**PROJECT TITLE: Banking Groundwater**

**I. PROJECT STATEMENT**

An interdisplinary team led by the Water Resources Center (WRC) will evaluate the engineering, hydrogeologic, economic and policy benefits of and barriers to aquifer recharge. The team will produce recommendations for recharge and how the state might proceed if recharge is needed for future water sustainability. Stakeholders will be engaged throughout the study for contributions and recommendations and results will be presented at the conclusion of the project.

For parts of Minnesota, groundwater recharge may be necessary to meet the competing needs of communities and agriculture that are expected to be exacerbated by changes in recharge that result from drainage and climate. This increases the uncertainty for a community. Options to increase water supply include conservation and reuse of water, but also recharging groundwater.

Passive aquifer recharge involves treating and directing surface water to unconfined aquifers. A more active approach is aquifer storage and recovery (ASR) through injection and recovery wells. Both methods are used around the world and have application to Minnesota.

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1: Identify areas where groundwater will be used more quickly than it is replenished based on compilation of DNR permit and water level data, climate projections, demographic data, and recharge data.**

* Assemble background materials to project changes in groundwater dependence and need by assessing: a) how water is currently being used; and b) how this use might change with anticipated demographic shifts.
* Put bounds on the magnitudes of projected groundwater availability from changes to: a) the seasonality and intensity of precipitation; b) evapotranspiration; and c) hydrology.

**ENRTF BUDGET: $25,000**

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| **Outcomes** | **Completion Date** |
| 1. Collect, compile and interpret demographic and water level data; present and report  | *9/30/2021* |
| 2. Narrow uncertainties: water balance , groundwater recharge and climate; report | *12/30/2021* |

**Activity 2: Characterize regionally shared aquifers for recharge and identify additional information needs.**

* Identify at least 4 regionally shared aquifers that are projected to have decreasing water levels for evaluation.
* Compile existing available information including data from the county geologic atlas and develop list of characteristics for those aquifers; develop a process that describes how to obtain and compile existing data.
* Develop a methodology for estimating injection capacity of Aquifer Storage and Recovery (ASR) wells;
* Apply the developed methodology to estimate injection capacity of wells at the selected aquifers.

**ENRTF BUDGET: $125,000**

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| **Outcomes** | **Completion Date** |
| 1. Describe regional aquifers, confined and surficial, extent, trends; present and report | *6/30/2021* |
| 2. Identify hydrogeologic data needs, how to acquire or compile if available; report | *9/30/2021* |
| 3. Develop understanding of recharge potential of aquifers; present and report | *12/30/2021* |

**Activity 3: Evaluate the environmental barriers and engineering requirements to treat water to the standard required to recharge groundwater while avoiding unwanted effects in aquifers.**

Using local and regional examples of successful recharge, identify best practices for ASR required to minimize risk to groundwater quality, human health and ecosystems.

**ENRTF BUDGET: $50,000**

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| **Outcome** | **Completion Date** |
| 1. Compile relevant case studies; present and report | *6/30/2021* |
| 2. In selected aquifers, review geochemistry, water sources  | *9/30/2021* |
| 3. Evaluate engineering and pre-treatment options required to minimize risk; report | *12/30/2021* |

**Activity 4:**  **Evaluate the economic and policy barriers to recharge.**

Assess the economics for aquifer recharge and evaluate the existing policy barriers for aquifer recharge.

**ENRTF BUDGET: $ 75,000**

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| **Outcomes** | **Completion Date** |
| 1. Determine economic conditions where recharge is feasible; present and report | *6/30/2021* |
| 2. Assess existing rule and statute changes to implement recharge; present and report | *9/30/2021* |

**Activity 5: Project management, stakeholder engagement, meeting facilitation, report and dissemination**

**ENRTF BUDGET: $ 75,000**

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| **Outcomes** | **Completion Date** |
| 1. Schedule and prepare for working meetings in which subgroups report out to full group | *9/30/2021* |
| 2. Engage broad stakeholder group with relevant experience and public  | *9/30/2021* |
| 3. Publish and disseminate report to LCCMR and legislative committees, and stakeholders  | *12/30/2021* |

**IIIA. PROJECT PARTNERS RECEIVING ENTRF FUNDING - Name, Title, Affiliation, Role**

* Jeff Peterson, Director, WRC: *Economics analysis*
* John Bilotta, Senior Research and Extension Coordinator, WRC: *Project management, policy analysis*
* Bob Tipping and Tony Runkel , Hydrologist, Minn. Geological Survey: *Aquifer and aquitard characterization*
* Bill Arnold, Faculty , CEGE, U of M: *Engineering analysis*
* Brian Bohman, Research Fellow, Freshwater Society and WRC: *Research*
* Lucia Levers, Research Associate, WRC: *Economic analysis*
* Carrie Jennings, Research and Policy Director, Freshwater Society: *Research, stakeholder engagement, facilitation*
* Peter Kang, Faculty, Earth Sciences: *Aquifer storage and recovery through wells*

**IIIB. COLLABORATORS AND PARTNERS PARTICIPATING BUT NOT RECEIVING FUNDING**

* Peter Boulay or Kenny Blumenfeld, State Climatologist, DNR: *Climate projections*
* Jeff Paddock or employee under Sandeep Burman, Hydrologist, MDH: *Health oversight*
* Greg Kruse or Joy Loughry, Groundwater Monitoring, DNR: *Groundwater monitoring and projections*
* Jared Troost, or Stephen M. Westenbroek, Hydrogeologists, USGS: *Water Balance projections*
* Tracy Twine, Faculty, Soil Water and Climate: *Climate projections*
* Ali El Hassan, Water Supply Planning, Metropolitan Council and Environmental Services: *Water supply projections*
* Chuck Regan, Modeler, MPCA: *Recharge partitioning (HSPF) models*