 16:14	1208900	1210395	(EPA 504.1)	1,2-Dibromopropane	96	%		1
EPA 551.1 - EDB/DBCP/HAN by EPA 551.1									
11/15/19	11/28/19 22:54	1209952	1212688	(EPA 551.1)	Dibromochloropropane (DBCP)	ND	ug/L	0.010	1
11/15/19	11/28/19 22:54	1209952	1212688	(EPA 551.1)	Ethylene Dibromide (EDB)	ND	ug/L	0.010	1
11/15/19	11/28/19 22:54	1209952	1212688	(EPA 551.1)	1,2-Dibromopropane	102	%		1

Rounding on totals after summation.

(c) - indicates calculated results. Analysis is a calculated result. Reported results are not rounded until the final step before reporting. Therefore methods that use a test result with further calculation may have slight differences in final result than the component analyses.

Tel: (626) 386-1100
Fax: (866) 988-3757
1 800 566 LABS (1 800 566 5227)

Laboratory Data

Report: 838086
Project: DRINKING-SOC
Group: SOC's Regulated

Inter-Mountain Labs - Sheridan
Ian Scofield
1673 Terra Avenue
Sheridan, WY 82801

Samples Received on:
11/12/2019 1040

Prepped	Analyzed	Prep Batch	Analytical Batch	Method	Analyte	Result	Units	MRL	Dilution
EPA 525.2 - Semivolatiles by GCMS									
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Alachlor	ND	ug/L	0.050	1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Atrazine	ND	ug/L	0.050	1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Benzo(a)pyrene	ND	ug/L	0.020	1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Di-(2-Ethylhexyl)adipate	ND	ug/L	0.60	1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Di(2-Ethylhexyl)phthalate	ND	ug/L	0.60	1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Hexachlorobenzene	ND	ug/L	0.050	1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Hexachlorocyclopentadiene	ND	ug/L	0.050	1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Molinate	ND	ug/L	0.10	1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Simazine	ND	ug/L	0.050	1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Thiobencarb (ELAP)	ND	ug/L	0.20	1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	1,3-Dimethyl-2-nitrobenzene	101	%		1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Acenaphthene-d10	100	%		1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Chrysene-d12	107	%		1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Perylene-d12	89	%		1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Phenanthrene-d10	101	%		1
11/14/19	11/19/19 21:35	1209681	1210820	(EPA 525.2)	Triphenylphosphate	116	%		1
EPA 548.1 - Endothall									
11/12/19	11/15/19 9:05	1209149	1209874	(EPA 548.1)	Endothall	ND (M2)	ug/L	7.5	1.5
EPA 1613B - 2,3,7,8-TCDD_Dioxin									
11/20/19	11/22/19 19:10	1210744	1212027	(EPA 1613B)	2,3,7,8-TCDD	ND	pg/L	5.00	1
11/20/19	11/22/19 19:10	1210744	1212027	(EPA 1613B)	C12-2,3,7,8-TCDD	63	%		1
EPA 547 - Glyphosate									
	11/17/19 15:26		1210278	(EPA 547)	Glyphosate	ND	ug/L	6.0	1
EPA 531.2 - Aldicarbs									
	11/16/19 00:31		1210316	(EPA 531.2)	Carbofuran (Furadan)	ND	ug/L	0.50	1
	11/16/19 00:31		1210316	(EPA 531.2)	Oxamyl (Vydate)	ND	ug/L	0.50	1
	11/16/19 00:31		1210316	(EPA 531.2)	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate	93	%		1
EPA 549.2 - Diquat and Paraquat									
11/13/19	11/13/19 19:40	1209165	1209748	(EPA 549.2)	Diquat	ND	ug/L	0.40	1

Rounding on totals after summation.

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Tel: (626) 386-1100
Fax: (866) 988-3757
1 800 566 LABS (1 800 566 5227)

Laboratory QC Summary

Report: 838086
Project: DRINKING-SOC
Group: SOC's Regulated

Inter-Mountain Labs - Sheridan

Diquat and Paraquat

Prep Batch: 1209165 Analytical Batch: 1209748

201911120085 C3 110519 0830 MC

Analysis Date: 11/13/2019

Analyzed by: XWO

Endothall

Prep Batch: 1209149 Analytical Batch: 1209874

201911120085 C3 110519 0830 MC

Analysis Date: 11/15/2019

Analyzed by: X8AA

Glyphosate

Analytical Batch: 1210278

201911120085 C3 110519 0830 MC

Analysis Date: 11/17/2019

Analyzed by: DYM

Aldicarb's

Analytical Batch: 1210316

201911120085 C3 110519 0830 MC

Analysis Date: 11/16/2019

Analyzed by: XWO

Chlorophenoxy Herbicides

Prep Batch: 1209558 Analytical Batch: 1210367

201911120085 C3 110519 0830 MC

Analysis Date: 11/15/2019

Analyzed by: LRL

EPA Method 504.1

Prep Batch: 1208900 Analytical Batch: 1210395

201911120085 C3 110519 0830 MC

Analysis Date: 11/15/2019

Analyzed by: DYM

Semivolatiles by GCMS

Prep Batch: 1209681 Analytical Batch: 1210820

201911120085 C3 110519 0830 MC

Analysis Date: 11/19/2019

Analyzed by: JWC

Organochlorine Pesticides/PCBs

Prep Batch: 1209243 Analytical Batch: 1211298

201911120085 C3 110519 0830 MC

Analysis Date: 11/13/2019

Analyzed by: VQT9

2,3,7,8-TCDD_Dioxin

Prep Batch: 1210744 Analytical Batch: 1212027

201911120085 C3 110519 0830 MC

Analysis Date: 11/22/2019

Analyzed by: JYH

EDB/DBCP/HAN by EPA 551.1

Prep Batch: 1209952 Analytical Batch: 1212688

201911120085 C3 110519 0830 MC

Analysis Date: 11/28/2019

Analyzed by: LRL

Tel: (626) 386-1100
Fax: (626) 988-3757
1 800 566 LABS (1 800 566 5227)

Report: 838086
Project: DRINKING-SOC
Group: SOC's Regulated

Inter-Mountain Labs - Sheridan

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
Diquat and Paraquat by EPA 549.2									
Analytical Batch: 1209748					Analysis Date: 11/13/2019				
CCCH	Diquat		10	10.5	ug/L	105	(80-120)		
CCCL	Diquat		0.4	0.416	ug/L	104	(50-150)		
CCCM	Diquat		4	4.08	ug/L	102	(80-120)		
LCS1	Diquat		5	4.44	ug/L	89	(73-96)		
MBLK	Diquat			<0.4	ug/L				
MRLLW	Diquat		0.4	0.431	ug/L	108	(50-150)		
MS_201910050088	Diquat	ND	5	4.52	ug/L	91	(70-130)		
MS2_201911120369	Diquat	ND	5	4.24	ug/L	85	(70-130)		
MSD_201910050088	Diquat	ND	5	4.59	ug/L	92	(70-130)	20	1.5
Endothall by EPA 548.1									
Prep Batch: 1209149 Analytical Batch: 1209874					Analysis Date: 11/15/2019				
LCS1	Endothall		25	22.3	ug/L	89	(66-117)		
LCS2	Endothall		25	22.1	ug/L	88	(66-117)	30	0.90
MBLK	Endothall			<5	ug/L				
MRL_CHK	Endothall		5	4.16	ug/L	83	(50-150)		
MS_201911120085	Endothall	ND	37.5	9.02	ug/L	<u>24</u>	(66-117)		
MSD_201911120085	Endothall	ND	37.5	9.88	ug/L	<u>26</u>	(66-117)	30	9.1
Glyphosate by EPA 547									
Analytical Batch: 1210278					Analysis Date: 11/17/2019				
CCCH	Glyphosate		25	24.5	ug/L	98	(80-120)		
CCCM	Glyphosate		10	10.1	ug/L	101	(80-120)		
LCS1	Glyphosate		10	10.5	ug/L	105	(80-120)		
MBLK	Glyphosate			<3	ug/L				
MRL_CHK	Glyphosate		6	6.55	ug/L	109	(50-150)		
MS_201911140360	Glyphosate	ND	10	10.1	ug/L	101	(80-120)		
MS2_201911140385	Glyphosate	ND	10	10.4	ug/L	104	(80-120)		
MSD_201911140360	Glyphosate	ND	10	10.6	ug/L	106	(80-120)	20	5.0
Aldicarb by EPA 531.2									
Analytical Batch: 1210316					Analysis Date: 11/15/2019				
CCCH	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate (:			90.6	%	91	(70-130)		
CCCM	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate (:			87.1	%	87	(70-130)		
LCS	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate (:			93.2	%	93	(70-130)		
MBLK	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate (:			88.3	%	88	(70-130)		

Spike recovery is already corrected for native results.

Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.

Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.

RPD not calculated for LCS2 when different a concentration than LCS1 is used.

RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).

(S) - Indicates surrogate compound.

(I) - Indicates internal standard compound.

Tel: (626) 386-1100
Fax: (866) 988-3757
1 800 566 LABS (1 800 566 5227)

Report: 838086
Project: DRINKING-SOC
Group: SOC's Regulated

Inter-Mountain Labs - Sheridan

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate (I)		100	98.2	%	98	(70-130)		
MS1_201911140421	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate (I)			96.4	%	96	(70-130)		
MSD1_201911140421	4-Bromo-3,5-dimethylphenyl-N-methylcarbamate (I)			99.9	%	100	(70-130)		
CCCH	Carbofuran (Furadan)		25	24.7	ug/L	99	(70-130)		
CCCM	Carbofuran (Furadan)		10	10.0	ug/L	100	(70-130)		
LCS	Carbofuran (Furadan)		5	4.91	ug/L	98	(70-130)		
MBLK	Carbofuran (Furadan)			<0.167	ug/L				
MRL_CHK	Carbofuran (Furadan)		0.5	0.491	ug/L	98	(50-150)		
MS1_201911140421	Carbofuran (Furadan)	ND	5	5.34	ug/L	107	(70-130)		
MSD1_201911140421	Carbofuran (Furadan)	ND	5	5.62	ug/L	112	(70-130)	20	5.2
CCCH	Oxamyl (Vydate)		25	24.5	ug/L	98	(70-130)		
CCCM	Oxamyl (Vydate)		10	9.87	ug/L	99	(70-130)		
LCS	Oxamyl (Vydate)		5	5.08	ug/L	102	(70-130)		
MBLK	Oxamyl (Vydate)			<0.167	ug/L				
MRL_CHK	Oxamyl (Vydate)		0.5	0.478	ug/L	96	(50-150)		
MS1_201911140421	Oxamyl (Vydate)	ND	5	5.43	ug/L	109	(70-130)		
MSD1_201911140421	Oxamyl (Vydate)	ND	5	5.45	ug/L	109	(70-130)	20	0.40

Chlorophenoxy Herbicides by EPA 515.4

Analytical Batch: 1210367

Analysis Date: 11/15/2019

CCC3	2,4,5-TP (Silvex)		4	3.85	ug/L	96	(70-130)		
CCCH	2,4,5-TP (Silvex)		4	3.88	ug/L	97	(70-130)		
CCCM	2,4,5-TP (Silvex)		1	1.05	ug/L	105	(70-130)		
MBLK	2,4,5-TP (Silvex)			<0.066	ug/L				
MRL_CHK	2,4,5-TP (Silvex)		0.2	0.230	ug/L	115	(50-150)		
MS1_201911120053	2,4,5-TP (Silvex)	ND	3	3.29	ug/L	110	(70-130)		
MSD1_201911120053	2,4,5-TP (Silvex)	ND	3	3.26	ug/L	109	(70-130)	30	0.98
CCC3	2,4-D		2	1.79	ug/L	90	(70-130)		
CCCH	2,4-D		2	1.75	ug/L	87	(70-130)		
CCCM	2,4-D		0.5	0.487	ug/L	97	(70-130)		
MBLK	2,4-D			<0.033	ug/L				
MRL_CHK	2,4-D		0.1	0.0717	ug/L	72	(50-150)		
MS1_201911120053	2,4-D	ND	1.5	1.27	ug/L	85	(70-130)		
MSD1_201911120053	2,4-D	ND	1.5	1.18	ug/L	79	(70-130)	30	7.6
CCC3	2,4-Dichlorophenyl acetic acid (S)		100	89.0	%	89	(70-130)		
CCCH	2,4-Dichlorophenyl acetic acid (S)		10	90.5	%	91	(70-130)		
CCCM	2,4-Dichlorophenyl acetic acid (S)		2.5	104	%	104	(70-130)		
MBLK	2,4-Dichlorophenyl acetic acid (S)			110	%	110	(70-130)		
MRL_CHK	2,4-Dichlorophenyl acetic acid (S)			106	%	106	(70-130)		

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Report: 838086
Project: DRINKING-SOC
Group: SOC's Regulated

Inter-Mountain Labs - Sheridan

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS1_201911120053	2,4-Dichlorophenyl acetic acid (S)			106	%	106	(70-130)		
MSD1_201911120053	2,4-Dichlorophenyl acetic acid (S)			99.3	%	99	(70-130)		
CCC3	4,4-Dibromooctafluorobiphenyl (I)		100	122	%	122	(50-150)		
CCCH	4,4-Dibromooctafluorobiphenyl (I)			120	%	120	(50-150)		
CCCM	4,4-Dibromooctafluorobiphenyl (I)			103	%	103	(50-150)		
MBLK	4,4-Dibromooctafluorobiphenyl (I)			105	%	105	(50-150)		
MRL_CHK	4,4-Dibromooctafluorobiphenyl (I)		100	91.0	%	91	(50-150)		
MS1_201911120053	4,4-Dibromooctafluorobiphenyl (I)		100	104	%	104	(50-150)		
MSD1_201911120053	4,4-Dibromooctafluorobiphenyl (I)			98.6	%	99	(50-150)		
CCC3	Bentazon		10	9.26	ug/L	93	(70-130)		
CCCH	Bentazon		10	9.14	ug/L	91	(70-130)		
CCCM	Bentazon		2.5	2.92	ug/L	117	(70-130)		
MBLK	Bentazon			<0.166	ug/L				
MRL_CHK	Bentazon		0.5	0.652	ug/L	130	(50-150)		
MS1_201911120053	Bentazon	ND	7.5	8.67	ug/L	116	(70-130)		
MSD1_201911120053	Bentazon	ND	7.5	9.16	ug/L	122	(70-130)	30	5.5
CCC3	Dalapon		20	18.1	ug/L	91	(70-130)		
CCCH	Dalapon		20	17.9	ug/L	90	(70-130)		
CCCM	Dalapon		5	5.06	ug/L	101	(70-130)		
MBLK	Dalapon			<0.333	ug/L				
MRL_CHK	Dalapon		1	1.03	ug/L	103	(50-150)		
MS1_201911120053	Dalapon	ND	15	15.5	ug/L	103	(70-130)		
MSD1_201911120053	Dalapon	ND	15	15.4	ug/L	103	(70-130)	30	0.53
CCC3	Dinoseb		4	3.92	ug/L	98	(70-130)		
CCCH	Dinoseb		4	3.71	ug/L	93	(70-130)		
CCCM	Dinoseb		1	1.04	ug/L	105	(70-130)		
MBLK	Dinoseb			<0.066	ug/L				
MRL_CHK	Dinoseb		0.2	0.243	ug/L	122	(50-150)		
MS1_201911120053	Dinoseb	ND	3	3.20	ug/L	107	(70-130)		
MSD1_201911120053	Dinoseb	ND	3	2.96	ug/L	99	(70-130)	30	7.6
CCC3	Pentachlorophenol		0.8	0.832	ug/L	104	(70-130)		
CCCH	Pentachlorophenol		0.8	0.771	ug/L	96	(70-130)		
CCCM	Pentachlorophenol		0.2	0.205	ug/L	103	(70-130)		
MBLK	Pentachlorophenol			<0.013	ug/L				
MRL_CHK	Pentachlorophenol		0.04	0.0366	ug/L	92	(50-150)		
MS1_201911120053	Pentachlorophenol	ND	0.6	0.677	ug/L	113	(70-130)		
MSD1_201911120053	Pentachlorophenol	ND	0.6	0.660	ug/L	110	(70-130)	30	2.6
CCC3	Picloram		2	1.89	ug/L	95	(70-130)		

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Report: 838086
Project: DRINKING-SOC
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Inter-Mountain Labs - Sheridan

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
CCCH	Picloram		2	1.95	ug/L	98	(70-130)		
CCCM	Picloram		0.5	0.510	ug/L	102	(70-130)		
MBLK	Picloram			<0.033	ug/L				
MRL_CHK	Picloram		0.1	0.110	ug/L	110	(50-150)		
MS1_201911120053	Picloram	ND	1.5	1.40	ug/L	93	(70-130)		
MSD1_201911120053	Picloram	ND	1.5	1.23	ug/L	82	(70-130)	30	13

EPA Method 504.1 by EPA 504.1

Analytical Batch: 1210395

Analysis Date: 11/15/2019

CCCH	1,2-Dibromo-3-chloropropane		0.25	0.233	ug/L	93	(70-130)		
CCCM2	1,2-Dibromo-3-chloropropane		0.05	0.0465	ug/L	93	(70-130)		
DUP_201910310099	1,2-Dibromo-3-chloropropane	ND		ND	ug/L		(0-20)		
LCS2	1,2-Dibromo-3-chloropropane		0.2	0.186	ug/L	93	(70-130)		
MBLK	1,2-Dibromo-3-chloropropane			<0.01	ug/L				
MRL_CHK	1,2-Dibromo-3-chloropropane		0.01	0.00910	ug/L	91	(60-140)		
MRLLW	1,2-Dibromo-3-chloropropane		0.008	0.00700	ug/L	88	(60-140)		
MS_201910310098	1,2-Dibromo-3-chloropropane	ND	0.25	0.244	ug/L	97	(65-135)		
CCCH	1,2-Dibromoethane		0.25	0.236	ug/L	94	(70-130)		
CCCM2	1,2-Dibromoethane		0.05	0.0510	ug/L	102	(70-130)		
DUP_201910310099	1,2-Dibromoethane	ND		ND	ug/L		(0-20)		
LCS2	1,2-Dibromoethane		0.2	0.193	ug/L	97	(70-130)		
MBLK	1,2-Dibromoethane			<0.01	ug/L				
MRL_CHK	1,2-Dibromoethane		0.01	0.00910	ug/L	91	(60-140)		
MRLLW	1,2-Dibromoethane		0.008	0.00790	ug/L	99	(60-140)		
MS_201910310098	1,2-Dibromoethane	ND	0.25	0.244	ug/L	98	(65-135)		
CCCH	1,2-Dibromopropane (S)		100	96.1	%	96	(60-140)		
CCCM2	1,2-Dibromopropane (S)		100	100	%	101	(60-140)		
DUP_201910310099	1,2-Dibromopropane (S)		100	97.4	%	97	(60-140)		
LCS2	1,2-Dibromopropane (S)		100	99.7	%	100	(60-140)		
MBLK	1,2-Dibromopropane (S)			94.0	%	94	(60-140)		
MRL_CHK	1,2-Dibromopropane (S)		100	104	%	104	(60-140)		
MRLLW	1,2-Dibromopropane (S)		100	102	%	102	(60-140)		
MS_201910310098	1,2-Dibromopropane (S)		100	97.2	%	97	(60-140)		

Semivolatiles by GCMS by EPA 525.2

Prep Batch: 1209681 Analytical Batch: 1210820

Analysis Date: 11/19/2019

DUP_201911120038	1,3-Dimethyl-2-nitrobenzene (S)			98.6	%	99	(70-130)		
LCS1	1,3-Dimethyl-2-nitrobenzene (S)		5	97.0	%	97	(70-130)		
LCS2	1,3-Dimethyl-2-nitrobenzene (S)		5	95.7	%	96	(70-130)		

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Report: 838086
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Inter-Mountain Labs - Sheridan

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	1,3-Dimethyl-2-nitrobenzene (S)			93.8	%	94	(70-130)		
MRL_CHK	1,3-Dimethyl-2-nitrobenzene (S)		5	95.1	%	95	(70-130)		
MS_201911120037	1,3-Dimethyl-2-nitrobenzene (S)		5	93.5	%	93	(70-130)		
DUP_201911120038	Acenaphthene-d10 (I)			118	%	119	(50-150)		
LCS1	Acenaphthene-d10 (I)		5	98.3	%	98	(50-150)		
LCS2	Acenaphthene-d10 (I)		5	109	%	109	(50-150)		
MBLK	Acenaphthene-d10 (I)			102	%	102	(50-150)		
MRL_CHK	Acenaphthene-d10 (I)		5	99.6	%	100	(50-150)		
MS_201911120037	Acenaphthene-d10 (I)		5	94.7	%	95	(50-150)		
DUP_201911120038	Alachlor			ND	ug/L		(0-20)		
LCS1	Alachlor		2	2.05	ug/L	103	(70-130)		
LCS2	Alachlor		2	2.07	ug/L	103	(70-130)	20	0.97
MBLK	Alachlor			<0.05	ug/L				
MRL_CHK	Alachlor		0.05	0.0520	ug/L	104	(50-150)		
MS_201911120037	Alachlor		2	2.06	ug/L	103	(70-130)		
DUP_201911120038	Atrazine	ND		ND	ug/L		(0-20)		
LCS1	Atrazine		2	2.30	ug/L	115	(70-130)		
LCS2	Atrazine		2	2.10	ug/L	105	(70-130)	20	9.1
MBLK	Atrazine			<0.05	ug/L				
MRL_CHK	Atrazine		0.05	0.0390	ug/L	78	(50-150)		
MS_201911120037	Atrazine	ND	2	2.12	ug/L	106	(70-130)		
DUP_201911120038	Benzo(a)pyrene	ND		ND	ug/L		(0-20)		
LCS1	Benzo(a)pyrene		2	2.04	ug/L	102	(70-130)		
LCS2	Benzo(a)pyrene		2	2.08	ug/L	104	(70-130)	20	1.9
MBLK	Benzo(a)pyrene			<0.02	ug/L				
MRL_CHK	Benzo(a)pyrene		0.02	0.0180	ug/L	90	(50-150)		
MS_201911120037	Benzo(a)pyrene	ND	2	1.78	ug/L	89	(70-130)		
DUP_201911120038	Chrysene-d12 (I)			112	%	112	(50-150)		
LCS1	Chrysene-d12 (I)		5	114	%	114	(50-150)		
LCS2	Chrysene-d12 (I)		5	121	%	121	(50-150)		
MBLK	Chrysene-d12 (I)			109	%	109	(50-150)		
MRL_CHK	Chrysene-d12 (I)		5	107	%	107	(50-150)		
MS_201911120037	Chrysene-d12 (I)		5	93.5	%	94	(50-150)		
DUP_201911120038	Di-(2-Ethylhexyl)adipate	ND		ND	ug/L		(0-20)		
LCS1	Di-(2-Ethylhexyl)adipate		2	2.31	ug/L	115	(70-130)		
LCS2	Di-(2-Ethylhexyl)adipate		2	2.23	ug/L	111	(70-130)	20	3.5
MBLK	Di-(2-Ethylhexyl)adipate			<0.6	ug/L				
MRL_CHK	Di-(2-Ethylhexyl)adipate		0.3	0.309	ug/L	103	(50-150)		

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201911120037	Di-(2-Ethylhexyl)adipate	ND	2	1.95	ug/L	98	(70-130)		
DUP_201911120038	Di(2-Ethylhexyl)phthalate	ND		ND	ug/L		(0-20)		
LCS1	Di(2-Ethylhexyl)phthalate		2	2.03	ug/L	102	(70-130)		
LCS2	Di(2-Ethylhexyl)phthalate		2	2.00	ug/L	100	(70-130)	20	1.5
MBLK	Di(2-Ethylhexyl)phthalate			<0.6	ug/L				
MRL_CHK	Di(2-Ethylhexyl)phthalate		0.6	0.643	ug/L	107	(50-150)		
MS_201911120037	Di(2-Ethylhexyl)phthalate	ND	2	1.90	ug/L	95	(70-130)		
DUP_201911120038	Hexachlorobenzene	ND		ND	ug/L		(0-20)		
LCS1	Hexachlorobenzene		2	1.99	ug/L	99	(70-130)		
LCS2	Hexachlorobenzene		2	1.86	ug/L	93	(70-130)	20	6.8
MBLK	Hexachlorobenzene			<0.05	ug/L				
MRL_CHK	Hexachlorobenzene		0.05	0.0480	ug/L	96	(50-150)		
MS_201911120037	Hexachlorobenzene	ND	2	1.95	ug/L	98	(70-130)		
DUP_201911120038	Hexachlorocyclopentadiene	ND		ND	ug/L		(0-20)		
LCS1	Hexachlorocyclopentadiene		2	1.88	ug/L	94	(70-130)		
LCS2	Hexachlorocyclopentadiene		2	1.92	ug/L	96	(70-130)	20	2.1
MBLK	Hexachlorocyclopentadiene			<0.05	ug/L				
MRL_CHK	Hexachlorocyclopentadiene		0.05	0.0440	ug/L	88	(50-150)		
MS_201911120037	Hexachlorocyclopentadiene	ND	2	2.02	ug/L	101	(70-130)		
DUP_201911120038	Molinate	ND		ND	ug/L		(0-20)		
LCS1	Molinate		2	2.06	ug/L	103	(70-130)		
LCS2	Molinate		2	1.94	ug/L	97	(70-130)	20	6.0
MBLK	Molinate			<0.1	ug/L				
MRL_CHK	Molinate		0.1	0.0980	ug/L	98	(50-150)		
MS_201911120037	Molinate	ND	2	2.00	ug/L	100	(70-130)		
DUP_201911120038	Perylene-d12 (S)			90.2	%	90	(70-130)		
LCS1	Perylene-d12 (S)		5	100	%	100	(70-130)		
LCS2	Perylene-d12 (S)		5	101	%	101	(70-130)		
MBLK	Perylene-d12 (S)			87.5	%	87	(70-130)		
MRL_CHK	Perylene-d12 (S)		5	91.4	%	91	(70-130)		
MS_201911120037	Perylene-d12 (S)		5	98.1	%	98	(70-130)		
DUP_201911120038	Phenanthrene-d10 (I)			124	%	124	(50-150)		
LCS1	Phenanthrene-d10 (I)		5	103	%	103	(50-150)		
LCS2	Phenanthrene-d10 (I)		5	111	%	111	(50-150)		
MBLK	Phenanthrene-d10 (I)			103	%	103	(50-150)		
MRL_CHK	Phenanthrene-d10 (I)		5	105	%	105	(50-150)		
MS_201911120037	Phenanthrene-d10 (I)		5	97.1	%	97	(50-150)		
DUP_201911120038	Simazine	ND		ND	ug/L		(0-20)		

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Inter-Mountain Labs - Sheridan

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Simazine		2	1.98	ug/L	99	(70-130)		
LCS2	Simazine		2	1.91	ug/L	95	(70-130)	20	3.6
MBLK	Simazine			<0.05	ug/L				
MRL_CHK	Simazine		0.05	0.0560	ug/L	112	(50-150)		
MS_201911120037	Simazine	ND	2	2.04	ug/L	102	(70-130)		
DUP_201911120038	Thiobencarb	ND		ND	ug/L		(0-20)		
LCS1	Thiobencarb		2	2.09	ug/L	104	(70-130)		
LCS2	Thiobencarb		2	2.06	ug/L	103	(70-130)	20	1.5
MBLK	Thiobencarb			<0.2	ug/L				
MRL_CHK	Thiobencarb		0.1	0.104	ug/L	104	(50-150)		
MS_201911120037	Thiobencarb	ND	2	2.08	ug/L	104	(70-130)		
DUP_201911120038	Triphenylphosphate (S)			112	%	113	(70-130)		
LCS1	Triphenylphosphate (S)		5	112	%	112	(70-130)		
LCS2	Triphenylphosphate (S)		5	116	%	116	(70-130)		
MBLK	Triphenylphosphate (S)			109	%	109	(70-130)		
MRL_CHK	Triphenylphosphate (S)		5	107	%	107	(70-130)		
MS_201911120037	Triphenylphosphate (S)		5	111	%	111	(70-130)		

Organochlorine Pesticides/PCBs by EPA 505

Prep Batch: 1209243 Analytical Batch: 1211298

Analysis Date: 11/13/2019

CCCH	Alachlor (Alanex)		1	1.15	ug/L	115	(70-130)		
CCCH	Alachlor (Alanex)		1	1.10	ug/L	110	(70-130)		
MBLK	Alachlor (Alanex)			<0.1	ug/L				
MRL_CHK	Alachlor (Alanex)		0.1	0.0730	ug/L	73	(50-150)		
MS1_201911080085	Alachlor (Alanex)	ND	0.2	0.201	ug/L	100	(65-135)		
MS2_201911070301	Alachlor (Alanex)	ND	1	1.10	ug/L	110	(65-135)		
MBLK	Chlordane			<0.1	ug/L				
CCCH	Endrin		0.1	0.112	ug/L	112	(70-130)		
CCCH	Endrin		0.1	0.108	ug/L	108	(70-130)		
MBLK	Endrin			<0.01	ug/L				
MRL_CHK	Endrin		0.01	0.00810	ug/L	81	(50-150)		
MS1_201911080085	Endrin	ND	0.02	0.0196	ug/L	98	(65-135)		
MS2_201911070301	Endrin	ND	0.1	0.107	ug/L	107	(65-135)		
CCCH	Heptachlor		0.1	0.116	ug/L	116	(70-130)		
CCCH	Heptachlor		0.1	0.107	ug/L	107	(70-130)		
MBLK	Heptachlor			<0.01	ug/L				
MRL_CHK	Heptachlor		0.01	0.00750	ug/L	75	(50-150)		
MS1_201911080085	Heptachlor	ND	0.02	0.0200	ug/L	100	(65-135)		
MS2_201911070301	Heptachlor	ND	0.1	0.111	ug/L	111	(65-135)		

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RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).

(S) - Indicates surrogate compound.

(I) - Indicates internal standard compound.

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1 800 566 LABS (1 800 566 5227)

Report: 838086
Project: DRINKING-SOC
Group: SOC's Regulated

Inter-Mountain Labs - Sheridan

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
CCCH	Heptachlor Epoxide		0.1	0.110	ug/L	111	(70-130)		
CCCH	Heptachlor Epoxide		0.1	0.108	ug/L	108	(70-130)		
MBLK	Heptachlor Epoxide			<0.01	ug/L				
MRL_CHK	Heptachlor Epoxide		0.01	0.00850	ug/L	85	(50-150)		
MS1_201911080085	Heptachlor Epoxide	ND	0.02	0.0202	ug/L	101	(65-135)		
MS2_201911070301	Heptachlor Epoxide	ND	0.1	0.105	ug/L	105	(65-135)		
CCCH	Lindane (gamma-BHC)		0.1	0.111	ug/L	111	(70-130)		
CCCH	Lindane (gamma-BHC)		0.1	0.106	ug/L	106	(70-130)		
MBLK	Lindane (gamma-BHC)			<0.01	ug/L				
MRL_CHK	Lindane (gamma-BHC)		0.01	0.0106	ug/L	106	(50-150)		
MS1_201911080085	Lindane (gamma-BHC)	ND	0.02	0.0213	ug/L	107	(65-135)		
MS2_201911070301	Lindane (gamma-BHC)	ND	0.1	0.106	ug/L	106	(65-135)		
CCCH	Methoxychlor		0.5	0.530	ug/L	106	(70-130)		
CCCH	Methoxychlor		0.5	0.501	ug/L	100	(70-130)		
MBLK	Methoxychlor			<0.05	ug/L				
MRL_CHK	Methoxychlor		0.05	0.0380	ug/L	76	(50-150)		
MS1_201911080085	Methoxychlor	ND	0.1	0.0928	ug/L	92	(65-135)		
MS2_201911070301	Methoxychlor	ND	0.5	0.506	ug/L	101	(65-135)		
MBLK	PCB 1016 Aroclor			<0.08	ug/L				
MBLK	PCB 1221 Aroclor			<0.1	ug/L				
MBLK	PCB 1232 Aroclor			<0.1	ug/L				
MBLK	PCB 1242 Aroclor			<0.1	ug/L				
MBLK	PCB 1248 Aroclor			<0.1	ug/L				
MBLK	PCB 1254 Aroclor			<0.1	ug/L				
MBLK	PCB 1260 Aroclor			<0.1	ug/L				
CCCH	Tetrachlorometaxylene (S)			114	%	114	(70-130)		
CCCH	Tetrachlorometaxylene (S)			110	%	110	(70-130)		
MBLK	Tetrachlorometaxylene (S)			110	%	110	(70-130)		
MRL_CHK	Tetrachlorometaxylene (S)			109	%	109	(70-130)		
MS1_201911080085	Tetrachlorometaxylene (S)			97.9	%	98	(70-130)		
MS2_201911070301	Tetrachlorometaxylene (S)			114	%	114	(70-130)		
CCCH	Toxaphene		2.5	2.45	ug/L	98	(70-130)		
MBLK	Toxaphene			<0.5	ug/L				
MRL_CHK	Toxaphene		0.5	0.612	ug/L	122	(50-150)		
MS1_201911080085	Toxaphene		2.5	2.30	ug/L	92	(65-135)		
MS2_201911070301	Toxaphene		2.5	2.70	ug/L	108	(65-135)		

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Inter-Mountain Labs - Sheridan

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
2,3,7,8-TCDD_Dioxin by EPA 1613B									
Prep Batch: 1210744 Analytical Batch: 1212027					Analysis Date: 11/22/2019				
DUP_201911140360	2,3,7,8-TCDD	ND		ND	pg/L		(0-20)		
LCS1	2,3,7,8-TCDD		200	158	pg/L	79	(73-146)		
LCS2	2,3,7,8-TCDD		200	163	pg/L	82	(73-146)	20	3.1
MBLK	2,3,7,8-TCDD			<1.67	pg/L				
MRL_CHK	2,3,7,8-TCDD		5	3.89	pg/L	78	(50-150)		
MS_201911180318	2,3,7,8-TCDD	ND	200	181	pg/L	90	(73-146)		
DUP_201911140360	C12-2,3,7,8-TCDD (S)		2000	62.6	%	63	(31-137)		
LCS1	C12-2,3,7,8-TCDD (S)		2000	69.7	%	70	(25-141)		
LCS2	C12-2,3,7,8-TCDD (S)		2000	57.0	%	57	(25-141)		
MBLK	C12-2,3,7,8-TCDD (S)			60.6	%	61	(31-137)		
MRL_CHK	C12-2,3,7,8-TCDD (S)		2000	75.9	%	76	(25-141)		
MS_201911180318	C12-2,3,7,8-TCDD (S)		2000	63.4	%	63	(25-141)		
EDB/DBCP/HAN by EPA 551.1 by EPA 551.1									
Prep Batch: 1209952 Analytical Batch: 1212688					Analysis Date: 11/28/2019				
CCC3	1,2-Dibromopropane (S)			95.9	%	96	(80-120)		
CCCM2	1,2-Dibromopropane (S)			93.5	%	94	(80-120)		
CCCM2	1,2-Dibromopropane (S)			112	%	112	(80-120)		
DUP1_201911070301	1,2-Dibromopropane (S)			137	%	<u>137</u>	(80-120)		
DUP2_201911060827	1,2-Dibromopropane (S)			107	%	107	(80-120)		
LCS2	1,2-Dibromopropane (S)		100	95.0	%	95	(80-120)		
MBLK	1,2-Dibromopropane (S)			<u>120</u>	%	120	(80-120)		
MBLK	1,2-Dibromopropane (S)			99.3	%	99	(80-120)		
MRL_CHK	1,2-Dibromopropane (S)		100	95.9	%	96	(80-120)		
MRL_CHK	1,2-Dibromopropane (S)		100	97.7	%	98	(80-120)		
MS_201911060826	1,2-Dibromopropane (S)			95.8	%	96	(80-120)		
MS_201911070301	1,2-Dibromopropane (S)			118	%	118	(80-120)		
CCC3	Dibromochloropropane (DBCP)		0.25	0.255	ug/L	102	(80-120)		
CCCM2	Dibromochloropropane (DBCP)		0.05	0.0516	ug/L	103	(80-120)		
DUP1_201911070301	Dibromochloropropane (DBCP)	ND		0	ug/L		(0-20)		
DUP2_201911060827	Dibromochloropropane (DBCP)	ND		0	ug/L		(0-20)		
LCS2	Dibromochloropropane (DBCP)		0.25	0.261	ug/L	105	(80-120)		
MBLK	Dibromochloropropane (DBCP)			<0.01	ug/L				
MRL_CHK	Dibromochloropropane (DBCP)		0.01	0.0107	ug/L	107	(50-150)		
MS_201911060826	Dibromochloropropane (DBCP)	ND	0.25	0.255	ug/L	102	(80-120)		
MS_201911070301	Dibromochloropropane (DBCP)	ND	0.25	0.284	ug/L	114	(80-120)		

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Inter-Mountain Labs - Sheridan

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
CCC3	Ethylene Dibromide (EDB)		0.25	0.261	ug/L	104	(80-120)		
CCCM2	Ethylene Dibromide (EDB)		0.05	0.0532	ug/L	106	(80-120)		
DUP1_201911070301	Ethylene Dibromide (EDB)	ND		0	ug/L		(0-20)		
DUP2_201911060827	Ethylene Dibromide (EDB)	ND		0	ug/L		(0-20)		
LCS2	Ethylene Dibromide (EDB)		0.25	0.256	ug/L	102	(80-120)		
MBLK	Ethylene Dibromide (EDB)			<0.01	ug/L				
MRL_CHK	Ethylene Dibromide (EDB)		0.01	0.0140	ug/L	140	(50-150)		
MS_201911060826	Ethylene Dibromide (EDB)	ND	0.25	0.251	ug/L	99	(80-120)		
MS_201911070301	Ethylene Dibromide (EDB)	ND	0.25	0.302	ug/L	<u>121</u>	(80-120)		

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Environmental Isotope Laboratory
Geosciences Department
University of Arizona

Room 208 Gould-Simpson Building
+1-520-621-4618
dettman@email.arizona.edu

UA EIL Project # WA927

20 December 2019

Data report for:

Mark Cunnane
Western Groundwater Services
6595 Bear Claw Lane
Bozeman, MT 59715

406-585-5947
markc@westerngroundwaterservices.com

REPORT OF ANALYSES for 1 water sample

Stable isotope analyses: water

W# lab ID	Sample	Date	$\delta^{18}\text{O}$ ‰ VSMOW	$\delta^2\text{H}$ ‰ VSMOW
W74681	C3 110519 0830 MC	11/5/2019	-18.2	-139.5
		Analytical precision (1 σ)	0.1	1.0

Stable isotope analyses: solutes

DIC lab ID		Sulfur lab ID	$\delta^{34}\text{S}$ ‰ CDT	$\delta^{13}\text{C}$ ‰ VPDB
D3643	C3 110519 0830 MC	11/5/2019 S17579	20.7	-2.4
			0.2	0.2

DIC Standards:

-8.07	
-7.95	
-7.68	
-7.87	
-7.89	Mean
0.17	SD
-8.62	Ref. Value
-0.73	offset

Cosmogenic isotope analyses: tritium

AT#	Sample	Collection date	Tritium (TU) at collection date	Error (TU)
AT-6198	C3 110519 0830 MC	11/5/2019	3.0	0.40
		Detection Limit, 9.5 x enrichment, 1500 minutes counting	0.5 TU	

Explanation of tritium data: The detection limit, 0.5 TU, is calculated as 0 + 2 sigma for low-counting samples, and applies for 10-fold enrichment and 1500 minutes of counting. Lower limits are possible for higher enrichment factors.

A sample with a mean calculated TU value between 0 and 1 sigma, say 0.20 ± 0.35 TU, is reported thus: <0.9 TU ($= 0.2 + 2 \times 0.35$). A sample with a mean calculated TU value between 1 and 2 sigma, say 0.51 ± 0.38 , is reported thus: <1.3 (Apparent 0.5), where $1.3 = 0.51 + 2 \times 0.38$, rounded. Samples with calculated TU values greater than 2 are reported thus: 1.1 ± 0.4 TU.



David Dettman
Research Scientist
Director, EIL

Input file: F:\Project Data\Great West Engineering, Inc\2019-03 CMRWA Well #3 Project
\PHREEQC\CMRWA#3-110519.pqi
Output file: F:\Project Data\Great West Engineering, Inc\2019-03 CMRWA Well #3 Project
\PHREEQC\CMRWA#3-110519.pgo
Database file: C:\Program Files (x86)\USGS\Phreeqc Interactive 3.4.0-12927\database
\phreeqc.dat

Reading data base.

SOLUTION_MASTER_SPECIES
SOLUTION_SPECIES
PHASES
EXCHANGE_MASTER_SPECIES
EXCHANGE_SPECIES
SURFACE_MASTER_SPECIES
SURFACE_SPECIES
RATES
END

Reading input data for simulation 1.

DATABASE C:\Program Files (x86)\USGS\Phreeqc Interactive 3.4.0-12927\database
\phreeqc.dat
SOLUTION 1 CMRWA #3 11-5-2019
pH 7.2 # field measured
pe 3.5 # field Eh 0.211 V / 0.0592
units mg/L
O(0) 4.4 # field measured
Alkalinity 172
Cl 35
S(6) 162
Ca 104
Mg 28
K 1
Na 3
Si 7
END

Beginning of initial solution calculations.

Initial solution 1. CMRWA

-----Solution composition-----

Elements	Molality	Moles
Alkalinity	3.439e-03	3.439e-03
Ca	2.596e-03	2.596e-03
Cl	9.877e-04	9.877e-04
K	2.559e-05	2.559e-05
Mg	1.152e-03	1.152e-03
Na	1.306e-04	1.306e-04
O(0)	2.751e-04	2.751e-04
S(6)	1.687e-03	1.687e-03
Si	1.166e-04	1.166e-04

-----Description of solution-----

pH	=	7.200
pe	=	3.500
Specific Conductance ($\mu\text{S}/\text{cm}$, 25°C)	=	709
Density (g/cm^3)	=	0.99753
Volume (L)	=	1.00305

Activity of water = 1.000
 Ionic strength (mol/kgw) = 1.152e-02
 Mass of water (kg) = 1.000e+00
 Total carbon (mol/kg) = 3.851e-03
 Total CO2 (mol/kg) = 3.851e-03
 Temperature (°C) = 25.00
 Electrical balance (eq) = -1.478e-04
 Percent error, 100*(Cat-|An|)/(Cat+|An|) = -1.07
 Iterations = 7
 Total H = 1.110163e+02
 Total O = 5.552484e+01

-----Redox couples-----

Redox couple	pe	Eh (volts)
O(-2)/O(0)	13.3550	0.7900

-----Distribution of species-----

Species	Molality	Activity	Log Molality	Log Activity	Log Gamma	mole V cm ³ /mol
OH-	1.794e-07	1.604e-07	-6.746	-6.795	-0.049	-4.02
H+	6.943e-08	6.310e-08	-7.158	-7.200	-0.042	0.00
H2O	5.551e+01	9.998e-01	1.744	-0.000	0.000	18.07
C(4)	3.851e-03					
HCO3-	3.328e-03	2.994e-03	-2.478	-2.524	-0.046	24.78
CO2	4.236e-04	4.247e-04	-3.373	-3.372	0.001	34.43
CaHCO3+	6.369e-05	5.740e-05	-4.196	-4.241	-0.045	9.73
MgHCO3+	2.561e-05	2.293e-05	-4.592	-4.640	-0.048	5.54
CaCO3	5.603e-06	5.618e-06	-5.252	-5.250	0.001	-14.60
CO3-2	3.398e-06	2.225e-06	-5.469	-5.653	-0.184	-4.98
MgCO3	1.386e-06	1.390e-06	-5.858	-5.857	0.001	-17.09
NaHCO3	1.956e-07	1.961e-07	-6.709	-6.707	0.001	1.80
NaCO3-	5.387e-09	4.827e-09	-8.269	-8.316	-0.048	-0.91
(CO2)2	3.303e-09	3.311e-09	-8.481	-8.480	0.001	68.87
Ca	2.596e-03					
Ca+2	2.297e-03	1.503e-03	-2.639	-2.823	-0.184	-17.91
CaSO4	2.298e-04	2.304e-04	-3.639	-3.638	0.001	7.50
CaHCO3+	6.369e-05	5.740e-05	-4.196	-4.241	-0.045	9.73
CaCO3	5.603e-06	5.618e-06	-5.252	-5.250	0.001	-14.60
CaOH+	4.411e-09	3.952e-09	-8.355	-8.403	-0.048	(0)
CaHSO4+	1.066e-10	9.556e-11	-9.972	-10.020	-0.048	(0)
Cl	9.877e-04					
Cl-	9.877e-04	8.837e-04	-3.005	-3.054	-0.048	18.15
H(0)	5.622e-25					
H2	2.811e-25	2.818e-25	-24.551	-24.550	0.001	28.61
K	2.559e-05					
K+	2.543e-05	2.274e-05	-4.595	-4.643	-0.049	9.07
KS04-	1.532e-07	1.378e-07	-6.815	-6.861	-0.046	34.18
Mg	1.152e-03					
Mg+2	9.933e-04	6.546e-04	-3.003	-3.184	-0.181	-21.59
MgSO4	1.319e-04	1.323e-04	-3.880	-3.878	0.001	5.84
MgHCO3+	2.561e-05	2.293e-05	-4.592	-4.640	-0.048	5.54
MgCO3	1.386e-06	1.390e-06	-5.858	-5.857	0.001	-17.09
MgOH+	4.173e-08	3.766e-08	-7.380	-7.424	-0.045	(0)
Na	1.306e-04					
Na+	1.298e-04	1.165e-04	-3.887	-3.934	-0.047	-1.37
NaSO4-	5.596e-07	5.034e-07	-6.252	-6.298	-0.046	14.39
NaHCO3	1.956e-07	1.961e-07	-6.709	-6.707	0.001	1.80
NaCO3-	5.387e-09	4.827e-09	-8.269	-8.316	-0.048	-0.91
NaOH	1.864e-21	1.869e-21	-20.730	-20.728	0.001	(0)
O(0)	2.751e-04					
O2	1.376e-04	1.379e-04	-3.861	-3.860	0.001	30.40
S(6)	1.687e-03					
SO4-2	1.325e-03	8.621e-04	-2.878	-3.064	-0.187	14.80

CaSO4	2.298e-04	2.304e-04	-3.639	-3.638	0.001	7.50
MgSO4	1.319e-04	1.323e-04	-3.880	-3.878	0.001	5.84
NaSO4-	5.596e-07	5.034e-07	-6.252	-6.298	-0.046	14.39
KSO4-	1.532e-07	1.378e-07	-6.815	-6.861	-0.046	34.18
HSO4-	5.902e-09	5.288e-09	-8.229	-8.277	-0.048	40.35
CaHSO4+	1.066e-10	9.556e-11	-9.972	-10.020	-0.048	(0)
Si	1.166e-04					
H4SiO4	1.163e-04	1.166e-04	-3.935	-3.933	0.001	52.08
H3SiO4-	3.042e-07	2.724e-07	-6.517	-6.565	-0.048	28.05
H2SiO4-2	4.485e-13	2.937e-13	-12.348	-12.532	-0.184	(0)

-----Saturation indices-----

Phase	SI**	log IAP	log K(298 K,	1 atm)	
Anhydrite	-1.61	-5.89	-4.28	CaSO4	
Aragonite	-0.14	-8.48	-8.34	CaCO3	
Calcite	0.00	-8.48	-8.48	CaCO3	
Chalcedony	-0.38	-3.93	-3.55	SiO2	
Chrysotile	-6.42	25.78	32.20	Mg3Si2O5(OH)4	
CO2(g)	-1.90	-3.37	-1.47	CO2	
Dolomite	-0.22	-17.31	-17.09	CaMg(CO3)2	
Gypsum	-1.31	-5.89	-4.58	CaSO4:2H2O	
H2(g)	-21.45	-24.55	-3.10	H2	
H2O(g)	-1.50	-0.00	1.50	H2O	
Halite	-8.56	-6.99	1.57	NaCl	
O2(g)	-0.97	-3.86	-2.89	O2	
Quartz	0.05	-3.93	-3.98	SiO2	
Sepiolite	-5.13	10.63	15.76	Mg2Si3O7.5OH:3H2O	
Sepiolite(d)	-8.03	10.63	18.66	Mg2Si3O7.5OH:3H2O	
SiO2(a)	-1.22	-3.93	-2.71	SiO2	
Sylvite	-8.60	-7.70	0.90	KCl	
Talc	-3.48	17.91	21.40	Mg3Si4O10(OH)2	

**For a gas, SI = log10(fugacity). Fugacity = pressure * phi / 1 atm.
For ideal gases, phi = 1.

End of simulation.

Reading input data for simulation 2.

End of Run after 0.027 Seconds.
