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PROJECT SUMMARY MEMORANDUM

TO: Trevor Walter, PE, City of Baxter

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

DATE: January 30, 2026

RE: 2025 Water Supply Improvements - Well Nos. 5 & 6
SEH No. BAXTE 181112 14.00
City No. 6011-45040

This memorandum provides a comprehensive summary of the development, construction and testing activities for the new Well Nos. 5 and 6 for the City of Baxter's water supply system. These wells were constructed to meet increasing water demand, improve system reliability, and align with long-term infrastructure planning objectives laid out in the 2024 Baxter Water System Planning and Hydraulic Model Report prepared by Short Elliott Hendrickson Inc. (SEH®). The new wells were necessary due to the existing four (4) wells experiencing a decrease in capacity from excessive pumping during historically high water demands during the summer of 2023.

TEST WELLS

In 2024, SEH hydrogeologists conducted a preliminary evaluation of potential new wellfield sites within the City, identifying candidate locations for test wells and future well development. The following two sites were chosen and are shown in the attachment: "Test Well Locations".

Well No. 5 Test Location: 6070 Mapleton Road, Baxter, MN 56425
N: 162343.24, E: 548761.72
Parcel ID: 40130757
Section 13, Township 133, Range 29

Well No. 6 Test Location: 6070 Mapleton Road, Baxter, MN 56425
N: 162286.85, E: 549163.51
Parcel ID: 40130757
Section 13, Township 133, Range 29

The selected locations were identified based on their hydrogeologic suitability and their proximity to existing City infrastructure (i.e., existing raw water main), for cost effective development and integration into the City's water supply system. The City already owned the property, eliminating site acquisition costs. Additionally, this location had no listed source of potential contamination and the sites considered all had the potential for buried outwash aquifer.

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

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DRILLING METHOD

An important aspect of well construction is the drilling method used to construct the well. Two common well drilling methods often considered for municipal water supply wells are mud rotary and dual rotary. Mud rotary drilling uses a rotating drill bit and drilling fluid (mud) to cut and remove material from the borehole. The mud stabilizes the hole, transports cuttings to the surface, and prevents borehole collapse. It is widely used for municipal water wells due to its efficiency in unconsolidated formations and ability to drill large-diameter holes. One of the downsides of mud rotary drilling is that, if not managed properly, mud can migrate from the borehole into the formation and lead to a well with diminished capacity.

Dual rotary drilling method involves simultaneous rotation of both the drill string and casing. The outer casing is advanced as the hole is drilled, providing continuous support and minimizing the risk of collapse in loose or unstable formations. It is particularly useful in challenging ground conditions but can be a more expensive drilling method. One of the primary advantages of using the dual rotary method is it does not require mud for the drilling process.

WELL CONSTRUCTION

During the design phase, drilling methods and schedules were discussed with well drillers. It was determined that dual rotary drilling would not be feasible for this project due to the tight timeline. As a result, mud rotary was selected, and equipment performance specifications were included in the contract documents to ensure proper well construction.

Bids for Wells 5 & 6 were opened on Tuesday, February 18, 2025. Traut Companies of St. Joseph, MN was awarded the contract in the amount of \$407,095.

Well drilling machines were registered in accordance with MDH Chapter 4725.1800. A solids control system for the purpose of clean and recycling drilling fluid and separate cuttings, as well as an air compressor capable of greater than 900 CFM at 350 psi were used for well construction and development, as well. The wells were developed to have a maximum sand content of less than 5 mg/L and a maximum turbidity of 0.01 NTU.

The well construction dates are provided in the table below.

Well No.	Drilling Dates	Casing Installation Date(s)
5	June 16-18, 2025	June 19, 2025
6	July 1-8, 2025	July 8, 2025

WELL DEVELOPMENT & TEST PUMPING

After the wells were drilled, three (3) rounds of development and test pumping were required to achieve satisfactory flow rates from the two new wells, with each round of development increasing the intensity of development. The well construction bid included 70 hours of development for each well and one (1) round of test pumping.

Round 1

Traut Companies utilized typical development methods of airlifting and surging during the first round of development. This consisted of surging water into the well and blowing compressed air into the well below the water column to lift water and debris to the surface to clean and develop the well. At the end of round one the well development crew believed the well to be sufficiently clean and expected the well to achieve the targeted flow rates. A summary of the development dates and duration is included in the table below.

Well No.	Development Dates	Duration (hours)
5	June 23-27, 2025	45
6	July 10-17, 2025	47.5

The wells were each pump tested after the initial round of development. The total capacity of the two wells was only about 57% of the targeted capacity, with neither well achieving the goal of 700 gpm.

Well	Specific Capacity (gpm/ft)	Maximum Flow (gpm)	Flow at 60' Pumping Water Level (gpm)
5	7.8	465	232
6	6.4	330	184
Total		795	416

Round 2

After the initial pump test, the project team determined a second round of development was necessary to improve the well capacity. SEH and Traut Companies determined that air and water jetting followed by airlifting should be used to dislodge fine particles in the formation surrounding the well screen to clean and develop the well. Traut Companies also used a dispersant chemical called Aqua-Clear® PFD to assist with sediment removal from the formation. The Round 2 development dates and durations, including total duration between Rounds 1 and 2, are summarized in the table below.

Well No.	Development Dates	Duration (hours)	Total Duration (hours)
5	August 20-25, 2025	32.5	77.5
6	August 13-18, 2025	23.25	70.75

The wells were test pumped a second time after the second round of development. While the specific capacity and flow of the wells were significantly increased, SEH worked with Traut Companies to devise a plan for a third round of development to increase the well capacity further.

Well	Specific Capacity (gpm/ft)	Maximum Flow (gpm)	Flow at 60' Pumping Water Level (gpm)
5	12.7	735	429
6	9.4	485	297
Total		1,220	726

Round 3

During the third round of development, Traut Companies simultaneously jetted the well while airlift pumping out about twice the volume of water that they were introducing to the well. The goal of this method was to remove fine particles that were dislodged by the jetting process while they were mobilized. Like Round 2, Traut Companies added Aqua-Clear® PFD to the well each night when development stopped to assist with sediment removal. The Round 3 development dates and durations, including total duration between all three rounds, are summarized in the table below.

Well No.	Development Dates	Duration (hours)	Total Duration (hours)
5	September 17-22, 2025	36.75	114.25
6	September 9-16, 2025	39	109.75

After the third round of development a final pump test was completed. The specific capacity and flow rates of both wells increased again and both wells were able to achieve a maximum flow rate of at least 700 gpm. Results from the third round of test pumping are presented in the table below. The next section includes a summary of the changes in well capacity between the three rounds of development and test pumping.

Well	Specific Capacity (gpm/ft)	Maximum Flow (gpm)	Flow at 60' Pumping Water Level (gpm)
5	20.1	869	638
6	13.2	705	407
Total		1,574	1,045

TEST PUMPING SUMMARY

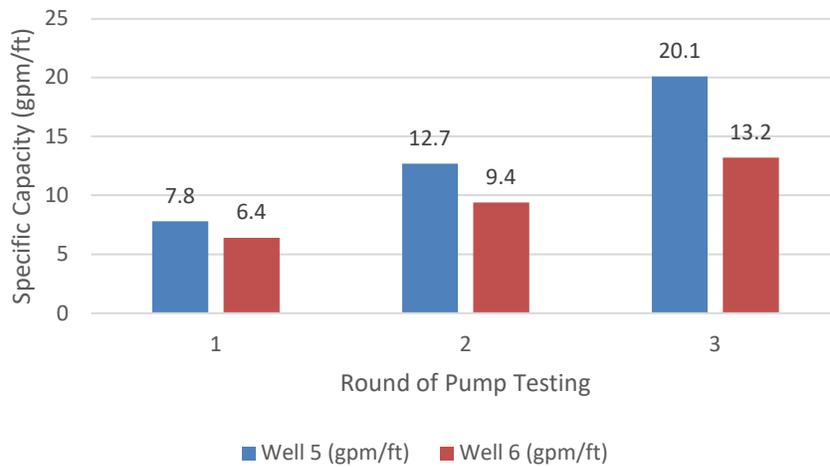
Pump testing conducted on Wells 5 and 6 across three development rounds revealed substantial performance enhancements. The following improvements occurred between the first and final pump tests:

Specific Capacity

Specific capacity is widely used to evaluate the productivity and health of a water production well because it provides a normalized measure of well performance that accounts for both discharge and drawdown. A higher specific capacity generally means the well can produce more water with less drawdown and can indicate good aquifer transmissivity and efficient well development. A lower specific capacity could suggest possible clogging of the well screen, formation damage, and declining aquifer performance.

Figure 1 presents how the specific capacity of both wells increased during each round of pump testing. The two additional rounds of development were able to achieve a 157% increase in specific capacity for Well 5; starting at 7.8 gpm/ft and increasing to 20.1 gpm/ft. Well 6 experienced a 107% increase; from 6.4 gpm/ft to 13.2 gpm/ft.

Figure 1 – Specific Capacity Improvement

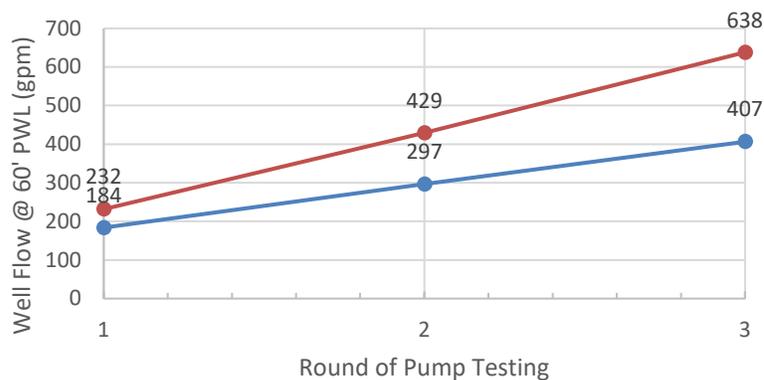


Flow

Throughout the three (3) rounds of development and test pumping, the well flow capacity increased significantly. The maximum capacity of the wells, or the amount of water that could be pumped from the well while using all available water column above the proposed pump setting, increased by 87% and 114% for Well Nos 5 and 6, respectively. The Well 5 maximum flow increased from 465 gpm to 869 gpm and the Well 6 flow increased from 330 gpm to 705 gpm.

For a more conservative well capacity, where the pumping water level (PWL) approaches 60' below the ground surface, the capacities also increased between the various rounds of development and test pumping. The well flow at 60' PWL for Well 5 increased by 175% from 232 gpm to 638 gpm. At Well 6, the well flow at 60' PWL increased by 121% from 184 gpm to 407 gpm.

Figure 2 – Well Pump Flow Improvement at 60' Pumping Water Level



Combined Well Performance

The combined performance of Well Nos. 5 and 6 showed substantial improvements following the multiple rounds of development. The total maximum flow achieved was 1,574 gallons per minute (gpm), equivalent to 1.5 million gallons per day (MGD). Overall, this represents a 98% increase in peak flow capacity and a 151% improvement at a pumping water level of 60 feet (PWL), significantly improving the well performance for each well.

Pump Test Results Comparison

Pump Test	Well No. 5			Well No. 6			Total			Total % Increase		
	1	2	3	1	2	3	1	2	3	Well No. 5	Well No. 6	Total
Specific Capacity, gpm/ft	7.8	12.7	20.1	6.4	9.4	13.2	n/a	n/a	n/a	157%	107%	
Flow (max), gpm	465	735	869	330	485	704	795	1,220	1,574	87%	114%	98%
Flow (max), MGD	0.7	1.1	1.3	0.5	0.7	1.0	1.1	1.8	2.3			
Flow @ 60' PWL, gpm	232	429	638	184	297	407	416	726	1045	175%	121%	151%
Flow @ 60' PWL, MGD	0.3	0.6	0.9	0.3	0.4	0.6	0.6	1.0	1.5			

Pumping Equipment

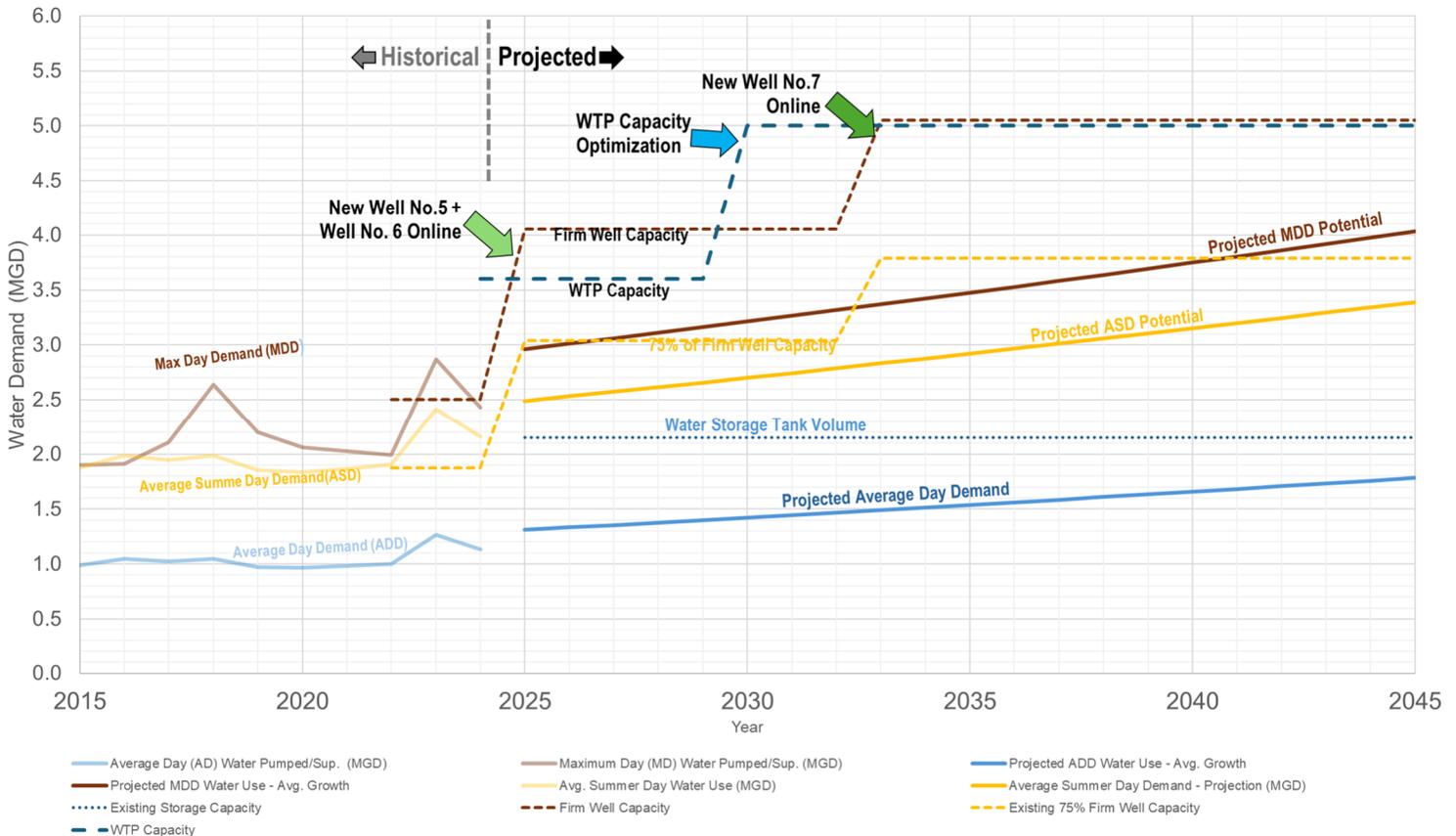
The major well equipment installed during the project is provided in the table below.

Description	Well 5	Well 6
Pitless Adapter Manufacturer	Baker Manufacturing Co., LLC.	Baker Manufacturing Co., LLC.
Pitless Adapter Model	10.5PS1214WBWE06M8EPX	10.5PS1214WBWE06M8EPX
Pump Manufacturer	Grundfos	Grundfos
Pump Model	625S400 – 2A Stage	625S400 – 2A Stage
Pump Setting	93'	88'
Motor Manufacturer	SME USA	SME USA
Motor Model	6SME 400T	6SME 400T
Motor HP	40	40

WATER SUPPLY SYSTEM UPDATE

The trigger chart for water infrastructure planning has been revised to incorporate the capacities of Well No. 5 and Well No. 6. This chart reflects updated thresholds for future expansions based on projected demand and ensures compliance with the City’s water planning goals. MN DNR has been informed of the addition of the wells, including documentation for approval through the MN DNR online MPARS system.

Figure 3 – Trigger Chart



The addition of Well No. 5 and Well No. 6 improved the City of Baxter’s water supply capacity and system resilience. Both wells have been developed and tested and are integrated into the City’s water system. The trigger chart provided in the 2024 water system plan assumed a capacity of 700 gpm for Well Nos. 5 and 6. Compared to the actual capacity of 640 gpm and 410 gpm, however, the continued performance of Well Nos. 1, 2, 3, and 4 maintains and slightly improves the firm pumping capacity. The recommended year to construct Well No. 7 remains in 2032-2033. Additionally, the water supply plan recommends the next well exploration in 2027, and this remains the same. For information, the City’s Water Enterprise Fund 20-year CIP (accepted April 16, 2025) identifies an estimated cost of \$250,000 for the “New Wellfield Expansion Exploration (for Well 7)” project.

CONCLUSION

The development and commissioning of Well Nos. 5 and 6 for the City of Baxter's water supply system have addressed the City's existing increasing water demand and improved system reliability. The project involved careful site selection, the use of mud rotary drilling for both wells, and three rounds of well development and test pumping. Each round of development led to notable improvements in well flow rates and specific capacities.

The new wells have been integrated into the City's water supply, strengthening overall infrastructure and ensuring compliance with long-term planning objectives. Overall, the project positions the City of Baxter for sustainable water supply management in the coming years.

tat/kby/mrb

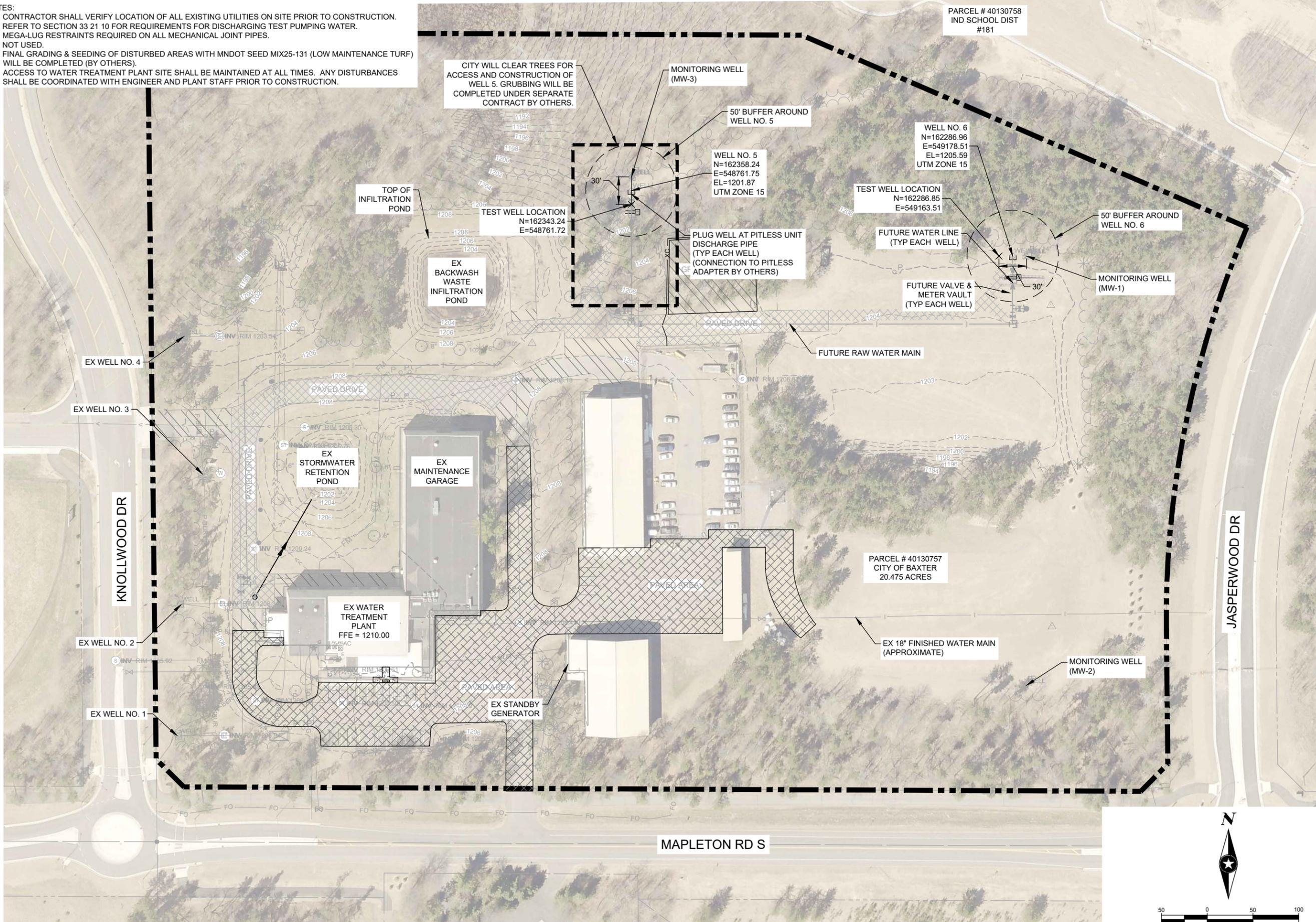
Attachment: Test Well Locations

c: Trevor Thompson, Assistant City Engineer
James Lueck, Utilities Supervisor

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NOTES:

1. CONTRACTOR SHALL VERIFY LOCATION OF ALL EXISTING UTILITIES ON SITE PRIOR TO CONSTRUCTION.
2. REFER TO SECTION 33 21 10 FOR REQUIREMENTS FOR DISCHARGING TEST PUMPING WATER.
3. MEGA-LUG RESTRAINTS REQUIRED ON ALL MECHANICAL JOINT PIPES.
4. NOT USED.
5. FINAL GRADING & SEEDING OF DISTURBED AREAS WITH MNDOT SEED MIX25-131 (LOW MAINTENANCE TURF) WILL BE COMPLETED (BY OTHERS).
6. ACCESS TO WATER TREATMENT PLANT SITE SHALL BE MAINTAINED AT ALL TIMES. ANY DISTURBANCES SHALL BE COORDINATED WITH ENGINEER AND PLANT STAFF PRIOR TO CONSTRUCTION.



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I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA

Kevin Young
KEVIN B. YOUNG, PE

DATE 01/17/2025 LICENSE NO. 54828



**CITY OF BAXTER, MN
2025 WATER SUPPLY IMPROVEMENTS - WELLS 5 & 6
BAXTER, MINNESOTA**

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SEH Project BAXTE 181112
Checked By MAH
Drawn By WSW

Project Status Issue Date
BIDDING DOCUMENTS 1/21/2025
ADDENDUM 1 2/14/2025
FIELD ORDER 1 4/8/2025

REVISION SCHEDULE
REV. # DESCRIPTION DATE

SITE PLAN

C001

