



Building a Better World
for All of Us®

MEMORANDUM

TO: Trevor Walter, PE

FROM: Kevin Young, PE (Lic. MN, VA)
Tayler Thom, PE (Lic. MN, WI)

DATE: July 29, 2025

RE: Well Nos. 1 and 4 Pump Replacement Project Summary
SEH No. BAXTE 183404 14.00

BACKGROUND

The City of Baxter contracted with Thein Well Company (Thein) for the replacement of the Well Nos. 1 and 4 pumps. On April 30th, 2025, Thein Well Company replaced the pump at Well 1(R) and on May 1st, 2025, Thein replaced the pump at Well 4(R). This memorandum summarizes the results of the 2025 Well Nos. 1 and 4 pump replacements.

Thein submitted pump and motor submittals for Goulds pumps in March and were reviewed by SEH for the pumps and motors to be released. The Goulds pumps were originally scheduled to arrive in March, but Thein received notice they were delayed until June without reason. SEH and Thein proceeded to select new Grundfos pumps and promptly review the pump and motor submittal. The Grundfos equipment was anticipated to be delivered the week of April 28th, 2025.

Once Grundfos pumps were received by Thein, they began pump replacement on April 30th, 2025 with Well 1(R) and finished pump replacement with Well 4(R) on May 1st, 2025. SEH completed pump testing on May 13th, 2025, and each pump was capable of pumping 700 gpm into the WTP as intended.

SUMMARY OF PUMP REPLACEMENT RESULTS

The pumps were tested at 100%, 90%, and 75% speed settings on the variable frequency drives (VFDs) and the WTP raw water influent valve was adjusted between the percent open range of 5%, 10%, 12.5%, 15%, and 100%. Flow and water level results are provided in the tables and graphs below.

Well 1(R) Pumping Results

The pumping water level remained above the target of 60 feet below grade when the flow rate was kept below approximately 730 gpm with the well operating at 60 Hz. Additionally, with the well operating at 90% (54 Hz), the pumping water level remained above 60 feet below grade when the flow was at 700 gpm. The maximum flow of 820 gpm at a pumping level of 62' is increased from the maximum flow rate of 585 gpm recorded with the previous pumps on November 21, 2024, following the 2024 well rehabilitations.

Engineers | Architects | Planners | Scientists

Short Elliott Hendrickson Inc., 13850 Bluestem Court, Suite 150, Baxter, MN 56425-6005

218.855.1700 | 866.852.8880 | 888.908.8166 fax | sehinc.com

SEH is 100% employee-owned | Affirmative Action–Equal Opportunity Employer

Graph 1 - Well 1(R) Pumping Water Level vs. Flow

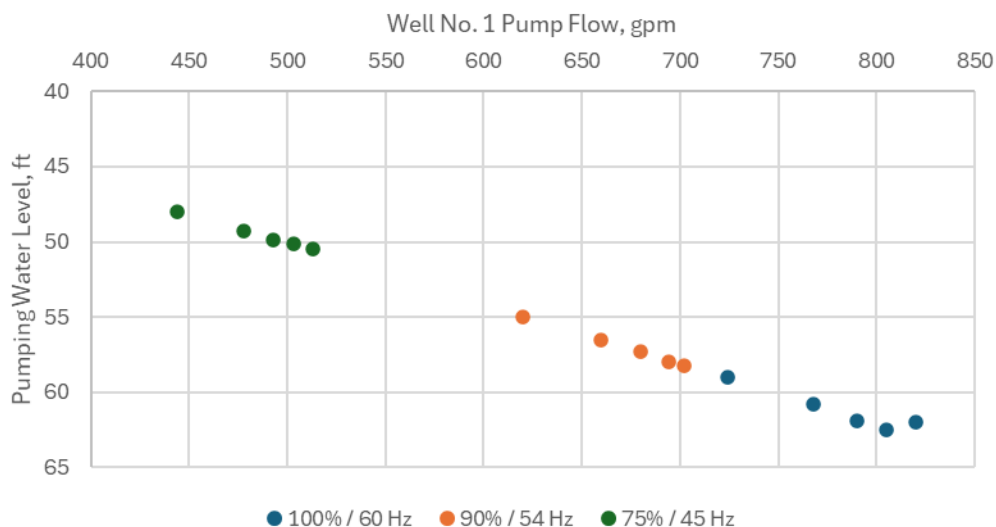


Table 1 – Well 1(R) Pump Test Results

WTP Valve Position*	100% / 60 Hz			90% / 54 Hz			75% / 45 Hz		
	Flow, gpm	PWL, ft	P**, psi	Flow, gpm	PWL, ft	P**, psi	Flow, gpm	PWL, ft	P**, psi
100%	820	62	7.6, 16.5	620	55	16.3, 27	444	48	12.1, 20
5%	724	59	19.3, 31	660	56.5	12.3, 22	478	49.3	9.9, 19.5
10%	768	60.8	14.1, 25.5	680	57.3	10.1, 20	493	49.9	8.8, 18
12.50%	790	61.9	11, 23.5	694	58	8.5, 17	503	50.1	8.1, 17
15%	805	62.5	9.3, 21	702	58.2	7.5, 16	513	50.5	7.4, 16

*Adjust throttling valve in WTP to create different head conditions at each step.

**Read pressure from pressure gauge inside WTP Chemical Room, static P in WTP is 16.5 psi on gauge.

Well 4(R) Pumping Results

The pumping water level (PWL) remained at or below the target of 60' when the flow rate was kept below approximately 760 gpm with the well operating at 60 hertz (Hz). Additionally, with the well operating at 54 Hz, the PWL remains below 60' at flows at or greater than 700 gpm. The maximum flow of 820 gpm at a PWL of 62' is increased from the maximum flow rate of 513 gpm recorded on November 21, 2024, following the 2024 well rehabilitations.

Graph 3 - Well 4(R) Pumping Water Level vs. Flow

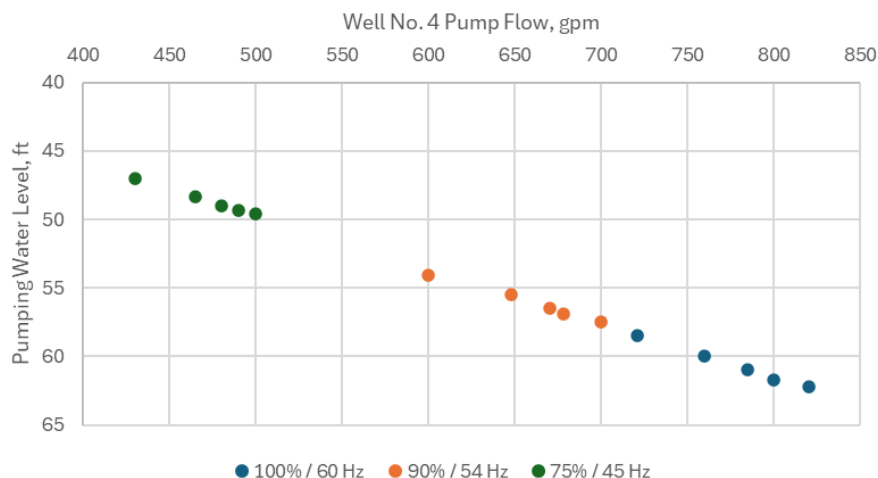


Table 2 – Well 4(R) Pump Test Results

WTP Valve Position*	100% / 60 Hz			90% / 54 Hz			75% / 45 Hz		
	Flow, gpm	PWL, ft	P**, psi	Flow, gpm	PWL, ft	P**, psi	Flow, gpm	PWL, ft	P**, psi
5%	721	58.5	18.9, 31	600	54.1	15.9, 26.5	430	47	11.8, 19.5
10%	760	60	13.9, 23.5	648	55.5	12.2, 21.5	465	48.3	9.8, 20
12.50%	785	61	11, 21	670	56.5	10, 20	480	49	8.6, 17.5
15%	800	61.7	9.3, 19	678	56.9	8.8, 18	490	49.3	8.1, 17
100%	820	62.2	7.6, 16	700	57.5	7.5, 16	500	49.6	7.4, 16

*Adjust throttling valve in WTP to create different head conditions at each step.

**Read pressure from pressure gauge inside WTP Chemical Room, static P in WTP is 16.5 psi on gauge.

WELL FIELD CAPACITY SUMMARY

Table 3 provides the maximum well flow rates for the existing Baxter well field compared to the design flow rates. The right-most column of the table provides the difference between the original design flow and the current flow as of June 2025. Since November of 2024, Wells 2 and 3 have experienced a decrease of 1 gpm and 64 gpm, respectively. In this same period, the new pumps for Wells 1 and 4 produce 43 gpm and 124 gpm of additional flow, respectively. The associated increase for Wells 1 and 4 is the results of changing the pumps for these wells. While changing the pumps provides nearly 150,000 gallons per day of additional capacity, the four (4) existing wells are not able to produce a total flow of 4 MGD as planned when they were originally designed.

The total capacity difference is a result of the close proximity of the four (4) wells, which causes interference. While the four wells were all designed for 700 gpm individually, they are not able to produce 700 gpm when pumped together without creating excessive drawdown in the well field. The addition of Wells 5 & 6, which will go online later in 2025, are anticipated to increase the City's well capacity to beyond 4 MGD. Test pumping of the new wells is being completed in July 2025.

Table 3 – Historical Well Flow Comparison

Well	Maximum Flow Rate (all wells running)		2013 Design Flow	Difference (Current Flow – Design Flow)
	June 2025	11/21/2024		
Well 1R (gpm)	628	585	700	-72
Well 2R (gpm)	577	578	700	-123
Well 3 (gpm)	564	628	700	-136
Well 4R (gpm)	637	513	700	-63
Total Capacity	2,406 gpm	2,304 gpm	2,800 gpm	-394 gpm
	3.5 MGD	3.3 MGD	4.0 MGD	-0.6 MGD
Firm Capacity ⁽¹⁾	1,769 gpm	1,676 gpm	2,100 gpm	-331 gpm
	2.5 MGD	2.4 MGD	3.0 MGD	-0.5 MGD

Notes: ⁽¹⁾ Firm capacity is defined as the capacity with the highest capacity pump/well out of service.

Source: Field Testing Data, City Records

RECOMMENDATIONS

- **Operate multiple wells at lower flow rates to reduce the drawdown** in the well field. For example, rather than pumping two (2) wells at 700 gpm each to produce 1,400 gpm the City could use three (3) wells each pumping about 465 gpm to keep the water level in the wells higher. Pumping from a higher water surface elevation in the aquifer also reduces the amount of electricity used to pump the water. SEH recommends targeting a pumping water level of less than about 60' across the well field, consistent with the summer 2024 recommendations. This recommendation is not a hard limit, as operators need to balance water production and pumping water level. If pumping levels begin to follow a dropping trend as demands pick up, water may need to be purchased from Brainerd.
 - The maximum pumping level for the wells is about 80' to maintain a required column of water over top of the pump without breaking suction. However, as the pumping level drops below 60' it is anticipated that the formation in the vicinity of the well will foul at an increased rate like it did in 2023, so there may be diminishing returns from dropping the pumping level below 60' to not purchase water from Brainerd.
- **Monitor specific capacity.** If the individual well specific capacities drop to the Well Rehabilitation Trigger Specific Capacity stated below, the well(s) should be rehabilitated. The Well Rehabilitation Trigger Specific Capacity is based on the specific capacity dropping 20% from the 2024 post-rehabilitation level.
 - Well Rehabilitation Trigger Specific Capacity:
 - Well No. 1: 17.8 gpm/ft
 - Well No. 2: 16.8 gpm/ft
 - Well No. 3: 14.4 gpm/ft
 - Well No. 4: 16.9 gpm/ft

TAT

c: Trevor Thompson, City of Baxter

Attachments:

- Well Information – Baxter

x:\ael\b\baxtel\183404\1-gen\14-corr\project summary memorandum\well 1 & 4 pump replacement project summary memorandum 7-29-2025.docx

Baxter Well Information

Well Field		Mapleton Rd WTP			
Well Information	Baxter Well Number	1R	2R	3	4R
	MDH Well Number	4	5	6	7
	Unique Well No.	752207	741694	733068	752208
	Address	Baxter 133 29 13 SW1/4 SW1/4 SE1/4	Baxter 133 29 13 SW 1/4 SW 1/4 SE 1/4	Baxter 133 29 13 SW 1/4 SW 1/4 SE 1/4	Baxter 133 29 13 SW 1/4 SW 1/4 SE 1/4
	Year Drilled	2007	2006	2006	2007
	Well Depth (completed)	132	121	136	135
	Aquifer	QWTA	QWTA	QWTA	QWTA
	Capacity (gpm) - Original	700	700	700	700
	Flow Rate (gpm) - June 2025	628	577	564	637
	Static Water Level (ft bgs) - Original	30.7	29.7	28.6	27.8
	Pumping Water Level (ft bgs) - Original	48.5	47.9		50.7
	Specific Capacity (gpm/ft) - Original	39.3	38.6	34.3	30.6
	Specific Capacity (gpm/ft) - 10/2024	22.2	21.0	18.0	21.1
	Casing Diameter (in)	12	12	12	12
	Casing Depth (ft)	102	96	111	105
	Screen Diameter (in)	12	12	12	12
	Screen Length (ft)	30	25	25	30
	Screen Set Between (ft)	102 - 132	96 - 121	111 - 136	105 - 135
	Screen Slot	0.025	0.018	0.040	0.025
	Year Televised	2024	2024	2024	2024
Well Pump Motor Information	Year Cleaned	2011 2024	2011 2021/2022 2024	2013 2021/2022 2024	2011 2024
	Motor Manufacturer	SME 6SME 400T	Hitachi	Hitachi	SME 6SME 400T
	Motor Type	Submersible	Submersible	Submersible	Submersible
	Pump Manufacturer	Grundfos	Goulds	Goulds	Grundfos
	Pump Model	625S400-2A			625S400-2A
	Starter ²	VFD	VFD	VFD	VFD
	Horse Power	40	40	40	40
	Year Installed/Replaced	2007 2013 2025	2007 2013	2007 2013	2007 2013 2025
	Voltage	460	460	460	460
	RPM	3450	3450	3450	3450
	Emergency Backup	WTP Gen.	WTP Gen.	WTP Gen.	WTP Gen.

¹ When pumps are pumping alone

² FV=Full Voltage; VFD=Variable Frequency Drive