

Vermillion River Headwaters Groundwater Recharge Area Inventory and Protection Plan



A project funded through a Metro Environmental Partnership grant from the Metropolitan Council with technical analysis by Emmons & Olivier Resources.



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Project Goals and Purpose

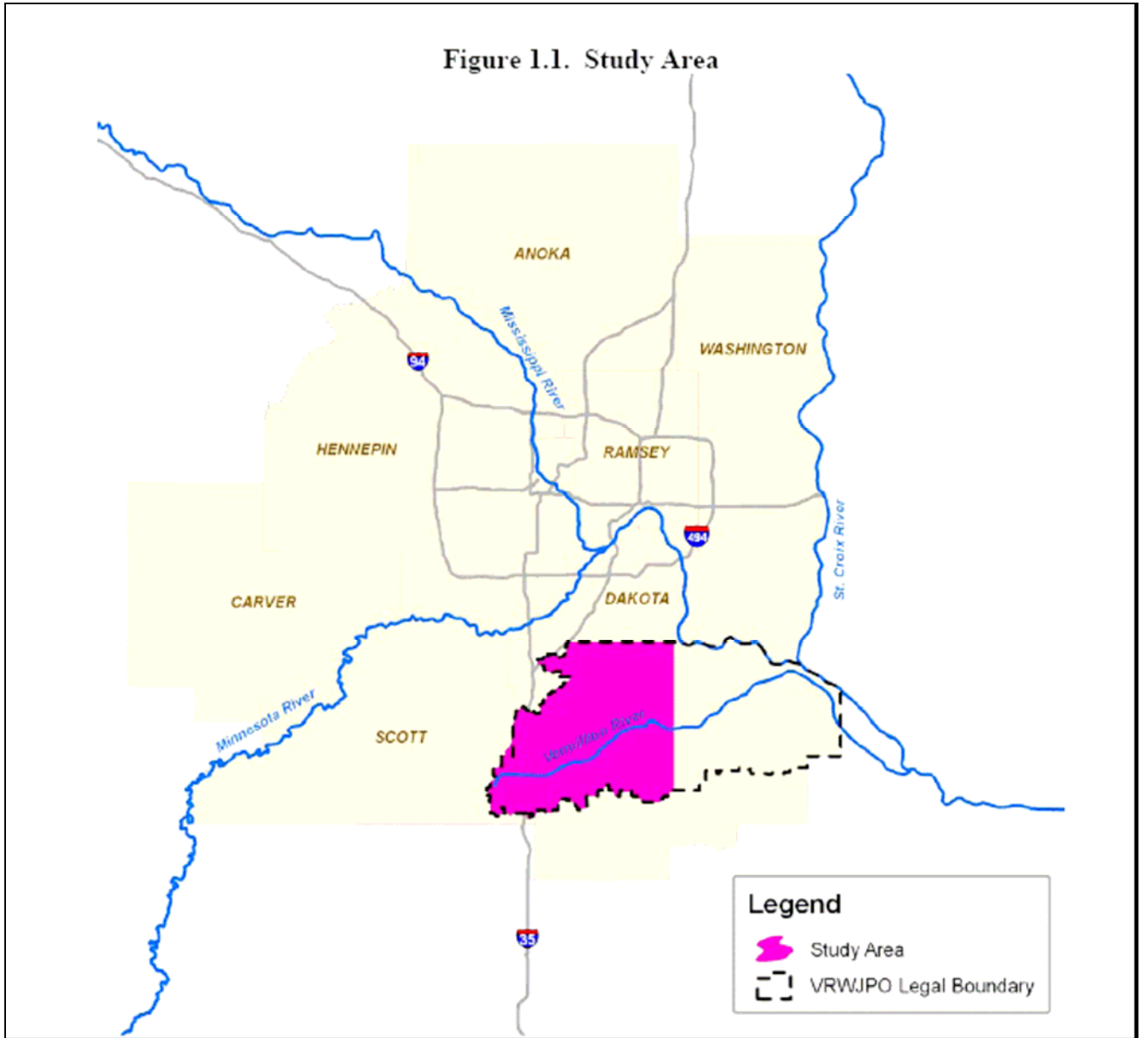
The Vermillion River Watershed includes 388 square miles of drainage area within Dakota and Scott Counties. The upper third of the watershed includes several cold-water tributaries and is expected to see more urban development than any other land area within the watershed. The Vermillion River contains 49 miles designated as trout waters. The River supports a naturally reproducing brown trout population which is dependent on the groundwater and sustained cold water temperatures for survival. This project is focused on the headwaters area of the Vermillion River, defined as upstream of Blaine Ave. ([Figure 1.1](#)).

Stormwater runoff volume control is critical to protect our water resources. Rate control is important but cannot adequately mitigate stormwater impacts in most situations. Infiltration is one of many important tools to mimic pre-development hydrology in a post-development scenario and will be promoted even more as Phase II of the National Pollutant Discharge Elimination System is implemented. Unfortunately, there is little information about where natural infiltration and groundwater recharge areas are located and how development within these areas will effect natural groundwater/surface water interactions.

Determining the location of groundwater recharge areas and their interrelationship with surface water is necessary to protect the cold water fishery, maintain stream base-flows, improve water quality, and protect the ecological integrity of the Vermillion River. Goals and objectives of the Vermillion River Headwaters Groundwater Recharge Area Inventory and Protection Plan include:

- Determine groundwater recharge areas in the upper reaches of the Vermillion River Watershed
- Identify the interrelationship between the recharge areas, Vermillion River flows, and potential development impacts
- Prioritize stormwater infiltration opportunity areas
- Obtain a consensus among watershed stakeholders to facilitate new initiatives
- Obtain knowledge about the feasibility of infiltration as a stormwater management technique to protect a cold-water resource
- Integrate stormwater management, groundwater protection, greenway planning, and smart growth
- Continue long-term economic growth of the region
- Incorporate the protection of critical groundwater recharge areas into community plans
- Educate others on findings and provide a long-term monitoring program

Figure 1.1. Study Area



Results

Groundwater Interaction

The interaction of groundwater in the Vermillion River was determined using data collected in the field including base flow measurements, in-river piezometer measurements, and stream and streambed temperatures.

Figure 4.1 summarizes the data by reach. Groundwater inflows were averaged and classified based on the following functions:

- Losing – the river reach is losing water to the soils and water table
- Gaining – the river reach is on average gaining between 0.001 – 0.1 cubic feet per second (cfs) per 500 feet
- Significant Gaining – the river reach is on average gaining greater than 0.1 cfs per 500 feet

Groundwater Dependent Resources

Groundwater dependent resources are defined by those natural resources that are dependent on sources of groundwater to maintain their structure, function, and diversity. The presence of these resources in the headwaters area of the Vermillion River watershed is a result of limited imperviousness and development, intact natural areas, minimal groundwater consumption for water supply, and the Vermillion River itself. The quality of these resources is an indication of the impact that human activities are having on the environment. These resources serve as a barometer for the health of the environment and ecosystems.

Groundwater dependent resources in the Vermillion River Headwaters include groundwater dependent lakes, cold-water streams, and groundwater dependent plant communities and wetlands (Figure 4.2).

Infiltration Potential

The infiltration potential, or runoff characteristic, of the study area was mapped by intersecting soils data with surficial geology data in a Geographic Information System (GIS). Figure 4.5 summarizes the infiltration potential for the western portion of the Vermillion River watershed. Figure 4.5 indicates the areas where stormwater infiltration will be feasible, not the location of current groundwater recharge areas.

Recharge and Discharge Areas

Groundwater recharge and discharge patterns in the Vermilion River Headwaters Area are complex. On a regional scale, recharge is prevalent along the relatively high areas of the water divide to the west of the River and within areas that have a flat water table north and east of North Creek. Groundwater then flows downward to deeper aquifers and flows east and west toward discharge points along the Vermilion, Credit, Mississippi and Minnesota Rivers. However, local geologic and hydrologic conditions can significantly alter these general recharge and discharge patterns.

It is not possible to display recharge areas and corresponding discharge areas on a single map or set of maps for the entire study area. To be accurate, the map would need to illustrate the following information about the groundwater flow:

- Three-dimensional movement – both horizontal and vertical through different aquifers
- Time-dependent variability, especially seasonal variations
- Probability of groundwater encountering geologic variability, dividing, and moving in different directions (i.e. dispersion)

The concept of recharge and discharge areas is useful for designating future management areas. The recharge and discharge areas only identify areas where recharge or discharge is prevalent or probable. [Figure 4.13](#) shows the recharge and discharge areas in the study area.

Figure 4.1. Stream and Groundwater Interactions

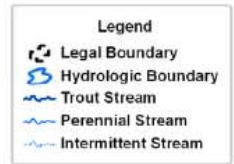
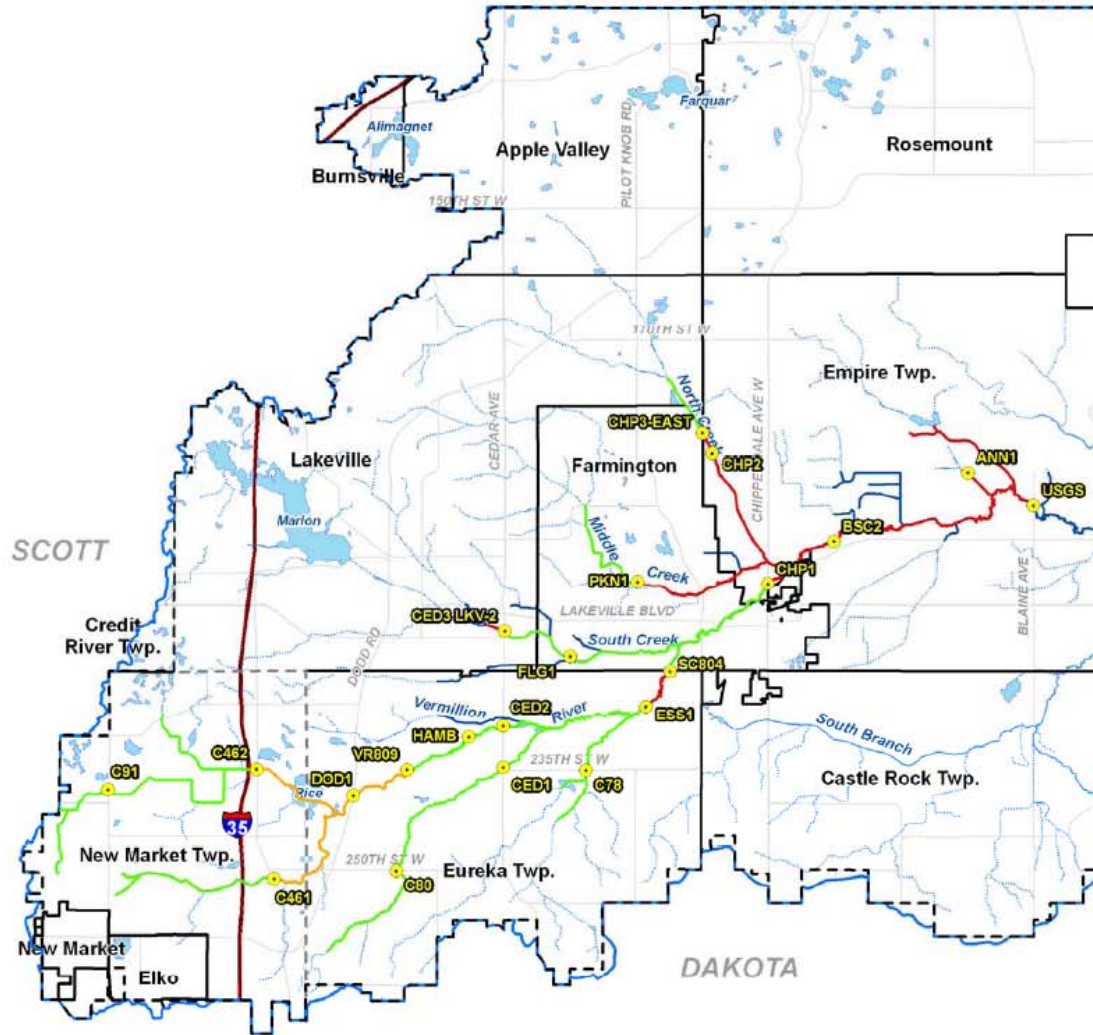
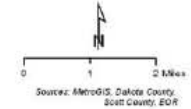
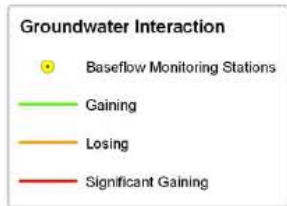
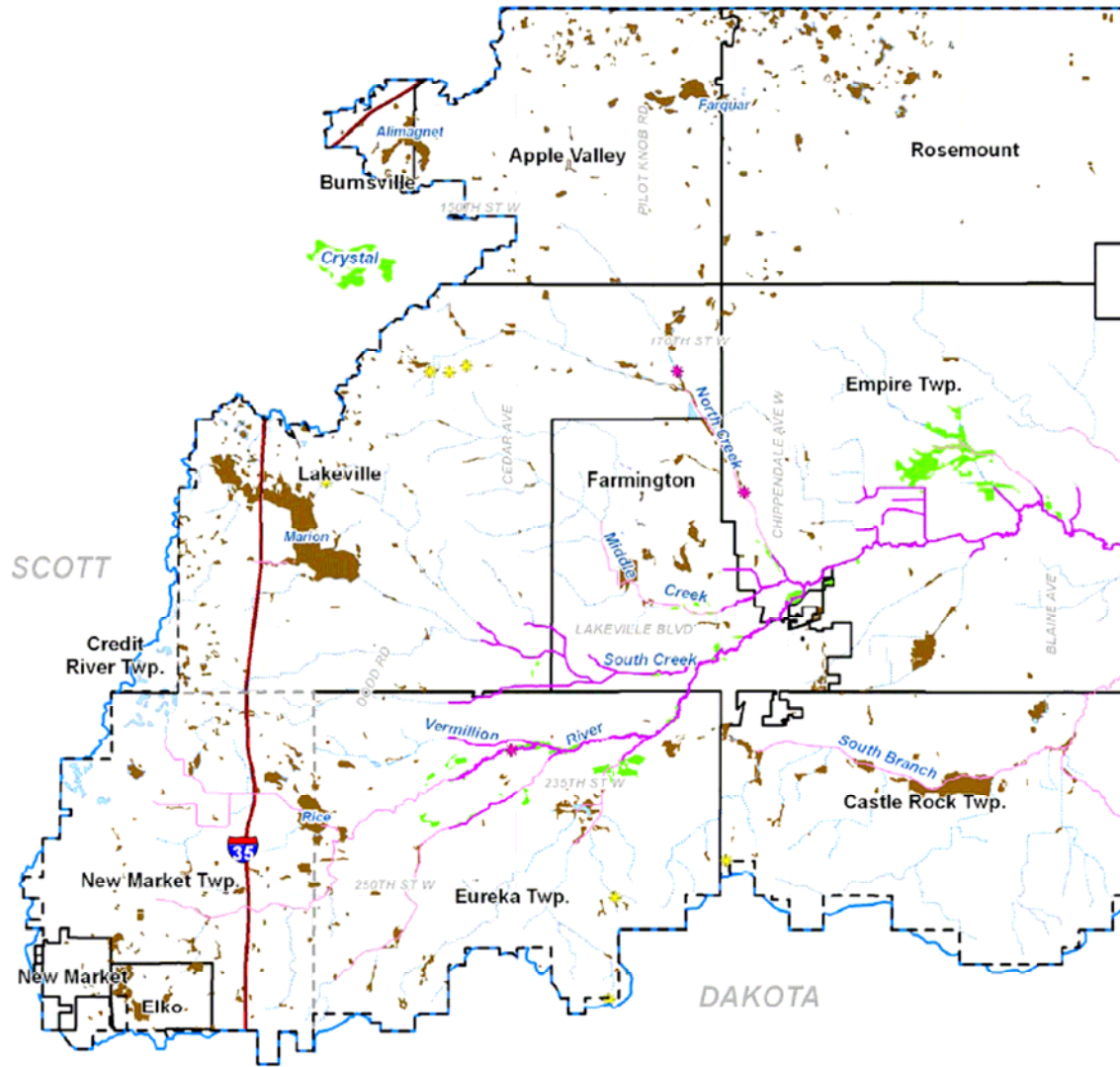
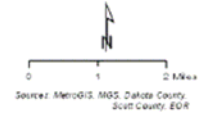


Figure 4.2. Groundwater Dependent Resources




- Groundwater Discharge Locations**
- ✳ 2004 Field Identification
 - ✳ MN Karst Database
- Dependent Resources**
- Identified Dependent Resource
 - Potential Dependent Resource
 - Identified Dependent Stream
 - Potential Dependent Stream

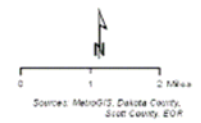


- Legend**
- Legal Boundary
 - Hydrologic Boundary
 - Trout Stream
 - Perennial Stream
 - Intermittent Stream

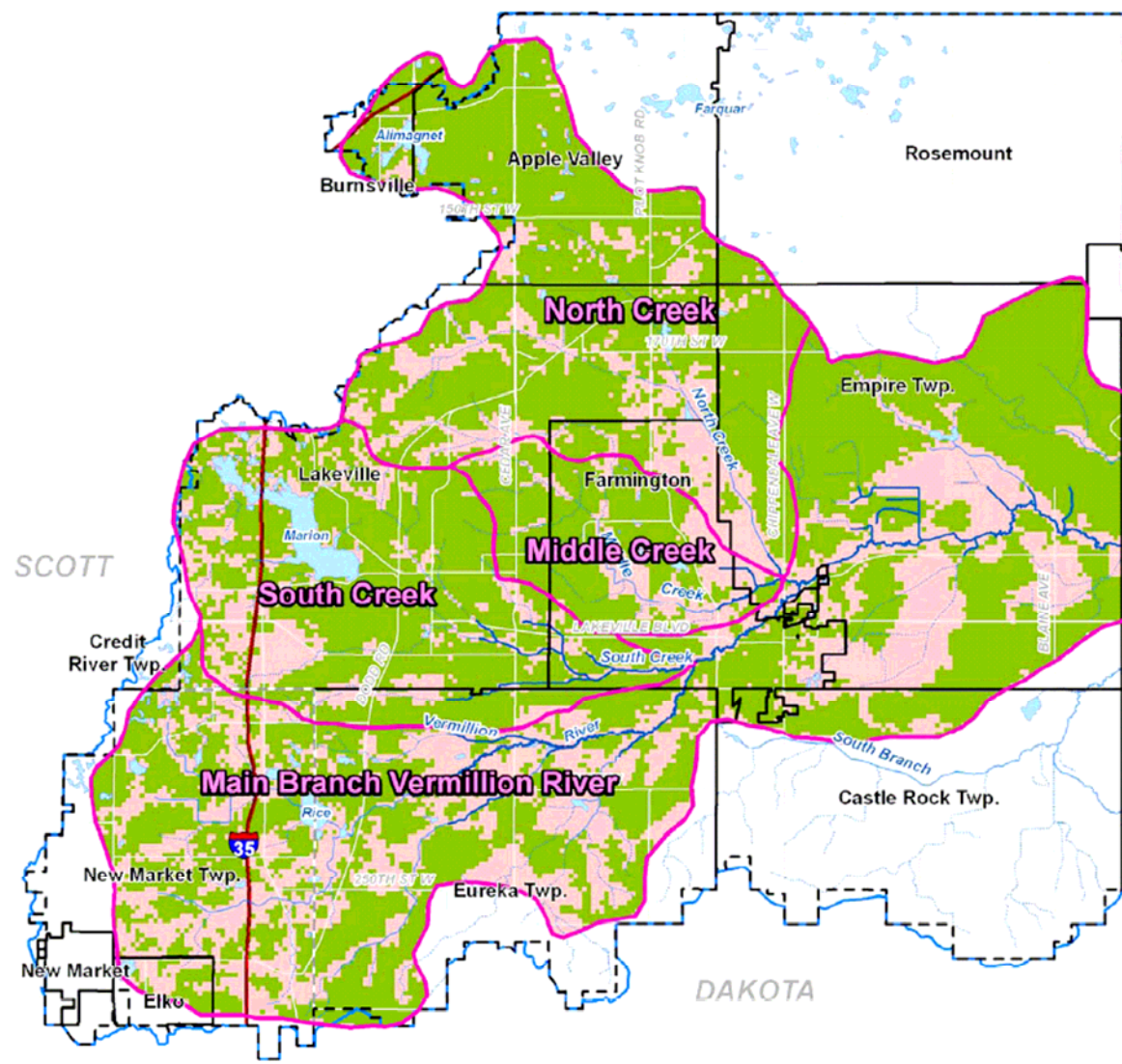
Figure 4.13. Recharge and Discharge Areas

Discharge/Recharge Areas






-  Minor Groundwatersheds
-  Discharge Areas
-  Recharge Areas



0 1 2 Miles
Source: MetroGIS, Dakota County, Scott County, EOR



Legend

-  Legal Boundary
-  Hydrologic Boundary
-  Trout Stream
-  Perennial Stream
-  Intermittent Stream