APPENDIX G. GRINDSTONE RIVER DAM REMOVAL DRAFT ENVIRONMENTAL IMPACT STATEMENT

Groundwater Technical Review

DEPARTMENT OF NATURAL RESOURCES

Ecological and Water Resources - Groundwater Technical Analysis

Groundwater Technical Review

Date: 06/30/2021

To: Becky Horton, Planner Principal, Division of Ecological and Water Resources

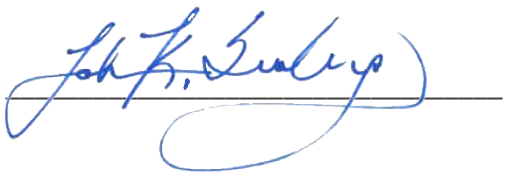
From: John Seaberg, PG, Groundwater Specialist, Groundwater Technical Analysis Workgroup

Subject: Grindstone River Dam Removal, Potential Impacts to Water Supply Wells

Reviewed by: Amanda Yourd, Hydrogeologist, Groundwater Technical Analysis Workgroup

PROFESSIONAL GEOLOGIST

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 Geologist under the Laws of the State of Minnesota.

License No: 30303 *Signature:* 

Executive Summary

Removal of the Grindstone River dam could potentially reduce the groundwater level by as much as 7 feet in the vicinity of the dam, with impacts decreasing moving away from it. This has the potential to create an out-of-water situation for private domestic water supply wells in the area. The risk of impacts to individual wells was evaluated by applying a worst-case scenario, using online data, and conducting a well survey. Two alternative recommendations were presented to mitigate potential impacts. One alternative would involve retaining a licensed well contractor to physically inspect any well identified as being at risk or for which the risk is unknown due to lack of information on the well. Since this would involve 25 wells, this alternative would be expensive and time-consuming. Given that impacts are likely to be significantly less than the worst-case scenario if the dam was removed, it was recommended that the well owners be notified by mail of possible impacts to their wells prior to dam removal and that a contingency plan be developed to immediately mitigate the water supplies of any well owners that might be impacted.

Introduction

Removal of the Grindstone River dam as proposed would lower the water table near the dam, which could impact local groundwater users in the area, specifically privately owned domestic wells near the dam. This report outlines the changes in hydrogeology and the potential issues that water supply wells may face if the dam is removed. The report also evaluates the risk of a well to be impacted by the dam removal, as well as the potential to mitigate impacts by lowering the pump in the well. Technical recommendations are provided.

To identify as many water wells as possible to assess their risk to impact from the proposed dam removal, personnel from the Groundwater Technical Analysis Workgroup of the Ecology and Water Resources Division of MDNR conducted a well survey, initially by identifying wells found in the Minnesota Well Index (MWI) (MGW and MDH, 2021), followed by a private well survey. On December 15, 2020, the DNR initiated the water well survey by sending out a letter and a well survey form to individual wells owners, requesting responses by January 15, 2021. Additionally, to follow up on property owners who had not responded, 12 surveys were hand delivered by a hydrologist from the Hydrogeology and Groundwater Unit to residences on April 28 as a part of field work activities.

Background

The Grindstone River generally serves as a groundwater discharge zone for the water table aquifer, which means that groundwater typically flows from the water table aquifer into the Grindstone River. In the area surrounding the Grindstone Reservoir, the opposite is true (water flows from the Reservoir into the water table aquifer). This is because the water level in the Reservoir has been artificially increased to approximately 1019 feet above mean sea level. The water level of the river immediately downstream of the dam is considerably lower than that in the reservoir. This elevation difference creates a “mound” in the water table aquifer, where the high Reservoir elevation maintains a higher water table elevation. If the Reservoir water level is decreased, nearby water table levels will also decrease, which could cause water levels to drop below the pumps in domestic wells.

A bathymetric map of the Grindstone Reservoir, prepared by DNR in 1990, indicates the maximum depth of the Reservoir to be approximately 10.5 feet at a location immediately upstream of the dam. The dam height is only actually about 7 feet above the water level of the downstream hydraulic control (riffle) of the river bed, indicating that the maximum drop would be about 7 feet if the dam were removed without any riffle construction. However, riffles proposed at the site could reduce this to about 5 feet. Therefore, assuming a maximum 7-foot decline in water levels represents a conservative worst-case scenario. The water level decline caused by dam removal would diminish moving upstream from the dam site.

Potential Impacts to Water Supply Wells

Data Collection Methods

To identify water supply wells with potential to be impacted by removal of the dam, a domestic well survey was conducted by:

- Mailing out a domestic well survey form to parcel owners;
- Searching the Minnesota Well Index (MWI) database (MGS and MDH, 2021) for domestic wells; and
- Follow-up delivery in-person of domestic well survey forms to residences for which we received no responses.

Data Collection Results

Domestic well survey forms were initially mailed to parcel owners over a relatively large area surrounding the reservoir. Out of 215 surveys mailed out, 16 were returned as undeliverable, and 58 responses were received, while no responses were received from the remaining 141. Of the 58 survey forms that were returned, 26 of them indicated the presence of a well on the property. Subsequent refinement of the well survey focused on the area most likely to be impacted by constraining the survey area to within a 2,000-foot radius of the Grindstone River dam itself based on professional judgement and experience. Within this area we received a total of 50 responses, of which 27 reported the presence of a well. Figure 1 shows the locations of the properties for which responses were received within the 2,000-foot radius of the dam.

Figure 2 shows the locations of existing wells that were identified in the well survey within 2,000 feet of the dam. A total of 54 wells were identified within 2,000 feet of the dam from the well survey and using MWI. A total of 38 wells were identified in MWI, of which 17 were sealed and eliminated from further consideration. These are listed in Table 1. In addition to the remaining 21 wells found in MWI, an additional 16 wells were identified in the well survey responses for a total of 37 wells that were evaluated as presented in Table 2. Inspection of individual well logs in MWI (MGS and MDH, 2021) for wells appearing to be owned by institutions indicated that several were domestic wells of private owners, except for three wells:

1. MN DNR (804703), monitoring well;
2. Bergquist Field 1 (260934), public non-community transient water supply well; and
3. Hinckley-Finlayson School District 2165 (805861), public non-community supply well.

All other wells in Table 2 are interpreted to be domestic water supply wells.

Analysis

For each well on Table 2, the available static head over the pump was computed from the length of the drop pipe minus the static water level at the time of drilling. The available head was then compared to the water level decline assumed under a worst-case scenario. The Groundwater Technical Analysis Workgroup uses the following convention for designating the risk level of a well to be impacted by a decrease in water level:

- Low risk when there is greater than 20 feet of water remaining above the pump intake after the decrease in water level is accounted for;
- Moderate risk when there is 10 to 20 feet of water remaining above the pump intake after the decrease in water level is accounted for;
- High risk when there is less than 10 feet of water remaining above the pump intake after the decrease in water level is accounted for; and
- Unknown risk when the available head remaining over the pump is not available.

As described above, the worst case water level decrease is expected to be approximately 7 feet—the maximum difference in present pool elevation and expected stream elevation near the dam once it is removed. In evaluating the risk to wells, we will conservatively assume the worst-case scenario of a 7-foot reduction in the water level for each well regardless of its location. Based on this 7-foot drop, and following DNR's typical convention presented above, the risk of impact to the wells is determined based on the height of water column above the pump in each prior to dam removal as follows:

- Low risk—greater than 27 feet above pump intake;
- Moderate risk—17 - 27 feet above pump intake; and
- High risk—less than 17 feet above pump intake.

Where available, well construction logs from CWI were used to estimate the height of the water column above the pumps in domestic water supply wells. The pump depth was assumed to be the same as the reported length of drop pipe. The water column height above the pump was estimated by subtracting the static water level from the length of drop pipe. Ten wells had sufficient information to determine the out-of-water risk. **The out-of-water risk was determined to be high for four wells, moderate for four wells, and low for two wells, assuming the worst-case scenario of a 7-foot decrease in water levels.** Figure 3 illustrates the locations and potential level of risk to be impacted by removal of the dam for each well.

If proposed riffle construction results in the maximum decrease in water level of 5 feet, the impacts would be further diminished. However, such a change would only change the risk level for one well from high to moderate, and still would not change recommendations that that well undergo inspection by a licensed well driller (see Technical Recommendations section).

Lowering the pump in a domestic well is common way to mitigate risk for well interference. If the information was available in the CWI well logs, the depth of the standing column of water in the well was used to evaluate the potential for lowering the pump in the well. This assumes that the well is of sufficient diameter, is outfitted with a submersible pump, and the pump can be lowered into the well with a longer drop pipe, which is not necessarily the case for each well. Table 2 also presents the depth of the standing column of water in the well based on the difference between the well depth and the static water level and indicates the likelihood of mitigating the impacts in each well by lowering the pump using the following criteria:

- Unlikely—less than 20 feet of standing water in the well;
- Maybe—20 - 30 feet of standing water in the well; and
- Likely—greater than 30 feet of standing water in the well.

Information was not available for 17 of the wells to make this determination—all of which are non-CWI wells except for one. Applying these criteria to the remaining CWI wells, the potential to mitigate the wells by lowering the pump is likely for 11, unlikely for six, and maybe a possibility for the remaining three wells.

Figure 3 illustrates the location of each of the wells identified with a small symbol indicating its risk level of impact from dam removal as previously described, inside a larger symbol that indicates the potential for mitigation based on the depth of standing water in the well.

Technical Recommendations

Based on the water table elevations and well construction details where available, there is potential for supply wells to be impacted if the Grindstone Dam is removed. The Groundwater Technical Analysis Workgroup presents two alternative approaches to mitigate potential impacts to the wells.

The first approach is based on the analysis presented above, and would require the collection of more information. The last column of Table 2 presents recommended actions for each well based on the information presented above, as well as the distance from the dam. The recommendations are based on applying the well interference risk and professional judgement to the information for each well. No further action is recommended for any well determined to have a low risk of impact from the dam removal. Additionally, no further action was recommended for any well close to the 2,000 distance from the dam

since impacts are expected to be negligible at that distance. Also, since DNR Well 804703 is not a water supply well, no further action is recommended for it. **Of the 37 wells within 2,000 feet of the dam that were not sealed, 25 were recommended for inspection by a licensed well driller to determine what if any further mitigation steps should be taken, and no further action was recommended for the remaining 12 wells. This approach is based on the very conservative assumption that there will be a 7-foot decrease in water levels in all the wells. Professional experience and judgement suggest that this is very unlikely to happen especially given the distance of the wells from the dam.**

Give the considerable time and expense that the first approach would entail, the Groundwater Technical Analysis Workgroup presents a second approach to mitigate potential impacts of the dam removal. As an alternative to well inspections, **the Groundwater Technical Analysis Workgroup recommends that all well owners be notified by mail of possible impacts to their wells prior to dam removal and that a contingency plan be developed to immediately mitigate the water supplies of any well owners that might be impacted.**

References

MGS and MDH, 2021, County Well Index: Database created and maintained by the Minnesota Geological Survey (MGS) a department of the University of Minnesota; with the assistance of the Minnesota Department of Health (MDH). Accessible through the MDH Minnesota Well Index mapping application at: Minnesota County Well Index

Tables

Table 1. Sealed Wells

Owner	County PIN	Unique Well Number
DNR – FISHERIES	400090000	131764
DNR – FISHERIES	400090000	507449
CABAK,KURTIS M	405088000	517609
CABAK,KURTIS M	405088000	517610
SCHMIDT,GERALD A & DOROTHY M	405081000	535843
ANGELL,AMY & ISAAC WOLTER	405087000	535845
CITY OF HINCKLEY	405018000	454241
CITY OF HINCKLEY	405081000	544231
DNR	400087000	548165
Gerald A & Dorothy M Schmidt	405081000	595106
CITY OF HINCKLEY	400112002	661515
CITY OF HINCKLEY	400112002	661516
CITY OF HINCKLEY	400112002	661517
CITY OF HINCKLEY	400112002	668850
DNR	400090000	703162
DNR	400090000	733775
DNR	400090000	733776

Table 2. Risk of Impacts to Nearby Wells from Dam Removal

Owner	County PIN	Unique Well Number	Survey Response Received?	In County Well Index?[a]	Is the well sealed?	Distance to the dam (feet)	Completed depth (feet BGS)[b]	Static water level (feet BGS)[b]	Pump depth (feet BGS)	Water column above pump (feet)	Potential for Impact Based on water column above pump	Water column above bottom of well (feet)	Likelihood to mitigate impact by lowering the pump	Recommended Action[c]
HOPKINS, LAWRENCE	150128001	219358	Yes	V	No	1,946	40	16	U[d]	U[d]	U[d]	24	Maybe	N
BERGQUIST FIELD 1	400118000	260934	No	V	U	1,367	U[d]	U[d]	U[d]	U[d]	U[d]	U[d]	U[d]	I
TAGGART,TIMOTHY O & LENIE D	400093000	552648	No	V	No	1,965	55	15	U[d]	U[d]	U[d]	40	Likely	N
SANDEEN, FLOYD	405030000	685625	Yes	V	No	760	50	1.5	U[d]	U[d]	U[d]	48.5	Likely	I
MN DNR	400112003	804703	No	V	No	1,100	15	7	NA[e]	NA[e]	NA[e]	8	Unlikely	N
NELSON, JAN	400119000	177538	Yes	V	No	1,310	40	18	20	2	High	22	Maybe	I
RAMSDELL, MYRLAND	400125000	142909	Yes	V	No	942	61	16	49	33	Low	45	Likely	N
ZEMAN,ANDREA B & DONALD G	400107003	520533	Yes	V	No	1,921	55	20	38	18	Moderate	35	Likely	N
CESSNA,WAYNE D & JANICE D	400107005	582345	Yes	V	No	1,258	66	18	40	22	Moderate	48	Likely	I
GRICE,DONALD A & NANCY L	400107004	598022	Yes	V	No	1,906	58	16	39	23	Moderate	42	Likely	N
AMBROSE,ANTHONY J & CHERIE J	400107006	720817	No	V	No	1,524	47	15	31	16	High	32	Likely	I
HINCKLEY-FINLAYSON SCHOOL DISTRICT 2165	400097000	805861	No	V	U	NA[e]	100	20	60	40	Low	80	Likely	N
GOEBEL, BERNARD	400123000	436770	No	V	No	1,660	50	17	27	10	High	33	Likely	I
CITY OF HINCKLEY	405018000	277375	No	U	No	1,140[f]	45	18	U[d]	U[d]	U[d]	27	Maybe	I
ISD #2165, HINCKLEY-FINLAYSON	400097000	277377	No	U	No	1,682[f]	33	15	U[d]	U[d]	U[d]	18	Unlikely	I
DNR	400110000	277378	No	U	No	1,668[f]	31	16	U[d]	U[d]	U[d]	15	Unlikely	I
ELLSTROM,SHIRLEY P R	400113000	436744	Yes	U	No	1,405[f]	55	16	27	11	High	39	Likely	I
SCHARPNICK,JACE & MICKEL	405005000	444087	Yes	U	No	684[f]	19	14	U[d]	U[d]	U[d]	5	Unlikely	I
SCHARPNICK,JACE & MICKEL	405005000	444088	Yes	U	No	684[f]	14	7	U[d]	U[d]	U[d]	7	Unlikely	I

Owner	County PIN	Unique Well Number	Survey Response Received?	In County Well Index? [a]	Is the well sealed?	Distance to the dam (feet)	Completed depth (feet BGS) [b]	Static water level (feet BGS) [b]	Pump depth (feet BGS)	Water column above pump (feet)	Potential for Impact Based on water column above pump	Water column above bottom of well (feet)	Likelihood to mitigate impact by lowering the pump	Recommended Action [c]
SCHARPNICK,JACE & MICKEL	405005000	444089	Yes	U	No	684 [f]	19	13	U [d]	U [d]	U [d]	6	Unlikely	I
DNR	400087000	758122	No	U	No	1,158 [f]	80	12	30	18	Moderate	68	Likely	I
BARTZ,ALAN	150134000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	N
WARD,JESSE D	400120000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	I
LONG,JOSEPH B & JANETTE A	400123000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	I
MCFERRAN,JOHN W & MARLYS E	405032000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	I
OLSON,DONNA M	405007000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	I
RILEY,PATRICK W & KATHY JO	400107000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	I
BERBERICH,STUART & JANESSA	400101000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	I
NISTLER,RONALD & BETH	400125000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	I
MOFFATT,JEANICE	400124000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	I
HICKLE,RANDALL J & SUSAN J	150130000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	N
EBERHARDT,KENNETH L	150133000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	N
O'DONOVAN,SHELLY & PATRICK	150128001	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	I
HENDRICKSON,DARNELL J	400099000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	N
MOWRY,MICHELLE	405129000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	N
PLANK,JOHN M	405078000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	I
JARVIS,JOSEPH R & TERESA J TEKAVEC	400092000	NA [e]	Yes	No	No	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	U [d]	I

[a] V = verified location, U = unverified location, in County Well Index

[b] Feet BGS = Feet Below Ground Surface

[c] N = No further action, I = Inspection of well by licensed well driller to obtain necessary information, and take mitigative measures if necessary

[d] U = Unknown

[e] NA = Not Applicable
[f] Since the well location is unverified, this distance may be inaccurate

Figures

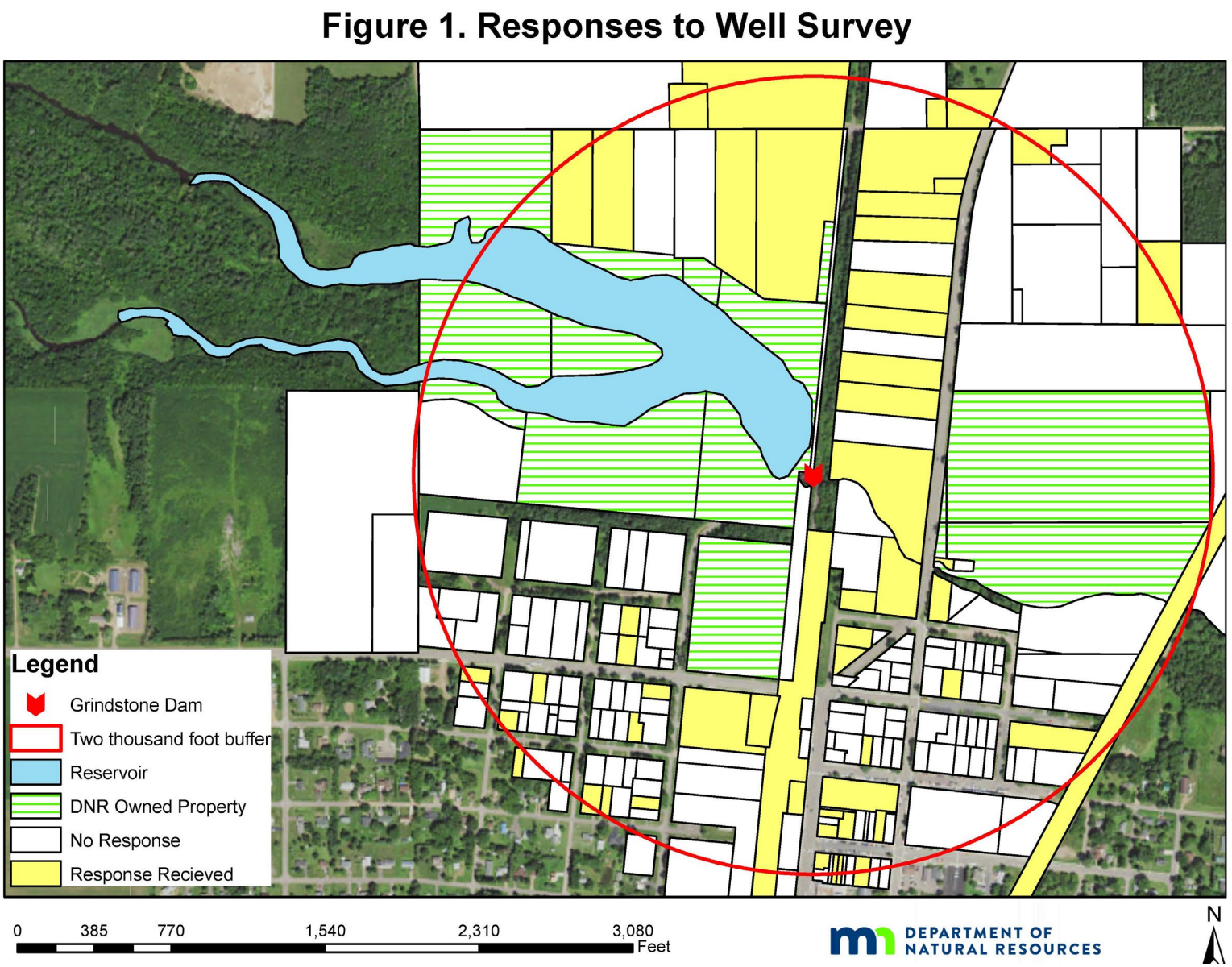


Figure 1. Responses to Well Survey
Legend
Grindstone Dam
Two thousand foot buffer
Reservoir
DNR Owned Property
No Response
Response Recieved
0
385
770
1,540
2,310
3,080
Feet
DEPARTMENT OF NATURAL RESOURCES
N

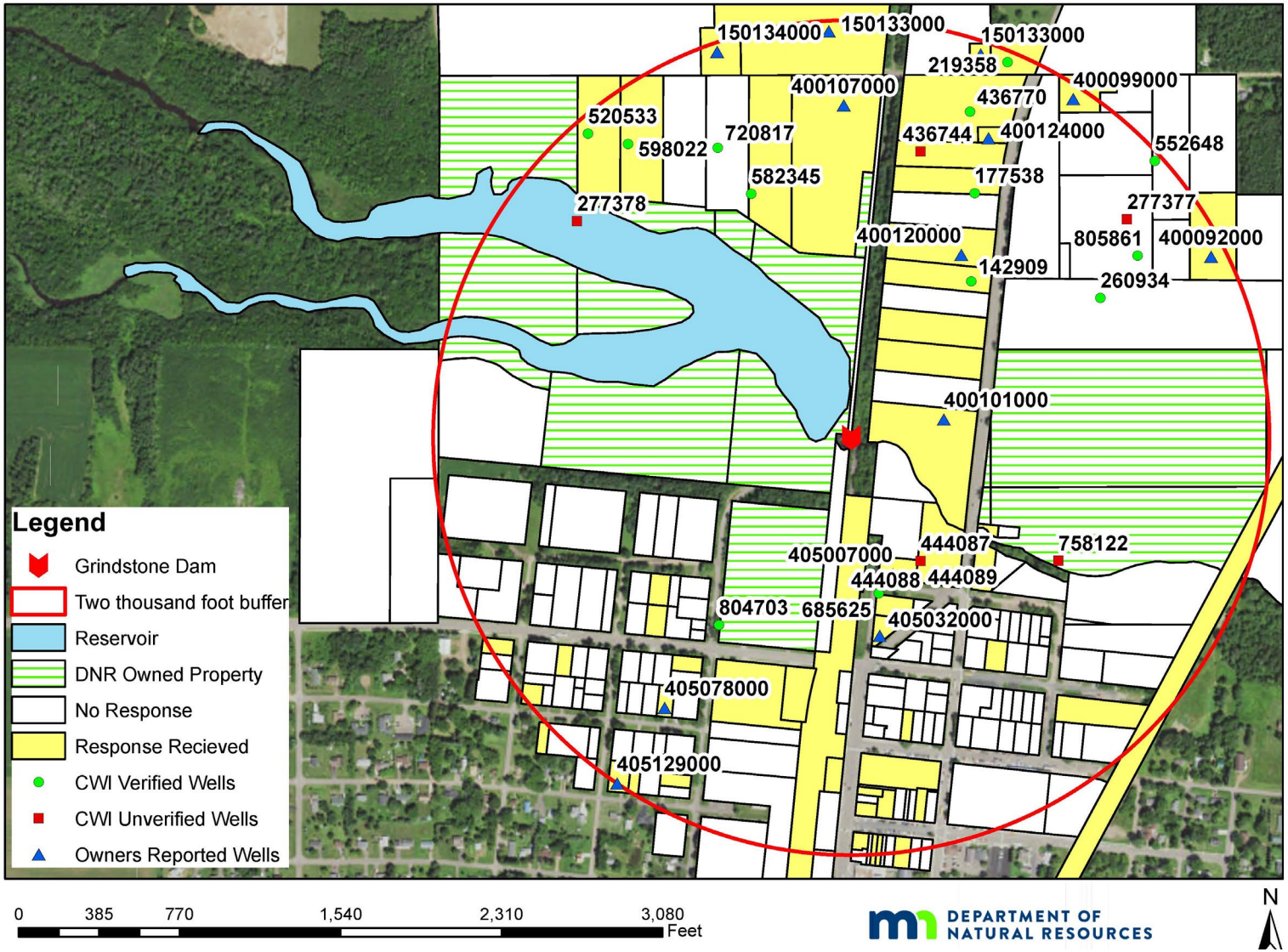


Figure 2. Well Locations
150134000
150133000
150133000
219358
400107000
400099000
436770
520533
720817
598022
436744
400124000
552648
582345
177538
277378
277377
400120000
805861
400092000
142909
260934
400101000
Legend
Grindstone Dam
Two thousand foot buffer
Reservoir
DNR Owned Property
No Response
Response Recieved
CWI Verified Wells
CWI Unverified Wells
Owners Reported Wells
405007000
444087
758122
444088
444089
804703
685625
405032000
405078000
405129000
0
385
770
1,540
2,310
3,080
Feet
DEPARTMENT OF NATURAL RESOURCES
N

Figure 3. Potential Risk for Well Impacts