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Technical Memorandum

To: Valley Branch Watershed District Landlocked Basin Comprehensive Planning Study Project Stakeholders
From: Adam Janzen, PE
Subject: VBWD Landlocked Basin Flood Mitigation Comprehensive Planning Study —Well-Level Data Summary
Date: October 2023
Project: 23821268.00

1 Background

The Valley Branch Watershed District (VBWD) partnered with the United States Army Corp of Engineers (USACE) through the Planning Assistance to States program (PAS) to perform a comprehensive planning study to determine how to manage high-water conditions and flood risk at ten landlocked basins within VBWD.

As part of this assessment, Barr Engineering Co. (Barr) has reviewed, compiled, and summarized the available VBWD groundwater level monitoring data in the study area from 1998 through 2021. This time period matches the simulated time period in the groundwater flow model calibration (**Appendix 10**).

2 VBWD Groundwater Monitoring Network

2.1 Long-Term Monitoring

The VBWD has maintained a network of water table monitoring wells since the mid-1970s. The locations of the 14 active VBWD monitoring wells are shown in Figure A1-1. The VBWD collected manual water level measurements at these wells approximately bimonthly through 2010 and semi-annually since then. The 1998–2021 data for 11 of these wells are shown in Figure A1-2; Wells 9A, 18, and 22 were not included due to their distance from the study area.

With the exception of Well 4, the groundwater level data show similar trends to the landlocked lake-level data (see **Appendix 7**). Groundwater levels showed a decreasing trend from 1998 to 2010–2011 and then a rising trend through 2020. The similarities between the water level data and the lake level data suggest that interactions between surface water and groundwater are important to the hydrology of the landlocked basins.

Note that the periods of apparently constant groundwater levels at Wells 8, 23, and 24 indicate times when the water table had declined below the bottom of the well and thus could not be measured. It is not clear why no increasing or decreasing trends were observed at Well 4.

2.2 Short-Term Monitoring (2021)

VBWD installed eight monitoring wells in late summer 2021. These wells supplemented the VBWD's existing groundwater monitoring well and lake level monitoring datasets and provided valuable data to refine a groundwater model for the local project area. The locations of these wells are shown in Figure A1-1. On August 23, 2021, Barr installed data logging pressure transducers in VBWD Wells 25, 27, 28, 29, 30, and 31 and Minnesota Pollution Control Agency (MPCA) well 783301. Well 26 was abandoned 6 days after it was installed due to utility interference, and VBWD obtained permission from the MPCA to monitor nearby well 783301 instead. Barr did not install a transducer in Well 32 because it was dry (i.e., the water table was below the bottom of the well). As a condition of the property access agreements for the well locations, the wells had to be abandoned before December 31, 2021. Water level monitoring ended on December 9, 2021, and Wells 25, 27, 28, 29, 30, 31, and 32 were sealed on December 10, 2021.

Figure A1-3 shows the water level data collected between August 23, 2021, and December 9, 2021, at the short-term monitoring wells. All seven wells showed a decreasing water level trend during the monitoring period, though with different slopes. Note that while the axis limits are different for many of the plots in Figure A1-3, the difference between the maximum and minimum values is the same (3 feet) for each plot so that the slopes can be directly compared. Well 25 had the strongest downward trend, and the MPCA well had the weakest downward trend. The downward trends are consistent with the data from the long-term monitoring wells (Figure A1-2), which also show declining water levels in 2021.

2.3 Slug Testing

Slug tests are a field technique for estimating hydraulic conductivity. Barr conducted slug tests in VBWD Wells 25, 27, 28, 29, 30, and 31 and MPCA well 783301 on September 1 and 2, 2021. Barr analyzed the slug test field data using standard analytical methods to estimate the aquifer hydraulic conductivity near each well. The analysis results are summarized in Table A1-1. The estimated hydraulic conductivity values ranged over 3 orders of magnitude from 0.13 feet per day at Well 25 to 360 feet per day at the MPCA well 783301. These results illustrate the spatial heterogeneity of the Quaternary (unconsolidated) aquifer.

Table A1-1 Slug Test Summary

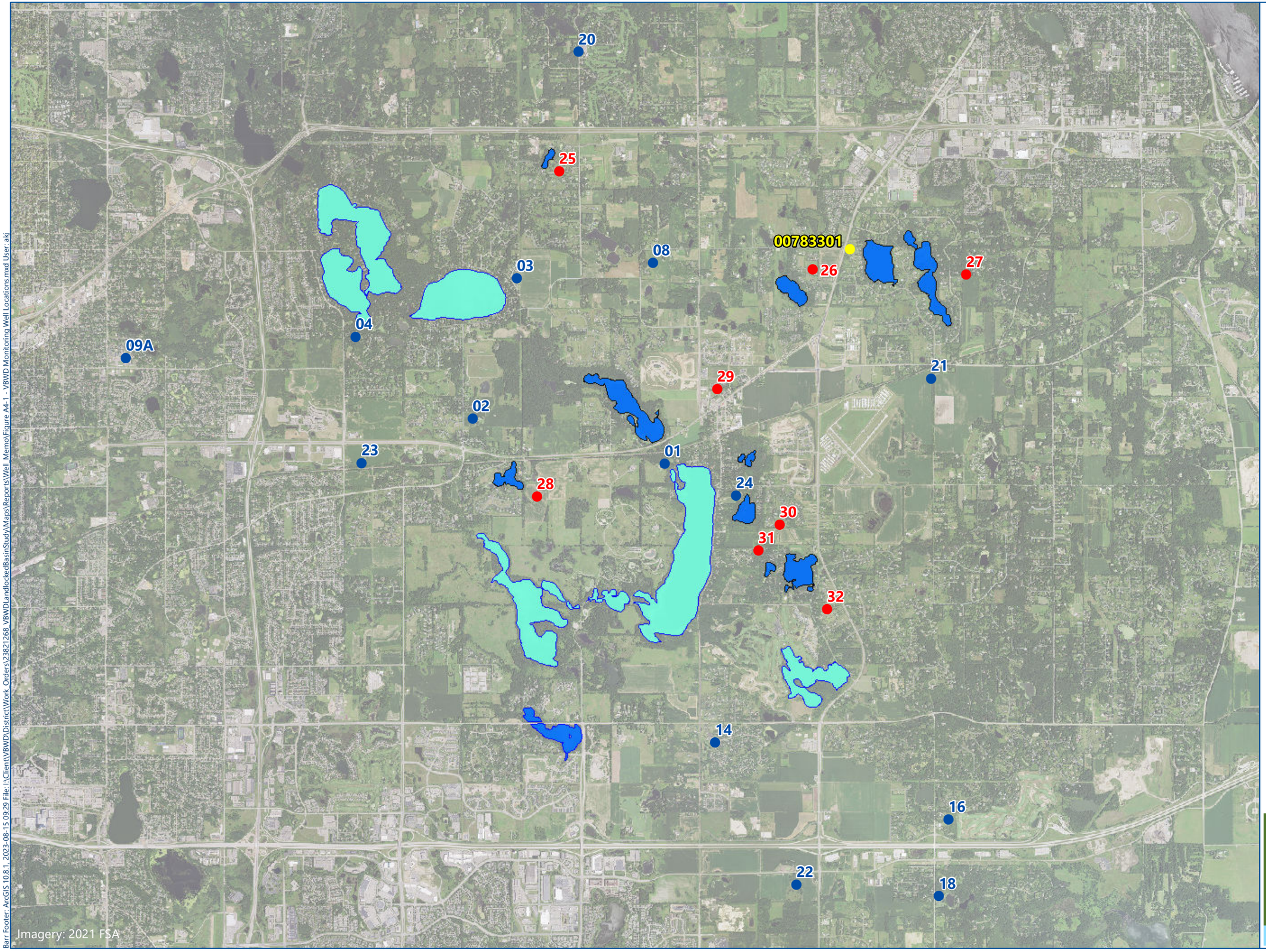
Well	Aquifer Material	Hydraulic Conductivity (feet per day)
25	Silty sand	0.13
27	Sandy lean clay	0.63
28	Sand	13
29	Sand	39
30	Silty sand	11
31	Silty sand	0.85
783301 (MPCA)	Sand	360

3 Summary

Barr reviewed, compiled, and summarized the available VBWD groundwater level monitoring data from the long-term monitoring wells (1998–2021) and the short-term monitoring wells (fall 2021 only). Except

for one well, the groundwater level data showed similar trends to the landlocked lake-level data, suggesting that interactions between surface water and groundwater are important to the hydrology of the landlocked basins.

The data presented in this memo were used to inform the calibration of the MODFLOW groundwater flow model (**Appendix 10**). The measured water levels were used as hydraulic head calibration targets, and the slug test results were used to constrain the calibrated hydraulic conductivity values for the Quaternary aquifer.



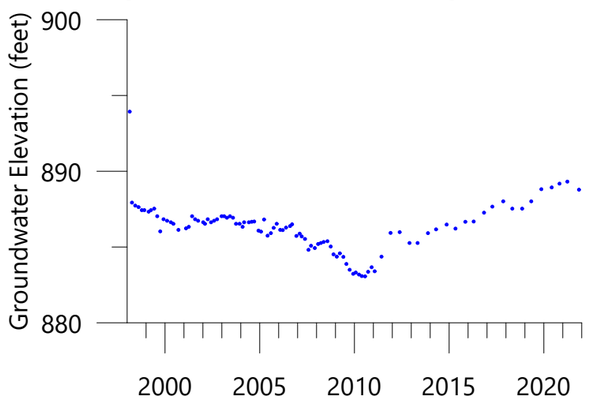
VBWD Monitoring Well

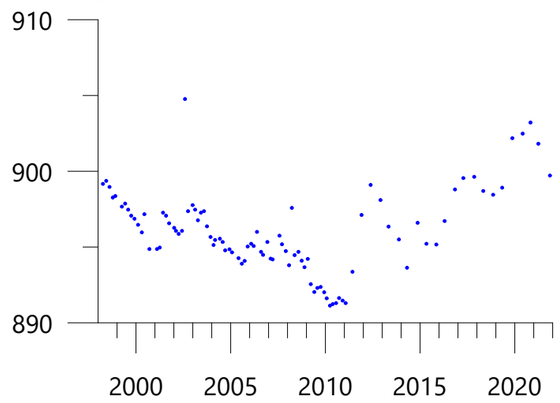
- Fall 2021 VBWD Monitoring Well
- Long-Term VBWD Monitoring Well
- MPCA Monitoring Well
- Landlocked Basin
- Project 1007 Basin

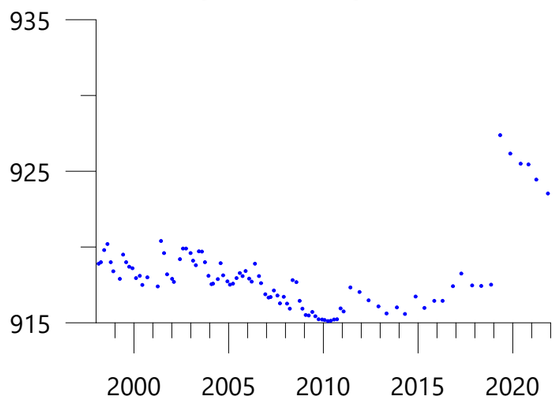
0 4,000
Feet

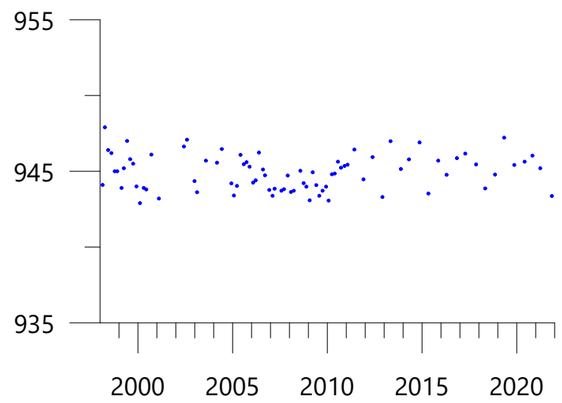
VBWD MONITORING WELL LOCATIONS
Landlocked Basin Study
Valley Branch Watershed District

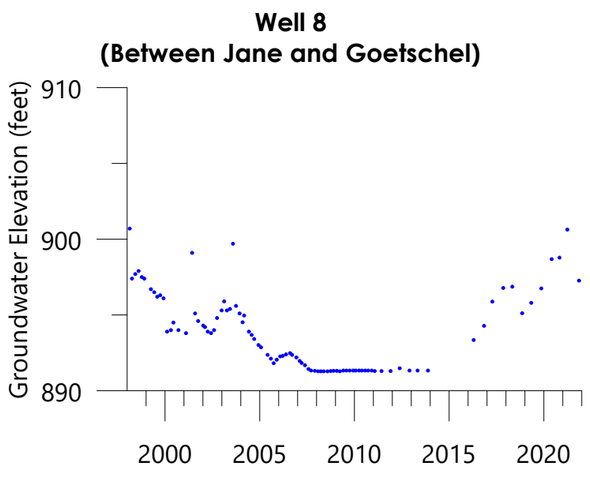
FIGURE A4-1

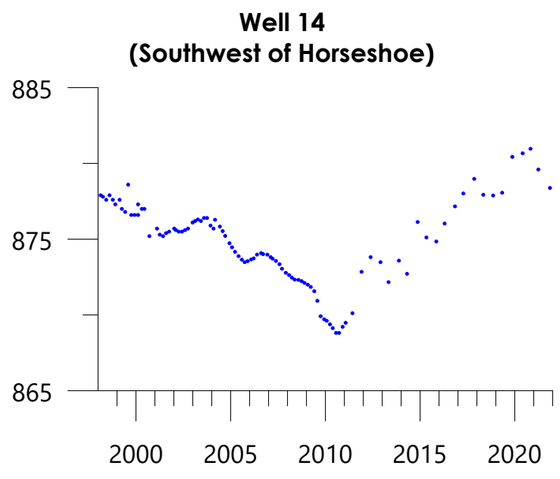


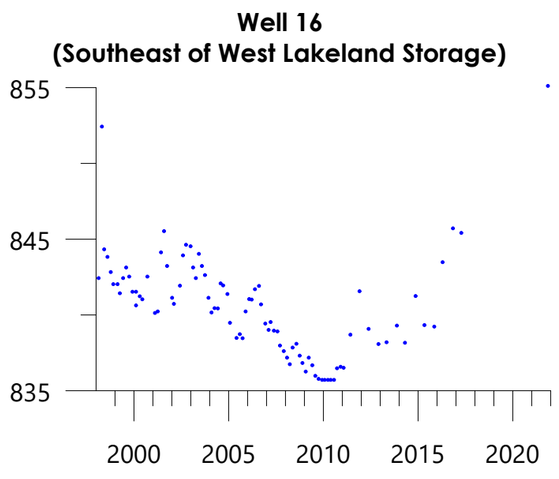


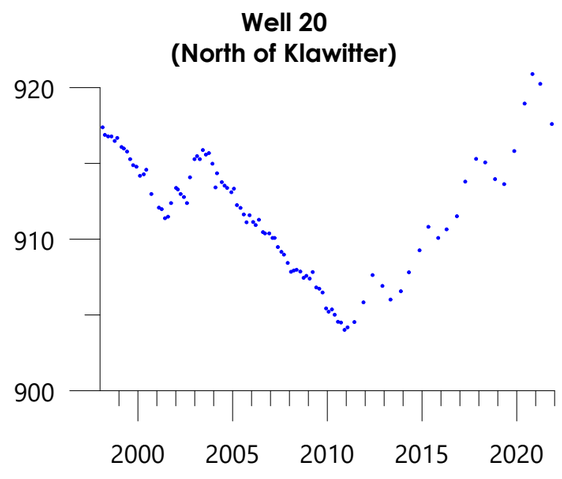


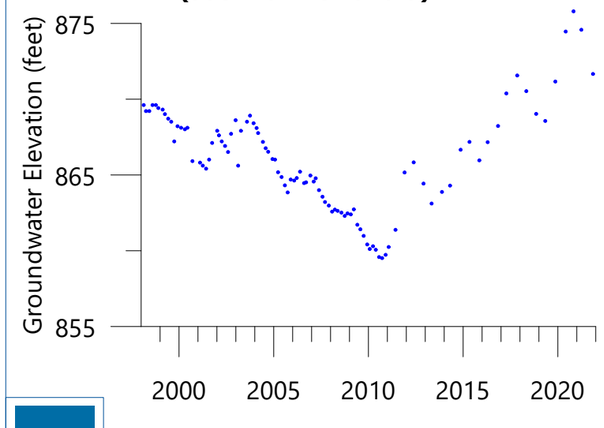


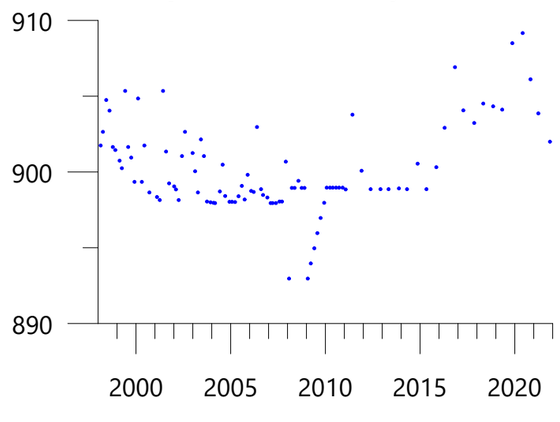


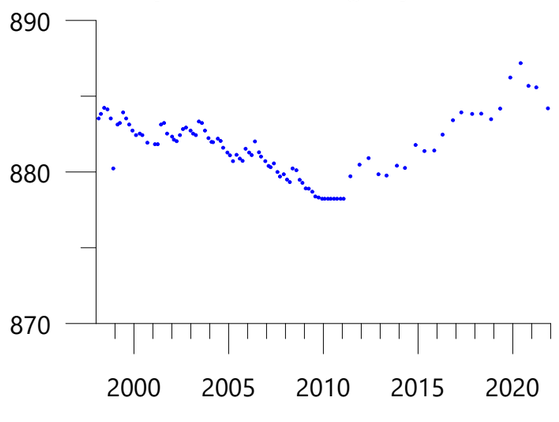








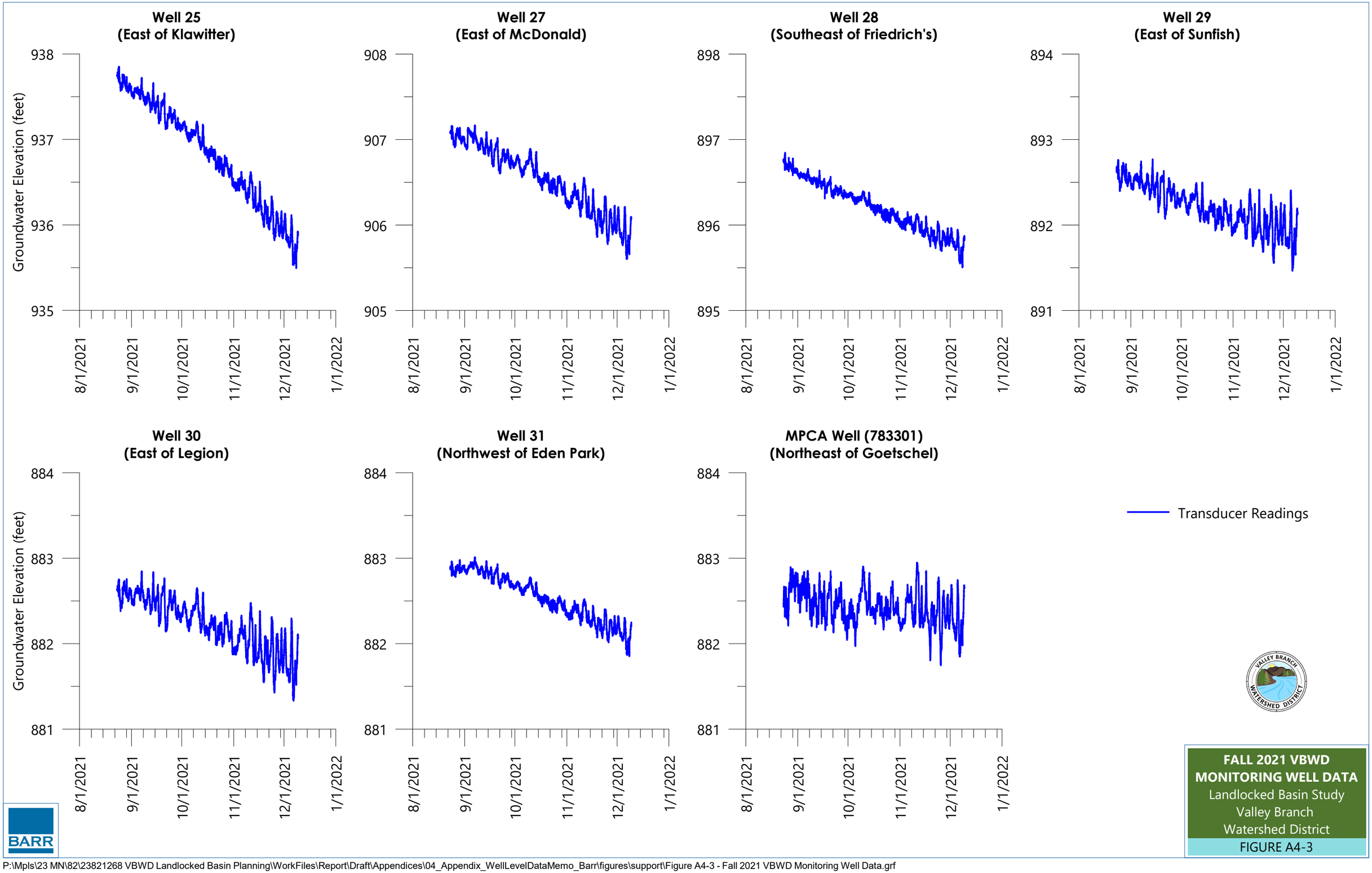




Manual Water Level Reading

LONG-TERM VBWD MONITORING WELL DATA
Landlocked Basin Study
Valley Branch Watershed District
FIGURE A4-2

P:\Mpls\23 MN\82\23821268 VBWD Landlocked Basin Planning\WorkFiles\Report\Draft\Appendices\04_Appendix_WellLevelDataMemo_Barr\figures\support\Figure A4-2 - Long-Term VBWD Monitoring Well Data.grf



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FALL 2021 VBWD MONITORING WELL DATA
Landlocked Basin Study
Valley Branch Watershed District
FIGURE A4-3

P:\Mpls\23 MN\82\23821268 VBWD Landlocked Basin Planning\WorkFiles\Report\Draft\Appendices\04_Appendix_WellLevelDataMemo_Barr\figures\support\Figure A4-3 - Fall 2021 VBWD Monitoring Well Data.grf