

GALLATIN VALLEY WATER EXCHANGE

A market-based approach to sustainable water management in Western Montana

PROJECT BRIEF

SPRING 2016

Gallatin Valley, Montana is experiencing rapid population growth. This new development depends on groundwater withdrawals and has placed increasing pressure on local water resources. From 2007 to 2016, over 118,000 groundwater wells were drilled in the state. In the Gallatin Valley, surface and groundwater are closely connected, and this significant groundwater pumping reduces streamflow in nearby rivers.

Streamflow is important not only for freshwater ecosystems, but also for agricultural and water-based recreational industries. Recognizing this, the State of Montana developed regulations that new water users must follow in order to minimize harm to streams and existing water users. Under these rules, new water users must offset – or mitigate – their impact to surface streams by purchasing and repurposing existing water rights. This process is complex, time-consuming and costly. The difficulty of meeting mitigation requirements threatens the future of sustainable water management in Montana.

THE GALLATIN VALLEY WATER EXCHANGE

In response to these challenges, there is a pressing need for a new institution, the Gallatin Valley Water Exchange (GVWE), to facilitate water transactions for mitigating new groundwater use. GVWE will acquire or contract for senior surface water rights, move the water rights through the change-of-use regulatory process to a mitigation or aquifer recharge purpose, recharge this water into the underlying aquifer or leave it instream, and then sell mitigation credits to new water users to offset the adverse effect of their groundwater use. By streamlining the mitigation process, GVWE will allow new development while maintaining surface streams that support the environment and the region's agriculture and recreational fishing industries.

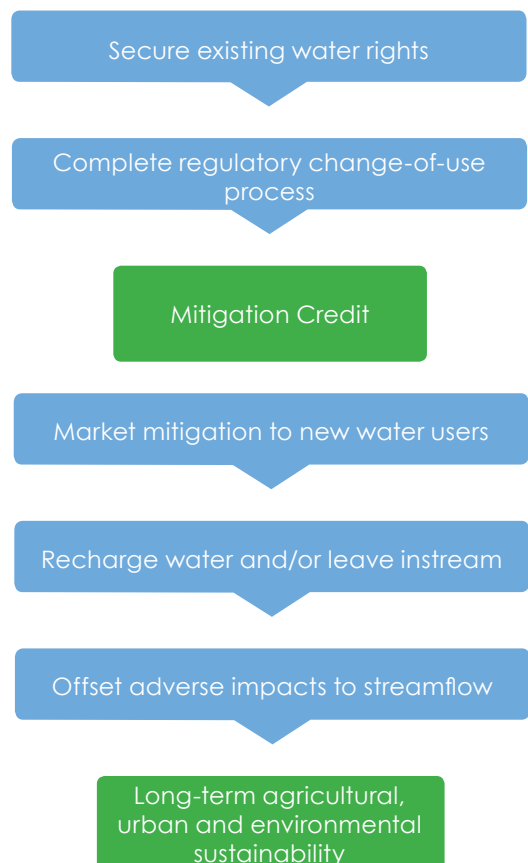


Figure 1: A view of the Gallatin Valley. Photo via <https://reganlangel.com/2014/06/20/gorgeous-gallatin-valley/>

Figure 2: A schematic of the Gallatin Valley Water Exchange's operations.

RECHARGE SUITABILITY ANALYSIS

In order to offset stream depletion throughout the year, water must be diverted during the summer irrigation season and infiltrated into the groundwater aquifer, delaying its flow back to rivers and streams. GVWE will need to construct managed aquifer recharge sites to conduct this infiltration, but only certain locations are suitable for recharge. Suitable parcels are relatively flat, undeveloped and overlie permeable soils and coarse geology. In addition, there must be enough space between the land surface and the water table to hold the recharged water.

Table 1: Groundwater recharge site selection suitability criteria.

Criterion	Threshold Value
Surficial Geology	Quaternary Alluvium or Tertiary Sediments
Slope	<3%
Soil Type	Hydrologic Groups A & B
Land Use	Undeveloped, Agriculture
Land Ownership	Private or City of Bozeman Property
Depth to Groundwater	>6 meters

A valley-wide site suitability analysis was conducted to inform GVWE's selection of recharge locations (see Table 1 for criteria). The final selected parcels are suitable under all six criteria. The results of the analysis show **three general suitable areas**: the southern portion of the valley, the raised bench west of the West Gallatin River, and areas north of Bozeman bordering the East Gallatin River.

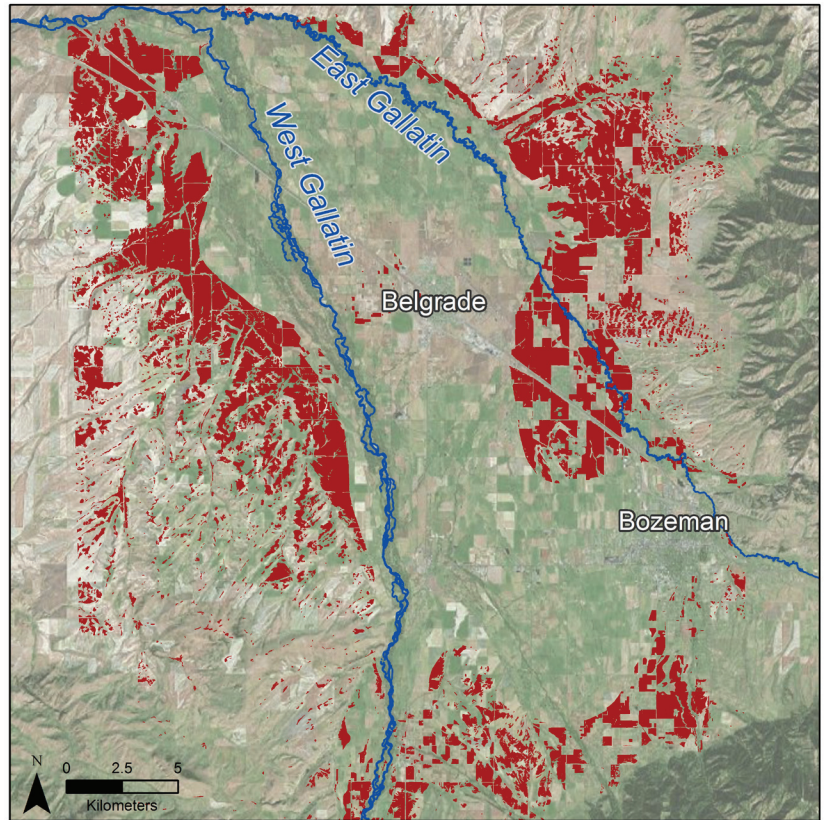


Figure 3: Recommended areas for recharge suitability investigations. Red indicates the areas that satisfy the recharge criterion outlined in Table 1. Sources: Baselayer - Esri Basemaps; Hydrologic Features: Gallatin County

DEMAND FOR MITIGATION

Water demand projections based on United States census population data and per-capita water use rates indicated in planning documents suggest that future water demand in Bozeman and unincorporated areas of the county cannot be met by current supply. A portion of this demand will require mitigation; this fraction will depend on 1) how much of this future demand is met by new wells that are large enough to require permits, and 2) how much of the pumping from those wells results in net depletion to surface waters. Varying these two factors results in several scenarios of potential demand for mitigation from GVWE.

A moderate demand scenario would see GVWE supplying nearly **6,000 acre feet per year (AFY) of mitigation by 2050. Most of this demand will come from the City of Bozeman**, which has expressed interest in finding mitigation options for future high-capacity wells to serve its growing population.

AVAILABLE WATER SUPPLY

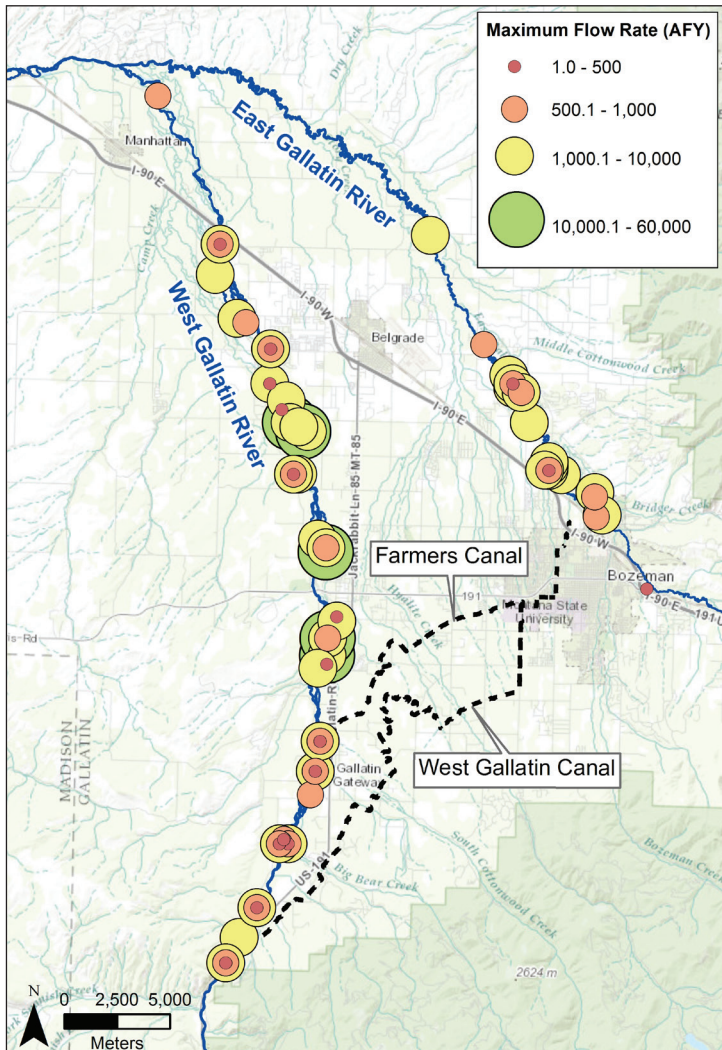


Figure 4: Maximum flow rate (AFY) of irrigation water rights with a priority date of 1882 and earlier along the East and West Gallatin Rivers. Colored circles indicate the maximum flow rate for each water right and are placed at the point of diversion associated with that water right. Sources: Water Rights Data - Montana DNRC, Waterways and Cities - Gallatin County

GVWE will need to repurpose existing water rights to use for mitigation, most likely water formerly used for irrigation. Only the historically consumed portion of a water right may be used for mitigation. Agricultural surveys suggest that a maximum of 89,243 to 122,538 AFY of water in the Valley have historically been used consumptively, indicating that the Exchange might need 7-10% of the total available surface water.

However, in determining which existing water rights could be used to mitigate new groundwater use, GVWE must also consider:

- The priority date of the water right. Water rights with an earlier priority date are more secure in dry years.
- The location of the water right. Upstream water rights have a larger potential mitigation service area and better access to conveyance infrastructure (Figure 4).
- Finding willing sellers.

When these additional constraints are considered, **the availability of suitable water rights is limited**, and may be a constraint to GVWE development. GVWE may need to use water rights with a later priority date as part of a mitigation portfolio.

FINANCIAL FEASIBILITY

The costs and revenue of operating GVWE were modeled to determine potential mitigation credit prices and options to reduce costs. The largest anticipated expenses for operating GVWE are water rights acquisition and managed aquifer recharge. As a result, under the most cost-effective model, GVWE could use a **portfolio of managed aquifer recharge and instream transfers** to meet mitigation needs. In addition, rather than purchasing existing water rights outright, it would **act as an intermediary** between existing rights holders and new water users.

Under this scenario, the cost of administering transactions and providing mitigation would range from \$2,500 to \$3,500 per acre foot (AF). The price paid by a new water user for a complete mitigation credit, including the cost of obtaining a water right, would range from \$5,000 to 7,500 per AF. The need to operate a mitigation program into perpetuity will raise these costs. In addition, the various funding sources available to GVWE - including grants, program related investments, and standard loans - and varying levels of risk throughout the project will affect the discount rate and can dramatically impact financial feasibility.

KEY RECOMMENDATIONS

- A basin-wide hydrologic model must be completed to find suitable recharge sites and understand the stream depletion resulting from new groundwater pumping.
- The City of Bozeman accounts for the vast majority of projected demand and is a critical component to the success of GVWE. GVWE is unlikely to be profitable without the City of Bozeman as a customer.
- As the exchange continues to grow, the opportunity to access sufficient senior, ideally located surface water rights will be limited. GVWE may need to use junior water rights as part of a mitigation portfolio.
- GVWE should explore opportunities to reduce costs by creating mitigation portfolios that de-emphasize aquifer recharge. Additionally, GVWE could act as an intermediary between buyers and sellers to avoid the upfront costs of purchasing water outright.
- Mitigation credit prices must be sufficiently high to account for the costs of mitigation into perpetuity.
- Currently, only new users pumping more than 10 AFY are required to mitigate. Lowering this exemption would create a much larger customer base for GVWE and help protect water resources.

STAKEHOLDER BENEFITS

If these conditions can be met and the Gallatin Valley Water Exchange can be successfully implemented, it will benefit numerous stakeholder groups:

Senior water users are protected from harm caused by new, unmitigated groundwater pumping.

New water users have a simplified way to offset their impact on rivers and streams.

Gallatin Valley's economy is supported by sustainable water use for agriculture, recreational fisheries, and residential development.

The environment is protected through mitigation requirements that maintain streamflow.

Water resources practitioners have an example of successful, sustainable management of surface water and groundwater.



Figure 5: A view of the Gallatin River. Photo via stpaulgirl on Flickr

Acknowledgments

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