DEPARTMENT OF NATURAL RESOURCES

Cold Spring Groundwater Study

Annual Report to the Legislature
07/19/2019

This report was prepared in response to Laws of 2016, Chapter 189, Article 3, Section 44, Part b

The commissioner must conduct necessary monitoring of stream flow and water levels and develop a groundwater model to determine the amount of water that can be sustainably pumped in the area of Cold Spring Creek for area businesses, agriculture, and city needs. Beginning July 1, 2017, the commissioner must submit an annual progress report to the chairs and ranking minority members of the House of Representatives and Senate committees and divisions with jurisdiction over environment and natural resources. The commissioner must submit a final report by January 15, 2022.

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Estimated cost of preparing this report (as required by Minn. Stat. § 3.197) was $1,129.

Background and Overview

The 2016 Minnesota Legislature directed the Minnesota Department of Natural Resources (DNR) to "conduct necessary monitoring of stream flow and water levels and develop a groundwater model to determine the amount of water that can be sustainably pumped in the area of Cold Spring Creek for area businesses, agriculture, and city needs."

This represents the third annual report, as required in legislation.

Multiple scientific investigations demonstrate that groundwater pumping in and around the City of Cold Spring (the City) reduces groundwater flow into Cold Spring Creek, a designated trout stream. The glacial aquifer system, which is strongly connected to Cold Spring Creek (Figure 1), supplies groundwater to the City, Cold Spring Brewing Company (CSBC), and numerous private wells and agricultural irrigation wells.

The City and CSBC are actively planning for potential growth and developing strategies to meet their current and anticipated water supply needs. To support these planning efforts the DNR has built a groundwater flow model (the 'interim model') that can be used to determine current and projected effects of groundwater use on streamflow in Cold Spring Creek. The DNR built the interim model using all available data through 2016.

The interim model calculates the average effect of groundwater use on base flow in Cold Spring Creek over a long period of time (years to decades). The model can also predict how changing pumping in the area of interest will affect base flow in the creek. The interim model is sufficient to approximate how much water can be sustainably pumped from the City and CSBC wells in relation to stream flow in Cold Spring Creek.

Tasks completed during fiscal year 2019 include the following:

- Continued monitoring of flow in Cold Spring Creek and water levels in observation wells;
- Met with the Technical Advisory Group (TAG) to discuss the interim model, corresponded with the TAG regarding their comments, and refined the interim model in response to suggestions from the TAG;
- Ran model simulations which explore how pumping affects base flow in Cold Spring Creek;
- Met with representatives of the City and CSBC to discuss the results of the interim model.

In-progress tasks include the following:

- Collecting streamflow and water level data (ongoing until 2020);
- Responding to comments from CSBC's consultant regarding the interim groundwater model;
- Further refining the interim model based on comments;
- Updating groundwater use simulations using the refined model;
- Updating the groundwater model report to reflect TAG comments, model refinements, and updated simulations; and
- Continuing discussions with the City and CSBC, regarding options for meeting sustainable water supply needs.

Data Collection

The DNR continues to operate two continuous stream flow gages and three flow measurement sites along Cold Spring Creek as well as measuring groundwater levels at 12 observation wells in the study area. Monitoring is planned to continue through summer 2020.

Engaging Technical Experts

During August 2018, the DNR held one meeting with the TAG to discuss the groundwater model and report, which was distributed to the TAG in June 2018 for their review. The following individuals are included in the TAG:

- Dr. Bob Tipping, Minnesota Geological Survey - University of Minnesota
- Mr. Jeppe Kjaersgaard - Minnesota Department of Agriculture
- Dr. Jon Walker - United States Geological Survey
- Mr. John Woodside - Minnesota Department of Health
- Mr. Larry Kramka - Foth Engineering (representing CSBC)
- Mr. Mark Brigham - United States Geological Survey
- Mr. Mark Janovec - Stantec (representing the City)
- Mr. Mike MacDonald - Minnesota Department of Agriculture
- Mr. Perry Jones - United States Geological Survey

The DNR modified the interim model during fall 2018 based on initial comments from the TAG. The modified interim model was provided to the TAG in January 2019. The DNR received additional comments from the consultant on behalf of CSBC in April 2019 and is now addressing those comments.

The interim model simulates average conditions over a long period of time (years to decades), as opposed to transient conditions that fluctuate seasonally, over periods of months. The DNR and the TAG discussed the advantages and disadvantages of an 'average condition' model (such as the interim model) versus a transient model in August 2018. Given that the results of the current modeling effort already show significant streamflow depletion, the DNR believes that a model that simulates seasonal fluctuations (i.e., a transient model) may not be necessary. Given the seasonality of water use, which is typically higher during the summer months, the DNR expects that a transient model would show an even greater base flow depletion in summer and fall than the 'average condition' in the interim model. Discussions about the value of a transient model will continue after completing the interim model report.

Engaging Stakeholders

The DNR met with representatives from the City and CSBC on Wednesday, February 6, 2019 to present findings of the interim model, summarized below. The DNR also met with Senator Howe and Representative Demuth on March 27, 2019 to inform them of the progress and to discuss the City's water use needs and the requested permit amendment for Well 7.

Several groundwater use scenarios (described below) were simulated using the interim model and discussed at the meeting. These scenarios were not intended to be prescriptive. Rather, these scenarios were chosen to help understand how the volume of groundwater used (Table 1) and the location of groundwater pumping (Figure 2) affects base flow in the stream. Scenarios 1 to 5 consisted of successively "turning off" wells at increments of distance away from the stream, as follows:

- **Scenario 1**: All permitted wells within the model area were pumped at 2017 reported water use, averaged over the year. This scenario serves as the baseline for comparison.
- **Scenario 2**: All permitted wells within ¼ mile of Cold Spring Creek were turned off, (i.e., no pumping), and the rest of the wells in the model area were pumped at 2017 reported water use, averaged over the year.
- **Scenario 3**: All permitted wells within ½ mile of Cold Spring Creek were turned off, (i.e., no pumping), and the rest of the wells in the model area were pumped at 2017 reported water use, averaged over the year.

- **Scenario 4**: All permitted wells within 1 mile of Cold Spring Creek were turned off (i.e., no pumping) and the rest of the wells in the model area were pumped at 2017 reported water use, averaged over the year.
- **Scenario 5**: All permitted wells within 2 miles of Cold Spring Creek were turned off (i.e., no pumping) and the rest of the wells in the model area were pumped at 2017 reported water use, averaged over the year.

Table 1 Pumping volumes, million gallons per year (mgy) reported for 2017 and used in the model simulations.

Scenario	Pumping (mgy)
1. 2017 Reported pumping within the entire model area	1,286.9
2. Total pumping volume within ¼ mile of Cold Spring Creek	184.0
3. Total pumping volume within ½ mile of Cold Spring Creek	188.8
4. Total pumping volume within 1 mile of Cold Spring Creek	494.1
5. Total pumping volume within 2 miles of Cold Spring Creek	880.0

The model results from scenarios 1 to 5 showed that the location of pumping wells, specifically the distance from the creek strongly affects base flow. To further inform active planning decisions by the City and CSBC, three additional model scenarios were simulated. In these scenarios the volume of water pumped was shifted to wells further away from the creek (i.e., an alternative source) and also increased (scenario 7) to accommodate future growth considerations.

- **Scenario 6**: All permitted wells within ¼ mile of Cold Spring Creek are turned off (i.e., no pumping), and the 184 mgy formerly supplied from wells within ¼ mile of Cold Spring Creek are supplied through city wells 4, 5, and 6, located about 1 mile north of the stream.
- **Scenario 7**: All permitted wells within ¼ mile of Cold Spring Creek are turned off (i.e., no pumping), and city wells 4, 5, and 6 located about 1 mile north of the stream, supply the 184 mgy in scenario 6, plus an additional 200 mgy.

- **Scenario 8**: Permitted wells within ¼ mile of Cold Spring Creek pump a total of 20 mgy and city wells 4, 5, and 6 supply the remaining 164 mgy formerly supplied by wells within ¼ mile of the creek.

These scenarios illustrate potential water supply solutions for the City and the CSBC. The model simulations showed that pumping near Cold Spring Creek diverts much more base flow from the creek than an equal amount of pumping that is farther from the creek. Additionally, the simulations to date show that the current rate and configuration of groundwater use diverts more than 20% of base flow from Cold Spring Creek.

The DNR is now addressing the comments received from the consultant on behalf of CSBC, including some further refinement of the interim model. It is likely that the model results will change slightly as the model is modified. The DNR expects to complete a final report on the interim model during fall 2019. This report will describe construction and calibration of the interim model, including any revisions based on comments from the TAG. The final model report will also describe the results of the predictive simulations.

The DNR will continue to work with the City and CSBC to find sustainable options for water supply needs.

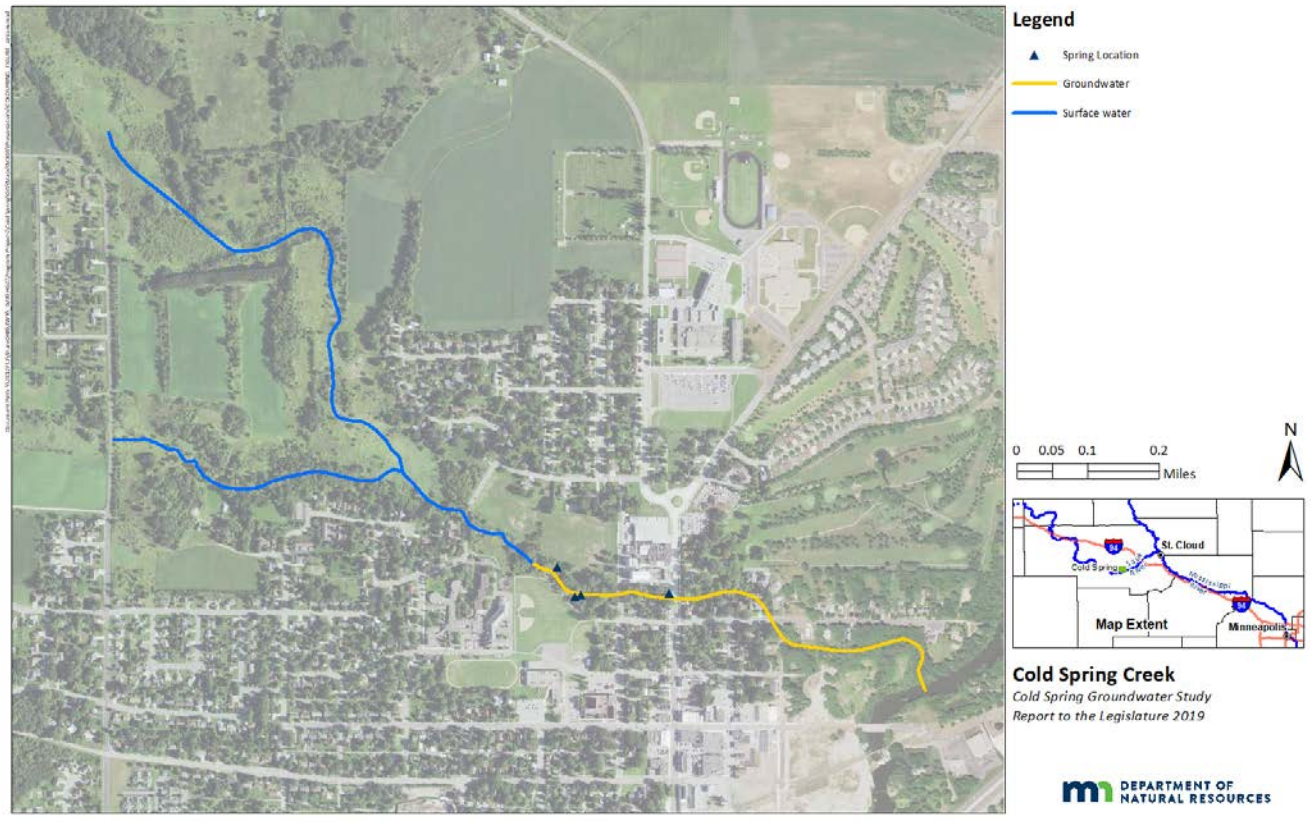

Figure 1. Cold Spring Creek displaying primary water source.

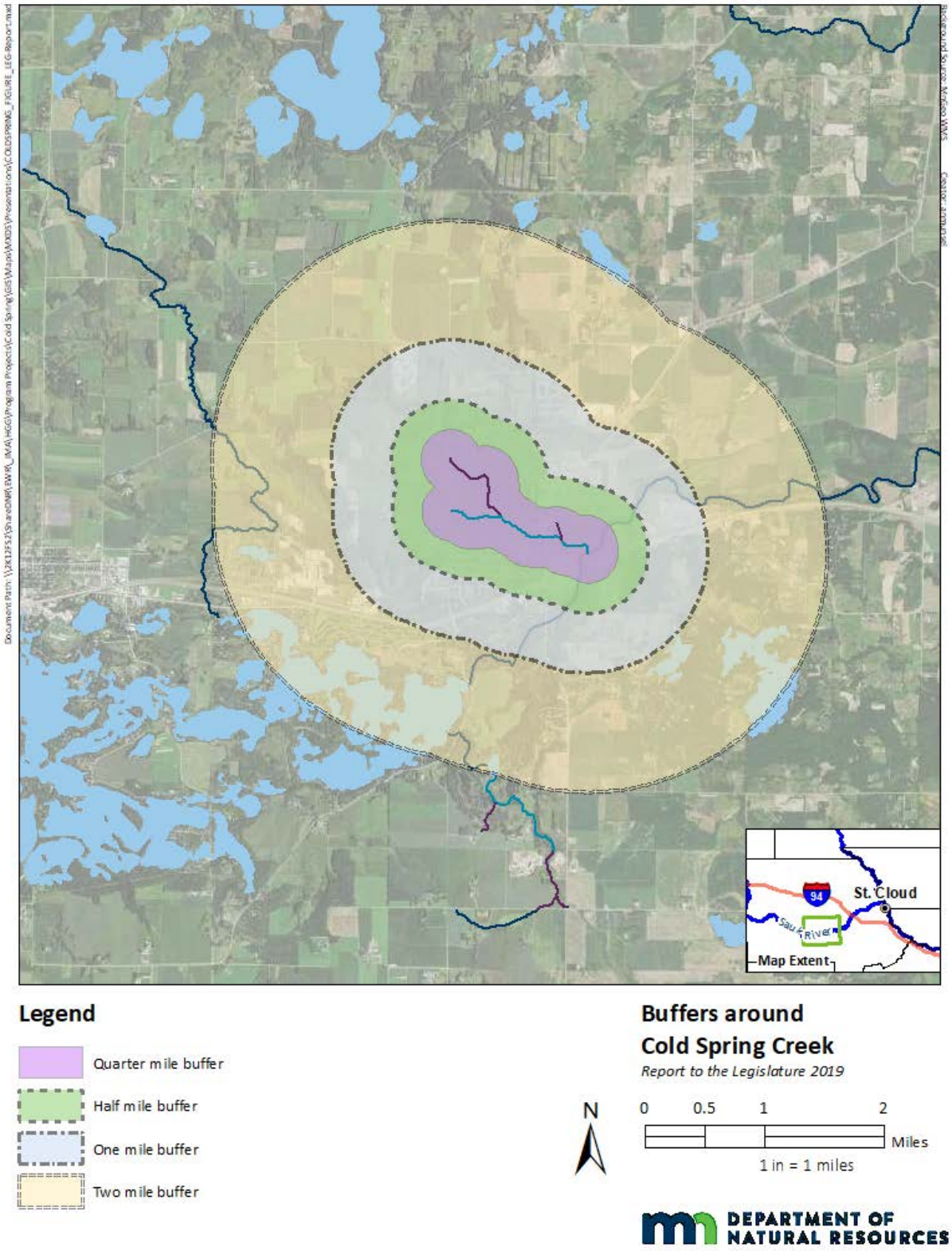

Figure 2. Map of Cold Spring Creek with associated distance buffers that were used in groundwater model analysis.