Nebraska Department of Natural Resources

2021-2022 Biennial Review Report

for the

Lewis and Clark Natural Resources District Integrated Management Plan

December 21, 2023

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DEPT. OF NATURAL RESOURCES

LEWIS & CLARK
NATURAL RESOURCES DISTRICT

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INTRODUCTION

In September of 2016, a voluntary integrated management plan (V-IMP) that was jointly developed by the Lewis and Clark Natural Resources District (LCNRD) and the Nebraska Department of Natural Resources (NeDNR) became effective. This V-IMP addresses coordinated management of groundwater (managed by LCNRD) and surface water (managed by NeDNR) and recognizes that the two sources of water are hydrologically connected in certain areas.

Integrated water management planning is an adaptive process that takes into account the changing needs of unique Natural Resources Districts (NRDs) and their constituents. Figure 1 provides a graphic that walks through the process of adaptive management used in drafting IMPs. This includes plan development, implementation, monitoring, and plan refinement. It is through this iterative process that progress is made towards achieving the goals of the plan.

The LCNRD V-IMP development involved consultation with a diverse group of stakeholders to help determine the goals and objectives of the V-IMP (Chapter 7 in the V-IMP). Included in the V-IMP is a monitoring plan (Chapter 9) that outlines data and information to be tracked and reported as a part of plan implementation. Chapter 12 of the plan describes the V-IMP review process. Here, the plan lays out the framework for the LCNRD and NeDNR to conduct biennial reviews to discuss V-IMP implementation and assess progress towards achieving the goals and objectives of the plan. In the event that the LCNRD and NeDNR jointly decide that plan refinements are necessary, amendments could be drafted, which would require a public hearing and possible reconvening of the stakeholder group.

This 2021-2022 NeDNR V-IMP report reviews surface water monitoring such as permitting, reporting and streamgaging. It also includes updates on collaborations with other entities, studies and research pertaining to hydrologically connected areas, and public outreach activities. As part of this review, the LCNRD and NeDNR jointly decided that no amendments were necessary at this time, as progress is being made towards achieving the goals and objectives of the V-IMP.

Figure 1. IMPs adaptive management framework

SURFACE WATER MONITORING

Chapter 9 of the V-IMP describes the monitoring plan to gather and evaluate data, information, and methodologies, which is an important part of IMP implementation. The following sections describe NeDNR's surface water monitoring activities for the 2021-2022 reporting period. These monitoring activities include surface water permitting actions, streamgage monitoring, a streamgage cooperative agreement for Bow Creek, and voluntary surface water use reporting.

NEDNR SURFACE WATER PERMITTING ACTIONS

NeDNR continued to monitor and administer surface water appropriations and maintain records for new, cancelled, or transferred rights. Figure 2 shows the geographic location of the permitting actions that resulted in new surface water irrigated acres within the LCNRD. Figure 3 shows those permitting actions that were either cancelled in full or cancelled in part within the LCNRD. Tables 1 and 2 provide information about all new and cancelled surface water permitting actions that occurred in 2021-2022, including the type of surface water use, the general location, and the area of irrigated land and/or volume of surface water associated with that permit.

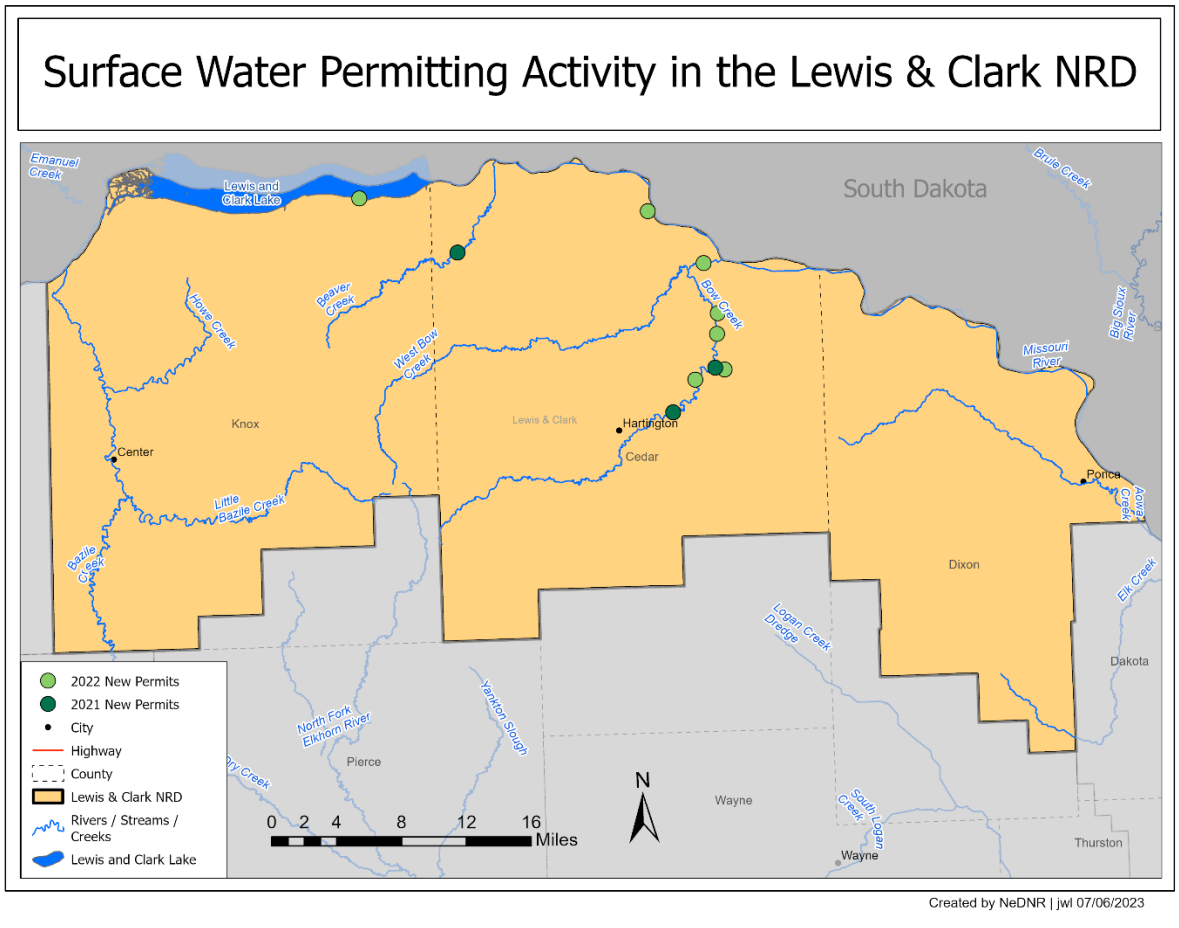


Figure 2. Locations of NeDNR new surface water permitting actions in 2021-2022

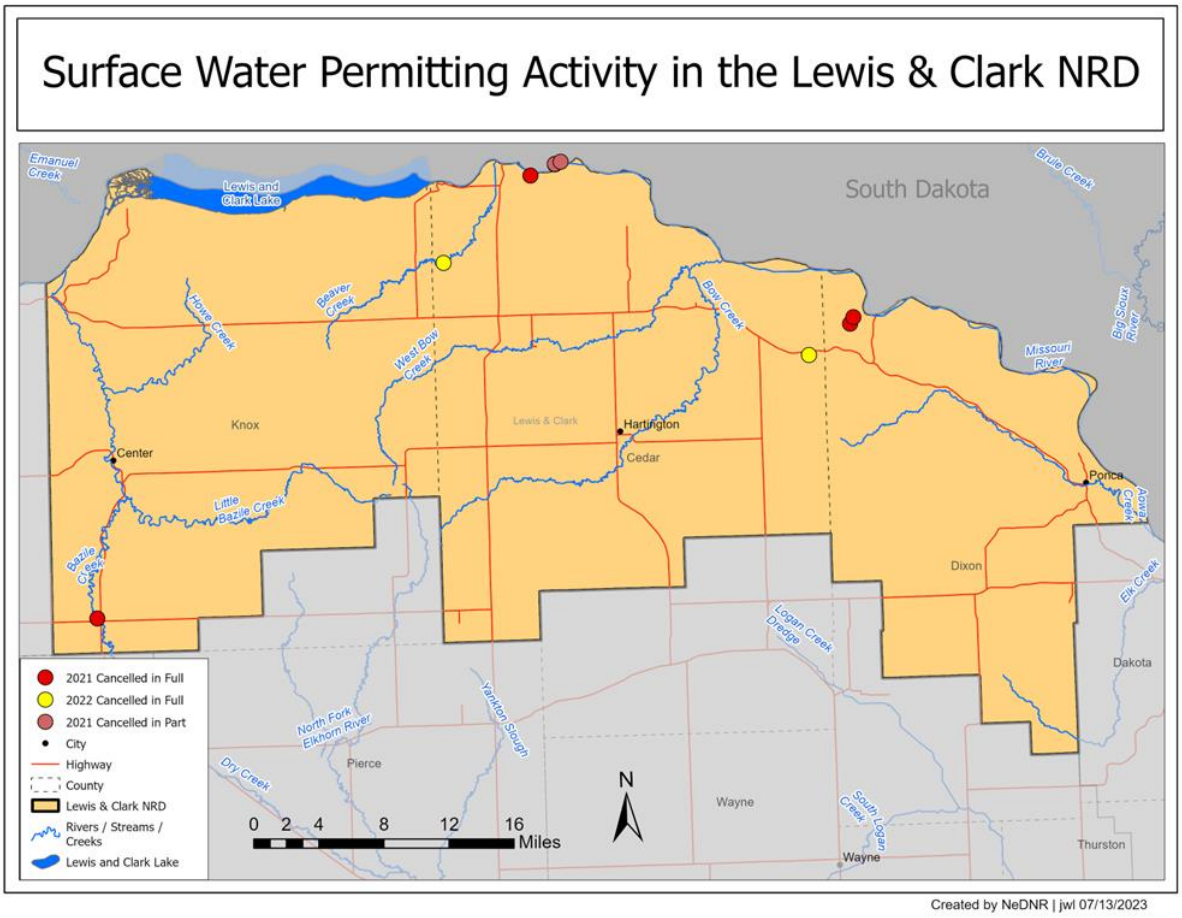


Figure 3. Locations of NeDNR cancelled surface water permitting actions in 2021-2022

Table 1 provides a listing of new permits within the LCNRD that NeDNR approved in 2021-2022. Seven surface water applications for irrigation and one domestic use permit totaling 758.5 acres were approved. All eight permits allow the appropriator to divert from a naturally flowing stream. Each of the permits has an approved map of the location of use (irrigation and domestic) and the location of the point of diversion from the stream. If the appropriators wish to change the location of use or the point of diversion, they must first obtain permission from NeDNR prior to implementation of any changes. One manufacturing permit[1] was approved for a total diversion that shall not exceed 10 acre-feet of water.

[1] Temporary permit issued for one year.

Table 1. New surface water permits approved by NeDNR in 2021-2022

Surface Water Applications Approved in 2021-2022						
Permit Number	Use	General Location	Source	Date Approved	New Acres	New storage
A-19761	Irrigation from Natural Stream	S12-T31-R2E	Bow Creek	6/21/2021	214.2	N/A
A-19780	Irrigation from Natural Stream	S28-T31-R2E	Bow Creek	9/15/2021	56.3	N/A
A-19782	Domestic	S5-T32-R1W	Beaver Creek	10/12/2021	0.6	N/A
A-19794	Irrigation from Natural Stream	S12-T31-R2E	East Bow Creek	1/12/2022	27.7	N/A
A-19795	Irrigation from Natural Stream	S14-T31-R2E	Bow Creek	1/12/2022	76.1	N/A
A-19800	Irrigation from Natural Stream	S36-T32-R2E	Bow Creek	1/28/2022	51.9	N/A
A-19802	Irrigation from Natural Stream	S11-T32-R2E	Bow Creek	3/1/2022	156.8	N/A
A-19860	Irrigation from Natural Stream	S20-T33-R2E	Missouri River	9/13/2022	49.3	N/A
A-19846	Irrigation from Natural Stream	S25-T32-R2E	Bow Creek	6/23/2022	125.6	N/A
A-19866[2]	Manufacturing	S17-T33-R2W	Missouri River	7/19/2022	N/A	N/A

Table 2 summarizes full or partial cancellations of surface water permits. All nine are permits that allowed irrigation from a natural stream. Six permits were cancelled in full of which three were beneficial use cancellations while the remaining three were relinquishments by the owner. Three permits were partial cancellations, all were relinquishments, that still irrigate a total of 82.4 acres. The beneficial use cancellations during this reporting period were because the appropriator failed to perfect the appropriation by irrigating all the approved acres. The relinquishments were initiated by the owners of the surface water right because it had not been used for at least five years.

NeDNR did not act upon any transfer applications within the LCNRD during 2021 and 2022.

[2] Permit A-19866 is a temporary permit of one year that will expire on 7/19/2023.

Table 2. Surface water permits within the LCNRD that were fully or partially cancelled in 2021-2022

Surface Water Appropriations Partially or Fully Cancelled in 2021-2022							
Permit Number	Use	General Location	Source	Date Cancelled	Acres Cancelled	Grant Cancelled	Status
A-11153	Irrigation from Natural Stream	S21-T29-R5W	Bazile Creek	1/20/2021	14.4	0.21	Cancelled in Full
A-19036	Irrigation from Natural Stream	S32-T32-R4E	Lime Creek	3/23/2021	49.7	0.71	Cancelled in Full
A-18684	Irrigation from Natural Stream	S7-T33-R1E	Antelope Creek	11/30/2021	19	0.27	Cancelled in Full
A-19554	Irrigation from Natural Stream	S29-T32-R4E	Lime Creek	11/29/2021	228	1.63	Cancelled in Full
A-19658	Irrigation from Natural Stream	S6-T32-R1W	Beaver Creek	12/13/2022	243	3.47	Cancelled in Full
A-19659	Irrigation from Natural Stream	S1-T31-R3E	Tributary to Lime Creek	12/13/2022	111.5	1.59	Cancelled in Full
A-17419R	Irrigation from Natural Stream	S5-T33-R1E	Missouri River	8/18/2021	16.2	0.23	Cancelled in Part
A-17550R	Irrigation from Natural Stream	S5-T33-R1E	Missouri River	12/21/2021	28.1	0.4	Cancelled in Part
A-17782R	Irrigation from Natural Stream	S5-T33-R1E	Missouri River	8/18/2021	10.7	0.15	Cancelled in Part

STREAMFLOW MONITORING

The U.S. Geological Survey (USGS) operates six streamgages within the boundaries of LCNRD. A listing of these streamgages is shown below in Table 3, and the locations of the streamgages are shown in Figure 4. Streamflow data on these gages is available on the USGS's National Water Information System (NWIS) at http://waterdata.usgs.gov/. NeDNR regularly assesses the need for modifications to the network in the IMP area.

Table 3. An overview of USGA streamgages in the LCNRD

Streamgages in the Lewis and Clark NRD					
Name	USGS Gage ID	Start Year	Gage Height	Discharge	USGS Cooperative Partners
Bazile Creek near Niobrara, NE	06466500	1990	X	X	Lewis & Clark NRD
Bazile Creek at Center, NE	06466400	2002	X	X	Santee Sioux Tribe of NE
Bow Creek near Wynot, NE	06478522	2015	X	X	Lewis & Clark NRD, NE Dept. of Natural Resources
Howe Creek near Center, NE	06466470	2017	X	X	Santee Sioux Tribe of NE
Missouri River near Maskell, NE	06478526	2012	X		U.S. Army Corps of Engineers
Missouri River near St. James, NE	06478523	2017	X		U.S. Army Corps of Engineers

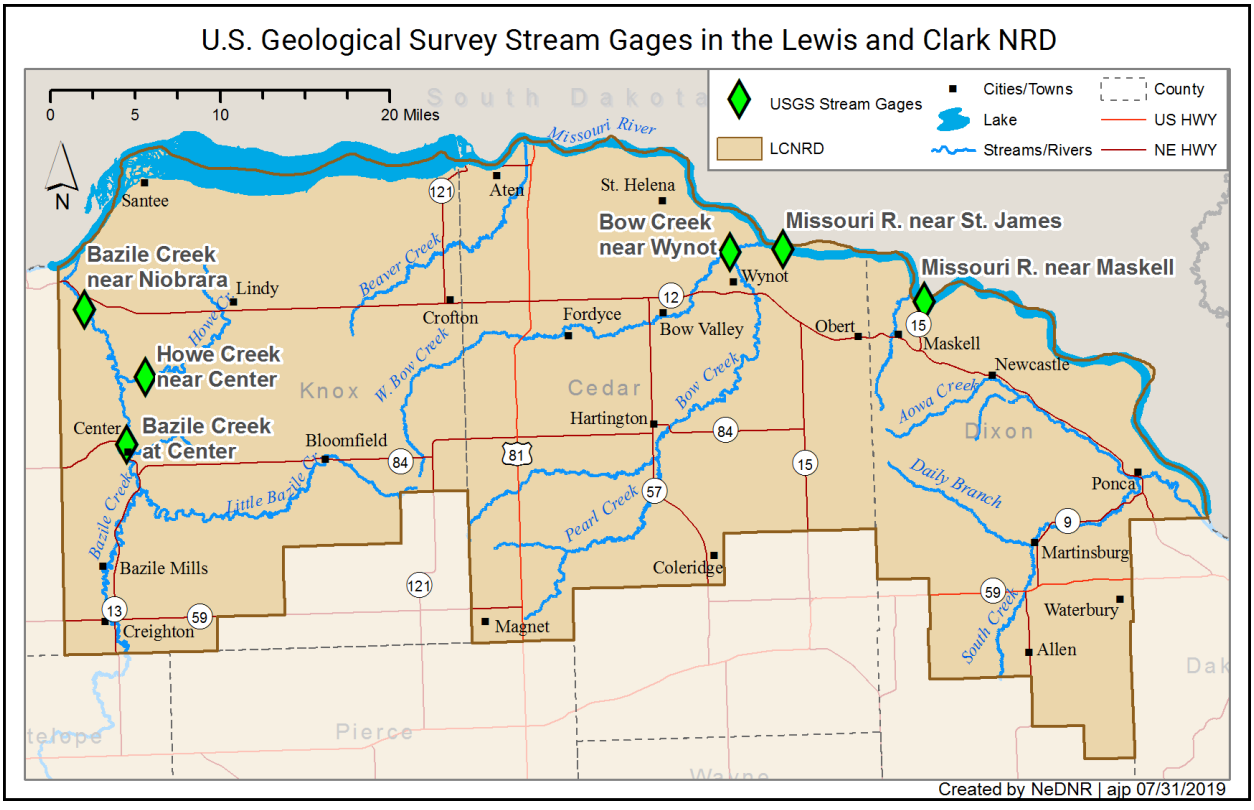


Figure 4. Map showing locations of streamgages (all USGS gages) in the LCNRD

NeDNR acquired streamflow data for select streamgages from the USGS NWIS portal (some data are provisional) as a part of this LCNRD biennial report. The streamgages include two locations on Bazile Creek and one location on Bow Creek. These gages provide insight to the overall water supply for a given year. The average annual streamflow (discharge) in cubic feet per second (cfs) for these streamgages is shown in Figures 5 through 7. Both the streamflow for the period of record, and period of record average streamflow are shown to provide a reference for fluctuations from average conditions. Because Bow Creek near Wynot only had six years of streamflow data, the Bow Creek gage near St. James was included in the chart to add fifteen years of data from a nearby location (although smaller watershed).

As indicated in the charts, 2021 and 2022 were much drier years in the LCNRD, with most of the stream flows being reduced to between 22.9% and 84.6% of the normal historical average. For example, the Bazile Creek's average annual discharge near Center, Nebraska (Figure 5) was 84.6 cfs in 2021 and 61.8 cfs in 2022. This compared to the historical average of 100.11 cfs shows the flows were 84.6% and 61.8% of normal for 2021 and 2022 respectively. The Bazile Creek near Niobrara, Nebraska (Figure 6) fared better in 2021 with the average flow being 0.18 cfs higher than the historical average of 101.02 cfs, but in 2022 the average dropped to 82.7 cfs or 81.3% of normal flows. The Bow Creek near Wynot, Nebraska (Figure 7) showed the largest loss of average flows for the 2021 and 2022 reporting period where flows were 36.8% and 22.9% of normal. The Bow Creek has a historical average flow of 257.1 cfs, yet in 2021 the average flow was 94.6 cfs and in 2022 an average of 59.1 cfs.

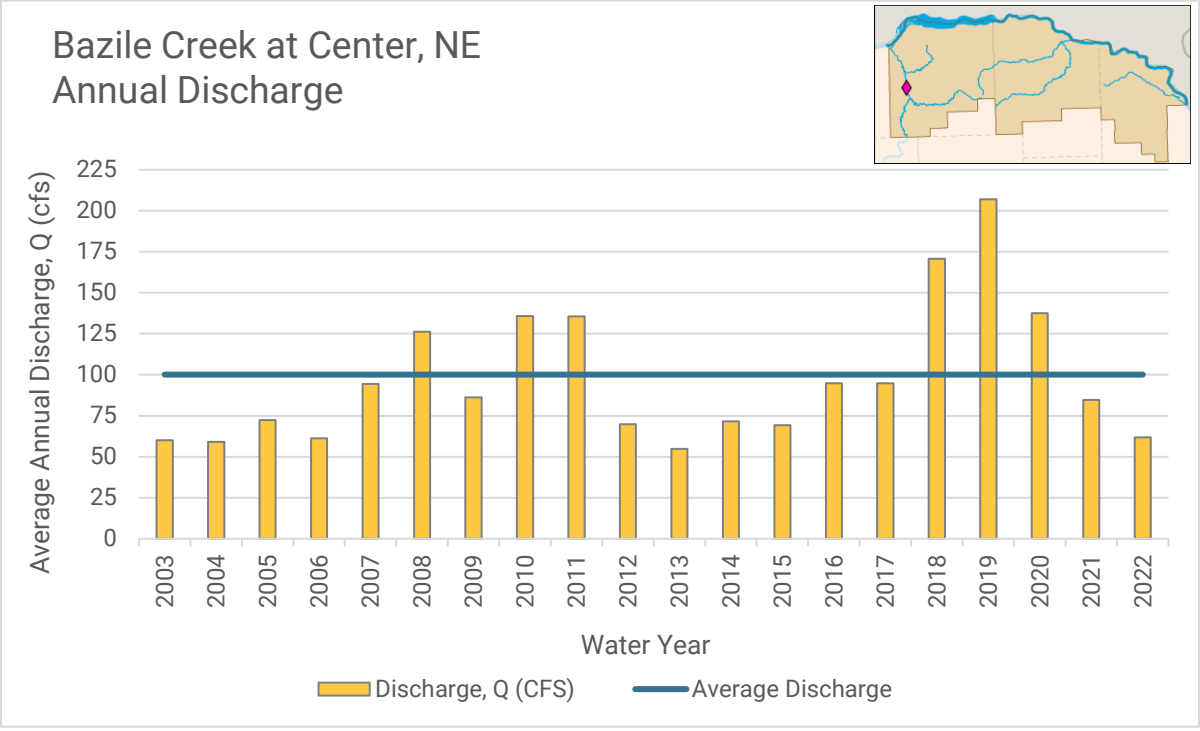


Figure 5. Average annual discharge for Bazile Creek near Center, NE from 2003-2022

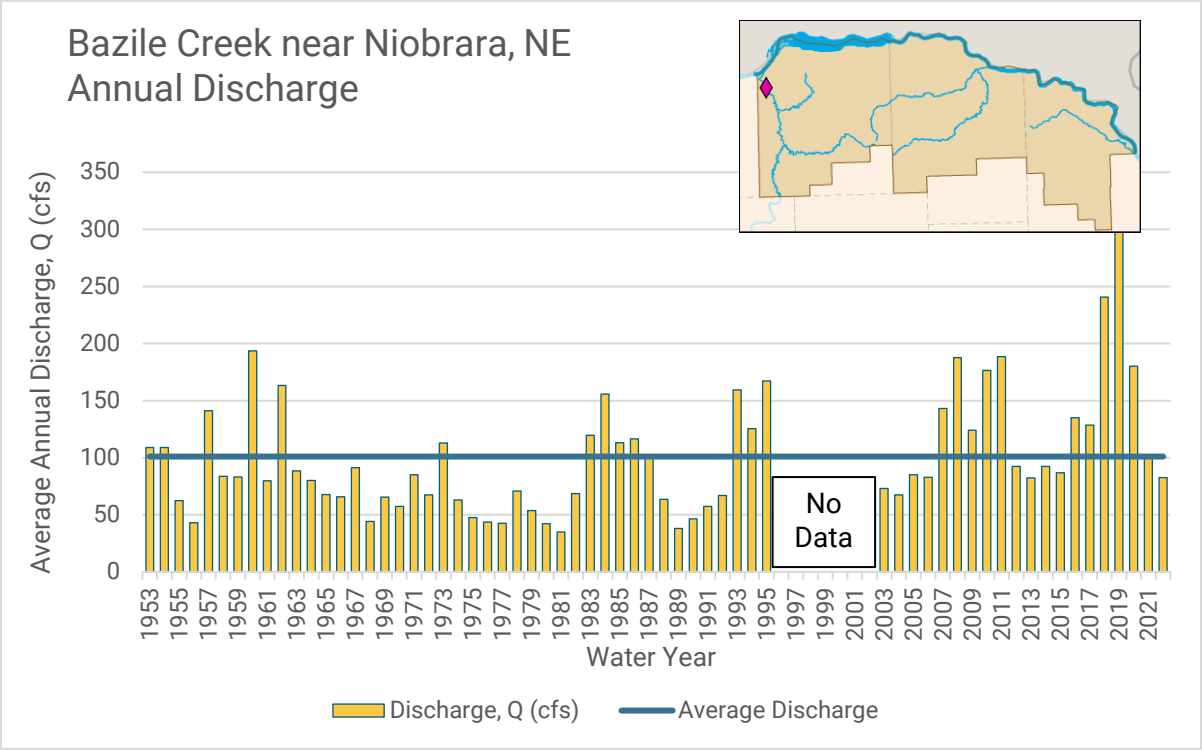


Figure 6. Average annual discharge for the Bazile Creek near Niobrara, NE from 1953-2022

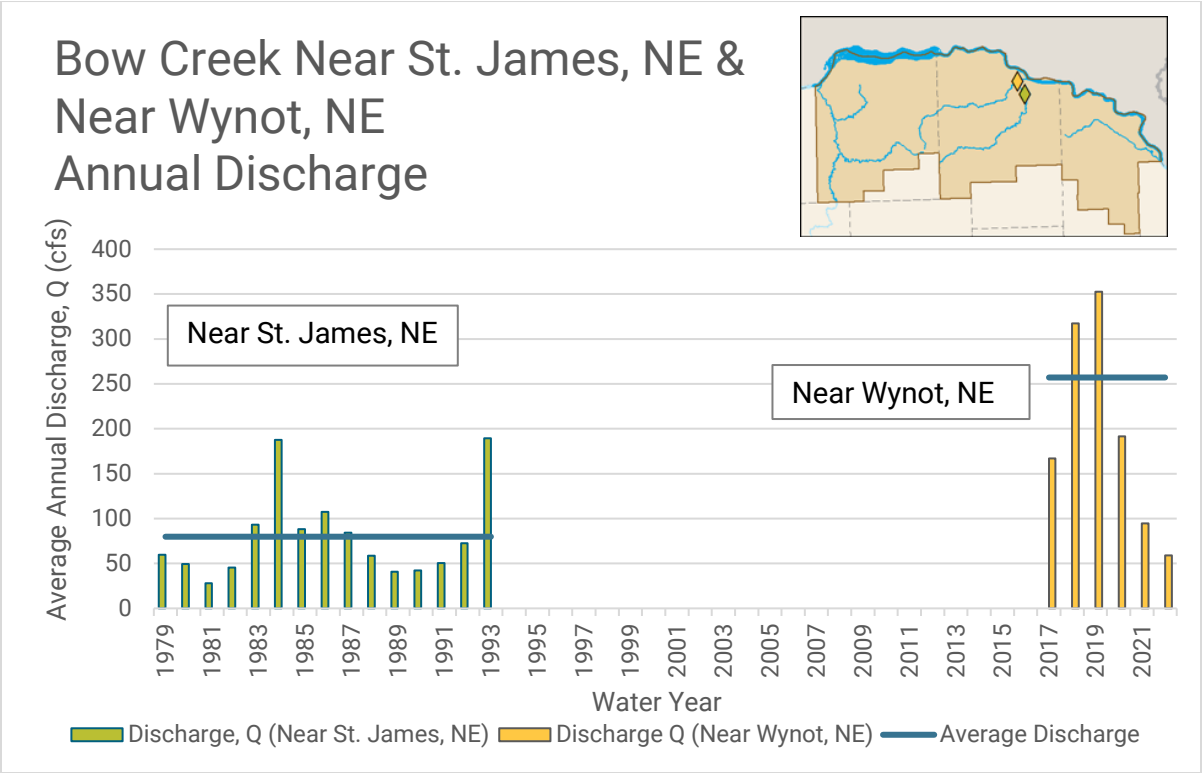


Figure 7. Average annual streamflow for the Bow Creek gages, 1979-1993 and 2017-2022

COOPERATIVE AGREEMENT FOR BOW CREEK NEAR WYNOT STREAMGAGE

The Bow Creek near Wynot streamgage is a newer streamgage that is operated and maintained by the USGS with additional funding provided by LCNRD and NeDNR. The streamgage provides stream discharge information for West Bow Creek and Bow Creek watersheds. When combined, these watersheds cover about 1/3 of the LCNRD land area (Figure 8). This land area is prone to flooding and had not been gaged since the closure of the Bow Creek near St. James gage in 1993. LCNRD and NeDNR considered Bow Creek gaging a priority to fill gaps in the water monitoring network.

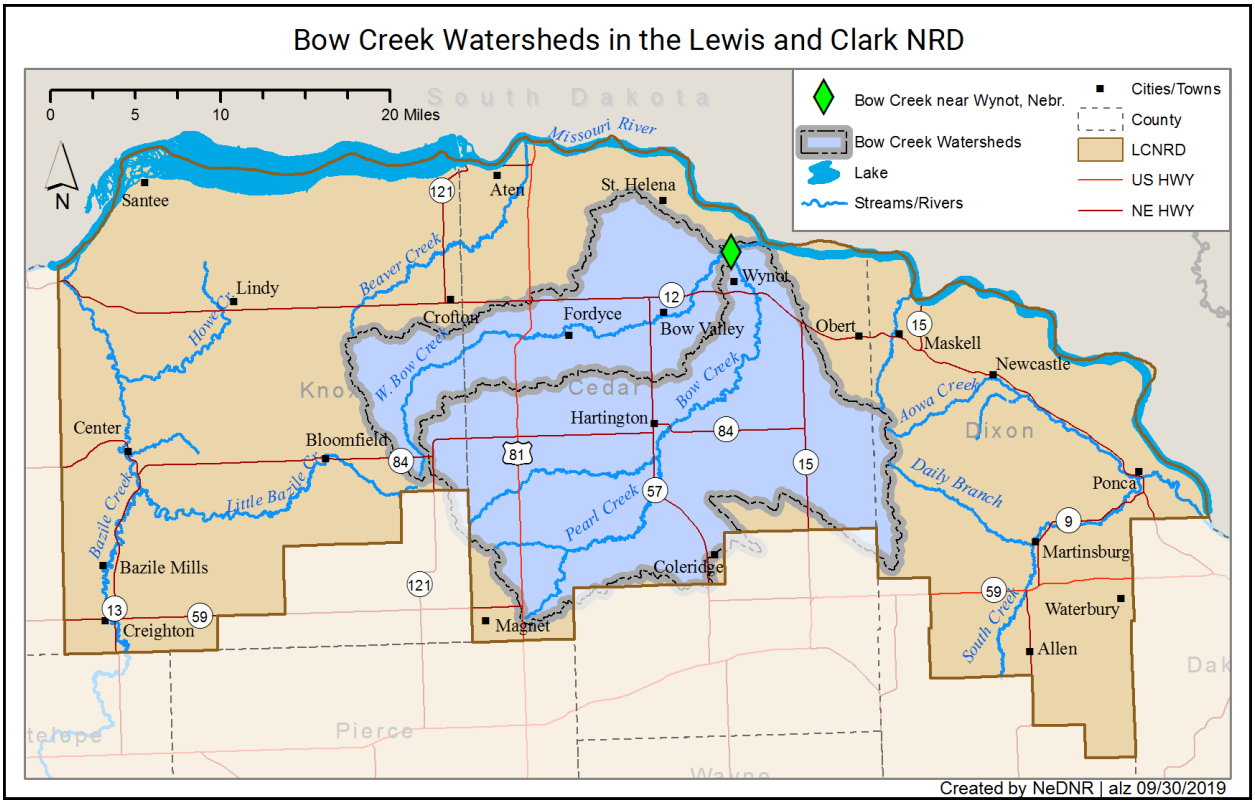


Figure 8. Bow Creek and West Bow Creek watersheds in the LCNRD

In the early 2010s, USGS installed instrumentation at the Wynot site to monitor water quality for a defined period, after which the instrumentation would be removed. Prior to removal and during IMP development, the LCNRD reached out to USGS and NeDNR to explore opportunities to keep the instrumentation in place and dedicate the site to year-round monitoring of streamflow. USGS agreed to provide roughly 40 percent of maintenance costs for continuation of the gage.

Since 2016, the LCNRD and NeDNR have been in cooperative agreements to share the remaining maintenance costs that are not covered by USGS. NeDNR has utilized Water Planning Division funds for the Bow Creek near Wynot streamgage maintenance, prioritizing the initiative as a part of statewide IMP implementation. The first cooperative agreement lasted three years and covered

streamgage maintenance from June 2016 to June 2019. NeDNR and LCNRD have extended the cooperative agreement through September 30, 2024.

Benefits of the Bow Creek near Wynot streamgage include increased knowledge about water supply at a critical point just upstream of the confluence with the Missouri River, better ability to monitor and make decisions about flooding, and improved insight into climate cycles and drought. In addition, river stages at Bow Creek can be compared to static water levels at observation wells in northern Cedar County, to increase understanding of hydrologically connected groundwater and surface water areas. The partnership between NeDNR and LCNRD to maintain the streamgage is helping to achieve IMP goals and objectives, specifically objectives 1.1 (development and maintenance of a District-wide water inventory) and 1.2 (filling gaps in monitoring networks).

VOLUNTARY WATER USE REPORTING

NeDNR requests water use data through its Voluntary Water Use Reporting Program throughout the state, from surface water irrigation (IR[3], SO[4] and SI[5] uses) permit holders in the LCNRD. NeDNR sends surveys to surface water irrigation permit holders around December of each year that requests information such as surface water use or non-use, estimated water use amounts, reasons for non-use, and crops grown. Most responses are received by February of the following year when NeDNR begins to compile the information received.

In 2021, NeDNR received 32 responses from a total of 111 permit holders, with a response rate of 28%. In 2022, 38 responses were received from a total of 115 permit holders, for a response rate of 33%. These response rates are similar to the last reporting period for LCNRD and the same from across the state.

For the 2021 irrigation season, see table 4, the responders that provided estimated water use indicated they had applied between 2 and 12 inches of water per acre for a total average of 5.13 inches of water per acre. For the 2022 irrigation season, see table 5, the responders again provided an estimated water use between 3 and 15 inches of water per acre for an average of 6.63 inches per acre. Summarized in Tables 4 and 5 are the respondents' indications for the source of water used for irrigation, or the lack of irrigation and the number of reported irrigated acres in 2021 and 2022.

[3] IR = Irrigation from a naturally flowing source
[4] SO = Irrigation from a reservoir
[5] SI = Irrigation from a reservoir on lands already covered by an IR permit

Table 4. Voluntary use reporting for 2021

Voluntary Use Reporting for 2021						
Appropriation Type	Number of Permits	Number of Respondents	Irrigated with Surface Water	Irrigated with Groundwater	Did not Irrigate	Reported Irrigated Acres
IR	101	32	25	6	7	2619
SI	6	3	1	0	2	214
SO	4	2	0	0	2	0
Total	111	37	26	6	11	2833

Table 5. Voluntary use reporting for 2022

Voluntary Use Reporting for 2022						
Appropriation Type	Number of Permits	Number of Respondents	Irrigated with Surface Water	Irrigated with Groundwater	Did not Irrigate	Reported Irrigated Acres
IR	105	38	29	10	9	3182
SI	6	3	3	1	0	552
SO	4	1	1	0	0	67
Total	115	42	33	11	9	3801

There were several reasons as to why respondents did not irrigate during the last reporting period:

- Not enough water,
- Wasn't enough water in creek to fill dugout,
- Didn't need to,
- Used groundwater well,
- Water level to low, planted beans and didn't need the water,
- Could not find a cheap enough pivot to put over there yet,
- Equipment failure.

GROUNDWATER LEVEL MONITORING

LCNRD performs water level measurements on 34 irrigation, domestic, or stock wells across the district in the spring and fall of each year. The results of the measurements are reported to United States Geological Survey (USGS) and University of Nebraska Conservation and Survey Division (UNLCSD). A summary report is also published in local newspapers and posted on the LCNRD website. Hydrographs of 31 wells, excluding 4 Dakota formation wells, were developed in 2014 by NeDNR staff and has subsequently been provided to LCNRD to maintain and update with current measurements for groundwater management. An example of these hydrographs is included in Figure 9 and charts for each monitored well can be found in Appendix 1. The charts are marked as draft this year because the data is currently being reviewed for quality assurance and quality control.

UNL-CSD Hydrogeologist, Susan Olafsen Lackey with LCNRD Office Manager, Marilyn Schumacher evaluating geologic samples collected using a geo-probe from the Missouri River Alluvium near Aten, NE.

Water levels of these wells are used as indicators of aquifer impact due to water level decline. Spring water levels in 2021 and 2022 have shown a decreasing trend in all but two of the monitored wells in 2021 and 2022, however; most of the monitored wells still measure above the levels observed with spring readings after the 2012 drought which highly impacted wells across LCNRD. Water levels recorded in the fall of 2022 showed declines in the majority of wells. This trend has continued, therefore the staff and board are paying close attention to the declining levels and are prepared to enact controls identified in rules and regulations if downward trends continue. In 2015, four new wells were added to the monitoring wells that are constructed in the Dakota Formation Aquifer. The only monitored well that was previously monitoring this aquifer, was located in Maskell, number 31N4E2DBAB1, which caved in in 2016 and can no longer be measured. The hydrographs include measurements for 31N4E2DBAB1 through 2016 when the well caved in and is included in Appendix 1. Changes in observed static water levels for the monitoring wells for 2021, 2022, and compared to post 2012 drought is in Table 6.

LCNRD has continued to drill test holes and develop observation wells in representative areas of aquifer to better understand the hydrogeologic framework of the district and to monitor water quality and quantity of district aquifers. As of 2022, there are 69 total observation wells in 43 different locations. Some locations have 2 or 3 wells screened at different intervals. A complete listing of district observation wells and the geologic formation they are constructed in is provided in Table 7 and a map of their locations and aquifer of development is found in Figure 10. Dedicated transducers are installed in each observation well. Transducers record water

level every eight hours in most settings and each observation well is sampled at least once a year for water quality with samples sent to a certified laboratory for testing of routine parameters. Parameters that are sampled include, but are not limited to, nitrate, pH, calcium, sulfur, and chloride. Dakota formation observation wells are also sampled and tested for iron and manganese concentrations. Example of hydrographs representing static water level and nitrate concentration correlated to one another in one of observation wells is found in Figure 11. Hydrographs for the observation wells with finalized data are included in Appendix 2.

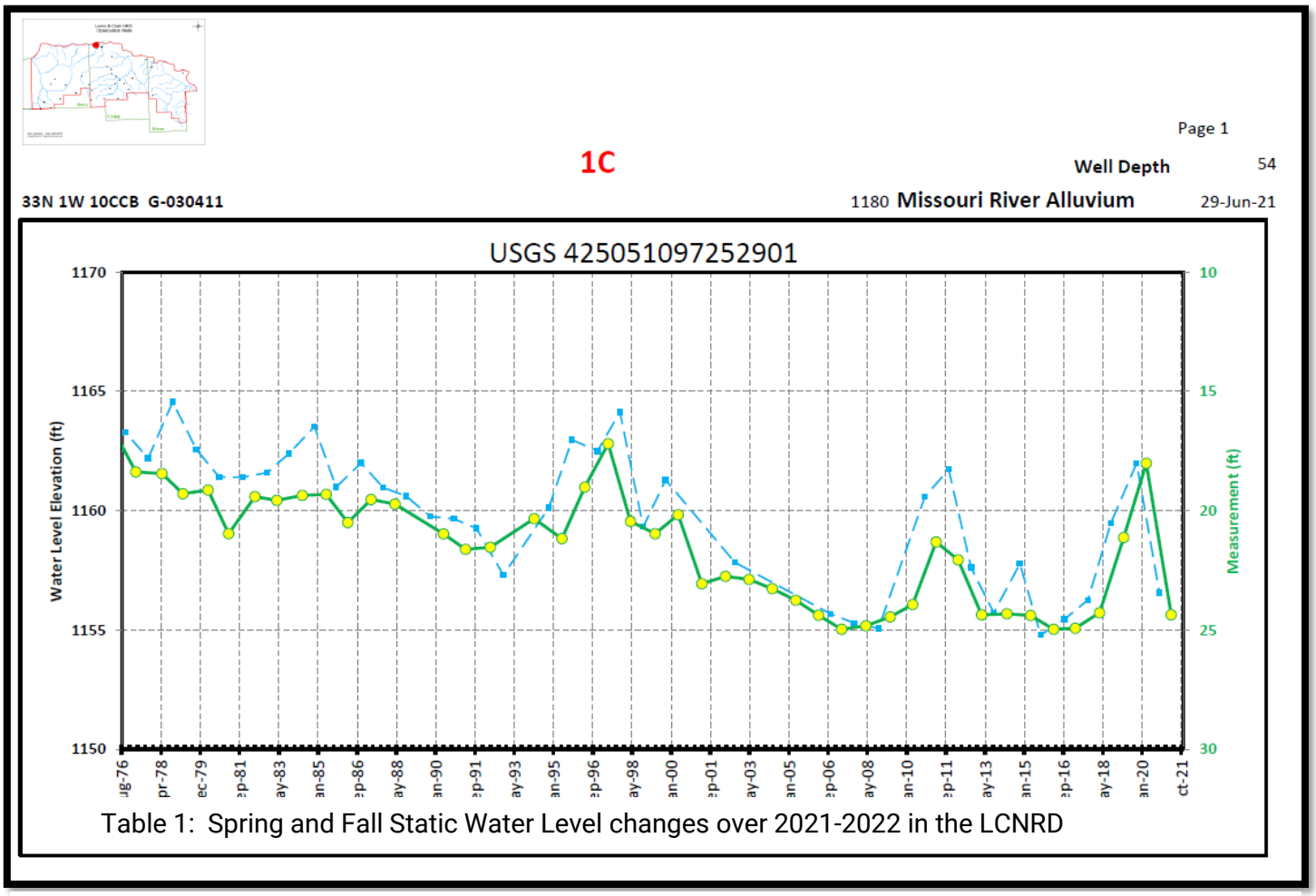


Table 1: Spring and Fall Static Water Level changes over 2021-2022 in the LCNRD

Figure 9: Example of hydrographs representing water levels from annually measured LCNRD monitoring wells

Table 6: LCNRD Monitoring Wells

Name	Registration #	Legal	Formation	2020 SWL Fall	2021 SWL Fall	2022 SWL Fall	2020 to 2021 SWL Fall Change	2021 to 2022 SWL Fall Change	2020 SWL Spring	2021 SWL Spring	2022 SWL Spring	2020 to 2021 SWL Spring Change	2021 to 2022 SWL Spring Change	2012 SWL Spring	Post 2012 Drought to 2021 SWL Spring Change	Post 2012 Drought to 2022 SWL Spring Change
3K	G-050508	12-30N-2W	UNDEFINED	191.88	191.90	193.99	-0.02	-2.09	189.45	190.08	190.27	-0.63	-0.19	192.83	2.75	2.56
6K	G-049645	31-30N-2W	UNDEFINED	173.28	174.04	175.82	-0.76	-1.78	172.03	171.88	172.51	0.15	-0.63	174.76	2.88	2.25
7K	G-030737	12-29N-4W	UNDEFINED	127.69	129.19	132.56	-1.50	-3.37	125.33	127.52	128.71	-2.19	-1.19	129.04	1.52	0.33
7C	G-014545	16-31N-1E	SANDGRAVEL	42.39	46.06	51.98	-3.67	-5.92	32.59	36.18	39.06	-3.59	-2.88	41.71	5.53	2.65
10C	G-036399	36-31N-2E	SANDGRAVEL	116.00	118.36	121.21	-2.36	-2.85	113.21	115.64	117.95	-2.43	-2.31	119.19	3.55	1.24
11C	G-042131	27-30N-2E	SANDGRAVEL	122.57	123.77	126.20	-1.20	-2.43	120.00	122.48	123.51	-2.48	-1.03	125.70	3.22	2.19
12C	G-056403	9-30N-2E	SANDGRAVEL	50.92	53.38	56.51	-2.46	-3.13	49.17	50.98	53.54	-1.81	-2.56	55.33	4.35	1.79
13C	G-035811	11-30N-1E	SANDGRAVEL	46.22	47.26	51.47	-1.04	-4.21	41.26	43.04	43.87	-1.78	-0.83	44.72	1.68	0.85
14C	G-033491	21-30N-1E	SANDGRAVEL	105.85	107.70	119.56	-1.85	-11.86	98.81	101.89	104.46	-3.08	-2.57	111.00	9.11	6.54
16C	G-056206	18-29N-1W	SANDGRAVEL	292.40	293.22	293.45	-0.82	-0.23	285.52	287.50	289.68	-1.98	-2.18	289.05	1.55	-0.63
17C	G-056985	13-29N-1W	SANDGRAVEL	92.97	93.85	95.45	-0.88	-1.60	90.85	92.85	92.55	-2.00	0.30	94.55	1.70	2.00
18C	G-054554	13-29N-1E	SANDGRAVEL	134.31	135.19	137.13	-0.88	-1.94	132.37	133.50	134.45	-1.13	-0.95	137.80	4.30	3.35
2K	G-043855	27-31N-4W	SANDGRAVEL	77.48	78.84	84.99	-1.36	-6.15	72.88	73.97	76.77	-1.09	-2.80	77.22	3.25	0.45
4K	G-008604	9-30N-3W	SANDGRAVEL	45.27	51.48	56.65	-6.21	-5.17	42.91	47.01	52.67	-4.10	-5.66	54.04	7.03	1.37
5K	G-054396	9-30N-4W	SANDGRAVEL	160.77	161.38	162.48	-0.61	-1.10	158.84	159.27	160.30	-0.43	-1.03	159.91	0.64	-0.39
8K	G-040674	13-29N-5W	SANDGRAVEL	38.17	41.20	45.24	-3.03	-4.04	34.78	38.42	41.14	-3.64	-2.72	45.30	6.88	4.16
9K	G-040860	32-29N-4W	SANDGRAVEL	116.70	121.03	128.00	-4.33	-6.97	116.62	116.77	121.09	-0.15	-4.32	129.89	13.12	8.80
10K	G-029546	34-29N-5W	SANDGRAVEL	7.44	7.44	8.16	0.00	-0.72	6.38	6.90	6.16	-0.52	0.74	7.31	0.41	1.15
3D	G-036891	8-29N-4E	SANDGRAVEL	148.49	160.53	163.83	-12.04	-3.30	148.84	154.38	157.10	-5.54	-2.72	156.93	2.55	-0.17
15C	G-050492	30-30N-1W	OGALLALA	102.57	104.00	105.79	-1.43	-1.79	102.24	102.90	103.04	-0.66	-0.14	105.20	2.30	2.16
1K	G-041985	21-31N-2W	OGALLALA	79.07	82.62	85.17	-3.55	-2.55	76.02	78.72	81.97	-2.70	-3.25	84.30	5.58	2.33
3C	G-034181	10-32N-1E	NIOBRARA	12.33	17.64	27.52	-5.31	-9.88	6.07	9.61	13.93	-3.54	-4.32	17.12	7.51	3.19
5C	G-035972	32-32N-1E	NIOBRARA	16.21	17.00	18.76	-0.79	-1.76	12.91	14.64	16.03	-1.73	-1.39	16.20	1.56	0.17
6C	G-042255	9-31N-1E	NIOBRARA	45.62	51.42	58.86	-5.80	-7.44	38.57	41.24	44.52	-2.67	-3.28	46.13	4.89	1.61
8C	G-041937	25-31N-1E	NIOBRARA	43.96	44.86	46.25	-0.90	-1.39	41.63	43.43	44.34	-1.80	-0.91	44.33	0.90	-0.01
9C	G-003900	31-31N-2E	NIOBRARA	11.86	12.91	14.39	-1.05	-1.48	9.50	10.97	12.43	-1.47	-1.46	11.87	0.90	-0.56
1C	G-030411	10-33N-1W	MORIALLV	23.45	24.34	25.37	-0.89	-1.03	22.37	24.36	25.81	-1.99	-1.45	24.36	0.00	-1.45
2C	G-009759	13-33N-1W	MORIALLV	16.61	20.32	22.49	-3.71	-2.17	13.38	17.91	20.84	-4.53	-2.93	18.77	0.86	-2.07
4C	G-005176	13-32N-3E	MORIALLV	16.12	18.39	19.52	-2.27	-1.13	14.21	17.04	19.11	-2.83	-2.07	17.98	0.94	-1.13
2D	G-025772	21-31N-6E	MORIALLV	13.26	15.99	17.01	-2.73	-1.02	9.92	15.56	19.92	-5.64	-4.36	15.54	-0.02	-4.38
Kd	G-169039	33-33N-1W	DAKOTA	39.38	41.32	47.55	-1.94	-6.23	32.33	34.37	41.93	-2.04	-7.56	N/A	N/A	N/A
Kd	G-168534	28-32N-2E	DAKOTA	53.82	55.82	64.52	-2.00	-8.70	43.55	45.59	47.32	-2.04	-1.73	N/A	N/A	N/A
Kd	G-167145	33-32N-2E	DAKOTA	143.08	144.55	154.22	-1.47	-9.67	140.80	138.12	142.88	2.68	-4.76	N/A	N/A	N/A
Kd	G-163433	36-33N-1E	DAKOTA	96.14	99.07	116.16	-2.93	-17.09	83.52	86.22	90.80	-2.70	-4.58	N/A	N/A	N/A

Table 7: District Observation Wells, Numbers, Locations, and the Geologic Formation of Construction

LCNRD Test Holes and Oberservation Wells (page 1 of 2)									
Site_#	TH_#	lat	lon	Location	T	R	RgDir	Sec	Qtr	Targets
1	05-LC-14	42.787000	-97.283683	St. Helena SW	33	1	E	35	SESW	Kd (Shallow)
1(2)	05-LC-14(2)	42.786910	-97.283694	St. Helena SW	33	1	E	35	SESW	Kd (Deep)
2	03-LC-13	42.757481	-97.348515	Menominee SE	32	1	E	18	NENE	S&G in Kn area
3	02-LC-13	42.703486	-97.288859	Fordyce East	32	1	E	34	NESE	Bow Creek Alluvial
3(2)	02-LC-13	42.703486	-97.288859	Fordyce East	32	1	E	34	NESE	Bow Creek Alluvial
4	09-LC-13	42.613128	-97.314471	Hartington West	31	1	E	33	SWSE	Green Gravel
5	08-LC-13	42.554956	-97.174672	Hartington SE	30	2	E	22	SESE	P-P S&G
6	04-LC-13	42.727792	-97.162839	Wynot WHPA	32	2	E	23	SESW	Bow Creek Alluvial
7	07-LC-13	42.496211	-97.201992	Coleridge WHPA	29	2	E	16	NENW	S&G (Deep)
8	01-LC-13	42.669685	-97.171923	Hartington NE	31	2	E	15	NENE	Bow Creek Alluvial
9	05-LC-13	42.569667	-97.454742	Pleasant Valley South	30	1	W	17	SWSE	S&G (Shallow)
9(2)	05-LC-13(2)	42.569500	-97.454906	Pleasant Valley South	30	1	W	17	SWSE	S&G (Deep)
10	06-LC-13	42.598400	-97.250017	Hartington WHPA 1	30	2	E	6	SWSW	P-P S&G
11	04-LC-14	42.823333	-97.643033	Knox-Dakota	33	3	W	22	SENE	Kd (Shallow)
12	01-LC-14	42.554667	-97.269517	Hartington SW-Kn	30	1	E	25	NWNW	Kn
12(2)	01-LC-14(2)	42.554647	-97.269111	Hartington SW-Kd	30	1	E	25	NWNW	Kd (Shallow)
13	02-LC-14	42.582450	-97.796400	Central - Knox Co	30	4	W	16	NWNW	P-P S&G
14	03-LC-14	42.583156	-97.231978	Hartington WHPA2	30	2	E	18	NENE	P-P S&G
15	Sp-LC-15	42.670239	-97.170763	Hartington NE	31	2	E	14	NWNW	Bow Creek Alluvial
15(2)	Sp-LC-15(2)	42.670236	-97.170453	Hartington NE-Kn	31	2	E	14	NWNW	Kn
16	Sp-LC-15	42.705116	-97.289792	Fordyce East	32	1	E	34	NESE	Bow Creek Alluvial
16(2)	Sp-LC-15(2)	42.705147	-97.289566	Fordyce East-Kn	32	1	E	34	NESE	Kn

LCNRD Test Holes and Oberservation Wells (page 2 of 2)										
Site_#	TH_#	lat	lon	Location	T	R	RgDir	Sec	Qtr	Targets
17	Sp-LC-15	42.601908	-97.346220	Hartington West	30	1	E	5	SWSW	Green Gravel
18	Sp-LC-15	42.612068	-97.173967	Hartington East	30	2	E	3	NENE	P-P S& G
18(2)	Sp-LC-15(2)	42.612065	-97.173842	Hartington East	30	2	E	3	NENE	P-P S& G
19	Sp-LC-15	42.655566	-97.544137	Dolphin-Bloom NE	31	2	W	22	NWNW	P-P S& G
19(2)	Sp-LC-15(2)	42.655420	-97.544179	Dolphin-Bloom NE	31	2	W	22	NWNW	P-P S& G
20	Sp-LC-15	42.596898	-97.681292	Bloomfield West	30	3	W	9	NWNW	P-P S& G
21	Sp-LC-15	42.539141	-97.779173	Bloomfield SW	30	4	W	34	NWNW	P-P S& G
22	Sp-LC-15	42.741724	-97.556690	Crofton-West	32	2	W	21	NENW	P-P S& G
23	Sp-LC-15	42.713402	-97.779137	Lindy-SW	32	4	W	27	SWSW	P-P S& G
24	Sp-LC-15	42.681056	-97.661239	Bloomfield-North	31	3	W	10	NWNW	P-P S& G
25	Fa-LC-15	42.753945	-97.347738	Menominee SE	32	1	E	17	SWNW	Narrow Paleo Valley
26	Sp-LC-16	42.844789	-97.372633	Yankton South	33	1	E	12	SWSE	Missouri River Alluv
26(2)	Sp-LC-16	42.844789	-97.372633	Yankton South	33	1	E	12	SWSE	Missouri River Alluv
27	Fa-LC-15	42.641101	-97.184731	Hartington NE	31	2	E	27	NENW	Bow Creek Alluvial
27(2)	Fa-LC-15(2)	42.641091	-97.184865	Hartington NE-Kn	31	2	E	27	NENW	Kn
28	Fa-LC-15(2)	42.649353	-97.328387	Hartington NW-Kn	31	1	E	20	SENE	Kn
29	Fa-LC-15	42.750000	-97.011389	Maskell-North	32	4	E	18	SENW	Missouri River Alluv
30	Fa-LC-15	42.423354	-96.943229	Dixon-East	28	4	E	10	NENE	P-P S&G
30(2)	Fa-LC-15(2)	42.423364	-96.943390	Dixon-East	28	4	E	10	NENE	P-P S&G
31	Fa-LC-15	42.568525	-96.937559	Dixon-North	30	4	E	15	SESE	P-P S&G
31(2)	Fa-LC-15(2)	42.568522	-96.937656	Dixon-North	30	4	E	15	SESE	P-P S&G
32	Fa-LC-15	42.423901	-96.862455	Allen WHPA	28	5	E	5	SESE	P-P S&G
33	Fa-LC-15	42.658864	-96.867960	Newcastle WHPA	31	5	E	17	NWSE	P-P S&G
34	Fa-LC-15	42.470396	-96.917631	Hwy 20	29	4	E	23	NESE	P-P S&G
35	Sp-LC-16	42.583447	-97.642176	Bloomfield WHPA	30	3	W	11	SWSW	S&G
35(2)	Sp-LC-16(2)	42.583355	-97.642181	Bloomfield WHPA	30	3	W	11	SWSW	S&G
36	Su-LC-17	42.509738	-96.830583	Martinsburg	29	5	E	10	NENW	Kd
x	Pre-14	42.491472	-97.759833	Cleaveland	29	4	W	15	SENE	S&G
x(2)	Pre-14	42.491472	-97.759778	Cleaveland	29	4	W	15	SENE	S&G
x	Spalding	42.444917	-97.808172	Creighton MW-1	29	4	W	32	NWSE	S&G
x(2)	Spalding	42.444917	-97.808172	Creighton MW-1	29	4	W	32	NWSE	S&G
x(3)	Spalding	42.444917	-97.808172	Creighton MW-1	29	4	W	32	NWSE	S&G
x	Pre-14	42.444911	-97.847481	Creighton MW-2	29	5	W	36	NWSE	S&G
x(2)	Pre-14	42.444911	-97.847481	Creighton MW-2	29	5	W	36	NWSE	S&G
x(3)	Pre-14	42.444911	-97.847481	Creighton MW-2	29	5	W	36	NWSE	S&G
x	Pre-14	42.444947	-97.867272	Creighton MW-3	29	5	W	35	NWSE	S&G
x(2)	Pre-14	42.444947	-97.867272	Creighton MW-3	29	5	W	35	NWSE	S&G
x(3)	Pre-14	42.444947	-97.867272	Creighton MW-3	29	5	W	35	NWSE	S&G
x	Pre-14	42.452353	-97.877167	Creighton MW-4	29	5	W	27	SESE	S&G
x(2)	Pre-14	42.452353	-97.877167	Creighton MW-4	29	5	W	27	SESE	S&G
x(3)	Pre-14	42.452353	-97.877167	Creighton MW-4	29	5	W	27	SESE	S&G
x	Pre-14	42.473931	-97.857272	Creighton MW-6	29	5	W	24	NWSW	S&G
x(2)	Pre-14	42.473931	-97.857272	Creighton MW-6	29	5	W	24	NWSW	S&G
x(3)	Pre-14	42.473931	-97.857272	Creighton MW-6	29	5	W	24	NWSW	S&G
x	Pre-14	42.481344	-97.857481	Creighton MW-7	29	5	W	14	SESE	S&G
x(2)	Pre-14	42.481344	-97.857481	Creighton MW-7	29	5	W	14	SESE	S&G
x(3)	Pre-14	42.481344	-97.857481	Creighton MW-7	29	5	W	14	SESE	S&G
x	03-LC-20	42.634355	-97.524246	Dolohin East	31	2	W	26	NWSW	S&G
x(2)	03-LC-20 (2)	42.634351	-97.524506	Dolphin East	31	2	W	26	NWSW	S&G
x	01-LC-20 (2)	42.670528	-97.583065	Dolphin West	31	2	W	8	SWSW	S&G
x(2)	01-LC-20	42.670515	-97.582996	Dolphin West	31	2	W	8	SWSW	S&G
x	04-LC-19	42.843697	-97.444258	Aten Shallow	33	1	W	16	NWNW	Missouri River Alluv
x	Su-LC-21	42.840705	-97.439031	Aten-East	33	1	W	16	SENW	Missouri River Alluv
x(2)	Su-LC-21	42.840705	-97.439031	Aten-East	33	1	W	16	SENW	Missouri River Alluv
x	Su-LC-21	42.760479	-97.741131	Lindy-second	32	4	W	11	NESE	P-P S&G
x	Su-LC-20	42.655407	-97.056165	Obert-North	31	3	E	15	SWSE	P-P S&G
x(2)	Su-LC-20	42.655407	-97.056165	Obert-North	31	3	E	15	SWSE	P-P S&G
x	Su-LC-20	42.635875	-97.054573	Obert-South	31	3	E	26	SWNW	P-P S&G

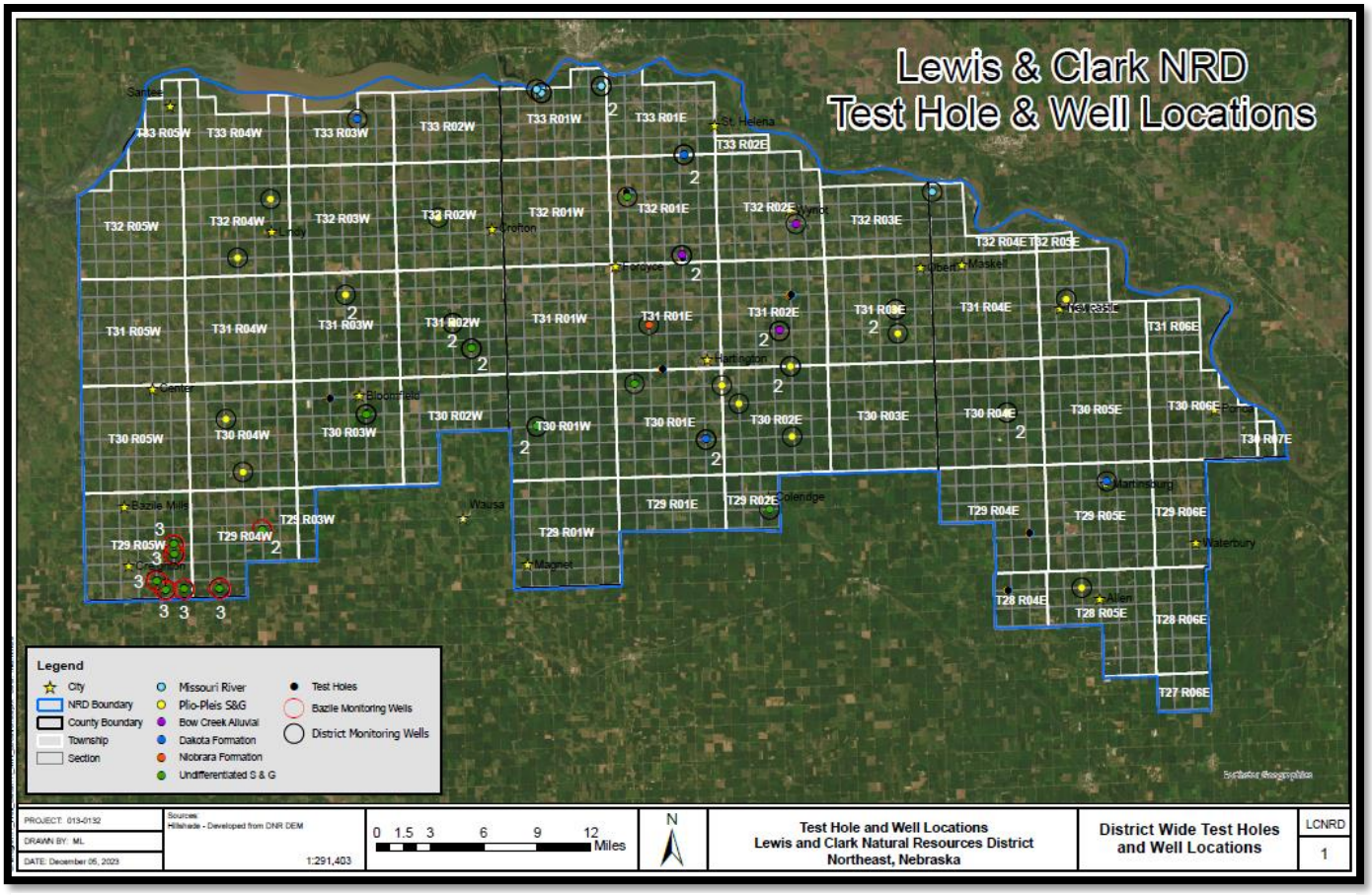


Figure 10: LCNRD Test Holes and Observation Wells, aquifers of development and location

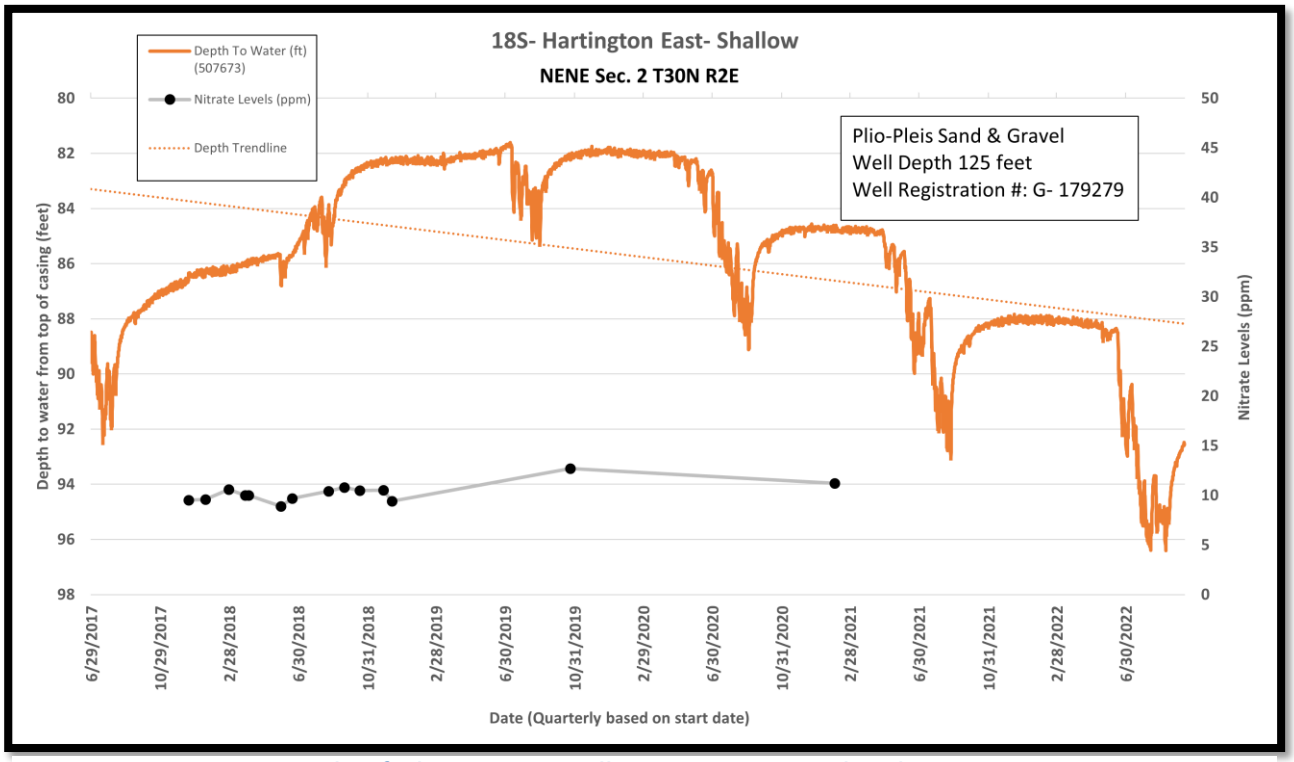


Figure 11: LCNRD Example of Observation Well Static Water Level and Nitrate Concentration Correlation hydrograph

GROUNDWATER PERMITTING AND REGULATIONS

Permits have been required since August 2014 for all new irrigation wells and for all newly irrigated acres developed in the district. Each proposed well is reviewed using a scale and scoring system which includes the number of existing wells within 6,000 feet of the proposed well, the transmissivity, and the saturated thickness of sand and gravel formations to evaluate water bearing potential of each well application. Each site proposed for groundwater irrigation expansion is also evaluated primarily to evaluate beneficial use of groundwater. Fields where more than 33% of the total acres are comprised of soil types that are 6e or greater with a slope of 12% or greater are required to implement an approved conservation plan with the Natural Resources Conservation Service (NRCS). In November of 2022 LCNRD entered a 180 day stay for new high capacity well permits due to the increasing trend in the number of permits received each month to allow for modification of the processes utilized to prepare the permits for review. The board of directors considered development in sensitive areas of the district and discussed drought impacts. An indicator score was established to facilitate review of permits with rank scores over 40. Permits with scores below 40 are discussed with the water resources committee and recommendations for approval are provided by the committee.

LCNRD directors approved 37 irrigation wells and 3,099 acres for irrigation in 2021. There were 64 wells and 6,667 acres approved for irrigation 2022. There were 7 conservation plans required over the two year period for groundwater to be applied on acres identified for agricultural

production. Table 8 and Figures 12 and 13 represent the irrigation wells and expanded irrigated acres approved during the report period.

Flow meters have been required on all new irrigation wells developed following adoption of revised groundwater quantity rules and regulations in 2014. Figure 14 and 15 represent irrigation water use and crops produced for 2021 and 2022 based on reports received. Annual reporting will continue to be required on all permitted wells in LCNRD.

Certification of irrigated acres in LCNRD continued to proceed slowly with the process being shifted over to a new WebApp and new personnel. The acre certification process is anticipated to be completed within two to three years. As of December 31, 2022, there have been 17,007 acres certified. Table 9 is a summary of the certified irrigated acres in LCNRD in 2021 and 2022. Official certification of irrigated acres is made upon board approval of the landowner provided information.

LCNRD has worked with USGS to maintain stream gages on Bazile Creek near Center and worked with USGS and NeDNR on the Bow Creek stream gage near Wynot. The first 3-year agreement for the Bow Creek gage concluded in early 2019. A second 3-year agreement has been re-negotiated for LCNRD and NeDNR to evenly split the portion of the annual cost not covered by the USGS. Stream gage hydrographs are included in the NeNRD IMP report. Additional stream gage needs will be assessed over the next two-year IMP review period.

LCNRD plans to revise the district groundwater management plan that is required by Nebraska Revised Statute 46-673.01 to bring it up to date with current understanding of water resources. The plan was originally drafted in 1984 and modified through an amendment in 2014. Modification to the Rules and regulations pertaining to groundwater quantity were board approved and implemented in 2021. The modifications were primarily made to clean up a variety of items to make the rules structure meet the intent of how they are carried out. Additional modifications are being considered to the rules and regulations including combining all existing rules and regulations into one document to facilitate implementation and remove duplications and conflicting requirements. Additional modifications may be needed following the groundwater management plan update.

Table 8: Board approved irrigation well permit and expanded irrigation permit applications for 2021 and 2022

2021 Well and Acre Expansion Permits				
Permit	Aquifer	New Irrigated Acres	Existing Irrigated Acres	Soils % 6e
Month				
JANUARY				
none	S&G	33	134	6.0%
LC-283	S&G	53	0	23.6%
LC-284	S&G	140	0	0.0%
LC-286	S&G		0	15.9%
FEBRUARY				
LC-288R	S&G	0	133	17.2%
LC-289R	S&G	106	0	0.0%
LC-290	S&G	0	68	42.7%
MARCH				
none	S&G	71	187	58%
none	Kd	66.5	115	15%
none	Kd	66.5	115	10%
LC-291	S&G	134	0	9%
LC-292	S&G	14	112	3%
none	S&G	33	66	0%
LC-293	S&G	90	0	7%
none	S&G	33	0	6%
LC-294	S&G	133	0	0%
APRIL				
LC-295	S&G	0	233	in
LC-296R	Kd	0	173	25%
LC-297	S&G	102	0	0%
LC-298	S&G	133	0	4%
LC-299	Kd	35	468	0%
MAY				
LC-300	S&G	0	135	0.0%
LC-301	S&G	133	0	6.7%
LC-302	S&G	0	219	26.4%
LC-303	S&G	134	0	0.0%
LC-304	S&G	110	0	0.0%
LC-305L	S&G	0	133	0.0%
JUNE				
LC-307	S&G	133	0	11.2%
LC-308	S&G	0	71	57.5%
July				
LC-309R	S&G	0	134	5.4%
LC-311	S&G	67	0	0.0%
August				
none				
September				
none	S&G	38	120	30.3%
LC-313	S&G	0	149	6.9%
LC-315NF	Kn	133	0	36.9%
LC-317	S&G	0	72	1.1%
none	S&G	66	133	0.0%
OCTOBER				
none				
NOVEMBER				
LC-319	S&G	66	0	3.3%
LC-320	S&G	250	0	57.3%
LC-321	S&G	123	0	26.2%
LC-322	S&G	133	0	0.3%
none	S&G	27	199	14.8%
none	S&G	23	100	0.0%
none	S&G	35	151	1.4%
DECEMBER				
LC-323	S&G	135	0	5.2%
LC-324	Kn	66	0	19.7%

2022 Well and Acre Expansion Permits									
Permit	Aquifer	New Irrigated Acres	Existing Irrigated Acres	Soils % 6e	Permit	Aquifer	New Irrigated Acres	Existing Irrigated Acres	Soils % 6e
Month					Month				
JANUARY					MAY				
none	Kn	0	66	Existing	LC-370	Kd	0	170	Existing
LC-325R	S&G	0	0	Livestock	None	S&G	30	65	0.0%
LC-327	S&G	120	0	0.0%	None	S&G	38	46	0.0%
LC-328	S&G	250	0	57.3%	LC-371	S&G	66	0	0.0%
LC-329L	Kn	0	133	0.0%	LC-372R	Kn	0	365	Existing
LC-330	S&G	75	0	59.6%	LC-373	S&G	0	133	Existing
LC-331	Kn	133	0	6.0%	LC-374	S&G	185	0	2.7%
LC-332	S&G	130	0	14.2%	JUNE				
LC-333	S&G	130	0	12.2%	None	S&G	21	130	1.1%
LC-335	S&G	220	0	19.5%	LC-376	Kn	38	0	0.0%
LC-336	S&G	0	91	Existing	None	Kn	58	0	0.0%
LC-337	S&G	0	70	Existing	LC-377	Kn	115	0	15.6%
none	S&G	80	266	68.3%	LC-334	S&G	0	0	Existing
LC-338	S&G	133	0	24.1%	July				
FEBRUARY					LC-378R	S&G	0	117	Existing
LC-339	S&G	136	0	16.1%	LC-379	S&G	110	0	0.0%
LC-340	S&G	51	0	0.0%	none	S&G	23	0	0.0%
LC-341	S&G	133	0	27.9%	LC-381	S&G	151	0	0.0%
LC-343	Kn	118	0	2.4%	LC-384	S&G	70	0	3.7%
LC-344	Kn	75	133	0.0%	August				
LC-345	S&G	250	0	23.1%	none	Kn	17	118	2%
LC-346	Kn	0	365	Existing	LC-385	Kd	405	0	0%
MARCH					September				
None	Kd	66	133	24%	LC-386	S&G	0	133	0.0%
None	S&G	284	0	53%	None	Kd	141	170	47.2%
None	S&G	66	186	0%	LC-387R	S&G	0	113	Existing
LC-347	Kn	0	110	0%	LC-388	S&G	0	102	Existing
LC-348	S&G	136	0	25%	None	S&G	98	133	0.0%
LC-349	S&G	19	0	6%	LC-389	S&G	135	0	19.3%
LC-346	Kn	0	365	Existing	LC-390	S&G	25	216	5.5%
APRIL					none	Kn	17	118	2%
LC-346	Kn	0	365	Existing	LC-385	Kd	405	0	0%
LC-350	S&G	0	173	Existing	OCTOBER				
LC-351	S&G	0	146	Existing	None	S&G	53	80	27.0%
LC-352	S&G	33	0	0%	None	S&G	42	172	16.2%
LC-353	S&G	102	0	0%	LC-391	S&G	0	660	7.3%
LC-354	Kn	88	0	0%	LC-393	S&G	137	0	16.3%
LC-355R	Kn	0	167	Existing	None	S&G	28	106	48.6%
LC-356	Kd	137	0	0%	LC-394	S&G	198	0	7.2%
LC-357R	S&G	0	133	Existing	LC-395	S&G	60	0	0.0%
LC-358	Kn	61	0	0%	LC-396	S&G	33	100	0.0%
LC-359	Kn	0	40	Existing	None	S&G	100	133	5.4%
LC-360	S&G	180	0	0%	None	S&G	120	266	2.5%
LC-361	S&G	33	0	23%	None	S&G	133	266	15.0%
LC-363	S&G	313	0	13%	LC-398	S&G	72	0	0.0%
None	S&G	100	134	41%	LC-400	S&G	133	0	15.8%
None	S&G	65	164	0%	NOVEMBER				
LC-365	S&G	0	135	Existing	LC-401	S&G	0	183	8%
LC-366	Kd	73	133	0%	LC-402	Kd	0	133	6%
LC-367	Kd	51	125	0%	DECEMBER				
LC-368	Kn	179	0	6%	none				
None	S&G	50	102	8%					
LC-369	Kn	0	208	0%					
None	S&G	12	103	0%					

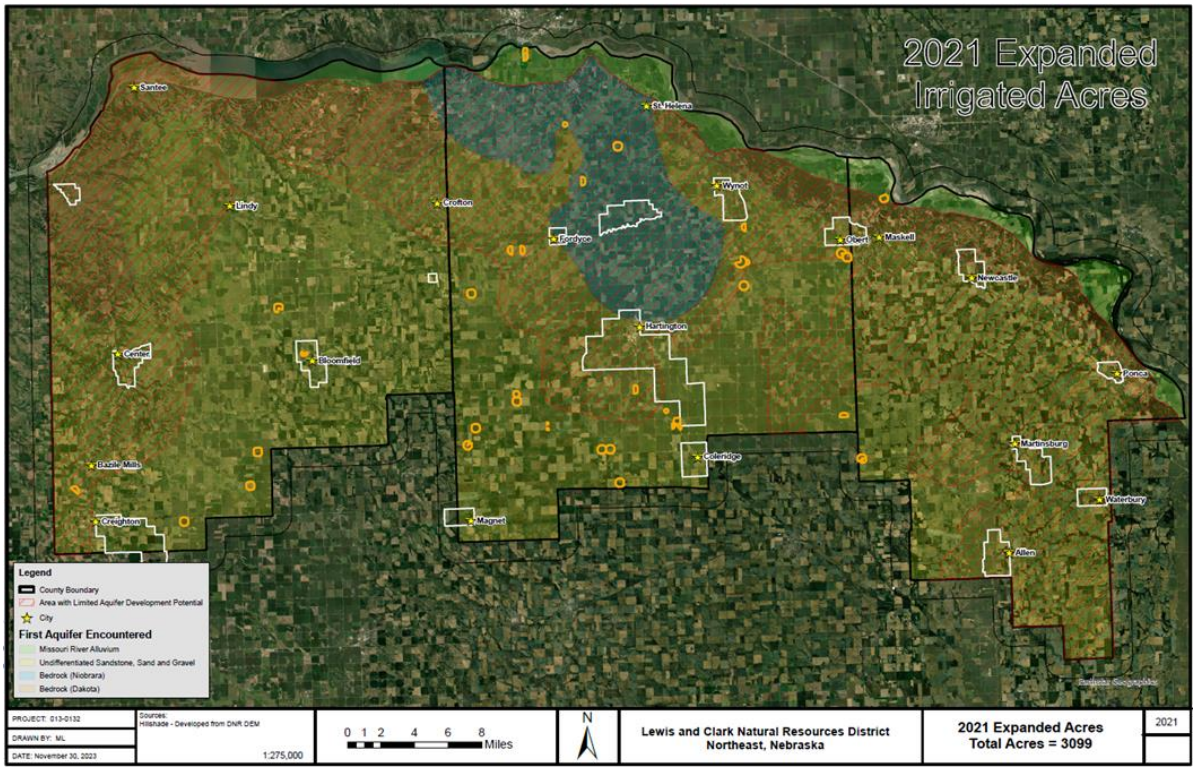


Figure 12: 2021 Expanded irrigated acres in LCNRD

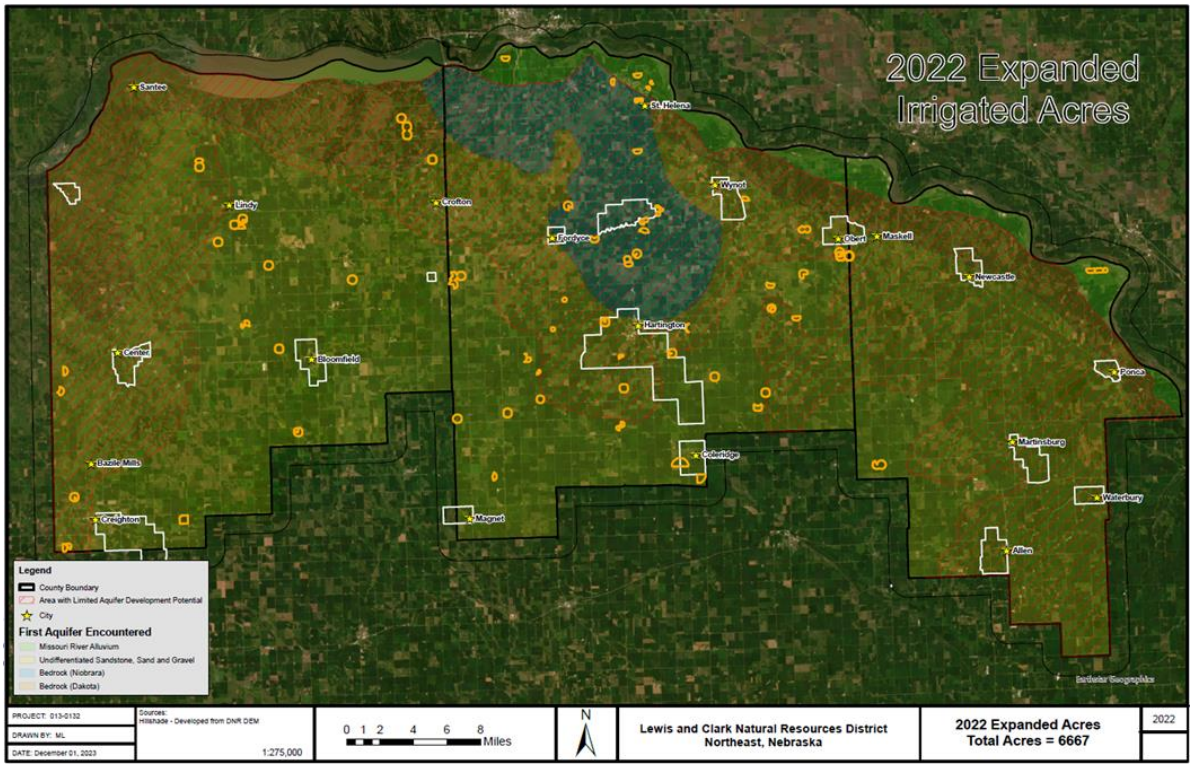


Figure 13: 2022 Expanded irrigated acres in LCNRD

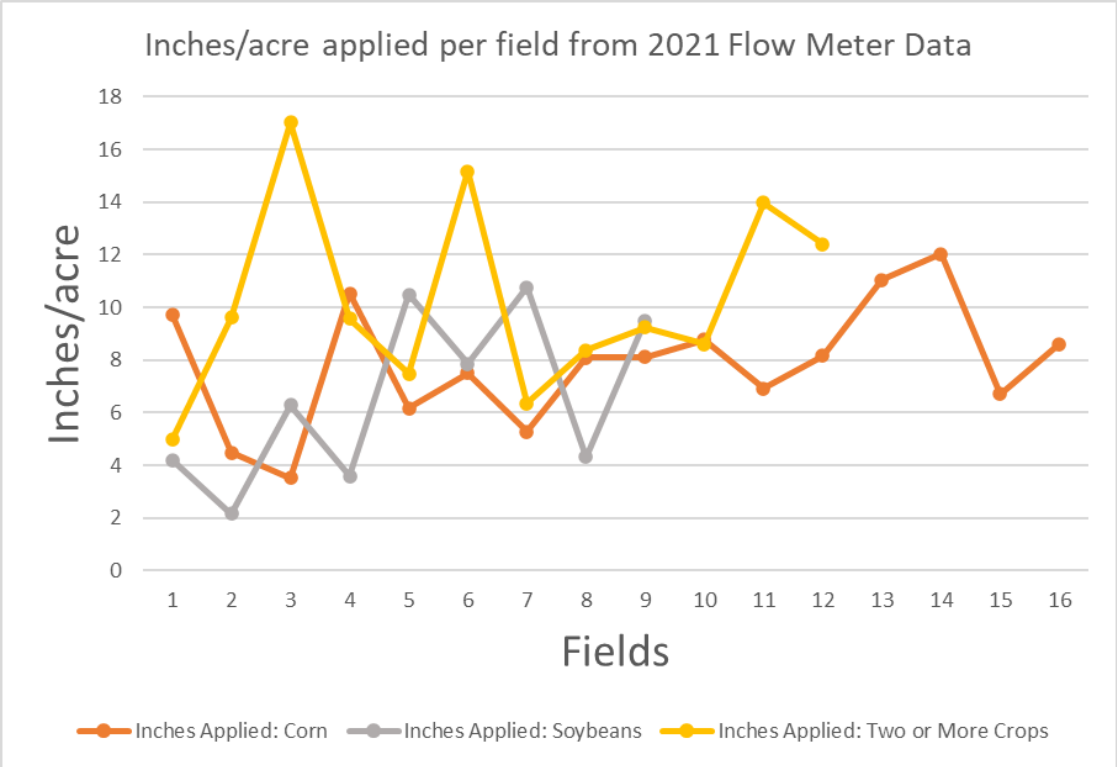


Figure 14: 2021 Flow Meter data representing groundwater applied from irrigation wells (only new and replacement wells constructed since 2014)

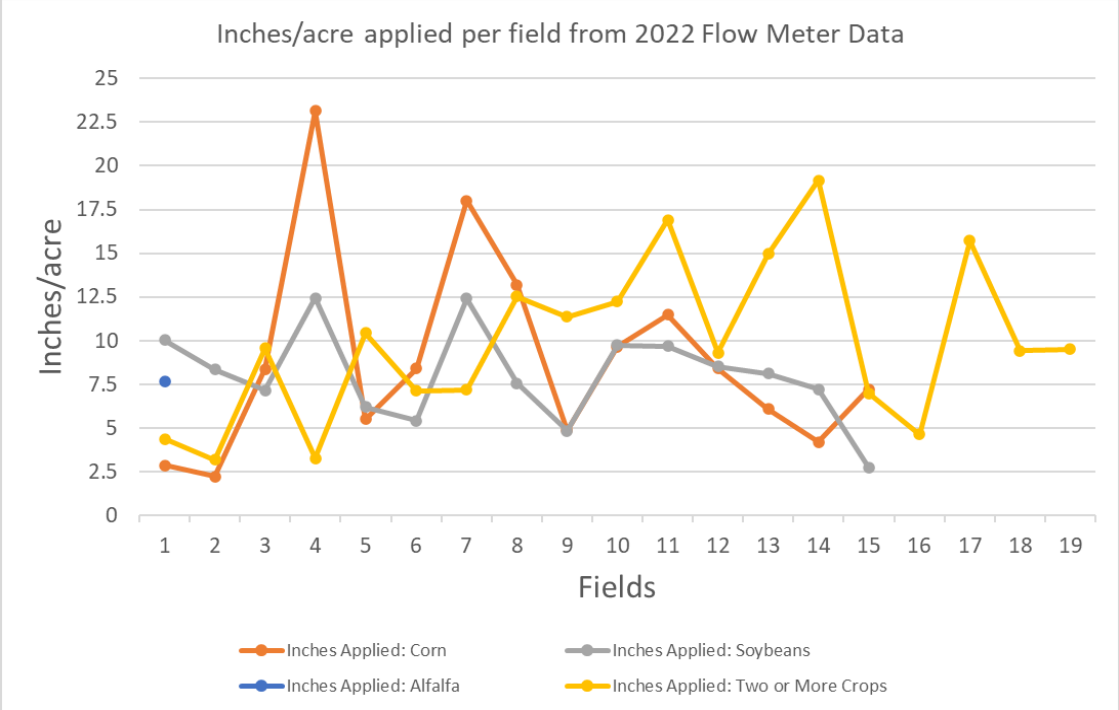


Figure 15: 2022 Flow Meter data representing groundwater applied from irrigation wells (only new and replacement wells constructed since 2014)

Table 9: Board approved certified irrigated acres for 2021, 2022 and total as of December 2022

Month Reviewed	Parcels or Certifications	Acres Certified
February 2021 Approvals	20	1901
April 2021 Approvals	14	1189
July 2021 Approvals	9	710
April 2022 Approvals	10	1169
2021-2022 Approved Acres	**53**	**4969**
End of 2022 Total Acres		**16957**

COLLABORATION WITH OTHER ENTITIES

MISSOURI RIVER RECOVERY IMPLEMENTATION COMMITTEE

Objective 2.2 in the IMP and related action items outline specific activities for NeDNR regarding Missouri River activities. It was important to the stakeholders and the LCNRD that NeDNR share knowledge gained through participation in the Missouri River Recovery Implementation Committee (MRRIC), as long as Nebraska remains a participating member. For more information about MRRIC, please see the website at https://www.nwo.usace.army.mil/mrrp/mrric/.

Shuhai Zheng, Division Head of NeDNR's Engineering Division, provided representation for Nebraska at MRRIC meetings and virtual calls during the IMP reporting period of 2021-2022. There was one MRRIC plenary meeting held in 2021(November) and two meetings held in 2022 (July and November). A record of decision for the Fort Peck Dam Test Release Environmental Impact Statement (EIS), which identifies and compares alternative test releases from Fort Peck Dam, was signed on November 12, 2021. Based on the Corps projected reservoir conditions, the Fort Peck Dam test releases could be implemented in 2024. According to the Fort Peck EIS, changes to the Fort Peck Dam releases (if implemented) would not have any significant effects on operations of the Gavins Point Dam.

The Corps are finalizing their environmental Assessment reports on two interception rearing complexes (IRC) for the endangered pallid sturgeon in the reach of the Missouri River below Kansas City and plan to reward construction contracts in 2023. The Corps will also initiate a limit re-consultation with USFWS to propose a different approach for resolving uncertainties with the lower basin pallid population and to develop a management action for the species that will be more broadly supported.

LCNRD

LCNRD became an active member of the Missouri Sedimentation Action Coalition (MSAC) in 2018. The group is working to garner support and funding to draft a plan to minimize the impacts of sediment in Lewis and Clark Lake and other reservoirs on the Missouri River. Since 2018, MSAC has been working with stakeholders and the US Army Corps of Engineers to develop a Sediment Management Plan for Lewis and Clark Lake. MSAC anticipates this process will assist the other Missouri River reservoirs in future planning. Section 22 program funding has been approved to draft the plan and identify activities to reduce/mitigate sedimentation in Lewis and Clark Lake that would be eligible for future federal funding if/when available. LCNRD and CKRWP have continued with a plan to locate an alternative source for the CKRWP water system despite the anticipated development of a plan. The likelihood sedimentation would be mitigated in time to maintain the CKRWP intake is extremely small. CKRWP is working to identify a solution to replace the intake in Lewis and Clark Lake.

LCNRD collaborates with the University of Nebraska Conservation and Survey Division (UNL-CSD) to conduct groundwater investigation and facilitate projects to further development of the LCNRD specific hydrogeologic framework. UNL-CSD has worked and continues to partner with

LCNRD to drill test holes, record stratigraphy and lithology, construct observation wells, develop grant applications and provide overall expertise relating to groundwater resources and geology of the district. The work of UNL-CSD to define areas of investigation for further study and for AEM surveys has been critical to protecting groundwater resources and defining future work in the district.

LCNRD continues to be an active member of the Eastern Nebraska Water Resources Assessment (ENWRA) which completes work through a cooperative agreement with 6 NRDs to develop a geologic framework and water budget for the previously glaciated portion of eastern Nebraska. Data complied pertaining to LCNRD through the partnership with ENWRA including AEM surveys completed is available on the ENWRA website at www.enwra.org. Working with UNL-CSD and using AEM data, LCNRD can assist landowners and communities trying to locate groundwater for municipal, livestock, domestic, or irrigation development. With limited aquifers in some areas of the district, the AEM flights provide additional information for development of beneficial use which would otherwise be unknown to the landowners. Figure 16 represents the AEM survey lines flown in LCNRD.

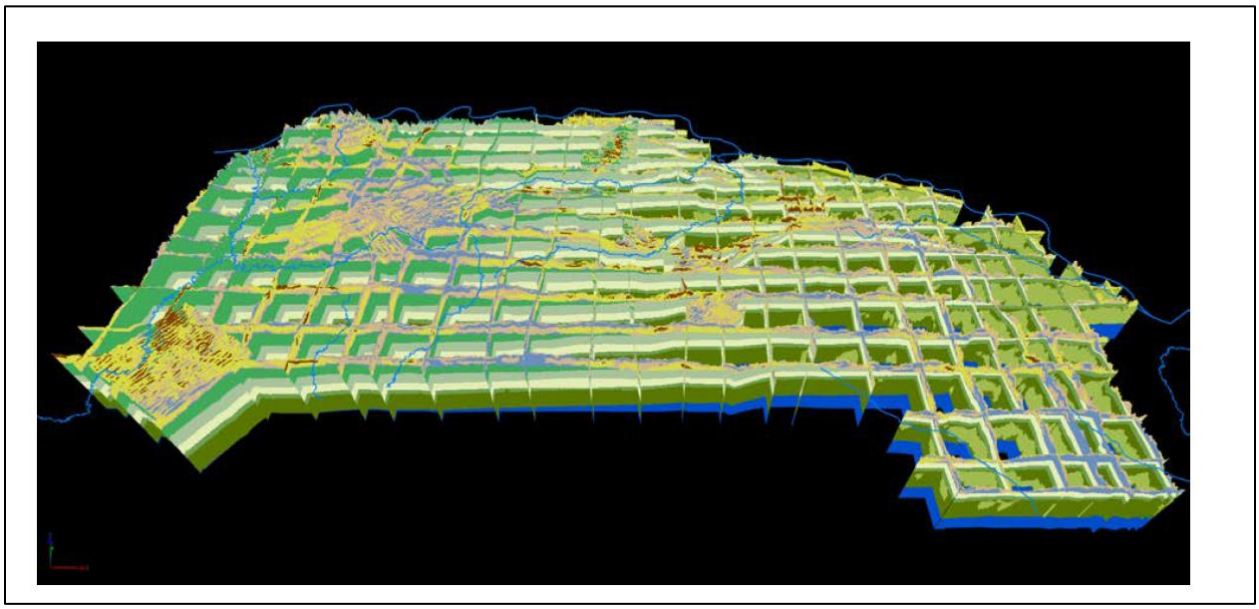


Figure 16: Airborne Electromagnetic Mapping and Hydrogeologic Framework of Selected Regions of the Eastern Nebraska Water Resources Assessment Area – Chapter on the Lewis and Clark Natural Resources District

TECHNICAL STUDIES, RESEARCH AND PROJECTS (NeDNR)

LOWER PLATTE MISSOURI TRIBUTARIES MODEL

In 2022, NeDNR began work to extend the LPMT model through 2021. There are several different inputs that are changing the way that data is gathered for the model. Weather data inputs from 2010-2021 will be sourced from PRISM grid locations, rather than from individual weather stations monitored through the High Plains Regional Climate Center. This change in inputs will reduce data gaps, both temporally and spatially, and will reduce the impacts of weather stations that might be decommissioned. Further, in 2023 NeDNR plans to update the current model from MODFLOW-2005 to MODFLOW 6. This will facilitate development of sub-regional models and analysis with coupled model scenarios.

LPMT SUB-REGIONAL MODELING

Currently the NRD's are developing models that can be coupled with the LPMT model to produce both regional and sub-regional analyses. The sub-regional models utilize the locally gathered AEM data, that then transforms that data into information that is used by the LPMT model. The data for the sub-regional models provide a higher spatial resolution and uses the LPMT model as a reference. This information along with the AEM data allows for better interpretation of the aquifer.

For additional information on what specific NRD's are doing in the Lower Platte Basin, please refer to the Lower Platte Basin Wide Annual Report that can be found on the NeDNR website at https://dnr.nebraska.gov/water-planning/lower-platte-basin-wide-plan.

TECHNICAL STUDIES, RESEARCH AND PROJECTS (LCNRD)

NeDNR has been working to develop the Lower Platte Missouri Tributaries Model for the last several years and LCNRD has provided information as requested for model development. LCNRD sees the need to review how data is interpreted in the model to ensure it is an accurate representation of the aquifer utilization in LCNRD. It was observed in the 2014 portion of the report provided for model production that wells were designated as bedrock wells in the southern portion of the district where very few, if any, wells are constructed in bedrock formations. This concern must be addressed with NeDNR prior to use of the model to determine Fully Appropriated Basin (FAB) status. The district plans to work with NeDNR and others to review and produce a workable, representative model for the Missouri Tributaries including LCNRD.

In the future AEM survey data could be utilized to identify areas of potential hydrogeologic connectivity and to identify where aquifer recharge occurs. LCNRD sees benefit to incorporating AEM survey data in the Lower Platte Missouri Tributaries Model prior to finalization. Currently, there is no defined plan to utilize the data to improve recharge models and calculations, however, the data is available to do so. The information from AEM surveys

have been used to evaluate aquifer systems of the district and to provide landowners geologic information when considering well development.

Work continues to create a central hub for the data collected and used at the LCNRD. Currently Longitute103, which is a data driven web app developer, is creating a WebApp that will house and tabulate much of the data that is collected throughout the year. The WebApp is intended to provide data management for flow meters, well permits, chemigation, groundwater annual report and related data, water quality parameters, water levels and acre certification.

EDUCATION AND OUTREACH

PUBLIC OUTREACH EVENTS (NEDNR)

NeDNR has continued to actively engage with partnering local natural resources agencies across the state through water planning, floodplain management, and field office activities. In addition, the Department continues to seek opportunities to interact with stakeholders through participation in a wide variety of public outreach events. Where applicable, the Department utilizes interactive exhibits that include two physical models (groundwater flow model and flood simulation) and three interactive web applications such as the stream flow simulation. The three simulations are designed for grades six through twelve or ages ten through eighteen and can be used by educators to help students understand basic water concepts. These simulations along with their associated worksheets can be found on the Department's website at https://dnr.nebraska.gov/water-planning/stream-simulation-games.

Due to the Covid-19 pandemic, NeDNR participated in a reduced number of outreach events during the last reporting period. There was no outreach participation by the Department in 2021, and it was not until late 2022, that the Department started to participate in outreach activities more regularly. While the Department's participation in the NRD's outreach events was severely limited, the Department did participate in the following statewide or regional events in 2022:

- Husker Harvest Days,
- Nebraska State Fair,
- Nebraska Women in Agriculture conference.

PUBLIC OUTREACH EVENTS (LCNRD)

LCNRD continues to work towards increasing public awareness of natural resources including ground and surface water conditions by providing educational materials and presentations. News articles published in 2021 and 2022 pertaining to ground or surface water include spring and fall updates on groundwater levels in the measured wells across the district, articles detailing educational events held to benefit the residents of the district, articles about the importance of sealing abandoned wells, and articles that address the importance of conservation and soil health for the protection of ground and surface water resources.

Directors and staff also take part in several conferences and educational opportunities throughout the year and share that information with fellow residents of the district.

In the 2021-2022 reporting period, LCNRD participated in the following public outreach events to engage stakeholders and/or to disseminate information:

- Cedar and Knox County Fairs
- Ponca State Park Outdoor Expo
- AquaFest for 5th graders
- Wonderful World of Water for high school students
- Bazile Groundwater Management Area – Field Days and Winter Meetings
- Bow Creek Watershed Project - Field Days, Producer Meetings, Soil Health Workshops
- Local Class Educational Outreach
- Know-Your-Well Outreach Program
- Haskell Ag Lab Family Day

The LCNRD staff will be creating brochures that focus on the 5 different aquifers that are across the district to inform the public more on the groundwater located in their region. The 5 aquifers that cover the district would be the Missouri River Alluvium, Ogalala Aquifer, Paloe-platazine sand and gravels, Dakota Formation and Niobrara formation.

LCNRD and NeDNR staff are jointly creating a brochure to well and surface water permit applicants that describes hydrogeologic connection and the purpose of integrated management. When completed, the document will be provided to all applicants for well permits and surface water permits. The district will work with NeDNR to develop and disseminate additional information and/or participate in public outreach events about integrated water management as deemed necessary or beneficial.

PROGRESS TOWARDS GOALS AND OBJECTIVES OF THE IMP

The following sections identify action items that were worked on by NeDNR during the reporting period. These actions help LCNRD and NeDNR make progress, in incremental steps, towards achieving the goals and objectives of the IMP.

GOAL 1: DEVELOP AND MAINTAIN A DISTRICT-WIDE WATER INVENTORY

- Objective 1.1. Create and maintain a comprehensive database of groundwater and surface water
    - 1.1.1 Compile and update information concerning streamflow, surface water uses and hydrologically connected areas.
    - 1.1.3 Inventory impact analyses and/or aquifer testing on new, large groundwater uses and surface water appropriations.
    - 1.1.4 Continue certification of acres District-wide.
    - 1.1.5 Update hydrographs for groundwater wells monitored.
- Objective 1.2. Address data gaps in monitoring networks.
    - 1.2.1 Implement and maintain a voluntary water use reporting system for surface water users.
    - 1.2.2 Evaluate the need for new stream or well level gages, and the best location for these.
    - 1.2.3 Expand knowledge of groundwater inventory by filling in the hydrogeologic framework with additional test holes and observation wells for monitoring in areas where deemed appropriate by CSD.
    - 1.2.4 Increase the number of monitoring wells in the Dakota and Niobrara Aquifer systems.
    - 1.2.5 Develop additional observation wells in areas that lack adequate data to follow the trends of groundwater levels.
- Objective 1.3. Improve delineations of hydrologically connected groundwater and surface water.
    - 1.3.1 Develop groundwater models for Eastern Nebraska to further understanding of hydrologically connected areas.
    - 1.3.2 Assess benefits/limitations of using remotely accessed electromagnetic data to aid interpretation of hydrologically connected areas.

GOAL 2: PROTECT EXISTING USERS WHILE ALLOWING FOR FUTURE WATER DEVELOPMENT

- Objective 2.1. Collaborate with local, state, and federal entities to better manage hydrologically connected groundwater and surface water.
    - 2.1.1 Stay up-to-date on USFWS, USACE and NPS water management efforts that may affect LCNRD and to facilitate compliance with state and federal laws.
    - 2.1.2 As hydrologically connected areas are refined, coordinate management efforts with affected local entities as needed.

    - 2.1.3 Collaborate with UNL, NRCS, others to identify areas in the District where the potential for groundwater recharge has changed and why.
- Objective 2.2. Maintain and Increase knowledge about activities along the Missouri River
    - 2.2.1 Continued Department participation in MRRIC as long as Nebraska remains a participating member.
    - 2.2.2 Coordination to disseminate pertinent information to the District regarding activities along the Missouri River.
    - 2.2.3 Continued monitoring of USACE potential to charge for surface water use from storage in Lewis and Clark Lake.
- Objective 2.3. Improve water resources sustainability through innovative management strategies.
    - 2.3.1 Consider establishing different requirements for groundwater wells drilled before the designation of a management area and those drilled afterward.
    - 2.3.3 Explore methods to minimize water use conflicts (surface or groundwater).

GOAL 3: INCREASE PUBLIC AWARENESS AND UNDERSTANDING OF INTEGRATED WATER MANAGEMENT

- Objectives 3.1. Expand public outreach programs for ground and surface water.
    - 3.1.1 Increase news releases regarding groundwater conditions and activities.
    - 3.1.2 Create new educational/informational handouts about groundwater and surface water (well/surface water permitting, trends in surface water and groundwater levels, etc.)
- Objectives 3.2. Expand public outreach programs related to integrated water management
    - 3.2.1 Disseminate information through the District website about federal activities on the Missouri River with respect to groundwater and surface water supply in the District.
    - 3.2.2 Develop informational materials about integrated water management and, as needed, other groundwater and/or surface water related topics affecting the District
    - 3.2.3 Jointly participate in public outreach events related to integrated water management.

JOINTLY IDENTIFIED ACTION ITEMS FOR THE NEXT TWO YEARS

LCNRD and NeDNR jointly identified actions that LCNRD will work on during the next two years and report on at the next biennial review. These actions are listed below.

GROUNDWATER LEVEL MONITORING

- Continue monitoring water levels in irrigation wells and observation wells.
- Continue updating hydrographs of water levels in irrigation wells.

- Track and report groundwater well permit and expanded irrigated acre applications and permits.
- Track and report flow meter data from irrigation wells constructed since 2014.

COLLABORATION WITH OTHERS

- Continue working with MSAC on options to address sedimentation in Lewis and Clark Lake and other Missouri River Tributaries.
- Continue working with ENWRA and to define the hydrogeologic framework in eastern Nebraska.
- Continue working with UNL-CSD to investigate groundwater resources and hydrogeologic connection in the district.

TECHNICAL PROJECTS AND STUDIES

- Continue to work with NeDNR on the Lower Platte Missouri Tributaries Model for FAB review and determination.
- Continue to utilize AEM surveys to evaluate the geology and geologic framework of the district to benefit knowledge and management of ground and surface water resources of the district.
- Identify with directors, staff, and/or stakeholders the need for additional projects and/or studies.

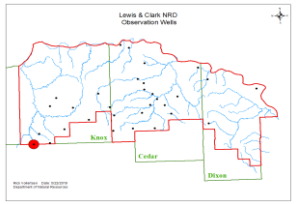
EDUCATION AND OUTREACH

- Continue distributing press releases to local newspapers to inform the public about water resource activities, conservation, and opportunities in LCNRD.
- Continue participation in educational events that promote water resource conservation and understanding.
- Complete the education component of the IMP with NeDNR and distribute with all well permit and irrigate acre expansion permits.

In addition to the 3 goals of the IMP the Stakeholder Committee identified 2 long-term goals. The first long-term goal is to increase understanding of tile drainage systems in the district and their impact on water supplies. Although the district sees benefit to investigating the impact of drainage tile on ground and surface water no additional studies have been proposed or implemented. The second long-term goal is to develop programs and or guidelines to encourage water conservation for municipal agricultural and industrial applications. Development of a specific program has not been accomplished, however water saving best management practices (BMPs) are encouraged across the district.

Appendix 1

Hydrographs of Monitoring Well static Water Levels



10K

Well Depth 59

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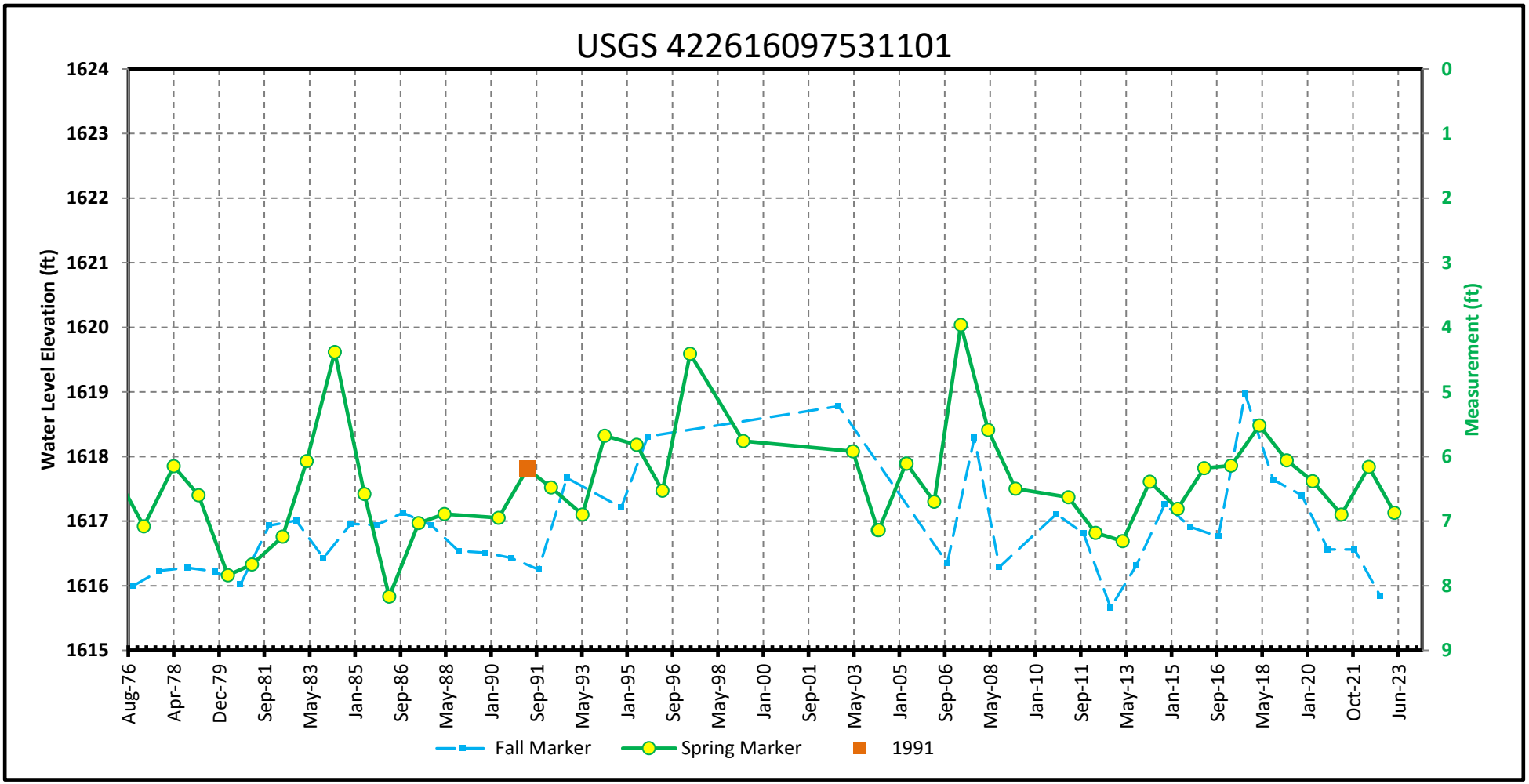

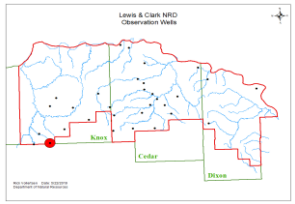

9K

Well Depth 244

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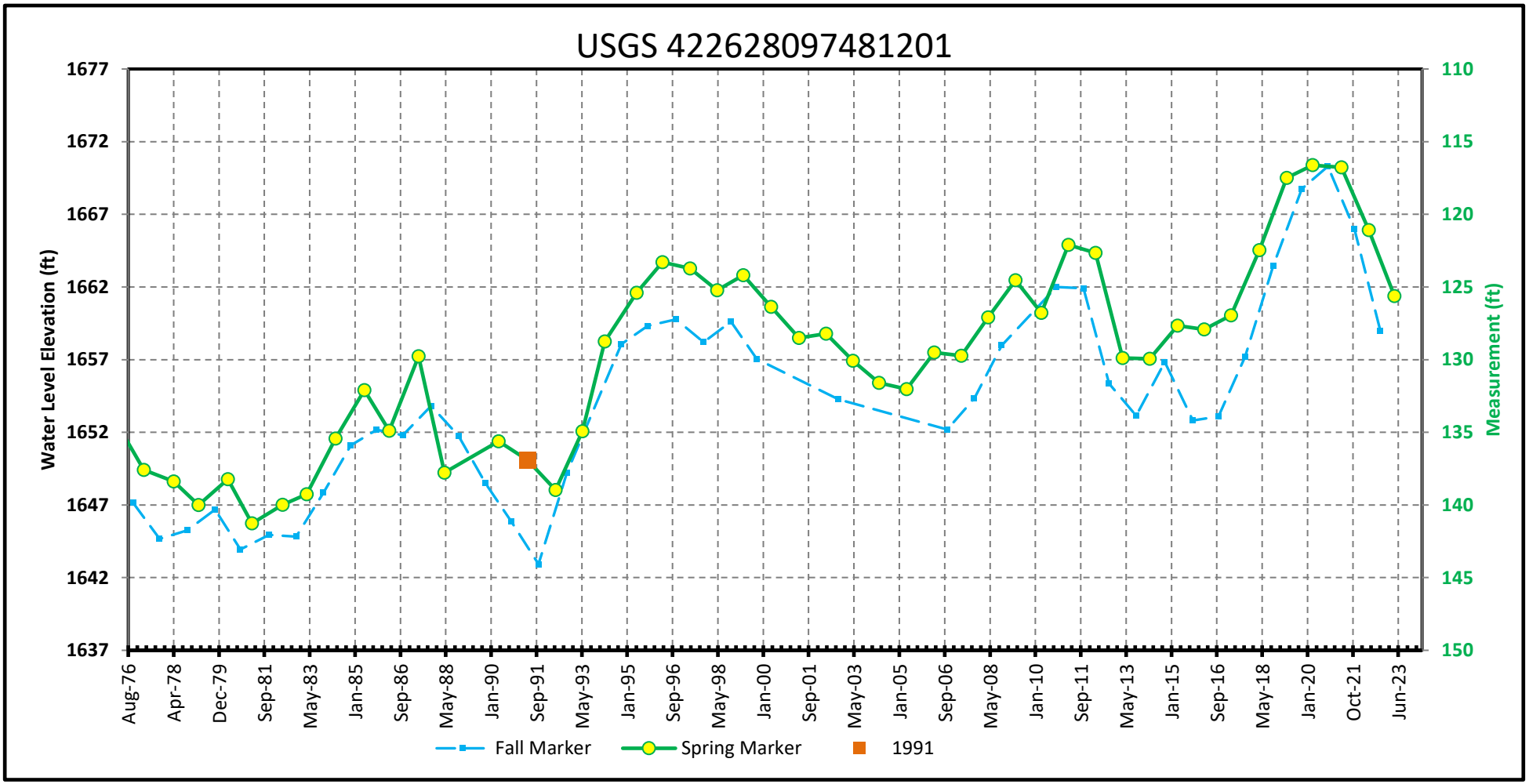

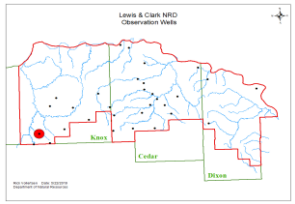

8K

Well Depth 83

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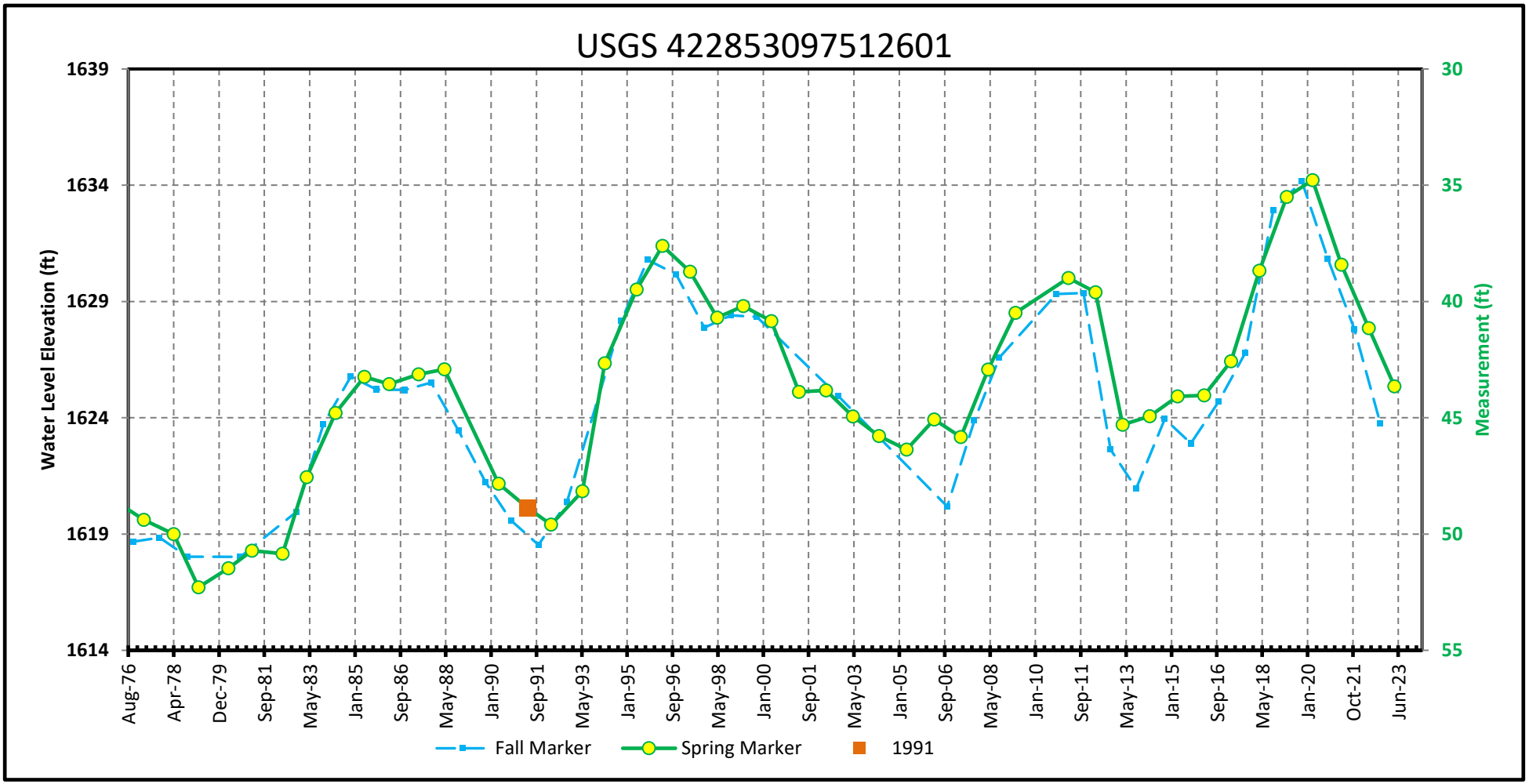

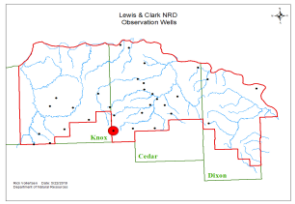

16C

Well Depth 320

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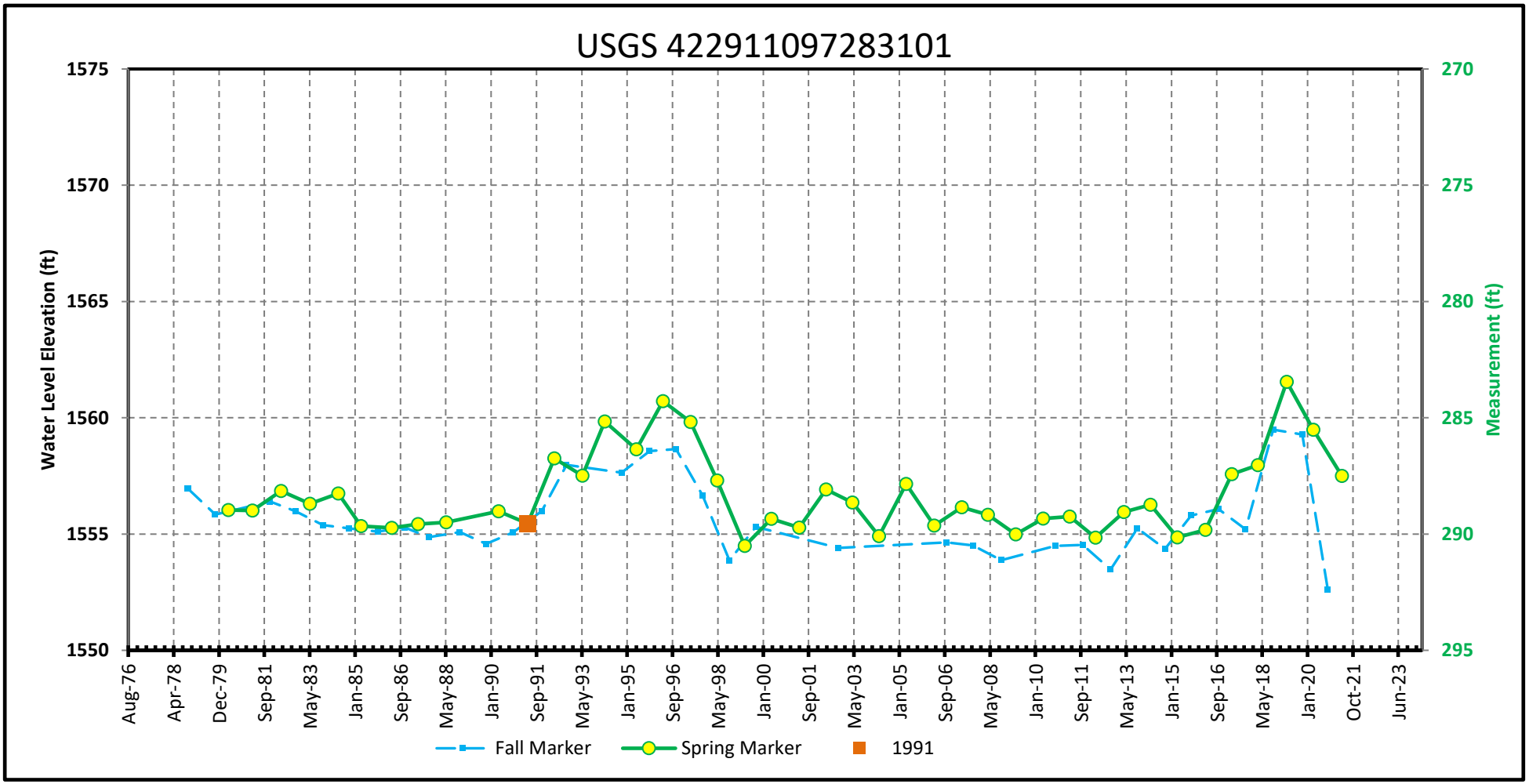

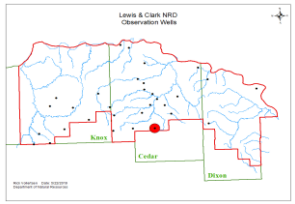

18C

Well Depth 235

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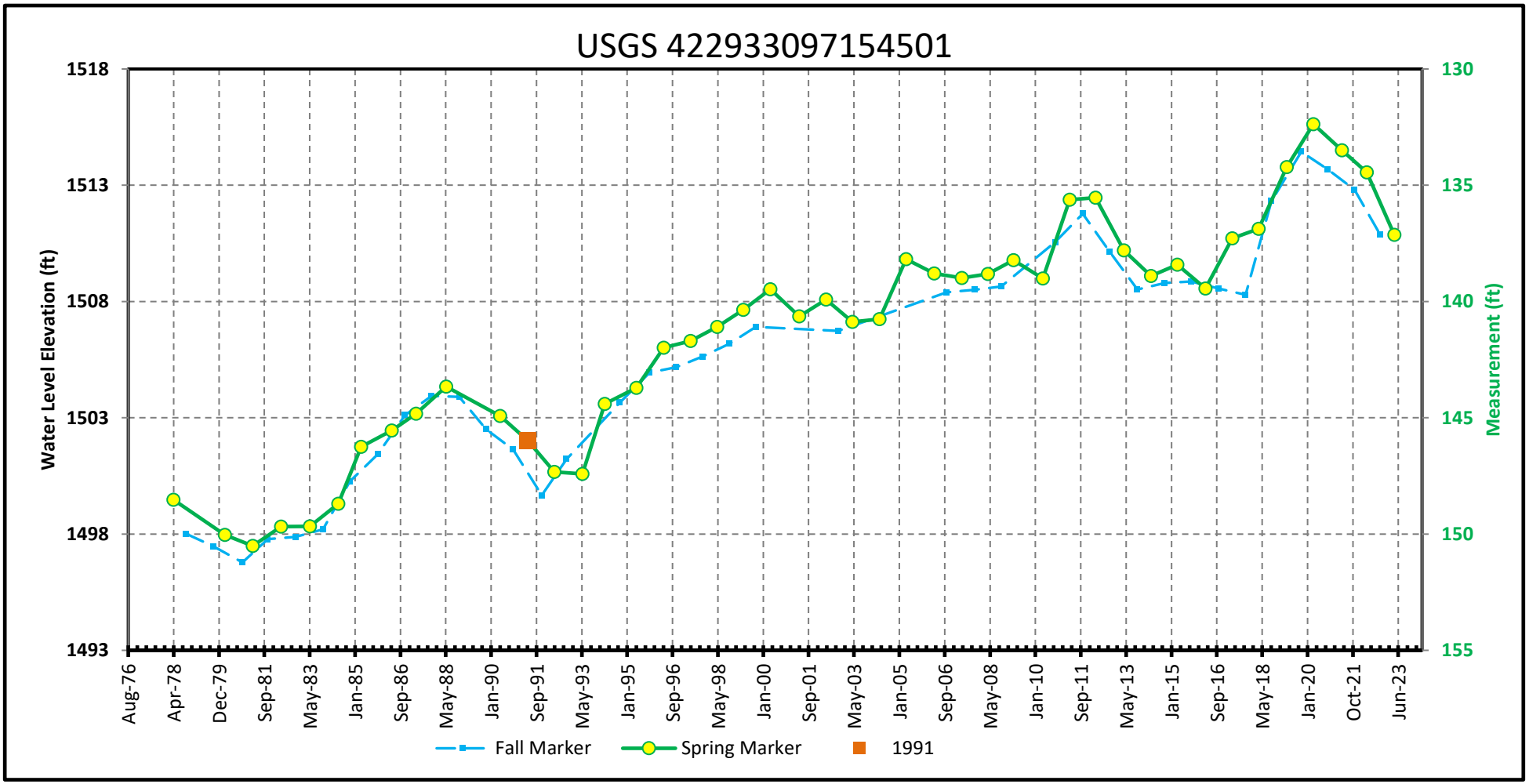

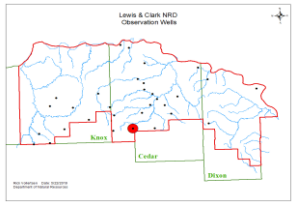

17C

Well Depth 195

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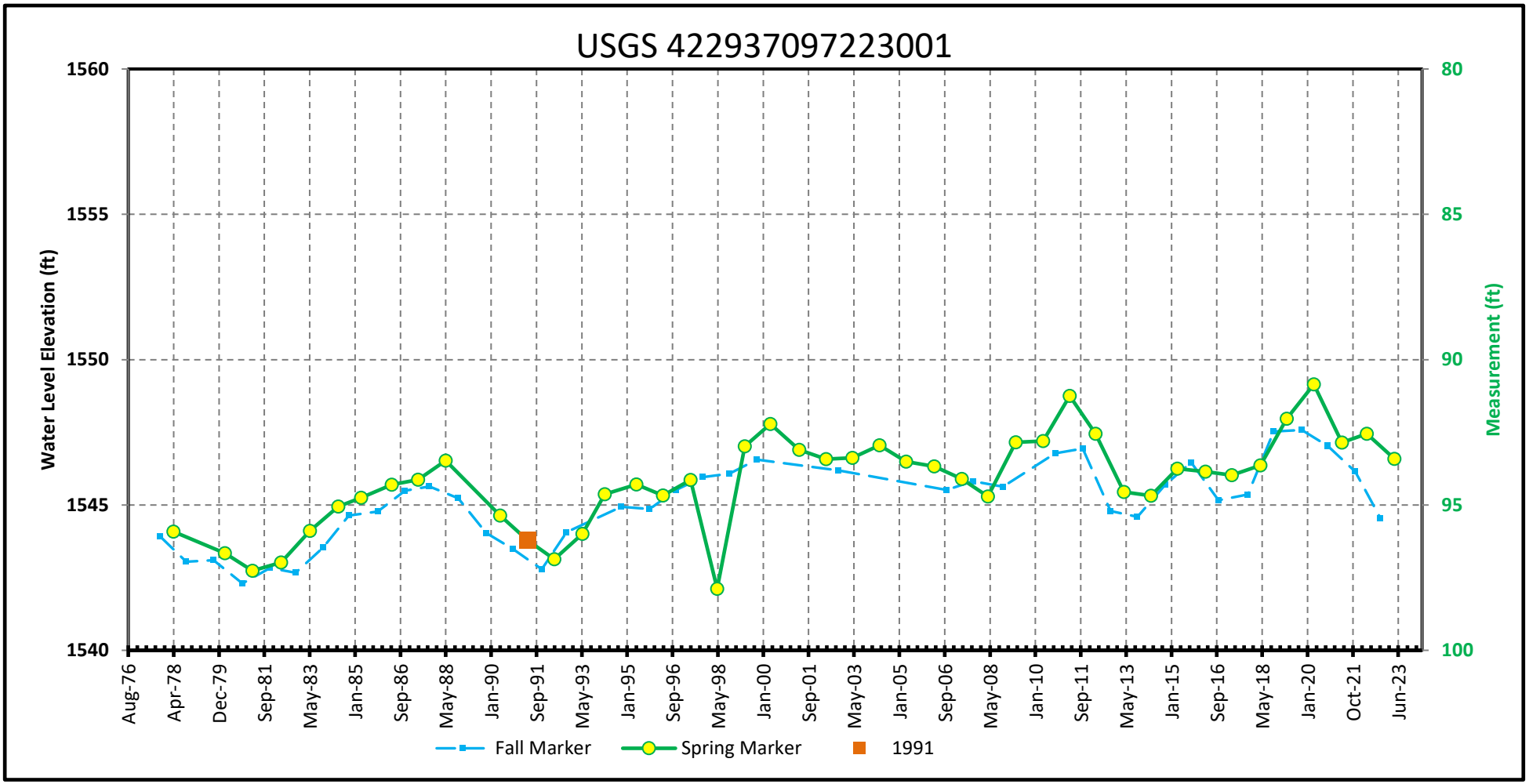

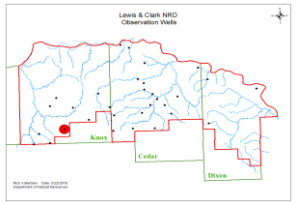

7K

Well Depth 210

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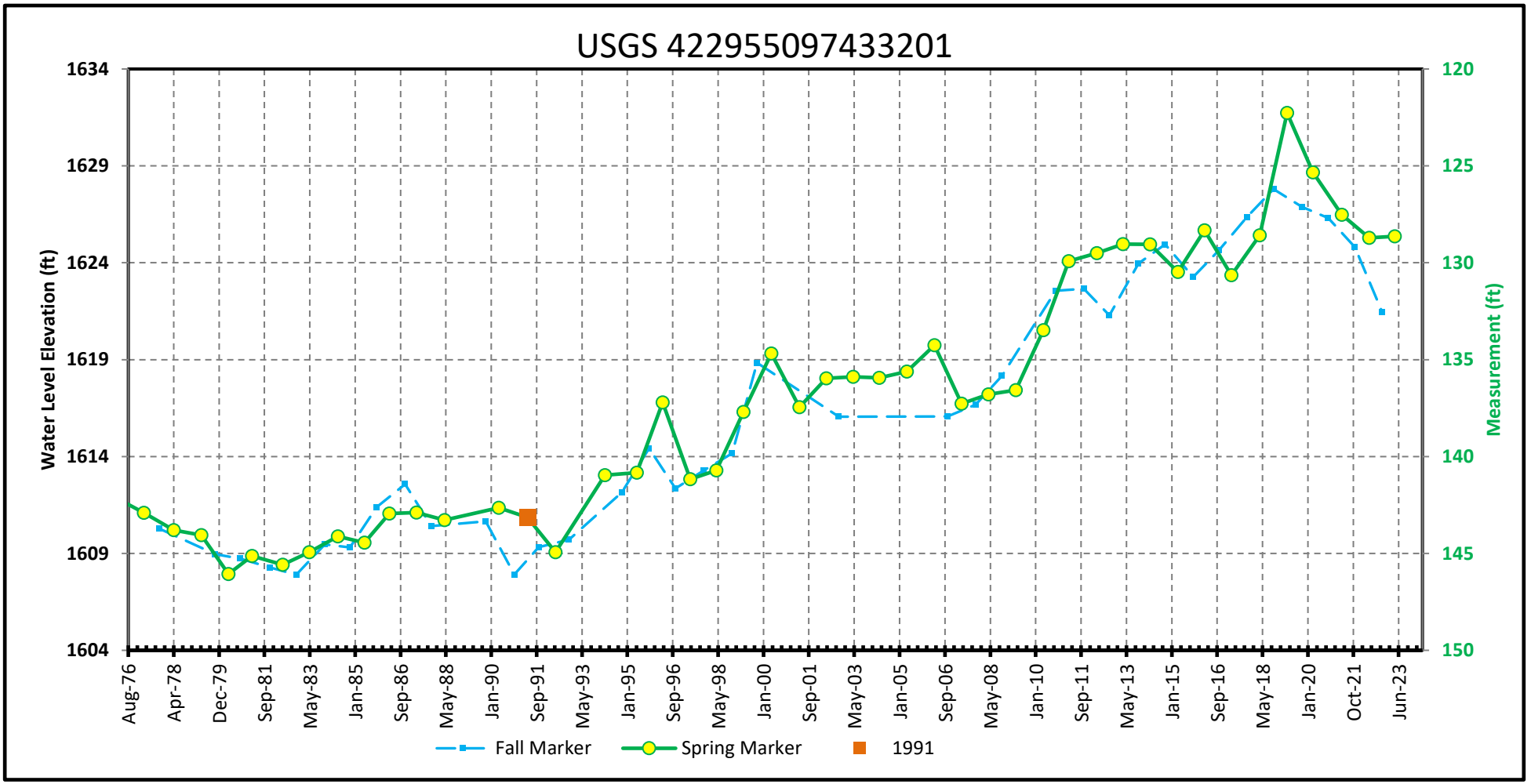

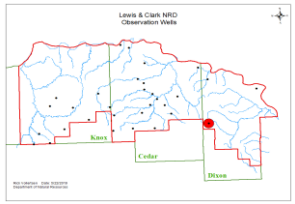

3D

Well Depth 213

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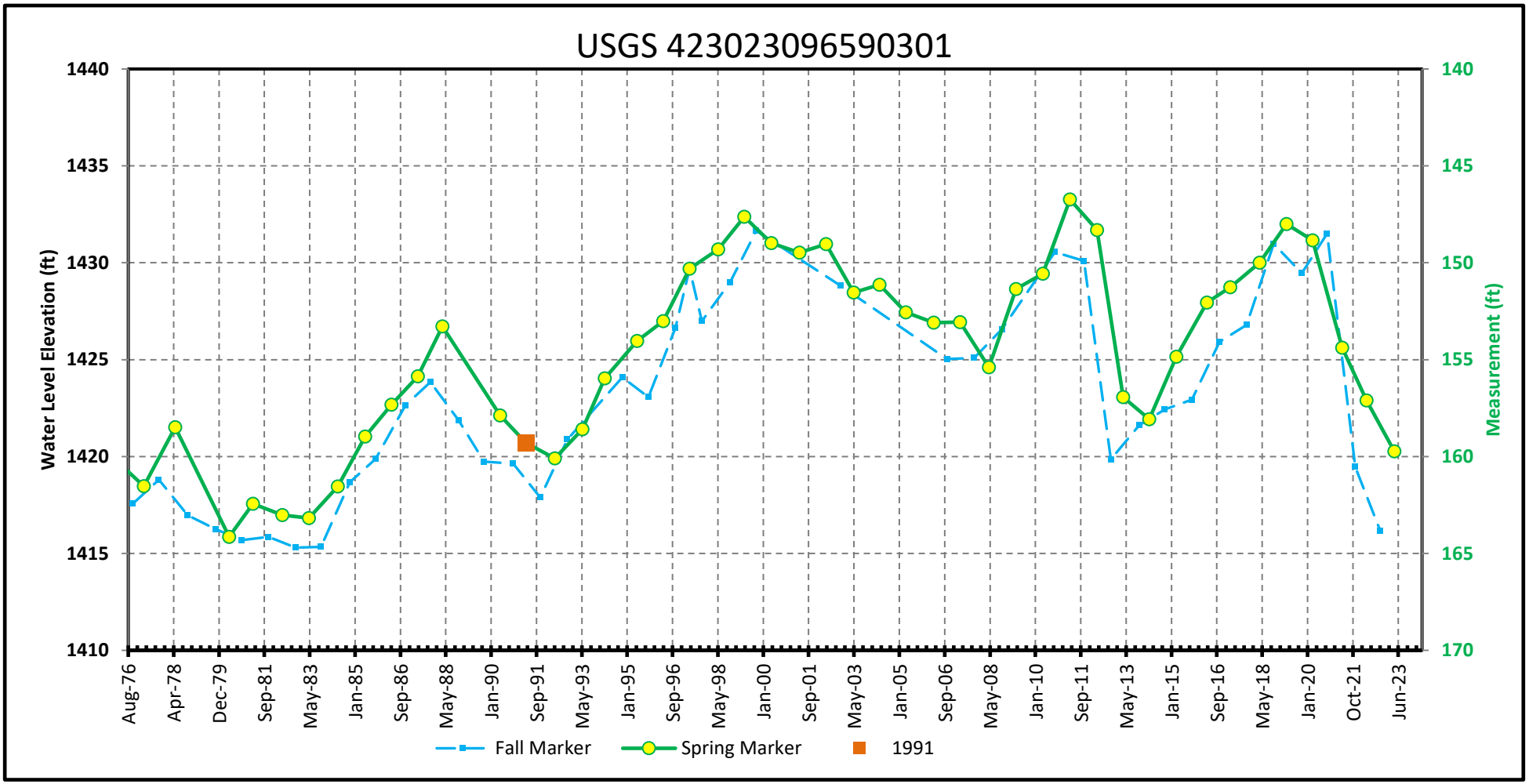

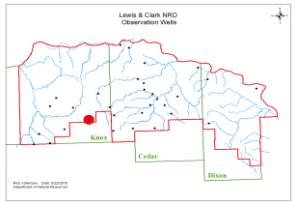

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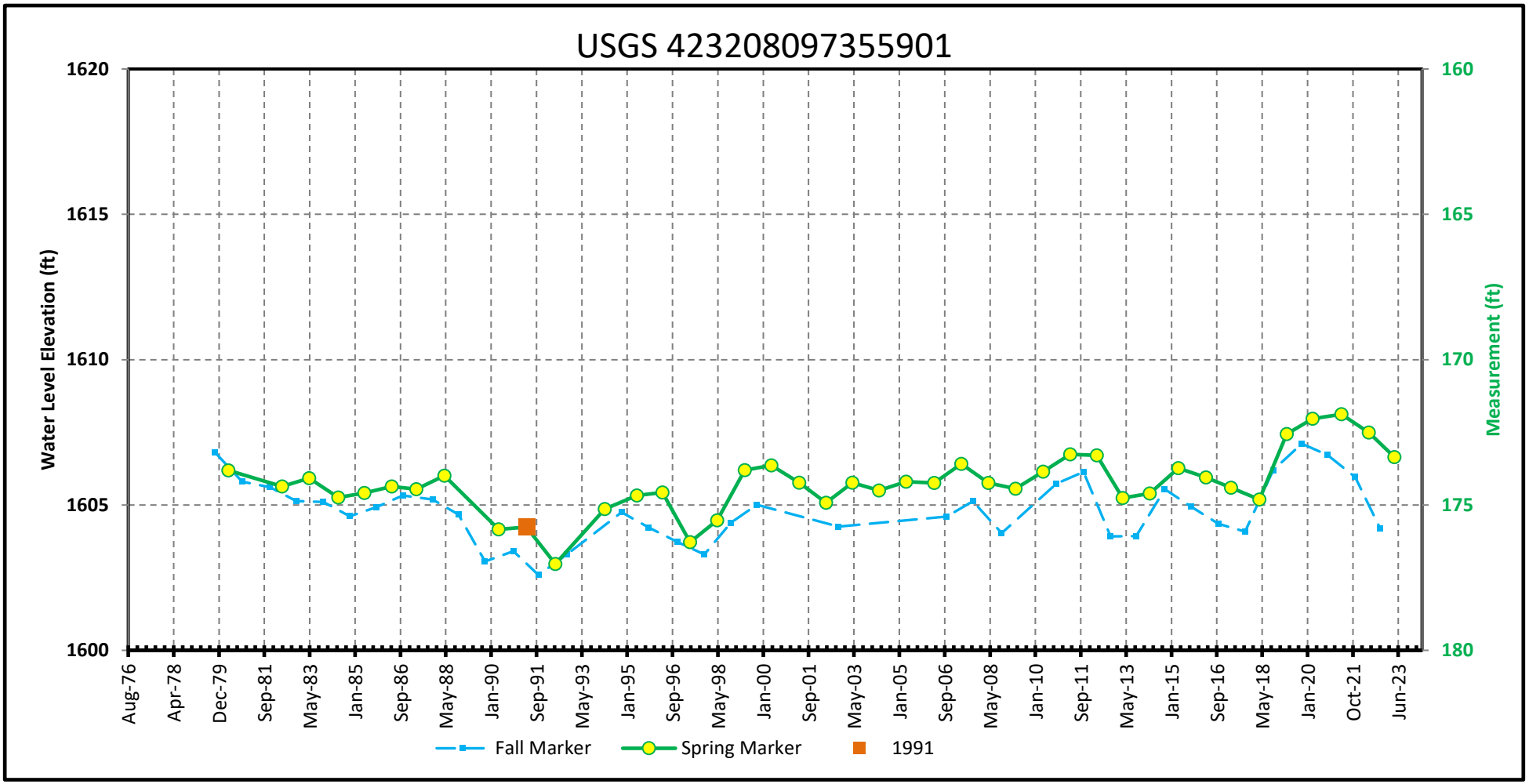
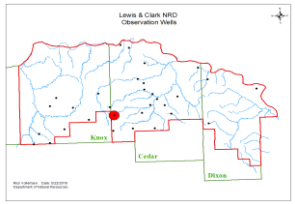
Well Depth 239

30N 2W 31BCAB G-049645 1780 **Undefined** 7-Dec-23





15C

Well Depth 172

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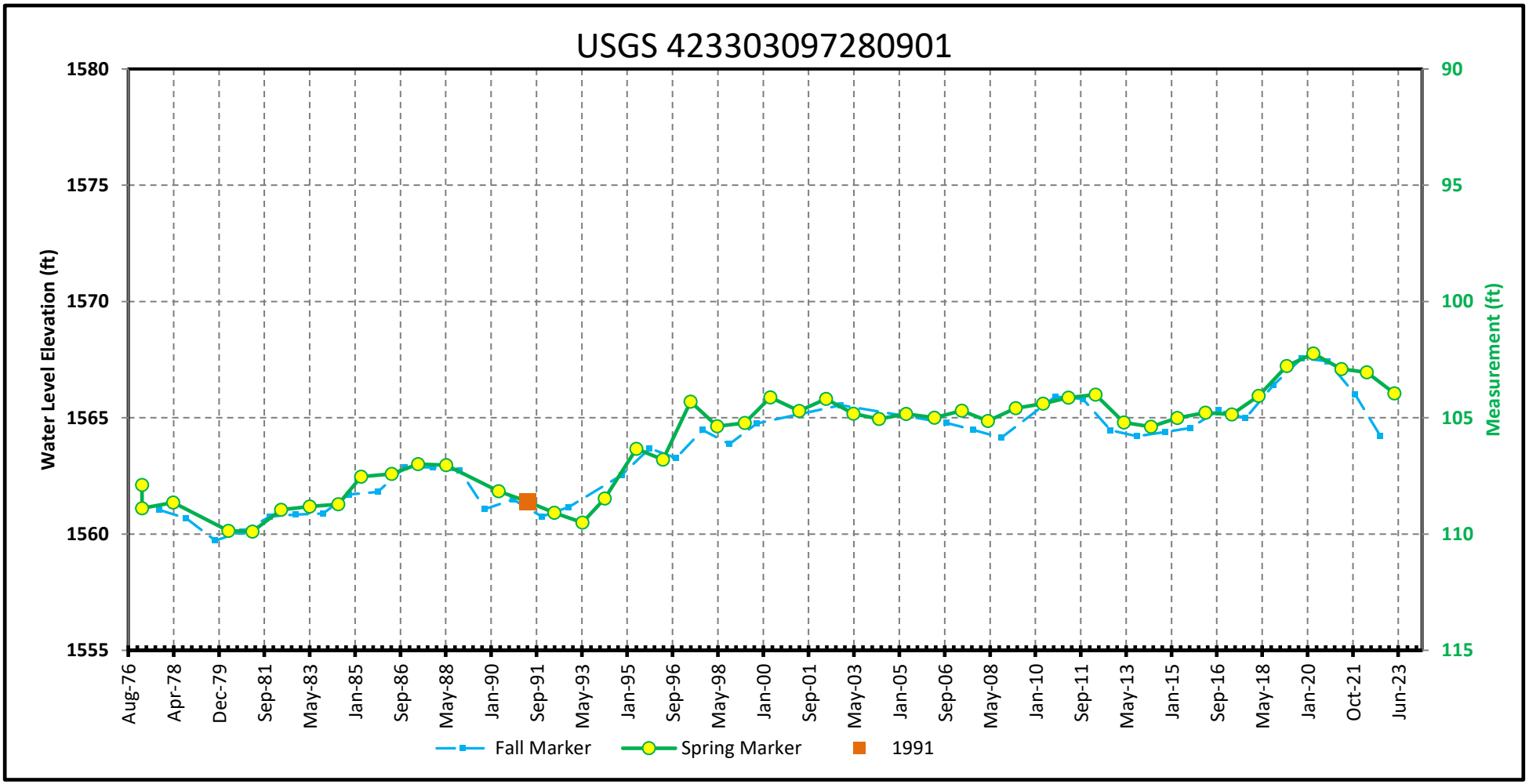
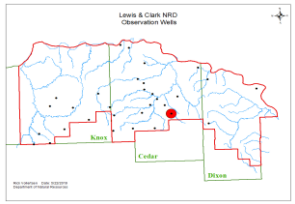
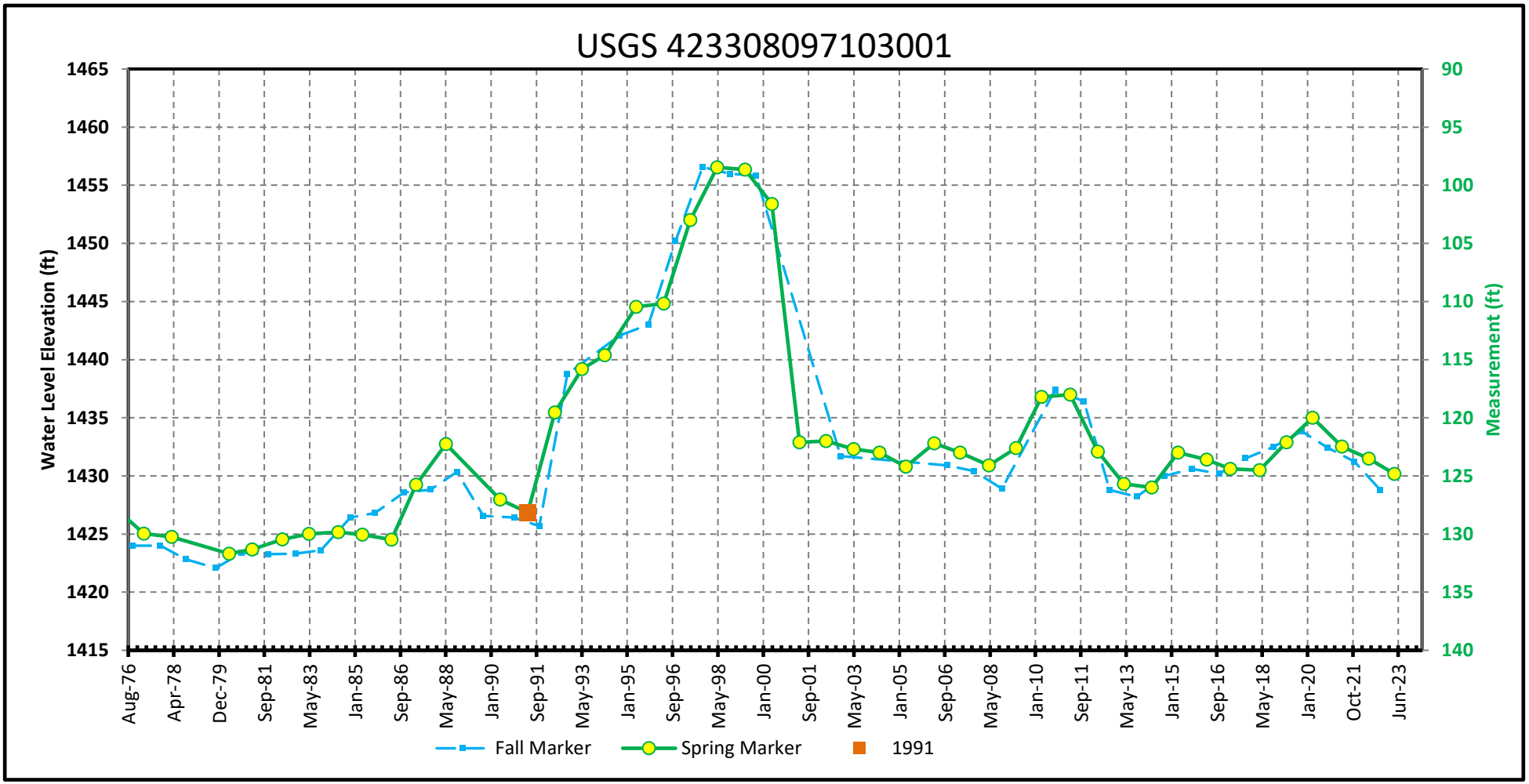


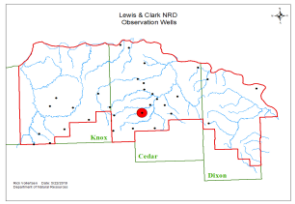


11C

Well Depth 188

30N 2E 27AADA G-042131 1555 **Sand and Gravel** 7-Dec-23

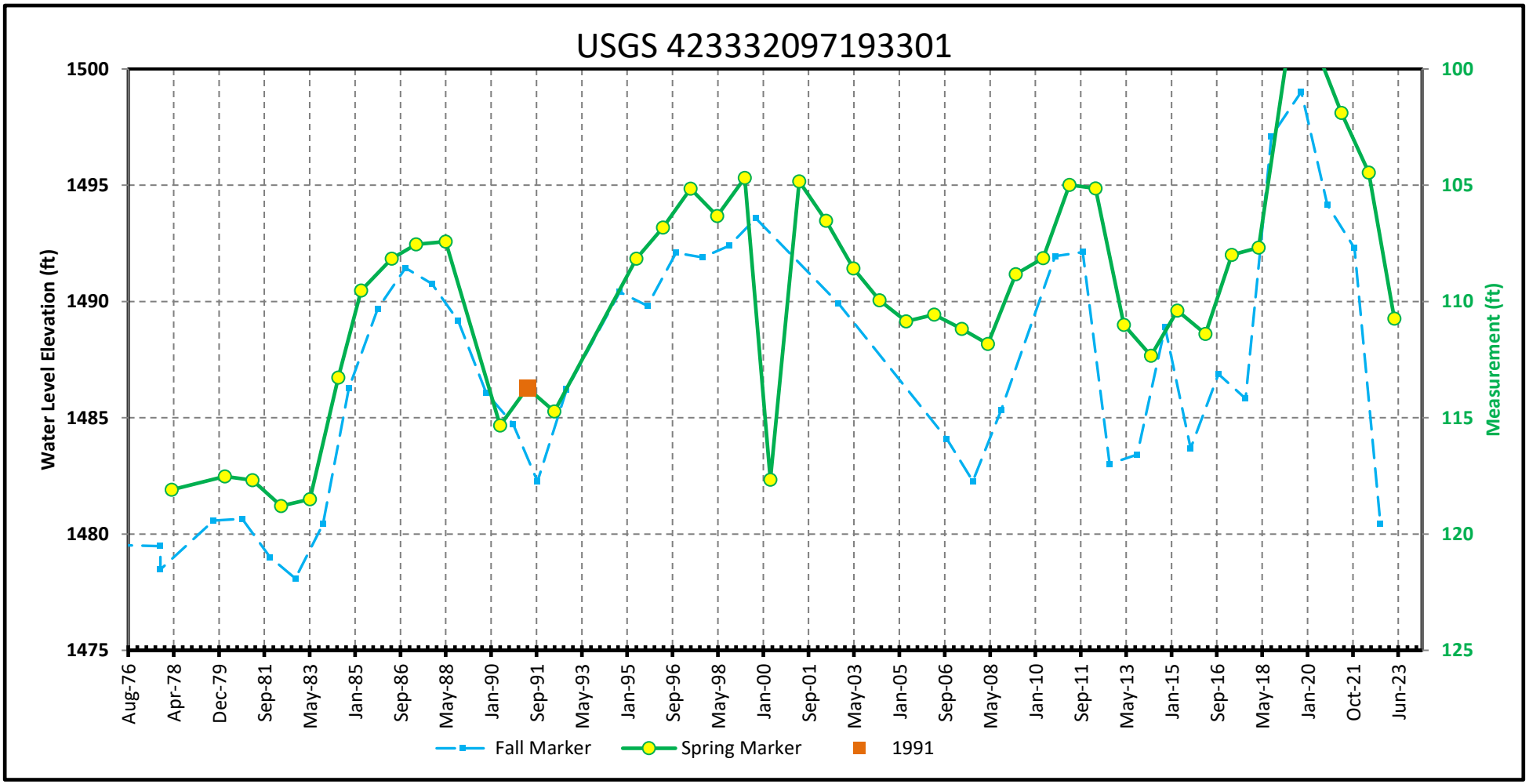


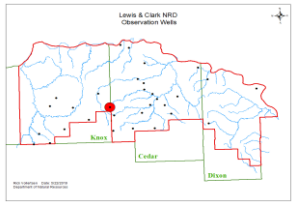


14C

Well Depth 170

30N 1E 21CBCC G-033491 1600 **Sand and Gravel** 7-Dec-23

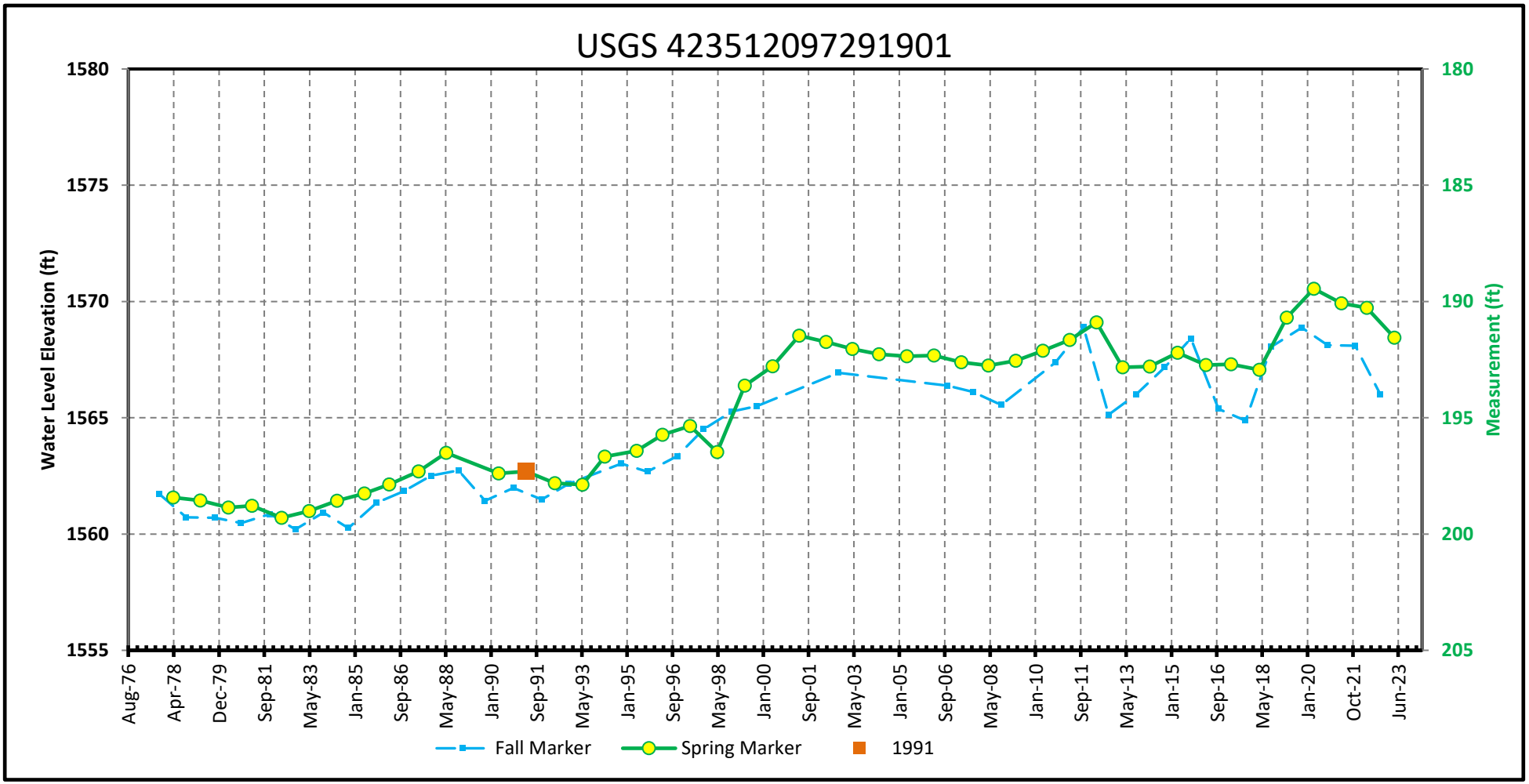


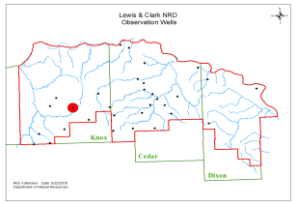


3K

Well Depth 405

30N 2W 12DDBB G-050508 1760 **Undefined** 7-Dec-23

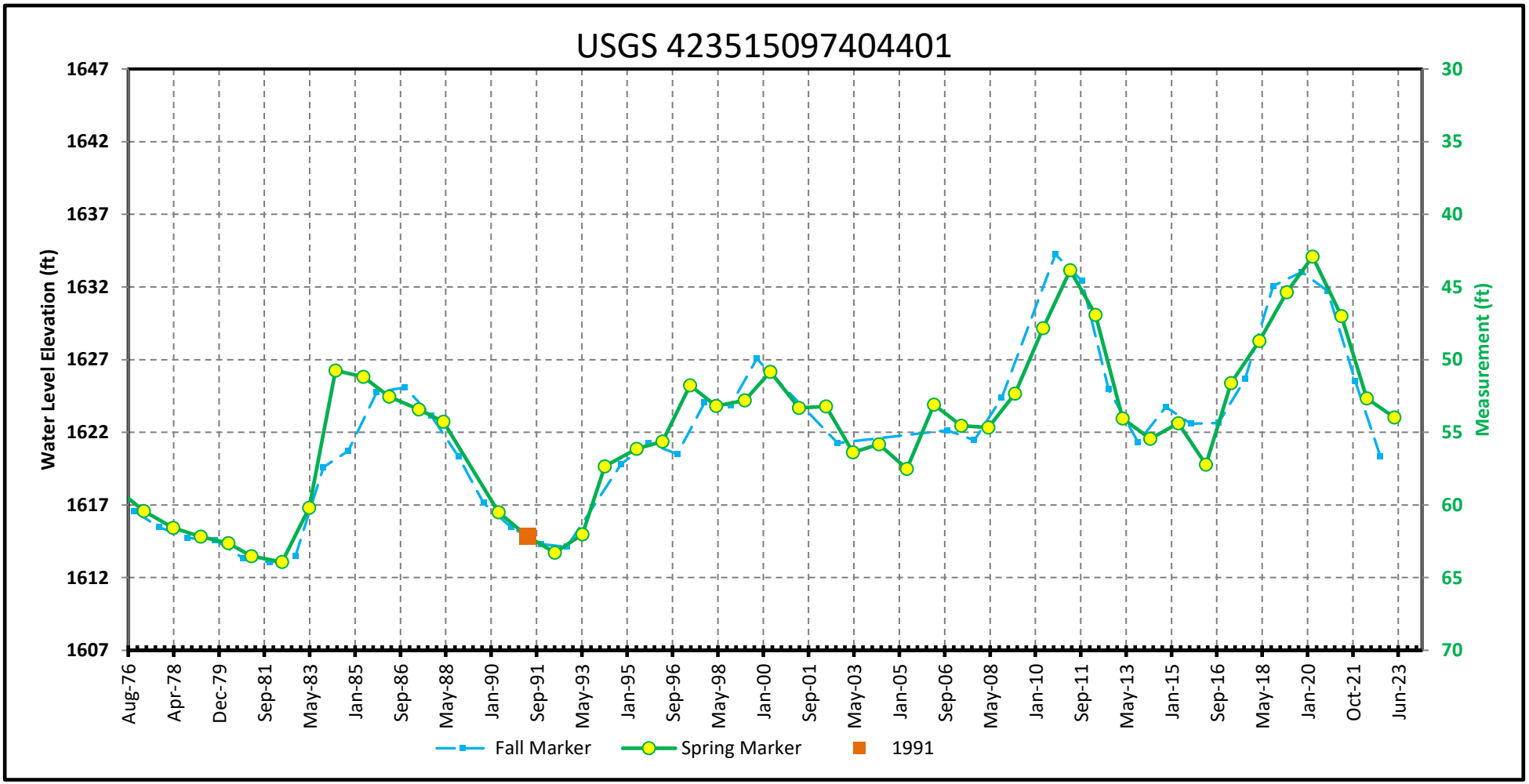


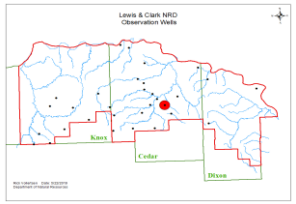


4K

Well Depth 125

30N 3W 9CBDD G-008604 1677 **Sand and Gravel** 7-Dec-23

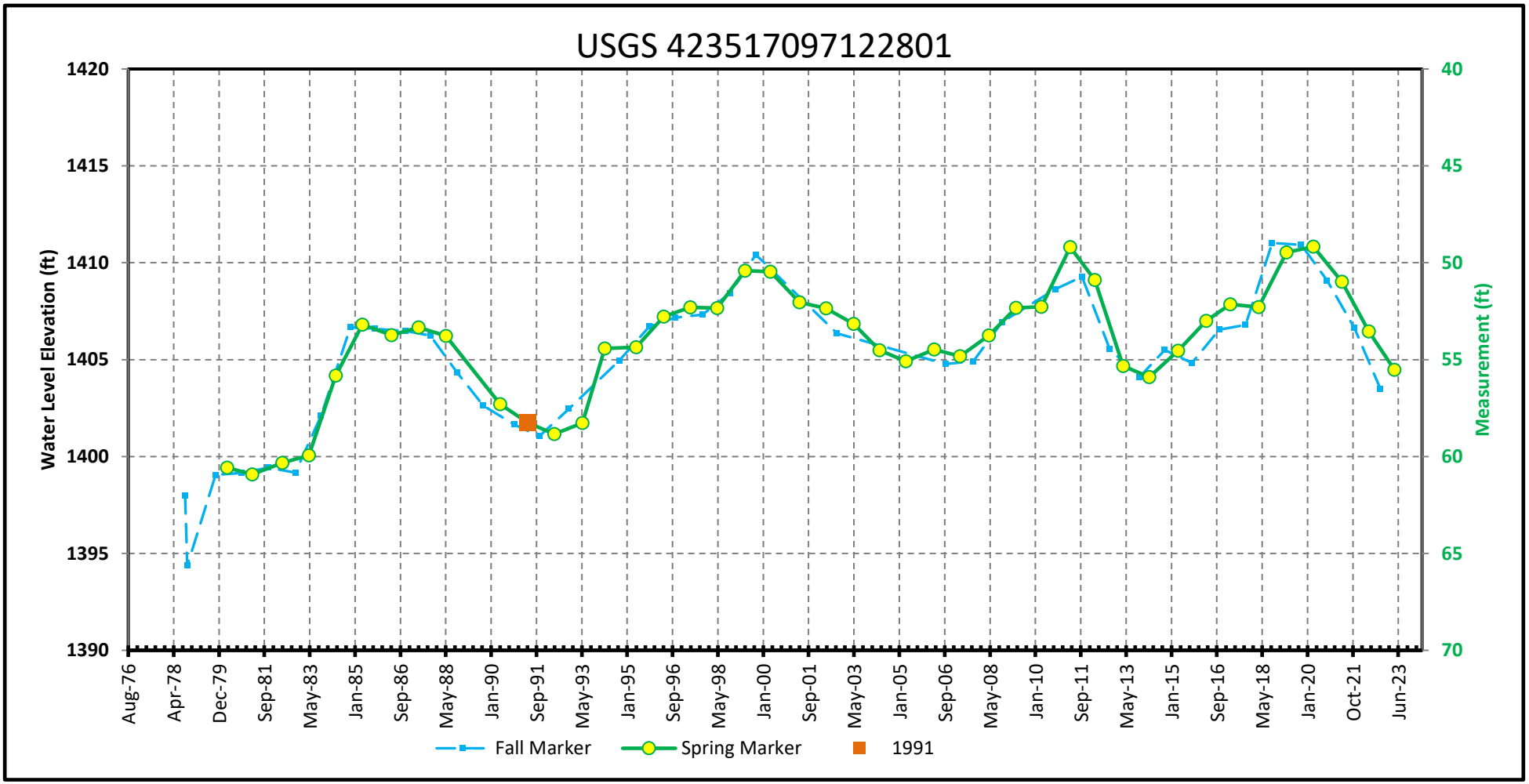


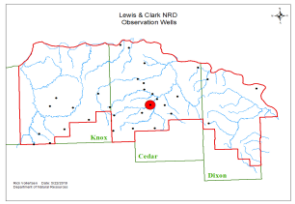


12C

Well Depth 87

30N 2E 9CAC G-056403 1460 **Sand and Gravel** 7-Dec-23

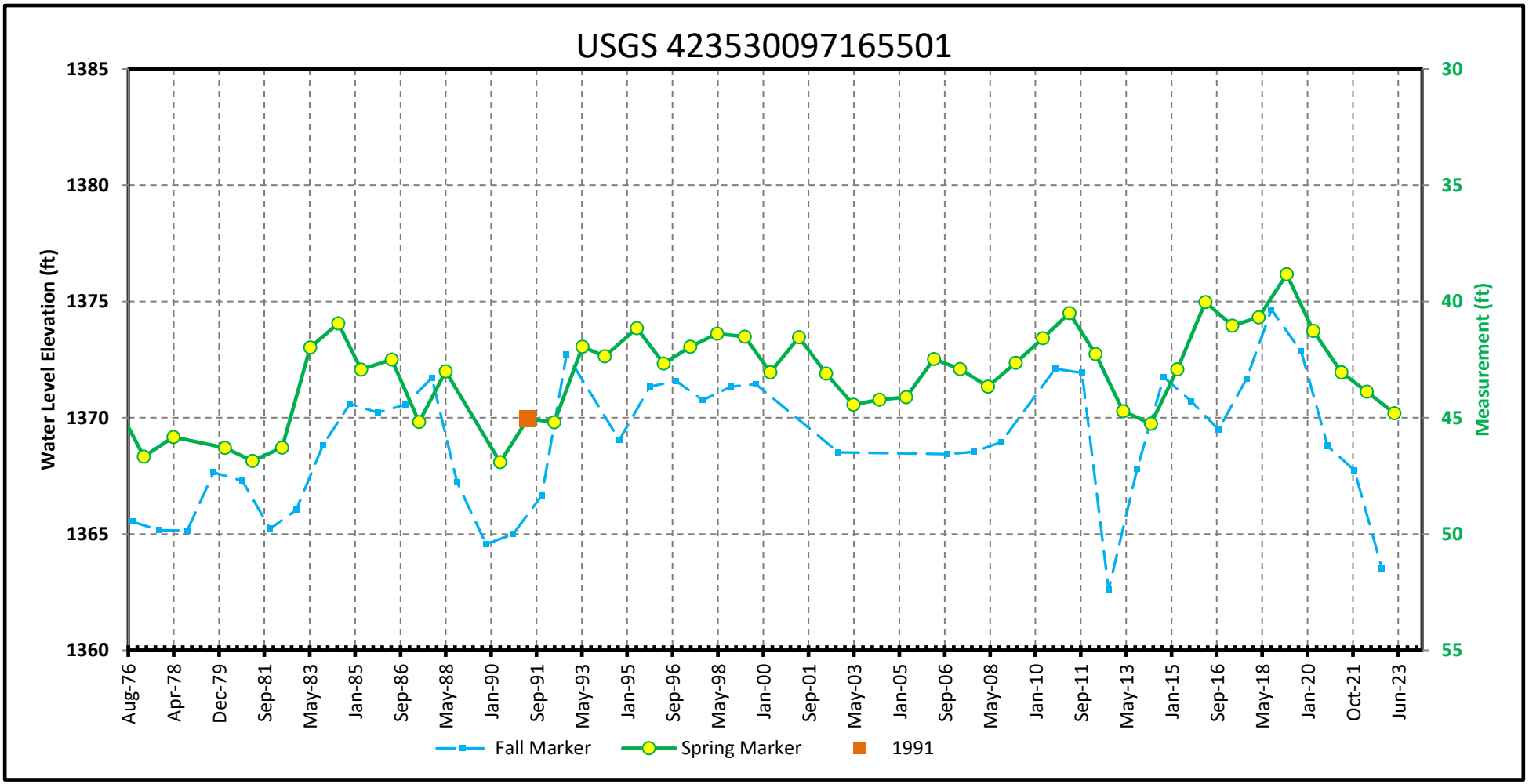


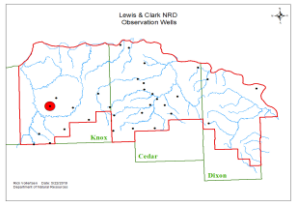


13C

Well Depth 89

30N 1E 11BDCC G-035811 1415 **Sand and Gravel** 7-Dec-23

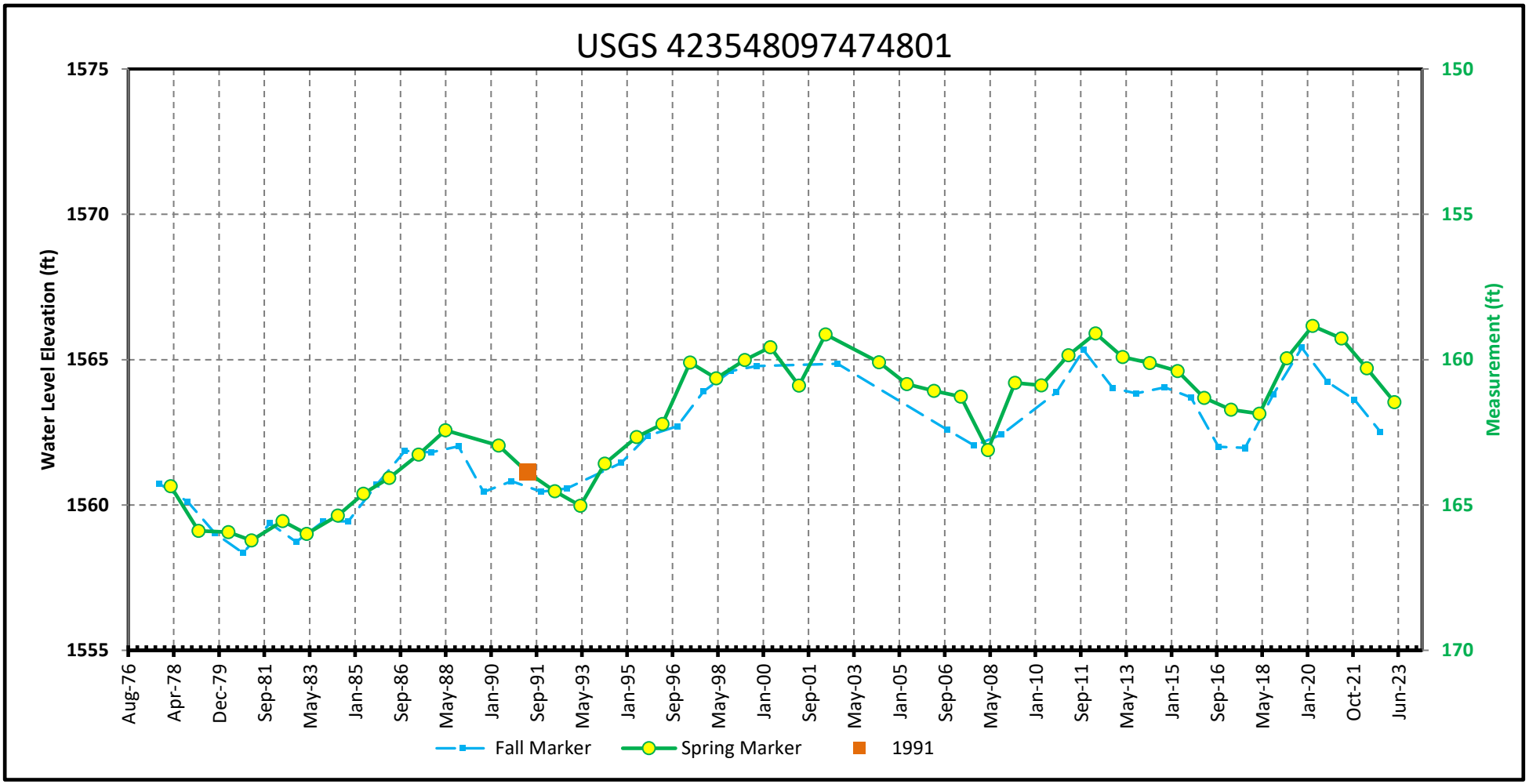


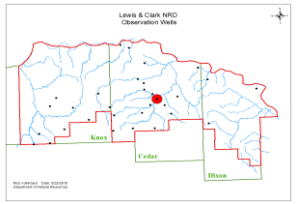


5K

Well Depth 221

30N 4W 9BBBB G-054396 1725 **Sand and Gravel** 7-Dec-23

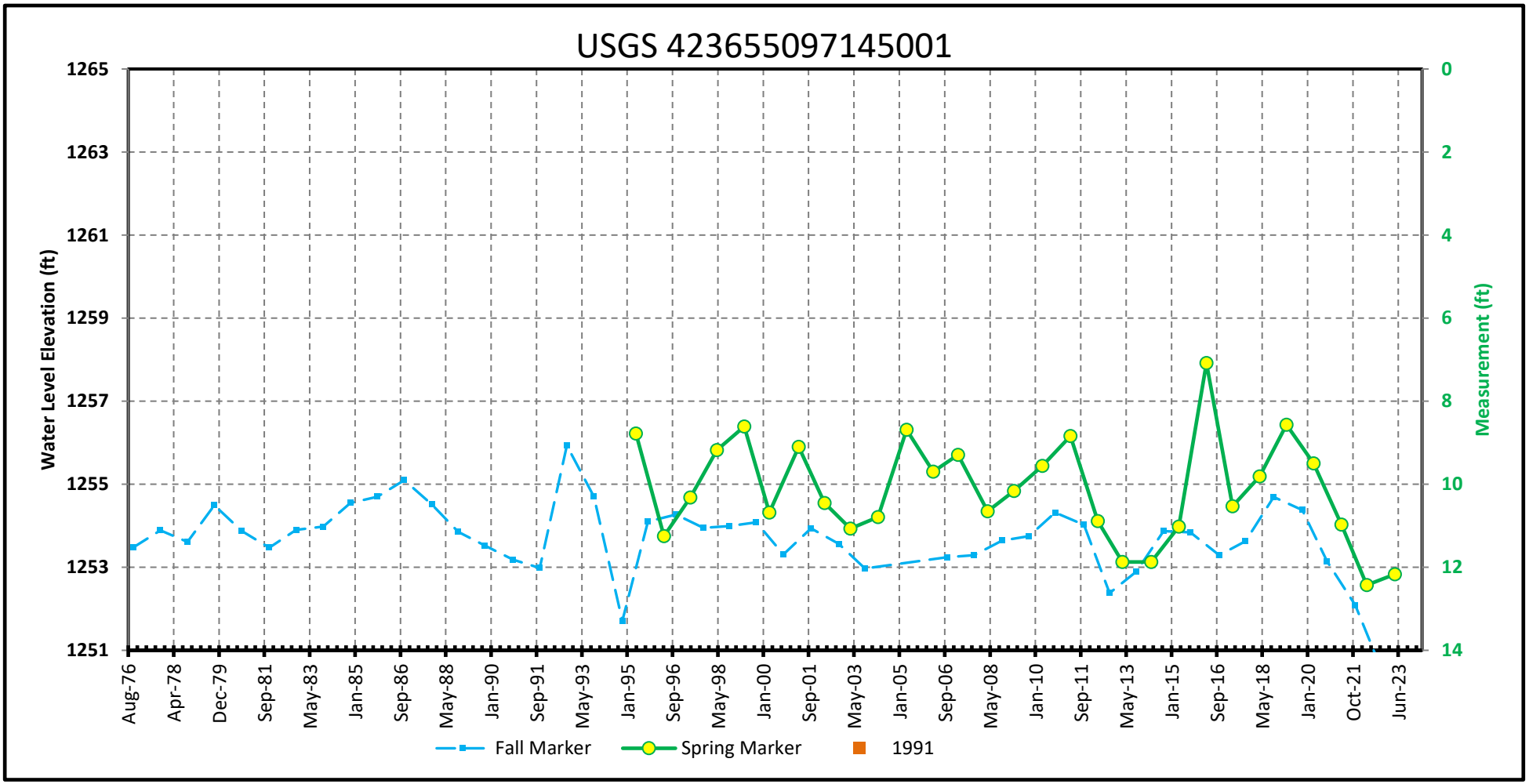


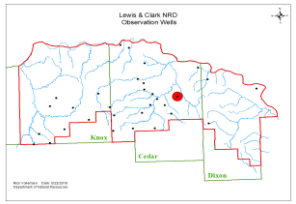


9C

Well Depth 65

31N 2E 31CC G-003900R 1265 **Niobrara** 7-Dec-23

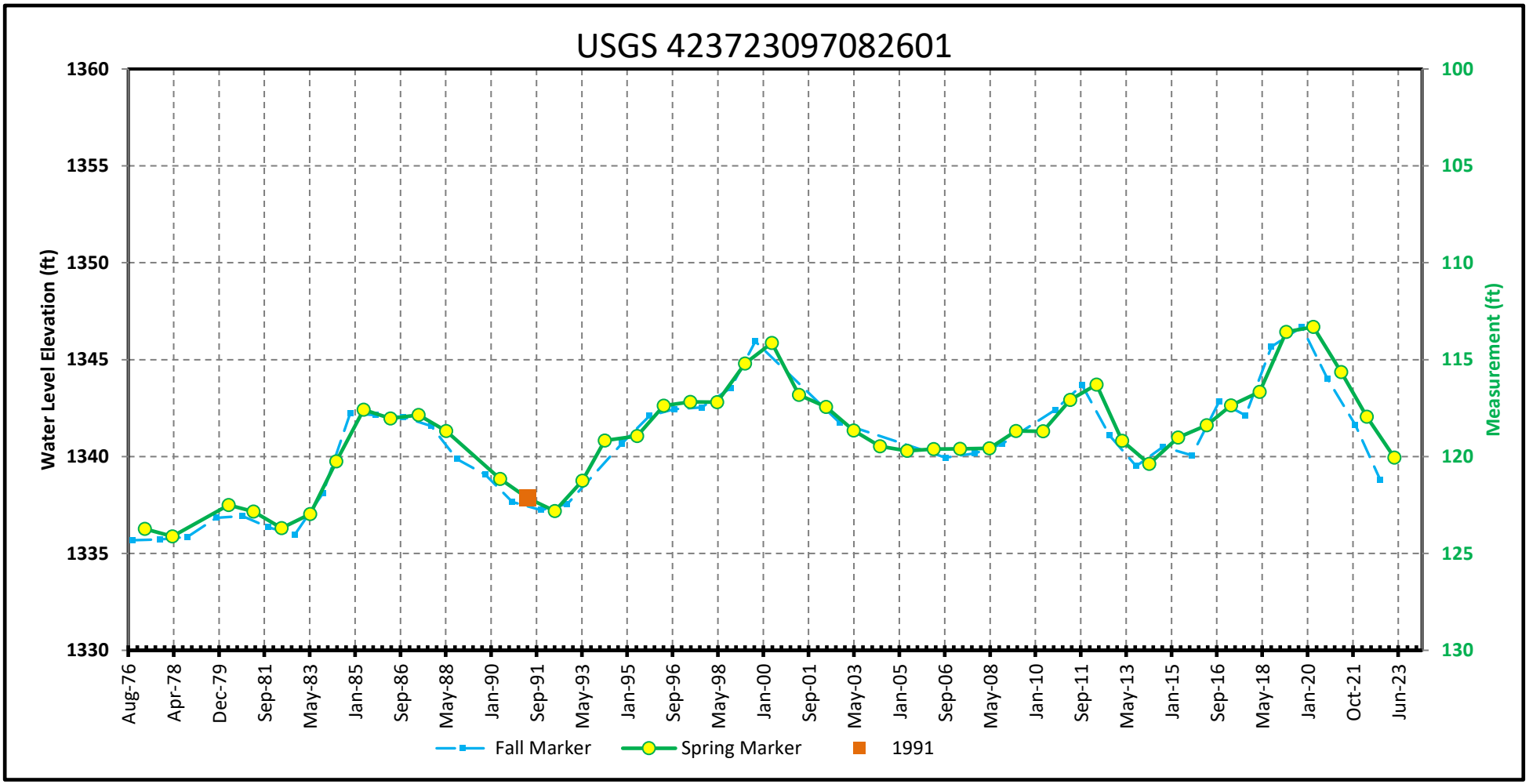


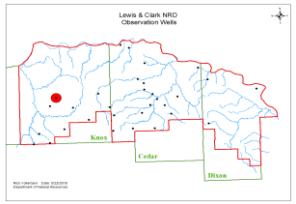


10C

Well Depth 178

31N 2E 36ACAA G-036399 1460 **Sand and Gravel** 7-Dec-23

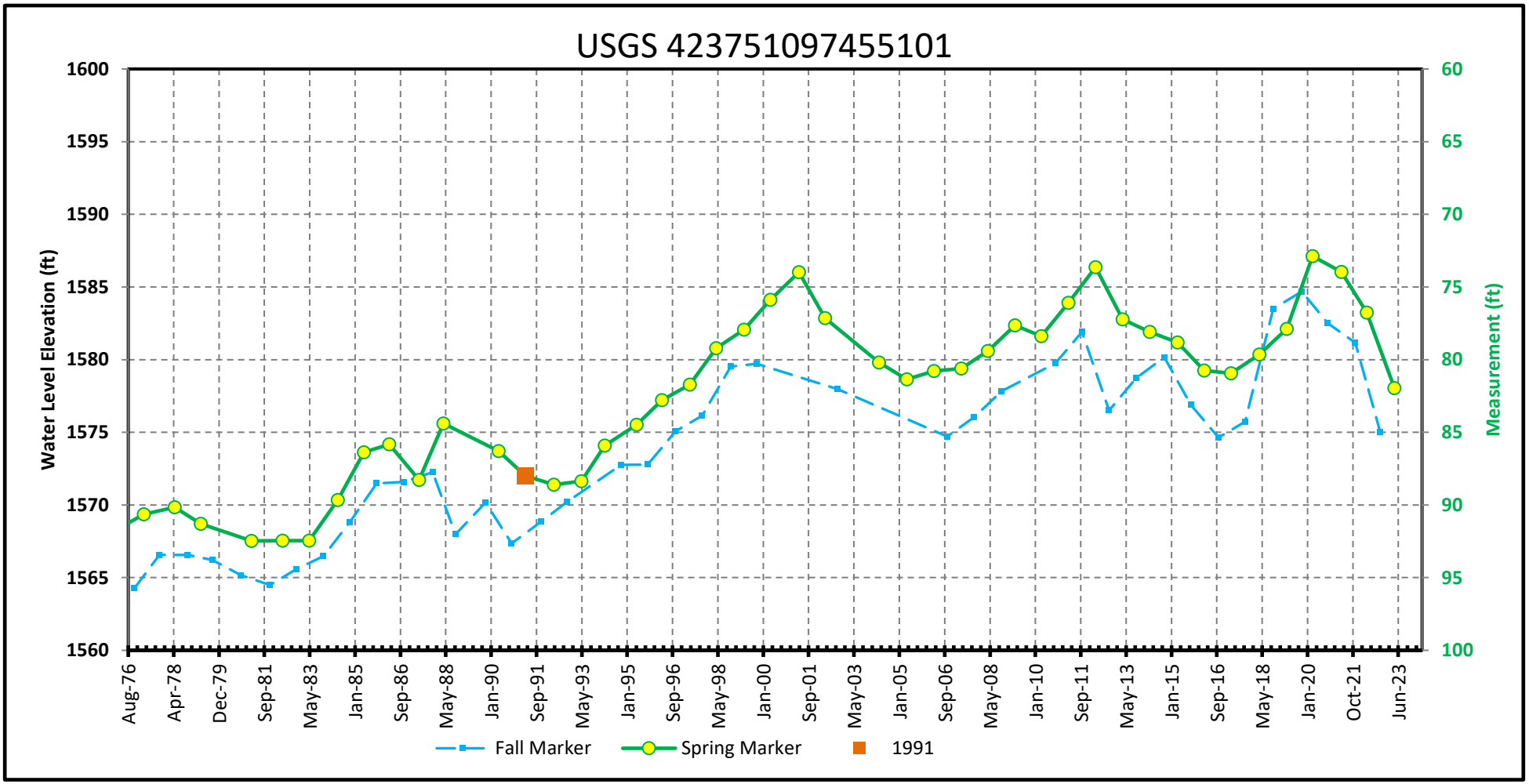


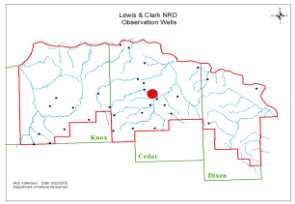


2K

Well Depth 140

31N 4W 27DBDD G-043855 1660 **Sand and Gravel** 7-Dec-23

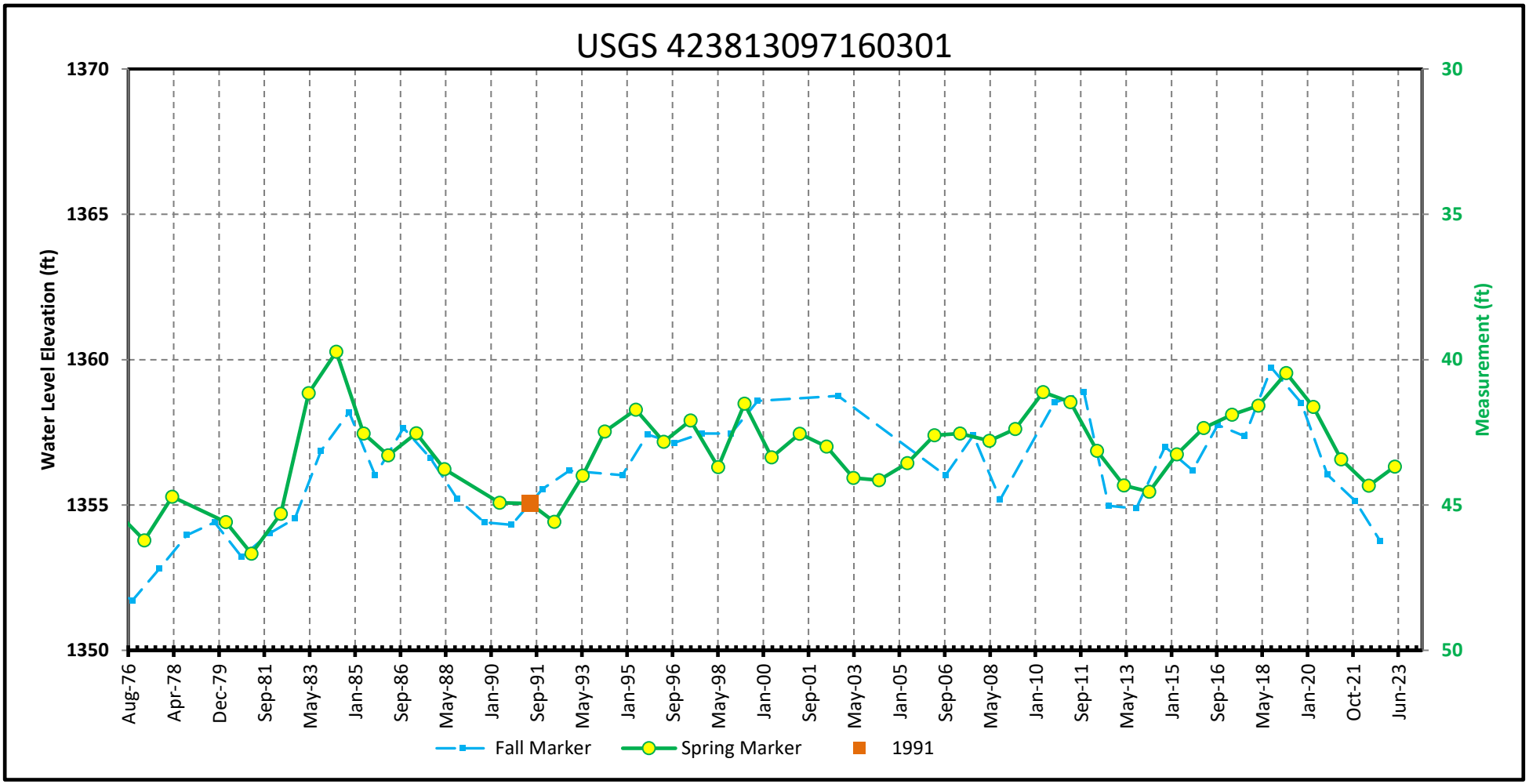


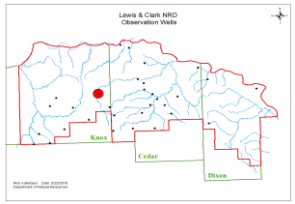


8C

Well Depth 100

31N 1E 25BCBC G-041937 1400 **Niobrara** 7-Dec-23

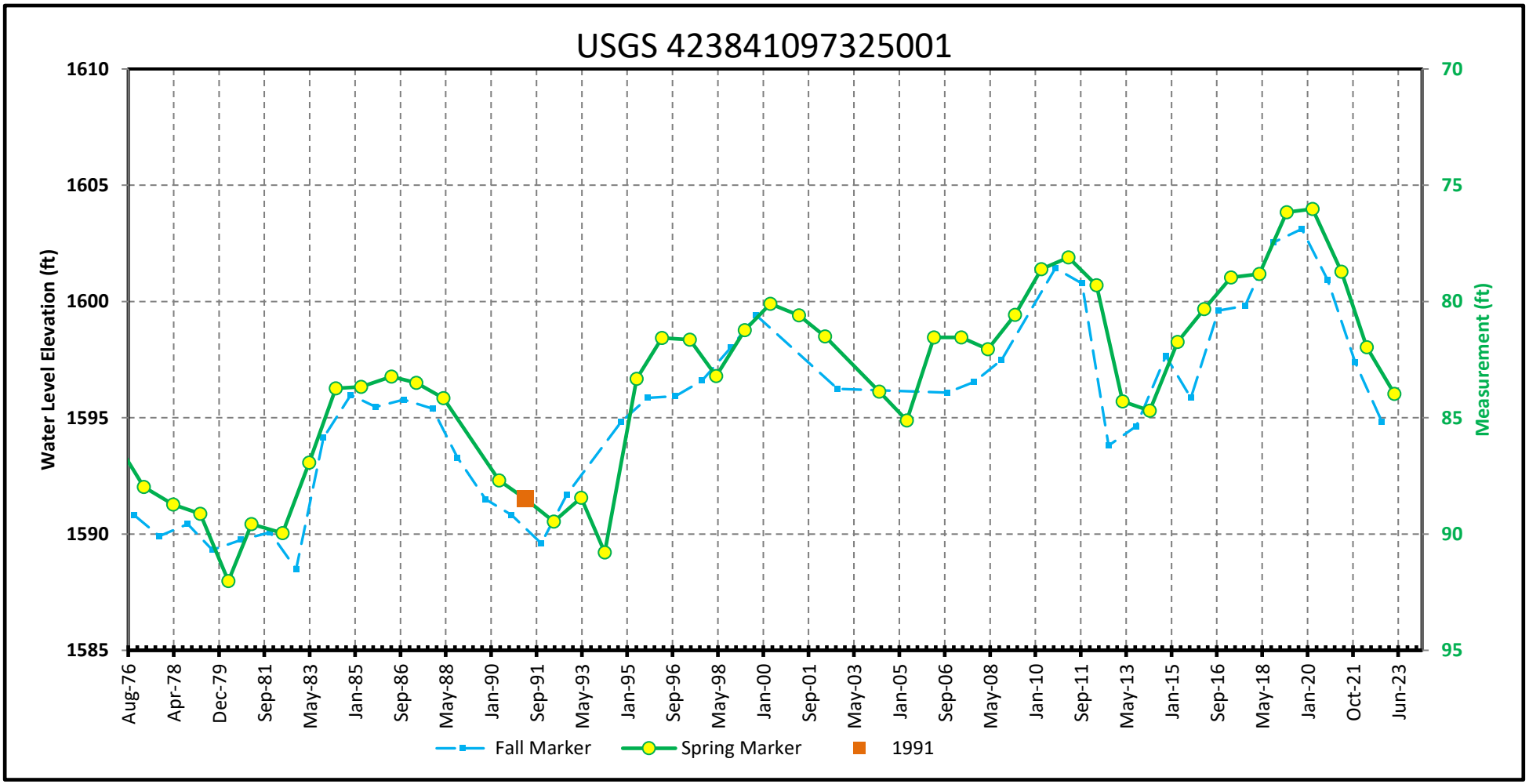


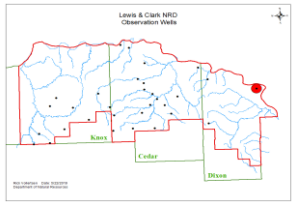


1K

Well Depth 208

31N 2W 21DDBB G-041985 1680 **Ogallala** 7-Dec-23

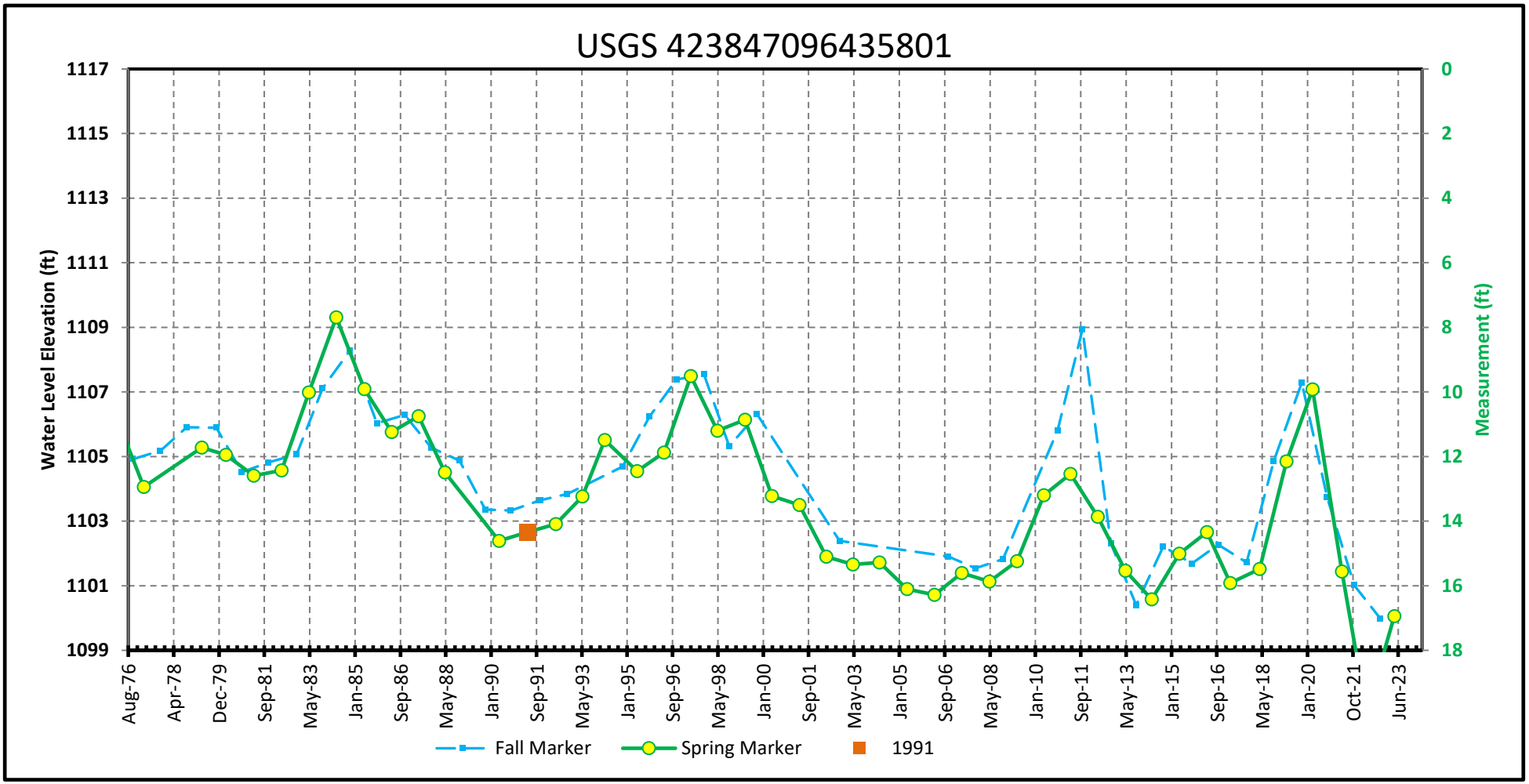


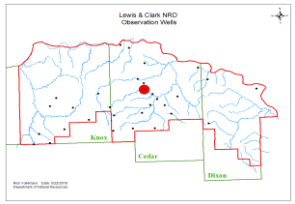


2D

Well Depth 78

31N 6E 21CAA G-025772 1117 **Missouri River Alluvium** 7-Dec-23

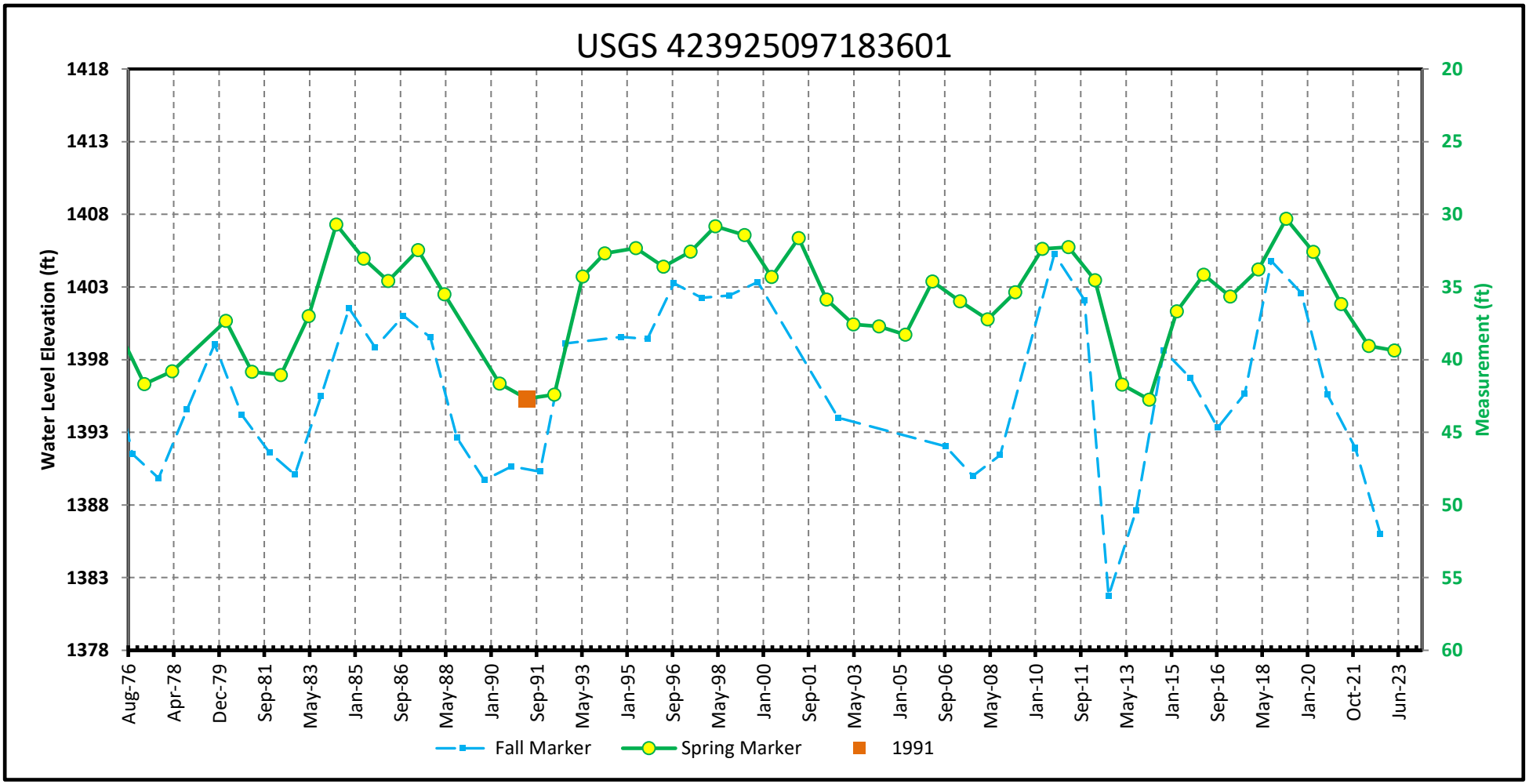


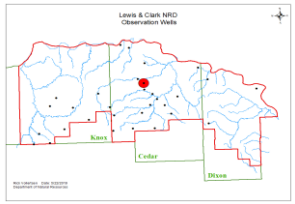


7C

Well Depth 140

31N 1E 16DDCD G-014545 1438 **Sand and Gravel** 7-Dec-23

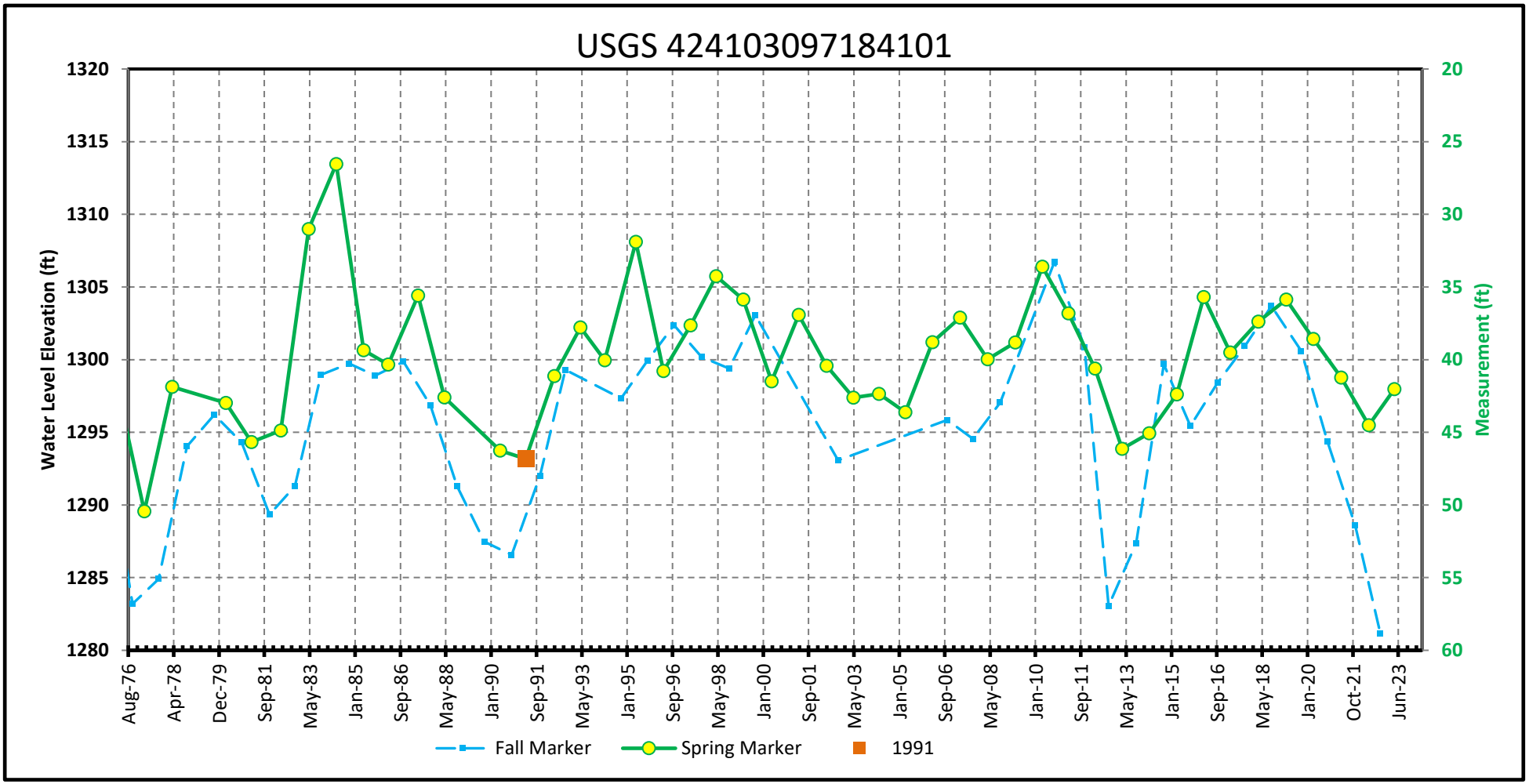


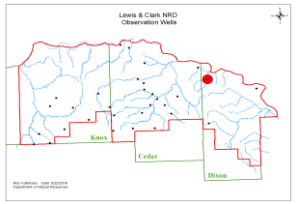


6C

Well Depth 104

31N 1E 9AABC G-042255 1340 **Niobrara** 7-Dec-23

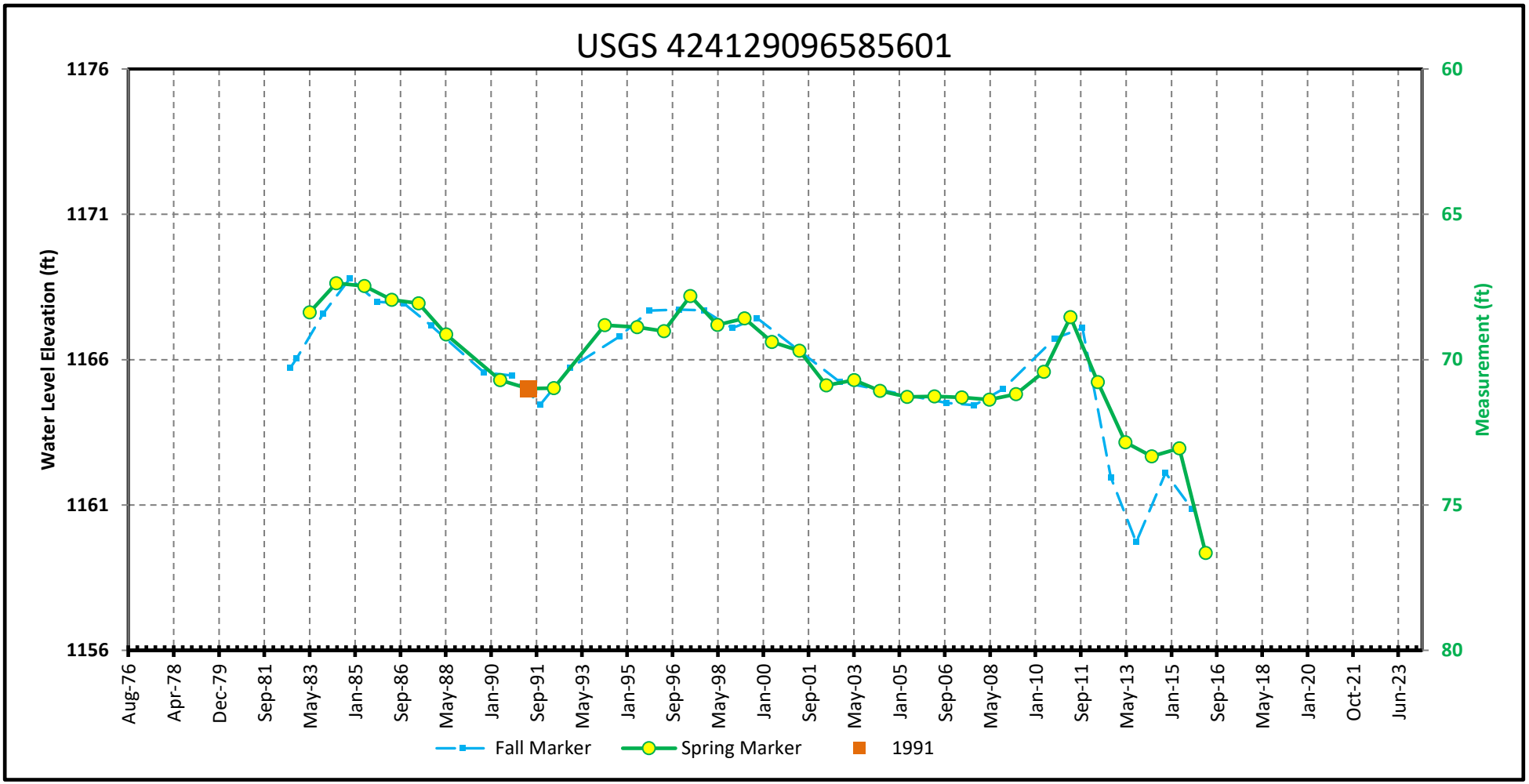


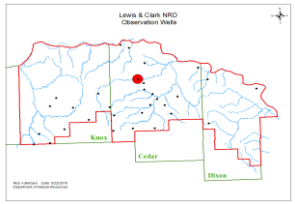


1D

Well Depth

31N 4E 5DBAB (Caved In 2016) 1236 **Dakota** 7-Dec-23

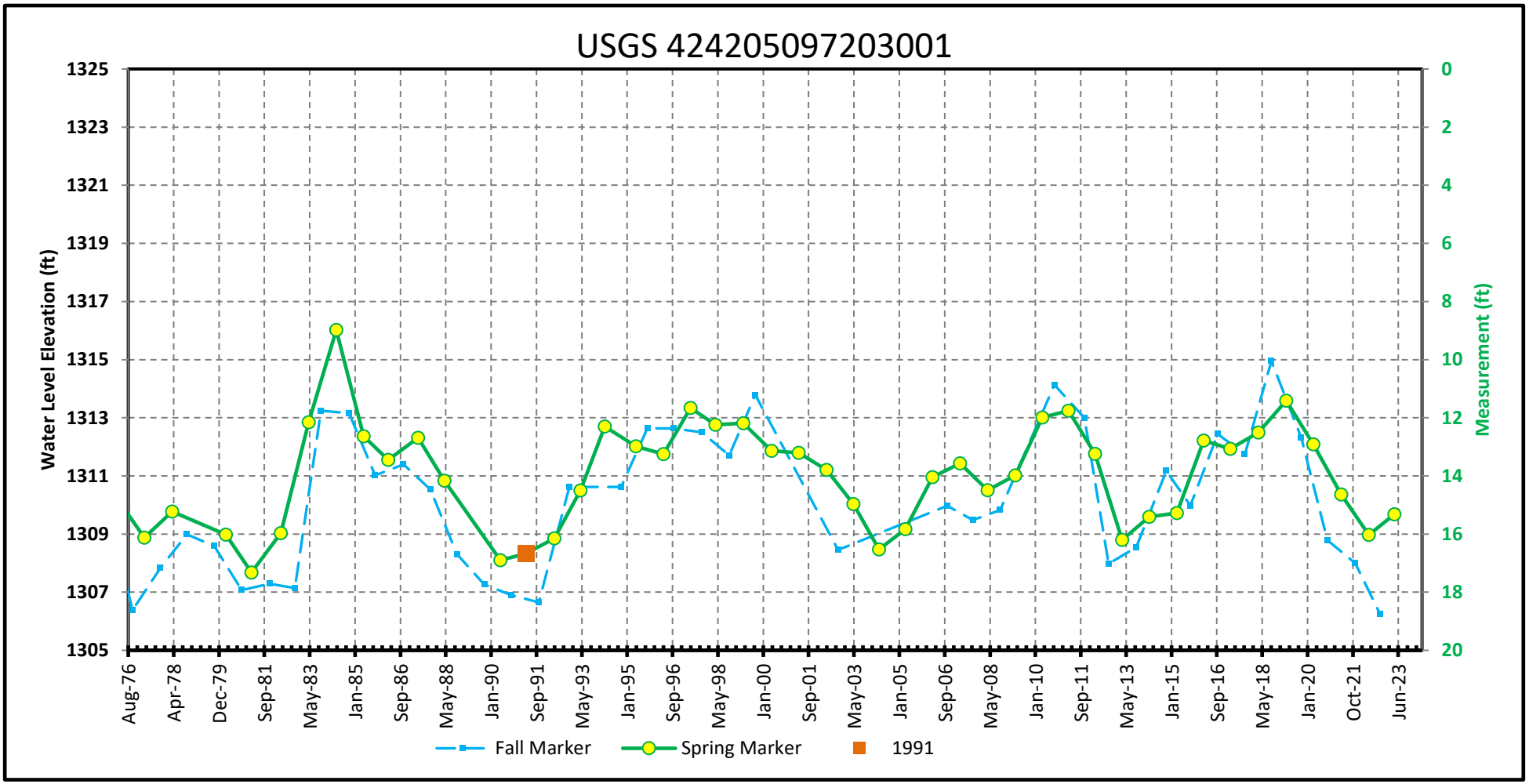


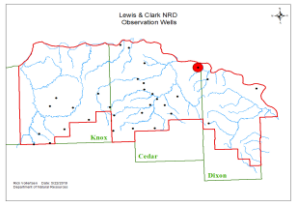


5C

Well Depth 104

32N 1E 32CCDA G-035972 1325 **Niobrara** 7-Dec-23

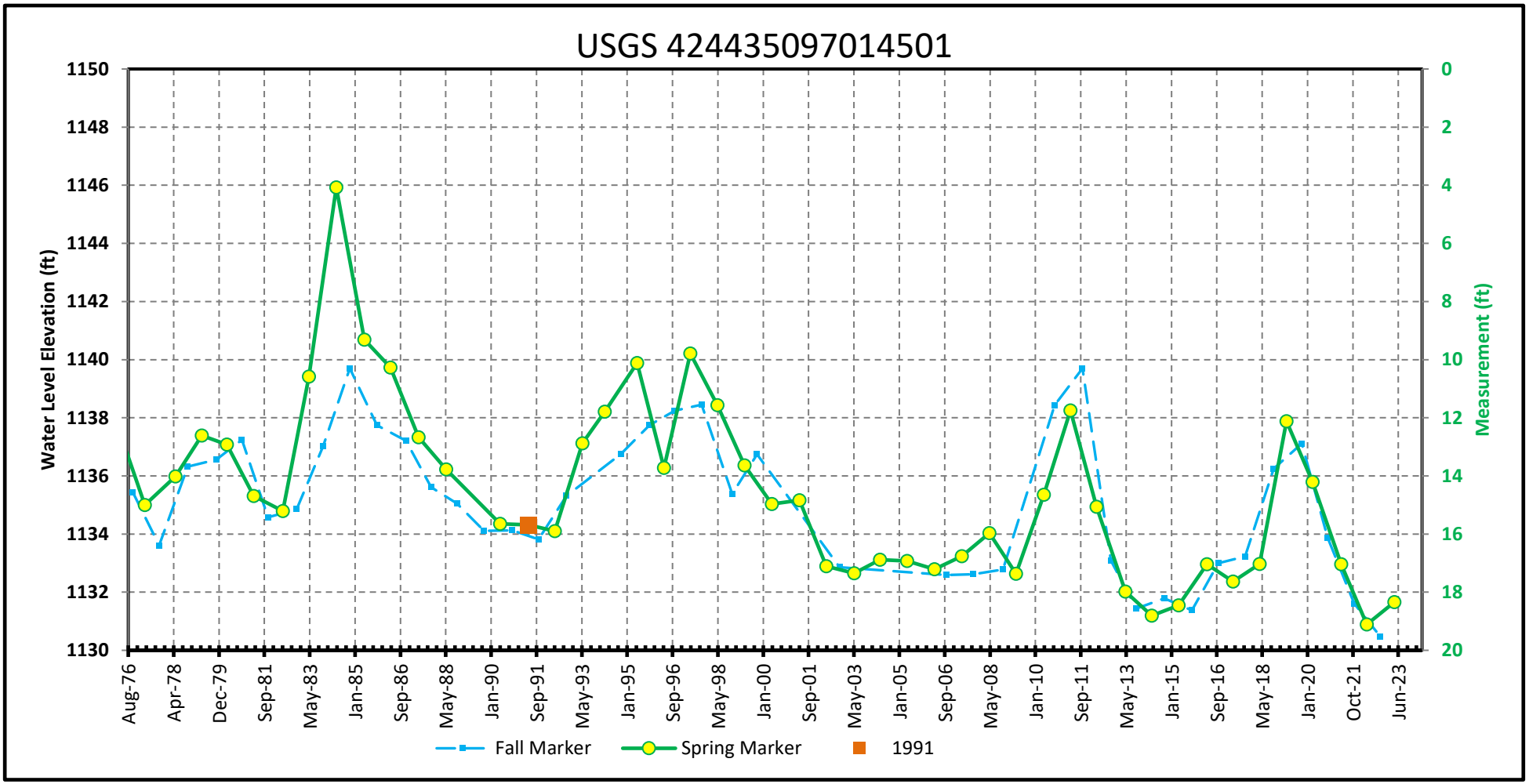


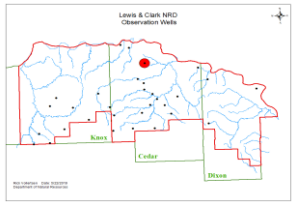


4C

Well Depth 88

32N 3E 13CDCC G-005176 1150 **Missouri River Alluvium** 7-Dec-23

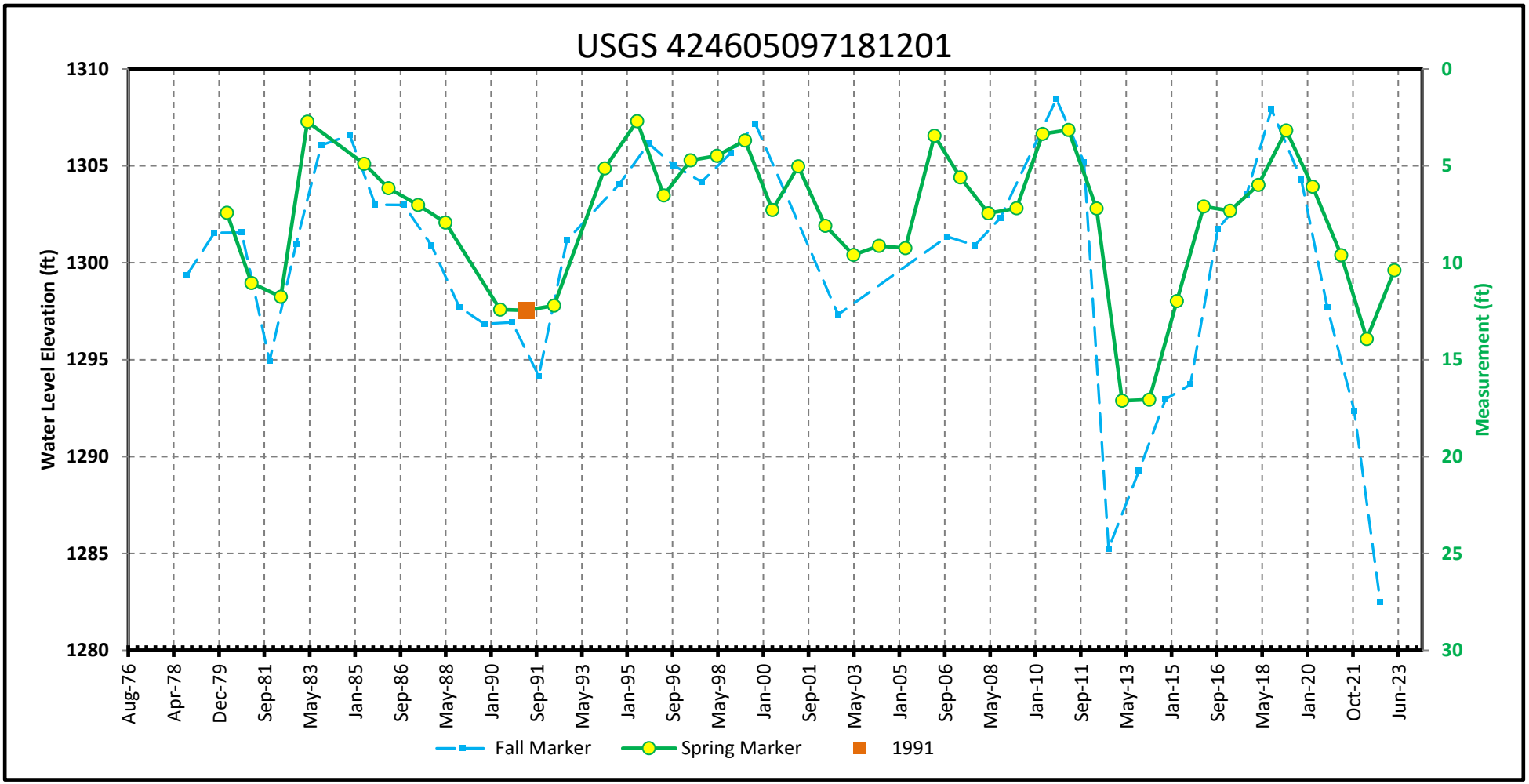


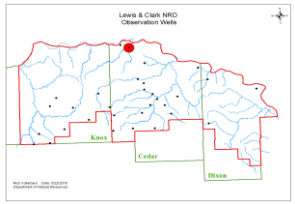


3C

Well Depth 105

32N 1E 10BCA G-034181 1310 **Niobrara** 7-Dec-23

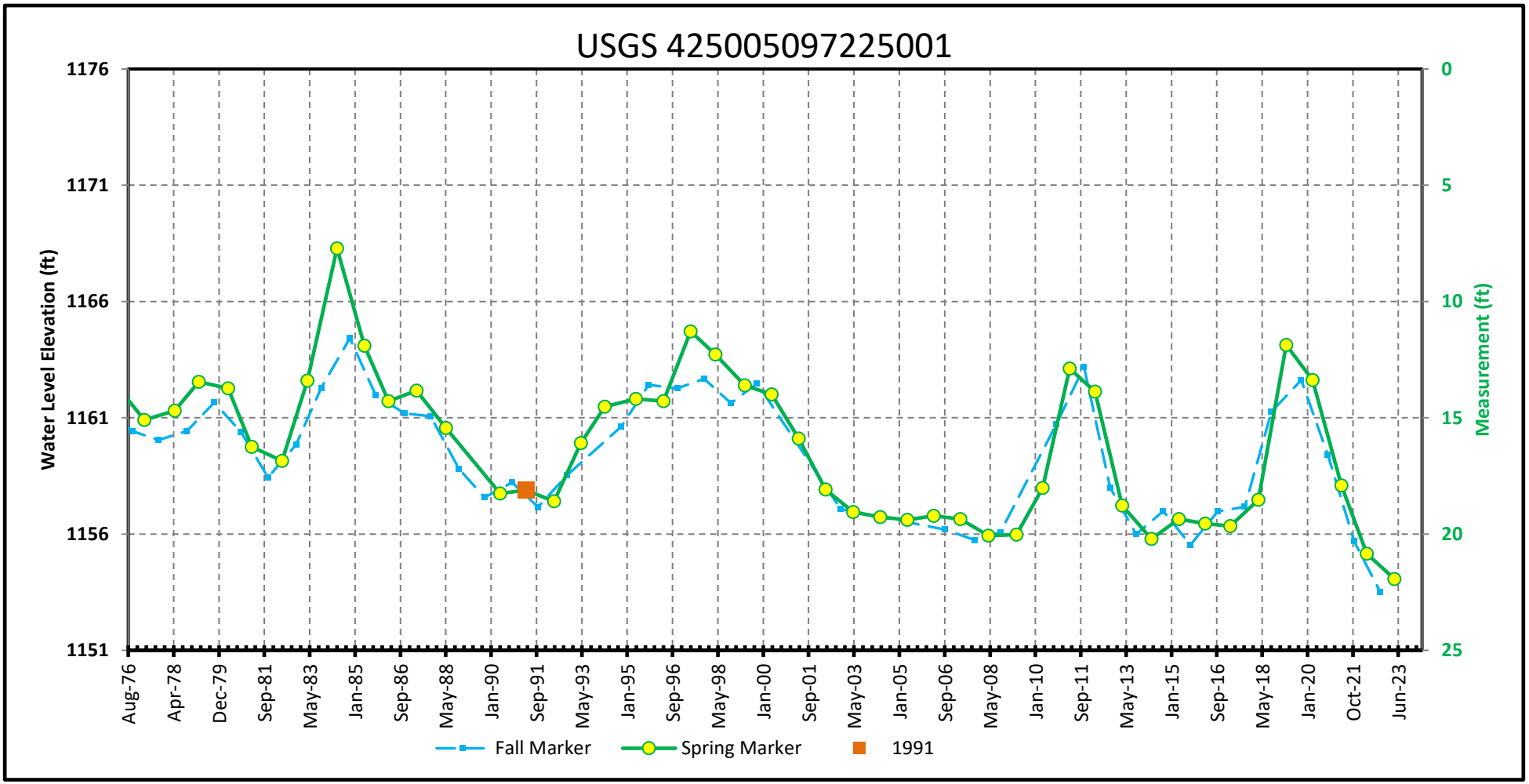


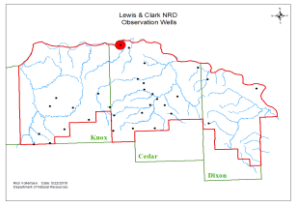


2C

Well Depth 88

33N 1W 13CAC G-009759 1176 **Missouri River Alluvium** 7-Dec-23

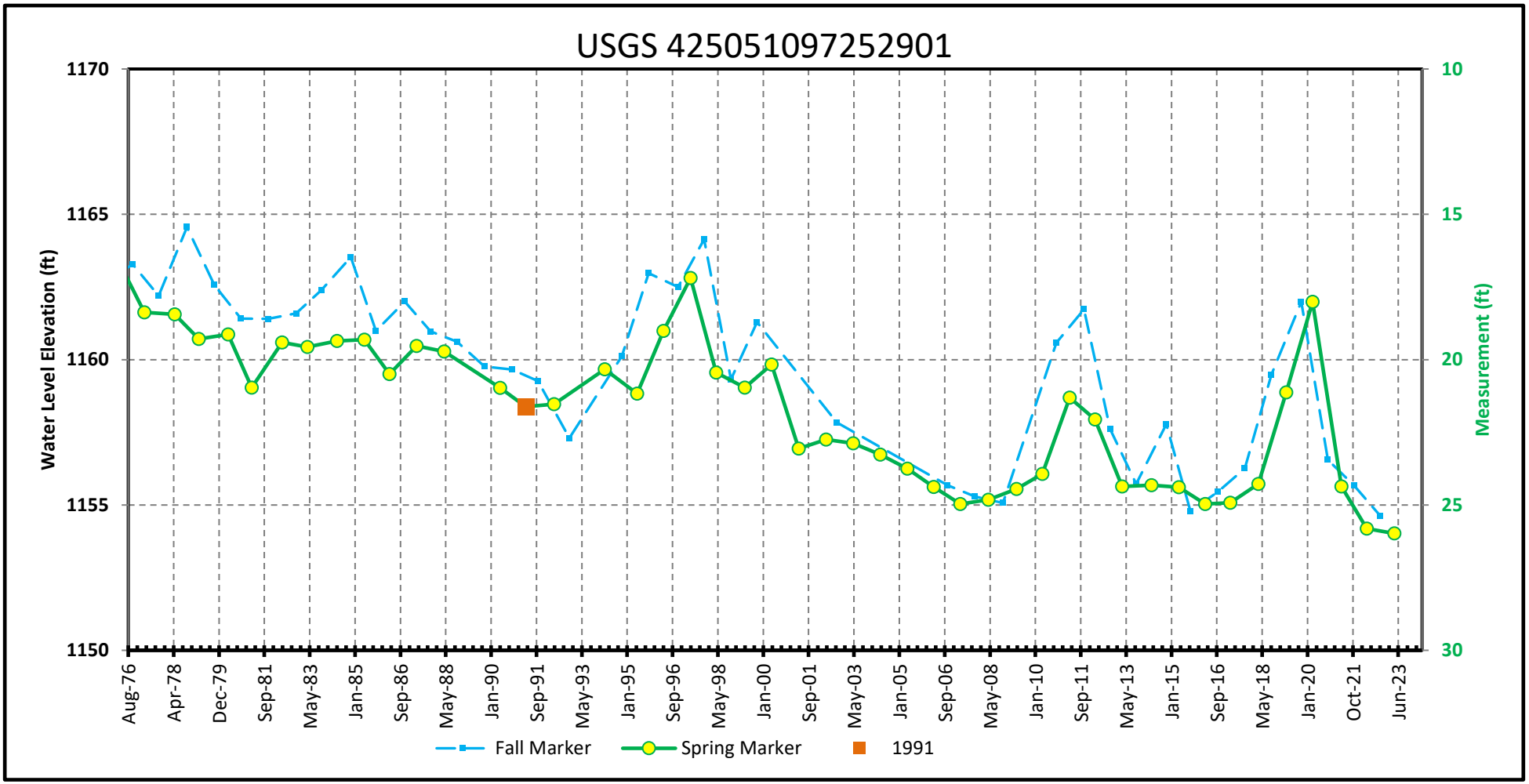




1C

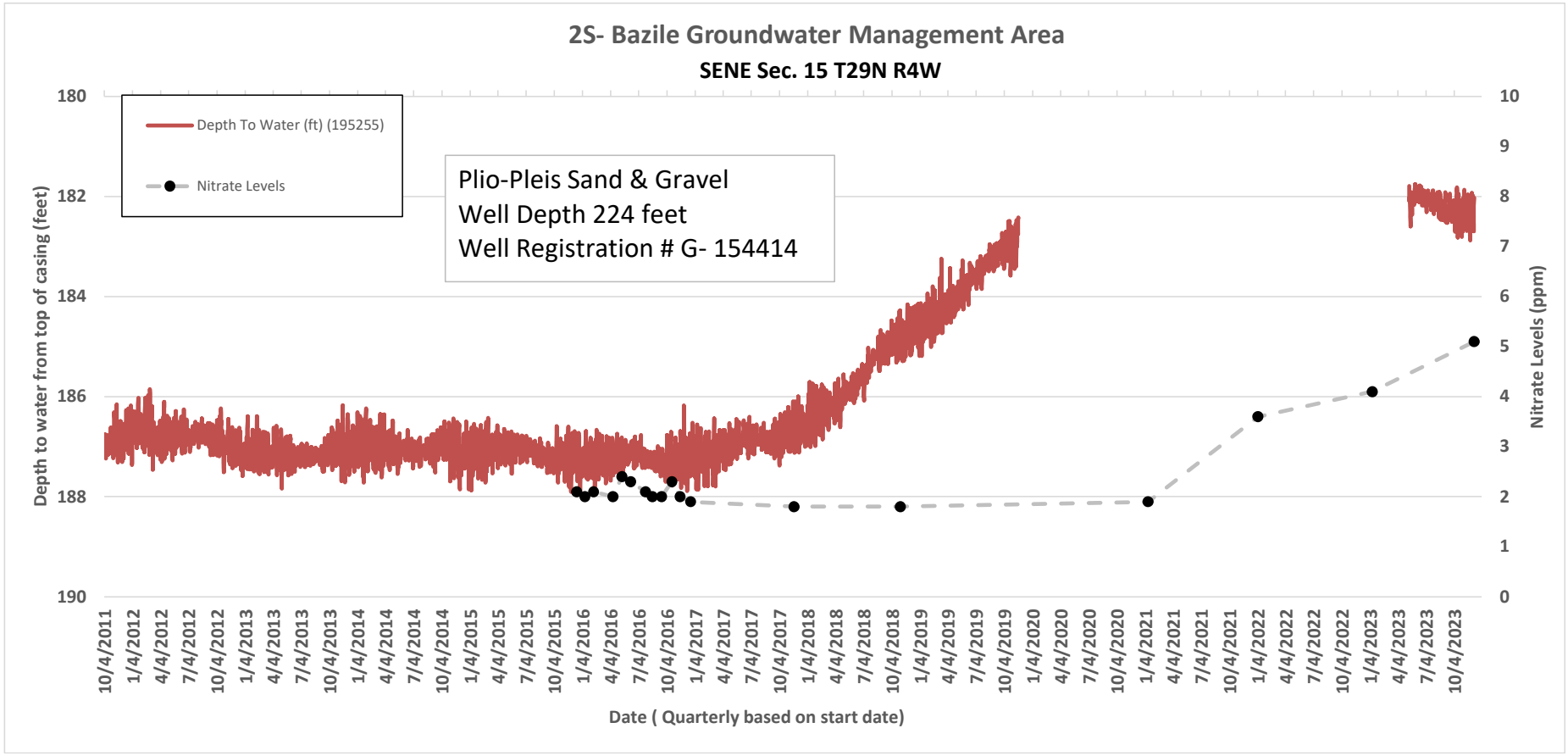
Well Depth 54

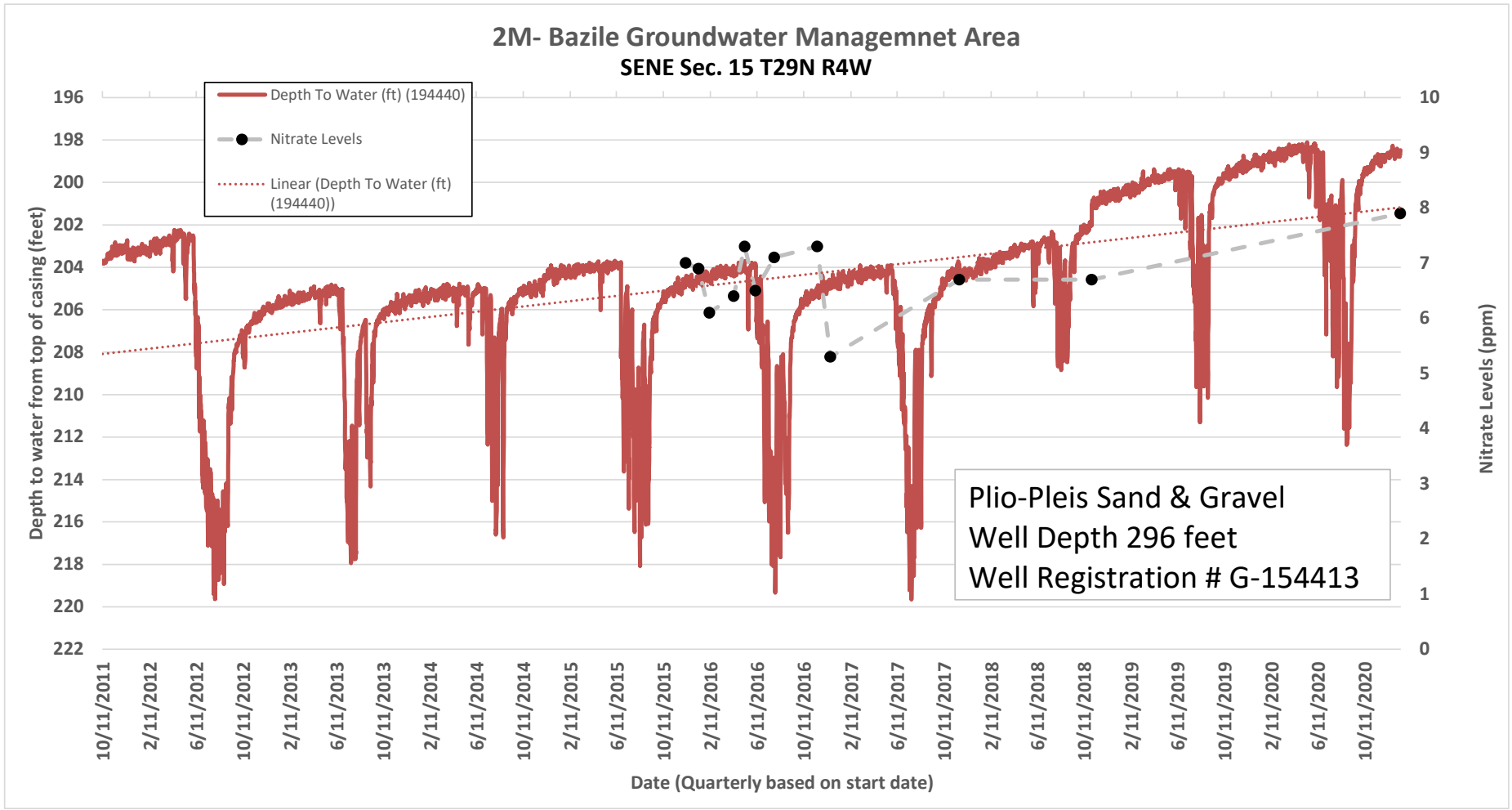
33N 1W 10CCB G-030411 1180 **Missouri River Alluvium** 7-Dec-23

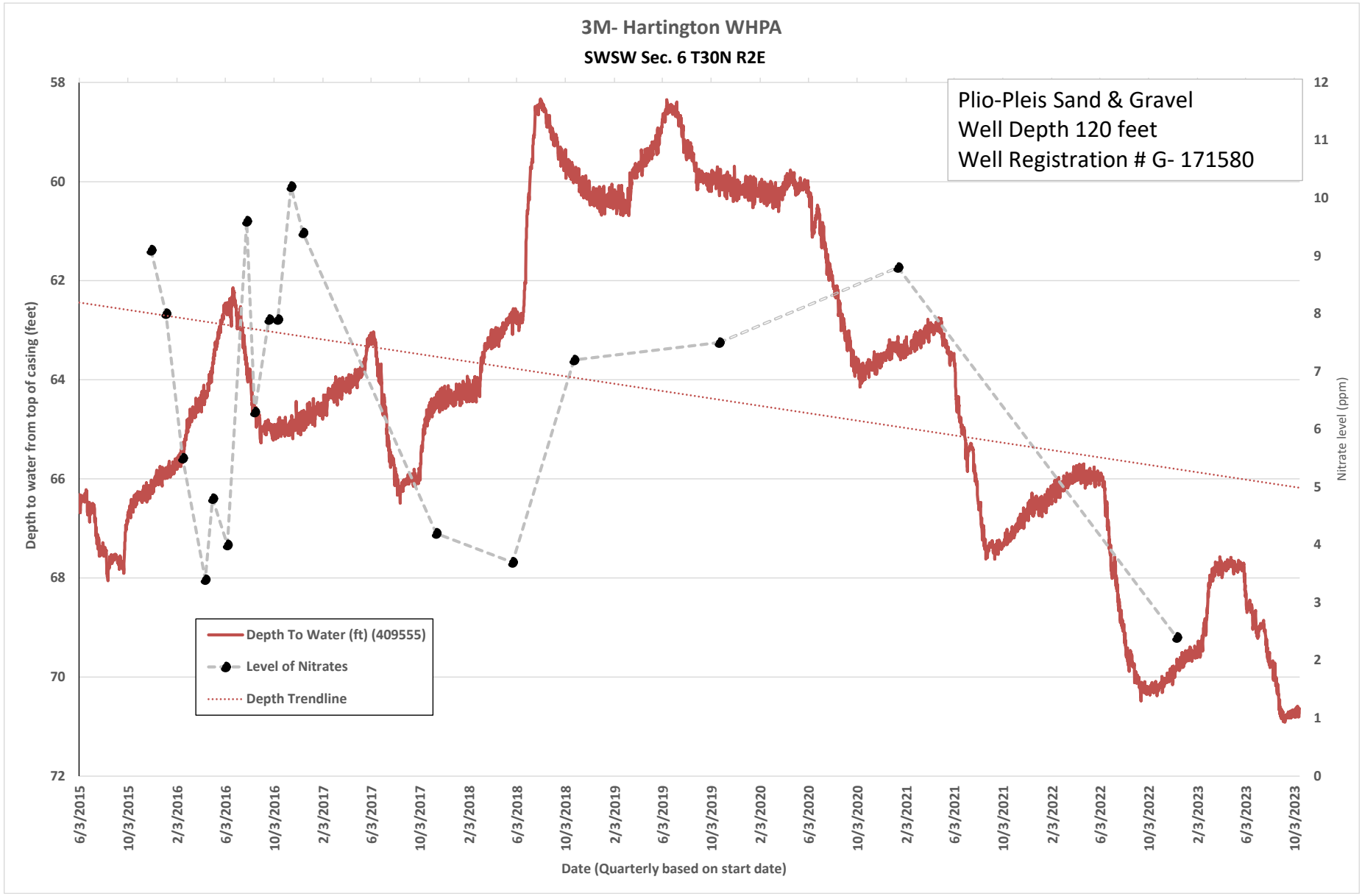


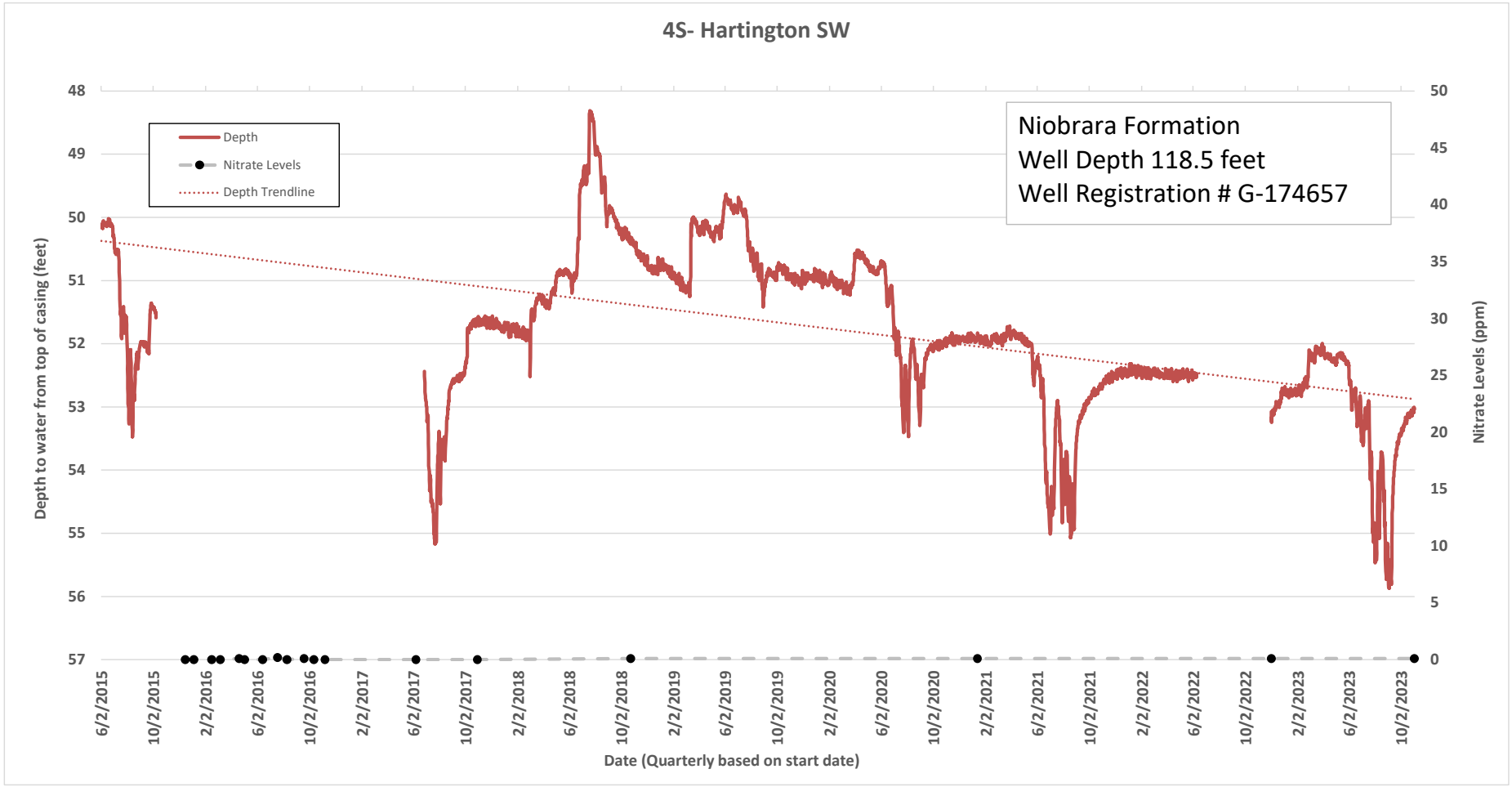
Appendix 2

Hydrographs of Observation Wells Static Water Levels and Nitrate Concentration


2S- Bazile Groundwater Management Area
SENE Sec. 15 T29N R4W
Depth To Water (ft) (195255)
Nitrate Levels
Plio-Pleis Sand & Gravel
Well Depth 224 feet
Well Registration # G- 154414
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly based on start date)


2M- Bazile Groundwater Managemnet Area
SENE Sec. 15 T29N R4W
Depth To Water (ft) (194440)
Nitrate Levels
Linear (Depth To Water (ft) (194440))
Depth to water from top of casing (feet)
196
198
200
202
204
206
208
210
212
214
216
218
220
222
Nitrate Levels (ppm)
10
9
8
7
6
5
4
3
2
1
0
10/11/2011
2/11/2012
6/11/2012
10/11/2012
2/11/2013
6/11/2013
10/11/2013
2/11/2014
6/11/2014
10/11/2014
2/11/2015
6/11/2015
10/11/2015
2/11/2016
6/11/2016
10/11/2016
2/11/2017
6/11/2017
10/11/2017
2/11/2018
6/11/2018
10/11/2018
2/11/2019
6/11/2019
10/11/2019
2/11/2020
6/11/2020
10/11/2020
Date (Quarterly based on start date)
Plio-Pleis Sand & Gravel
Well Depth 296 feet
Well Registration # G-154413


3M- Hartington WHPA
SWSW Sec. 6 T30N R2E
Plio-Pleis Sand & Gravel
Well Depth 120 feet
Well Registration # G- 171580
Depth To Water (ft) (409555)
Level of Nitrates
Depth Trendline
Depth to water from top of casing (feet)
Nitrate level (ppm)
Date (Quarterly based on start date)
58
60
62
64
66
68
70
72
12
11
10
9
8
7
6
5
4
3
2
1
0
6/3/2015
10/3/2015
2/3/2016
6/3/2016
10/3/2016
2/3/2017
6/3/2017
10/3/2017
2/3/2018
6/3/2018
10/3/2018
2/3/2019
6/3/2019
10/3/2019
2/3/2020
6/3/2020
10/3/2020
2/3/2021
6/3/2021
10/3/2021
2/3/2022
6/3/2022
10/3/2022
2/3/2023
6/3/2023
10/3/2023


4S- Hartington SW
Depth
Nitrate Levels
Depth Trendline
Niobrara Formation
Well Depth 118.5 feet
Well Registration # G-174657
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly based on start date)
48
49
50
51
52
53
54
55
56
57
50
45
40
35
30
25
20
15
10
5
0
6/2/2015
10/2/2015
2/2/2016
6/2/2016
10/2/2016
2/2/2017
6/2/2017
10/2/2017
2/2/2018
6/2/2018
10/2/2018
2/2/2019
6/2/2019
10/2/2019
2/2/2020
6/2/2020
10/2/2020
2/2/2021
6/2/2021
10/2/2021
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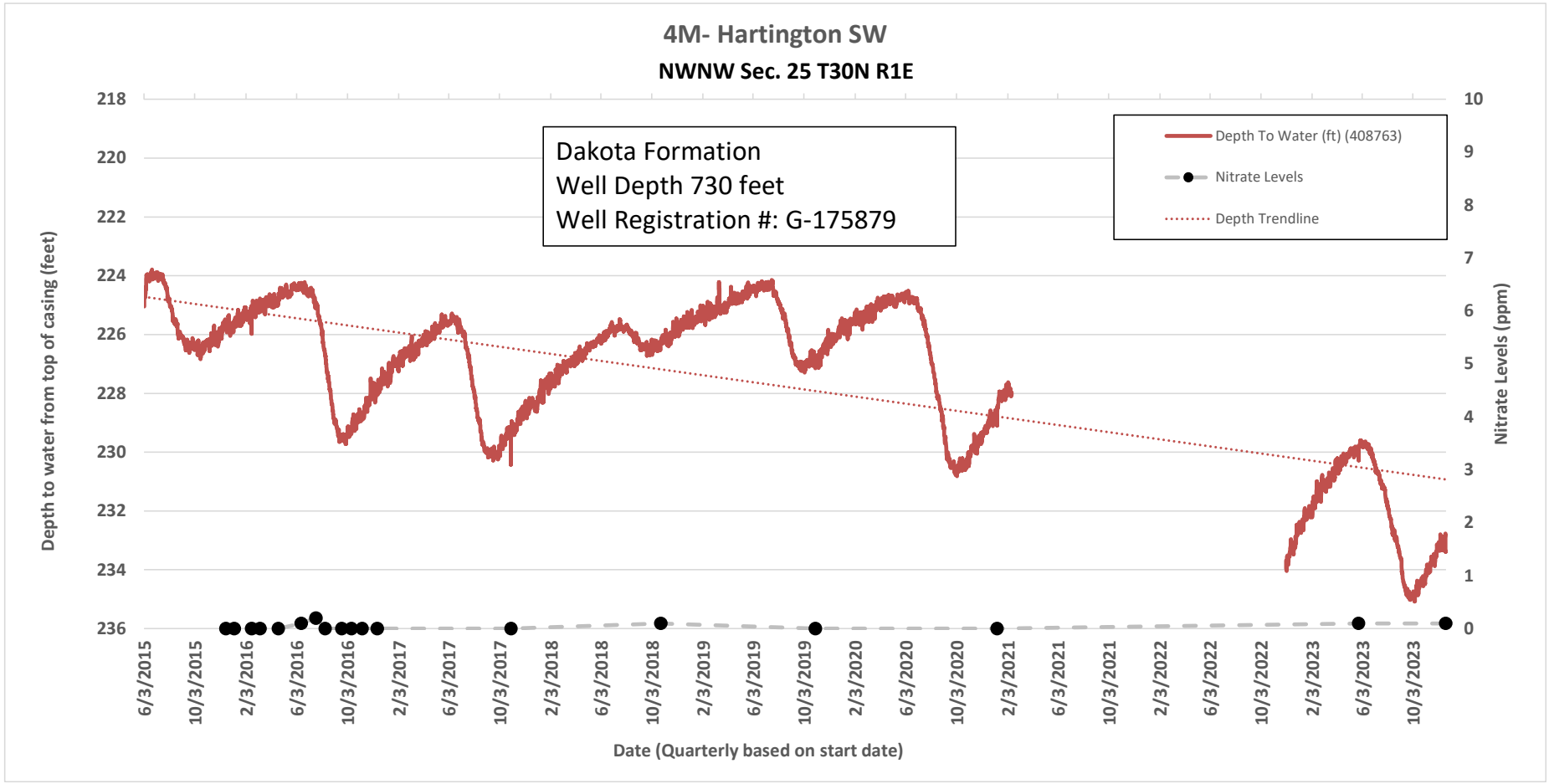
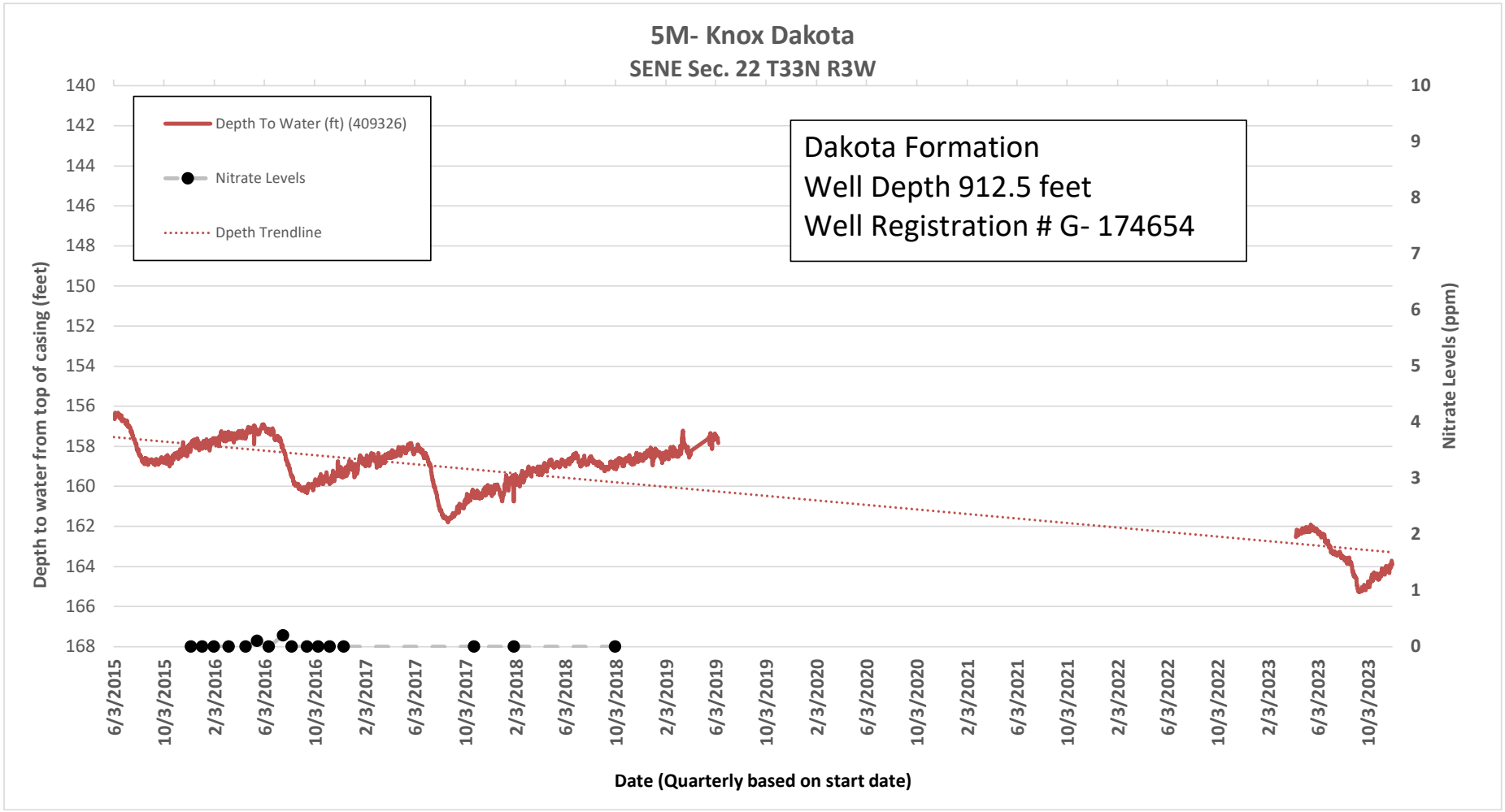
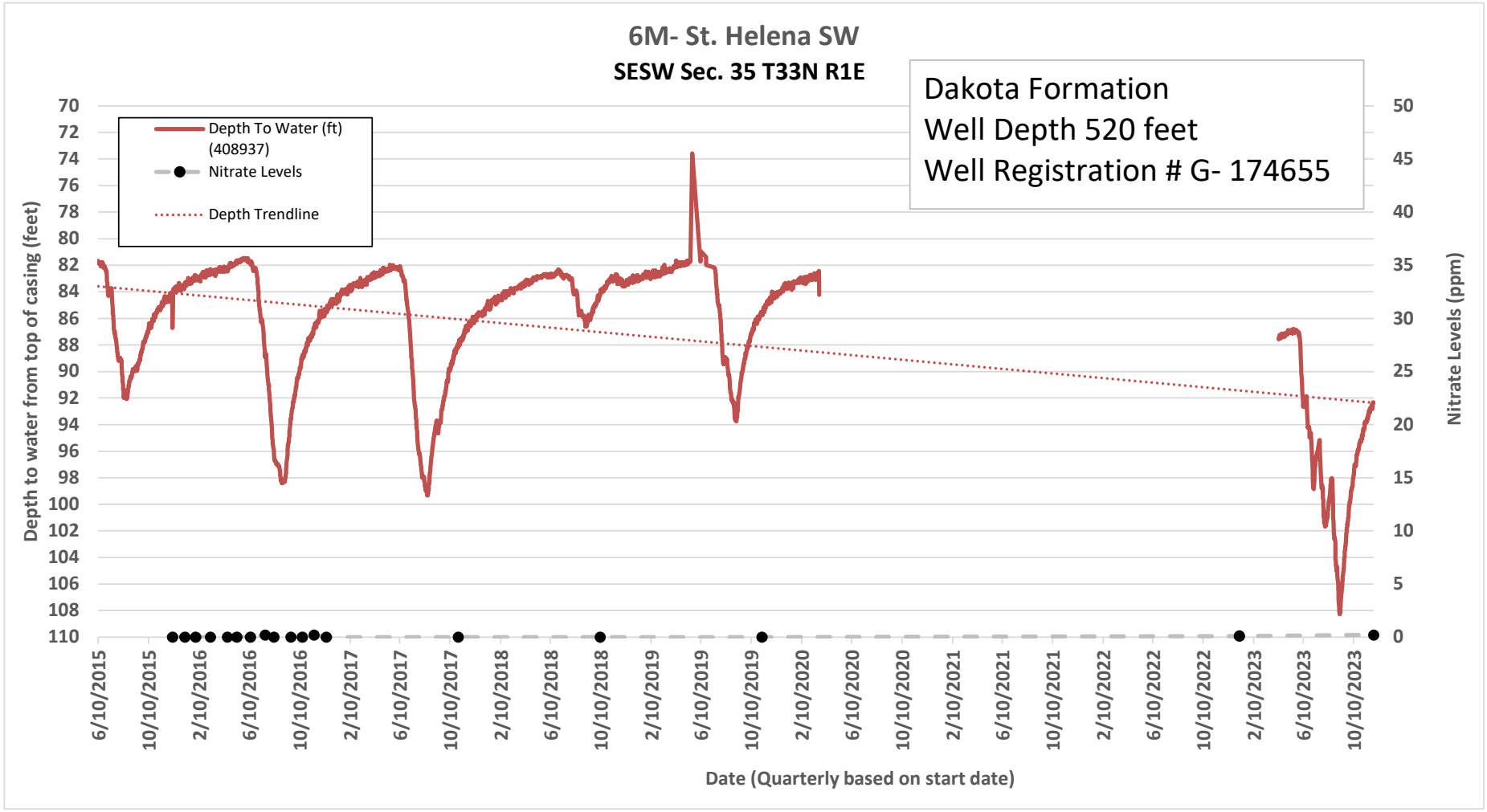
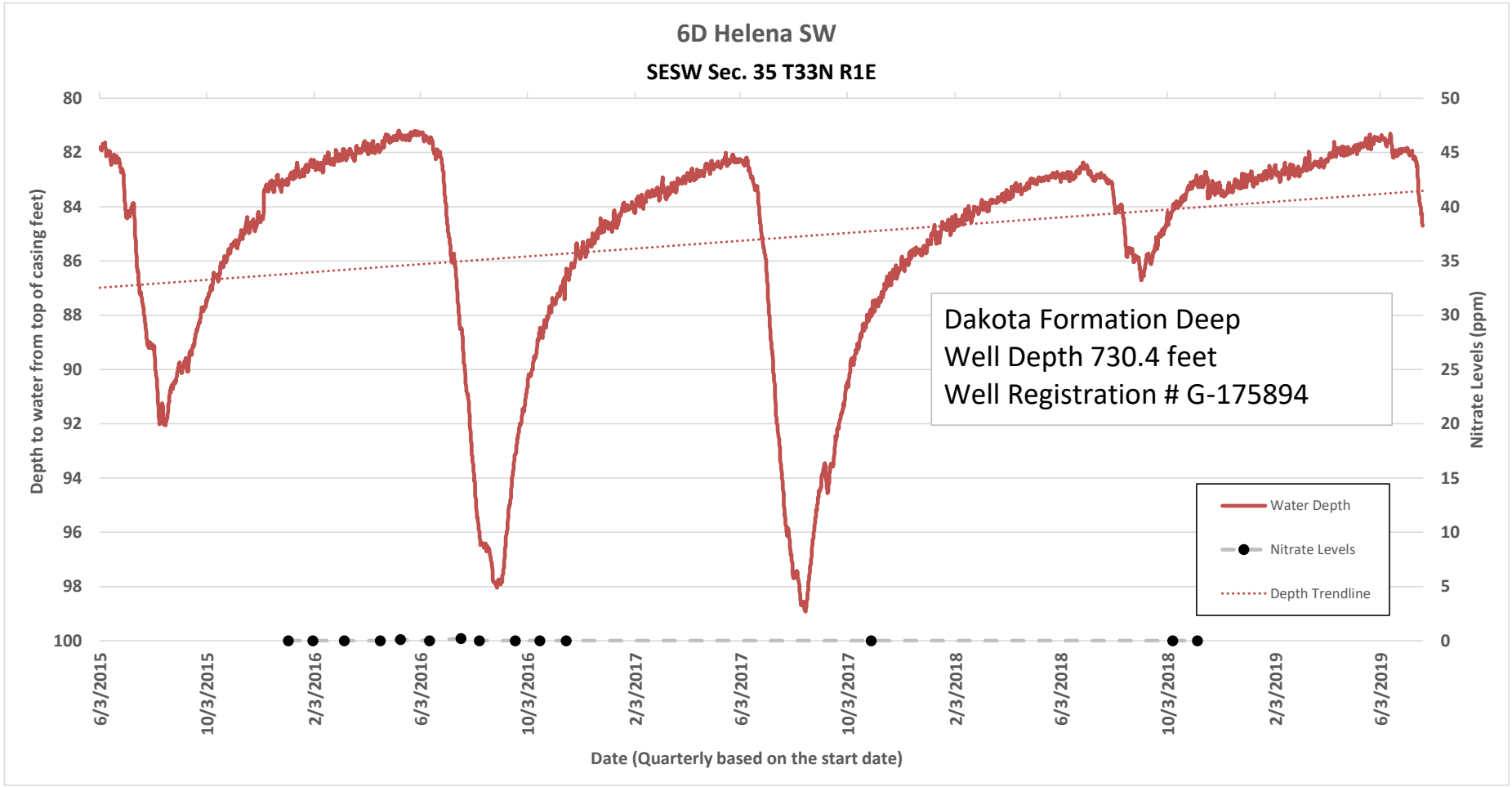
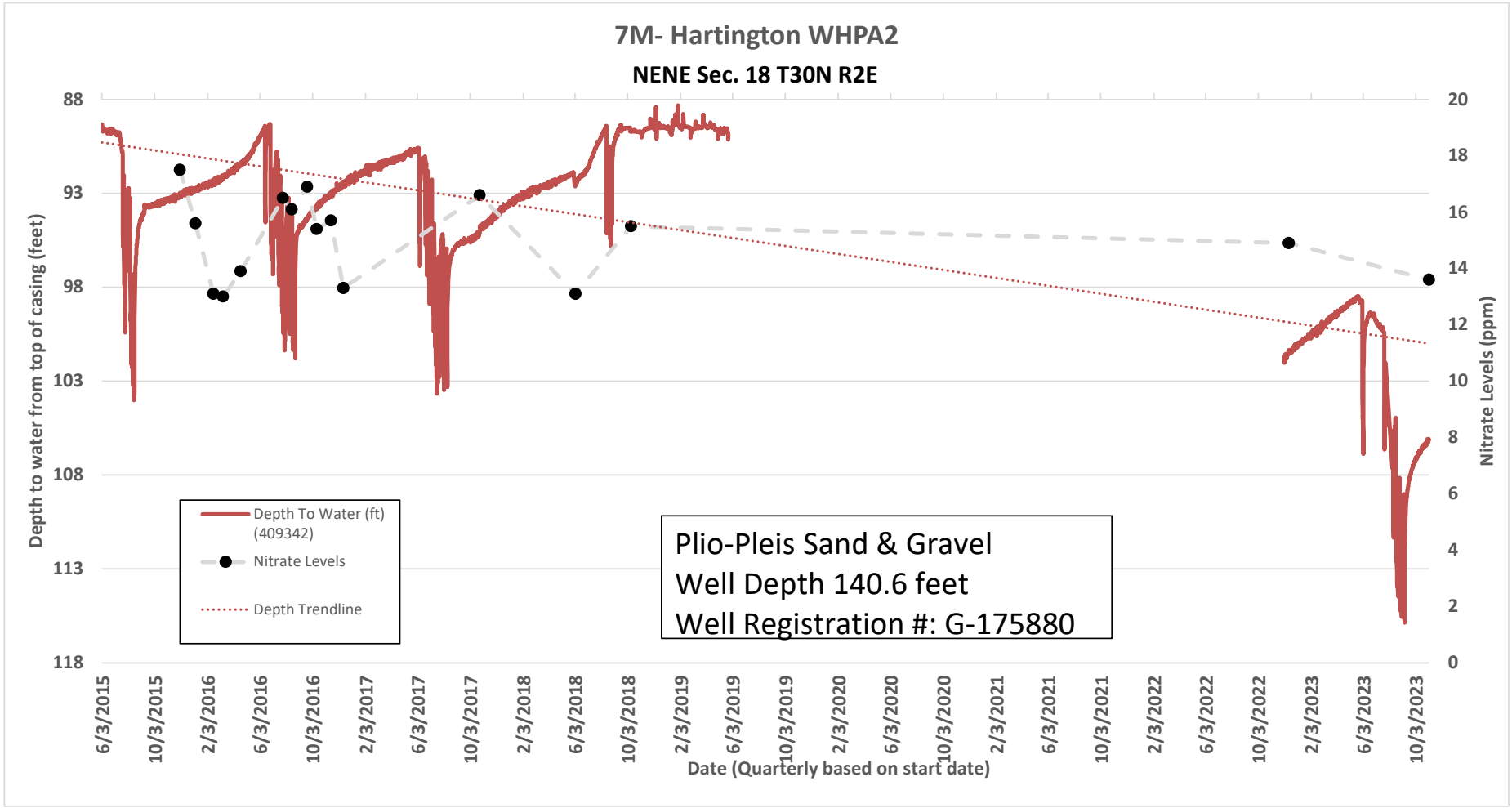
10/2/2022
2/2/2023
6/2/2023
10/2/2023

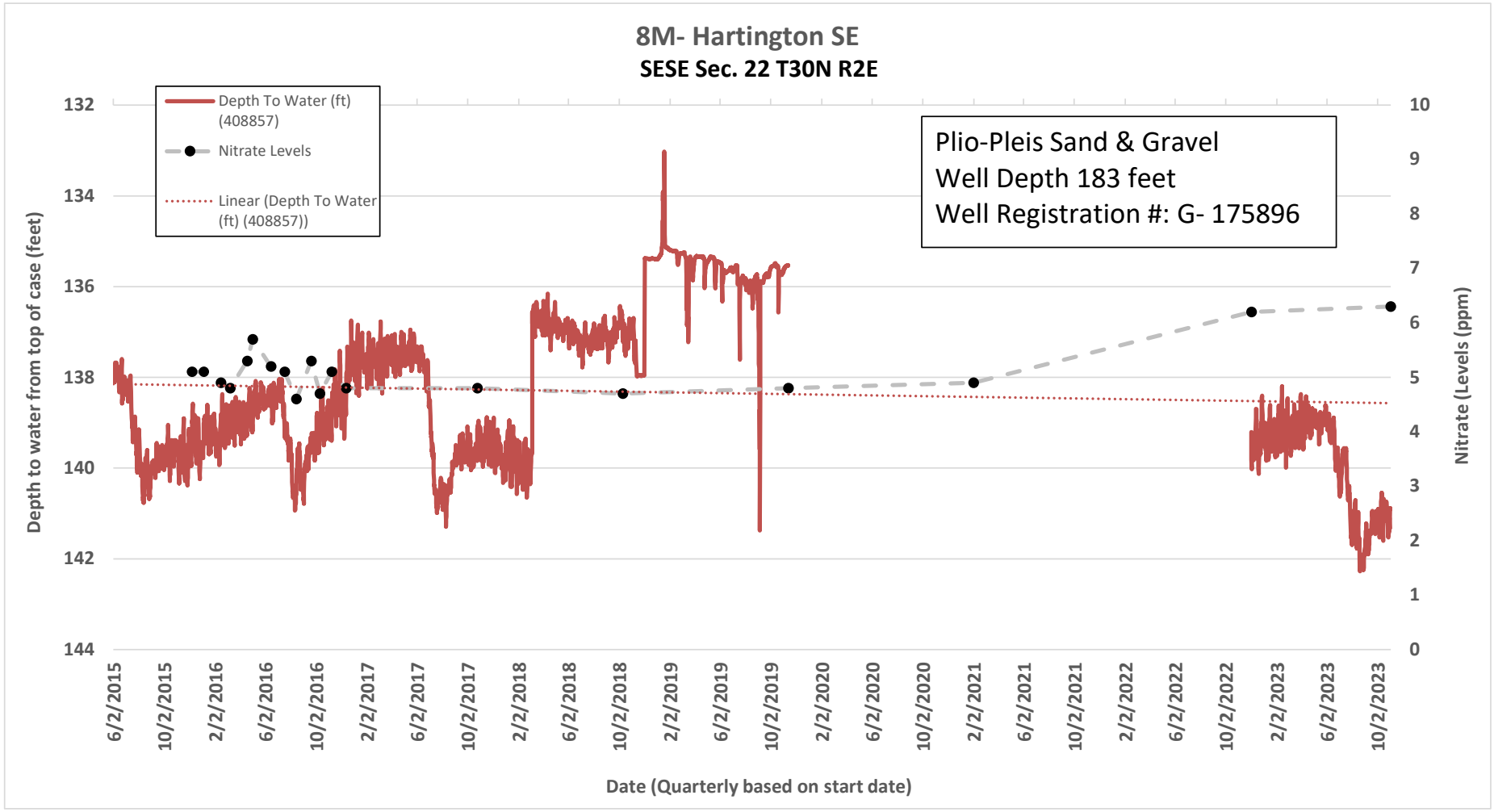

4M- Hartington SW
NWNW Sec. 25 T30N R1E
Dakota Formation
Well Depth 730 feet
Well Registration #: G-175879
Depth To Water (ft) (408763)
Nitrate Levels
Depth Trendline
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly based on start date)
218
220
222
224
226
228
230
232
234
236
10
9
8
7
6
5
4
3
2
1
0
6/3/2015
10/3/2015
2/3/2016
6/3/2016
10/3/2016
2/3/2017
6/3/2017
10/3/2017
2/3/2018
6/3/2018
10/3/2018
2/3/2019
6/3/2019
10/3/2019
2/3/2020
6/3/2020
10/3/2020
2/3/2021
6/3/2021
10/3/2021
2/3/2022
6/3/2022
10/3/2022
2/3/2023
6/3/2023
10/3/2023

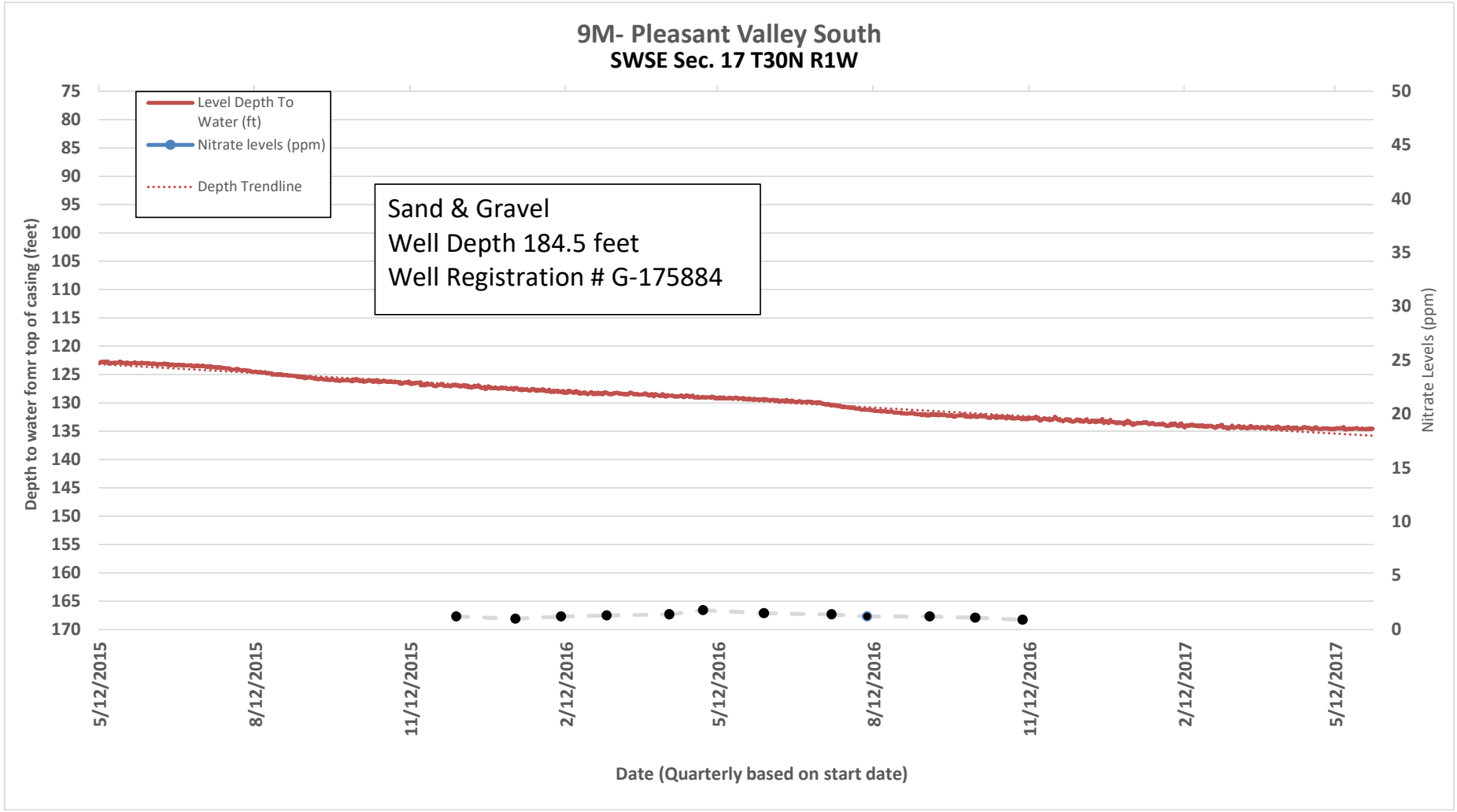

5M- Knox Dakota
SENE Sec. 22 T33N R3W
Depth To Water (ft) (409326)
Nitrate Levels
Dpeth Trendline
Dakota Formation
Well Depth 912.5 feet
Well Registration # G- 174654
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly based on start date)
140
142
144
146
148
150
152
154
156
158
160
162
164
166
168
10
9
8
7
6
5
4
3
2
1
0
6/3/2015
10/3/2015
2/3/2016
6/3/2016
10/3/2016
2/3/2017
6/3/2017
10/3/2017
2/3/2018
6/3/2018
10/3/2018
2/3/2019
6/3/2019
10/3/2019
2/3/2020
6/3/2020
10/3/2020
2/3/2021
6/3/2021
10/3/2021
2/3/2022
6/3/2022
10/3/2022
2/3/2023
6/3/2023
10/3/2023

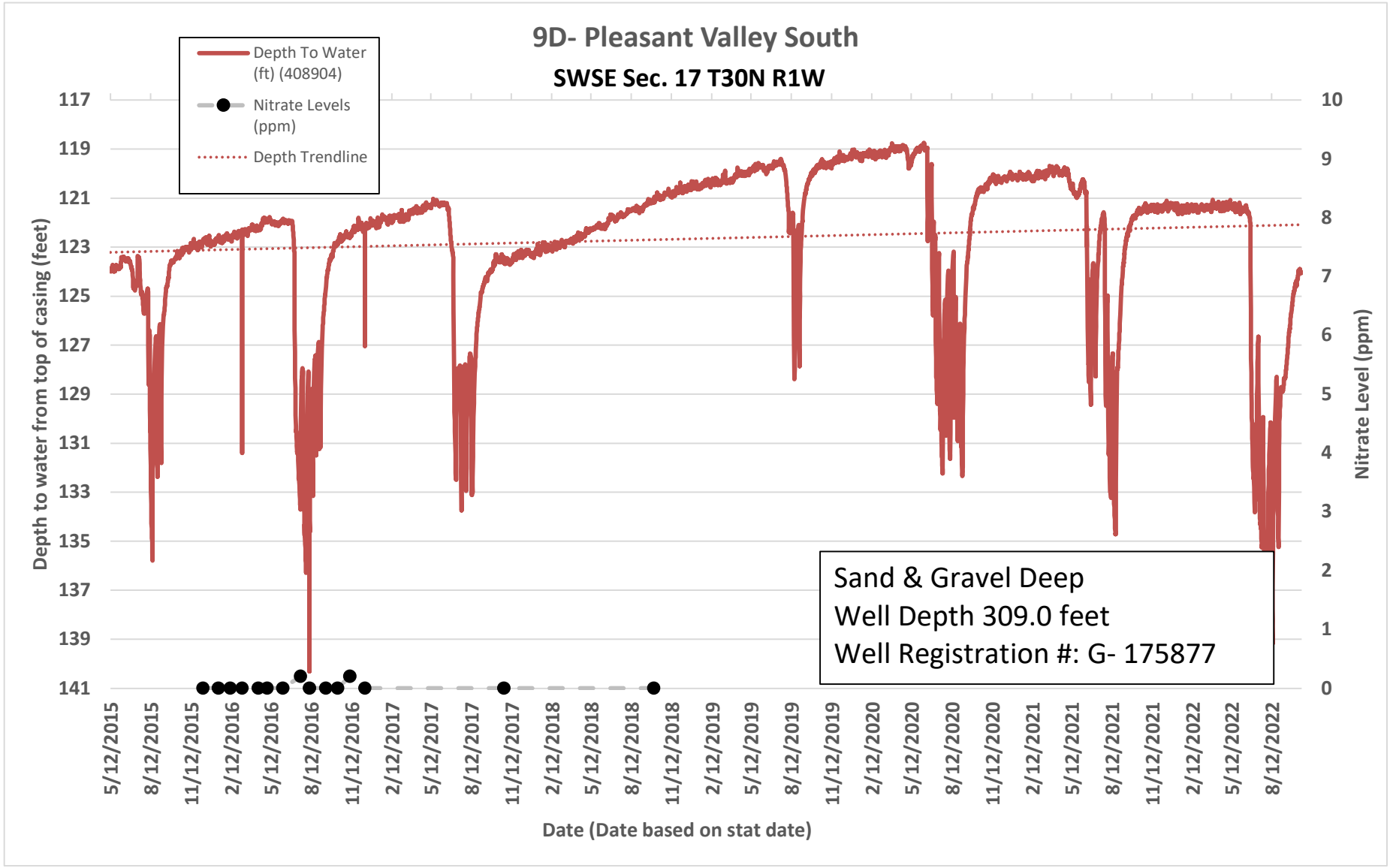

6M- St. Helena SW
SESW Sec. 35 T33N R1E
Dakota Formation
Well Depth 520 feet
Well Registration # G- 174655
Depth To Water (ft) (408937)
Nitrate Levels
Depth Trendline
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly based on start date)
70
72
74
76
78
80
82
84
86
88
90
92
94
96
98
100
102
104
106
108
110
50
45
40
35
30
25
20
15
10
5
0
6/10/2015
10/10/2015
2/10/2016
6/10/2016
10/10/2016
2/10/2017
6/10/2017
10/10/2017
2/10/2018
6/10/2018
10/10/2018
2/10/2019
6/10/2019
10/10/2019
2/10/2020
6/10/2020
10/10/2020
2/10/2021
6/10/2021
10/10/2021
2/10/2022
6/10/2022
10/10/2022
2/10/2023
6/10/2023
10/10/2023

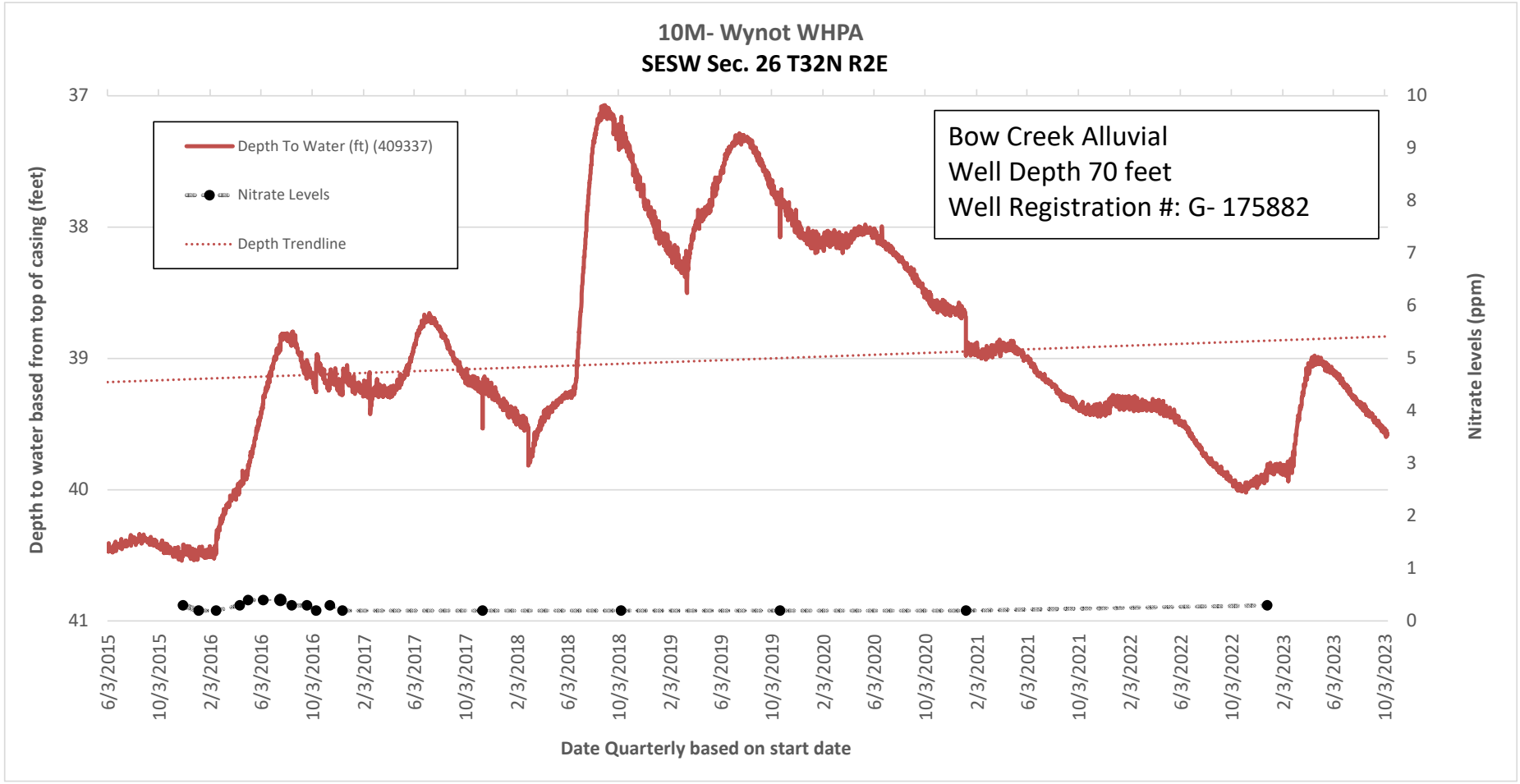

6D Helena SW
SESW Sec. 35 T33N R1E
Depth to water from top of casing feet)
Nitrate Levels (ppm)
80
82
84
86
88
90
92
94
96
98
100
50
45
40
35
30
25
20
15
10
5
0
6/3/2015
10/3/2015
2/3/2016
6/3/2016
10/3/2016
2/3/2017
6/3/2017
10/3/2017
2/3/2018
6/3/2018
10/3/2018
2/3/2019
6/3/2019
Date (Quarterly based on the start date)
Dakota Formation Deep
Well Depth 730.4 feet
Well Registration # G-175894
Water Depth
Nitrate Levels
Depth Trendline

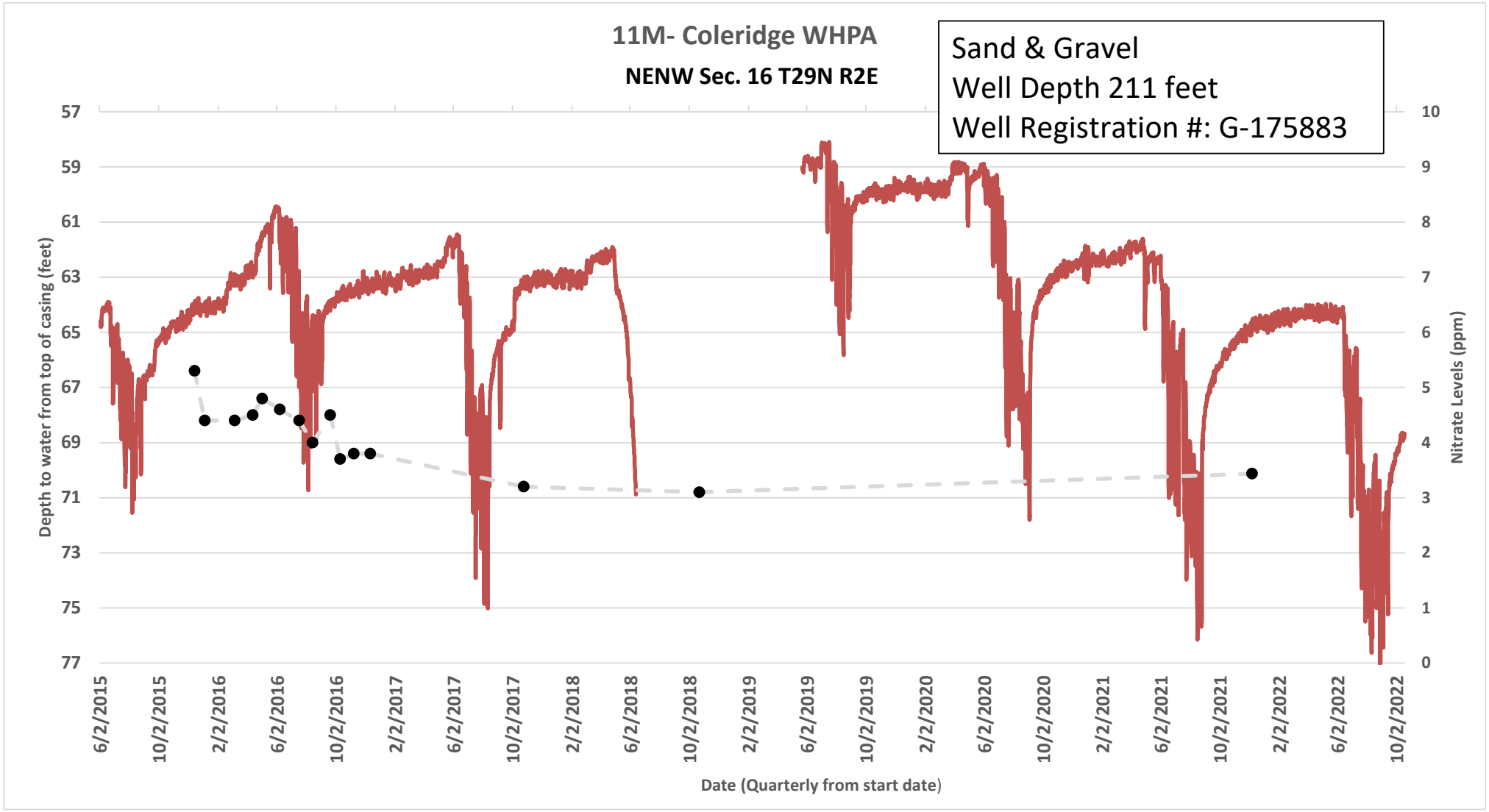

7M- Hartington WHPA2
NENE Sec. 18 T30N R2E
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly based on start date)
Depth To Water (ft) (409342)
Nitrate Levels
Depth Trendline
Plio-Pleis Sand & Gravel
Well Depth 140.6 feet
Well Registration #: G-175880

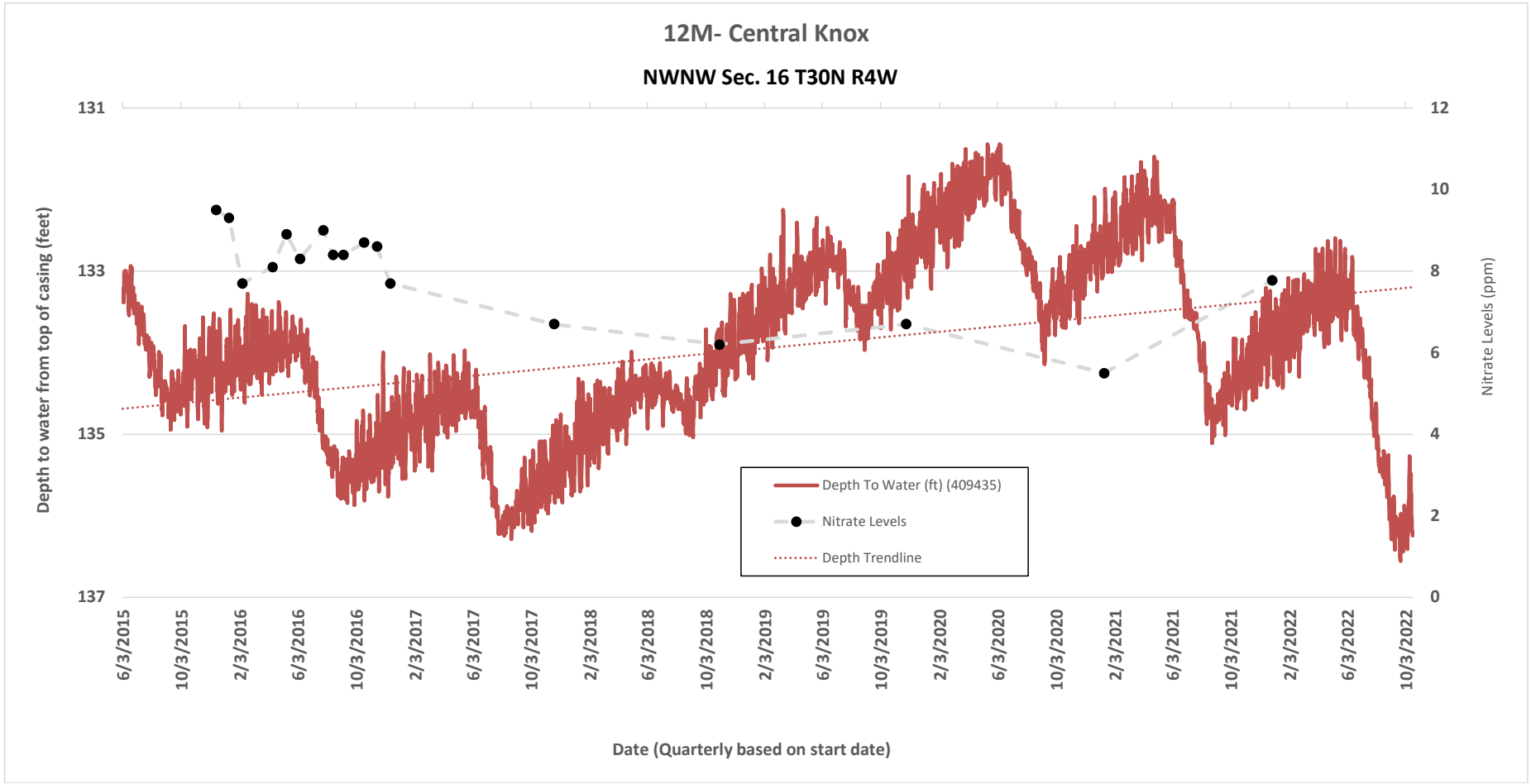

8M- Hartington SE
SESE Sec. 22 T30N R2E
Depth To Water (ft) (408857)
Nitrate Levels
Linear (Depth To Water (ft) (408857))
Plio-Pleis Sand & Gravel
Well Depth 183 feet
Well Registration #: G- 175896
Depth to water from top of case (feet)
Nitrate (Levels (ppm)
Date (Quarterly based on start date)
132
134
136
138
140
142
144
10
9
8
7
6
5
4
3
2
1
0
6/2/2015
10/2/2015
2/2/2016
6/2/2016
10/2/2016
2/2/2017
6/2/2017
10/2/2017
2/2/2018
6/2/2018
10/2/2018
2/2/2019
6/2/2019
10/2/2019
2/2/2020
6/2/2020
10/2/2020
2/2/2021
6/2/2021
10/2/2021
2/2/2022
6/2/2022
10/2/2022
2/2/2023
6/2/2023
10/2/2023

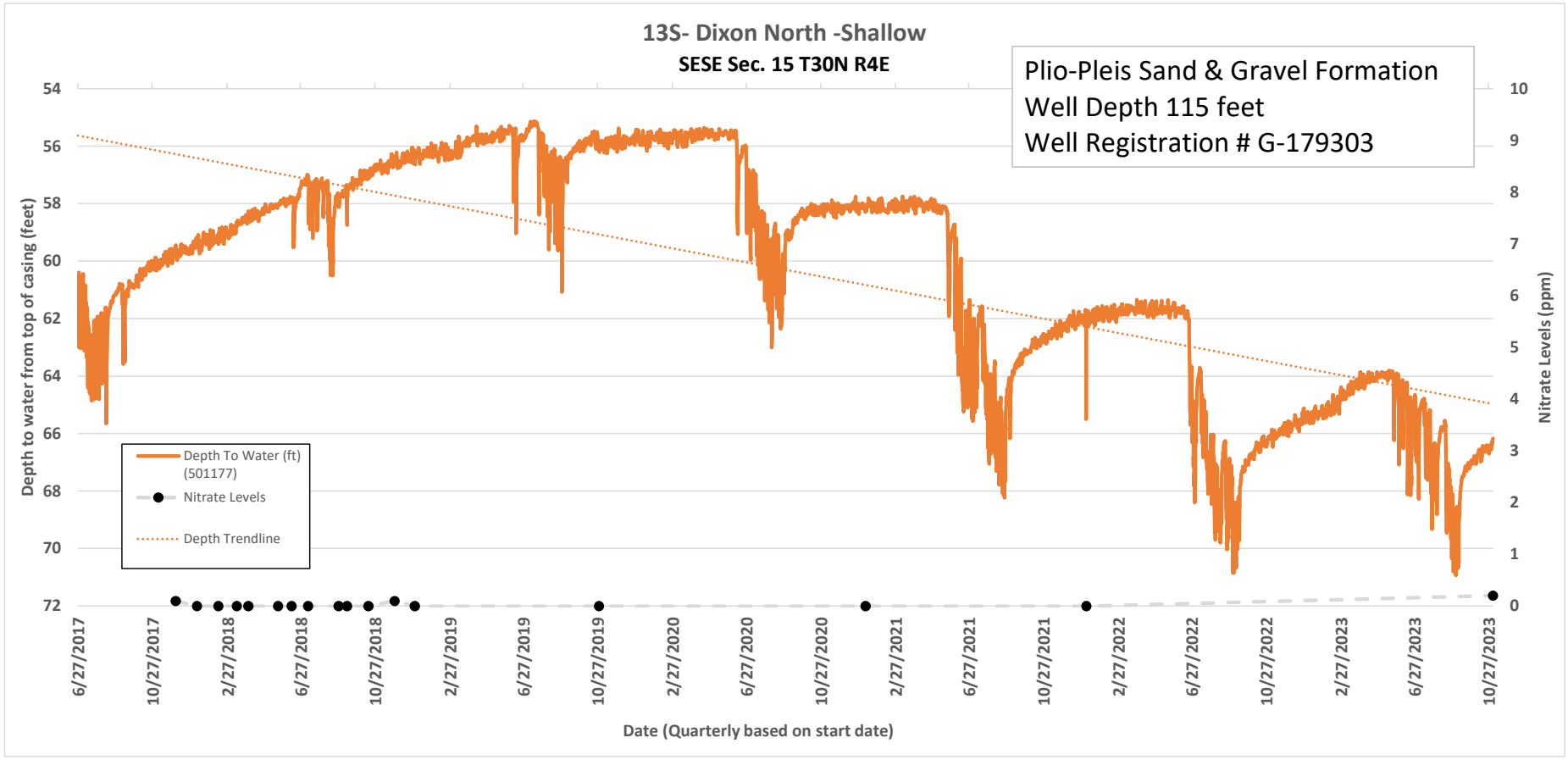

9M- Pleasant Valley South
SWSE Sec. 17 T30N R1W
Level Depth To Water (ft)
Nitrate levels (ppm)
Depth Trendline
Sand & Gravel
Well Depth 184.5 feet
Well Registration # G-175884
Depth to water fomr top of casing (feet)
Nitrate Levels (ppm)
75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
50
45
40
35
30
25
20
15
10
5
0
5/12/2015
8/12/2015
11/12/2015
2/12/2016
5/12/2016
8/12/2016
11/12/2016
2/12/2017
5/12/2017
Date (Quarterly based on start date)

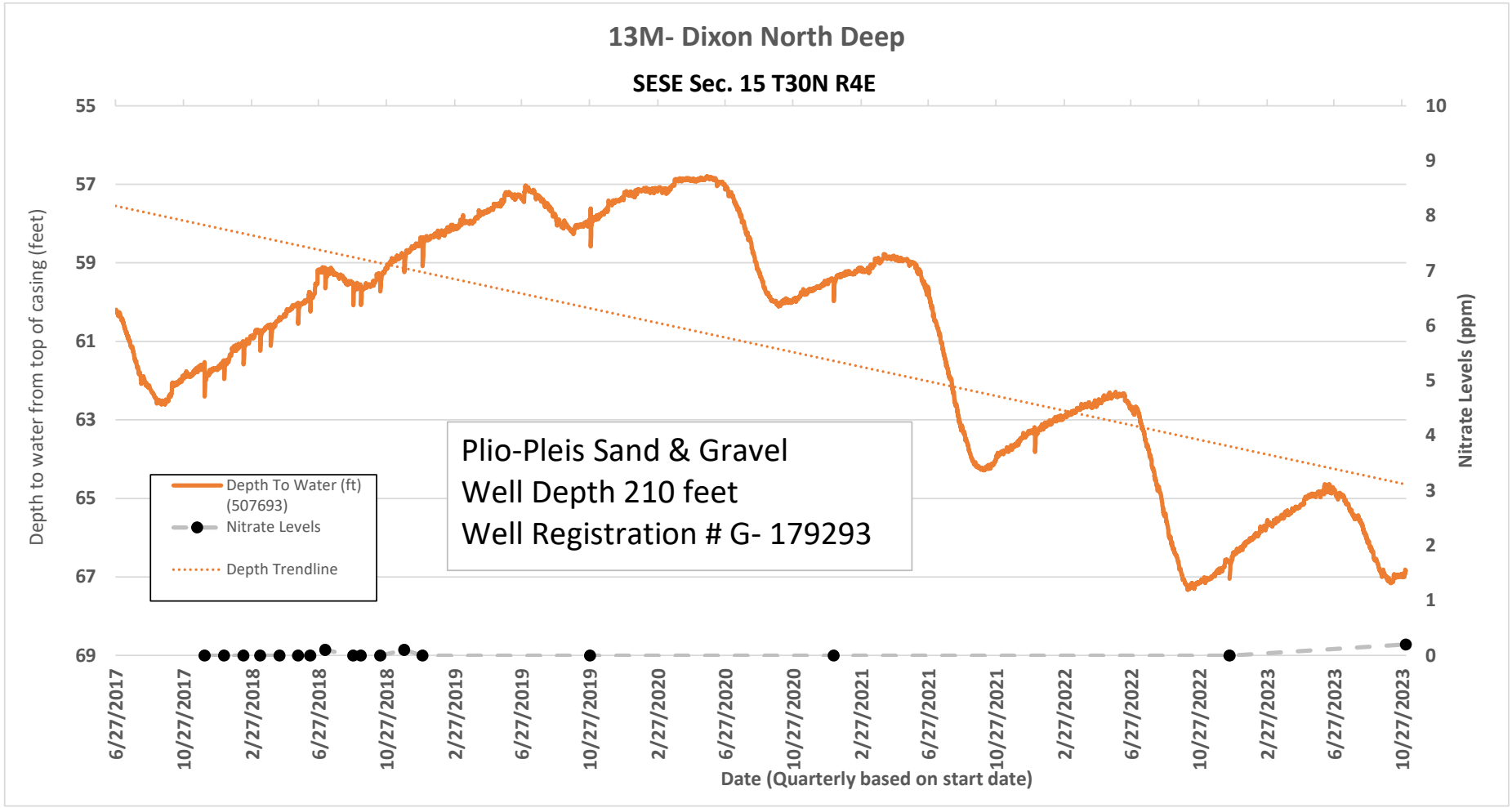

9D- Pleasant Valley South
SWSE Sec. 17 T30N R1W
Depth To Water (ft) (408904)
Nitrate Levels (ppm)
Depth Trendline
Depth to water from top of casing (feet)
Nitrate Level (ppm)
Date (Date based on stat date)
Sand & Gravel Deep
Well Depth 309.0 feet
Well Registration #: G- 175877

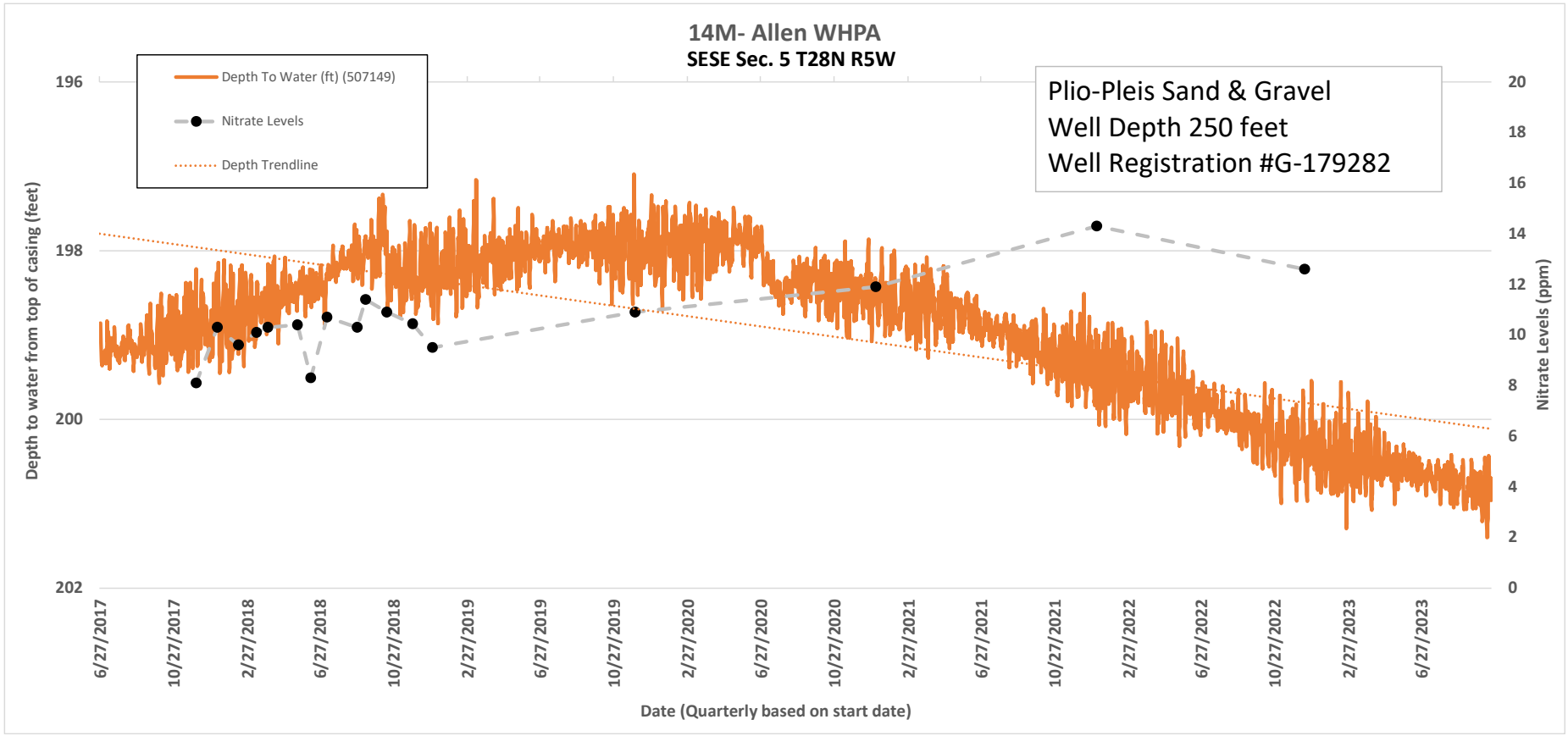

10M- Wynot WHPA
SESW Sec. 26 T32N R2E
Depth To Water (ft) (409337)
Nitrate Levels
Depth Trendline
Bow Creek Alluvial
Well Depth 70 feet
Well Registration #: G- 175882
Depth to water based from top of casing (feet)
Nitrate levels (ppm)
Date Quarterly based on start date
37
38
39
40
41
10
9
8
7
6
5
4
3
2
1
0
6/3/2015
10/3/2015
2/3/2016
6/3/2016
10/3/2016
2/3/2017
6/3/2017
10/3/2017
2/3/2018
6/3/2018
10/3/2018
2/3/2019
6/3/2019
10/3/2019
2/3/2020
6/3/2020
10/3/2020
2/3/2021
6/3/2021
10/3/2021
2/3/2022
6/3/2022
10/3/2022
2/3/2023
6/3/2023
10/3/2023

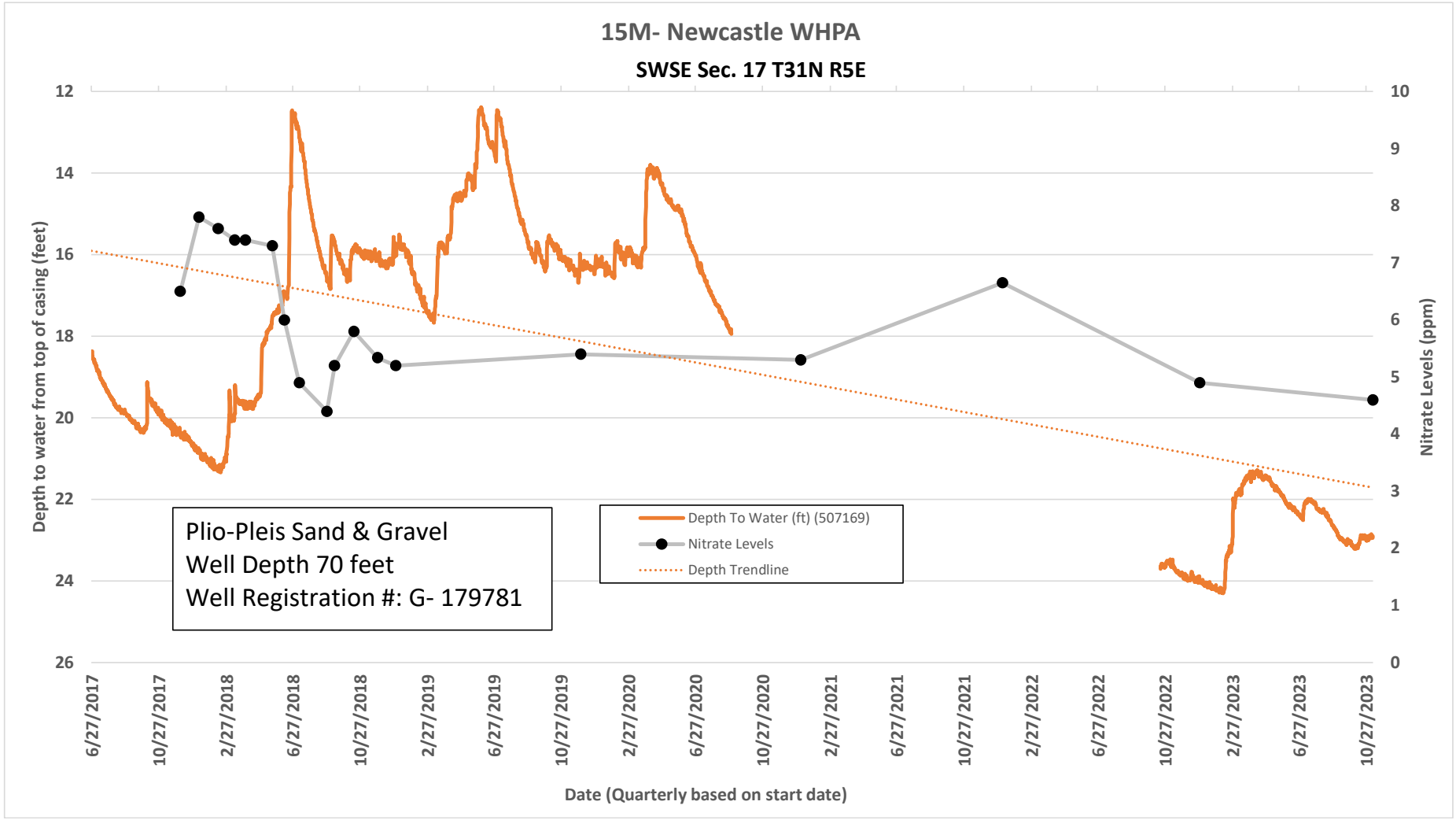

11M- Coleridge WHPA
NENW Sec. 16 T29N R2E
Sand & Gravel
Well Depth 211 feet
Well Registration #: G-175883
Depth to water from top of casing (feet)
57
59
61
63
65
67
69
71
73
75
77
Nitrate Levels (ppm)
10
9
8
7
6
5
4
3
2
1
0
6/2/2015
10/2/2015
2/2/2016
6/2/2016
10/2/2016
2/2/2017
6/2/2017
10/2/2017
2/2/2018
6/2/2018
10/2/2018
2/2/2019
6/2/2019
10/2/2019
2/2/2020
6/2/2020
10/2/2020
2/2/2021
6/2/2021
10/2/2021
2/2/2022
6/2/2022
10/2/2022
Date (Quarterly from start date)

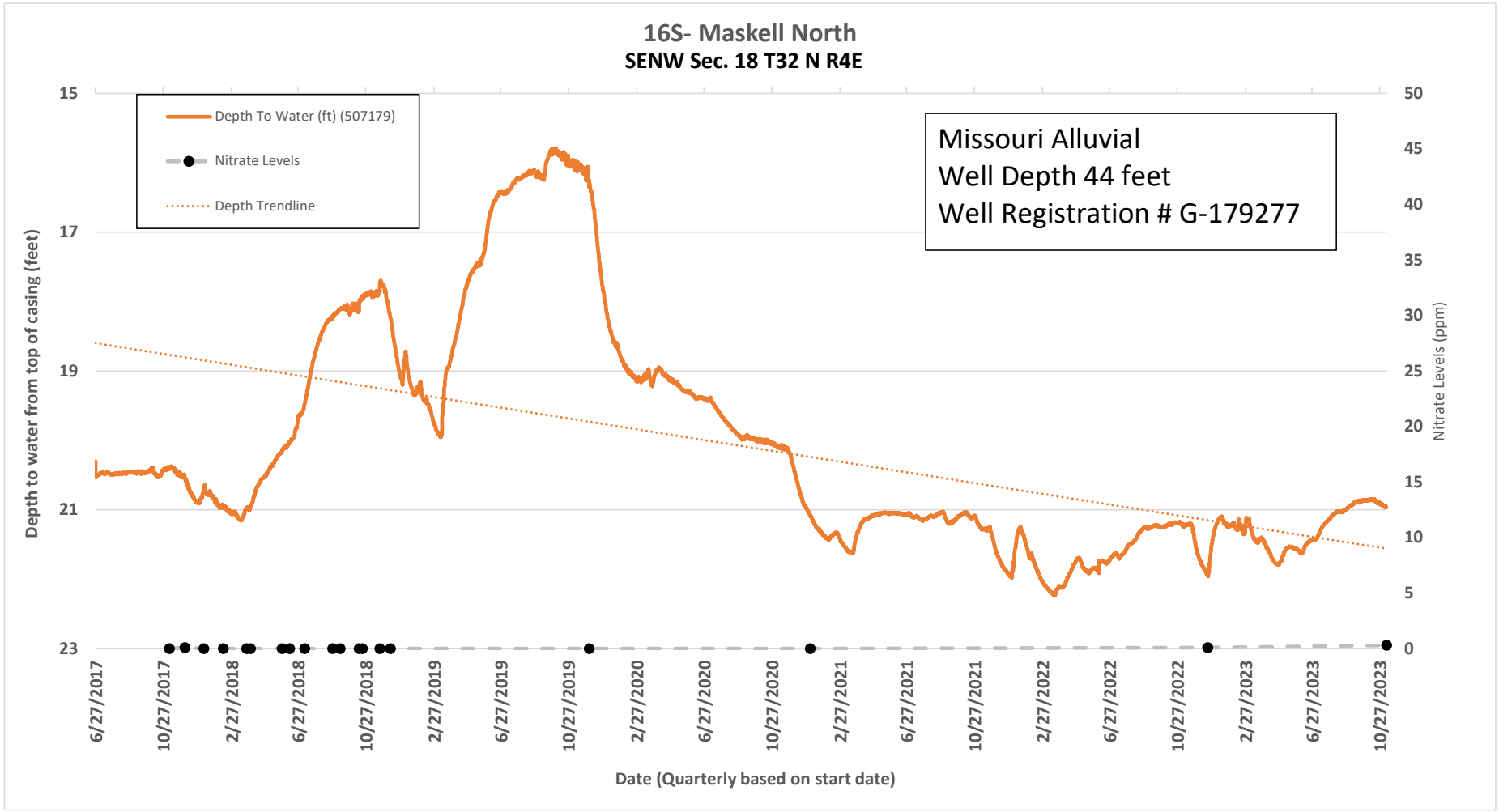

12M- Central Knox
NWNW Sec. 16 T30N R4W
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
131
133
135
137
12
10
8
6
4
2
0
6/3/2015
10/3/2015
2/3/2016
6/3/2016
10/3/2016
2/3/2017
6/3/2017
10/3/2017
2/3/2018
6/3/2018
10/3/2018
2/3/2019
6/3/2019
10/3/2019
2/3/2020
6/3/2020
10/3/2020
2/3/2021
6/3/2021
10/3/2021
2/3/2022
6/3/2022
10/3/2022
Depth To Water (ft) (409435)
Nitrate Levels
Depth Trendline
Date (Quarterly based on start date)

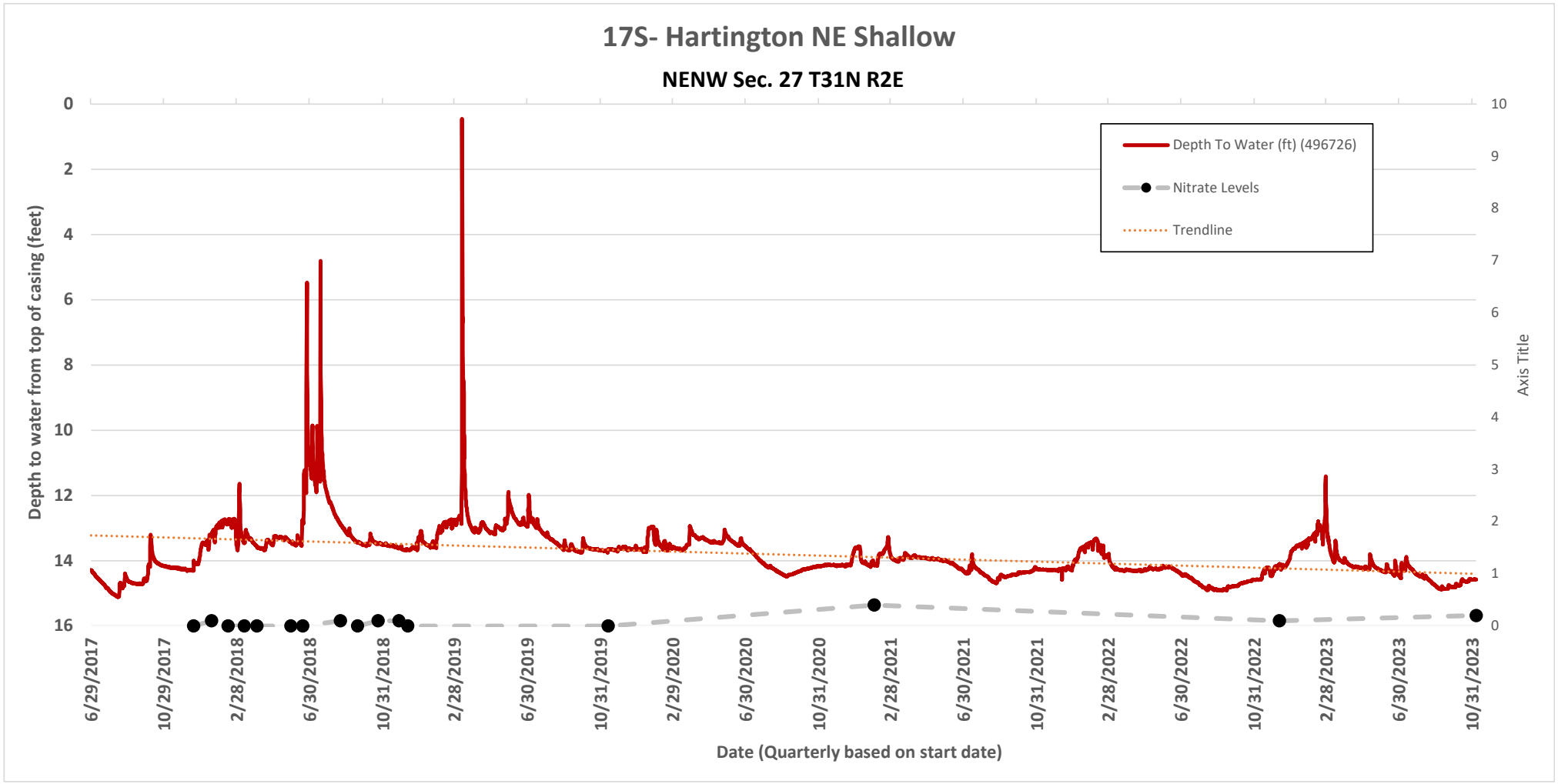

13S- Dixon North -Shallow
SESE Sec. 15 T30N R4E
Plio-Pleis Sand & Gravel Formation
Well Depth 115 feet
Well Registration # G-179303
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Depth To Water (ft) (501177)
Nitrate Levels
Depth Trendline
Date (Quarterly based on start date)
54
56
58
60
62
64
66
68
70
72
10
9
8
7
6
5
4
3
2
1
0
6/27/2017
10/27/2017
2/27/2018
6/27/2018
10/27/2018
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
2/27/2023
6/27/2023
10/27/2023

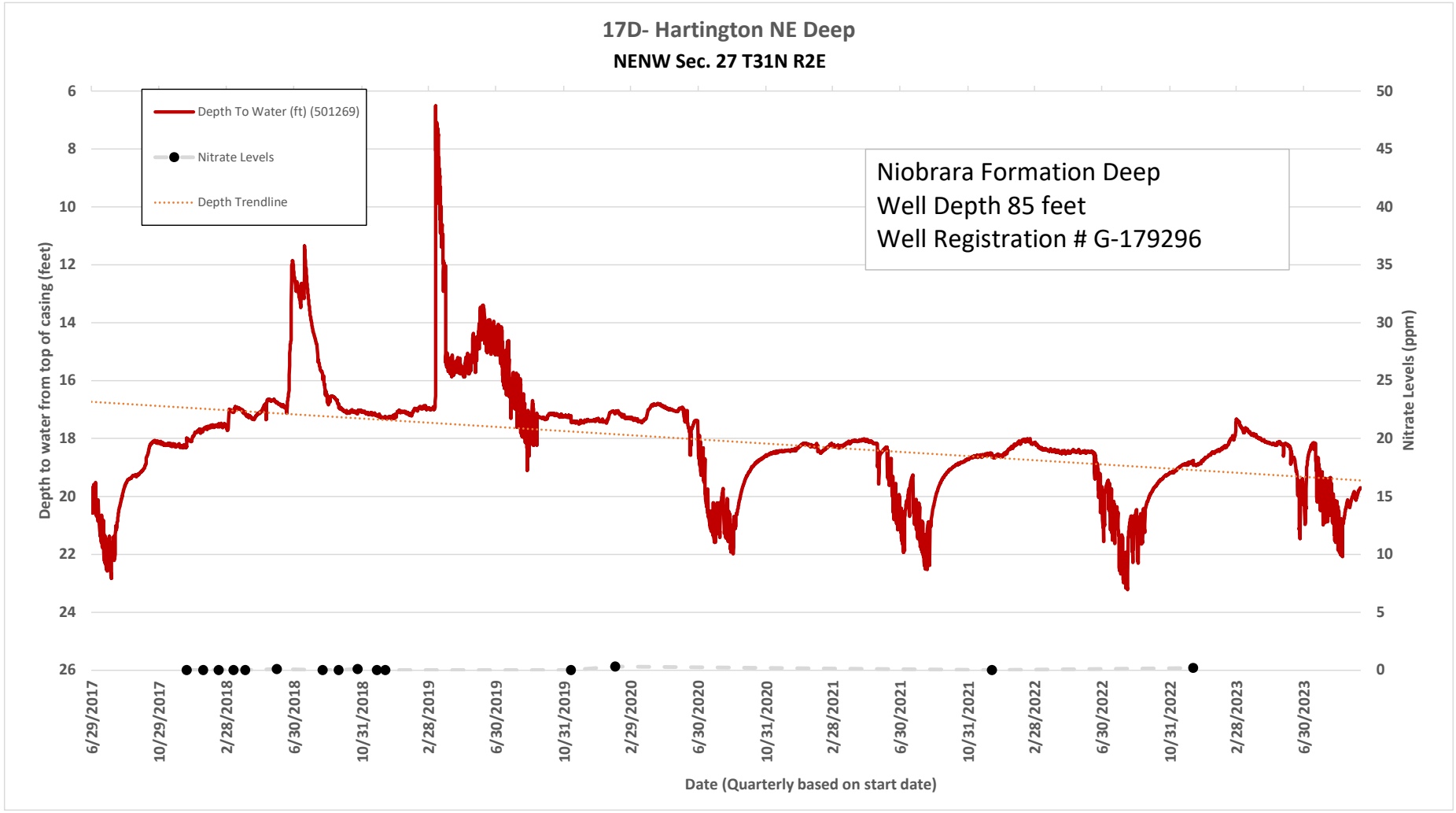

13M- Dixon North Deep
SESE Sec. 15 T30N R4E
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly based on start date)
Depth To Water (ft) (507693)
Nitrate Levels
Depth Trendline
Plio-Pleis Sand & Gravel
Well Depth 210 feet
Well Registration # G- 179293
55
57
59
61
63
65
67
69
10
9
8
7
6
5
4
3
2
1
0
6/27/2017
10/27/2017
2/27/2018
6/27/2018
10/27/2018
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
2/27/2023
6/27/2023
10/27/2023

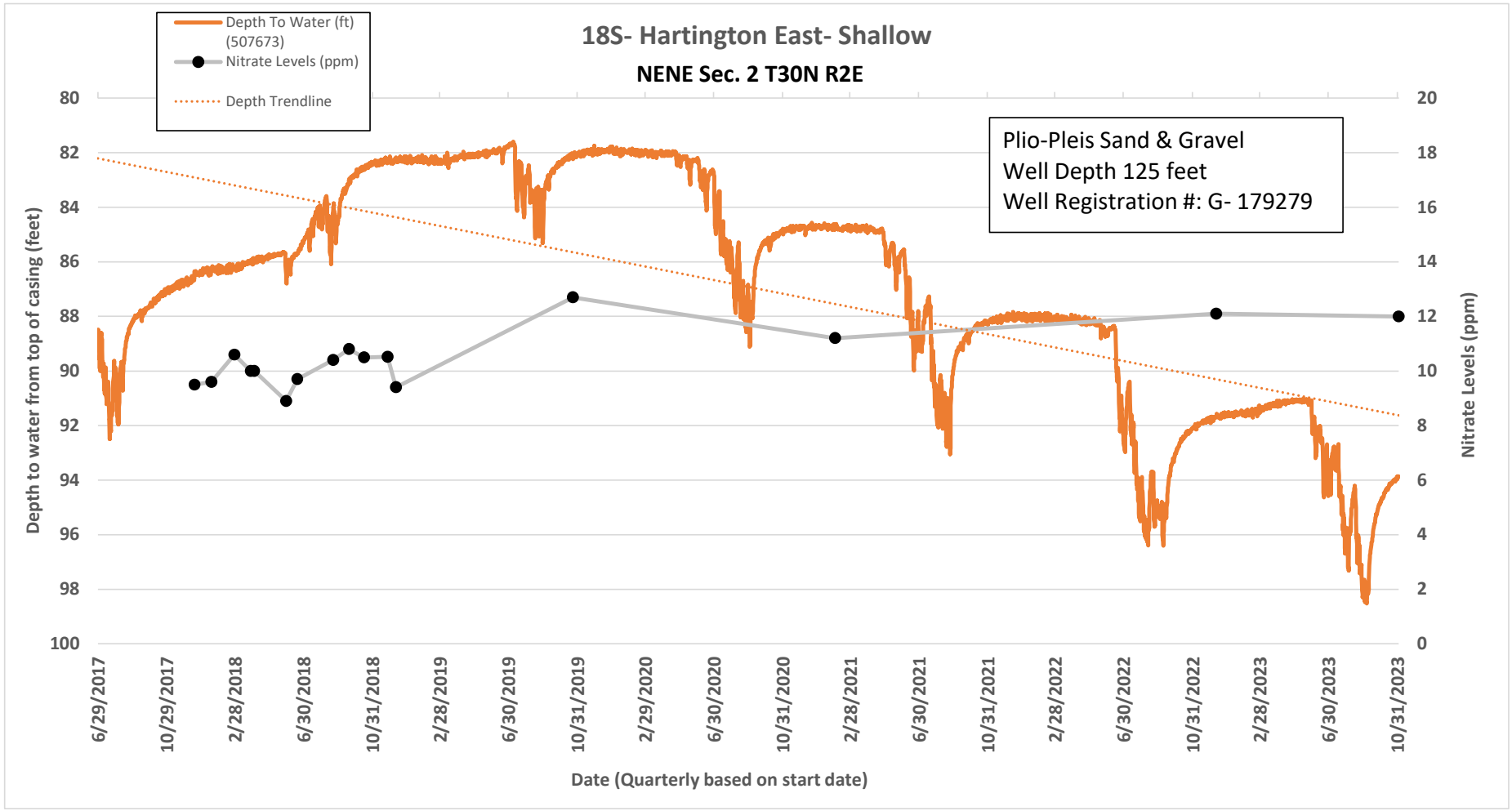

14M- Allen WHPA
SESE Sec. 5 T28N R5W
Depth To Water (ft) (507149)
Nitrate Levels
Depth Trendline
Plio-Pleis Sand & Gravel
Well Depth 250 feet
Well Registration #G-179282
Depth to water from top of casing (feet)
196
198
200
202
Nitrate Levels (ppm)
20
18
16
14
12
10
8
6
4
2
0
6/27/2017
10/27/2017
2/27/2018
6/27/2018
10/27/2018
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
2/27/2023
6/27/2023
Date (Quarterly based on start date)

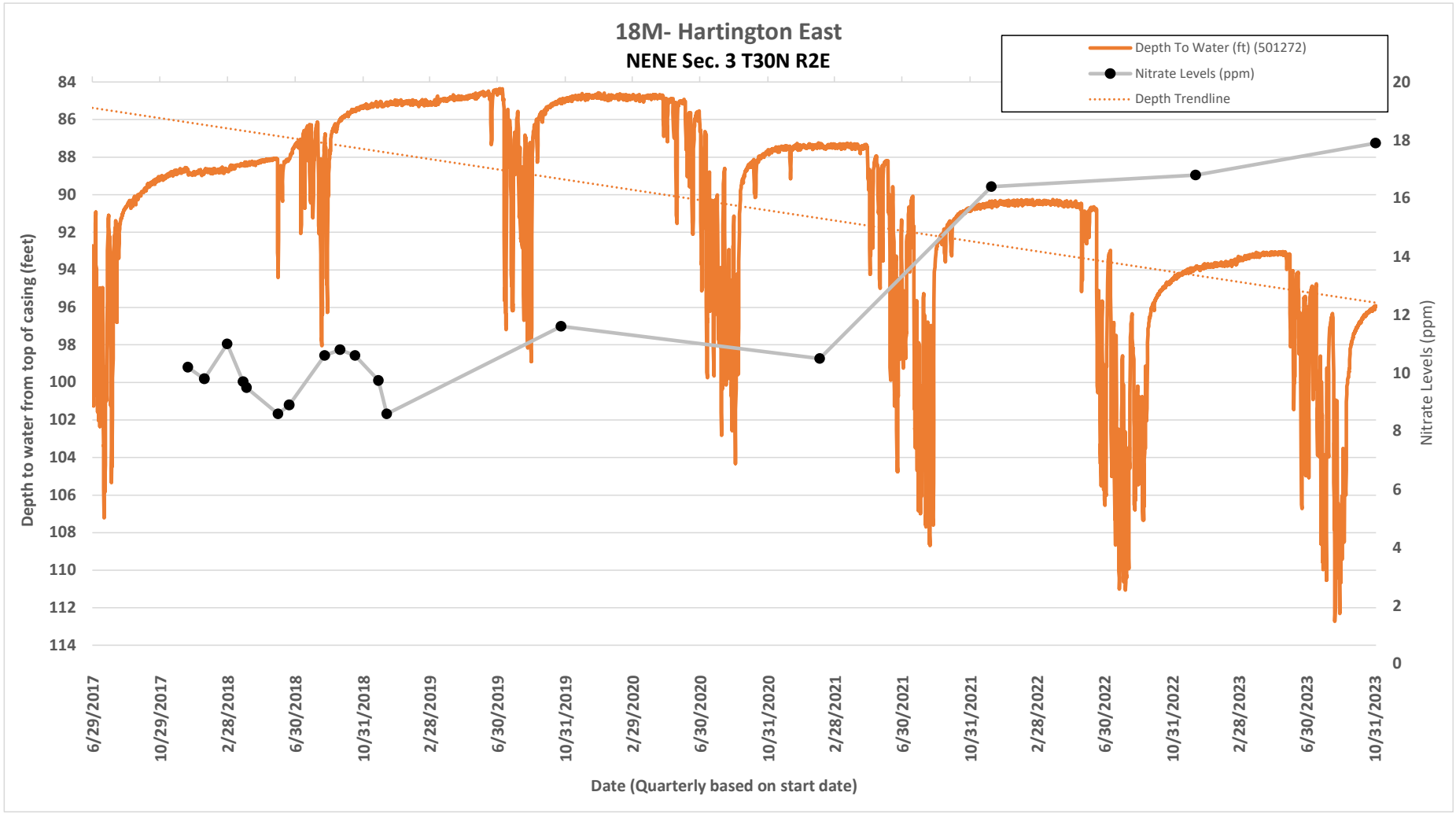

15M- Newcastle WHPA
SWSE Sec. 17 T31N R5E
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly based on start date)
Plio-Pleis Sand & Gravel
Well Depth 70 feet
Well Registration #: G- 179781
Depth To Water (ft) (507169)
Nitrate Levels
Depth Trendline
12
14
16
18
20
22
24
26
10
9
8
7
6
5
4
3
2
1
0
6/27/2017
10/27/2017
2/27/2018
6/27/2018
10/27/2018
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
2/27/2023
6/27/2023
10/27/2023

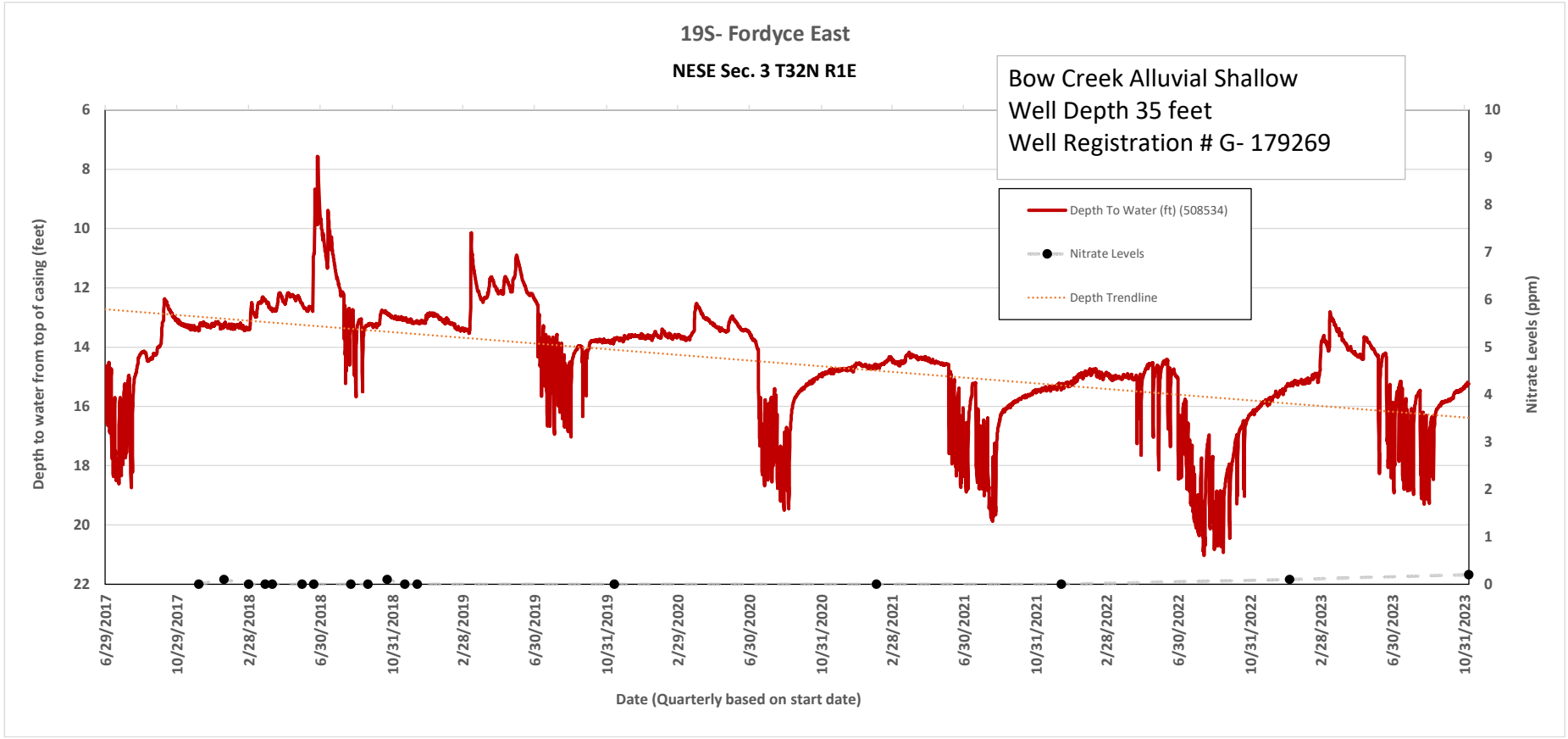

16S- Maskell North
SENW Sec. 18 T32 N R4E
Depth To Water (ft) (507179)
Nitrate Levels
Depth Trendline
Missouri Alluvial
Well Depth 44 feet
Well Registration # G-179277
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
15
17
19
21
23
50
45
40
35
30
25
20
15
10
5
0
6/27/2017
10/27/2017
2/27/2018
6/27/2018
10/27/2018
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
2/27/2023
6/27/2023
10/27/2023
Date (Quarterly based on start date)

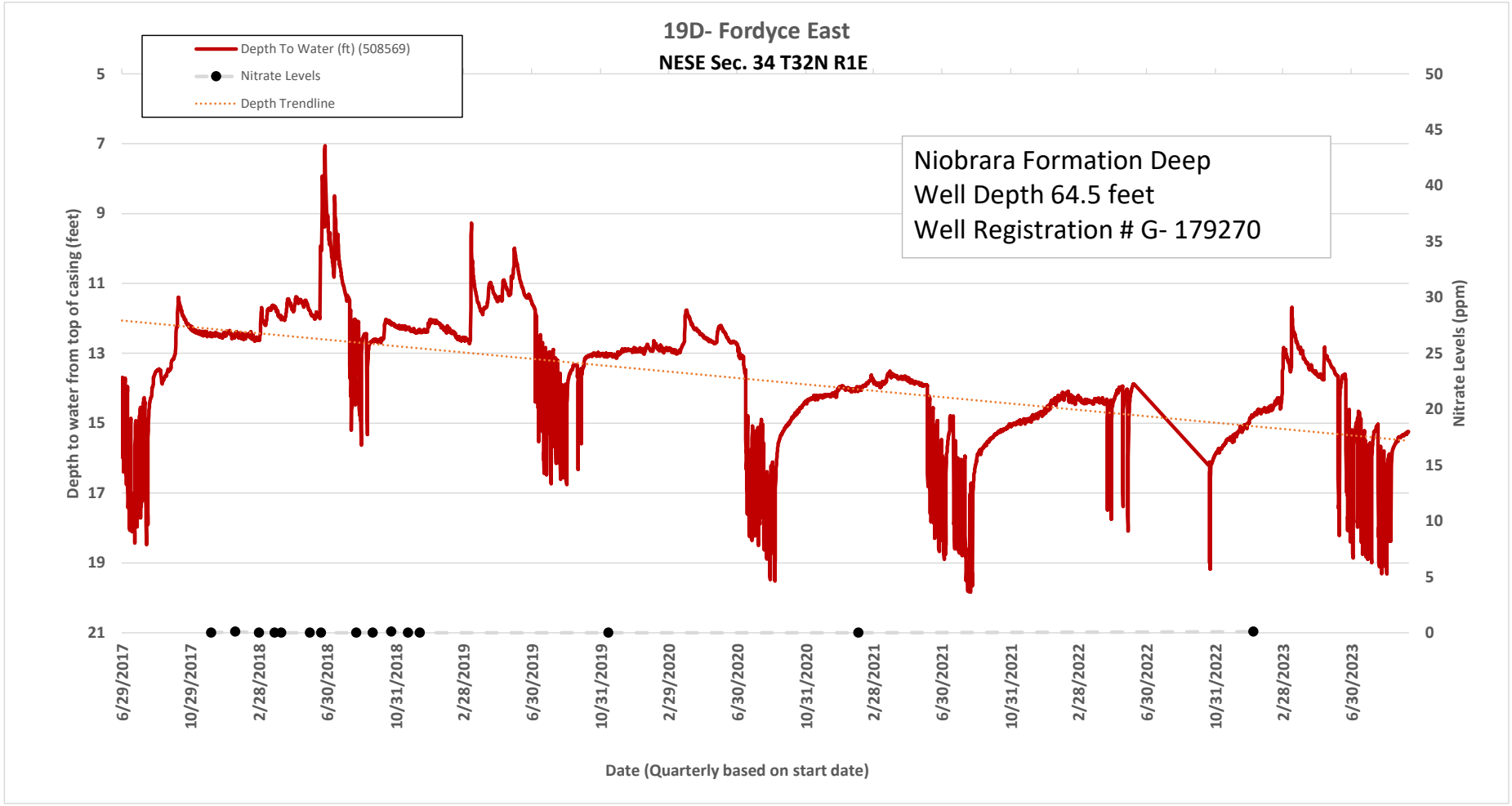

17S- Hartington NE Shallow
NENW Sec. 27 T31N R2E
Depth To Water (ft) (496726)
Nitrate Levels
Trendline
Depth to water from top of casing (feet)
Axis Title
Date (Quarterly based on start date)
0
2
4
6
8
10
12
14
16
10
9
8
7
6
5
4
3
2
1
0
6/29/2017
10/29/2017
2/28/2018
6/30/2018
10/31/2018
2/28/2019
6/30/2019
10/31/2019
2/29/2020
6/30/2020
10/31/2020
2/28/2021
6/30/2021
10/31/2021
2/28/2022
6/30/2022
10/31/2022
2/28/2023
6/30/2023
10/31/2023

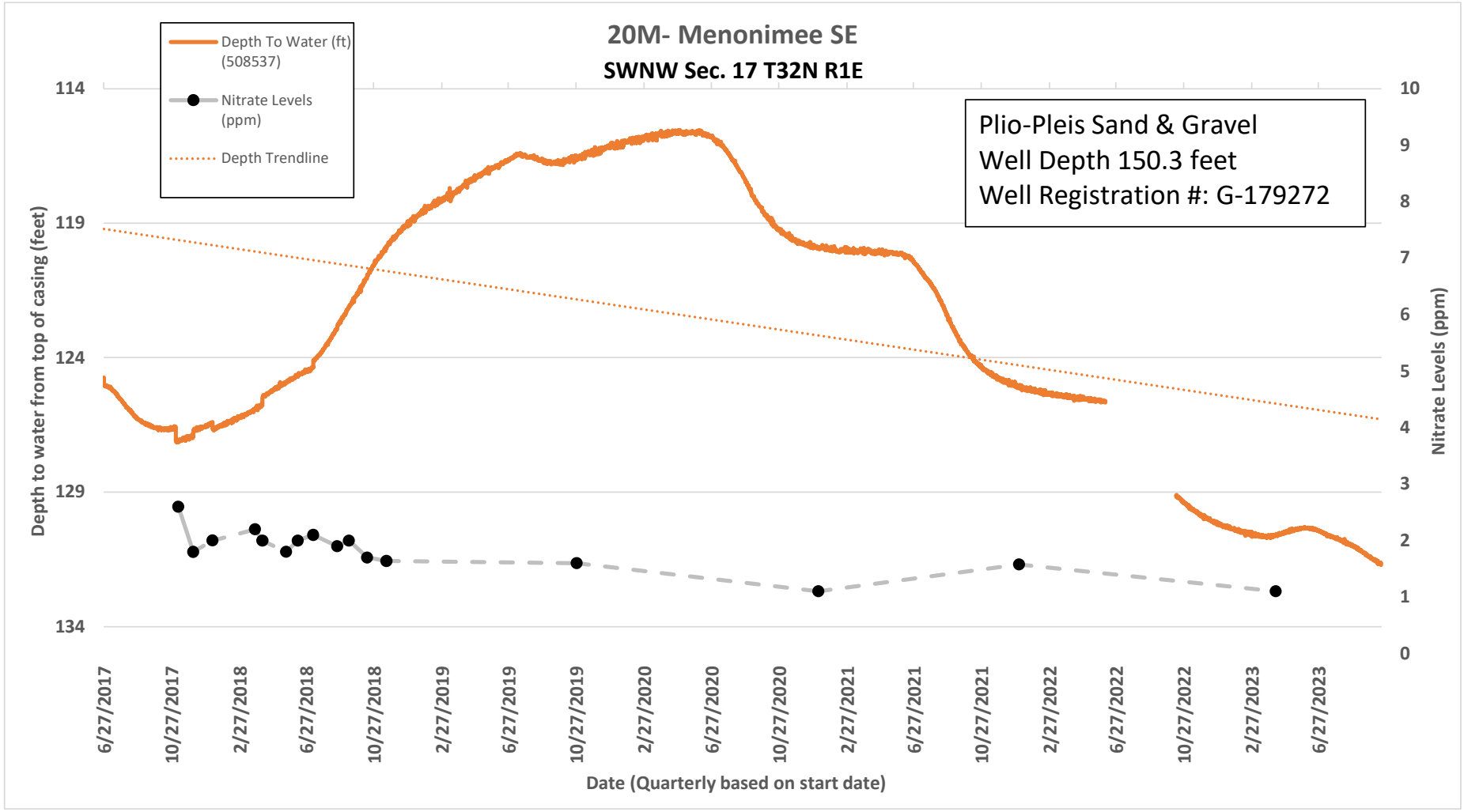

17D- Hartington NE Deep
NENW Sec. 27 T31N R2E
Depth To Water (ft) (501269)
Nitrate Levels
Depth Trendline
Niobrara Formation Deep
Well Depth 85 feet
Well Registration # G-179296
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly based on start date)
6
8
10
12
14
16
18
20
22
24
26
50
45
40
35
30
25
20
15
10
5
0
6/29/2017
10/29/2017
2/28/2018
6/30/2018
10/31/2018
2/28/2019
6/30/2019
10/31/2019
2/29/2020
6/30/2020
10/31/2020
2/28/2021
6/30/2021
10/31/2021
2/28/2022
6/30/2022
10/31/2022
2/28/2023
6/30/2023

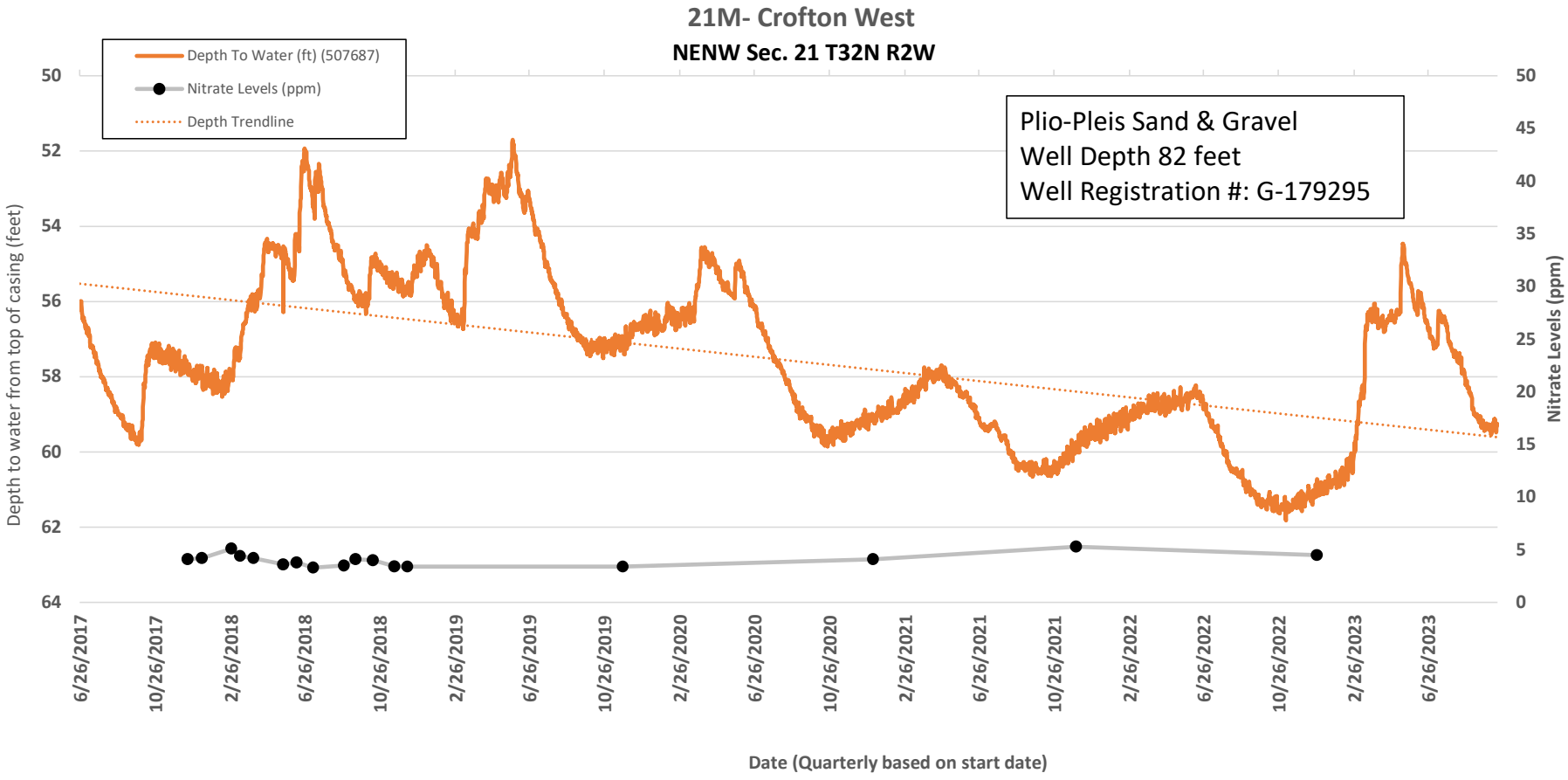

18S- Hartington East- Shallow
NENE Sec. 2 T30N R2E
Depth To Water (ft) (507673)
Nitrate Levels (ppm)
Depth Trendline
Plio-Pleis Sand & Gravel
Well Depth 125 feet
Well Registration #: G- 179279
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
80
82
84
86
88
90
92
94
96
98
100
20
18
16
14
12
10
8
6
4
2
0
6/29/2017
10/29/2017
2/28/2018
6/30/2018
10/31/2018
2/28/2019
6/30/2019
10/31/2019
2/29/2020
6/30/2020
10/31/2020
2/28/2021
6/30/2021
10/31/2021
2/28/2022
6/30/2022
10/31/2022
2/28/2023
6/30/2023
10/31/2023
Date (Quarterly based on start date)

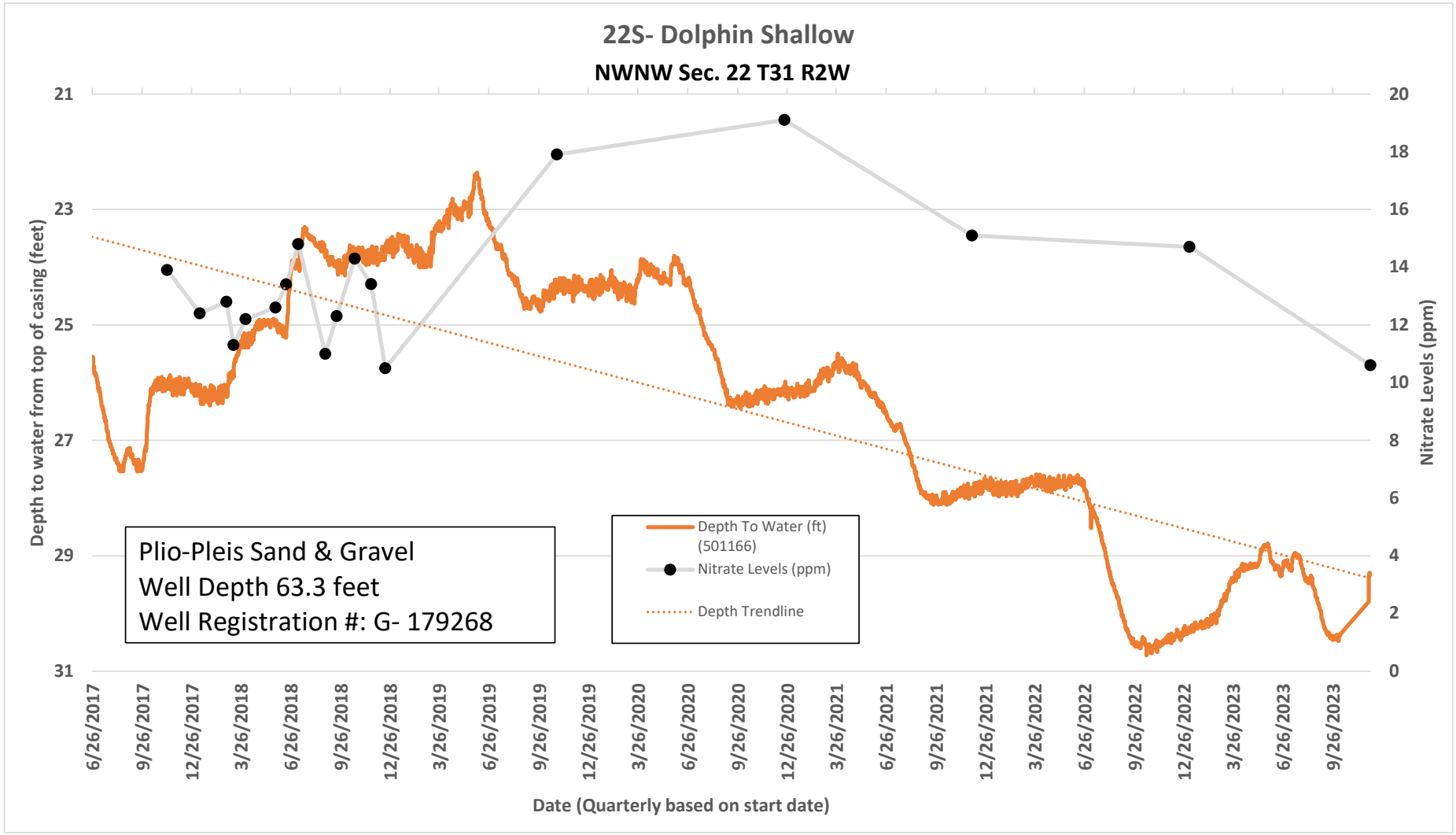

18M- Hartington East
NENE Sec. 3 T30N R2E
Depth To Water (ft) (501272)
Nitrate Levels (ppm)
Depth Trendline
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly based on start date)
84
86
88
90
92
94
96
98
100
102
104
106
108
110
112
114
0
2
4
6
8
10
12
14
16
18
20
6/29/2017
10/29/2017
2/28/2018
6/30/2018
10/31/2018
2/28/2019
6/30/2019
10/31/2019
2/29/2020
6/30/2020
10/31/2020
2/28/2021
6/30/2021
10/31/2021
2/28/2022
6/30/2022
10/31/2022
2/28/2023
6/30/2023
10/31/2023

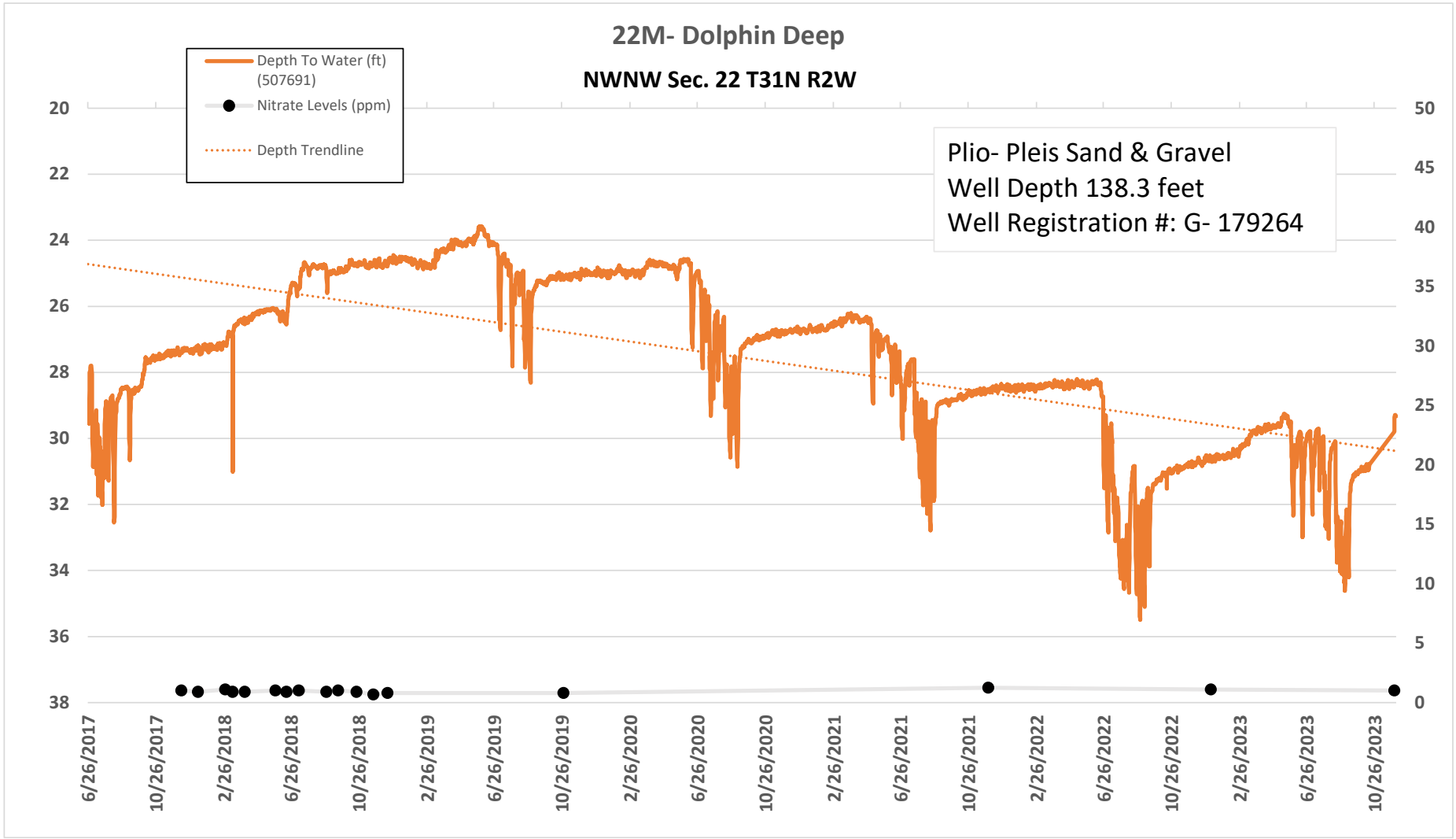

19S- Fordyce East
NESE Sec. 3 T32N R1E
Bow Creek Alluvial Shallow
Well Depth 35 feet
Well Registration # G- 179269
Depth To Water (ft) (508534)
Nitrate Levels
Depth Trendline
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly based on start date)
6
8
10
12
14
16
18
20
22
10
9
8
7
6
5
4
3
2
1
0
6/29/2017
10/29/2017
2/28/2018
6/30/2018
10/31/2018
2/28/2019
6/30/2019
10/31/2019
2/29/2020
6/30/2020
10/31/2020
2/28/2021
6/30/2021
10/31/2021
2/28/2022
6/30/2022
10/31/2022
2/28/2023
6/30/2023
10/31/2023

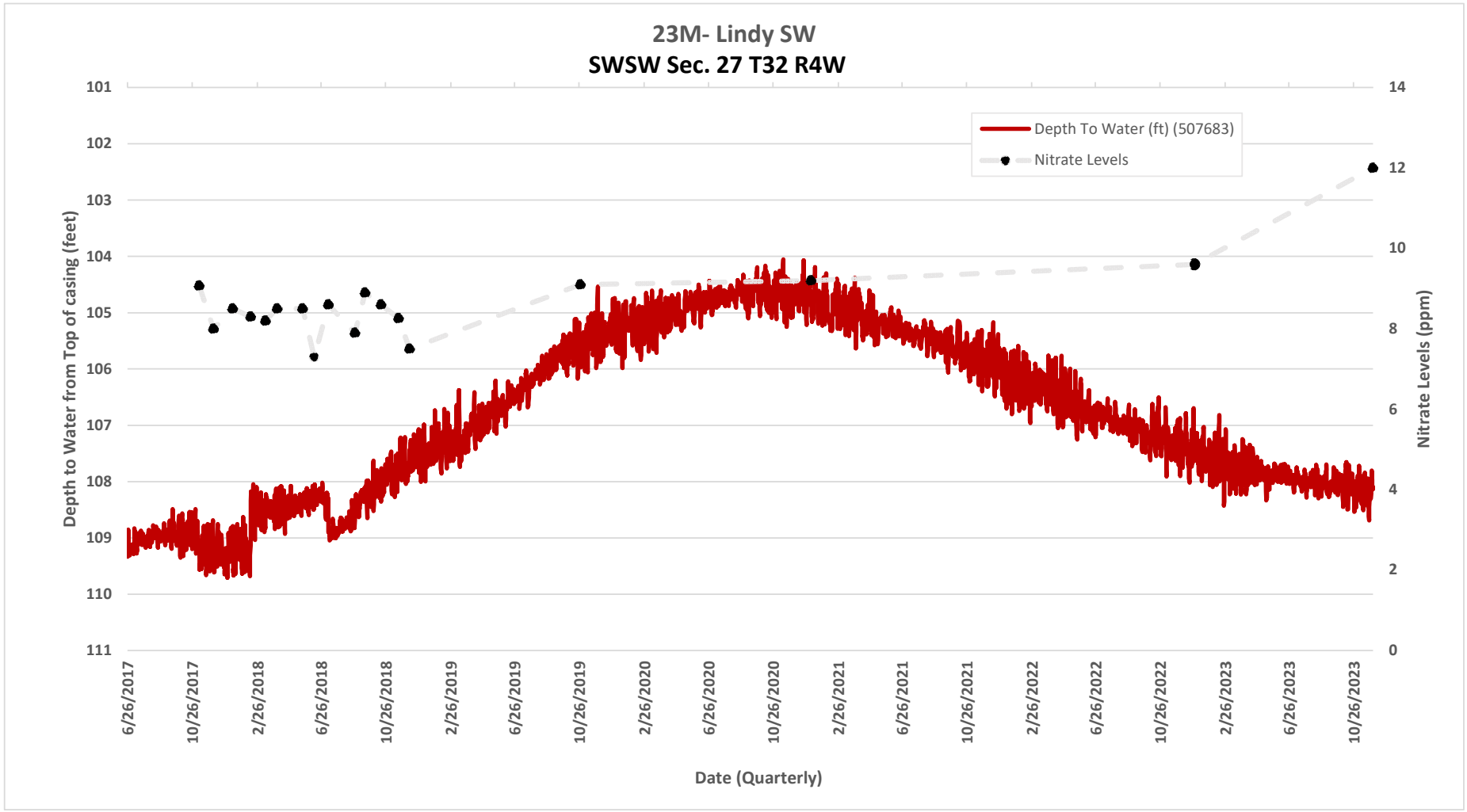

19D- Fordyce East
NESE Sec. 34 T32N R1E
Depth To Water (ft) (508569)
Nitrate Levels
Depth Trendline
Niobrara Formation Deep
Well Depth 64.5 feet
Well Registration # G- 179270
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
5
7
9
11
13
15
17
19
21
50
45
40
35
30
25
20
15
10
5
0
6/29/2017
10/29/2017
2/28/2018
6/30/2018
10/31/2018
2/28/2019
6/30/2019
10/31/2019
2/29/2020
6/30/2020
10/31/2020
2/28/2021
6/30/2021
10/31/2021
2/28/2022
6/30/2022
10/31/2022
2/28/2023
6/30/2023
Date (Quarterly based on start date)

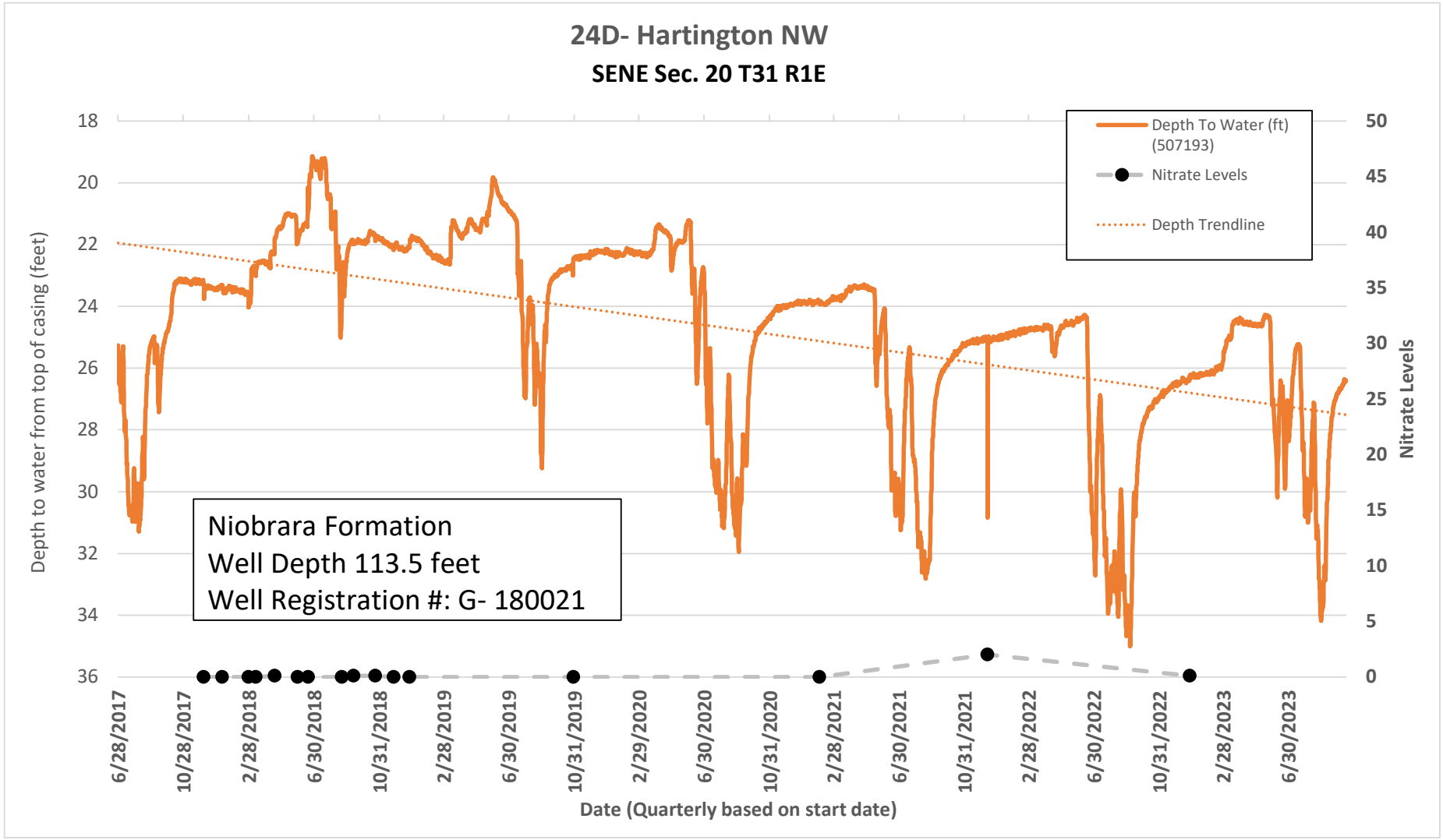

20M- Menonimee SE
SWNW Sec. 17 T32N R1E
Depth To Water (ft) (508537)
Nitrate Levels (ppm)
Depth Trendline
Plio-Pleis Sand & Gravel
Well Depth 150.3 feet
Well Registration #: G-179272
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly based on start date)
114
119
124
129
134
10
9
8
7
6
5
4
3
2
1
0
6/27/2017
10/27/2017
2/27/2018
6/27/2018
10/27/2018
2/27/2019
6/27/2019
10/27/2019
2/27/2020
6/27/2020
10/27/2020
2/27/2021
6/27/2021
10/27/2021
2/27/2022
6/27/2022
10/27/2022
2/27/2023
6/27/2023

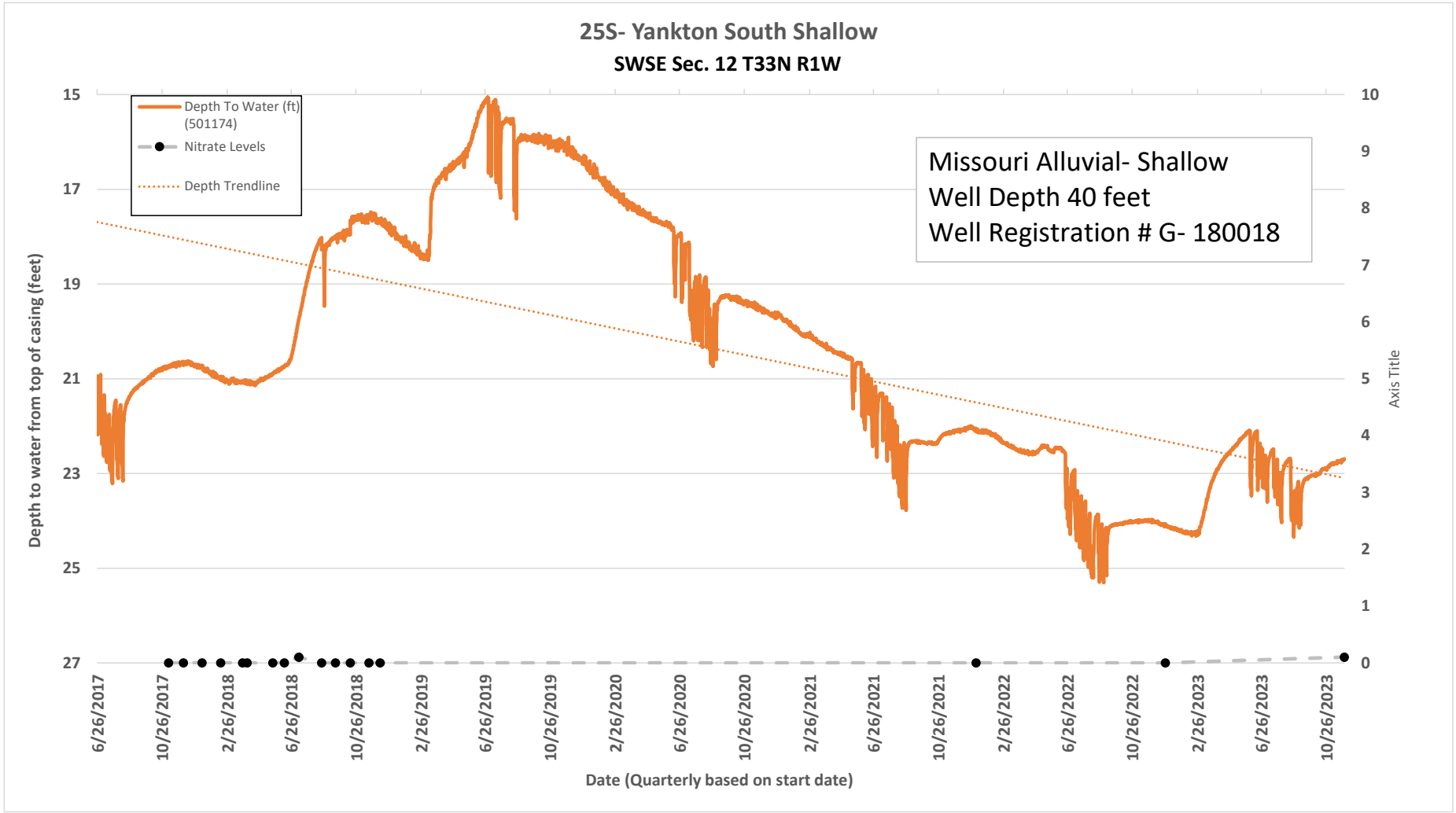

21M- Crofton West
NENW Sec. 21 T32N R2W
Depth To Water (ft) (507687)
Nitrate Levels (ppm)
Depth Trendline
Plio-Pleis Sand & Gravel
Well Depth 82 feet
Well Registration #: G-179295
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
50
52
54
56
58
60
62
64
45
40
35
30
25
20
15
10
5
0
6/26/2017
10/26/2017
2/26/2018
6/26/2018
10/26/2018
2/26/2019
6/26/2019
10/26/2019
2/26/2020
6/26/2020
10/26/2020
2/26/2021
6/26/2021
10/26/2021
2/26/2022
6/26/2022
10/26/2022
2/26/2023
6/26/2023
Date (Quarterly based on start date)

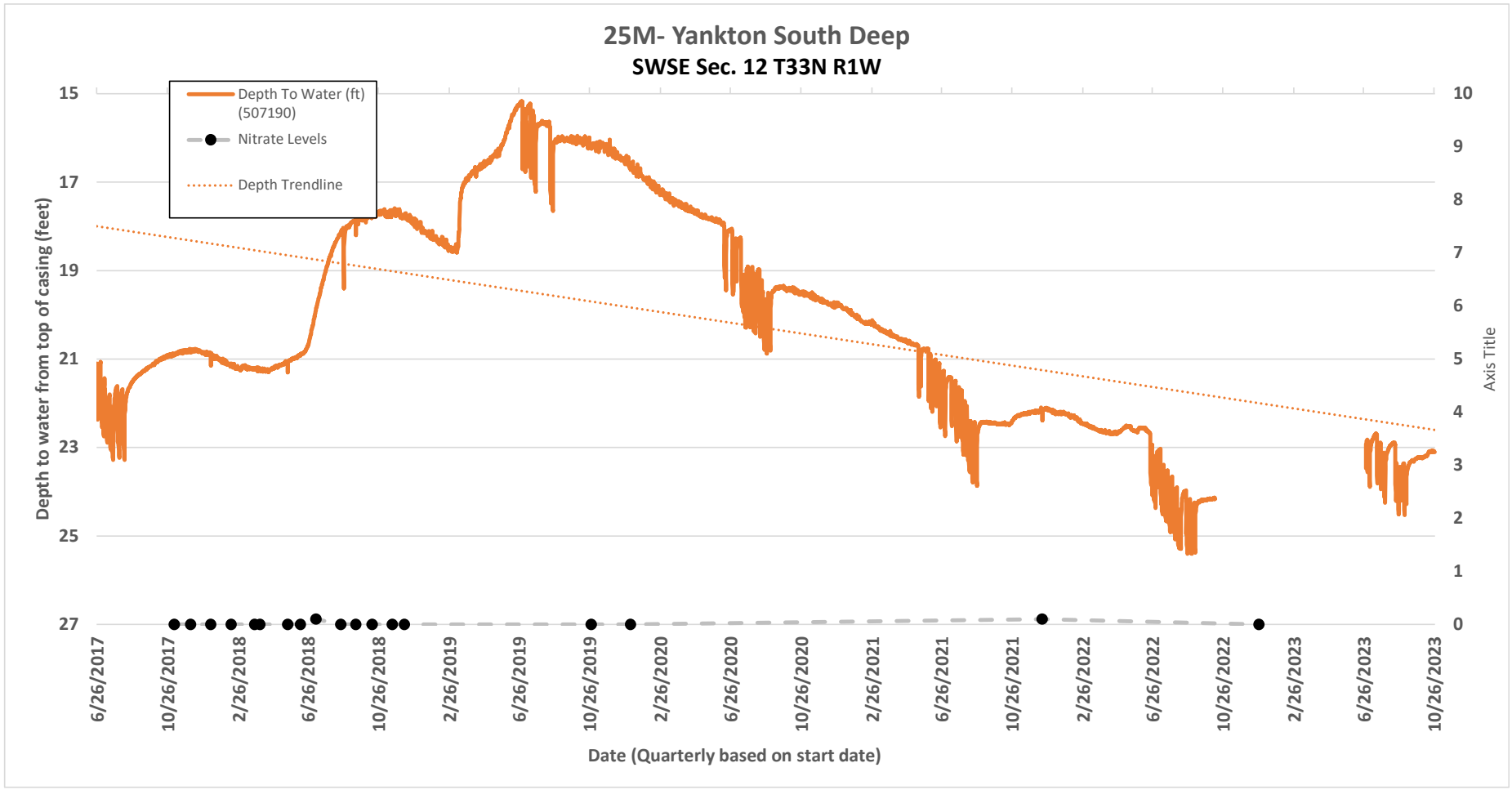

22S- Dolphin Shallow
NWNW Sec. 22 T31 R2W
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
21
23
25
27
29
31
20
18
16
14
12
10
8
6
4
2
0
6/26/2017
9/26/2017
12/26/2017
3/26/2018
6/26/2018
9/26/2018
12/26/2018
3/26/2019
6/26/2019
9/26/2019
12/26/2019
3/26/2020
6/26/2020
9/26/2020
12/26/2020
3/26/2021
6/26/2021
9/26/2021
12/26/2021
3/26/2022
6/26/2022
9/26/2022
12/26/2022
3/26/2023
6/26/2023
9/26/2023
Date (Quarterly based on start date)
Plio-Pleis Sand & Gravel
Well Depth 63.3 feet
Well Registration #: G- 179268
Depth To Water (ft) (501166)
Nitrate Levels (ppm)
Depth Trendline

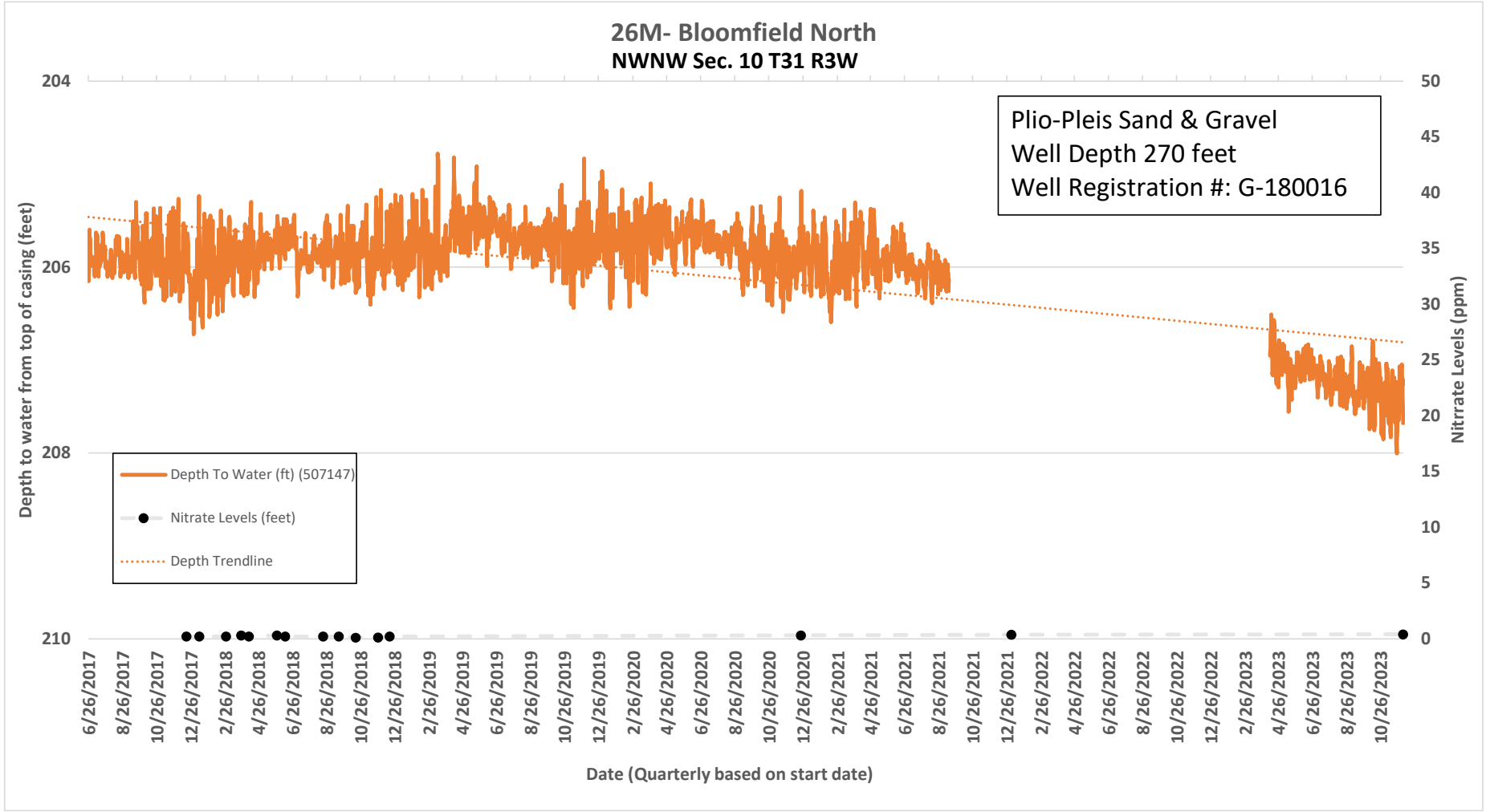

22M- Dolphin Deep
NWNW Sec. 22 T31N R2W
Depth To Water (ft) (507691)
Nitrate Levels (ppm)
Depth Trendline
Plio- Pleis Sand & Gravel
Well Depth 138.3 feet
Well Registration #: G- 179264
20
22
24
26
28
30
32
34
36
38
50
45
40
35
30
25
20
15
10
5
0
6/26/2017
10/26/2017
2/26/2018
6/26/2018
10/26/2018
2/26/2019
6/26/2019
10/26/2019
2/26/2020
6/26/2020
10/26/2020
2/26/2021
6/26/2021
10/26/2021
2/26/2022
6/26/2022
10/26/2022
2/26/2023
6/26/2023
10/26/2023

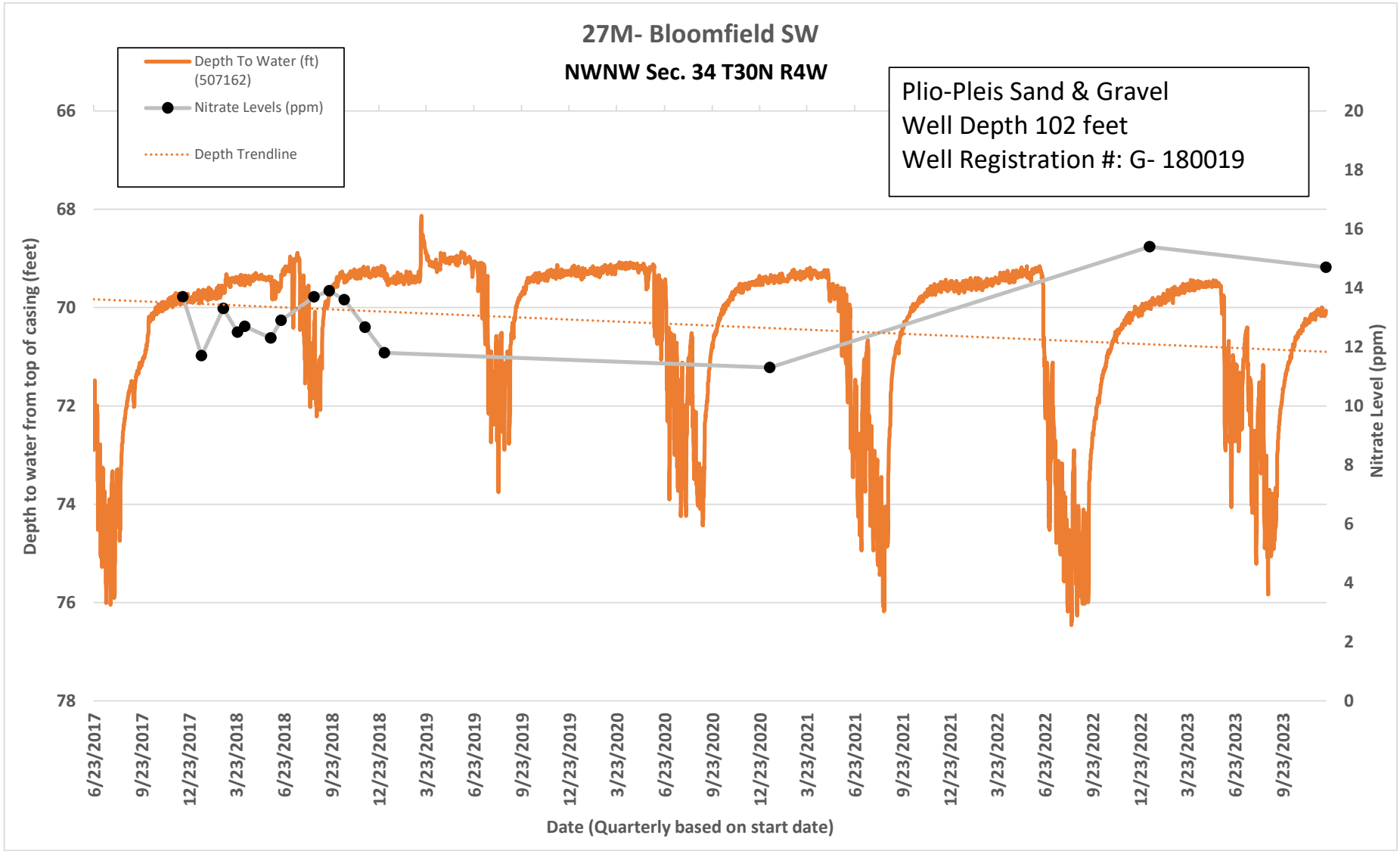

23M- Lindy SW
SWSW Sec. 27 T32 R4W
Depth To Water (ft) (507683)
Nitrate Levels
Depth to Water from Top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly)
101
102
103
104
105
106
107
108
109
110
111
14
12
10
8
6
4
2
0
6/26/2017
10/26/2017
2/26/2018
6/26/2018
10/26/2018
2/26/2019
6/26/2019
10/26/2019
2/26/2020
6/26/2020
10/26/2020
2/26/2021
6/26/2021
10/26/2021
2/26/2022
6/26/2022
10/26/2022
2/26/2023
6/26/2023
10/26/2023

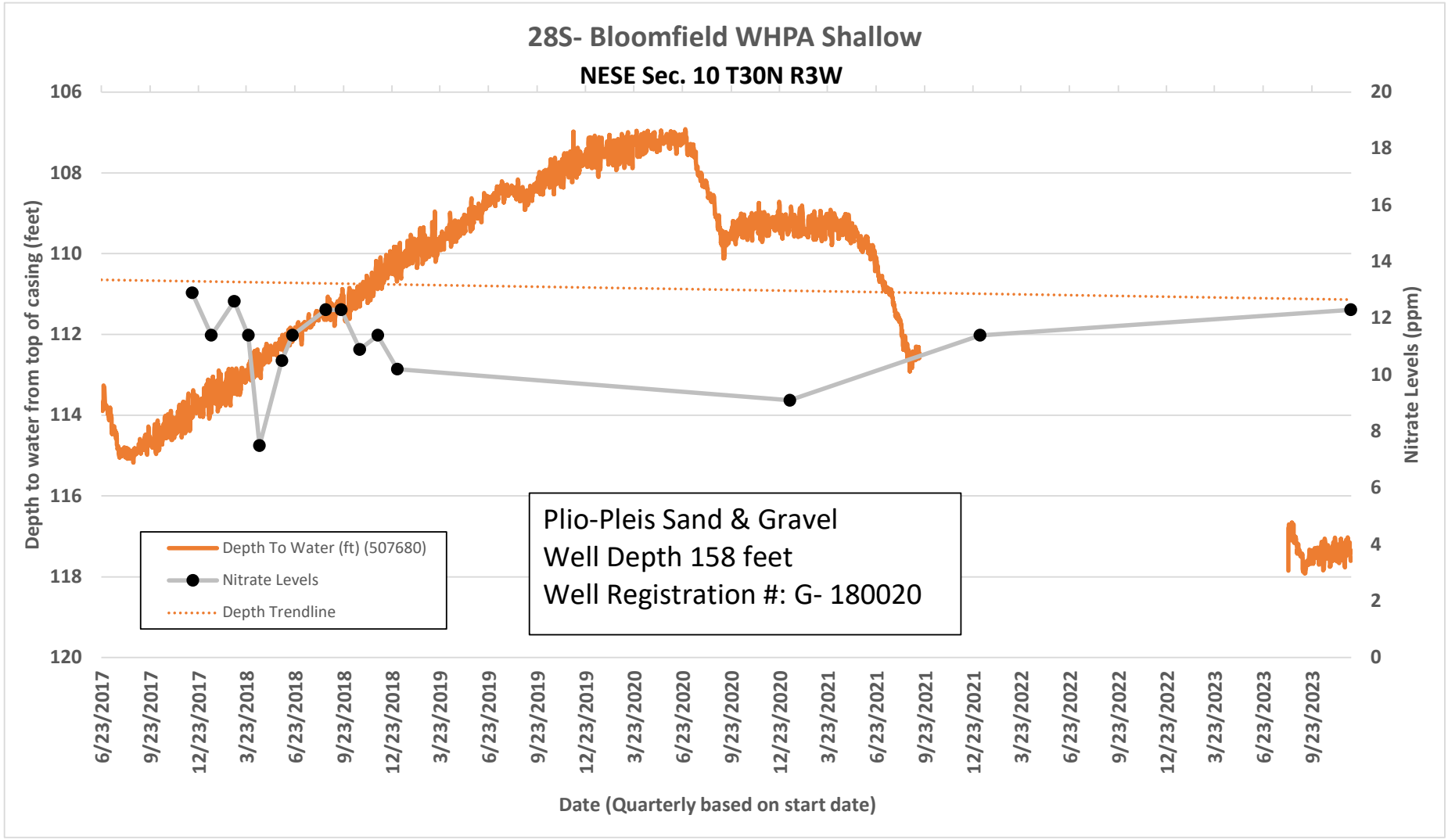

24D- Hartington NW
SENE Sec. 20 T31 R1E
Depth to water from top of casing (feet)
Nitrate Levels
Depth To Water (ft) (507193)
Nitrate Levels
Depth Trendline
Niobrara Formation
Well Depth 113.5 feet
Well Registration #: G- 180021
Date (Quarterly based on start date)
18
20
22
24
26
28
30
32
34
36
50
45
40
35
30
25
20
15
10
5
0
6/28/2017
10/28/2017
2/28/2018
6/30/2018
10/31/2018
2/28/2019
6/30/2019
10/31/2019
2/29/2020
6/30/2020
10/31/2020
2/28/2021
6/30/2021
10/31/2021
2/28/2022
6/30/2022
10/31/2022
2/28/2023
6/30/2023

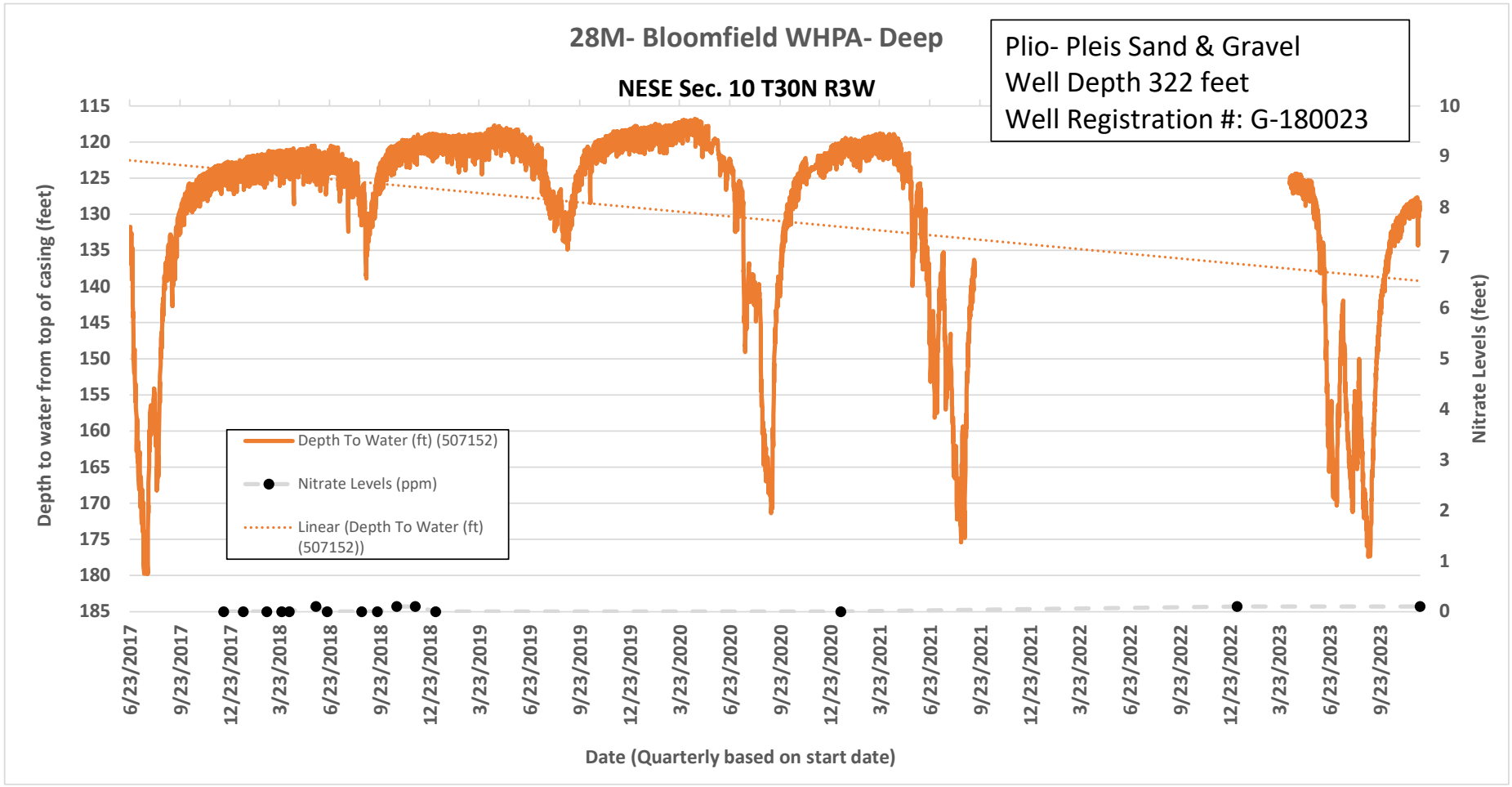

25S- Yankton South Shallow
SWSE Sec. 12 T33N R1W
Depth To Water (ft) (501174)
Nitrate Levels
Depth Trendline
Missouri Alluvial- Shallow
Well Depth 40 feet
Well Registration # G- 180018
Depth to water from top of casing (feet)
15
17
19
21
23
25
27
10
9
8
7
6
5
4
3
2
1
0
Axis Title
6/26/2017
10/26/2017
2/26/2018
6/26/2018
10/26/2018
2/26/2019
6/26/2019
10/26/2019
2/26/2020
6/26/2020
10/26/2020
2/26/2021
6/26/2021
10/26/2021
2/26/2022
6/26/2022
10/26/2022
2/26/2023
6/26/2023
10/26/2023
Date (Quarterly based on start date)

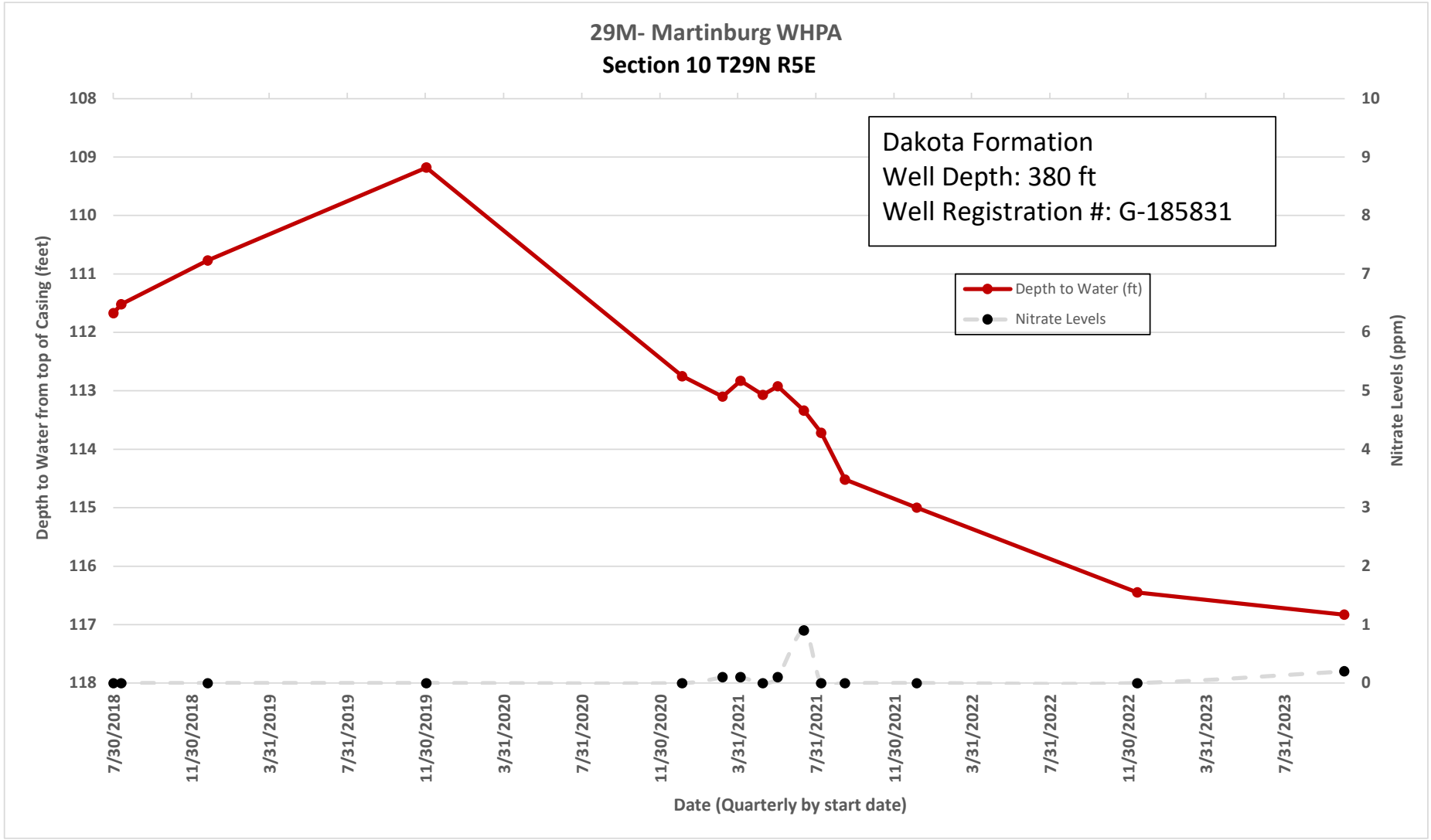

25M- Yankton South Deep
SWSE Sec. 12 T33N R1W
Depth To Water (ft) (507190)
Nitrate Levels
Depth Trendline
Depth to water from top of casing (feet)
15
17
19
21
23
25
27
10
9
8
7
6
5
4
3
2
1
0
Axis Title
6/26/2017
10/26/2017
2/26/2018
6/26/2018
10/26/2018
2/26/2019
6/26/2019
10/26/2019
2/26/2020
6/26/2020
10/26/2020
2/26/2021
6/26/2021
10/26/2021
2/26/2022
6/26/2022
10/26/2022
2/26/2023
6/26/2023
10/26/2023
Date (Quarterly based on start date)

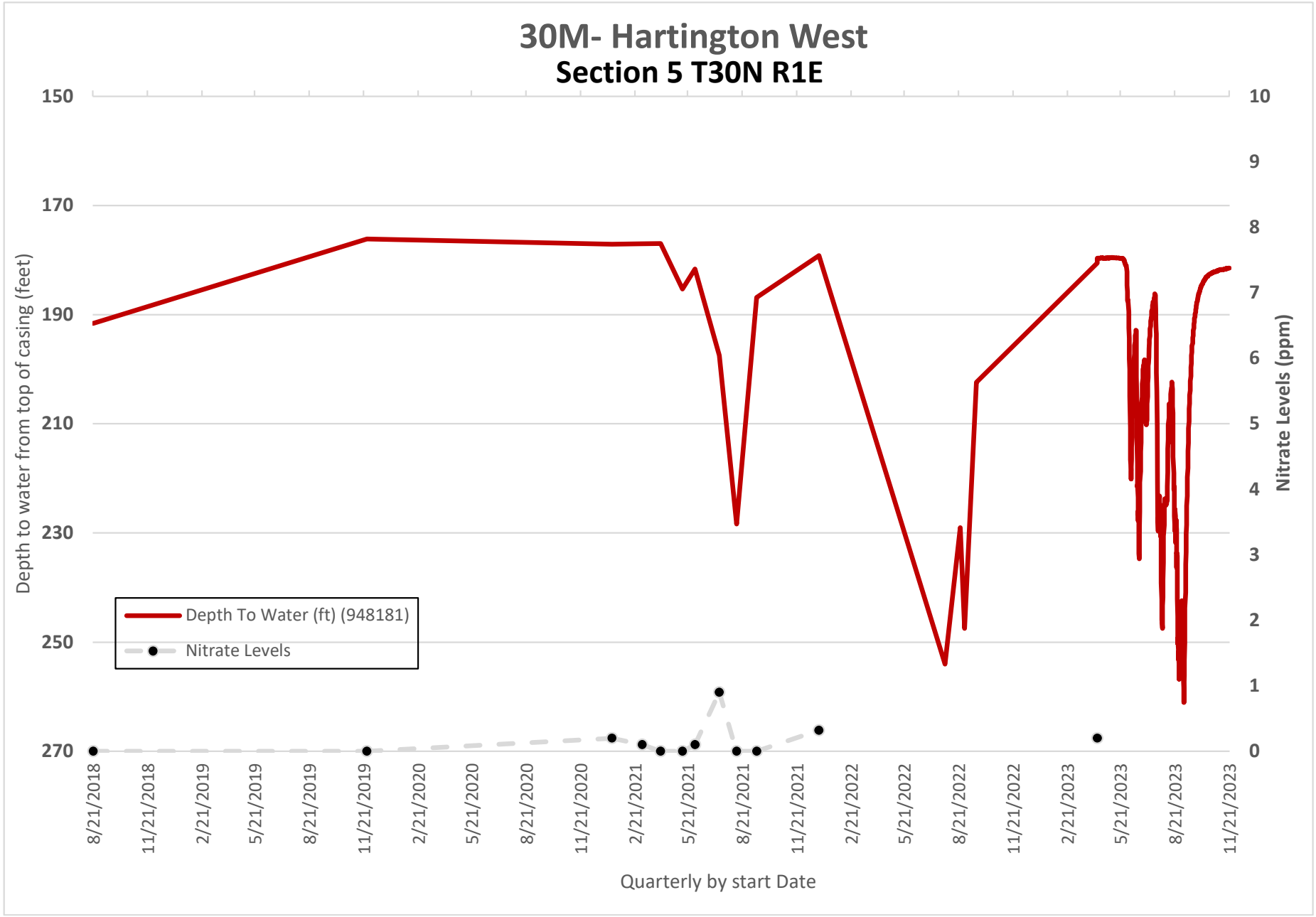

26M- Bloomfield North
NWNW Sec. 10 T31 R3W
Plio-Pleis Sand & Gravel
Well Depth 270 feet
Well Registration #: G-180016
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
Depth To Water (ft) (507147)
Nitrate Levels (feet)
Depth Trendline
Date (Quarterly based on start date)

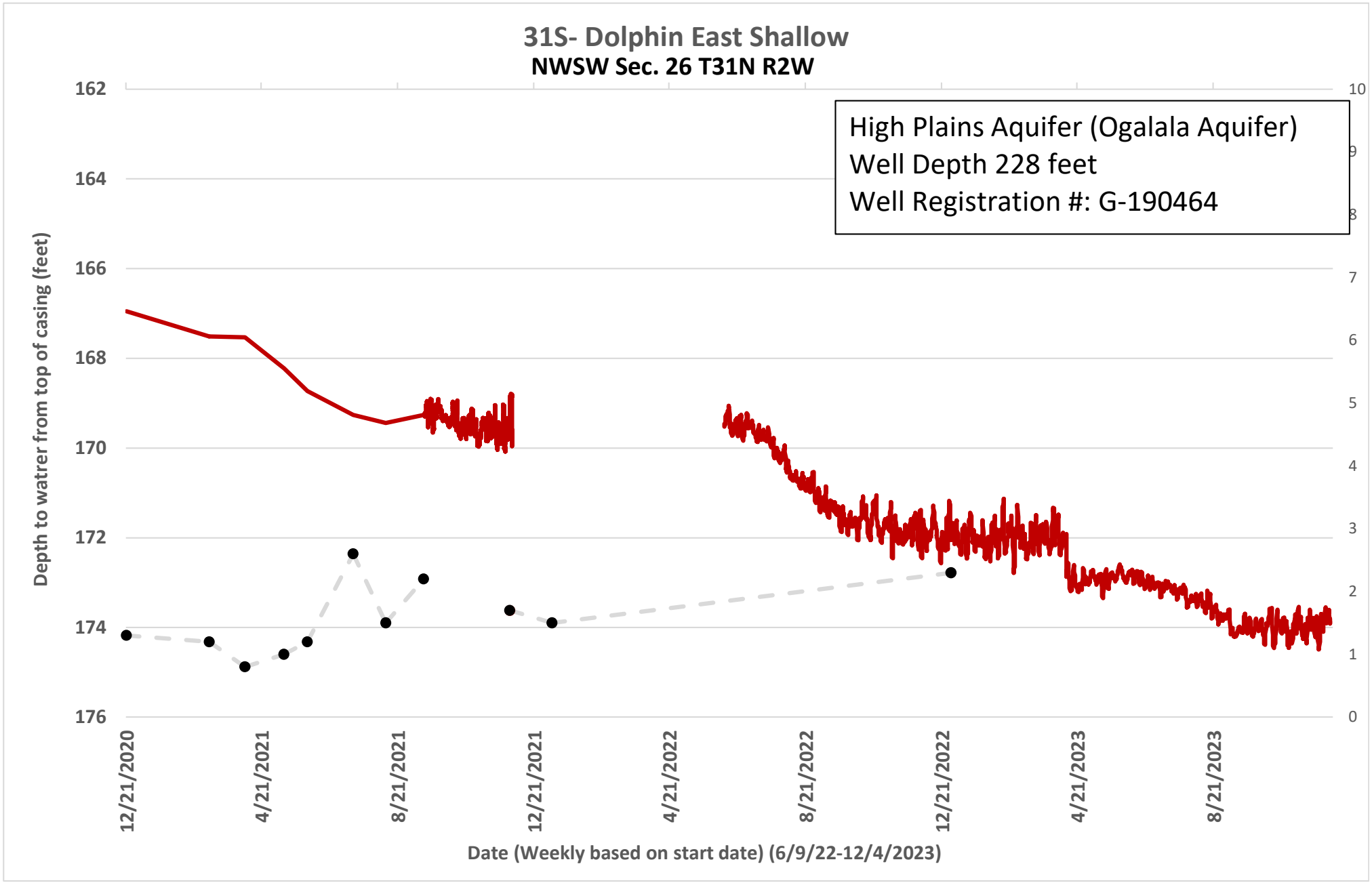

27M- Bloomfield SW
NWNW Sec. 34 T30N R4W
Depth To Water (ft) (507162)
Nitrate Levels (ppm)
Depth Trendline
Plio-Pleis Sand & Gravel
Well Depth 102 feet
Well Registration #: G- 180019
Depth to water from top of casing (feet)
Nitrate Level (ppm)
66
68
70
72
74
76
78
20
18
16
14
12
10
8
6
4
2
0
6/23/2017
9/23/2017
12/23/2017
3/23/2018
6/23/2018
9/23/2018
12/23/2018
3/23/2019
6/23/2019
9/23/2019
12/23/2019
3/23/2020
6/23/2020
9/23/2020
12/23/2020
3/23/2021
6/23/2021
9/23/2021
12/23/2021
3/23/2022
6/23/2022
9/23/2022
12/23/2022
3/23/2023
6/23/2023
9/23/2023
Date (Quarterly based on start date)

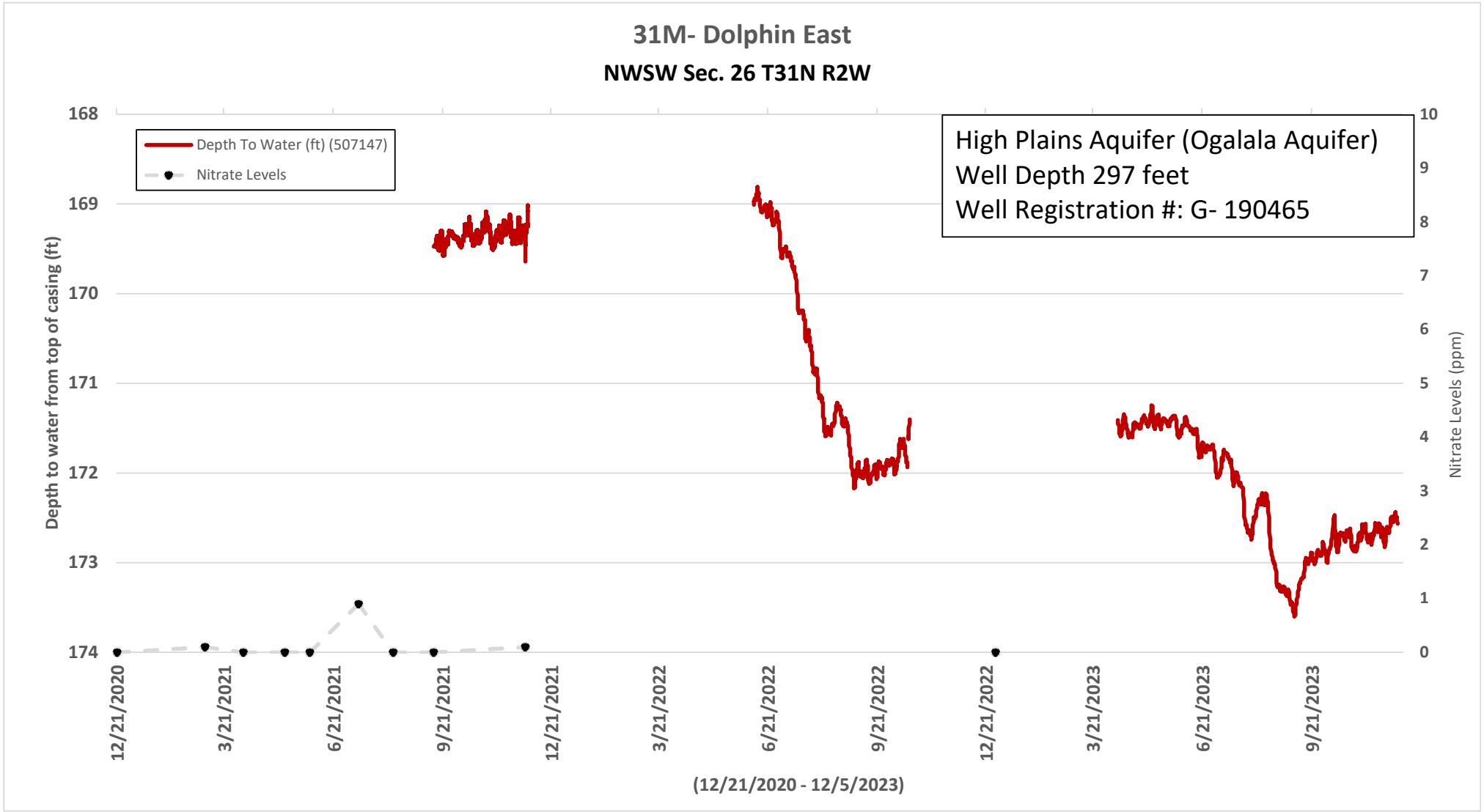

28S- Bloomfield WHPA Shallow
NESE Sec. 10 T30N R3W
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
106
108
110
112
114
116
118
120
20
18
16
14
12
10
8
6
4
2
0
6/23/2017
9/23/2017
12/23/2017
3/23/2018
6/23/2018
9/23/2018
12/23/2018
3/23/2019
6/23/2019
9/23/2019
12/23/2019
3/23/2020
6/23/2020
9/23/2020
12/23/2020
3/23/2021
6/23/2021
9/23/2021
12/23/2021
3/23/2022
6/23/2022
9/23/2022
12/23/2022
3/23/2023
6/23/2023
9/23/2023
Date (Quarterly based on start date)
Depth To Water (ft) (507680)
Nitrate Levels
Depth Trendline
Plio-Pleis Sand & Gravel
Well Depth 158 feet
Well Registration #: G- 180020

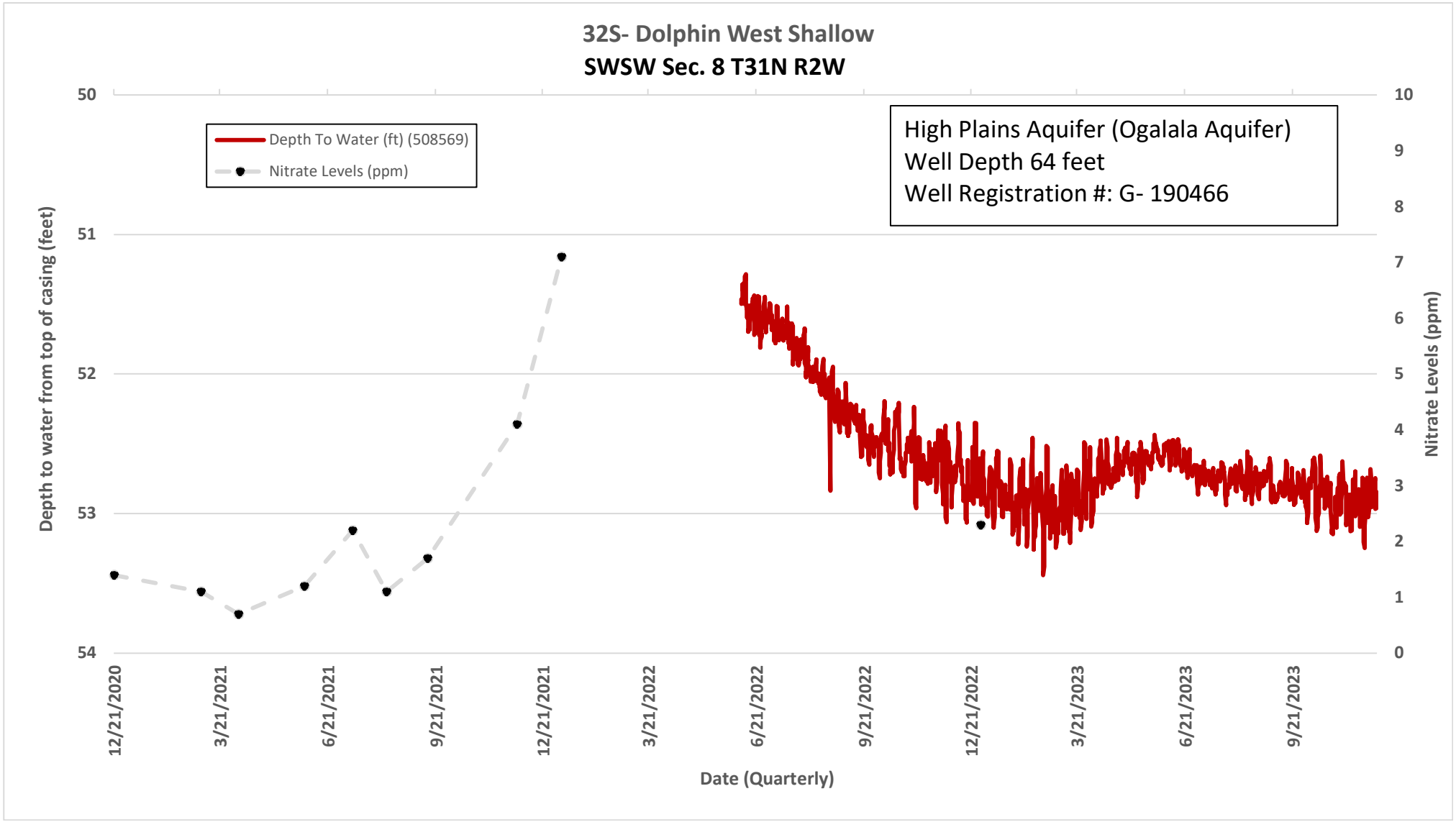

28M- Bloomfield WHPA- Deep
NESE Sec. 10 T30N R3W
Plio- Pleis Sand & Gravel
Well Depth 322 feet
Well Registration #: G-180023
Depth to water from top of casing (feet)
Nitrate Levels (feet)
Depth To Water (ft) (507152)
Nitrate Levels (ppm)
Linear (Depth To Water (ft) (507152))
115
120
125
130
135
140
145
150
155
160
165
170
175
180
185
10
9
8
7
6
5
4
3
2
1
0
6/23/2017
9/23/2017
12/23/2017
3/23/2018
6/23/2018
9/23/2018
12/23/2018
3/23/2019
6/23/2019
9/23/2019
12/23/2019
3/23/2020
6/23/2020
9/23/2020
12/23/2020
3/23/2021
6/23/2021
9/23/2021
12/23/2021
3/23/2022
6/23/2022
9/23/2022
12/23/2022
3/23/2023
6/23/2023
9/23/2023
Date (Quarterly based on start date)

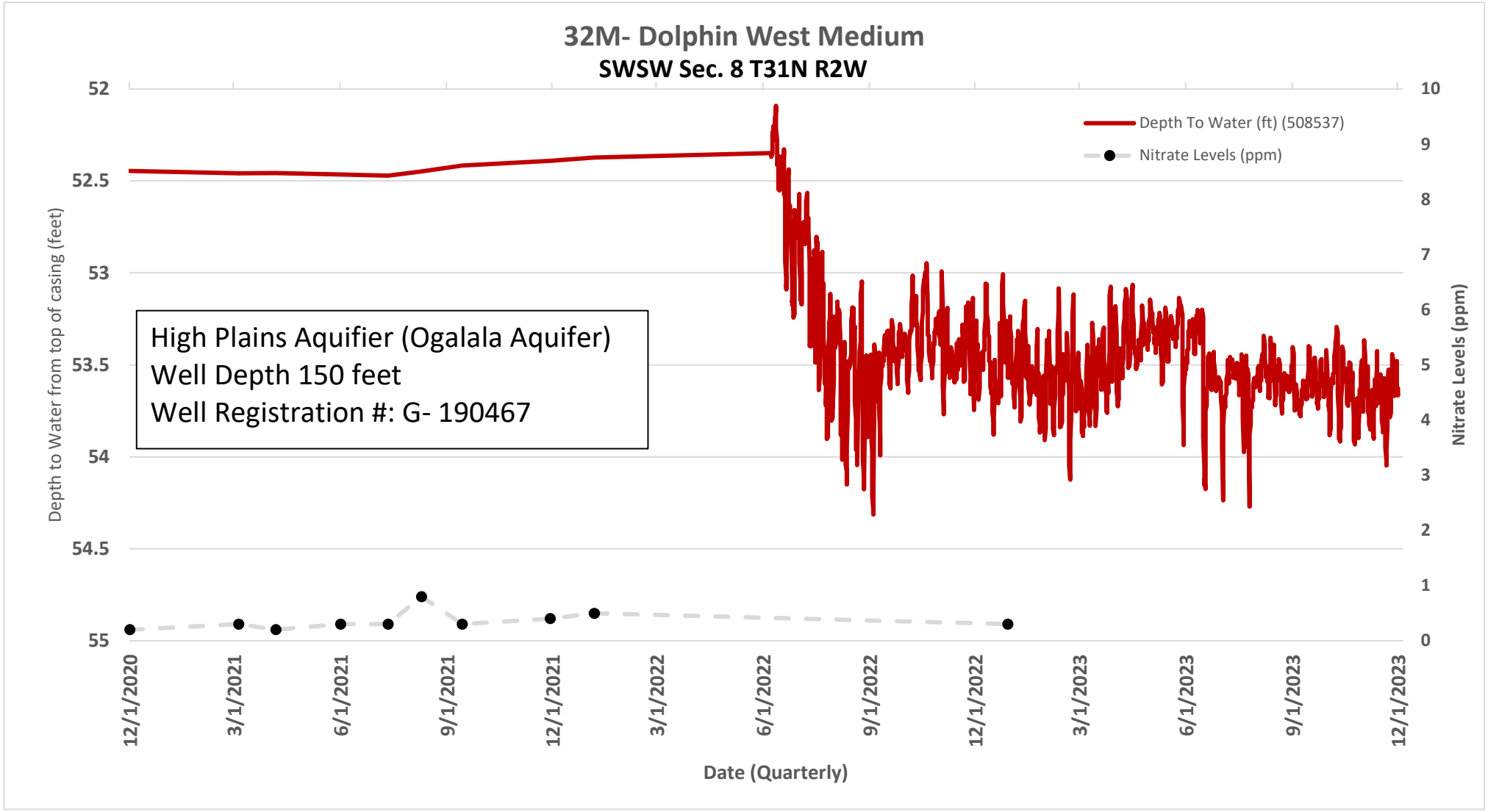

29M- Martinburg WHPA
Section 10 T29N R5E
Dakota Formation
Well Depth: 380 ft
Well Registration #: G-185831
Depth to Water (ft)
Nitrate Levels
Depth to Water from top of Casing (feet)
Nitrate Levels (ppm)
Date (Quarterly by start date)
108
109
110
111
112
113
114
115
116
117
118
10
9
8
7
6
5
4
3
2
1
0
7/30/2018
11/30/2018
3/31/2019
7/31/2019
11/30/2019
3/31/2020
7/31/2020
11/30/2020
3/31/2021
7/31/2021
11/30/2021
3/31/2022
7/31/2022
11/30/2022
3/31/2023
7/31/2023

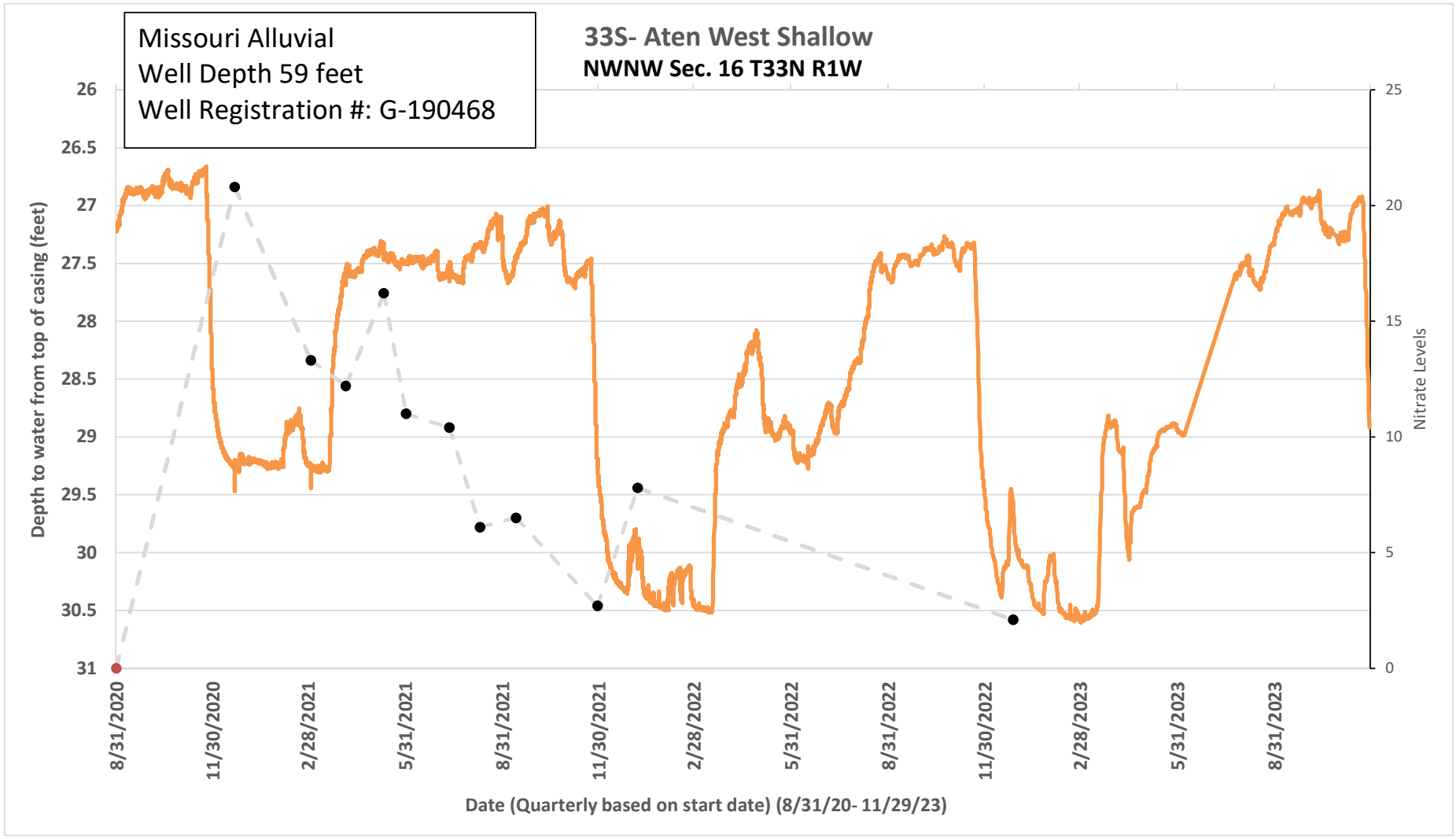

30M- Hartington West
Section 5 T30N R1E
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
150
170
190
210
230
250
270
10
9
8
7
6
5
4
3
2
1
0
Depth To Water (ft) (948181)
Nitrate Levels
8/21/2018
11/21/2018
2/21/2019
5/21/2019
8/21/2019
11/21/2019
2/21/2020
5/21/2020
8/21/2020
11/21/2020
2/21/2021
5/21/2021
8/21/2021
11/21/2021
2/21/2022
5/21/2022
8/21/2022
11/21/2022
2/21/2023
5/21/2023
8/21/2023
11/21/2023
Quarterly by start Date


31S- Dolphin East Shallow
NWSW Sec. 26 T31N R2W
High Plains Aquifer (Ogalala Aquifer)
Well Depth 228 feet
Well Registration #: G-190464
Depth to watrer from top of casing (feet)
162
164
166
168
170
172
174
176
10
9
8
7
6
5
4
3
2
1
0
12/21/2020
4/21/2021
8/21/2021
12/21/2021
4/21/2022
8/21/2022
12/21/2022
4/21/2023
8/21/2023
Date (Weekly based on start date) (6/9/22-12/4/2023)


31M- Dolphin East
NWSW Sec. 26 T31N R2W
Depth To Water (ft) (507147)
Nitrate Levels
High Plains Aquifer (Ogalala Aquifer)
Well Depth 297 feet
Well Registration #: G- 190465
Depth to water from top of casing (ft)
168
169
170
171
172
173
174
Nitrate Levels (ppm)
10
9
8
7
6
5
4
3
2
1
0
12/21/2020
3/21/2021
6/21/2021
9/21/2021
12/21/2021
3/21/2022
6/21/2022
9/21/2022
12/21/2022
3/21/2023
6/21/2023
9/21/2023
(12/21/2020 - 12/5/2023)


32S- Dolphin West Shallow
SWSW Sec. 8 T31N R2W
Depth To Water (ft) (508569)
Nitrate Levels (ppm)
High Plains Aquifer (Ogalala Aquifer)
Well Depth 64 feet
Well Registration #: G- 190466
Depth to water from top of casing (feet)
Nitrate Levels (ppm)
50
51
52
53
54
10
9
8
7
6
5
4
3
2
1
0
12/21/2020
3/21/2021
6/21/2021
9/21/2021
12/21/2021
3/21/2022
6/21/2022
9/21/2022
12/21/2022
3/21/2023
6/21/2023
9/21/2023
Date (Quarterly)


32M- Dolphin West Medium
SWSW Sec. 8 T31N R2W
Depth To Water (ft) (508537)
Nitrate Levels (ppm)
High Plains Aquifier (Ogalala Aquifer)
Well Depth 150 feet
Well Registration #: G- 190467
Depth to Water from top of casing (feet)
Nitrate Levels (ppm)
Date (Quarterly)
52
52.5
53
53.5
54
54.5
55
10
9
8
7
6
5
4
3
2
1
0
12/1/2020
3/1/2021
6/1/2021
9/1/2021
12/1/2021
3/1/2022
6/1/2022
9/1/2022
12/1/2022
3/1/2023
6/1/2023
9/1/2023
12/1/2023


Missouri Alluvial
Well Depth 59 feet
Well Registration #: G-190468
33S- Aten West Shallow
NWNW Sec. 16 T33N R1W
Depth to water from top of casing (feet)
26
26.5
27
27.5
28
28.5
29
29.5
30
30.5
31
Nitrate Levels
25
20
15
10
5
0
8/31/2020
11/30/2020
2/28/2021
5/31/2021
8/31/2021
11/30/2021
2/28/2022
5/31/2022
8/31/2022
11/30/2022
2/28/2023
5/31/2023
8/31/2023
Date (Quarterly based on start date) (8/31/20- 11/29/23)