**PROJECT TITLE: Minnesota Sentinel Springs, Understanding Groundwater Recharge and Chemistry**

**I. PROJECT STATEMENT**

Springs provide us with measurable indicators of what is happening under the land surface and can tell us when aquifers may be in trouble. In southeastern Minnesota, many springs quickly respond to changes in precipitation, land-use activity, and pumping. Springs emerge from the same groundwater that maintains coldwater streams for trout habitat and provides nourishment to homes and businesses. Understanding how spring flow and chemistry respond to agricultural management practices is critical for measurable improvement.

The project proposes expanding data collection from a successful collaborative pilot project begun in Spring 2017 which characterized precipitation responses at eight “Sentinel Springs” in southeastern Minnesota. Initial results illustrated chemical changes in spring water after precipitation emanating from differing geologic layers and land uses. The expansion for this project would add four sites; increase data collection to 15 to 60 minute intervals, which will provide information on how quickly aquifer response and chemistry changes reach aquifers; and add project data to user friendly databases accessible to the public.

These data can help identify the most sensitive aquifers and show how practices on the surface such as the timing of surface applications and the planting of buffers and cover crops impacts groundwater. Intensive land use practices have increased the problems and the need for more information. Outcomes will provide the data necessary for water management issues such as agricultural Best Management Practices evaluation, impaired water identification and remediation, trout stream management, groundwater protection and allocation issues, and local land and water management decisions.

**II. PROJECT ACTIVITIES AND OUTCOMES**

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| **Activity 1: Expansion of spring monitoring network, database development, and report publication.**  **Description:** Work with collaborative partners and identify up to four additional spring sites in different hydrogeologic units (aquifers) to include in the network (currently eight sites). Collect and analyze spring water samples. Collect continuous data at the sites, at 15 to 60 minute intervals. Maintain, download, and manage spring flow, spring temperature, nutrient, and chemistry data from each of the spring sites into a single database. Data will go through quality assurance and quality control steps and then be uploaded into state databases available to the public. Data will be analyzed and summarized in reports, including spring flow, temperature, response to precipitation and snowmelt, chemistry, and relationships to hydrogeology and land use.  Examples of recent reports using data collected in the pilot phase of the project are listed below.   * Report: Bear Spring <https://conservancy.umn.edu/handle/11299/201602> * Report: Crystal Creek <https://conservancy.umn.edu/handle/11299/201569> * Presentation: Nitrate Reduction Strategies <https://conservancy.umn.edu/handle/11299/202271>   **ENRTF BUDGET: $182,267** |  |

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| **Outcome** | **Completion Date** |
| 1. Identify potential springs to add based on hydrogeologic setting and land use. | June 30, 2023 |
| 2. Collect, archive, and develop database from existing springs data. | June 30, 2023 |
| 3. Measured groundwater flow from springs, collected and analyzed groundwater chemistry from springs, developed spring level and flow curves | June 30, 2023 |
| 4. Data quality assurance, quality control, and archiving | June 30, 2023 |
| 5. Peer reviewed report(s) and public presentations of project findings, increased understanding of aquifer recharge and pollution sensitivity, increased understanding of groundwater input to streams and nutrient loading to streams | June 30, 2023 |
| 6. Reviewed data and associated metadata made available to the public through existing databases. Meaningful data shared for use in improving nutrient management strategies, groundwater modeling, surface water modeling, nutrient loading calculations, and fisheries management. | June 30, 2023 |

**III. PROJECT PARTNERS AND COLLABORATORS:**

This project will expand on the existing collaborative efforts between the Minnesota DNR, Minnesota Pollution Control Agency, Minnesota Geological Survey, Olmsted County Environmental Health, and Minnesota Department of Agriculture. Each of the project partners has overlapping interest in spring behavior, aquifer characterization, and determining nutrient levels emanating from these aquifers.

Project Partners Receiving Funds:

* Minnesota Pollution Control Agency – Expertise in continuous nitrate monitoring, field installation, and data acquisition.
* Minnesota Geological Survey – Determine hydrogeologic units from which springs emerge and assist with data analysis and reporting.
* Olmsted County Environmental Health – Analyze water samples and assist with data acquisition, land owner relations, and reporting.

Project Partners Not Receiving Funds:

* Minnesota Department of Agriculture –Providing in-kind assistance with data acquisition, land owner relations, and reporting.

**IV. LONG-TERM IMPLEMENTATION AND FUNDING:**

The MN DNR successfully conducts groundwater and surface water monitoring across large portions of the state. However, outside of the pilot project monitoring of springs, there is no current spring monitoring in place. The successful pilot project has shown that multiple agencies and collaborators are looking for these data to better understand multiple natural resource issues. Funding this proven project will enhance fundamental understanding of groundwater characteristics, such as aquifer recharge and pollution sensitivity. Outcomes of this project will develop the data necessary for impaired water identification and remediation, trout stream management, groundwater protection and allocation issues, and local land and water management decisions.

The DNR will continue to seek external funds to increase capacity for building upon the outcomes of past, present, and future projects.