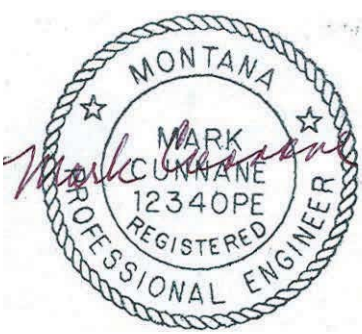
Great West Engineering, Inc.

Spring Inventory Report
Central Montana Regional Water Authority

March 2017



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WESTERN GROUNDWATER SERVICES

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1. INTRODUCTION

Central Montana Regional Water Authority (CMRWA) is building a public water system to serve communities extending from Hobson to Melstone. The water system is intended to be supplied from the Madison aquifer through a wellfield located west of Garneill, and CMRWA has obtained water rights for the project. Montana Fish, Wildlife and Parks (FWP) objected to the CMRWA water right application[1], but agreed to withdraw their objection under the condition that CMRWA complete an inventory of representative springs in Judith Basin. FWP and CMRWA executed a memorandum of understanding (MOU) for the spring inventory that also addressed annual reporting of pumped water volumes, and mitigation of adverse effects, should such impacts be identified. The MOU is provided in Appendix A.

In 2014, CMRWA prepared a water resources monitoring plan that included participation by FWP, DNRC, and other stakeholders in Judith Basin (WGS 2014). The spring inventory as per the MOU with FWP was included as a plan activity. Field work for the spring inventory was completed in 2016, and this report presents the results of the study. By completing the spring inventory report, CMRWA is fulfilling its obligation for provision I of the MOU.

The water resources monitoring plan also included an activity to conduct additional pump testing of a Madison aquifer well at the U Bet wellfield (CMRWA #2). This well was tested and sampled for water quality in 2016. Water quality data from this well are being used in this report as representative of the Madison aquifer groundwater.

A Kootenai aquifer monitoring well (CMRWA MW#1) was also newly constructed at the U Bet wellfield as part of the water resources monitoring plan. This monitoring well also was constructed and sampled for water quality in 2016, and these data are being used as representative of the Kootenai aquifer.

1.1 Acknowledgments

This project was made possible by the spring landowners who granted permission to their properties for evaluations of the springs. The landowners willfully discussed their springs and in many cases provided transportation to/from the spring for sampling. Staff at FWP and DNRC also provided valuable input concerning springs for the project and land owner contact information.

2. SPRING SELECTION

A preliminary list of springs was identified in the water resources monitoring plan, which was subsequently refined to a final list (WGS 2015).[2] FWP and DNRC staff in Lewistown and Helena provided information on spring locations for consideration, and FWP concurred with the final list for which private land owner consent was obtained (Figure 1).

A total of 18 spring locations were included in the project, and additionally, groundwater sampling results from the CMRWA #2 well (two samples) and the CMRWA MW#1 monitoring well were also included. Of these sites, it was known that CMRWA #2 provides a sample of Madison aquifer groundwater, and that CMRWA MW#1 provides a sample of Kootenai aquifer groundwater. It was also presumed that Big Spring provides a sample of Madison aquifer groundwater.

1 The objection was filed in relation to a water right application for the CMRWA #1 well located in Utica (41S 30019140, 300 gpm, 484.30 af). This well is not currently planned for use in the water system. The U Bet wellfield wells were added to the Utica well water right by a change application. There is also a second water right for the U Bet wellfield (41S 30065672, 5.66 cfs, 825.70 af).

2 Changes were made to the spring locations subsequent to the final list due to land access consents, which results in differences between the locations shown in WGS (2015) and this report.

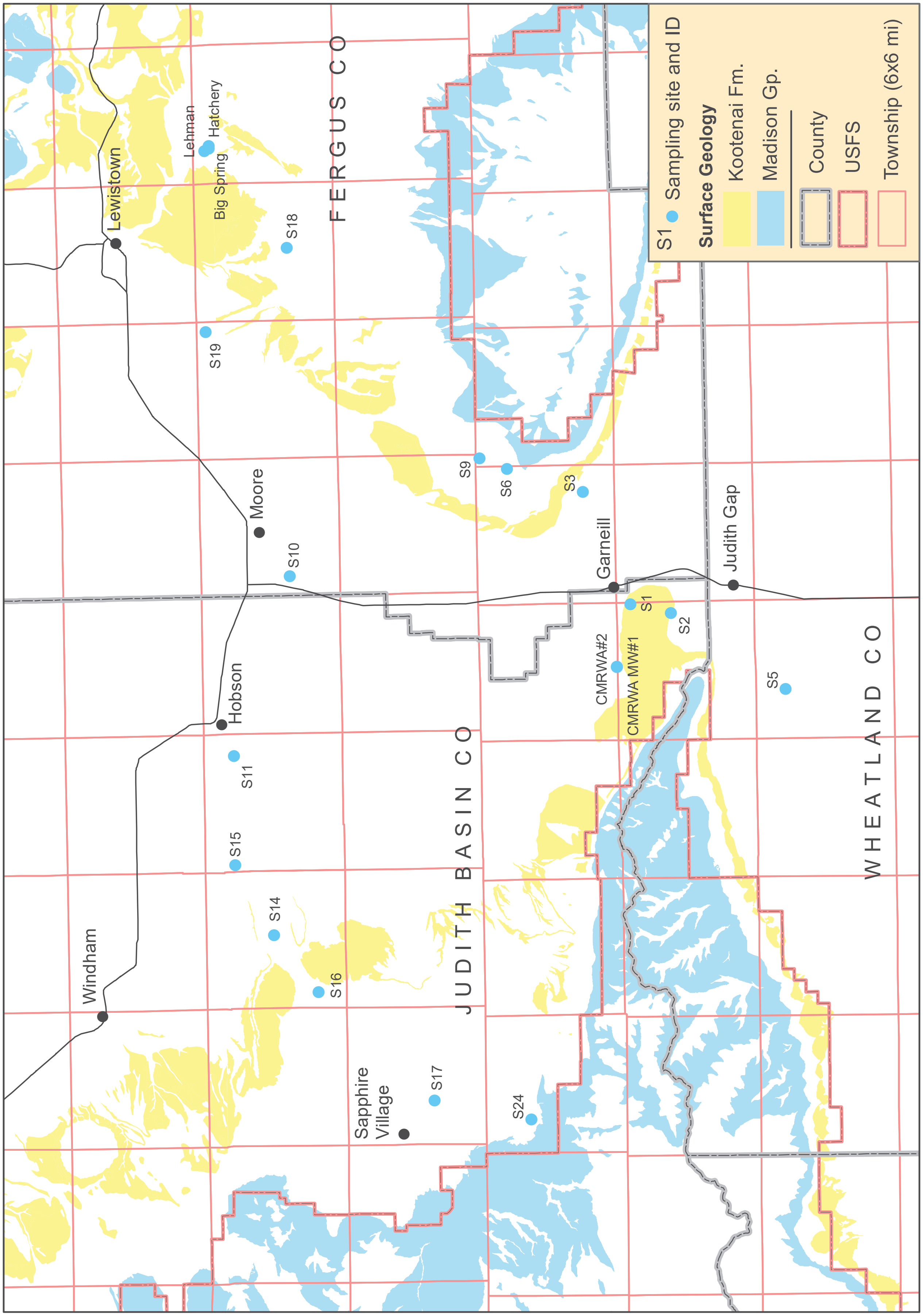


Figure 1. Spring Inventory Location Map

The remaining 17 springs were evaluated to assess if they were likely to be sourced from the Madison aquifer, or if they were more likely sourced from a different aquifer. The Kootenai aquifer and localized aquifers in unconsolidated alluvium are the most likely other sources that could be discharging from area springs.

3. LOCATIONS AND HYDROGEOLOGY

Appendix B includes exhibits illustrating the spring locations in aerial photos and geological maps. This section provides information on the geology and the physical relation of the springs to the Madison aquifer and the U Bet wellfield.

The data provided in Table 1 were developed in ArcGIS as summarized below:

- Radial Offset is the radial distance from the U Bet wellfield to the location of the spring, presented in miles. These offsets were calculated based on the coordinates for the spring and the CMRWA #2 well.

- Elevation is the land elevation in feet above mean sea level determined from a digital elevation model for the land surface obtained from the U.S. Geological Survey through their website (https://viewer.nationalmap.gov/basic/). The data are provided in 30 meter (m) square grid cells (1/3 arc-second).

- Madison Top refers to the upper contact of the Madison aquifer and is reported both as elevation and as depth from surface. These values were obtained from the contour map prepared by Feltis (1980). The contour map was converted to a raster image with 30 m square grid cells and then grid cell values were extracted at the locations of springs. Figure 2 shows the contours prepared by Feltis (1980).

- Madison Static is the estimated static water level that would occur in a Madison aquifer well at the same location as the spring. It also is reported as an elevation and a depth from surface. These levels were obtained from a contour map prepared by Feltis (1980). However, in order to estimate values outside the area of the contours, the contour data were extrapolated in the up gradient direction along lines orthogonal to the contours.[3] The contour and extrapolated values were input as point data and then interpolated to a raster image, also with a 30 m square grid cell size. Figure 3 shows the contours by Feltis (1980) and also contours created from the raster data.

- The discharge rate is a visually estimated rate or one given by the land owner. These are simply ballpark values. Actual values may be significantly different and also can vary with time of year at some locations.

3 Streamlines were created across the contours, each with about 20 to 25 points 1-mile apart. Feltis (1980) contour values were assigned to points at the location of intersection with the streamline. A quadratic polynomial was fit to these data, and then used to interpolate between the Feltis contours and to extrapolate to unknown up-gradient points.

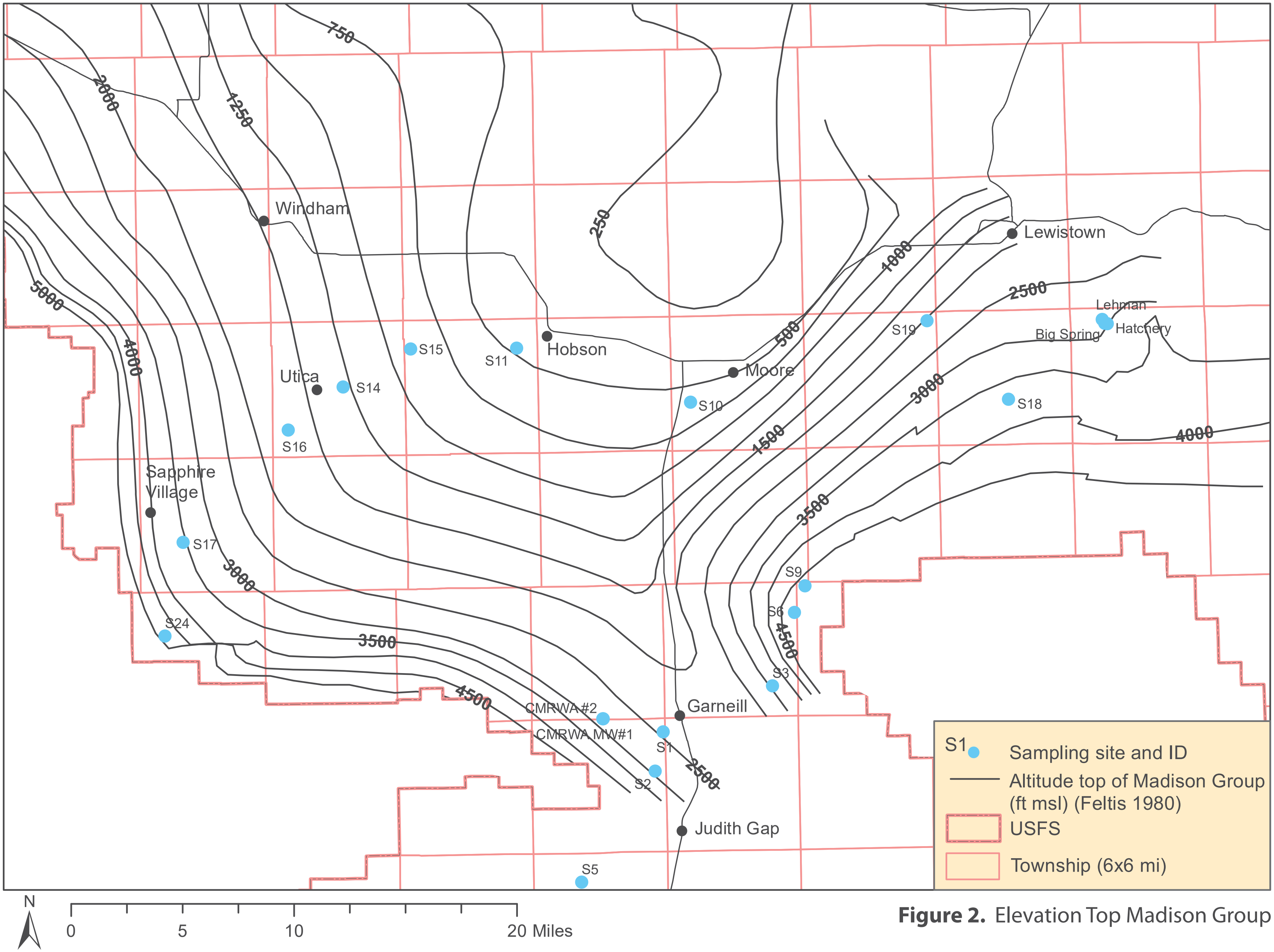


Figure 2. Elevation Top Madison Group

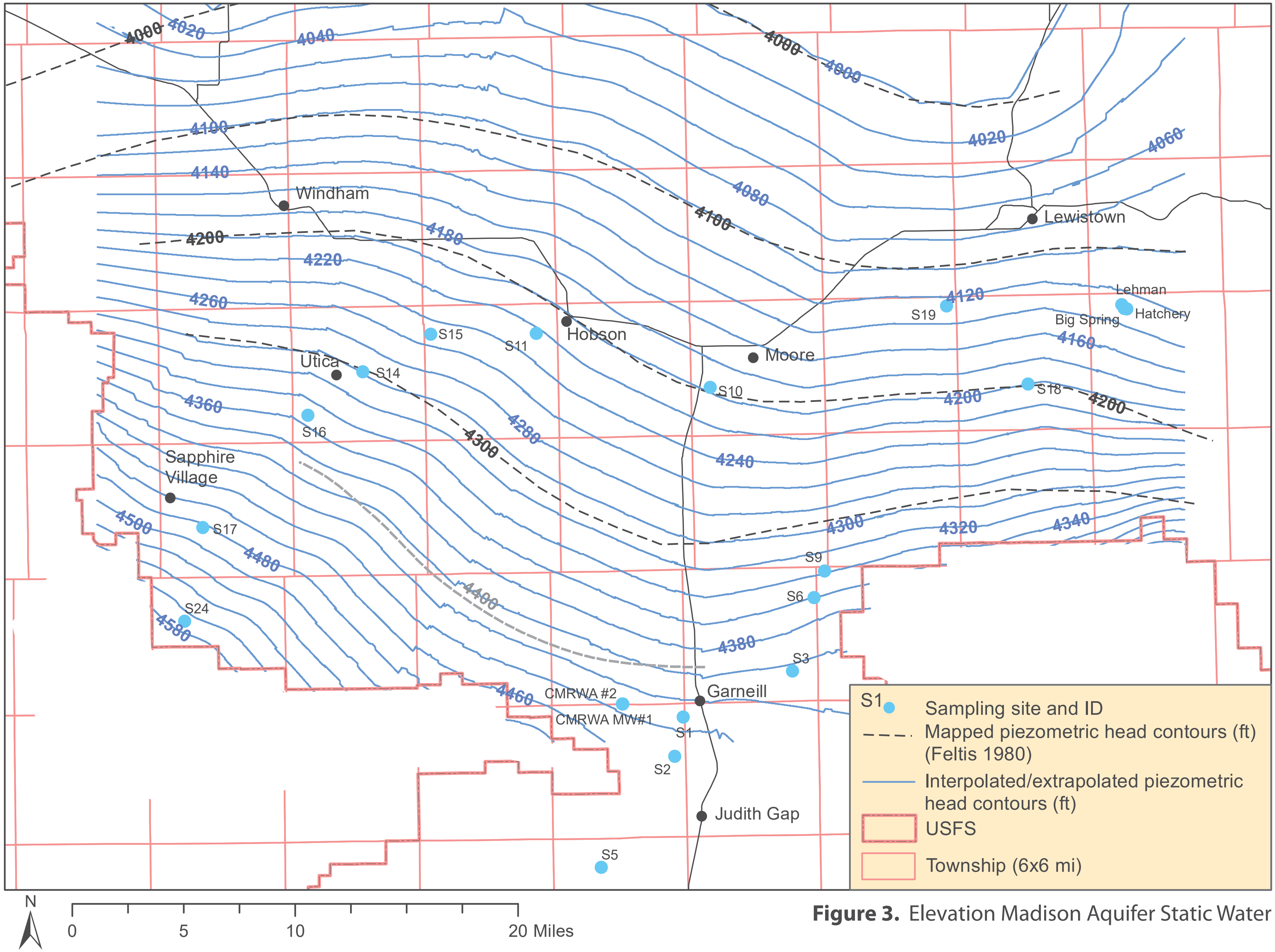


Figure 3. Elevation Madison Aquifer Static Water

Table 1. Spring Physical Data

Site ID	Owner	Radial Offset (mi)	Elevation (ft msl)	Madison Top (ft msl)	Madison Top (ft bgs)	Madison Static (ft msl)	Madison Static (ft bgs)	Discharge Rate (gpm)
CMRWA #2	CMRWA	0.0	4,701	2,852	1,849	4,434	267	500
CMRWA MW#1	CMRWA	0.0	4,701	2,848	1,853	4,434	267	15
Big Spring	City of Lewistown	28.7	4,183	2,965	1,218	4,130	53	45,000
Hatchery	FWP	28.7	4,219	2,988	1,231	4,129	90	14,000
Lehman	FWP	28.7	4,176	2,926	1,250	4,128	48	25,000
S1	Brewington	2.8	4,501	2,439	2,062	4,431	70	20
S2	Mauws	3.3	4,610	2,940	1,670	4,450	160	35
S3	Page	7.8	4,826	3,103	1,723	4,404	422	8
S5	Phillippi	7.4	4,862	2,500	2,362	4,400	462	375
S6	Birch	9.8	5,469	4,704	765	4,360	1,109	675
S9	Horan	10.9	5,397	4,634	763	4,338	1,059	23
S10	Tyler	14.7	4,091	582	3,509	4,197	-106	3,400
S11	Thomas	17.1	4,160	488	3,672	4,224	-64	20
S14	Perry	18.9	4,423	1,280	3,143	4,299	124	10
S15	Mikkelson	18.7	4,281	908	3,373	4,251	30	20
S16	Wertheimer	19.2	4,547	1,665	2,882	4,352	195	80
S17	Eklund/Noel	20.4	5,522	3,530	1,992	4,483	1,039	6
S18	Burg	23.2	4,495	3,702	793	4,200	295	13
S19	Otten	23.0	4,222	2,037	2,185	4,127	95	3,400
S24	Perry	20.0	5,482	4,872	610	4,569	913	3

Units: miles (mi); feet above mean sea level (ft msl); feet below ground surface (ft bgs); gallons per minute (gpm).

The values provided in Table 1 have associated error that may range from 5% to 10% of the value, or more in some cases. For example, Madison static at Big Spring was estimated as 53 ft bgs, when it should be a negative value indicating a static level above ground surface. Also, the depth to the top of the Madison in the CMRWA #2 well is reported as 1,849 ft bgs, whereas the top of the Madison formation occurred at 2,000 ft based on borehole samples.

In using the data presented in Table 1, some general principals can be applied. Firstly, if the Madison aquifer static level is substantially deep, beyond what can be explained by data error, it cannot be a source to a spring at the surface. Secondly, if the depth to the top of the Madison is great, it is unlikely that the Madison could be a source to the spring, even if the Madison static is at the surface or reasonably close. By these principals, springs S6, S9, S17, and S24 are likely not sourced from the Madison as the statics are too deep. Springs S1, S2, S3, S5, S10, S11, S14, S15, S16, S17, and S19 are also likely not sourced from the Madison because the aquifer is too deep below the surface.

With respect to potential adverse effects attributable to the U Bet wellfield, in principal, the greater the offset distance, the less likely it is that an adverse effect will occur to a spring sourced from the Madison aquifer. As the offset distance increases, there becomes greater likelihood that changes in aquifer geology could interrupt hydraulic continuity between the wellfield and the spring.

The geological conditions at the springs are summarized in Table 2 based on the geology mapping that is shown on exhibits in Appendix B. Geology mapping used to interpret the springs was prepared by the Montana Bureau of Mines and Geology (MBMG) at a scale of 1:100,000. There are four quadrangles included in the project area, Belt, Lewistown, White Sulphur Springs, and Big Snowy Mountains. The White Sulphur Springs quadrangle was completed by the U.S. Geological Survey, but has been published electronically by MBMG. Mapping data were obtained electronically in a Geographic Information System (GIS) database that joins all of the existing 1:100,000 quadrangle maps and uses consistent colors and symbols (http://mbmg.mtech.edu). The plots shown in Appendix B were prepared using ArcGIS. The air photos also shown in Appendix B were obtained for the 2005 National Agricultural Imagery Program (NAIP). The extents of the air photo and geological map are the same, and use a scale of 1:60,000, or 1-inch equals 5,000 feet.

Table 2. Spring Geology

Spring ID	Exhibit	Description
S1, S2	B-1	These spring orifices are located on a broad anticline fold in the Kootenai formation (Kk) off the east end of the Little Belt Mountains. Both spring orifices are shown to occur in the upper part of the formation, well above the basal sandstone.
S3	B-2	This spring orifice occurs at the contact between the Thermopolis (Kt) shale and younger Mowry (Km) shale, where both formations are concealed by a younger alluvium formation (QTab). A sandstone that occurs at the base of the Mowry may be a source to the spring, although the spring orifice appears to be located in the alluvium.
S5	B-3	This spring orifice is located in a large area of alluvium (QTab) that is shown to overlie concealed Judith River formation (Kjr), a marine sandstone.
S6, S9	B-4	Both of these springs appear to have orifices in landslide deposits (Qls) that overlie Pennsylvanian (ℙ) and Mississippian (M) age rocks, including from youngest to oldest: ℙab – Alaska Bench; ℙMt – Tyler; Mo – Otter; Mk – Kibbey; Mmc – Mission Canyon (Madison aquifer); and Ml – Lodgepole (Madison group).
S10	B-5	This spring orifice occurs in a large area mapped at the surface as alluvium deposits (QTab). The spring channel where sampled runs over Marias River formation (Kmr). The spring orifice is located upstream a short distance and likely occurs at the contact between alluvium and Marias River.
S11	B-6	The orifice of this spring occurs in the north slope of an east trending terrace. The terrace surface is largely mapped as alluvium deposits (QTab), which can be seen to overlie bedrock of the Marias River formation (Kmr), cropping out in the terrace slope. The orifice is most likely occurring at the contact of the alluvium and Marias River formation.
S14	B-7	This spring orifice occurs in more recent alluvium deposits limited to the Judith River floodplain area (Qac). These deposits have a reported thickness of about 30 ft and are older than recent channel deposits (Qal).
S15	B-6	This spring orifice occurs in alluvium deposits (QTab) near to the contact with the Marias River formation, which also underlies the alluvium. It is most likely the spring orifice is occurring at the contact between these formations.
S16	B-7	This spring orifice occurs in alluvium deposits (QTab) and does not appear to be located near to any mapped formation contacts. The Morrison formation (KJm) occurs to either side and below the alluvium, and would be a flow limiting boundary to groundwater. The large band of Kootenai formation (Kk) outcrop has been eroded and does not exist at the spring.

Spring ID	Exhibit	Description
S17	B-8	This spring orifice is located within a small band of rock mapped as the middle sandstone of the Tyler formation (Mtm), which occurs within the Tyler formation (Mt), that is underlain by the Heath formation (Mh) and overlain be the Alaska Bench formation (ℙab).
S18	B-9	This spring orifice occurs where alluvium (Qal) of Casino Creek is mapped. The bedrock formation underlying the alluvium is most likely the Piper formation, which is expected to be a flow barrier to groundwater in the alluvium.
S19	B-10	This spring discharges at the surface to the south of the mapped location. The spring orifice appears to be diffuse and is located in young alluvium deposits (Qal) of the West Fork Beaver Creek. The spring discharge is tributary to the main channel. Concealed bedrock that underlies the spring orifice area includes the upper Kootenai (Kku) and Fall River (Kfr) formations. Neither of these formations is considered to be highly permeable.
S24	B-11	This spring orifice is located in alluvial deposits (QTgr) designated as gravel, but which include textures from clay to boulders. Concealed bedrock underlying the spring location is estimated to include the Mission Canyon (Mmc, Madison aquifer) near to the contact with the overlying Kibbey formation (Mk). The fault shown to the south of the spring is a major structure with a length of about 15-miles, but exhibits limited displacement near the spring; greater displacement appears to have occurred to the east.
Big, Hatchery, and Lehman Springs	B-12	These spring orifices discharge from the Swift formation (Jsw) on the northwest flank of Heath Dome. There are no faults mapped at the springs, indicating that conduit flow occurs in fractures that lack displacement (i.e., joints). Northwest trending faults to the south of the springs extend into the dome and may be important conduits for groundwater flow (between the recharge area and the dome). The source of the springs is determined to be the Madison aquifer based on magnitude and water chemistry. The Madison aquifer is estimated by interpolation at a depth of about 1,200 feet below land surface at the springs. The recharge area for the springs is presumed to coincide with the Madison outcrop area in the Big Snowy Mountains about 10-miles south.

4. WATER CHEMISTRY

Each of the locations identified on Figure 1 were analyzed for water quality by lab and field analyses. These data were used to identify water chemistry parameters that could be indicative of whether or not the spring was sourced from the Madison aquifer. The results are presented in this section. A table presenting the sampling results is provided in Appendix C.

The CMRWA #2 well was sampled a second time and was analyzed for an expanded list of parameters including Phase II/V metals and radionuclide contaminants. The levels were unchanged from previous samples, meeting primary drinking water standards. This lab report also is included in Appendix C.

4.1 Sampling and Analysis

Samples were collected during October and November 2016.[4] Analyses included field parameters measured at the time of sampling. Laboratory analyses were also performed for general parameters, major ions, trace metals, gas and diesel range organics, stable isotopes, and tritium.

Field parameters were measured using an Horiba U-52 multi-sensor that was manually calibrated for each of the parameters (temperature, pH, oxidation reduction potential, specific conductance, dissolved oxygen, and turbidity). The multi-sensor was set into the spring whenever feasible; otherwise measurements were taken by setting the sensor into a plastic pitcher immediately after filling. Well samples were measured under pressure using a flow cell.

Lab samples were collected into a plastic pitcher at the spring that was used to fill a 1-gallon temporary plastic sampling container.[5] Three to four springs were sampled in a day. The temporary containers were stored in a cooler without ice and transported back to lodging facilities in Lewistown, where lab sample bottles were filled. Sample bottles for metals, stable isotopes, and tritium were filtered using a disposable 0.45 µm in-line filter and peristaltic pump.[6]

Lab samples for major ions, trace metals, and organics were shipped by UPS ground transportation to Inter-Mountain Laboratories, Sheridan, WY. Lab samples for stable isotope and tritium analyses were shipped by UPS next-day air to the University of Arizona Environmental Isotope Laboratory, Tucson, AZ. Samples were shipped in coolers (without ice) on the day of sampling or on the following day. None of the samples were in transport over a weekend.

Samples were received at the labs in compliance with method holding times, except for nitrate and phosphate in a few of the samples (48-hour holding time exceeded). There is some possibility that nitrate and phosphorous analyses are less than actual due to nutrient consumption by microorganisms present in the samples, although this impact would normally be minimal for groundwater.

4 Except that CMRWA MW#1 was sampled in late September.

5 Reusable temporary containers were rinsed with deionized water immediately after use and rinsed with sample water prior to filling.

6 Tubing used to pump sample water through filters was reused three to four times. Tubing was rinsed in deionized water immediately after use and rinsed in sample water before filtering to sample bottles. Two types of filters were used: 1) fully contained disposable; and 2) disposable membrane in a reusable holder. The reusable holder was rinsed in deionized water between uses.

4.2 Major Ions

Plotting techniques were used to assess differences in major ion concentrations among the samples.[7] These include positive ions of calcium (Ca), magnesium (Mg), potassium (K), and sodium (Na) and negative ions of bicarbonate (HCO3), carbonate (CO3), sulfate (SO4), and choride (Cl).

Piper, or trilinear, diagrams are shown on Figure 4. As shown on Figure 4A, Madison aquifer samples from Big Spring and the CMRWA #2 well plot at different locations than the known Kootenai aquifer sample from monitoring well CMRWA MW#1. A sample collected during November 2005 from the CMRWA #1 well located at Utica also is shown. It plots farther from the Kootenai sample than does CMRWA #2. The location of the Big Spring sample on this plot suggests it is a mixture of Madison and Kootenai groundwater. Figure 4B shows that the Hatchery Spring plots identically to the CMRWA #2 sample, and that Lehman Spring plots identically to Big Spring. Both the Hatchery and Lehman samples appear to be Madison groundwater.

Figures 4C, 4D, and 4E generally show that the other springs are most likely derived from sources other than the Madison aquifer. None of the data points plot onto either the Big Spring or CMRWA #2 data points. Most of these springs plot closer to the Kootenai aquifer data point (CMRWA MW#1). The data have variability however, and it is not expected that Kootenai groundwater would be the source to all of these springs, as very few have orifices in the Kootenai.

Figure 5 presents Stiff diagrams for each of the samples, which evaluate the same major ions as presented in the Piper diagrams. There are differences and similarities among these plots, which are standard to water chemistry evaluations. A critical review of the shapes shown on Figure 5 generally supports the same findings as the Piper diagrams. The Stiff diagrams most clearly show how the major ion chemistry of many spring samples differs significantly from the Kootenai groundwater sampled by monitoring well CMRWA MW#1. This distinction is more clear on the Stiff diagrams as they are based on actual concentrations rather than percentages.

7 Water quality plots were prepared using the Aq-QA program by Rockware, Inc.

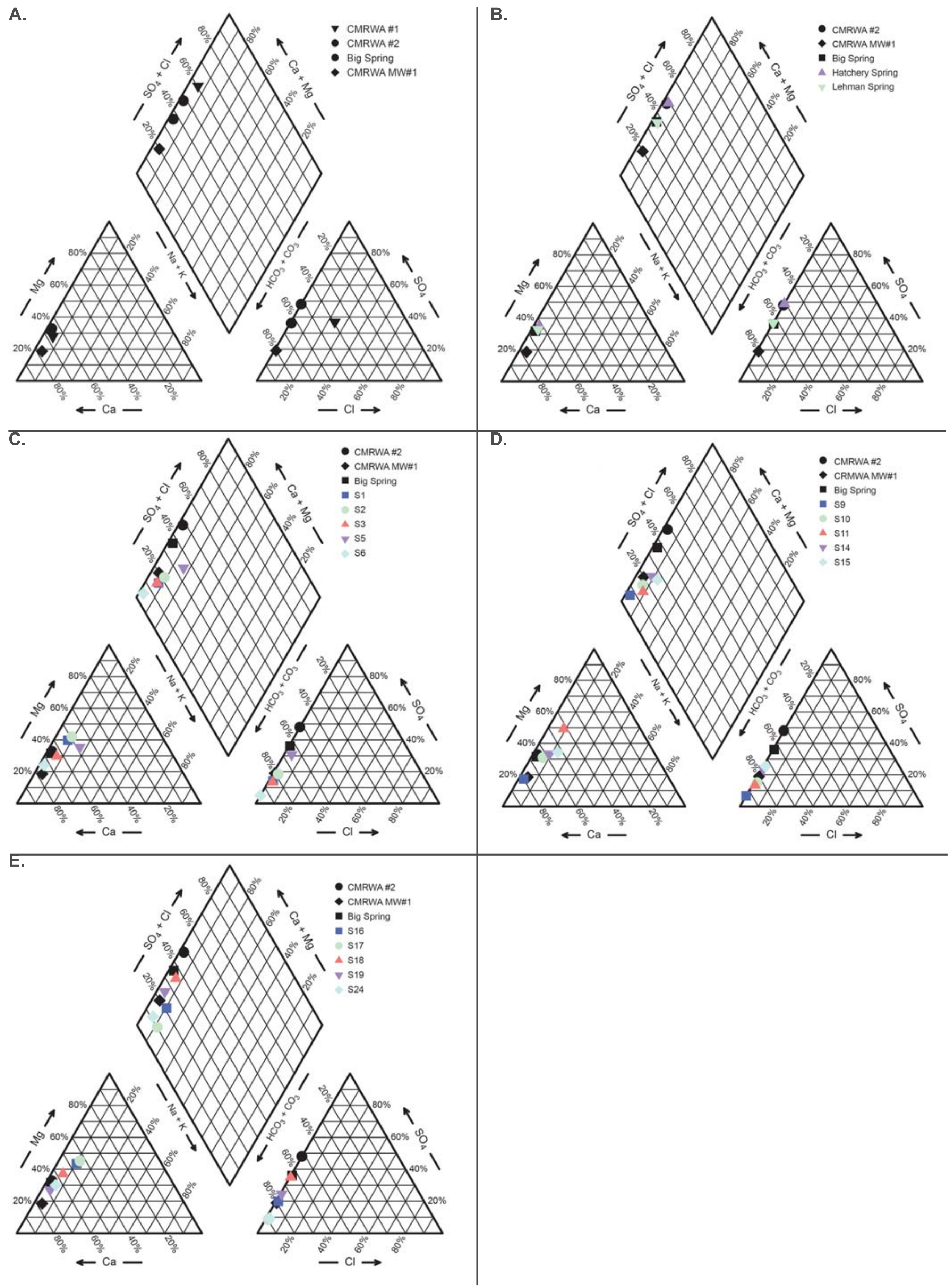


Figure 4. Piper Diagrams

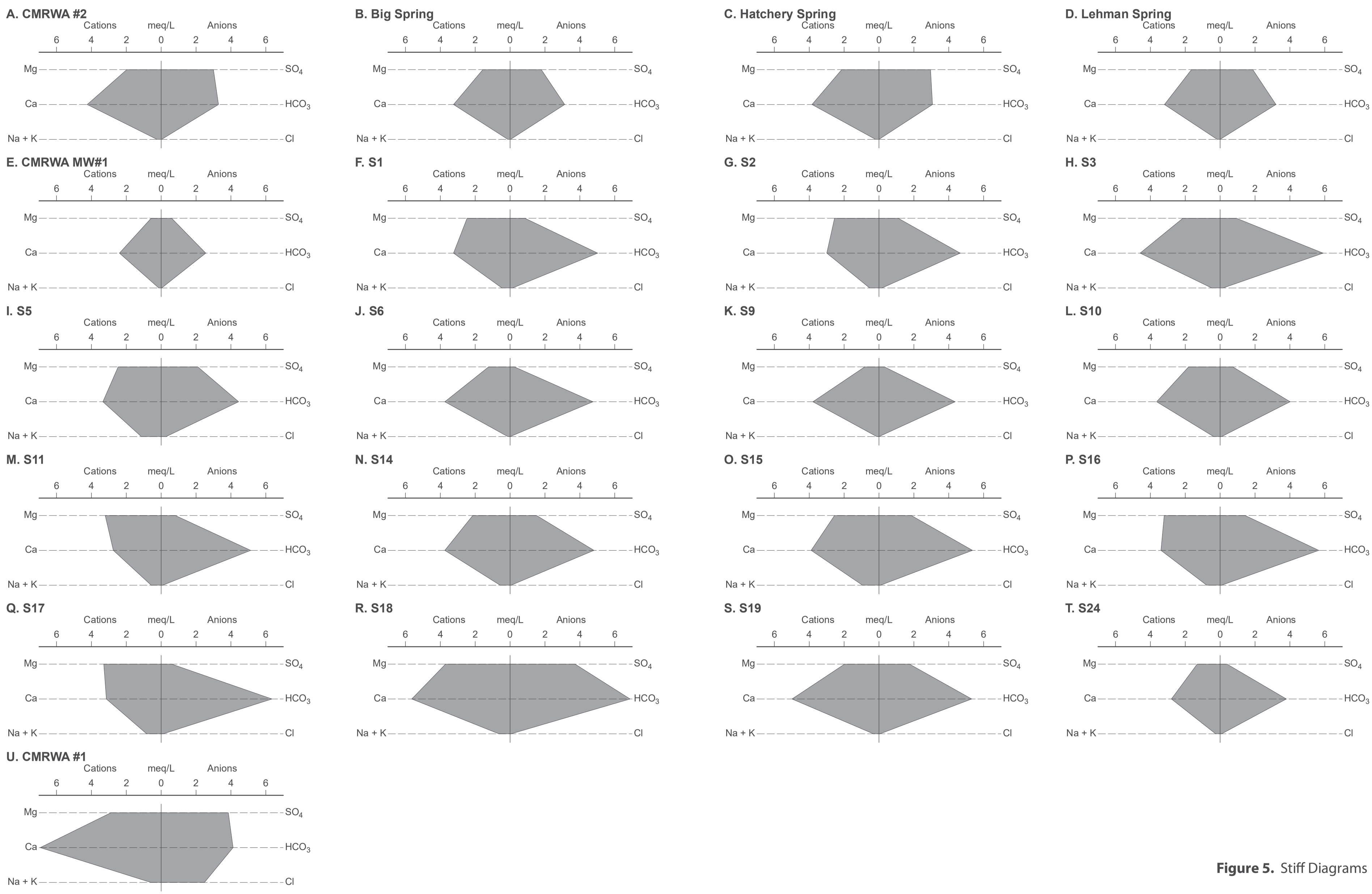


Figure 5. Stiff Diagrams

4.3 Selected Parameters

Selected parameters from the water analyses were identified that most clearly illustrated differences and similarities between groundwater derived from the Madison aquifer and other sources. Figure 6 presents series plots that show values for a single parameter in each of the samples.[8] Figures 6A, 6B, and 6C show results that clearly distinguish the Madison springs. Madison samples include CMRWA #2 (1 & 2), Big Spring, Hatchery Spring, and Lehman Spring. The CMRWA MW#1 sample, and samples from all other springs are shown to be from groundwater other than Madison. Carbon-13 in Madison samples is less depleted than other samples. Conversely, sulfur-34 in Madison samples is enriched as compared to the other samples. The separation of these data are distinct and indicate that at least in this area, Carbon-13 and Sulfur-34 are effective indicators for Madison groundwater.

Figure 6C shows the saturation index for quartz in a series plot. Saturation index (SI) was calculated for each sample using the geochemical modeling program PHREEQC v. 3.3 (released 1/12/17) (Parkhurst and Appelo 1999). The quartz SI values show useful separation between Madison and other groundwaters. Madison groundwaters exhibit greater undersaturation (SI < 0). Other samples show near equilibrium (SI = 0) and supersaturation (SI > 0). This result is consistent with the carbonate minerals that make up the Madison aquifer formation, and the common occurrence of silicate minerals that occur in alluvium and sandstone bedrock.

Figure 6D shows the results for tritium, which does not distinguish Madison groundwater from other groundwater, but provides information on groundwater age. All of the samples except for CMRWA MW#1 were found to have significantly detectable tritium. This finding implies that these groundwaters were recharged sometime after 1952, when atmospheric tritium first became elevated due to nuclear bomb testing (1952 – 1977). Based on these results, travel time from the recharge area to the springs with detectable tritium would be less than 70 years, including Big Spring and the CMRWA #2 Madison well.

Nitrate also was found to distinguish Madison aquifer groundwater from other groundwater in selected cases (see data table in Appendix C). Nitrate was detectable in Madison aquifer samples, but at low levels ranging from 0.14 to 0.16 milligrams per liter (mg/L) as nitrogen (N). It was also undetected in the Kootenai monitoring well CMRWA MW#1. In contrast, several springs were measured to have nitrate concentrations well above 1.00 mg/L as N, and in one case a value of 11.2 mg/L as N was measured (S10). Using a value of 1.5 mg/L as N as a cutoff, springs S1, S2, S3, S5, S10, and S11 are shown to be discharging from a non-Madison source.

4.4 ORGANICS

Gas range (GRO) and diesel range (DRO) organic compounds were sampled to assess generally if any of the sample locations had been contaminated by petroleum. These data were collected to establish a baseline for comparison in the future should any of the spring sites be suspected of contamination from new oil and gas development in Judith Basin. Inclusion of these parameters was requested by stakeholders that participated in the water resources monitoring plan. The GRO and DRO data are provided in the data table of Appendix C.

With one exception, the samples were non-detect for GRO at a level of 20 micrograms per liter (µg/L). A level of 20 µg/L was detected at spring S6. The lab confirmed this was not a gasoline occurrence, but an unknow compound in the same range. There was no detections of DRO in any of the samples at the method detection limit of 5 mg/L.

8 Series plots were screened for all of the parameters evaluated in the samples. Only those parameters distinguishing Madison groundwater are shown.

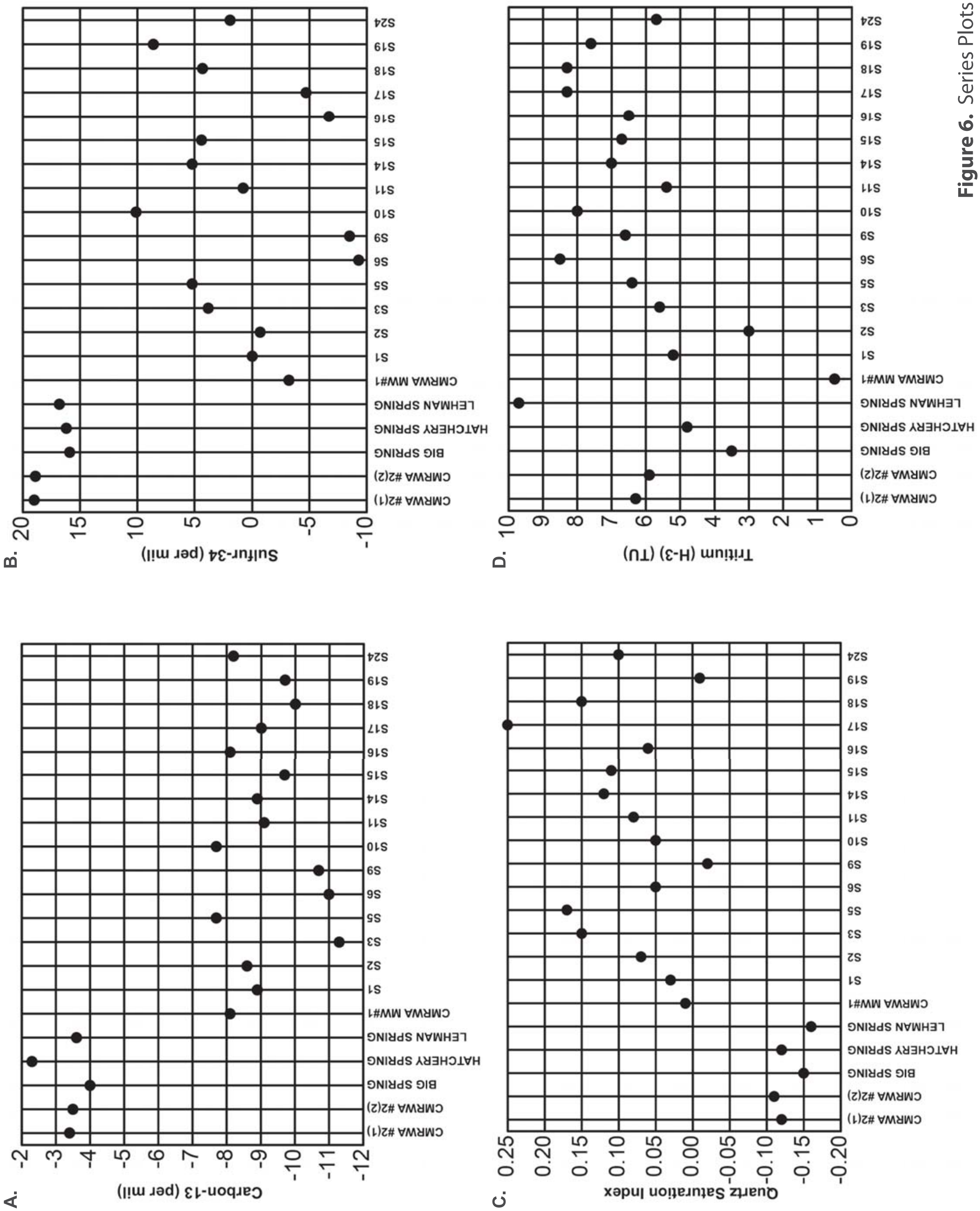


Figure 6. Series Plots

5. CONCLUSIONS

- Flow rate from the spring appears to be a significant indicator as to whether or not a spring is derived from the Madison aquifer. Springs with flow rates less than approximately 14,000 gpm (30 cfs) were identified to have non-Madison sources.

- Surface geology may be a useful determining factor as to the source of spring water. Springs located away from geological structures exhibiting significant deformation (e.g., folding, faulting, and jointing) are likely to be sourced from local near-surface formations. Where the Madison is at great depth and geological structures are absent or minimal, it is unlikely the Madison is sourcing springs in the area.

- Water chemistry analysis for selected parameters provided a clear distinction of Madison and non-Madison groundwater sources to springs. Useful separation was achieved on the Piper diagram for the springs that were sampled. Series plots for Carbon-13, Sulfur-34, and Quartz saturation index also clearly separated Madison from non-Madison groundwater.

- Tritium analysis, which provides information on groundwater age, was detected in all of the springs and the CMRWA #2 well at the U Bet Wellfield. Groundwater age at these locations is less than 70 years. Tritium was non-detectable in the Kootenai monitoring well at the U Bet Wellfield, CMRWA MW#1, indicating the groundwater sampled from this well was 70 years or older.

- The spring inventory identified three springs to be sourced from the Madison. These were Big Spring, Hatchery Spring, and Lehman Spring. The other springs included in the study, which are considered to be representative of springs overall in Judith Basin and within about 30-miles of the U Bet Wellfield, were found to be sourced from non-Madison groundwater. Several of these springs are likely sourced directly from alluvial aquifers.

6. REFERENCES

Feltis, R. D. (1980) Water Resources of the Judith Basin, Central Montana, Hydrogeologic Map 1, Montana Bureau of Mines and Geology.

Parkhurst, D. L. and C. A. J. Appelo (1999) User's Guide to PHREEQC (Version 2) – A Computer Program for Speciation, Batch-Reaction, One-Dimensional Transport, and Inverse Geochemical Calculations, Water-Resources Investigations Report 99-4259, U.S. Geological Survey, Denver, CO.

WGS (2014) Water Resources Monitoring Plan, Central Montana Regional Water System, report to Great West Engineering, Inc. by Western Groundwater Services, LLC (5/13/2014).

WGS (2015) Spring Inventory Sampling Plan, Central Montana Regional Water Authority, report to Great West Engineering, Inc. by Western Groundwater Services, LLC (11/25/2015).

APPENDIX A – MEMORANDUM OF UNDERSTANDING

COPY

Memorandum of Understanding
Between Central Montana Regional Water Authority
And Montana Fish, Wildlife, & Parks

The Central Montana Regional Water Authority (CMRWA) has applied for a water right on State Lands north of Utica, Montana. The water right will eventually be used to supply members of the CMRWA including the Town of Hobson, Town of Judith Gap, City of Harlowton, Town of Ryegate, Town of Lavina, City of Roundup, Town of Broadview, and Town of Melstone with quality drinking water. The CMRWA has drilled a well into the Madison Aquifer and conducted extensive testing of the well which was presented in the water right application. The Montana Fish, Wildlife and Parks (FWP) has existing water rights in the region and is concerned about potential impacts to springs and surface water in the area from wells developed in the Madison Aquifer near Utica. As a result of these concerns the FWP objected to the CMRWA's water right application.

In order to settle Montana Fish, Wildlife and Parks' (FWP) objection to permit 41S-30019140 by Central Montana Regional Water Authority (CMRWA), FWP and CMRWA agree to the following plan that demonstrates that CMRWA use of water will be controlled so that the water right of a prior appropriator will be satisfied or other measures will be taken to prevent adverse affects to the water rights of prior appropriators.

I. Spring Inventory Report

CMRWA agrees to provide FWP a report inventorying springs within the Judith River basin that are hydrologically connected to the Madison Aquifer. The inventory shall include a representative sampling of springs and spring complexes discharging greater than 50 gpm within a 20-mile radius of the permitted well and springs and spring complexes discharging greater than 1 cfs within a 40-mile radius of the well. The hydrologic connection to the Madison Aquifer will be determined using geological data, well hydraulics analyses, comparison of the potentiometric surface of the Madison Aquifer with the elevation of the springs, water chemistry comparisons of the spring discharge to water in the Madison Aquifer or other acceptable means agreed to by FWP. This report is due to FWP prior to the use of the permitted well for actual water delivery to the CMRWA customers.

As new information becomes available, CMRWA agrees to update or amend the Spring Inventory Report. Updates or amendments shall be provided to FWP by March 1 of the year following the development of new information, and shall include:

a. Report on additional wells constructed by CMRWA in the vicinity of the permitted well.
b. Revised estimates of aquifer properties based on new information obtained during the preceding year.
c. Analysis of potential impacts to spring discharges for springs identified in the Spring Inventory Report based on new information obtained during the preceding year and revised estimates of aquifer properties.

II. Annual Report to DNRC

CMRWA agrees to provide an annual report to DNRC by March 1 reporting the following for the preceding calendar year:

a. Diversion report including flow rate, pumping schedule, and volume diverted from each well developed on the property.
b. Static water level measurement. (at least one measurement per year within 11-13 months of the previous years state water level measurement).

III. Mitigation of Adverse Effects to Water Rights

Upon a finding by DNRC that spring discharges are being reduced due to the exercise of this permit and the water rights of a prior appropriator are being adversely affected, CMRWA agrees to mitigate the adverse affects through the reduction in diversion under this permit, the replacement of depleted water or through other augmentation measures to the extent necessary to offset all adverse effects to existing senior water rights.

In exchange for the CMRWA's commitment to complete the plan itemized above, the FWP agrees to withdraw its objection to the water right application referenced above. Any of the above may be modified or deleted only upon written mutual agreement between both parties.

Central Montana Regional Water Authority

[signature] Chairman

11-8-06

Date

Montana Fish, Wildlife & Parks

Chris Hunt

11-16-06

Date

APPENDIX B – SPRING GEOLOGY EXHIBITS

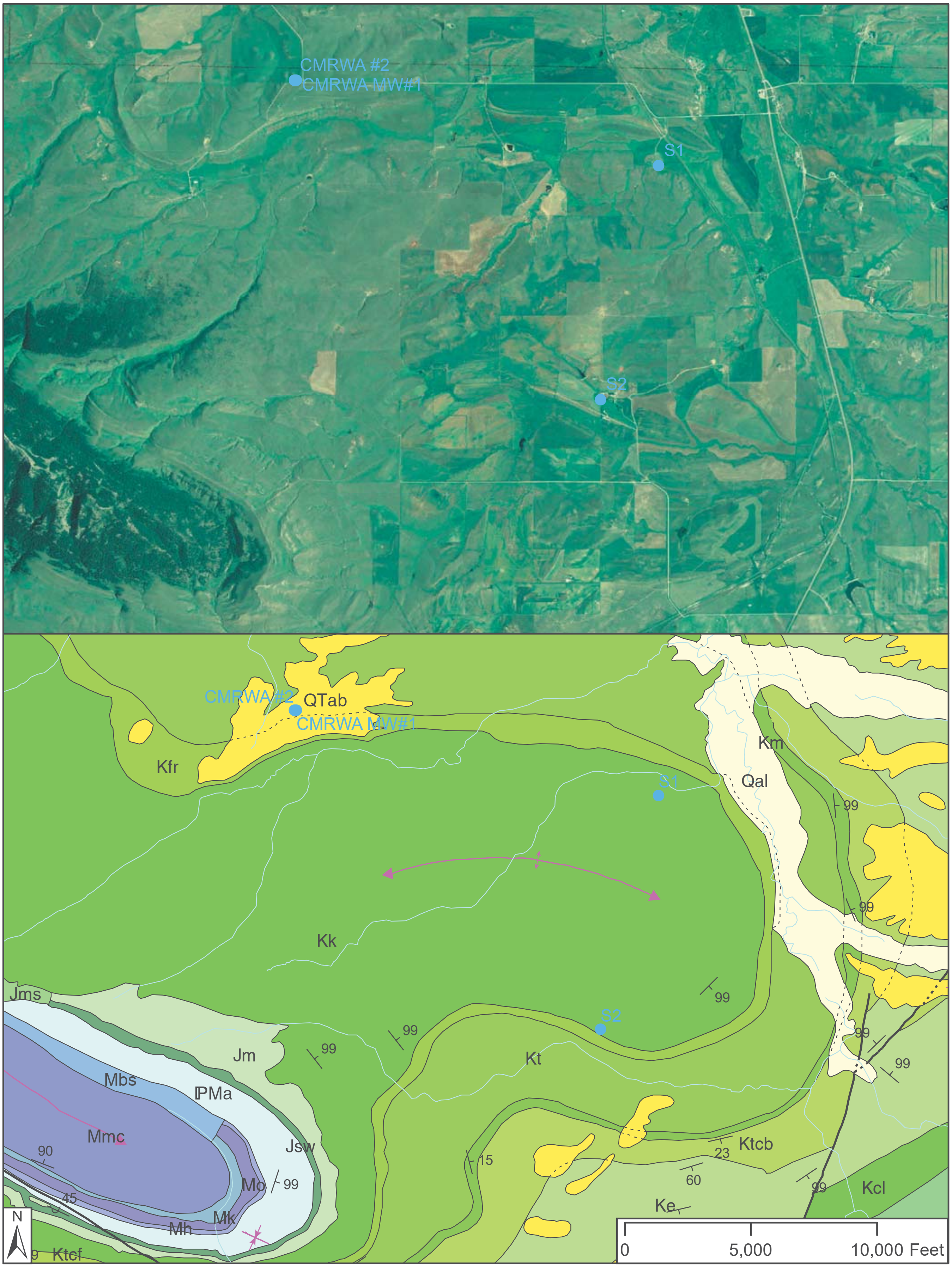
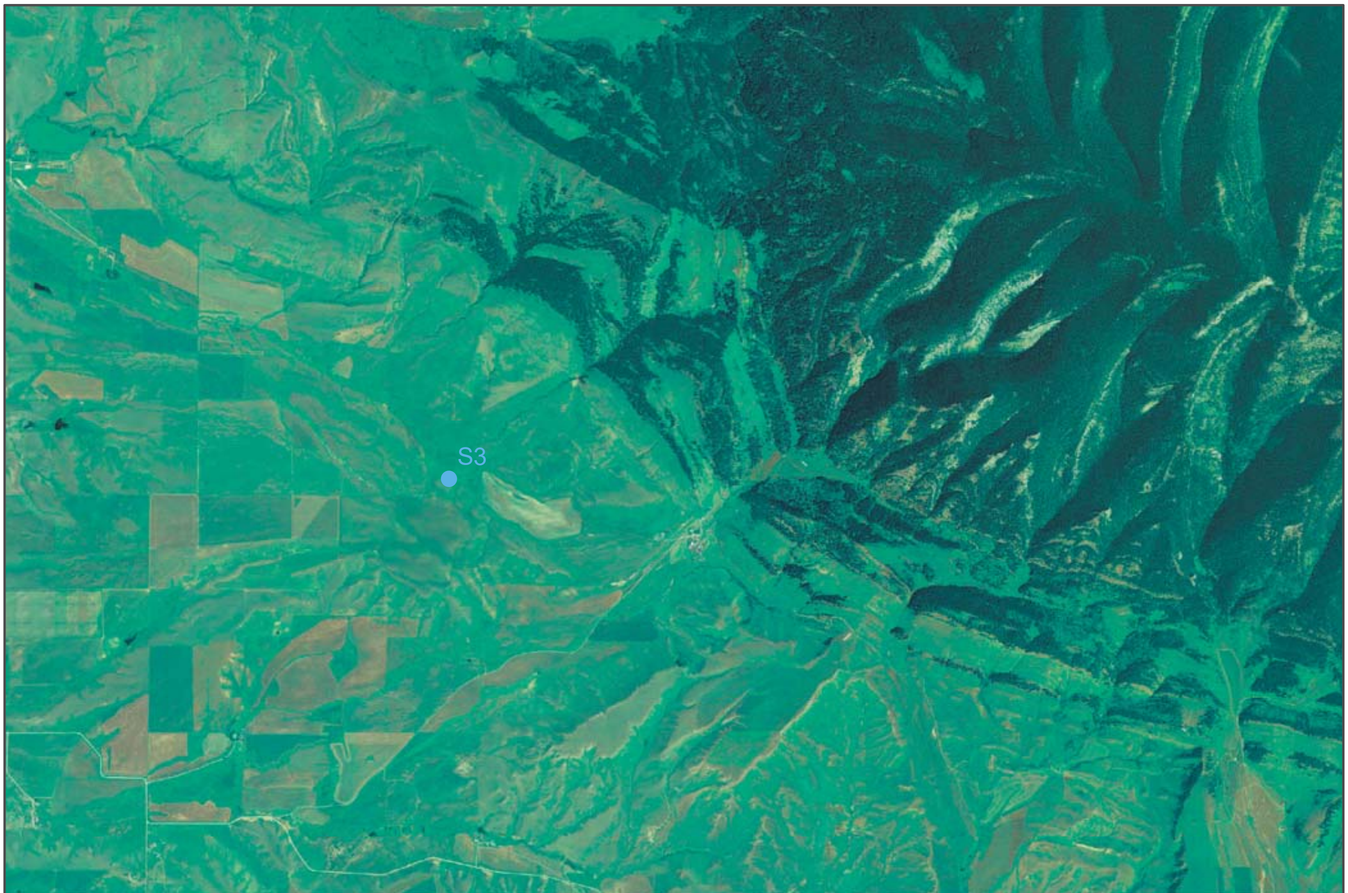


Exhibit B-1 Springs S1 and S2



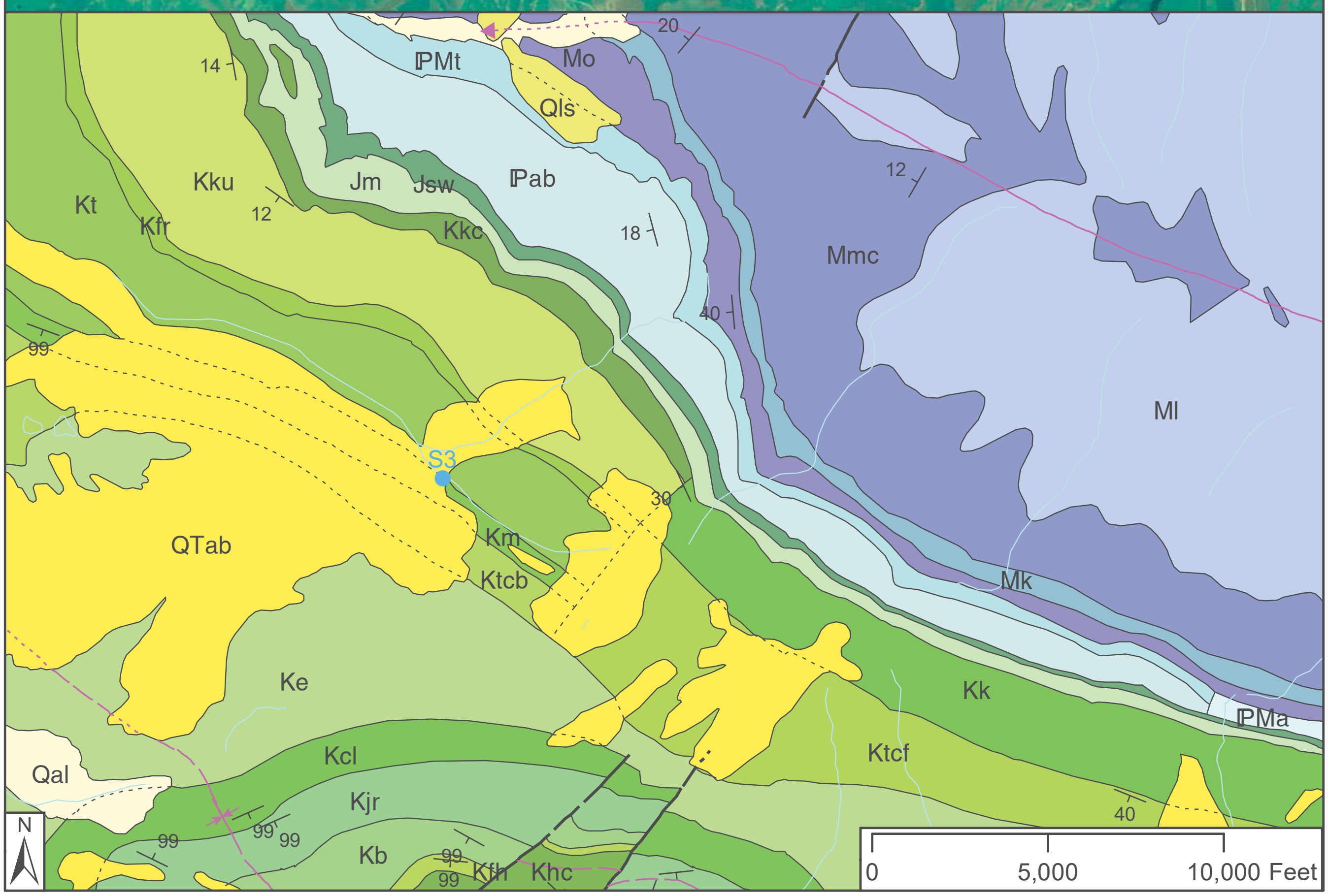


Exhibit B-2 Spring S3

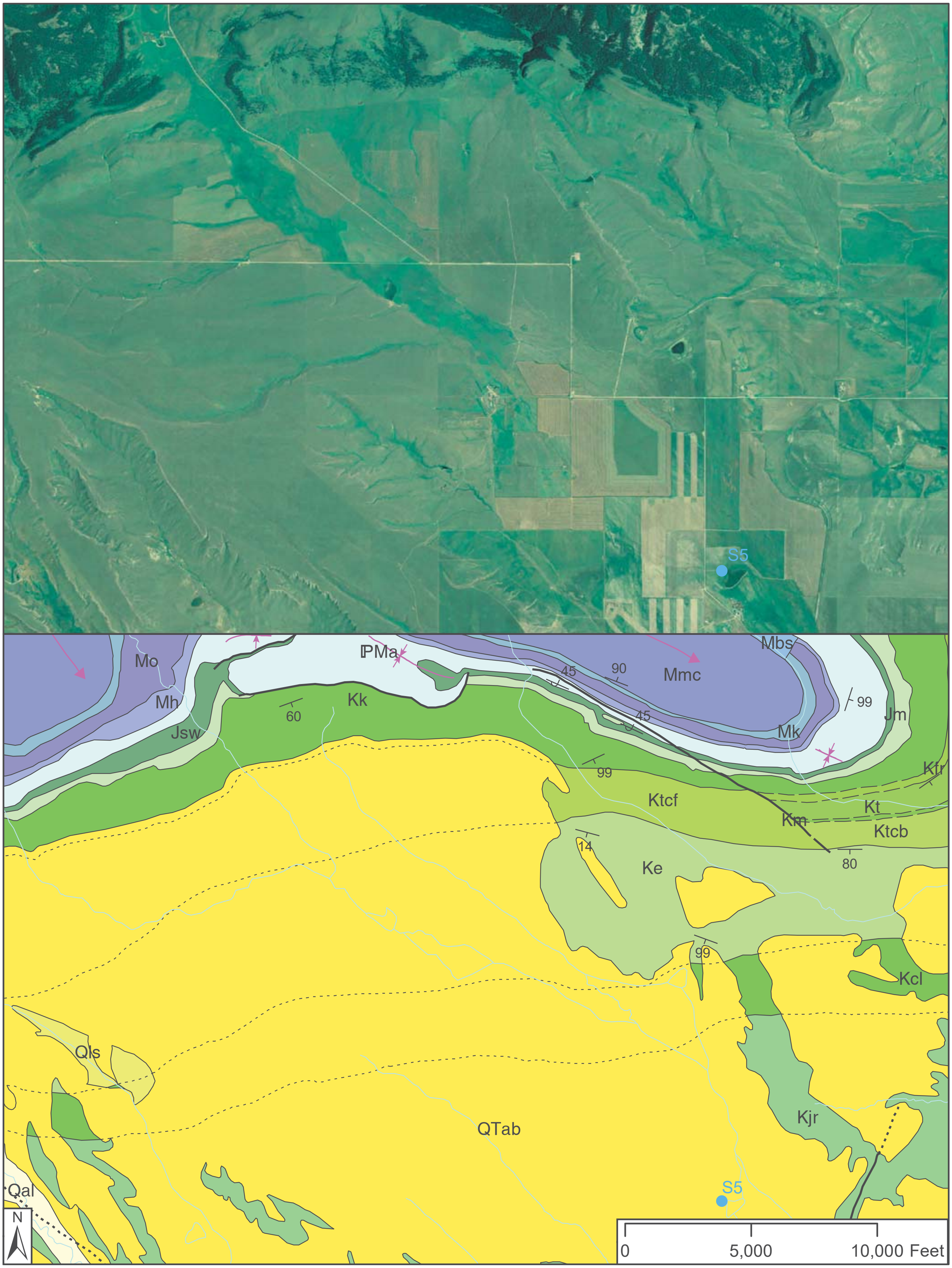


Exhibit B-3 Spring S5

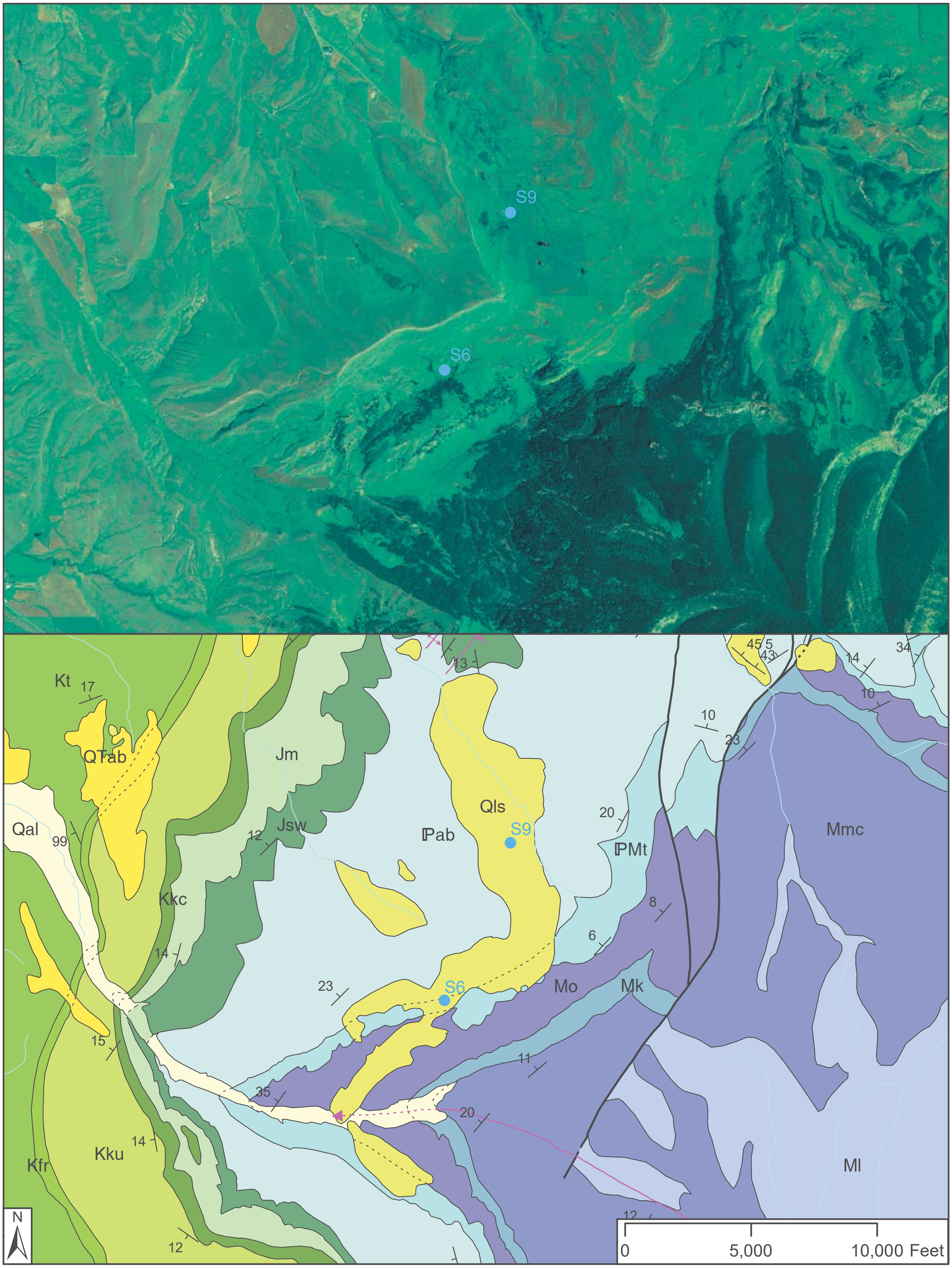


Exhibit B-4 Springs S6 and S9

Exhibit B-5 Spring S10

Exhibit B-6 Springs S11 and S15

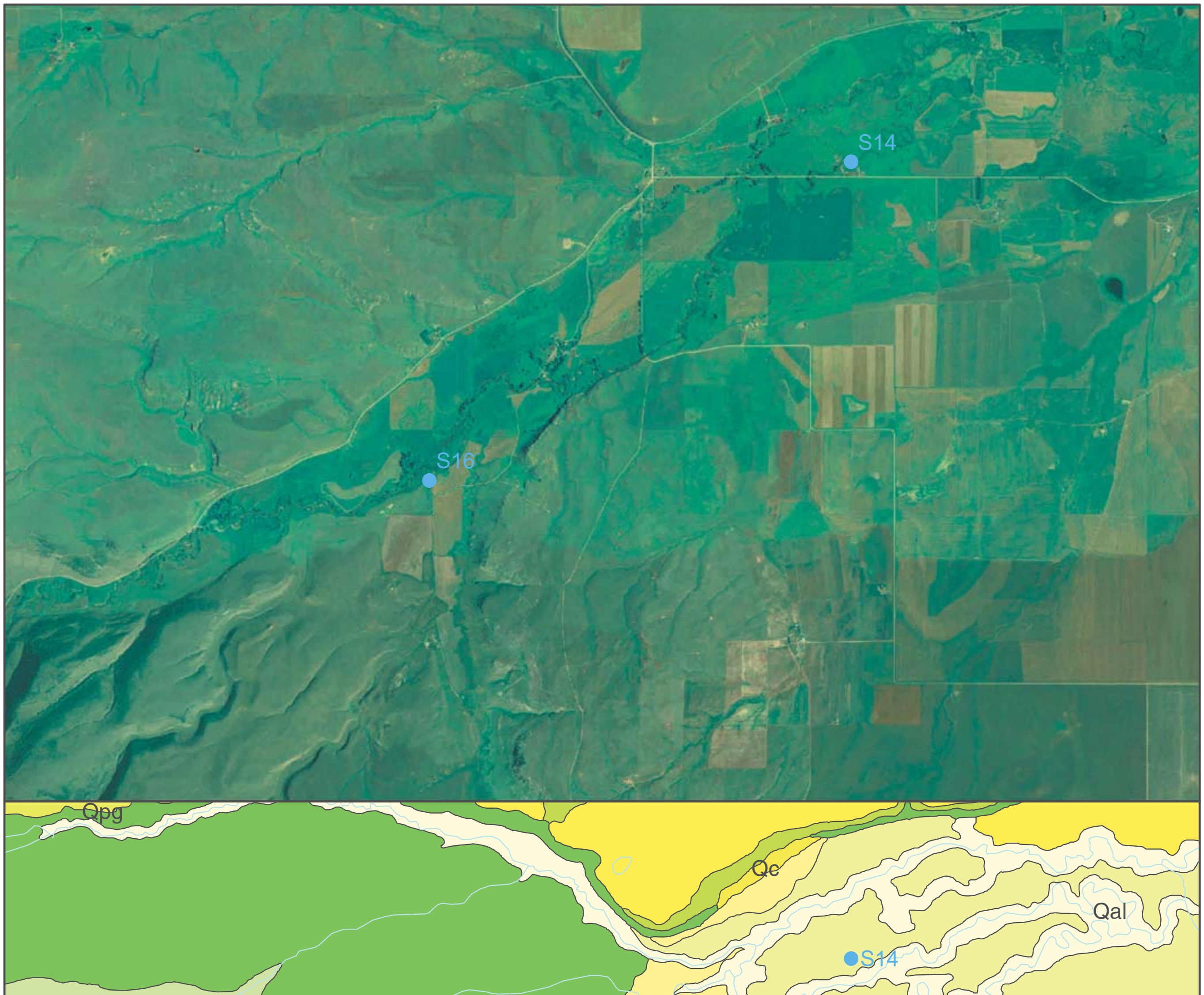


Exhibit B-7 Springs S14 and S16

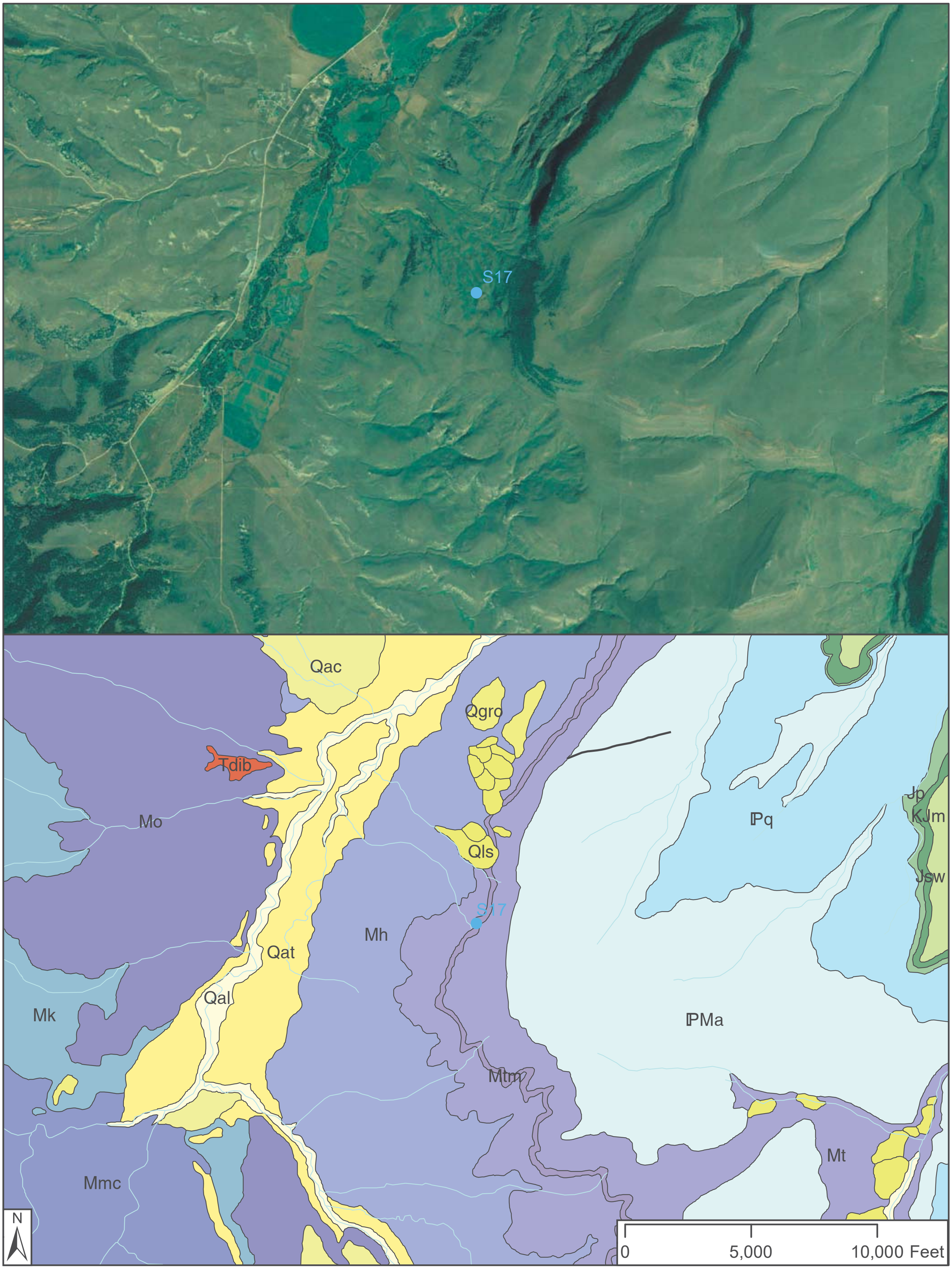


Exhibit B-8 Spring S17

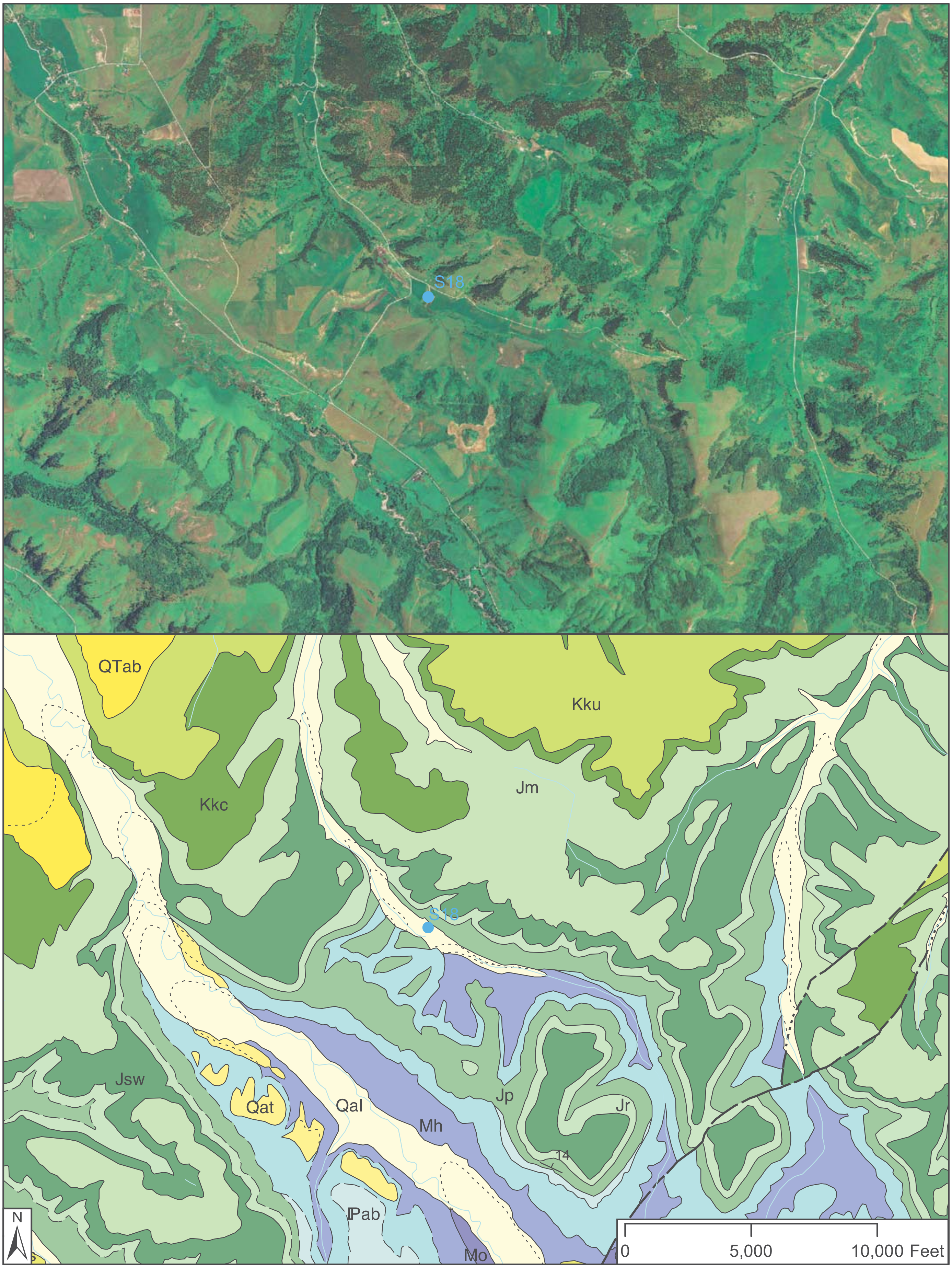


Exhibit B-9 Spring S18

Exhibit B-10 Spring S19

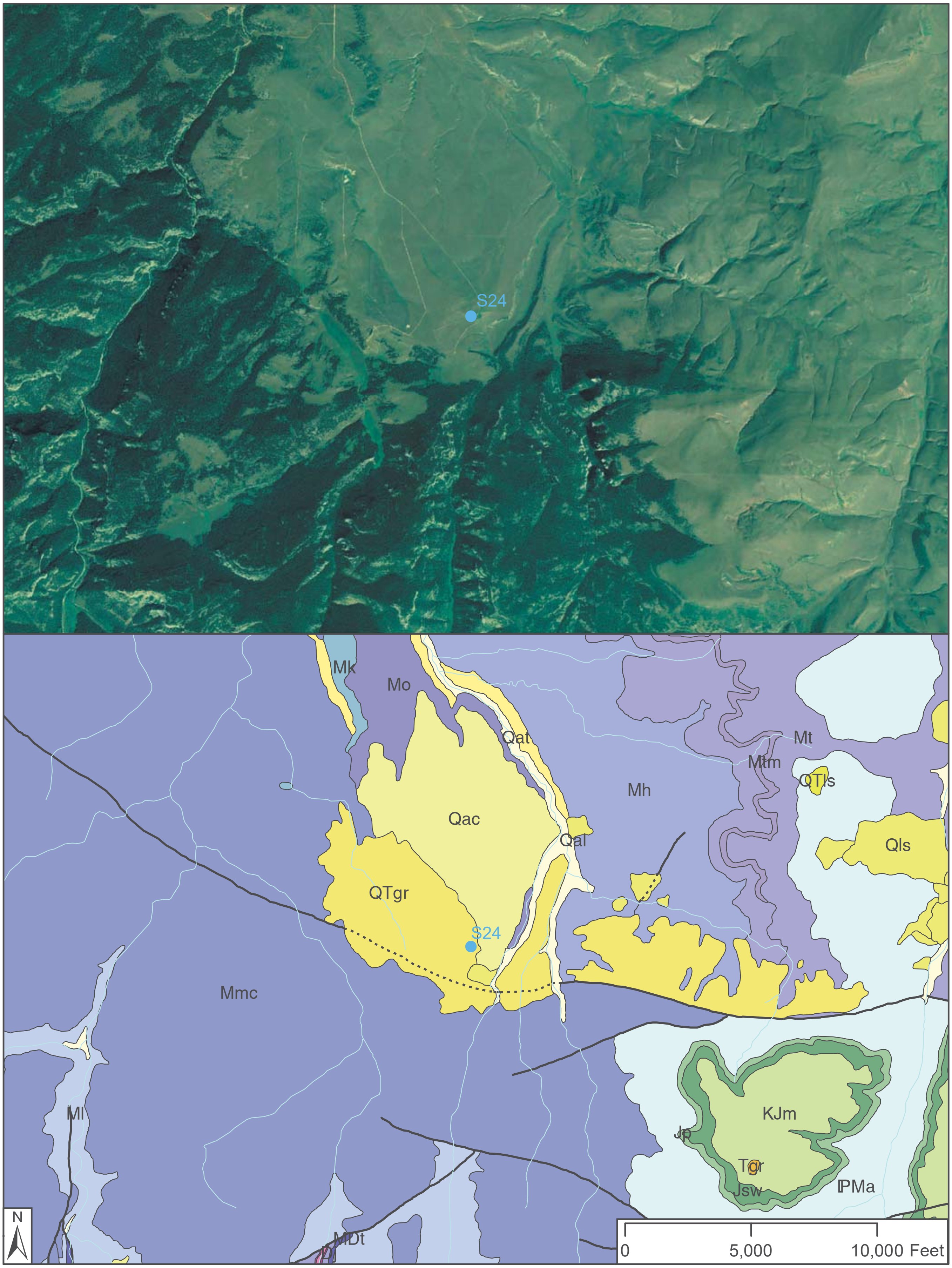


Exhibit B-11 Spring S24

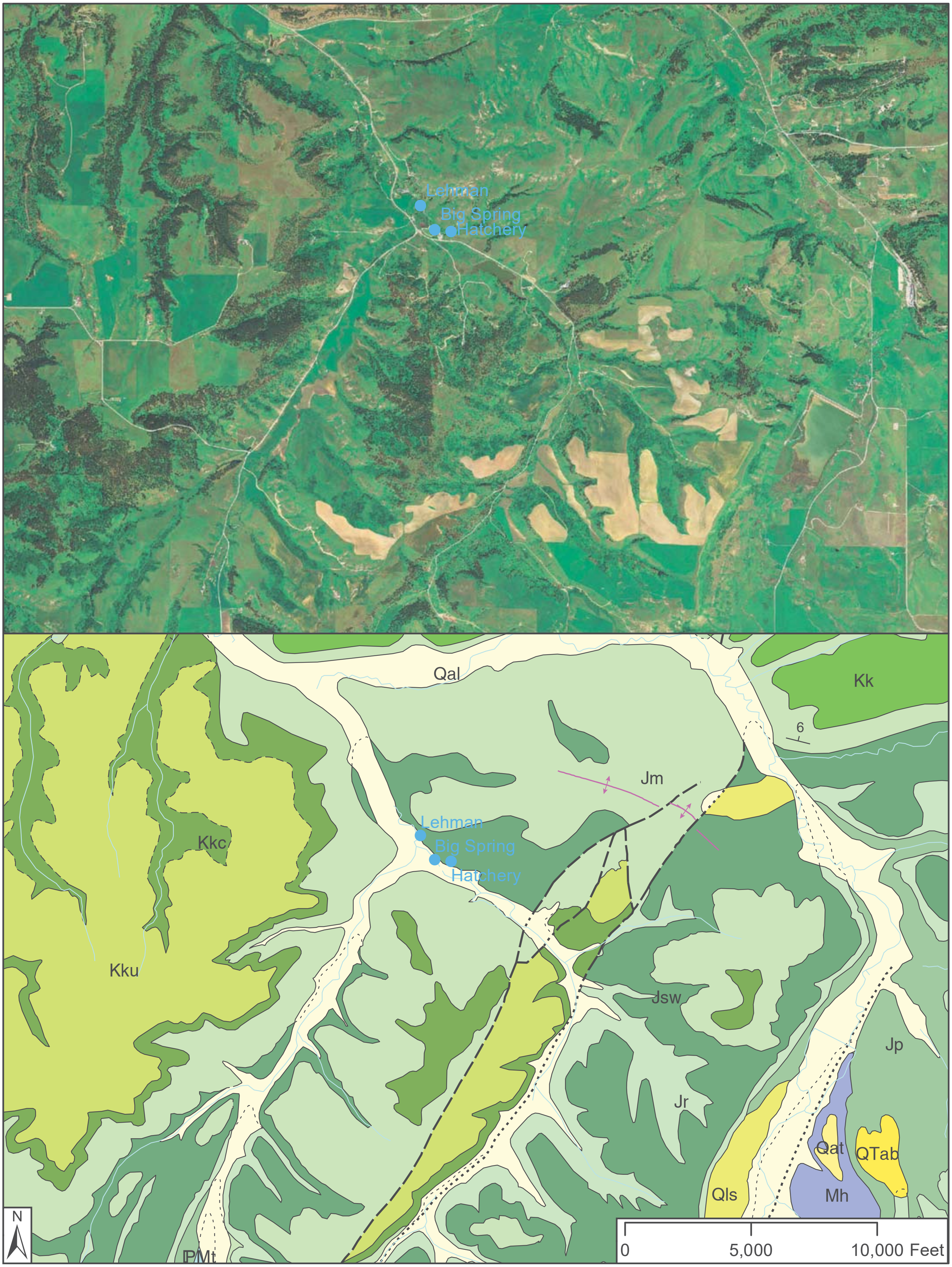


Exhibit B-12 Big Spring, Hatchery Spring and Lehman Spring

APPENDIX C – WATER CHEMISTRY DATA

CENTRAL MONTANA REGIONAL WATER AUTHORITY
SPRING INVENTORY 2016
WATER QUALITY DATA

Sample ID	Sample Date	pH	Electrical Conductivity	Total Dissolved Solids (Calc)	Total Alkalinity (as CaCO3)	Hardness (Ca/Mg As CaCO3)	Nitrate Nitrogen (As N)	Phosphorus (Orthophosphate as P)	Sulfide	Total Organic Carbon	Bicarbonate as HCO3	Carbonate as CO3
		s.u.	µmhos/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
CMRWA #2 101116 MC	10/11/16	8.3	592	360	167	311	0.15	<0.01	<0.01	<1	201	<5
CMRWA #2 101916 MC	10/19/16	8.3	589	360	166	302	0.15	<0.01	<0.01	<1	201	<5
CMRWA MW#1 092116 MC	9/21/16	8.4	307	170	130	150	<0.05	<0.01	<0.01	1	156	<5
S1 101016 MC	10/10/16	8.4	578	320	259	285	1.94	<0.01	0.01	<1	307	<5
S2 101016 MC	10/10/16	8.3	562	310	239	275	1.46	<0.01	<0.01	1	286	<5
S3 110216 MC	11/2/16	8.2	678	380	298	338	5.22	<0.01	<0.01	<1	364	<5
S5 101016 MC	10/10/16	8.4	654	380	229	289	2.58	<0.01	<0.01	4	271	<5
S6 110216 MC	11/2/16	8.3	476	260	245	249	0.44	<0.01	<0.01	<1	292	<5
S9 110116 MC	11/1/16	8.3	446	240	224	229	0.28	<0.01	<0.01	2	268	<5
S10 101216 MC	10/12/16	8.4	549	320	208	270	11.2	<0.01	<0.01	<1	245	<5
S11 101216 MC	10/12/16	8.4	587	320	263	298	3.14	<0.01	<0.01	<1	313	<5
S14 101916 MC	10/19/16	8.3	596	340	247	291	0.12	<0.01	0.01	<1	295	<5
S15 101216 MC	10/12/16	8.4	666	390	273	323	0.14	<0.01	<0.01	1	321	6
S16 101916 MC	10/19/16	8.3	671	370	288	329	0.52	<0.01	0.01	<1	347	<5
S17 101916 MC	10/19/16	8.3	649	350	320	320	1.05	<0.01	0.01	1	390	<5
S18 101216 MC	10/12/16	8.2	928	570	348	465	0.72	<0.01	<0.01	<1	424	<5
S19 101116 MC	10/11/16	8.5	647	380	273	348	0.38	<0.01	<0.01	<1	312	11
COL S21 101116 MC (Big Spring)	10/11/16	8.4	470	270	160	240	0.16	<0.01	0.01	<1	191	<5
FWP S22 101116 MC (Hatchery Spring)	10/11/16	8.4	573	350	157	301	0.14	<0.01	<0.01	<1	187	<5
FWP S23 101116 MC (Lehman Spring)	10/11/16	8.4	498	300	163	263	0.14	<0.01	<0.01	<1	195	<5
S24 110116 MC	11/1/16	8.4	418	220	195	207	1.13	<0.01	<0.01	2	232	<5
Analytical Lab		IML	IML	IML	IML	IML	IML	IML	IML	IML	IML	IML

IML - Inter-Mountain Labs
UA - University of Arizona

Western Groundwater Services

Exhibit C-1 Water Chemistry Data Table

CENTRAL MONTANA REGIONAL WATER AUTHORITY
SPRING INVENTORY 2016
WATER QUALITY DATA

Sample ID	Sample Date	Chloride	Fluoride	Sulfate	Calcium	Magnesium	Potassium	Sodium	Dissolved Aluminum	Dissolved Iron	Dissolved Manganese	Dissolved Silicon
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
CMRWA #2 101116 MC	10/11/16	1	0.7	144	85	24	1	5	0.01	<0.05	<0.02	3.4
CMRWA #2 101916 MC	10/19/16	<1	0.7	146	81	25	1	3	<0.01	<0.05	<0.02	3.7
CMRWA MW#1 092116 MC	9/21/16	1	0.2	29	48	7	2	2	0.02	<0.05	0.04	4.0
S1 101016 MC	10/10/16	5	0.5	41	65	30	3	9	<0.01	<0.05	<0.02	3.6
S2 101016 MC	10/10/16	6	0.5	53	60	31	4	10	<0.01	<0.05	<0.02	4.0
S3 110216 MC	11/2/16	6	0.2	45	92	26	2	10	0.01	<0.05	<0.02	5.0
S5 101016 MC	10/10/16	10	0.4	101	67	30	2	25	0.01	<0.05	<0.02	5.4
S6 110216 MC	11/2/16	<1	0.2	12	75	15	<1	3	0.01	<0.05	<0.02	3.6
S9 110116 MC	11/1/16	<1	0.2	15	76	10	<1	3	<0.01	<0.05	<0.02	3.3
S10 101216 MC	10/12/16	3	0.3	35	73	22	1	8	0.01	<0.05	<0.02	3.9
S11 101216 MC	10/12/16	3	0.6	39	55	39	2	12	<0.01	<0.05	<0.02	4.6
S14 101916 MC	10/19/16	2	0.2	73	75	26	2	12	<0.01	<0.05	<0.02	4.7
S15 101216 MC	10/12/16	3	0.3	89	78	31	3	20	0.01	<0.05	<0.02	4.7
S16 101916 MC	10/19/16	3	0.4	69	68	39	3	16	<0.01	<0.05	<0.02	4.0
S17 101916 MC	10/19/16	4	0.5	29	63	40	2	18	<0.01	<0.05	<0.02	5.7
S18 101216 MC	10/12/16	2	0.3	179	113	45	3	13	0.01	<0.05	<0.02	4.8
S19 101116 MC	10/11/16	2	0.1	84	100	24	4	5	0.01	<0.05	<0.02	3.2
COL S21 101116 MC (Big Spring)	10/11/16	1	0.6	86	65	19	<1	3	<0.01	<0.05	<0.02	2.7
FWP S22 101116 MC (Hatchery Spring)	10/11/16	<1	1.0	142	77	26	1	4	0.01	<0.05	<0.02	3.0
FWP S23 101116 MC (Lehman Spring)	10/11/16	<1	0.8	90	64	20	<1	4	<0.01	<0.05	<0.02	2.8
S24 110116 MC	11/1/16	3	0.3	19	56	16	<1	6	<0.01	<0.05	<0.02	4.5
Analytical Lab		IML	IML	IML	IML	IML	IML	IML	IML	IML	IML	IML

IML - Inter-Mountain Labs
UA - University of Arizona

CENTRAL MONTANA REGIONAL WATER AUTHORITY
SPRING INVENTORY 2016
WATER QUALITY DATA

Sample ID	Sample Date	Dissolved Strontium	Gas Range Organics (nC6-nC10)	Diesel Range Organics (nC10-nC32)	Oxygen O18	Deuterium H2	Carbon C13	Sulphur S34	Tritium H3	Field Temp.	Field pH
		mg/L	µg/L	mg/L	per mil	per mil	per mil	per mil	TU	C	su
CMRWA #2 101116 MC	10/11/16	0.96	<20	<0.5	-18.0	-138.2	-3.4	19.0	6.3	15.60	7.65
CMRWA #2 101916 MC	10/19/16	1.07	<20	<0.5	-18.2	-138.1	-3.5	18.9	5.9	16.84	7.54
CMRWA MW#1 092116 MC	9/21/16	0.38	<20	<0.5	-17.8	-135.6	-8.1	-3.2	< 0.5	11.05	8.26
S1 101016 MC	10/10/16	0.45	<20	<0.5	-17.8	-138.5	-8.9	0.0	5.2	7.53	7.35
S2 101016 MC	10/10/16	0.64	<20	<0.5	-19.2	-148.1	-8.6	-0.7	3.0	8.23	7.06
S3 110216 MC	11/2/16	1.09	<20	<0.5	-18.4	-143.2	-11.3	3.8	5.6	8.97	7.20
S5 101016 MC	10/10/16	2.06	<20	<0.5	-16.8	-134.8	-7.7	5.2	6.4	9.98	7.51
S6 110216 MC	11/2/16	0.21	20	<0.5	-18.2	-139.1	-11.0	-9.3	8.5	6.67	7.30
S9 110116 MC	11/1/16	0.19	<20	<0.5	-16.8	-131.2	-10.7	-8.5	6.6	8.14	7.20
S10 101216 MC	10/12/16	0.80	<20	<0.5	-16.5	-128.2	-7.7	10.1	8.0	8.17	7.67
S11 101216 MC	10/12/16	0.43	<20	<0.5	-15.4	-124.5	-9.1	0.8	5.4	11.22	7.55
S14 101916 MC	10/19/16	0.75	<20	<0.5	-17.9	-138.4	-8.9	5.2	7.0	9.21	7.53
S15 101216 MC	10/12/16	0.69	<20	<0.5	-17.1	-134.0	-9.7	4.4	6.7	9.91	7.57
S16 101916 MC	10/19/16	0.49	<20	<0.5	-17.5	-137.1	-8.1	-6.7	6.5	8.74	7.42
S17 101916 MC	10/19/16	0.56	<20	<0.5	-17.6	-138.4	-9.0	-4.7	8.3	6.67	7.42
S18 101216 MC	10/12/16	1.89	<20	<0.5	-17.8	-136.5	-10.0	4.3	8.3	8.04	7.27
S19 101116 MC	10/11/16	0.86	<20	<0.5	-17.7	-135.4	-9.7	8.6	7.6	6.67	7.94
COL S21 101116 MC (Big Spring)	10/11/16	0.61	<20	<0.5	-18.4	-138.7	-4.0	15.9	3.5	10.74	7.51
FWP S22 101116 MC (Hatchery Spring)	10/11/16	0.86	<20	<0.5	-18.4	-139.6	-2.3	16.2	4.8	11.83	7.65
FWP S23 101116 MC (Lehman Spring)	10/11/16	0.78	<20	<0.5	-18.4	-140.8	-3.6	16.8	9.7	12.63	7.63
S24 110116 MC	11/1/16	0.48	<20	<0.5	-15.4	-124.6	-8.2	1.9	5.7	8.93	7.65
Analytical Lab		IML	IML	IML	UA	UA	UA	UA	UA	Field	Field

IML - Inter-Mountain Labs
UA - University of Arizona

CENTRAL MONTANA REGIONAL WATER AUTHORITY
SPRING INVENTORY 2016
WATER QUALITY DATA

Sample ID	Sample Date	Field Eh (from ORP)	Field Conductivity	Field Turbidity	Field Dissolved Oxygen
		mV	uS/cm	NTU	mg/L
CMRWA #2 101116 MC	10/11/16	371	596	3.0	6.28
CMRWA #2 101916 MC	10/19/16	297	598	0.5	4.45
CMRWA MW#1 092116 MC	9/21/16	-54	294	5.4	0.51
S1 101016 MC	10/10/16	490	551	2.5	13.08
S2 101016 MC	10/10/16	492	561	1.9	4.94
S3 110216 MC	11/2/16	509	675	0.0	6.47
S5 101016 MC	10/10/16	467	647	6.4	9.01
S6 110216 MC	11/2/16	449	478	0.0	7.31
S9 110116 MC	11/1/16	482	452	0.5	6.02
S10 101216 MC	10/12/16	479	535	4.4	10.19
S11 101216 MC	10/12/16	490	583	1.0	8.76
S14 101916 MC	10/19/16	481	605	3.0	5.31
S15 101216 MC	10/12/16	462	659	2.1	4.83
S16 101916 MC	10/19/16	462	672	0.9	5.11
S17 101916 MC	10/19/16	426	663	11.2	7.10
S18 101216 MC	10/12/16	511	908	1.5	3.65
S19 101116 MC	10/11/16	476	633	3.0	12.96
COL S21 101116 MC (Big Spring)	10/11/16	448	459	1.6	12.04
FWP S22 101116 MC (Hatchery Spring)	10/11/16	491	567	2.3	10.91
FWP S23 101116 MC (Lehman Spring)	10/11/16	484	492	2.0	8.12
S24 110116 MC	11/1/16	503	417	0.0	8.29
Analytical Lab		Field	Field	Field	Field

IML - Inter-Mountain Labs
UA - University of Arizona

Inter-Mountain Labs

Your Environmental Monitoring Partner

1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Date: 12/8/2016

CLIENT: Western Groundwater Services
Project:
Lab Order: S1610313

CASE NARRATIVE

Report ID: S1610313001

Sample CMRWA #2 101916 MC was received on October 21, 2016.

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 Inter-Mountain Laboratories except as indicated in this case narrative.

Where noted, analysis was performed at our lab located at 555 Absaraka Street, Sheridan, WY 82801.

Reviewed by: Bill Courtney
Bill Courtney, Project Manager

Page 1 of 1

Exhibit C-2 CMRWA #2 Lab Report

IML INTER-MOUNTAIN LABS
Inter-Mountain Labs
Your Environmental Monitoring Partner
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

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

Date Reported: 12/8/2016
Report ID: S1610313001

Work Order: S1610313
Collection Date: 10/19/2016 1:00:00 PM
Date Received: 10/21/2016 10:25:00 AM
Sampler: MC
Matrix: Water
COC: 162928

Project:
Lab ID: S1610313-001
Client Sample ID: CMRWA #2 101916 MC

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
General Parameters						
pH	8.3	0.1		s.u.	10/21/2016 2329 IBS	SM 4500 H B
Electrical Conductivity	589	5		µmhos/cm	10/21/2016 2329 IBS	SM 2510B
Solids, Total Dissolved (Calc)	360	10		mg/L	11/07/2016 0834 BC	SM 1030E
Alkalinity, Total (As CaCO3)	166	5		mg/L	10/21/2016 2329 IBS	SM 2320B
Hardness, Calcium/Magnesium (As CaCO3)	302	1		mg/L	11/07/2016 0834 BC	SM 2340B
Nitrogen, Nitrate (As N)	0.15	0.05		mg/L	10/21/2016 1309 LAB	EPA 300.0
Phosphorus, Orthophosphate as P	ND	0.01		mg/L	10/21/2016 1309 LAB	EPA 300.0
Sulfide	ND	0.01		mg/L	10/24/2016 0744 KB	HACH 8131
Total Organic Carbon	ND	1		mg/L	10/28/2016 1312 AB	SM 5310B
Sulfide as H2S	ND	0.01		mg/L	10/24/2016 0744 KB	HACH 8131
Anions						
Alkalinity, Bicarbonate as HCO3	201	5		mg/L	10/21/2016 2329 IBS	SM 2320B
Alkalinity, Carbonate as CO3	ND	5		mg/L	10/21/2016 2329 IBS	SM 2320B
Chloride	ND	1		mg/L	10/21/2016 1309 LAB	EPA 300.0
Fluoride	0.7	0.1		mg/L	10/21/2016 2329 IBS	SM 4500FC
Sulfate	146	1		mg/L	10/21/2016 2054 LAB	EPA 300.0
Cations						
Calcium	81	1		mg/L	10/26/2016 1248 DG	EPA 200.7
Magnesium	25	1		mg/L	10/26/2016 1248 DG	EPA 200.7
Potassium	1	1		mg/L	10/26/2016 1248 DG	EPA 200.7
Sodium	3	1		mg/L	10/26/2016 1248 DG	EPA 200.7
Radiochemistry (SDWA)						
Gross Alpha	ND	2		pCi/L	11/17/2016 1555 MB	SM 7110 B
Gross Beta	ND	3		pCi/L	11/17/2016 1555 MB	SM 7110 B
Radium 226	0.3 ± 0.1	0.2		pCi/L	11/17/2016 1009 MB	SM 7500 RA_B
Radiochemistry						
Total Radium 228	ND	1		pCi/L	12/01/2016 0123 MB	Ga-Tech

These results apply only to the samples tested. **RL - Reporting Limit**

Qualifiers:

B	Analyte detected in the associated Method Blank	C	Calculated Value
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	L	Analyzed by another laboratory
M	Value exceeds Monthly Ave or MCL or is less than LCL	ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions	S	Spike Recovery outside accepted recovery limits
X	Matrix Effect		

Reviewed by: Bill Courtney
Bill Courtney, Project Manager

Page 1 of 2

Inter-Mountain Labs
Your Environmental Monitoring Partner
1673 Terra Avenue, Sheridan, Wyoming 82801 ph: (307) 672-8945

Sample Analysis Report

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

Date Reported: 12/8/2016
Report ID: S1610313001

Work Order: S1610313
Collection Date: 10/19/2016 1:00:00 PM
Date Received: 10/21/2016 10:25:00 AM
Sampler: MC
Matrix: Water
COC: 162928

Project:
Lab ID: S1610313-001
Client Sample ID: CMRWA #2 101916 MC

Analyses	Result	RL	Qual	Units	Date Analyzed/Init	Method
Dissolved Metals						
Aluminum	ND	0.01		mg/L	10/26/2016 1248 DG	EPA 200.7
Antimony	ND	0.005		mg/L	10/24/2016 1527 MS	EPA 200.8
Arsenic	ND	0.005		mg/L	10/24/2016 1527 MS	EPA 200.8
Barium	ND	0.5		mg/L	10/24/2016 1527 MS	EPA 200.8
Beryllium	ND	0.004		mg/L	10/26/2016 1248 DG	EPA 200.7
Cadmium	ND	0.002		mg/L	10/24/2016 1527 MS	EPA 200.8
Chromium	ND	0.01		mg/L	10/26/2016 1248 DG	EPA 200.7
Copper	ND	0.01		mg/L	10/24/2016 1527 MS	EPA 200.8
Iron	ND	0.05		mg/L	10/26/2016 1248 DG	EPA 200.7
Lead	ND	0.003		mg/L	10/24/2016 1527 MS	EPA 200.8
Manganese	ND	0.02		mg/L	10/26/2016 1248 DG	EPA 200.7
Mercury	ND	0.001		mg/L	10/25/2016 1029 AW	EPA 245.1
Nickel	ND	0.05		mg/L	10/26/2016 1248 DG	EPA 200.7
Selenium	ND	0.005		mg/L	10/24/2016 1527 MS	EPA 200.8
Silicon	3.7	0.1		mg/L	10/26/2016 1248 DG	EPA 200.7
Strontium	1.07	0.02		mg/L	10/26/2016 1248 DG	EPA 200.7
Thallium	ND	0.002		mg/L	10/24/2016 1527 MS	EPA 200.8
Zinc	0.01	0.01		mg/L	10/26/2016 1248 DG	EPA 200.7
8015C Gasoline Range Organics-Water (Absaraka Lab)						
Gasoline Range Organics (nC6-nC10)	ND	20		µg/L	10/24/2016 1438 MAB	8015
Surr: 4-Bromofluorobenzene	96.6	84-117		%REC	10/24/2016 1438 MAB	8015
8015C Micro Diesel Range Organics-Water (Absaraka Lab)						
Diesel Range Organics (nC10-nC32)	ND	0.5		mg/L	10/27/2016 1823 SFK	8015C
Surr: o-Terphenyl	82.0	35-103		%REC	10/27/2016 1823 SFK	8015C

These results apply only to the samples tested. **RL - Reporting Limit**

Qualifiers:

B	Analyte detected in the associated Method Blank	C	Calculated Value
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	L	Analyzed by another laboratory
M	Value exceeds Monthly Ave or MCL or is less than LCL	ND	Not Detected at the Reporting Limit
O	Outside the Range of Dilutions	S	Spike Recovery outside accepted recovery limits
X	Matrix Effect		

Reviewed by: Bill Courtney
Bill Courtney, Project Manager

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