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GreatWest ENGINEERING

Judith Basin 2023 Long-Term Monitoring Data Summary Report

CENTRAL MONTANA REGIONAL WATER AUTHORITY

March 2024

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1. INTRODUCTION

1.1 Background

In 2023, the Central Montana Regional Water Authority (CMRWA) began operation of a portion of the Musselshell-Judith Regional Water System (MJRWS). Two deep water supply wells (CMRWA Wells 2 and 3) have been completed in the Madison Aquifer approximately 3 miles west of Garneill, Montana (**Figure 1**). The wells are currently supplying water to Harlowtown and select private property owners to the south. In 2024, two additional Madison wells (CMRWA Wells 4 and 5) are planned for construction immediately north of the existing wells. CMRWA wells in this area are collectively known as the U Bet Wellfield.

Beginning in 2016, a Long-Term Hydrogeologic Monitoring (LTM) program was initiated by CMRWA to evaluate and monitor water resources in the Judith Basin, prior to and during production from the U Bet Wellfield. Monitoring results have been summarized annually in previous years by Western Groundwater Services, LLC under contract to Great West Engineering. This report presents streamlined results of historical monitoring and begins to incorporate water production and groundwater monitoring data collected using the newly commissioned on-site U Bet Wellfield SCADA system.

1.2 Project Setting

As presented in detail in a 2014 Water Resources Monitoring Plan[1] developed by Western Groundwater Services, the project area lies within the Judith River Basin in Central Montana. The basin is underlain by several thousand feet of late-Mesozoic and early-Cenozoic sedimentary rocks; primarily shales, sandstones and carbonates. Important aquifers in the basin include the Kootenai Formation and the deeper Madison Group. Most water supply wells in the basin are completed in aquifers and water-bearing units of the Kootenai, which ranges in depth from land surface to as much as approximately 700-800 feet below ground surface (ft bgs) depending on the location. The Madison is deeper; ranging in depths from approximately 2,000 to 5,000 ft bgs, and as such is less frequently targeted for water production in the Judith Basin. Both the Kootenai and Madison aquifers are recharged regionally by precipitation and snow melt where outcropping; the Kootenai at the margins of the basin, and the Madison where exposed in the adjacent mountains including the Little Belts, the Big Snowy Mountains, the Judith Mountains and the North and South Moccasin Mountains.

2. LONG-TERM HYDROGEOLOGIC MONITORING (LTM)

2.1 Monitoring Objectives

The 2014 Water Resources Monitoring Plan was intended to develop baseline hydrogeologic data, information and trends of water resources in the Judith Basin over time. The LTM data has served to guide project development and inform the public of the relationships between the various surface and groundwater supplies in the Basin. One area of specific concern was how development of high-capacity wells completed in the deep Madison Group could potentially affect the more commonly

utilized Kootenai aquifer, surface waters or springs in the area. The LTM has evolved over time from primarily baseline data collection and interpretation to more recently, the specific hydraulic connection, or lack thereof, between the Kootenai aquifer and pumping of newly developed production wells in the U Bet Wellfield. Sections 2.2 and 2.3 identify the historic and current LTM components. Details of LTM well constructions and depths have been provided in prior annual LTM summary reports and CMRWA well construction/testing reports authored by Western Groundwater Services.

2.2 Historic Monitoring

Pursuant to a written water resources plan[1] and associated monitoring program[2], and as illustrated on **Figure 1**, the historic scope of monitoring included:

- High-frequency (15-minute interval) monitoring of water levels and water temperature measurements in several area wells completed in both the Kootenai and Madison aquifers,
- High-frequency (15-minute interval) water level and water temperature measurements in completed (but idle) production wells CMRWA 2 and 3 until mid-2022, leading up to installation of submersible pumps and commissioning of the wells.
- Review of surface water discharge measurement data collected by FWP at Big Spring near Lewistown
- Review of meteorologic data recorded at the MDOT Judith Gap Road Weather Information System (RWIS) station, and
- Review of Judith River stream flow data collected by the USGS at the gauge station near Sapphire Village.

2.3 Current Monitoring

The current high-frequency LTM network consists of the following components:

- **Groundwater**
    - **Madison Aquifer Wells**
        - Production Wells CMRWA 2 and 3: water levels and water production are continuously recorded by the onsite SCADA system.
        - Well CMRWA 1: located near the Town of Utica (water levels daily).
    - **Kootenai Aquifer Wells**:
        - Well CMRWA MW-1: Located in the U Bet Wellfield (water levels at 15-minute interval).
        - Nicholson Ranch Well: Located approximately 12 miles WNW of the U Bet Wellfield (water levels daily).
        - Judith Gap/Mauws Well: Located approximately 4 miles SE of the U Bet Wellfield (water levels daily).

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1. Western Groundwater Services, LLC (2014) Water Resources Monitoring Plan, Central Montana Regional Water Authority, report to Great West Engineering, Inc.
2. Western Groundwater Services, LLC (2020) Judith Basin Monitoring System, Final Report, Central Montana Regional Water Authority, report to Great West Engineering, Inc.

- **Surface Water**
  - Judith River USGS Gauge Station: Near Sapphire Village above Carr Creek. USGS monitoring of daily average stream discharge.
  - Big Spring: Near Lewistown. FWP monitoring of surface water discharges (daily average). Includes Crystal Lake SNOTEL daily precipitation data. Note: Discharge monitoring of the Big Spring is also applicable to groundwater conditions in the Madison Group.

- **Climate Data**
  - Judith Gap RWIS: Located just south of Judith Gap on US Route 191. MDOT monitoring of precipitation (daily) and ambient air temperature (mean daily).

2.4 Data Archive

Well data are reported to the Montana Bureau of Mines and Geology (MBMG) Ground Water Information Center (GWIC) and can be accessed on the GWIC website[3]. Big Spring data are collected by the Montana Fish Wildlife and Parks (FWP) and can be accessed on the Montana Department of Natural Resources (DNRC) Stream and Gauge Explorer (StAGE) website[4] by searching "Big Springs". Judith River stream flows are available at the USGS stream flow monitoring website[5]. The Judith Gap RWIS meteorological data is available by public information request to MDOT[6].

3. MONITORING DATA SUMMARY

Graphical presentations of historic LTM data through 2023 are presented in **Figures 2-11**. The well data in this report should be considered provisional and may be modified slightly when ground elevations are confirmed by survey.

3.1 Groundwater Monitoring

Groundwater levels and water temperature have been collected from area wells for several years using dedicated, downhole, data-logging pressure/temperature transducers recording at 15-minute intervals. The historical well data is robust; several wells each have over 250,000 individual records of water level and temperature. The data have been included in previous reports, but the record has become unwieldy and redundant at 15-minute intervals. Beginning with this report, the historic well data record has been simplified to represent monthly average water levels in all wells *except* the 2023 U Bet production wells (Madison CMRWA Wells 2 and 3), and Kootenai monitoring well CMRWA MW-1, which continue to collect water level data at a high frequency (10 or 15-minute intervals).

Previously collected groundwater temperature values from the monitoring well network have shown that water temperatures are relatively stable. The historical temperature values have been archived but not carried forward in this report. Temperature measurements will continue to be collected and archived but not presented unless the results indicate trends of interest.

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3. http://mbmggwic.mtech.edu
4. https://gis.dnrc.mt.gov/apps/stage/gage-report
5. https://waterdata.usgs.gov/mt/nwis/uv/?site_no=06110020
6. https://www.mdt.mt.gov/mdt/information request.shtml

3.1.1 Madison Aquifer Wells

Madison well CMRWA 1 is located near Utica, Montana and serves as a sentinel well not expected to be affected by pumping of U Bet Madison wells CMRWA 2 and 3. **Figure 2** plots static water levels in well CMRWA 1. The graph presents high-frequency data presented as average monthly water level elevation above mean sea level (amsl) and depth (ft bgs). The data shows 30 to 40-foot annual fluctuations trending upward from 2016 through 2020, followed by a steep decline (over 200 ft) in water levels through 2022. Water levels rebound in 2023, approaching historic levels.

It is noted that the 2022 annual monitoring report[7] suspects spurious data recorded in 2021-2022 may have been due to pressure transducer malfunction. The transducer was pulled from the well in December 2023 and found to calibrate reasonably close to a water level sounder reading. In addition, a lesser downward 2021-2022 trend is seen in pre-pumping water elevations in both U Bet wells CMRWA-2 and 3, so it is unclear if the suspect data from well CMRWA 1 are indeed erroneous. However, the current well CMRWA 1 transducer will be replaced to ensure accurate water levels are being recorded.

Figure 3 illustrates the trend of historic water levels recorded at high-frequency in production well CMRWA 2 from September 2016 thru 2023 presented as monthly averages.

The transducer was removed from the well from July 2021 until July 2022, reportedly to facilitate well completion and pump installation. **Figure 4** plots historic high-frequency water levels recorded in production well CMRWA 3 from July 2020 thru 2023; again reported as monthly averages. Data gaps occur in the periods between November 2020 -July 2021, and July 2022-July 2023 again reportedly associated with well completion and pump installation.

Until July 2023, water levels recorded in U Bet wells CMRWA 2 and 3 are considered static (non-pumping) measurements. As mentioned above, the available data suggest a cyclical annual fluctuation in static water levels in both these U Bet wells, with general trends that correlate reasonably with sentinel well CMRWA 1 located near Utica.

Figures 3a and 4a are high-frequency water levels recorded in U Bet wells CMRWA 2 and 3, respectively, since July 2023. According to the CMRWA system operator, production pumping began effectively in September. When in operation, well CMRWA 2 has reportedly been pumped on the order of 550 gpm and well CMRWA 3 at rates of approximately 1170-1270 gpm. The wells are not currently operated simultaneously. Both wells show immediate drawdown of 40-50 ft and rapid recovery of in-well water levels associated with individual pumping cycles. As expected, based on initial aquifer testing of well CMRWA 3, comparison of the two plots does not suggest obvious well interference during the short-interval, operational pumping events performed to date.

The hydraulic relationship between these two wells, and U Bet Kootenai well CMRWA MW-1 are discussed further in **Section 4**.

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7. Western Groundwater Services, LLC (2022) Judith Basin 2022 Monitoring Data Summary Report, Central Montana Regional Water Authority, report to Great West Engineering, Inc.

3.1.2 Kootenai Aquifer Wells

As mentioned in **Section 2.2**, Kootenai wells monitored in the current LTM program include the Nicholson Ranch Well, the Judith Gap/Mauws Well and monitoring well CMRWA MW-1. Historic monitoring also included the Peterson Ranch and Jenni Ranch wells, but that monitoring was discontinued in 2021 due to installation of a pump in the Peterson Well by the well owner, and reported seasonal freezing issues in the Jenni Ranch well which inhibited pressure transducer operation[8]. **Figures 5 thru 7** plot historic (September 2016 thru 2023) water level elevations in the current Kootenai monitoring well network. The plots are high-frequency data converted to monthly averages.

Figure 5 plots water levels recorded in the Kootenai Nicholson Ranch Well. The well is an operating well used for household and stock water supply and as such is periodically pumped. However, the data can be considered essentially static water levels over the duration and frequency of the plot. An interruption in transducer recording from September 2017-May 2018. The data suggests moderate seasonal fluctuations of water in the well on the order of 5 ft, upwards through 2020 with a downward trend reversed in early 2023 but perhaps continuing in late 2023. The overall trend is similar to the monitored Madison wells, but less pronounced.

Figure 6 is a historic plot of water levels recorded in the Kootenai Judith Gap/Mauws well. The well is the municipal supply for the Town of Judith Gap and as such is frequently pumped. The high-frequency data set includes only resting, shut-in water levels, but are considered static water levels under some influence from pumping events. However, the data shows a trend not dissimilar to other Kootenai wells; minor annual fluctuations of a few feet, increasing water levels through 2020 followed by perhaps a slight decrease in 2021-2022 and a rebound beginning in 2023.

Figure 7 plots the historic water levels recorded in Kootenai well CMRWA MW-1, again reduced to monthly averages. Water levels are shut-in values and are considered static water levels . A modest seasonal fluctuation is overprinted on a rising, declining and then rising again trend similar to the other two Kootenai wells, and subdued with respect to magnitude of the monitored Madison wells.

Kootenai Well CMRWA MW-1 is located adjacent to Madison production Well CMRWA 2 in the U Bet Wellfield, and as such is useful in evaluating the potential immediate and long-term effects locally of U Bet production well pumping on the Kootenai aquifer. **Figure 7a** plots the 2023 high-frequency water level elevations recorded at well CMRWA MW-1. The data expresses itself as essentially a scatter plot with an amplitude of <0.3 feet fluctuation throughout 2023. **Figure 8** compares 2023 high-frequency water level elevations recorded in Madison production wells CMRWA 2 and 3, and Kootenai monitoring well CMRWA MW-1. As expected from initial aquifer testing of wells CMRWA 2[9] and 3[10], no significant response in CMRWA MW-1 is evident from pumping of either production well. The hydraulic relationship between these wells is discussed further in **Section 4**.

8. Western Groundwater Services, LLC (2021) Judith Basin 2021 Monitoring Data Summary Report, Central Montana Regional Water Authority, report to Great West Engineering, Inc.

3.2 Surface Water Monitoring

3.2.1 Big Spring

The Montana FWP monitors surface water flows in and immediately around the Big Springs near Lewiston, Montana. These discharges are useful in understanding both surface water flows in Big Spring Creek as week as groundwater discharge and a measure of dynamic hydraulic conditions in the Madison Aquifer.

Figure 9a is a plot of the reported historical discharge associated with the Big Springs from June 2017 thru 2023. The discharge varies historically for the period plotted from a high of about 100 cubic feet per second (cfs) to a low of nearly 75 cfs reported in 2023. The trend of the data remains steady through 2020, after which flows decreased in the 2022 and 2023 interval. It is noted flows in 2023 recovered to near average levels in 2023, perhaps correlating with wet spring/summer conditions. **Figure 9b** is a concurrent plot of monthly precipitation recorded at the Crystal Lake SNOTEL station illustrating significant precipitation recorded at the station in mid-2023.

3.2.2 Judith River Streamflows

The USGS maintains a stream gauging station on the Judith River, upstream of Carr Creek near Sapphire Village. **Figure 10** is a plot of recorded streamflows for the period from September 2016 thru 2023. The historical data indicates decreasing streamflows beginning in 2021 (baseflow approaching 1 cfs) and increasing in 2023 with peak flows (nearly 800 cfs) the highest in the past seven years.

3.3 Climate Data

MDOT maintains a meteorologic station (Judith Gap RWIS) located on US 191 about 2 miles south of Judith Gap and 6 miles southeast of the U Bet Wellfield. The station collects high-frequency measurements of a variety of climate data including ambient air temperature and precipitation.

Figures 11a and 11b display RWIS-reported meteorologic data for the period from January 2017 thru 2023. **Figure 11a** plots both daily and monthly average precipitation. **Figure 11b** illustrates both daily mean and monthly mean ambient air temperature. The plots illustrate seasonal fluctuation with annual variability, as expected. It is noted 2023 was the sixth lowest reported annual precipitation recorded at the station in the past seven years. However, both plots are generally as expected and depict relatively stable climatic conditions.

Previous annual monitoring summary reports (*Western Groundwater Services*) presented these same climate data. In the 2022 report, the 5-year data from 2017 thru 2021 data were analyzed to estimate groundwater recharge, primarily to the Kootenai Aquifer, but also to the Madison Aquifer. The report concludes that for the 5-year period, there appears to be a variable lag time for aquifer recharge each year, but that "…there is not a consistent proportional relation between total precipitation and groundwater recharge".

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9. Western Groundwater Services, LLC (2017) Water Supply Well CMRWA #2 Pumping Test Report, Central Montana Regional Water Authority, report to Great West Engineering, Inc.
10. Western Groundwater Services, LLC (2020) Well Construction Report Production Well CMRWA #3, Central Montana Regional Water Authority, report to Great West Engineering, Inc.

This report merely reports the recorded data. As additional long-term monitoring data are collected it may be possible to refine interpretation and estimates of recharge rates and lag times related to precipitation in the Judith Basin.

3.4 Water Production Monitoring

According to the CMRWA system operator, water production from U Bet Wells CMRWA 2 and 3 began effectively on September 10, 2023. With respect to the operation of the water wells, the SCADA system is recording the following information at high frequency (10-minute) intervals for each of the wells:

- Pumping and static water levels (depth to water and water elevation)
- Pumping rates (gpm)
- Water production (gallons)

SCADA reports are currently being refined to auto-generate monthly reports summarizing this information. These reports will be appended to the annual long-term monitoring reports in the future and will be archived on the SCADA system.

Table 1 summarizes the SCADA- reported monthly and total production volumes (gallons) from each well September thru December 2023.

Table 1 . 2023 Monthly Water Production (gallons)

WELL	SEPT	OCT	NOV	DEC	ANNUAL TOTAL
CMRWA 2	1,963,500	1,592,600	3,304,900	1,879,400	8,740,400
CMRWA 3	1,348,900	1,652,500	1,100	1,012,800	4,015,300
TOTAL	**3,312,400[1]**	**3,245,100**	**3,306,000**	**2,892,200**	**12,755,700**

1. Estimated from instantaneous flow data

4. DISCUSSION OF RESULTS

This report is the latest presentation of the results of the LTM program from its inception in 2016 thru 2023. The record is robust and provides an understanding of the baseline groundwater conditions over time prior to beginning pumping operations at the U Bet Wellfield.

4.1 U Bet Wellfield Monitoring

Production from the U Bet Wellfield began in September 2023, and the monitoring and interpretation has begun to encompass water production from the U Bet wells and associated groundwater monitoring of both the Madison and Kootenai Aquifers.

Production wells CMRWA 2 and 3 have reportedly been operated at rates on the order of 550 gpm and 1200 gpm, respectively. The wells have not been operated simultaneously for production. CMRWA 2 was the primary production well in 2023.

As presented in **Section 3.1** and subsections, **Figures 3a and 4a** illustrate the high-frequency water levels recorded in Madison production wells CMRWA 2 and 3, respectively, beginning July 2023. For the same duration, **Figures 7a** plots high-frequency water level measurements in Kootenai monitoring well CMRWA MW-1, located adjacent to Madison production well CMRWA 2. **Figure 8** compares the recorded water levels in all three wells. For the period of record the plots suggest the following:

- Water levels in the Madison wells CMRWA 2 and 3 individually experience well drawdown of 40-50 ft in response to 2023 pumping events and recover rapidly upon cessation of pumping.
- No interference is observed between the two Madison production wells CMRWA 2 and 3 due to pumping.
- No response to pumping of either Madison production well CMRWA 2 or 3 is observed in the adjacent Kootenai monitoring well CMRWA MW-1.

Figure 7a, depicts a low amplitude (<0.3 ft) fluctuation in water level throughout 2023; suggesting no interference from operation of the Madison production wells. While the scale of the **Figures 3a, 4a and 8** precludes close inspection of potential interference between production wells CMRWA 2 and 3, review of initial SCADA water level data confirms no observed interference between the pumping wells during the 2023 period of record. *Note: SCADA reports are currently being refined; the data will be appended to future LTM annual reports.*

The 2023 empirical results appear to corroborate hydraulic interpretation of results from previous long-term pumping tests performed during construction of the U Bet production wells (*Western Groundwater Services reports, 2017 and 2020*).

4.2 Aquifer Recharge

Previous work has been conducted and presented (*Western Groundwater Services report, 2022*) to evaluate the timing and relation between precipitation and groundwater recharge in both the Madison and Kootenai Aquifers. This analysis inherently requires long-term data collection of recharge inputs (precipitation and snowmelt) and aquifer response in the form of groundwater levels and other measurement points i.e. Big Spring discharge and discharges from area Kootenai springs. It is suggested that this topic be revisited when a longer period of record is compiled.

5. CONCLUSION

The Long-Term Monitoring program was initially designed to provide documentation of baseline hydrogeologic conditions in the basin with respect to the Kootenai and Madison Aquifers, and surface water resources in anticipation of CMRWA water production from the U Bet Wellfield. Several years of high-frequency data have been collected including groundwater levels in Kootenai and Madison wells, discharges from the Madison Aquifer via the Big Spring, streamflows in the Judith River and basin precipitation and ambient air temperature.

This 2023 Judith Basin Annual Long-Term Monitoring Report provides a synopsis of the high-frequency baseline data and identifies the current LTM approach to continued hydrogeologic data collection inclusive of U Bet Wellfield production (water levels, pumping rates and production volumes) now that the wellfield is in operation. Continued monitoring will include planned U Bet production Wells CMRWA 4 and 5. LTM data and interpretation should be documented in subsequent annual LTM reports, and the data archived as appropriate to the existing public databases and on-site SCADA system.

FIGURES

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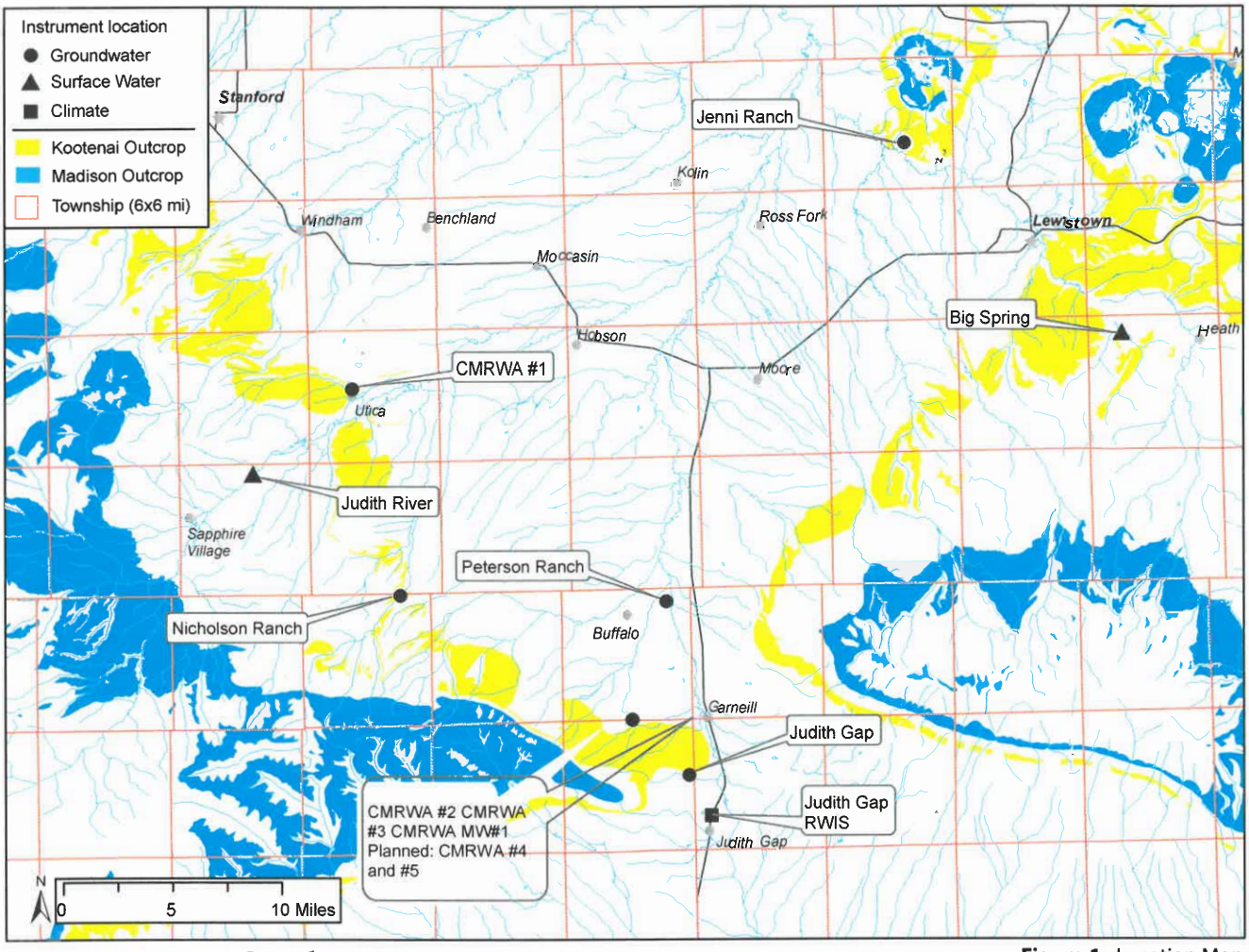


Source: Western Groundwater Services, 2022

Figure 1. Location Map

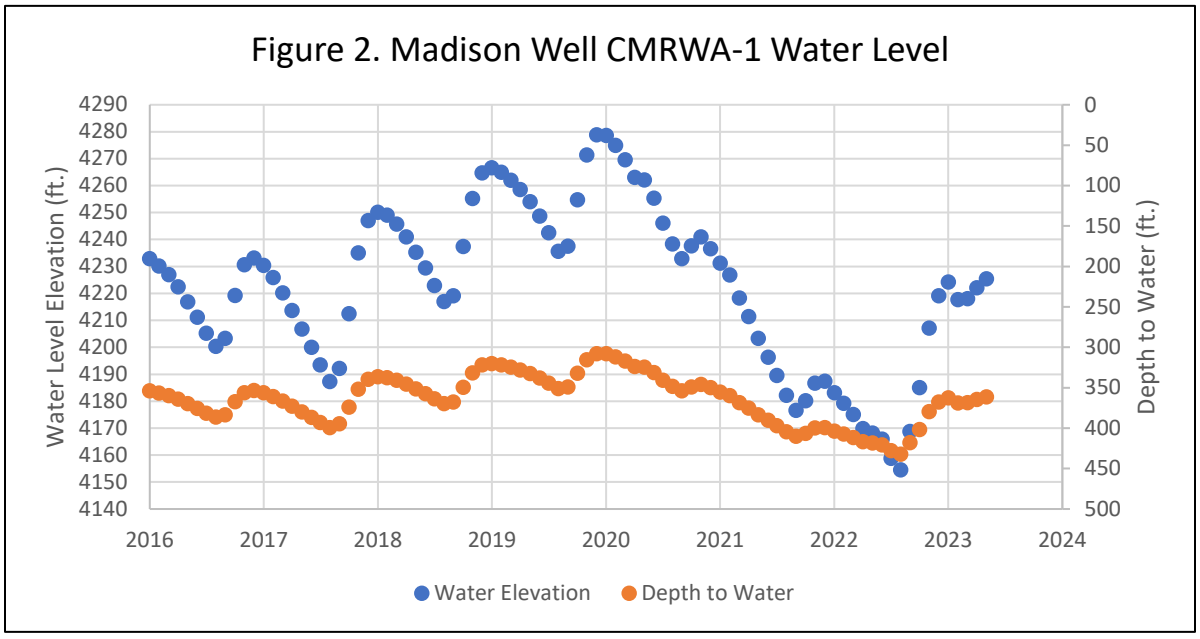


Figure 2. Madison Well CMRWA-1 Water Level
Water Level Elevation (ft.)
4290
4280
4270
4260
4250
4240
4230
4220
4210
4200
4190
4180
4170
4160
4150
4140
Depth to Water (ft.)
0
50
100
150
200
250
300
350
400
450
500
2016
2017
2018
2019
2020
2021
2022
2023
2024
Water Elevation
Depth to Water

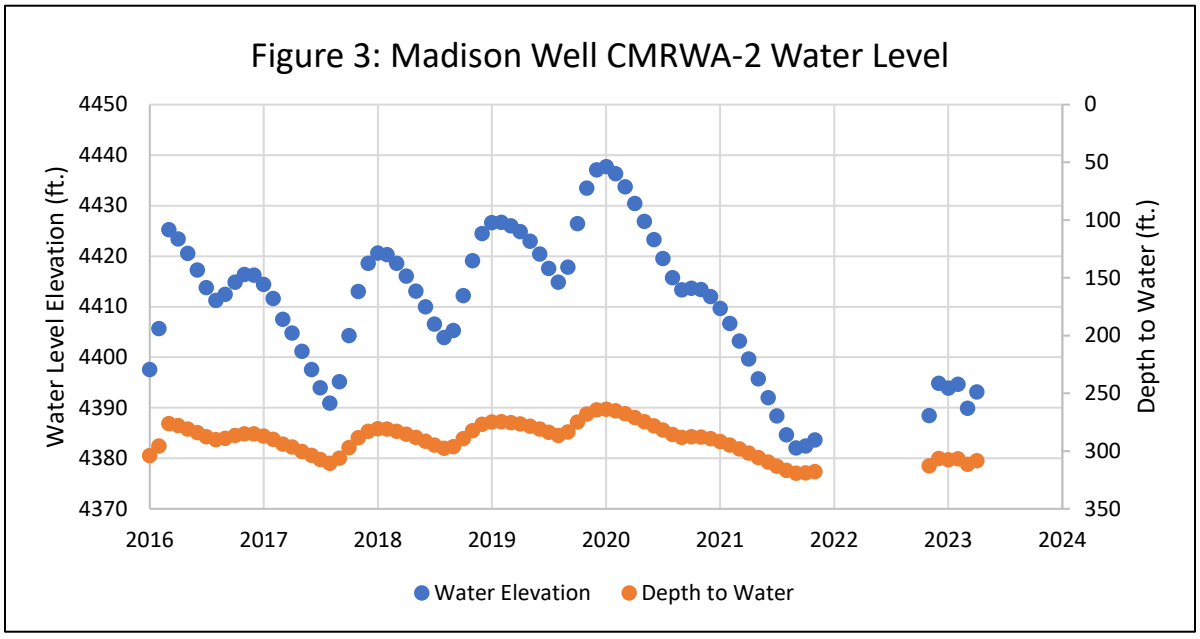


Figure 3: Madison Well CMRWA-2 Water Level
Water Level Elevation (ft.)
4450
4440
4430
4420
4410
4400
4390
4380
4370
Depth to Water (ft.)
0
50
100
150
200
250
300
350
2016
2017
2018
2019
2020
2021
2022
2023
2024
Water Elevation
Depth to Water

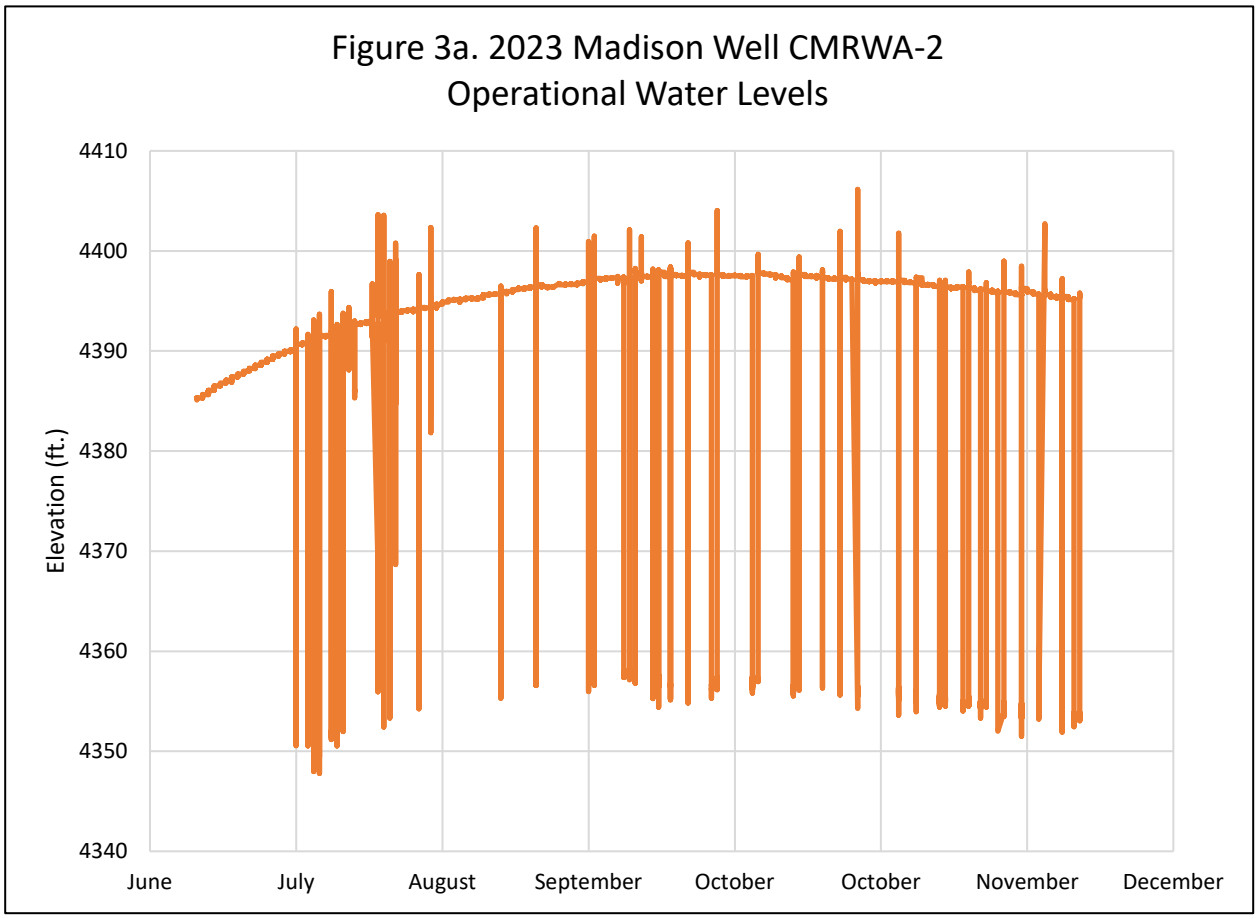


Figure 3a. 2023 Madison Well CMRWA-2
Operational Water Levels
Elevation (ft.)
4410
4400
4390
4380
4370
4360
4350
4340
June
July
August
September
October
October
November
December

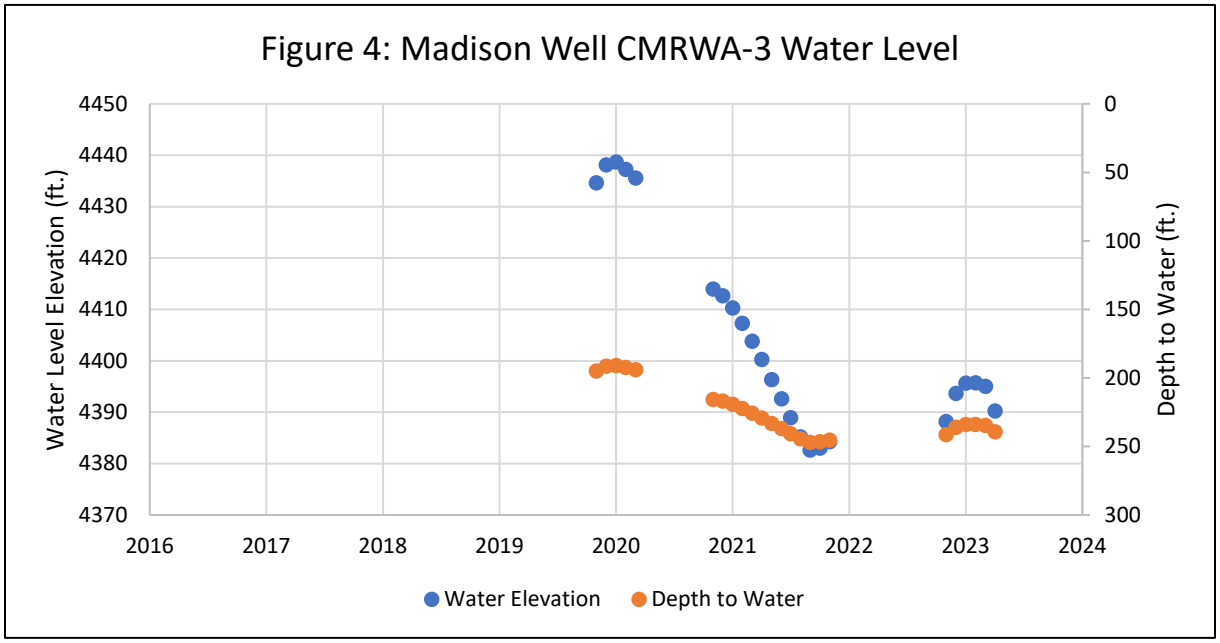


Figure 4: Madison Well CMRWA-3 Water Level
Water Level Elevation (ft.)
4450
4440
4430
4420
4410
4400
4390
4380
4370
Depth to Water (ft.)
0
50
100
150
200
250
300
2016
2017
2018
2019
2020
2021
2022
2023
2024
Water Elevation
Depth to Water

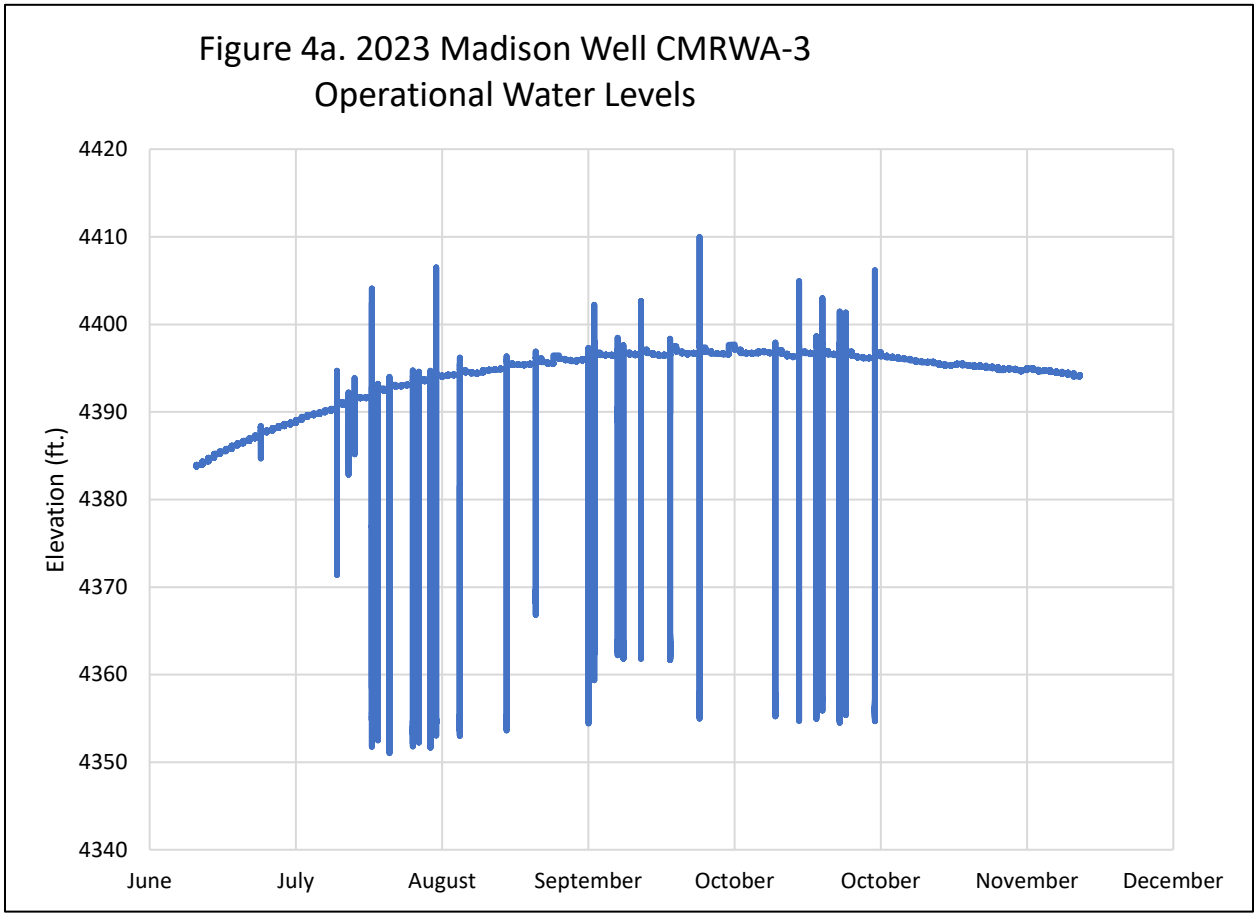


Figure 4a. 2023 Madison Well CMRWA-3
Operational Water Levels
Elevation (ft.)
4420
4410
4400
4390
4380
4370
4360
4350
4340
June
July
August
September
October
October
November
December

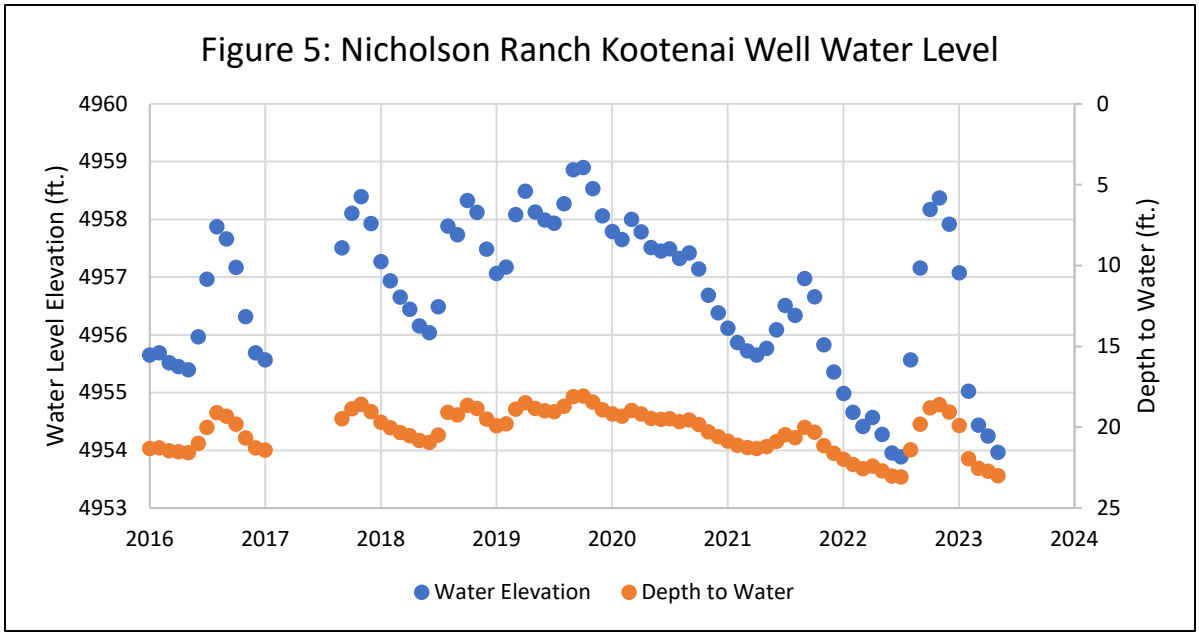


Figure 5: Nicholson Ranch Kootenai Well Water Level
Water Level Elevation (ft.)
Depth to Water (ft.)
4960
4959
4958
4957
4956
4955
4954
4953
0
5
10
15
20
25
2016
2017
2018
2019
2020
2021
2022
2023
2024
Water Elevation
Depth to Water

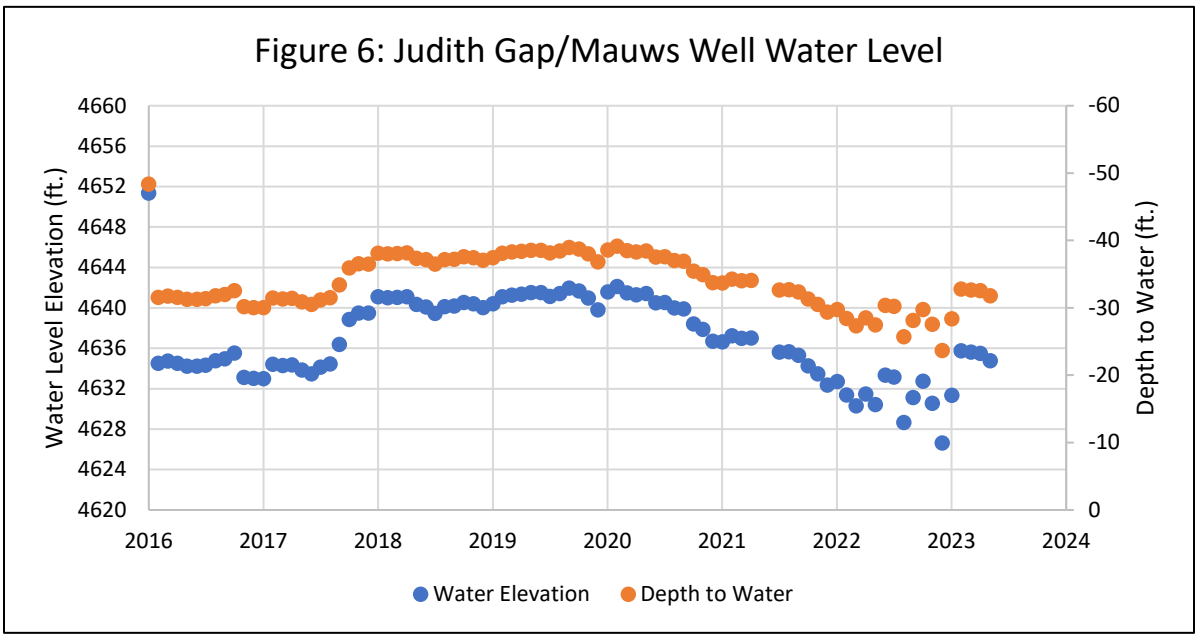


Figure 6: Judith Gap/Mauws Well Water Level
Water Level Elevation (ft.)
Depth to Water (ft.)
4660
4656
4652
4648
4644
4640
4636
4632
4628
4624
4620
-60
-50
-40
-30
-20
-10
0
2016
2017
2018
2019
2020
2021
2022
2023
2024
Water Elevation
Depth to Water

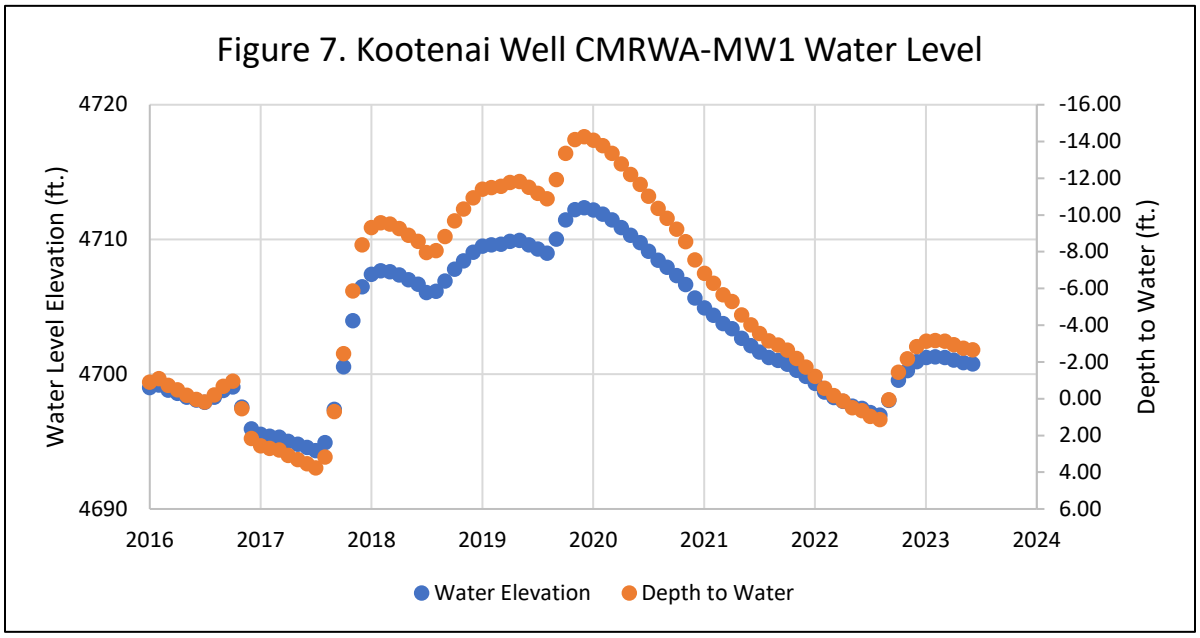


Figure 7. Kootenai Well CMRWA-MW1 Water Level
Water Level Elevation (ft.)
Depth to Water (ft.)
4720
4710
4700
4690
-16.00
-14.00
-12.00
-10.00
-8.00
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
2016
2017
2018
2019
2020
2021
2022
2023
2024
Water Elevation
Depth to Water

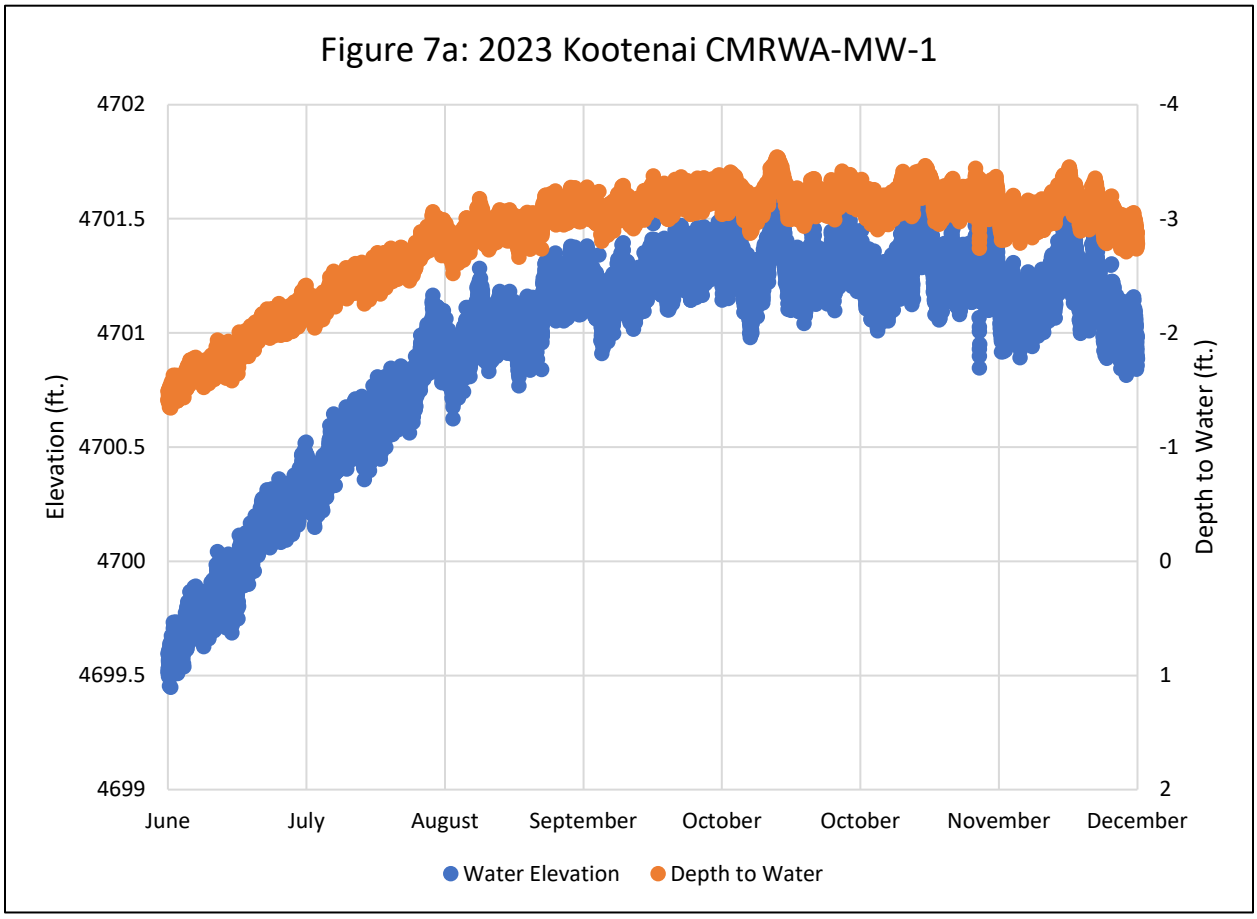


Figure 7a: 2023 Kootenai CMRWA-MW-1
Elevation (ft.)
Depth to Water (ft.)
4702
4701.5
4701
4700.5
4700
4699.5
4699
-4
-3
-2
-1
0
1
2
June
July
August
September
October
October
November
December
Water Elevation
Depth to Water

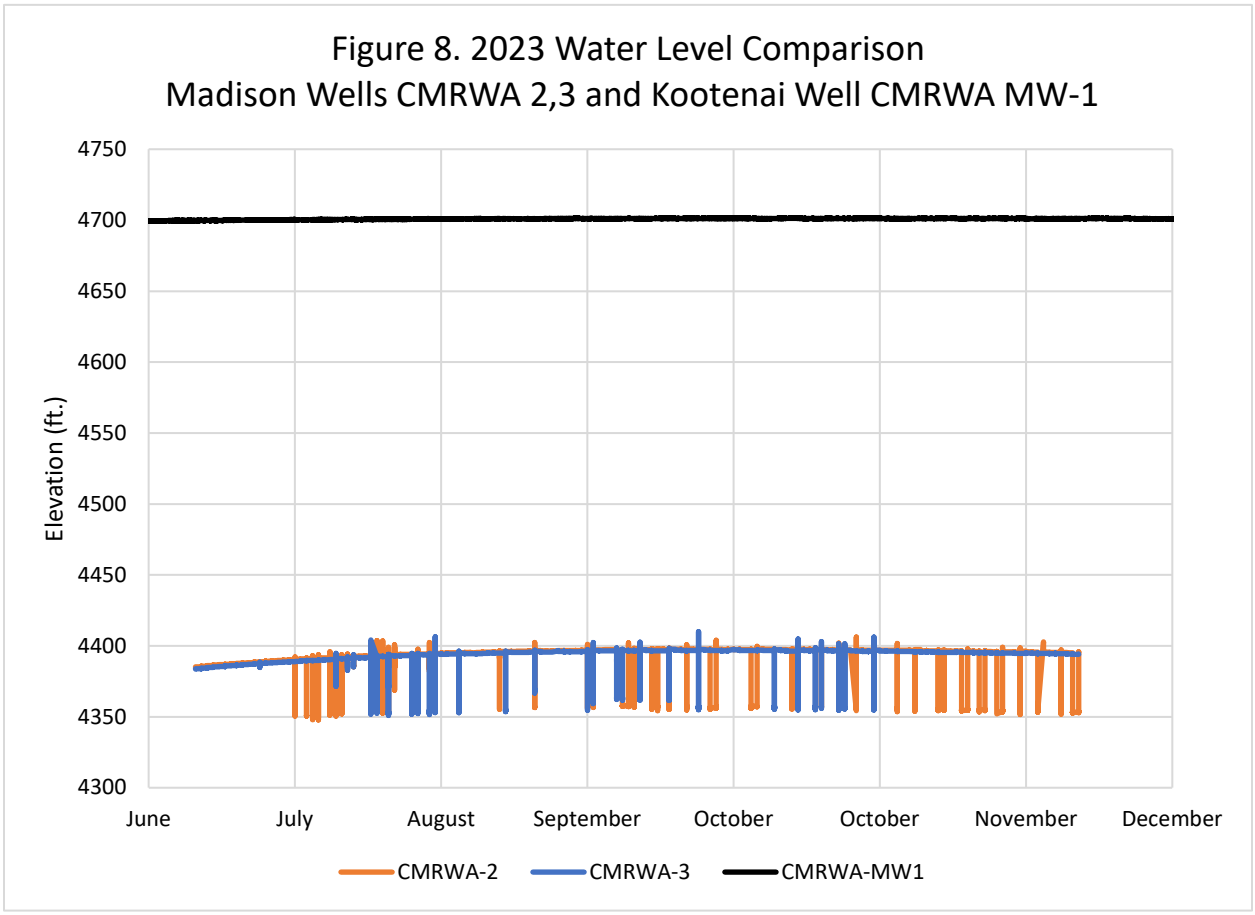


Figure 8. 2023 Water Level Comparison
Madison Wells CMRWA 2,3 and Kootenai Well CMRWA MW-1
Elevation (ft.)
4750
4700
4650
4600
4550
4500
4450
4400
4350
4300
June
July
August
September
October
October
November
December
CMRWA-2
CMRWA-3
CMRWA-MW1

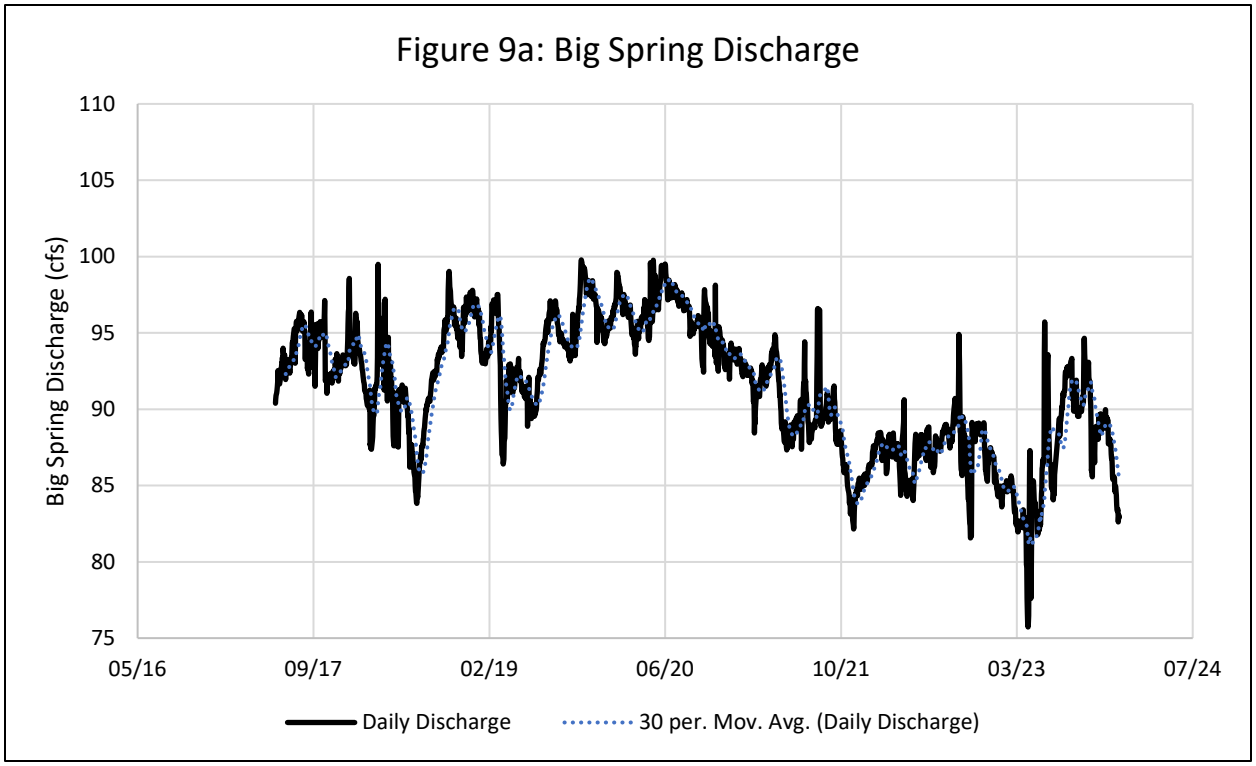


Figure 9a: Big Spring Discharge
Big Spring Discharge (cfs)
110
105
100
95
90
85
80
75
05/16
09/17
02/19
06/20
10/21
03/23
07/24
Daily Discharge
30 per. Mov. Avg. (Daily Discharge)

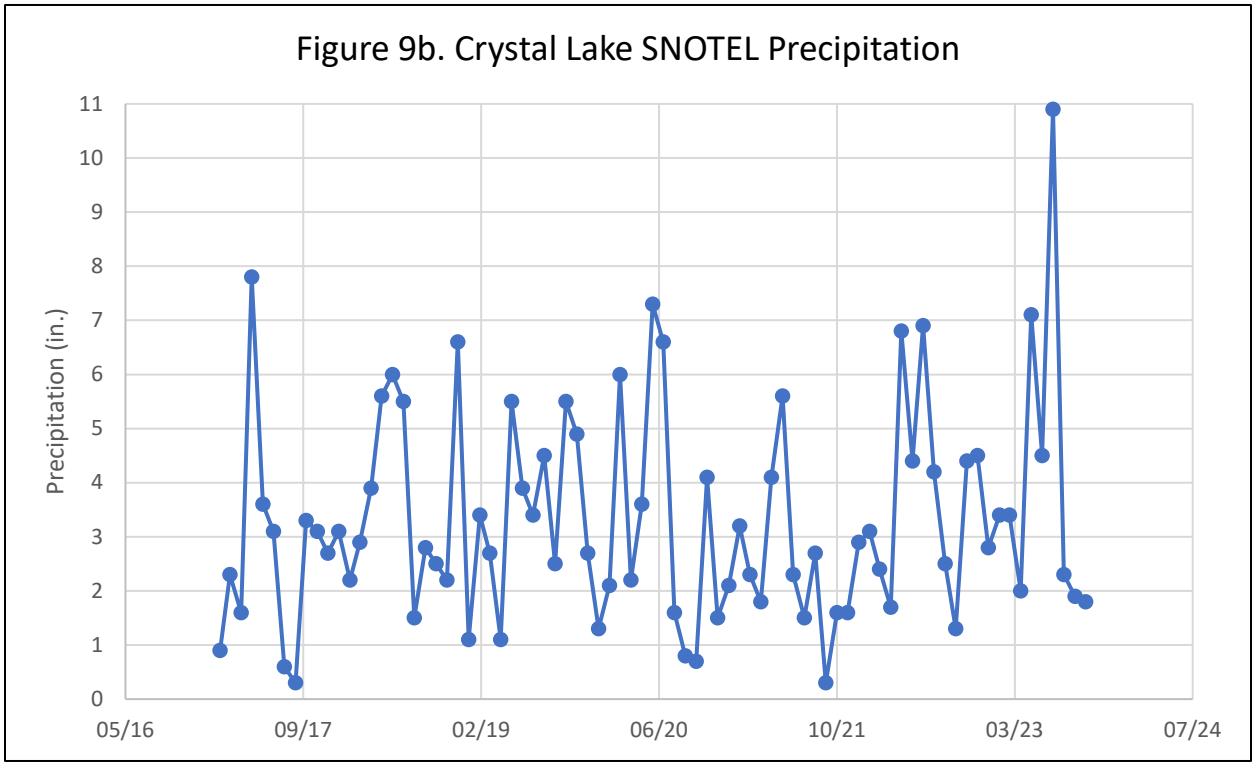
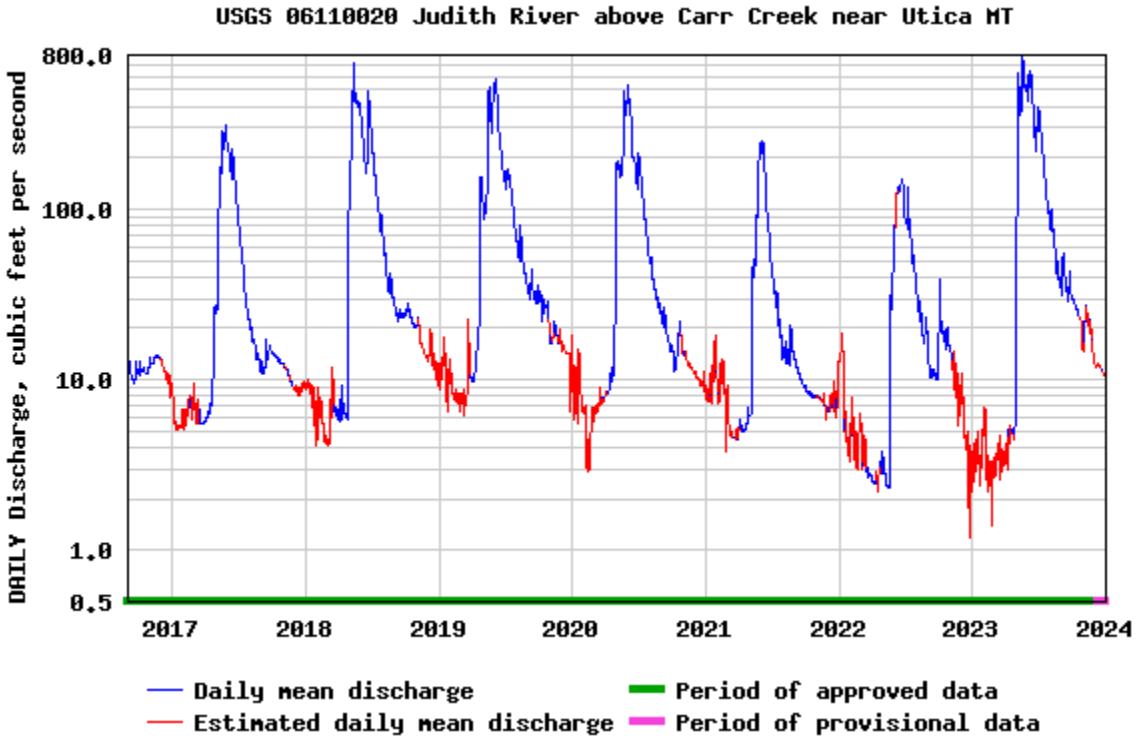


Figure 9b. Crystal Lake SNOTEL Precipitation
Precipitation (in.)
11
10
9
8
7
6
5
4
3
2
1
0
05/16
09/17
02/19
06/20
10/21
03/23
07/24

Figure 10. Judith River Daily Mean Discharge (Feet^3/Sec)



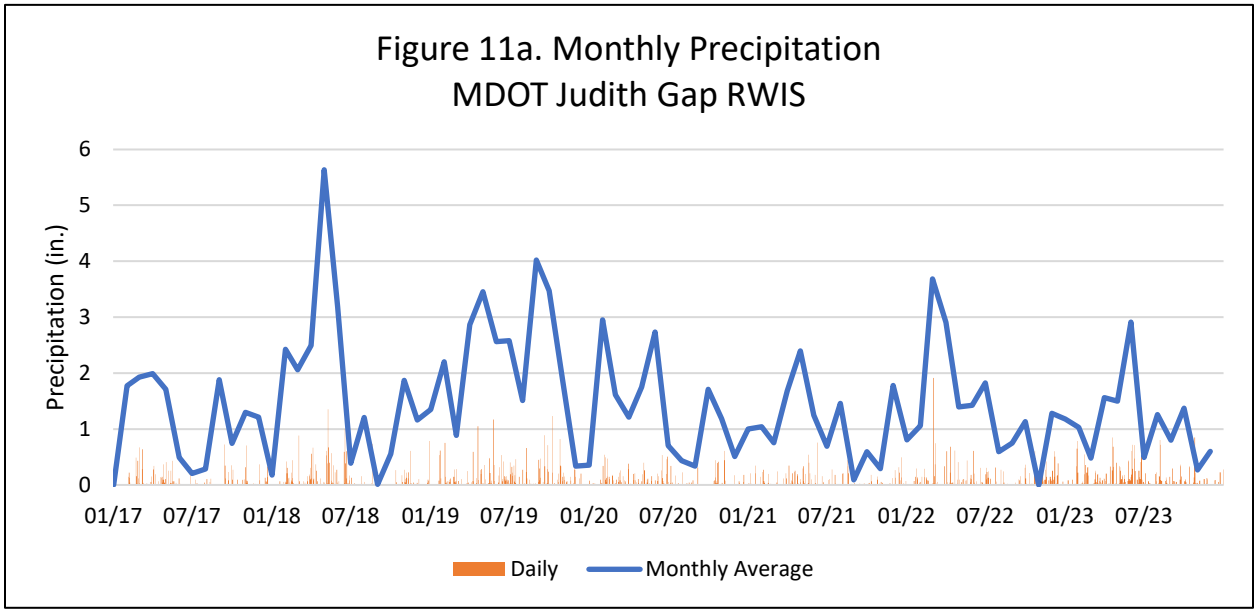


Figure 11a. Monthly Precipitation
MDOT Judith Gap RWIS
Precipitation (in.)
6
5
4
3
2
1
0
01/17
07/17
01/18
07/18
01/19
07/19
01/20
07/20
01/21
07/21
01/22
07/22
01/23
07/23
Daily
Monthly Average

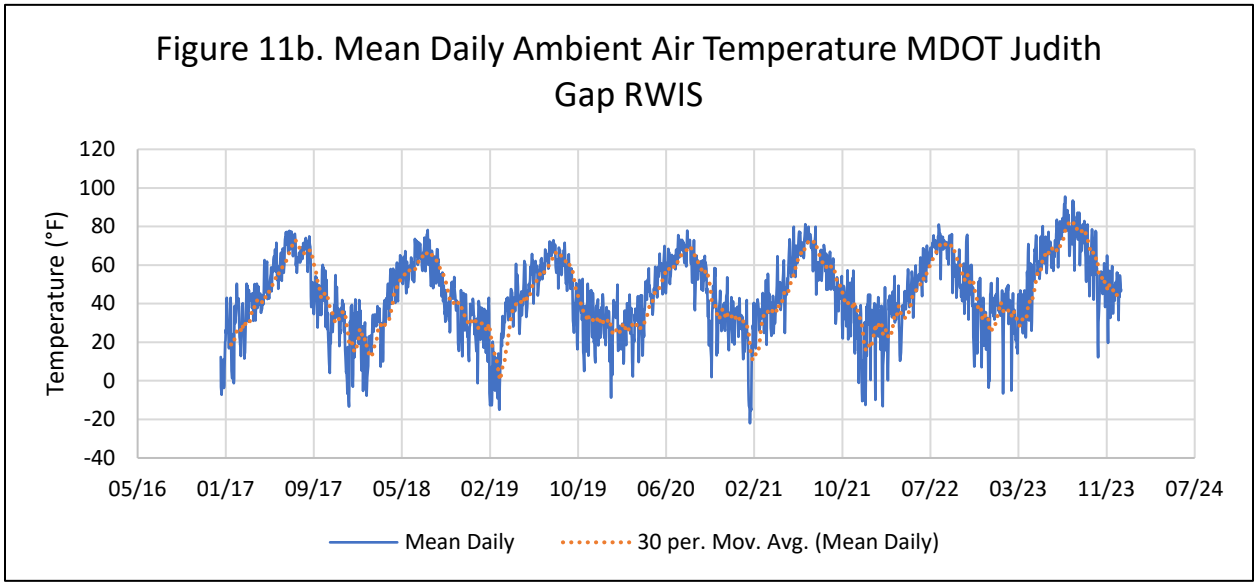


Figure 11b. Mean Daily Ambient Air Temperature MDOT Judith Gap RWIS
Temperature (°F)
120
100
80
60
40
20
0
-20
-40
05/16
01/17
09/17
05/18
02/19
10/19
06/20
02/21
10/21
07/22
03/23
11/23
07/24
Mean Daily
30 per. Mov. Avg. (Mean Daily)