Groundwater Level Trends in the Harney Basin Critical Groundwater Area – Summary Statistics by Subarea

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Background & Introduction

The purpose of this technical memo is to provide an updated summary of groundwater level trends for each of the seven Harney Basin Critical Groundwater Area (HBCGWA) subareas (Figure 1), using data available through spring 2026.

This update includes the following changes and modifications from previous versions:

- Groundwater level trends are evaluated and summarized for the seven Harney Basin Critical Groundwater subareas described in OAR 690-512-041.
- 2026 annual high measurements are required for analysis.
- The groundwater level decline rate evaluation requires a minimum of 4 static groundwater level measurements in the target date range (2020-2026) for inclusion in the analysis.
- A map depicting the period of record for the groundwater level decline magnitude analysis is included.
- A list of wells used for the groundwater level trends analysis is included in Appendix 1.
- A list of wells identified as requiring further review, and therefore not included in the analysis is included in Appendix 2.

Note: Negative values presented throughout this document represent declining trends.

Groundwater Level Data

Static groundwater level measurements provide the basis for the groundwater level trend analysis described here. These groundwater level measurements are housed in the Oregon Water Resources Department (OWRD) Groundwater Information System (GWIS) database. These data include static groundwater level measurements from dedicated observation wells, domestic wells, livestock wells, and irrigation wells. Groundwater level data in GWIS comes from a variety of sources including measurements made by OWRD staff, U.S. Geological Survey staff, water well drillers, and measurements reported to the Department from water rights holders as a part of the permit condition reporting program. Field data-collection procedures used by OWRD staff parallel those outlined in Groundwater Technical Procedures of the U.S. Geological Survey (Cunningham and Schalk, 2011). Data from sources other than the OWRD or the U.S. Geological Survey may not have been collected using these protocols. The Groundwater Section periodically reviews recent data collected by OWRD staff and classifies the quality and accuracy of individual data elements; however, much historic data collected by the Department has not been thoroughly reviewed. Data from outside sources is only reviewed and classified as time permits. These groundwater level data can be explored in the OWRD Groundwater Information System (GWIS).

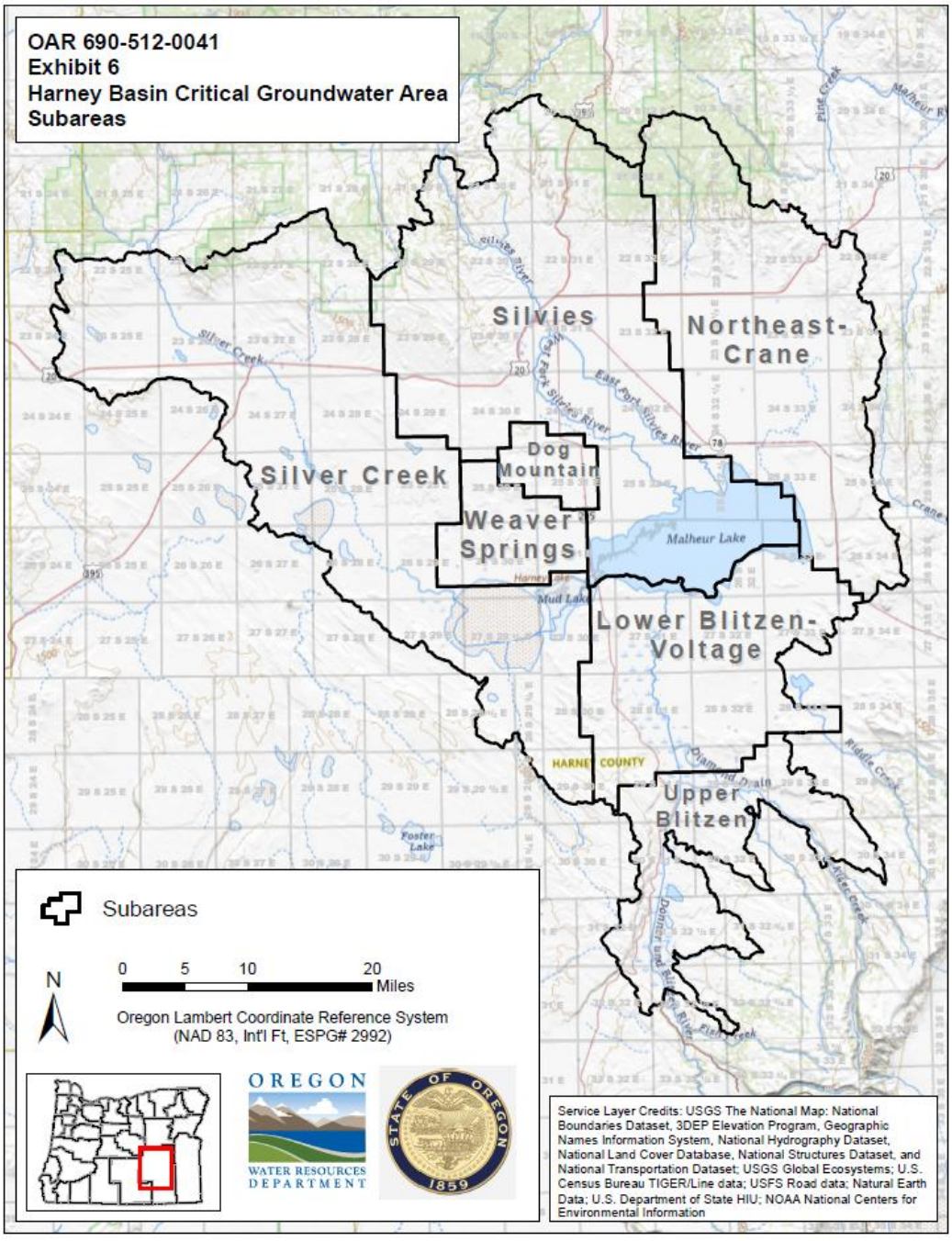

Figure 1: Map showing Harney Basin Critical Groundwater Area subareas.

Data review

For the purposes of the current groundwater level trend analyses, the water level records for wells across the Harney Basin were reviewed for quality and accuracy. A visual inspection of each hydrograph was performed to identify abnormal or inconsistent patterns in the water level record. Where abnormal or inconsistent patterns were observed, the water level record was further evaluated to identify if measuring, reporting, or recording errors or inconsistencies were present. Examples of issues identified through this review process include:

- Wells with turbine oil causing difficulty in precise measurement.
- Wells that had been deepened, causing substantial changes in the static water level in the well.
- Wells with static water level measurements reported by numerous individuals over time, with inconsistent measuring point descriptions and heights suggesting some measurements in the record for that well likely correspond to a different well.
- Wells with measurements reported after abandonment of the well, indicating the measurements correspond to a different well.
- Wells with measurement comments suggesting the measurements correspond to a different well.
- Water levels reported by well drillers on well logs that are affected by the drilling process (i.e. not static).

In some cases, these issues could be resolved by additional review or through conversation with the individuals reporting the measurements, but in some cases there was not sufficient documentation to resolve the issue prior to completing this water level trends analysis. Complete resolution of all issues identified was beyond the scope of this analysis. After thorough review of all available groundwater level data there were 11 wells with data covering the required period of record that were identified as still needing further review and therefore were not included in this analysis. The list of wells excluded from the analysis and corresponding justification for exclusion are included in Appendix 2.

Calculating Groundwater Level Trends

Groundwater level trends for wells across the 7 subareas can be evaluated to better understand how groundwater level declines vary between subareas as well as the variation that exists within an individual subarea. Two primary groundwater level trend metrics are summarized here:

1. Groundwater level decline magnitude
2. Groundwater level decline rate

For both groundwater level trend metrics there are several possible approaches to making the calculation. The groundwater level trends summarized here represent groundwater level decline magnitude calculated as the total groundwater level change from the highest measured to the most recent annual high, and groundwater level decline rate calculated as the Sen's slope (Sen, 1968), also known as the Theil-Sen estimator. Sen's slope, which is relatively insensitive to outliers, is a robust method of determining the slope via the median of the slopes of all lines that can be drawn through the data points.

Calculating these groundwater level trend metrics requires specifying several parameters that have a significant impact on the overall results of the calculation. For example, calculation of groundwater level decline rate requires specifying the period of time over which the rate of interest will be calculated. As groundwater level decline rates in the basin have changed over time, we are most interested in calculating the decline rate over the most recent period of record, rather than calculating what the decline rate might have been between 1990 and 1995, for example. Additionally, for both groundwater level decline magnitude and groundwater level decline rate it is important to minimize the effects of seasonal variation when pumping impacts cause groundwater levels to be drawn down. To address this,

only annual high groundwater level measurements are used in most cases (generally January – May). The parameters specified for the groundwater level trend metrics presented here are described below.

Specified Parameters: Groundwater Level Decline Magnitude

- Calculated as change in water level from the highest measured to the most recent annual high.
- The most recent annual high measurement must be in the year 2026.
- The most recent annual high measurement can be measured in any month if it is shallower than the most recent January-May annual high.
- The highest measured can be measured in any month.

Specified Parameters: Groundwater Level Decline Rate

- Calculated as Sen's slope (Sen, 1968).
- Decline rate only calculated for annual high measurements in the range 2020-2026.
- The most recent annual high measurement must be in the year 2026.
- Minimum 4 data points required for inclusion in the analysis.

Summary Statistics of Groundwater Level Trends

Summary statistics for groundwater level trends can be used to evaluate the relative severity of groundwater level declines across the 7 subareas. Table 1 provides maximum, minimum, arithmetic mean, and median values of groundwater level decline magnitude among all wells in each subarea. Table 2 provides maximum, minimum, arithmetic mean, and median values groundwater level decline rate for each subarea. Only wells with sufficient data to satisfy the requirements specified in the parameters above are included in the analysis. A total of 272 wells are included in the groundwater level decline magnitude analysis, and 230 wells are included in the decline rate analysis. The number of wells included in the summary statistics in Tables 1 and 2 varies strongly between subareas, with as many as 113 wells with decline magnitude evaluations in the Northeast-Crane Subarea and as few as 1 well in the Upper Blitzen Subarea.

Table 1: Summary statistics of groundwater level decline magnitude by subarea. Negative values indicate a declining trend.

subarea	Well Count	Minimum Magnitude (feet)	Maximum Magnitude (feet)	Mean Magnitude (feet)	Median Magnitude (feet)
Dog Mountain	20	-34.75	-1.75	-13.58	-11.08
Lower Blitzen-Voltage	30	-17.39	0	-6.24	-5.18
Northeast-Crane	113	-69.7	0	-19.37	-15.25
Silver Creek	33	-25.12	-0.05	-7.09	-5.9
Silvies	44	-43.36	0	-7.3	-4.23
Upper Blitzen	1	-2.92	-2.92	-2.92	-2.92
Weaver Springs	32	-133.45	-1.22	-51.99	-48.78

Wells with decline magnitude value of 0 indicate that the most recent annual high measurement in 2026 is the highest annual high measurement in the record for that well, in which case the change in water level from the highest measured to the most recent annual high is zero. There are 13 wells for which 2026 is the highest annual high measurement in the record (Appendix 1).

Table 2: Summary statistics of groundwater level decline rate by subarea. Negative values indicate a declining trend.

subarea	Well Count	Minimum Rate (feet/year)	Maximum Rate (feet/year)	Mean Rate (feet/year)	Median Rate (feet/year)
Dog Mountain	17	-5.07	0.62	-1.2	-0.87
Lower Blitzen-Voltage	27	-0.67	3.42	-0.08	-0.29
Northeast-Crane	90	-3.93	4.53	-0.92	-0.91
Silver Creek	32	-0.51	0.84	-0.09	-0.16
Silvies	39	-0.59	1.72	0.57	0.51
Upper Blitzen	1	-0.08	-0.08	-0.08	-0.08
Weaver Springs	24	-5.26	7.3	-1.49	-1.24

The spatial distribution of decline magnitude and decline rate values across the 7 Harney Basin Critical Groundwater Area subareas are shown in Figures 2 and 3.

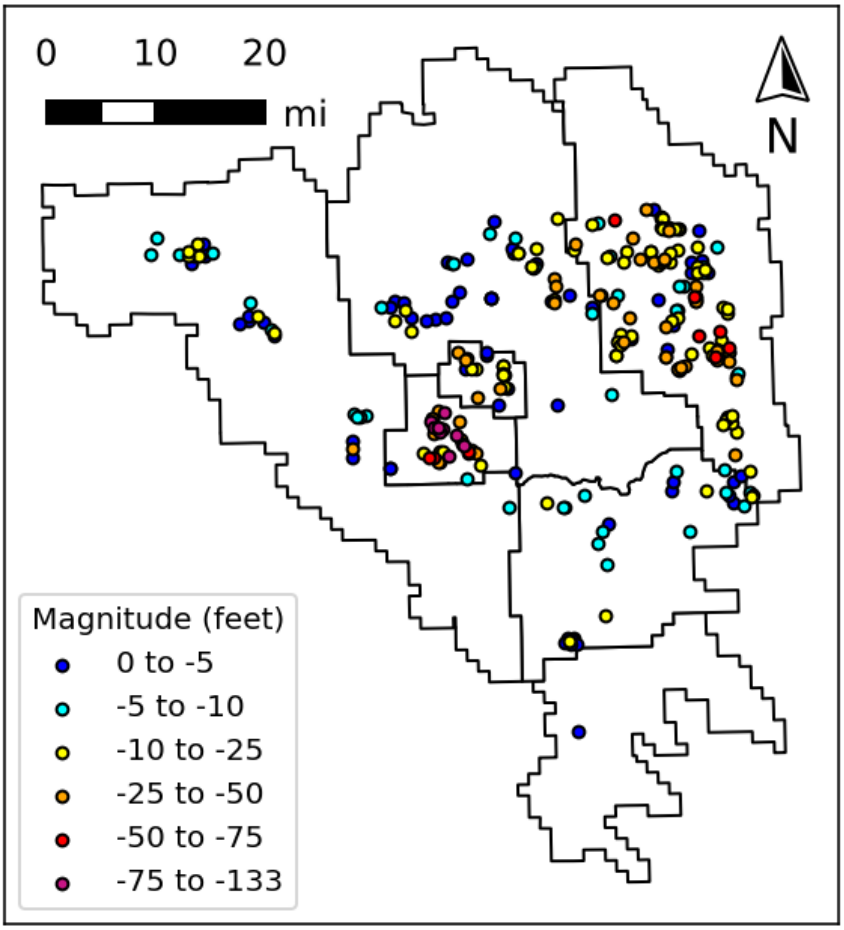

Figure 2: Map showing the spatial distribution of groundwater decline magnitude values across the Harney Basin Critical Groundwater Area.

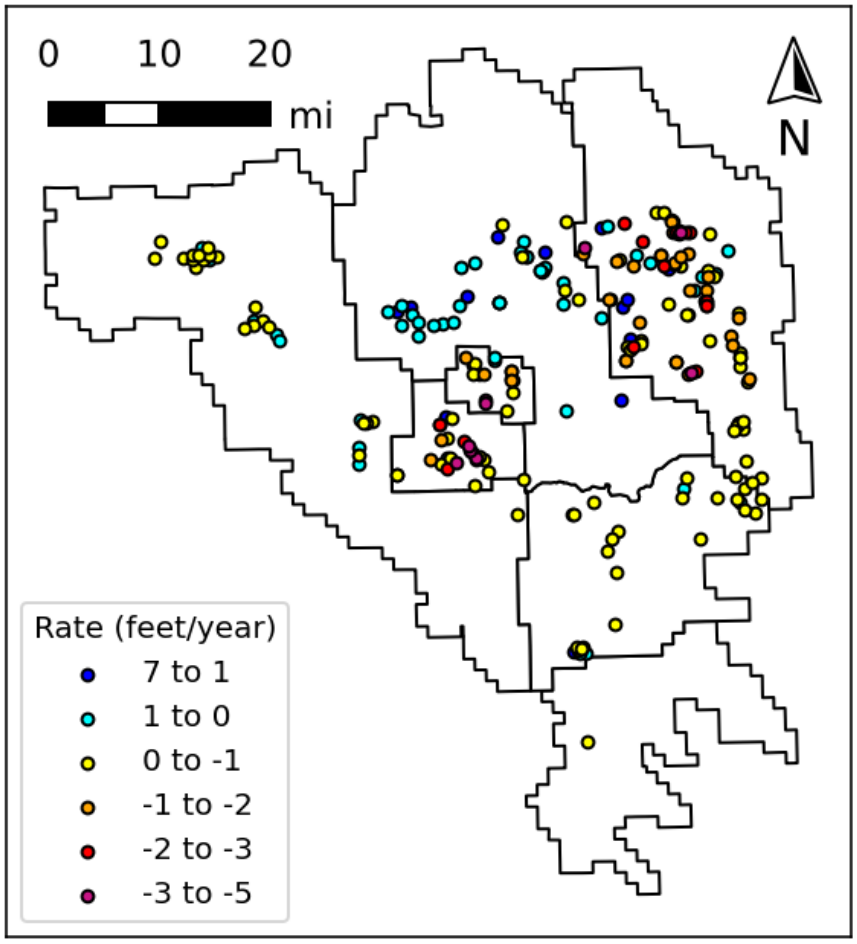

Figure 3: Map showing the spatial distribution of groundwater decline rate values across the Harney Basin Critical Groundwater Area.

An important consideration when evaluating groundwater level decline magnitude data is the period of record over which the value was calculated, especially in areas where groundwater level declines have been occurring over a long period of time. The total magnitude of decline calculated for wells with a short period of record likely do not accurately reflect the true total magnitude of groundwater level decline for that part of the aquifer system. Table 3 provides summary statistics for the periods of record for wells used in each subarea for the decline magnitude analysis. Figure 4 is a map showing the spatial distribution of the periods of record for wells used for the decline magnitude analysis.

Table 3: Summary statistics for the periods of record used to calculate decline magnitude by subarea (POR = period of record).

subarea	Well Count	Minimum POR (years)	Maximum POR (years)	Mean POR (years)	Median POR (years)
Dog Mountain	20	5	67	15.3	10
Lower Blitzen-Voltage	30	4	68	23.9	14
Northeast-Crane	113	1	66	18	13
Silver Creek	33	4	58	17.8	11
Silvies	44	1	97	29.5	16.5
Upper Blitzen	1	10	10	10	10
Weaver Springs	32	6	47	18	15

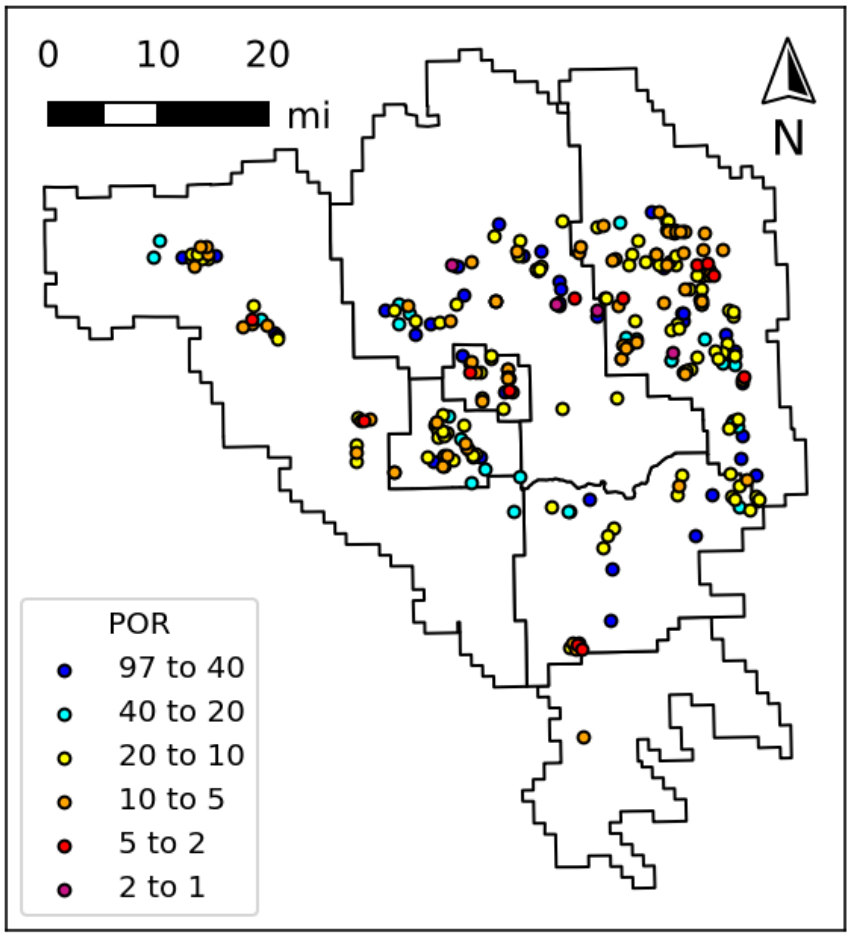

Figure 4: Map showing the spatial distribution of the period of record for wells used for the decline magnitude analysis. POR = period of record in years.

The groundwater level trend data can also be evaluated graphically using box and whisker plots. A box and whisker plot, also known as a boxplot, is a graphical method of displaying variation in a set of data by showing how the data is distributed based on percentiles and identifying outliers. Figure 5 is a box

and whisker plot showing groundwater level decline magnitude by subarea calculated as change in groundwater level from the highest measured to the most recent annual high measurement. Figure 6 is a box and whisker plot showing groundwater level decline rate by subarea calculated as Sen's slope.

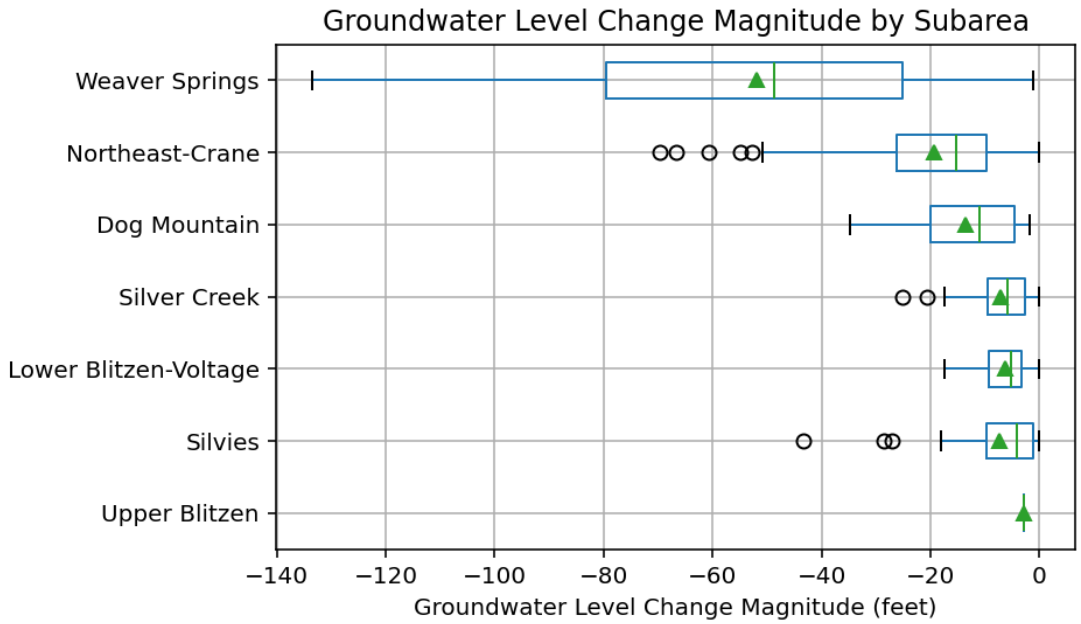

Figure 5: Box and whisker plot showing groundwater level decline magnitude by subarea. Negative values indicate declining trend. Green vertical line = median value; green triangle = mean; open black circle = outlier. Number of wells per subarea noted in Table 1.

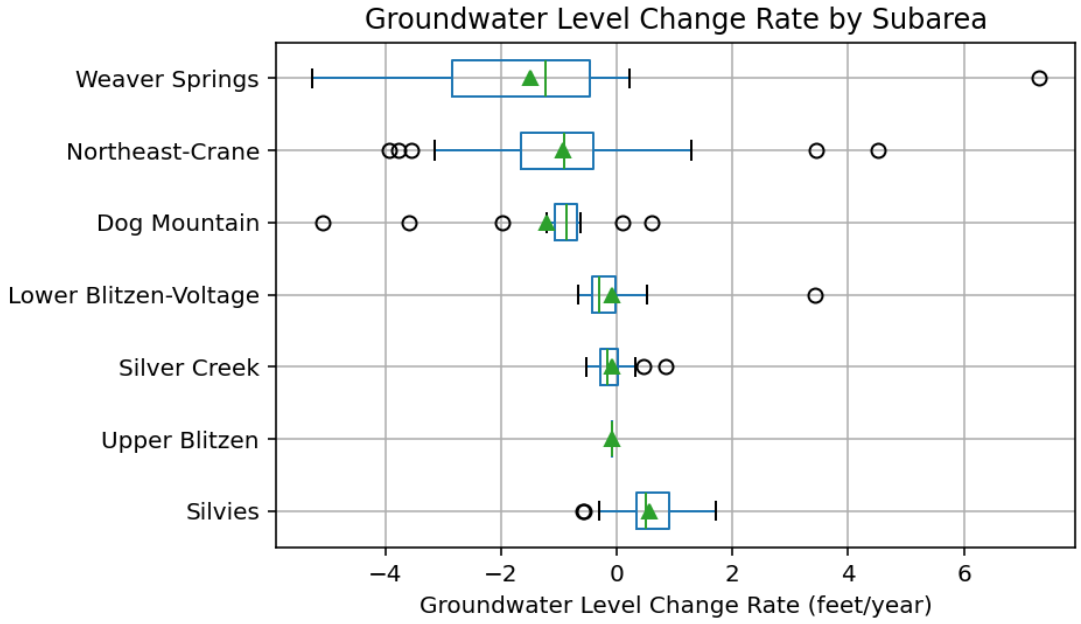

Figure 6: Box and whisker plot showing groundwater level decline rate by subarea. Negative values indicate declining trend. Green vertical line = median value; green triangle = mean; open black circle = outlier. Number of wells per subarea noted in Table 2.

Other considerations

It is important to recognize that each individual well has a unique groundwater level record in terms of the overall period of record, frequency of measurement, and source of measurement. Additionally, each well has a unique well construction and well construction history. Well deepenings in particular can have a significant impact on the groundwater level record, particularly in areas with significant vertical hydraulic gradients. The data summaries provided here are a valuable tool for evaluating groundwater level trends across the basin, however for any individual well it may be important to review the specific groundwater level record and well construction history for that well to fully interpret and understand the calculated groundwater level trend values. The calculations and summary statistics provided here do not fully capture every unique situation, and in some cases may misrepresent the overall water level record for an individual well simply due to the unique characteristics of each well's measurement and construction history and the parameters specified for calculating the groundwater level trend metrics.

OWRD groundwater data links

Harney Basin Critical Groundwater Area Process Interactive Map:
https://experience.arcgis.com/experience/2db5f0d5e50142138304801e09b72fb7/

Groundwater Information System (GWIS):
https://apps.wrd.state.or.us/apps/gw/gw_info/gw_info_report/gw_search.aspx

GWIS Mapping Tool:
https://apps.wrd.state.or.us/apps/gw/gw_info/gw_map/Default.aspx

OWRD Groundwater Hydrographs:
https://apps.wrd.state.or.us/apps/gw/gw_info/gw_hydrograph/Hydrograph.aspx

Well Report Database:
https://apps.wrd.state.or.us/apps/gw/well_log/Default.aspx

References

Cunningham, W.L., and Schalk, C.W., comps., 2011, Groundwater technical procedures of the U.S. Geological Survey: U.S. Geological Survey Techniques and Methods 1–A1, 151 p.

Sen, P. K., 1968, Estimates of the Regression Coefficient Based on Kendall's Tau. Journal of the American Statistical Association, 63(324), 1379–1389.

Appendix 1: List of wells used for the groundwater level trend analysis

Appendix 1					
gw_logid	Subarea	Measured Period (years)	Number of Years Measured	Decline Magnitude (feet)	Decline Rate (feet/year)
HARN0000844	Dog Mountain	67	16	-27.93	-1.003
HARN0001128	Dog Mountain	50	11	-34.75	Insufficient Data
HARN0050368	Dog Mountain	14	13	-3.74	-0.681
HARN0051332	Dog Mountain	19	17	-25.7	-0.978
HARN0051707	Dog Mountain	16	11	-24.2	-1.058
HARN0051783	Dog Mountain	15	12	Impacted by Deepening	-5.072
HARN0051942	Dog Mountain	12	13	-13.75	-1.036
HARN0052055	Dog Mountain	12	10	-2	0.099
HARN0052221	Dog Mountain	11	8	-4.6	0.615
HARN0052225	Dog Mountain	10	5	-1.75	Insufficient Data
HARN0052518	Dog Mountain	9	9	-12.32	-0.625
HARN0052606	Dog Mountain	9	10	-15.81	-1.978
HARN0052629	Dog Mountain	9	10	-8.72	-0.86
HARN0052646	Dog Mountain	9	7	-31.34	-3.583
HARN0052696	Dog Mountain	8	8	-10.07	-0.718
HARN0052853	Dog Mountain	5	4	-3.69	-0.766
HARN0052863	Dog Mountain	7	3	-10.96	Insufficient Data
HARN0052877	Dog Mountain	5	6	-4.35	-0.874
NLOG0057977	Dog Mountain	10	8	-11.08	-0.687
NLOG0057978	Dog Mountain	9	7	-11.18	-1.199
HARN0001363	Lower Blitzen-Voltage	61	47	-5.02	-0.256
HARN0001408	Lower Blitzen-Voltage	68	54	-14.69	-0.395
HARN0001464	Lower Blitzen-Voltage	40	12	-8.22	0.023
HARN0001467	Lower Blitzen-Voltage	61	13	-4.05	-0.035
HARN0001482	Lower Blitzen-Voltage	50	14	-5.35	-0.392
HARN0001489	Lower Blitzen-Voltage	36	3	-17.2	Insufficient Data
HARN0001540	Lower Blitzen-Voltage	60	12	-6.55	-0.294
HARN0001541	Lower Blitzen-Voltage	62	12	-17.39	-0.115
HARN0002000	Lower Blitzen-Voltage	17	11	-5.25	-0.556

Appendix 1					
gw_logid	Subarea	Measured Period (years)	Number of Years Measured	Decline Magnitude (feet)	Decline Rate (feet/year)
HARN0050135	Lower Blitzen-Voltage	29	8	-4.52	-0.255
HARN0050318	Lower Blitzen-Voltage	11	10	-9.85	-0.297
HARN0050728	Lower Blitzen-Voltage	17	14	-4.4	-0.387
HARN0051387	Lower Blitzen-Voltage	17	18	-5.55	-0.293
HARN0051541	Lower Blitzen-Voltage	17	12	-5.1	-0.604
HARN0051764	Lower Blitzen-Voltage	11	8	0	0.532
HARN0051800	Lower Blitzen-Voltage	15	10	-3.12	-0.565
HARN0051841	Lower Blitzen-Voltage	14	14	-6.4	-0.45
HARN0051886	Lower Blitzen-Voltage	14	13	-6.9	-0.455
HARN0051892	Lower Blitzen-Voltage	14	11	-10.83	0.271
HARN0051894	Lower Blitzen-Voltage	14	11	-13.02	-0.666
HARN0051895	Lower Blitzen-Voltage	9	10	-3.83	-0.382
HARN0051923	Lower Blitzen-Voltage	13	13	-4.5	-0.448
HARN0052056	Lower Blitzen-Voltage	13	2	-9.55	Insufficient Data
HARN0052101	Lower Blitzen-Voltage	12	6	-0.17	3.422
HARN0052299	Lower Blitzen-Voltage	11	2	-10.71	Insufficient Data
HARN0052507	Lower Blitzen-Voltage	10	9	-0.45	0.443
HARN0052617	Lower Blitzen-Voltage	9	10	-0.28	0.279
HARN0052801	Lower Blitzen-Voltage	4	5	-0.48	-0.041
HARN0052802	Lower Blitzen-Voltage	4	5	-2.66	-0.223
HARN0052808	Lower Blitzen-Voltage	4	5	-1.09	0.009

Appendix 1					
gw_logid	Subarea	Measured Period (years)	Number of Years Measured	Decline Magnitude (feet)	Decline Rate (feet/year)
HARN0000198	Northeast-Crane	34	18	-28.82	-0.593
HARN0000226	Northeast-Crane	49	8	-26.9	-3.141
HARN0000621	Northeast-Crane	52	12	-52.67	-1.974
HARN0000657	Northeast-Crane	50	19	-21.55	1.294
HARN0000982	Northeast-Crane	48	9	-13.2	Insufficient Data
HARN0000985	Northeast-Crane	48	15	-5.3	-0.06
HARN0000986	Northeast-Crane	48	15	-2.4	0.701
HARN0001028	Northeast-Crane	47	10	-54.97	-1.245
HARN0001046	Northeast-Crane	52	5	-60.6	Insufficient Data
HARN0001061	Northeast-Crane	42	15	-69.7	-0.856
HARN0001245	Northeast-Crane	39	20	-40.45	-0.695
HARN0001274	Northeast-Crane	50	9	-27	Insufficient Data
HARN0001387	Northeast-Crane	64	48	-25.95	-0.547
HARN0001414	Northeast-Crane	49	10	-11.15	Insufficient Data
HARN0001431	Northeast-Crane	66	6	-19.67	-0.76
HARN0002072	Northeast-Crane	31	13	-23.4	-0.426
HARN0050178	Northeast-Crane	29	12	-6.34	0.491
HARN0050179	Northeast-Crane	29	12	-43.57	-1.591
HARN0050236	Northeast-Crane	29	12	-22.25	-0.501
HARN0050285	Northeast-Crane	28	13	-14.9	-0.427
HARN0050407	Northeast-Crane	28	12	-50.74	-0.302
HARN0050514	Northeast-Crane	26	12	-11.03	0.626
HARN0050766	Northeast-Crane	24	13	-66.66	-2.201
HARN0050789	Northeast-Crane	24	12	-20.1	3.448
HARN0051015	Northeast-Crane	10	12	-7.75	0.733
HARN0051066	Northeast-Crane	22	3	-29.45	Insufficient Data
HARN0051076	Northeast-Crane	10	11	-9.27	-0.985
HARN0051154	Northeast-Crane	21	11	-18.8	-0.526
HARN0051237	Northeast-Crane	20	18	-15.69	-0.861
HARN0051238	Northeast-Crane	20	18	-19.51	-0.744
HARN0051275	Northeast-Crane	20	17	-21.15	-1.414
HARN0051353	Northeast-Crane	17	16	-23.1	0.183
HARN0051408	Northeast-Crane	17	11	-18.2	Insufficient Data
HARN0051443	Northeast-Crane	18	6	-13.23	-0.402
HARN0051473	Northeast-Crane	17	13	-9.5	0.061
HARN0051475	Northeast-Crane	13	12	-21.14	-1.892
HARN0051478	Northeast-Crane	15	14	-21.57	-1.329
HARN0051524	Northeast-Crane	18	11	-27.59	-1.7

Appendix 1					
gw_logid	Subarea	Measured Period (years)	Number of Years Measured	Decline Magnitude (feet)	Decline Rate (feet/year)
HARN0051532	Northeast-Crane	17	17	-45.7	-2.687
HARN0051542	Northeast-Crane	17	11	-25	0.324
HARN0051545	Northeast-Crane	17	17	-15.25	-1.006
HARN0051547	Northeast-Crane	17	11	-13.3	-0.68
HARN0051549	Northeast-Crane	17	16	-27.6	-1.426
HARN0051550	Northeast-Crane	17	15	-24.4	-0.972
HARN0051565	Northeast-Crane	17	14	-9.35	-0.483
HARN0051585	Northeast-Crane	17	15	-45	-1.033
HARN0051586	Northeast-Crane	16	14	-35	-1.984
HARN0051587	Northeast-Crane	17	15	-45	-2.13
HARN0051589	Northeast-Crane	16	16	-13.19	-0.533
HARN0051637	Northeast-Crane	16	15	-11.25	1.102
HARN0051701	Northeast-Crane	16	14	-45	-3.545
HARN0051759	Northeast-Crane	15	3	-26.1	Insufficient Data
HARN0051782	Northeast-Crane	15	10	-25.5	-1.36
HARN0051805	Northeast-Crane	13	14	-7.25	-0.665
HARN0051823	Northeast-Crane	15	13	-14.6	-0.587
HARN0051825	Northeast-Crane	9	8	-39.75	4.526
HARN0051837	Northeast-Crane	14	11	-13.7	-0.629
HARN0051883	Northeast-Crane	7	8	-11.4	-1.532
HARN0051890	Northeast-Crane	10	11	-14.46	-1.395
HARN0051903	Northeast-Crane	13	4	-23.1	Insufficient Data
HARN0051932	Northeast-Crane	13	8	-22.1	-1.796
HARN0051944	Northeast-Crane	13	10	-29.15	-2.433
HARN0051972	Northeast-Crane	13	13	-34.6	-1.552
HARN0051979	Northeast-Crane	12	2	-19.5	Insufficient Data
HARN0051987	Northeast-Crane	11	8	-10.9	Insufficient Data
HARN0051989	Northeast-Crane	12	6	-6.67	Insufficient Data
HARN0051993	Northeast-Crane	11	3	-14.33	Insufficient Data
HARN0052001	Northeast-Crane	12	11	-10.07	-0.513
HARN0052010	Northeast-Crane	12	12	-13	-1.614
HARN0052011	Northeast-Crane	11	11	-5.05	-0.351
HARN0052023	Northeast-Crane	12	3	-16.3	Insufficient Data
HARN0052027	Northeast-Crane	12	12	-31.4	-1.561
HARN0052035	Northeast-Crane	12	11	-15.5	-1.198
HARN0052050	Northeast-Crane	12	8	-32.76	-2.868
HARN0052052	Northeast-Crane	11	6	-1	0.4
HARN0052063	Northeast-Crane	10	5	-8.95	Insufficient Data

Appendix 1					
gw_logid	Subarea	Measured Period (years)	Number of Years Measured	Decline Magnitude (feet)	Decline Rate (feet/year)
HARN0052064	Northeast-Crane	12	10	-39.4	-2.232
HARN0052085	Northeast-Crane	12	2	-33	Insufficient Data
HARN0052127	Northeast-Crane	12	2	-4	Insufficient Data
HARN0052132	Northeast-Crane	1	2	0	Insufficient Data
HARN0052175	Northeast-Crane	11	11	-27.67	-2.076
HARN0052189	Northeast-Crane	8	9	-17.89	-2.258
HARN0052215	Northeast-Crane	9	8	-12.41	-0.58
HARN0052232	Northeast-Crane	11	6	-17	Insufficient Data
HARN0052234	Northeast-Crane	10	11	-1.39	0.636
HARN0052235	Northeast-Crane	10	11	-24.59	-1.786
HARN0052456	Northeast-Crane	7	8	0	-0.382
HARN0052494	Northeast-Crane	10	11	-3.33	-0.08
HARN0052502	Northeast-Crane	10	11	-13.95	0.149
HARN0052504	Northeast-Crane	10	11	-3.22	-0.539
HARN0052511	Northeast-Crane	7	3	-11.7	Insufficient Data
HARN0052520	Northeast-Crane	6	7	-11.5	-1.687
HARN0052604	Northeast-Crane	7	8	-5.75	-0.695
HARN0052611	Northeast-Crane	6	7	-5.7	0.11
HARN0052619	Northeast-Crane	9	10	-29.03	-3.779
HARN0052620	Northeast-Crane	8	8	-10.32	-1.275
HARN0052624	Northeast-Crane	9	10	-16.45	-0.964
HARN0052708	Northeast-Crane	8	7	-16.1	-0.96
HARN0052746	Northeast-Crane	9	5	-10.15	Insufficient Data
HARN0052754	Northeast-Crane	7	7	-11.52	-2.42
HARN0052757	Northeast-Crane	6	6	-6.2	-1.026
HARN0052760	Northeast-Crane	6	4	-2.32	-0.753
HARN0052765	Northeast-Crane	7	7	-10.02	-1.658
HARN0052767	Northeast-Crane	7	6	-11.6	-3.934
HARN0052770	Northeast-Crane	7	7	-2.58	-0.283
HARN0052789	Northeast-Crane	7	7	-9.65	-2.398
HARN0052792	Northeast-Crane	7	7	-13.02	-1.177
HARN0052805	Northeast-Crane	6	5	-11.51	-2.965
HARN0052855	Northeast-Crane	3	3	-4	Insufficient Data
HARN0052856	Northeast-Crane	3	3	0	Insufficient Data
HARN0052857	Northeast-Crane	3	3	0	Insufficient Data
HARN0052907	Northeast-Crane	5	5	-8.78	1.16
HARN0052983	Northeast-Crane	4	5	-5.15	-1.146
HARN0000243	Silver Creek	47	13	-8.4	-0.269

Appendix 1					
gw_logid	Subarea	Measured Period (years)	Number of Years Measured	Decline Magnitude (feet)	Decline Rate (feet/year)
HARN0000260	Silver Creek	47	11	-6.9	-0.339
HARN0000754	Silver Creek	37	12	-11.64	-0.082
HARN0000756	Silver Creek	58	16	-6.05	0.839
HARN0000767	Silver Creek	47	5	-11.3	Insufficient Data
HARN0001084	Silver Creek	11	11	-5.9	0.462
HARN0001309	Silver Creek	11	12	-0.05	0.112
HARN0002056	Silver Creek	32	15	-7.13	0
HARN0050192	Silver Creek	29	10	-5.2	-0.353
HARN0050233	Silver Creek	29	13	-3.7	-0.347
HARN0051010	Silver Creek	23	10	-8.59	-0.278
HARN0051756	Silver Creek	15	14	-5.9	-0.307
HARN0051867	Silver Creek	11	11	-2.61	0.067
HARN0051921	Silver Creek	12	13	-3.07	0.1
HARN0051990	Silver Creek	13	12	-9.42	0
HARN0052102	Silver Creek	11	12	-2.84	-0.211
HARN0052116	Silver Creek	10	10	-1.4	-0.133
HARN0052118	Silver Creek	12	10	-20.69	-0.274
HARN0052168	Silver Creek	11	11	-1.8	0.169
HARN0052484	Silver Creek	8	9	-2.9	-0.167
HARN0052495	Silver Creek	9	10	-1.98	-0.067
HARN0052534	Silver Creek	10	11	-8.89	-0.101
HARN0052603	Silver Creek	9	9	-5.94	-0.514
HARN0052626	Silver Creek	11	10	-14.1	-0.195
HARN0052627	Silver Creek	11	10	-17.48	-0.182
HARN0052628	Silver Creek	11	10	-9.44	-0.174
HARN0052634	Silver Creek	8	9	-2.69	-0.15
HARN0052635	Silver Creek	10	10	-11.84	0.071
HARN0052717	Silver Creek	8	7	-2.73	-0.29
HARN0052718	Silver Creek	8	9	-2.33	-0.309
HARN0052913	Silver Creek	5	6	-5.5	-0.175
HARN0053004	Silver Creek	4	5	-0.4	0.324
MALH0002322	Silver Creek	45	12	-25.12	-0.036
HARN0000106	Silvies	58	16	-3.9	-0.063
HARN0000295	Silvies	61	3	-8.7	Insufficient Data
HARN0000296	Silvies	59	13	-5.95	0.559
HARN0000323	Silvies	55	36	-1.75	1.019
HARN0000440	Silvies	66	35	-8.84	0.85
HARN0000441	Silvies	66	38	-13.75	0.651

Appendix 1					
gw_logid	Subarea	Measured Period (years)	Number of Years Measured	Decline Magnitude (feet)	Decline Rate (feet/year)
HARN0000503	Silvies	61	14	-13.4	1.209
HARN0000547	Silvies	97	77	-16.05	1.097
HARN0000607	Silvies	58	27	-43.36	0.351
HARN0000615	Silvies	58	10	-27.07	-0.594
HARN0000619	Silvies	61	3	-28.5	Insufficient Data
HARN0000812	Silvies	37	17	-12.8	0.939
HARN0000837	Silvies	51	17	-12.1	0.363
HARN0000901	Silvies	52	15	-16.5	0.334
HARN0000921	Silvies	48	7	-5.7	0.438
HARN0050406	Silvies	28	8	-18.1	0.942
HARN0050578	Silvies	1	2	0	Insufficient Data
HARN0050719	Silvies	11	12	-8.76	1.548
HARN0051143	Silvies	21	14	0	0.352
HARN0051335	Silvies	19	19	-3.83	1.333
HARN0051343	Silvies	19	11	-0.34	0.581
HARN0051405	Silvies	14	14	-13.75	-0.562
HARN0051503	Silvies	16	16	-1.15	0.501
HARN0051557	Silvies	17	16	-3.85	0.402
HARN0051617	Silvies	13	13	-1.83	0.59
HARN0051622	Silvies	48	10	0	0.438
HARN0051736	Silvies	11	12	-4.57	0.894
HARN0051830	Silvies	14	13	-6.45	0.228
HARN0051843	Silvies	14	7	-3.58	0.09
HARN0051885	Silvies	9	10	-1.61	0.508
HARN0051887	Silvies	13	13	-5.31	0.42
HARN0051917	Silvies	13	13	-7.92	1.106
HARN0051963	Silvies	11	12	-5.06	1.118
HARN0052032	Silvies	12	13	-1.14	-0.055
HARN0052136	Silvies	48	12	-7.51	0.767
HARN0052431	Silvies	5	6	0	-0.299
HARN0052485	Silvies	10	10	0	0.608
HARN0052492	Silvies	10	6	-3.25	1.718
HARN0052544	Silvies	1	2	0	Insufficient Data
HARN0052685	Silvies	8	9	-0.1	0.21
HARN0052747	Silvies	7	8	0	0.324
HARN0052748	Silvies	7	8	-1.67	0.676
HARN0052749	Silvies	7	8	-2.9	0.489
HARN0053157	Silvies	1	2	0	Insufficient Data

Appendix 1					
gw_logid	Subarea	Measured Period (years)	Number of Years Measured	Decline Magnitude (feet)	Decline Rate (feet/year)
HARN0051017	Upper Blitzen	10	11	-2.92	-0.082
HARN0001094	Weaver Springs	20	12	-133.45	Insufficient Data
HARN0001335	Weaver Springs	45	12	-52.59	-0.7
HARN0001336	Weaver Springs	45	5	-60.35	Insufficient Data
HARN0001348	Weaver Springs	47	13	-28.99	-0.473
HARN0001990	Weaver Springs	33	21	-80.36	-0.302
HARN0050399	Weaver Springs	27	12	-10.09	-0.745
HARN0050516	Weaver Springs	26	9	-117.25	-2.794
HARN0050950	Weaver Springs	23	12	-9.38	-0.95
HARN0051259	Weaver Springs	20	11	-49.27	7.304
HARN0051272	Weaver Springs	20	14	-96.5	Insufficient Data
HARN0051339	Weaver Springs	19	7	-48.29	Insufficient Data
HARN0051448	Weaver Springs	18	9	-100	Insufficient Data
HARN0051606	Weaver Springs	17	12	-14.19	-0.378
HARN0051761	Weaver Springs	15	12	-28.27	-1.779
HARN0051765	Weaver Springs	15	7	-99.1	-0.622
HARN0051767	Weaver Springs	15	12	-23.22	-1.521
HARN0051791	Weaver Springs	15	11	-64.6	-3.015
HARN0051871	Weaver Springs	14	7	-82.6	Insufficient Data
HARN0051970	Weaver Springs	12	6	-82.09	Insufficient Data
HARN0051973	Weaver Springs	10	8	-16.85	0.221
HARN0052007	Weaver Springs	13	8	-79.25	-4.165
HARN0052015	Weaver Springs	12	7	-67	-4.12
HARN0052169	Weaver Springs	10	9	-29.31	-2.163
HARN0052469	Weaver Springs	10	8	-51.23	-3.516
HARN0052513	Weaver Springs	10	4	-25.7	Insufficient Data
HARN0052630	Weaver Springs	9	10	-43.93	-2.386
HARN0052631	Weaver Springs	9	10	-42.89	-2.482
HARN0052639	Weaver Springs	9	7	-20.2	-0.7
HARN0052640	Weaver Springs	9	8	-1.22	-0.395
HARN0052807	Weaver Springs	6	6	-2	-0.399
HARN0052875	Weaver Springs	6	6	-27.4	-4.486
MALH0002323	Weaver Springs	42	12	-76.2	-5.258

Appendix 2: List of wells identified as needing further review

gw_logid	subarea	Review note
HARN0000967	Northeast-Crane	Measuring point heights and descriptions are inconsistent; record shows an unexplained ~12 ft drop from 2020–2021.
HARN0001014	Northeast-Crane	Measuring point heights and descriptions are inconsistent; 2024 water level comment indicates prior measurements may have been the wrong well (ID tag does not match this well).
HARN0001867	Northeast-Crane	Measuring point heights and descriptions are inconsistent; record shows an unexplained ~20 ft drop between 2008–2010.
HARN0001913	Northeast-Crane	Measuring point heights and descriptions are inconsistent; unexplained ~12 ft swings beginning in 2011 correspond to measuring point changes.
HARN0051322	Northeast-Crane	Measuring point heights and descriptions are inconsistent; record shows an unexplained ~20 ft drop from 2020–2021.
HARN0051378	Northeast-Crane	Unexplained ~10 ft drop from 2021–2022; measuring point changed in 2022 and reverted the following year; three identical static water levels reported consecutively.
HARN0051577	Northeast-Crane	Measuring point heights and descriptions are inconsistent; record shows an unexplained ~40 ft drop from 2020–2021.
HARN0051582	Northeast-Crane	Record shows an unexplained ~18 ft drop from 2025–2026; 2026 measurement needs review once 2027 data are available.
HARN0051783	Dog Mountain	Well deepened in 2016, resulting in ~50 ft lower water levels; post-2017 measurements remain usable for rate calculation.
HARN0051941	Silvies	Measuring point heights and descriptions are inconsistent; record shows an unexplained ~18 ft rise from 2021–2022 coinciding with measuring point change.
HARN0051991	Silver Creek	Measuring point heights and descriptions are inconsistent; record shows unexplained ~10 ft swings from 2020–2023 corresponding to measuring point changes.