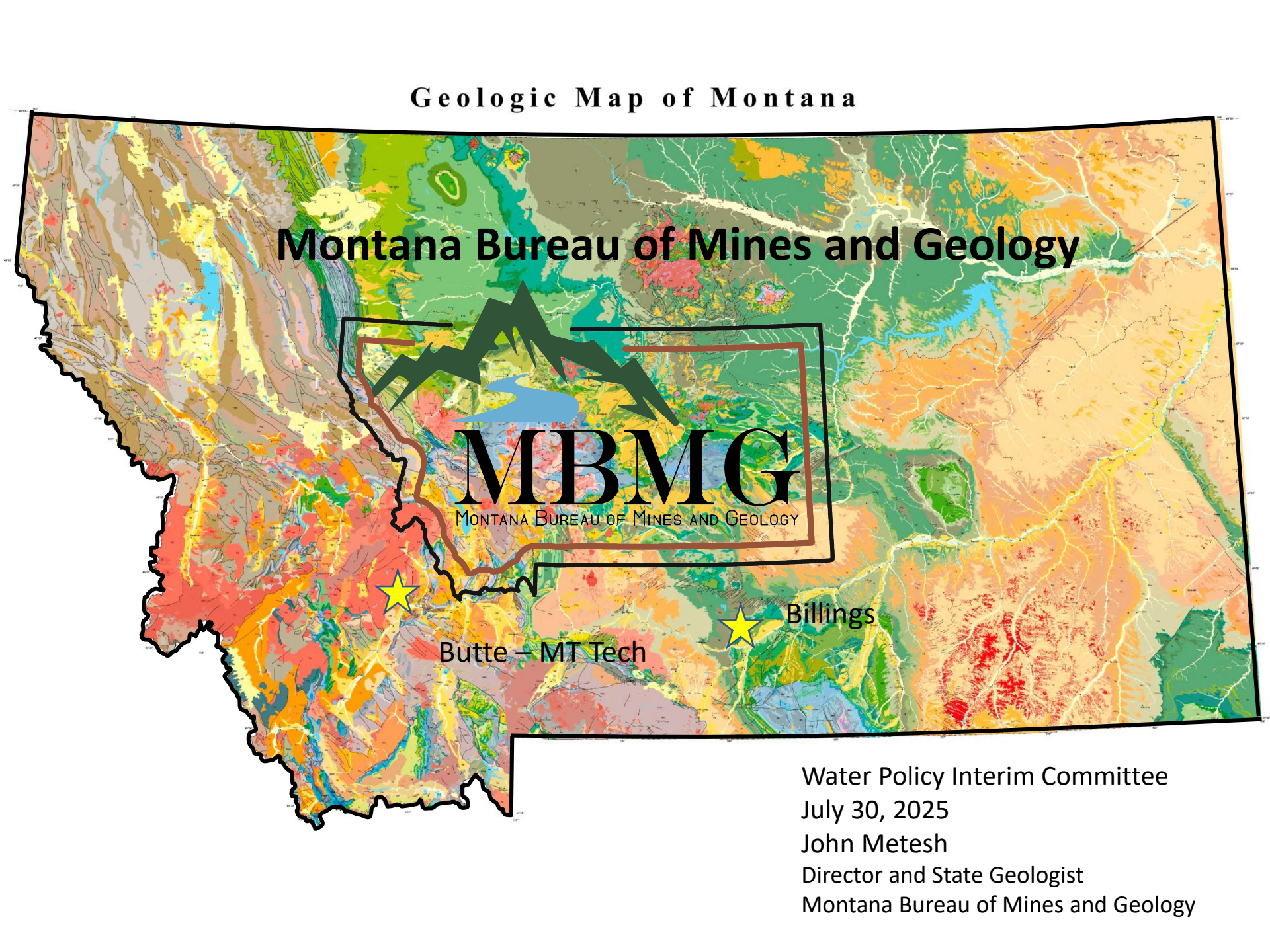



Water Policy Interim Committee
July 30, 2025

John Metesh
Director and State Geologist
Montana Bureau of Mines and Geology

# Ground Water Assessment Program

*Established by the State legislature in 1991*

*Statewide Aquifer Monitoring and Characterization*

## 1. Tracking Montana's Groundwater

- Long-Term groundwater monitoring across Montana. Over 800 wells across the State
- Tracking aquifer response to climate, development, and other land use
- Over 3,500 water quality samples
- Cooperators: Tribes, local water quality districts, and conservation districts

## 2. Characterizing Aquifers

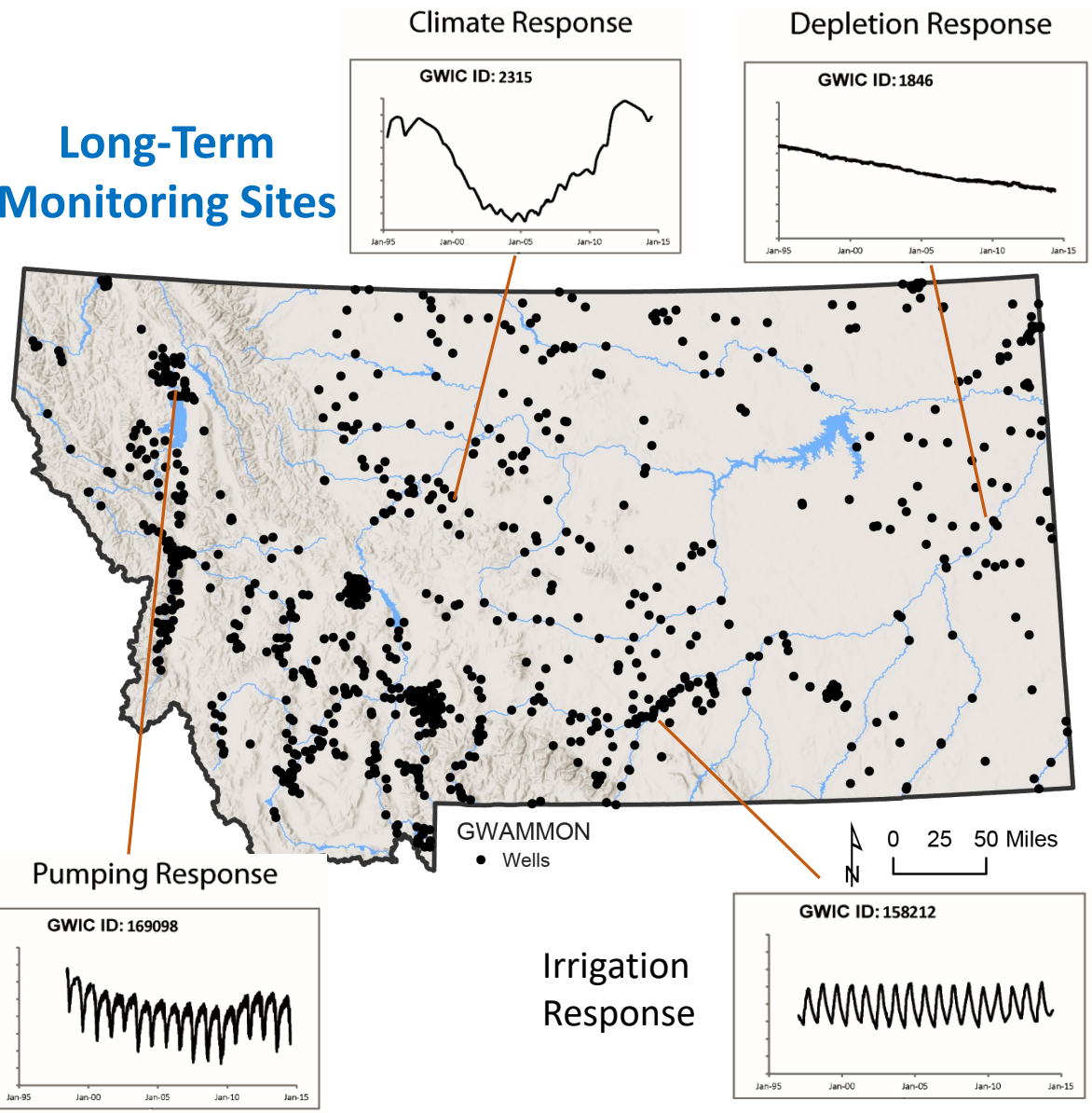
- Mapping and describing aquifers at a regional scale
- Assessing groundwater flow patterns, aquifer properties, water quality, and water uses

## 3. Publicly Available Data

- Ground Water Information Center Database
- **GWIC (https://mbmggwic.mtech.edu/)**

- All the water resource data collected by the GWAP, GWIP, and other MBMG programs is available from the **GWIC website.**

## Long-Term Monitoring Sites

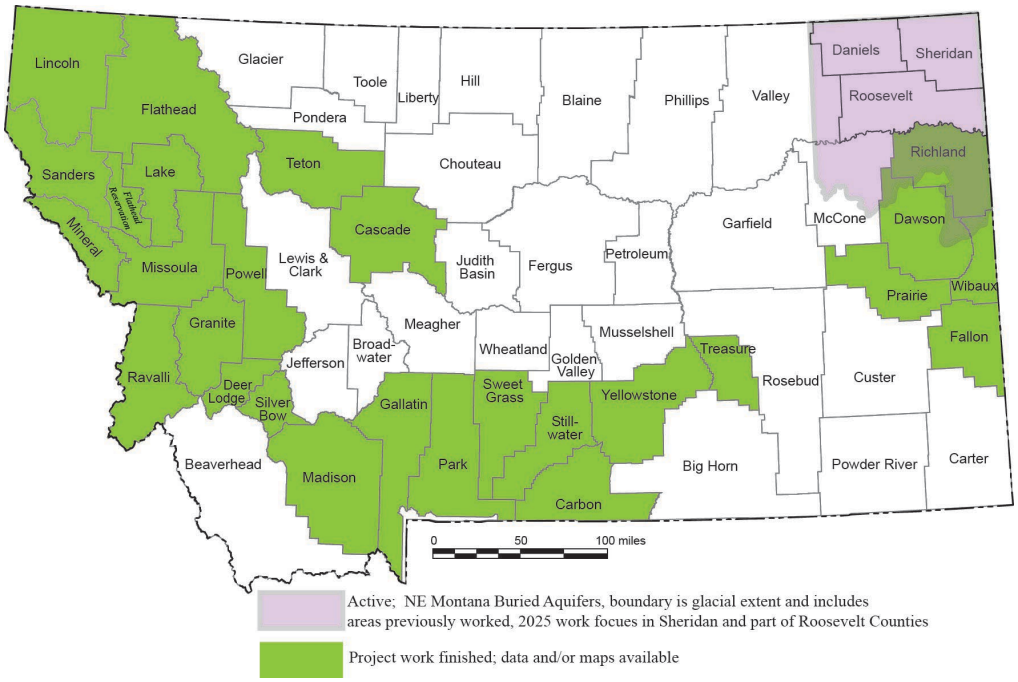


# Ground Water Assessment Program

*Statewide Aquifer Characterization*

## Characterizing Aquifers across Montana

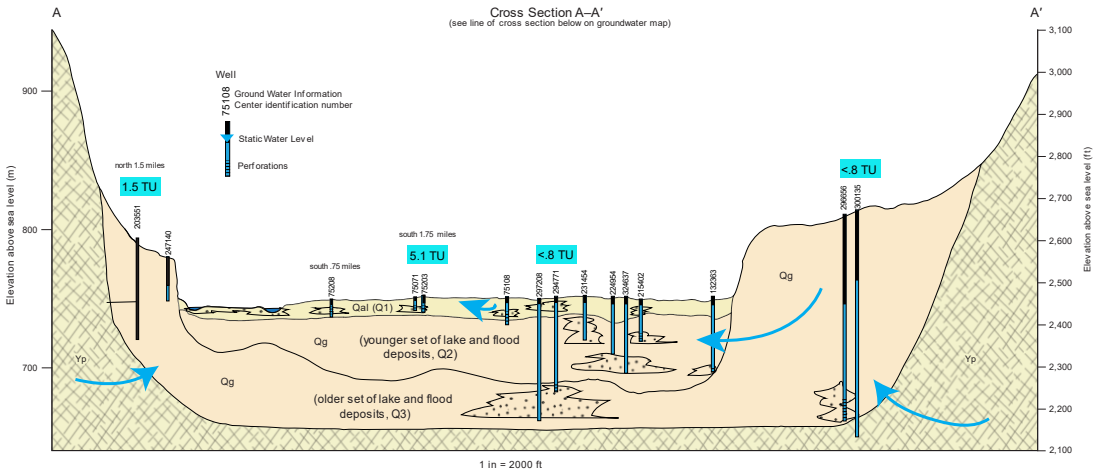
- Map and describe available aquifers at a regional scale
- Evaluate groundwater flow patterns in the aquifers
- Evaluate water quality in the different aquifers
- Establish long-term monitoring sites




## Providing Information

- Publishing reports, maps, and data
- Presentations to interested groups, organizations, and agencies
- Data available in GWIC

**GWIC (https://mbmggwic.mtech.edu/)**



# Ground Water Assessment Program

*Evaluating Buried Channel Aquifers in Northeastern Montana*

## What are these aquifers?

- Sands and gravels deposited by rivers and streams before the last glacial period
- Glacial ice sheets expanded into Montana from Canada, displacing the rivers and streams and covered the channel deposits with glacial till
- There is usually no visible indication of the aquifer locations
- Exploratory drilling and geophysical surveys are commonly used to locate these aquifers
- MBMG is currently assessing the use of geophysical methods to locate

*Field trip for landowners and agencies, Buried aquifer river valleys, Sidney*

*Drilling at a buried channel site*

*Electrical Resistivity Equipment*

# Ground Water Investigation Program

*Established by the 2009 Montana Legislature*

- Designed to support science based water management
- Answer locally identified questions

- ✓ Land use change to residential development
- ✓ Effects on stream flow due to increased groundwater withdrawals
- ✓ Changes in water quantity and quality due to increased subdivisions
- ✓ Impacts to groundwater and surface water from changing irrigation methods
- ✓ Effects of drought on water resources

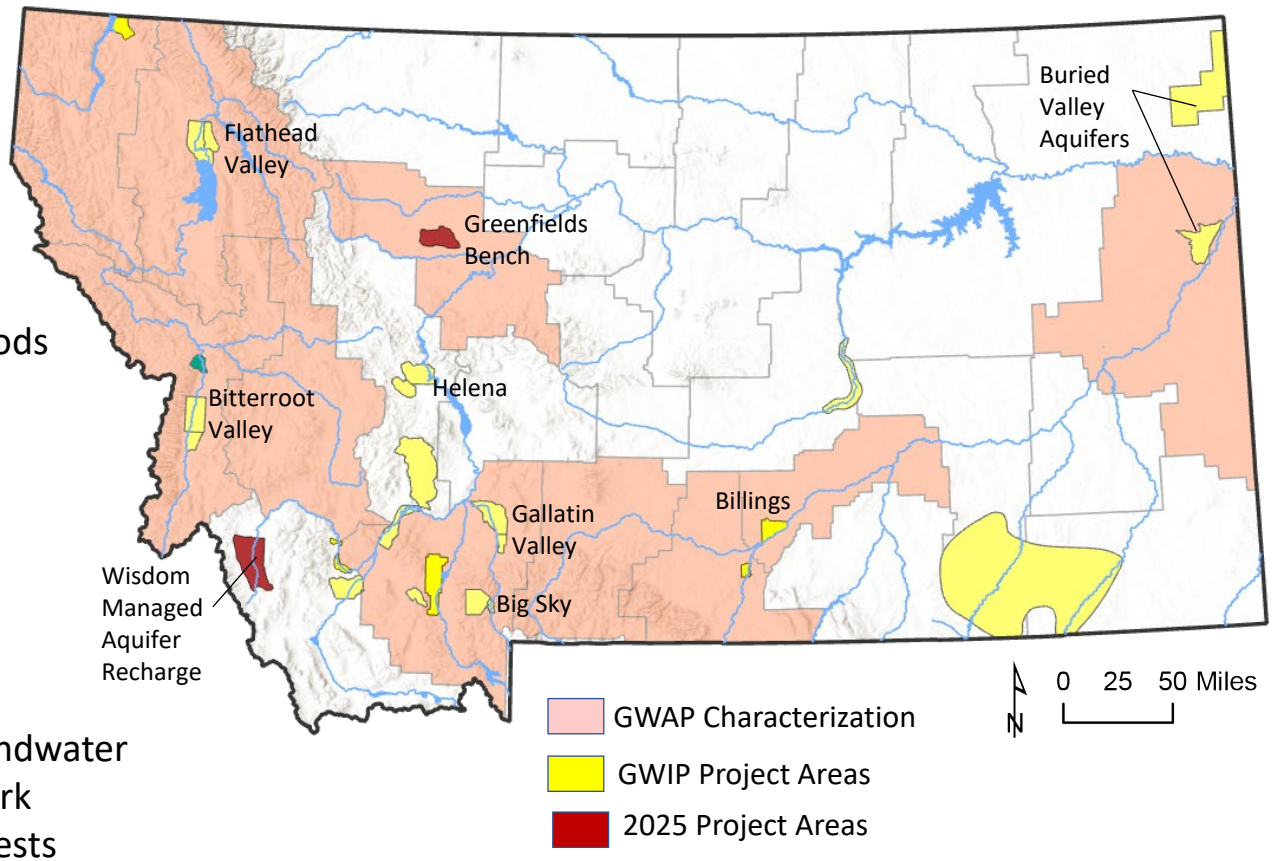
# Ground Water Investigation Program

*Providing Tools for Water Management*

## Stakeholder Driven Process

Projects prioritized by the **Ground Water Steering Committee**

- Stream Depletion
- Agricultural to residential development
- More efficient irrigation methods
- Irrigation development
- Water quality

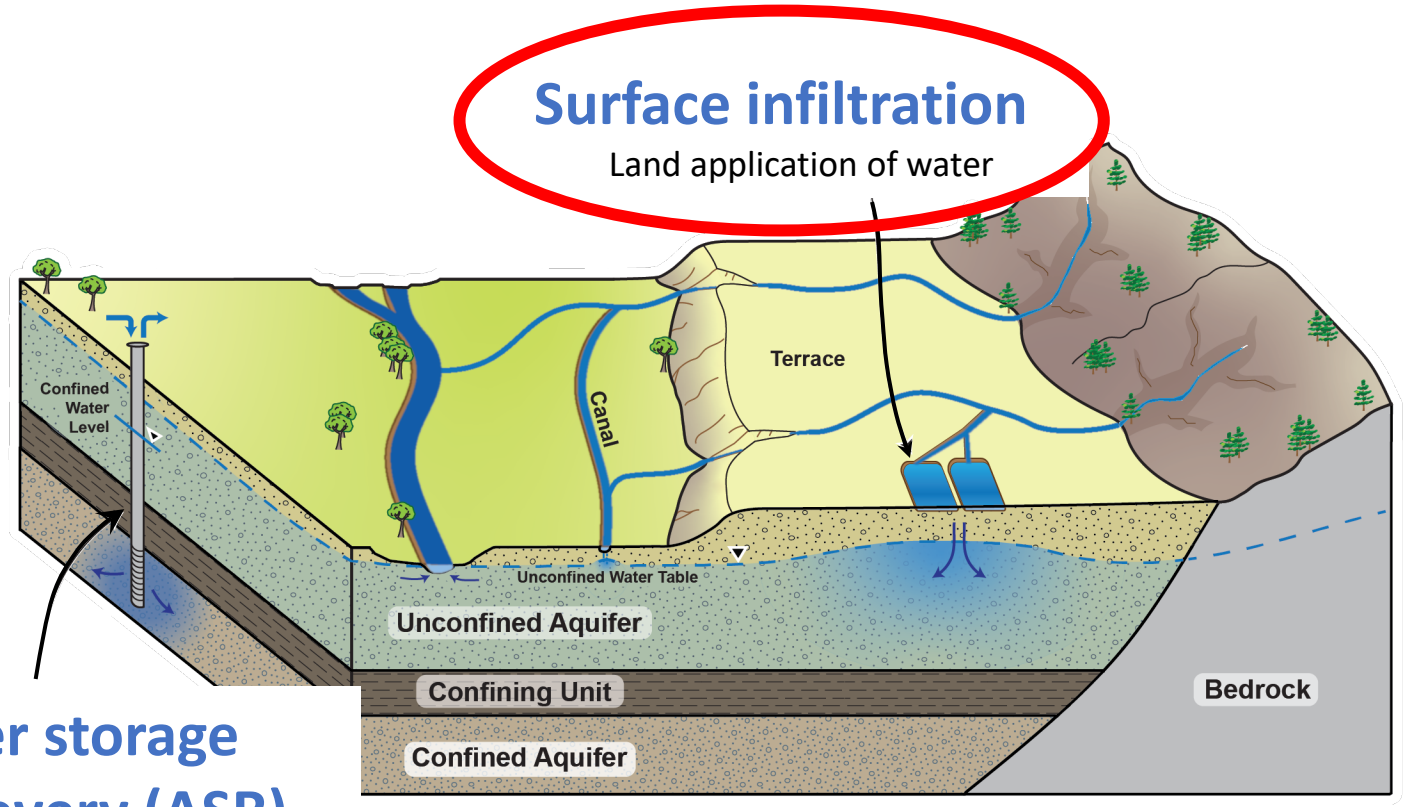



## Detailed Hydrogeologic Studies

- Monitor surface water and groundwater
- Develop hydrogeologic framework
- Drill wells and perform aquifer tests
- Develop groundwater and surface water budgets
- Water chemistry
- Construct groundwater flow models

# Managed Aquifer Recharge (MAR)

**MAR** supplements water supplies by intentionally recharging aquifers; it is a method to **"slow water down"** or store water with the intent of recovering water later during times of need or to achieve an ecological benefit (NGWA, 2024).




## Aquifer storage and recovery (ASR)

Uses wells to inject and extract water

# Surface Infiltration

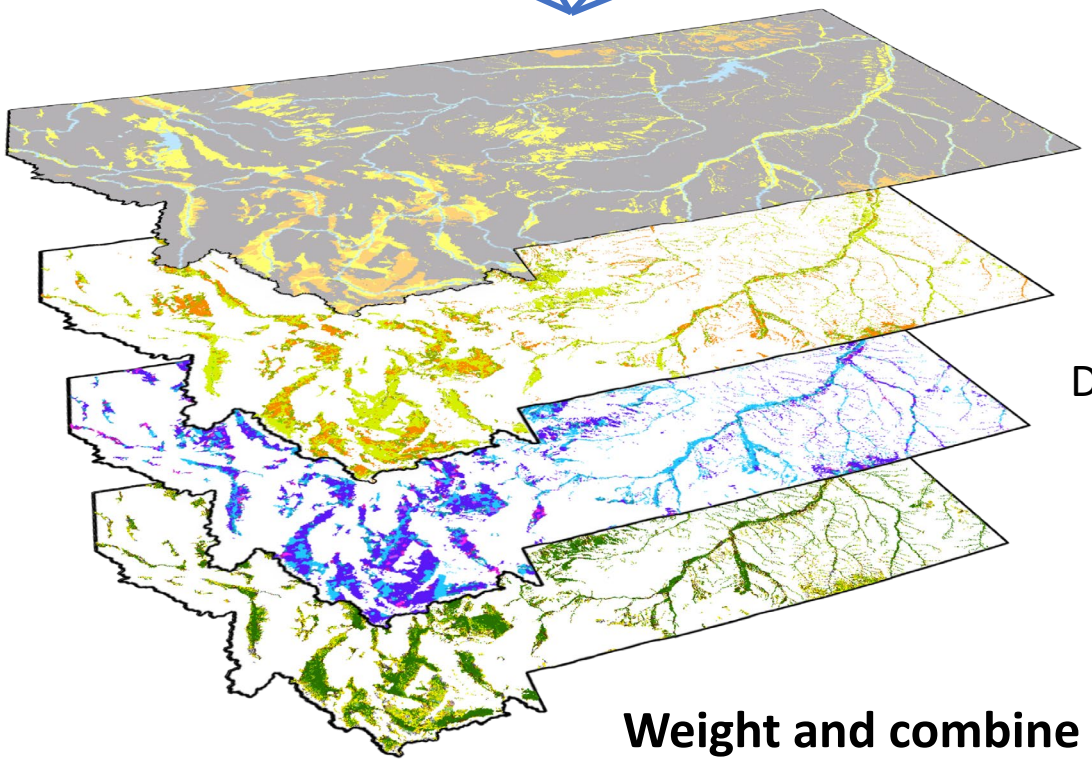
## Choosing Hydrogeologic Criteria

**Can the water move through the aquifer?**

**Can the water infiltrate to groundwater?**

**Is their room to store water?**

**Will the water runoff or infiltrate?**



Geologic/Aquifer Properties (MBMG)

Soil permeability NRCS SURRGO

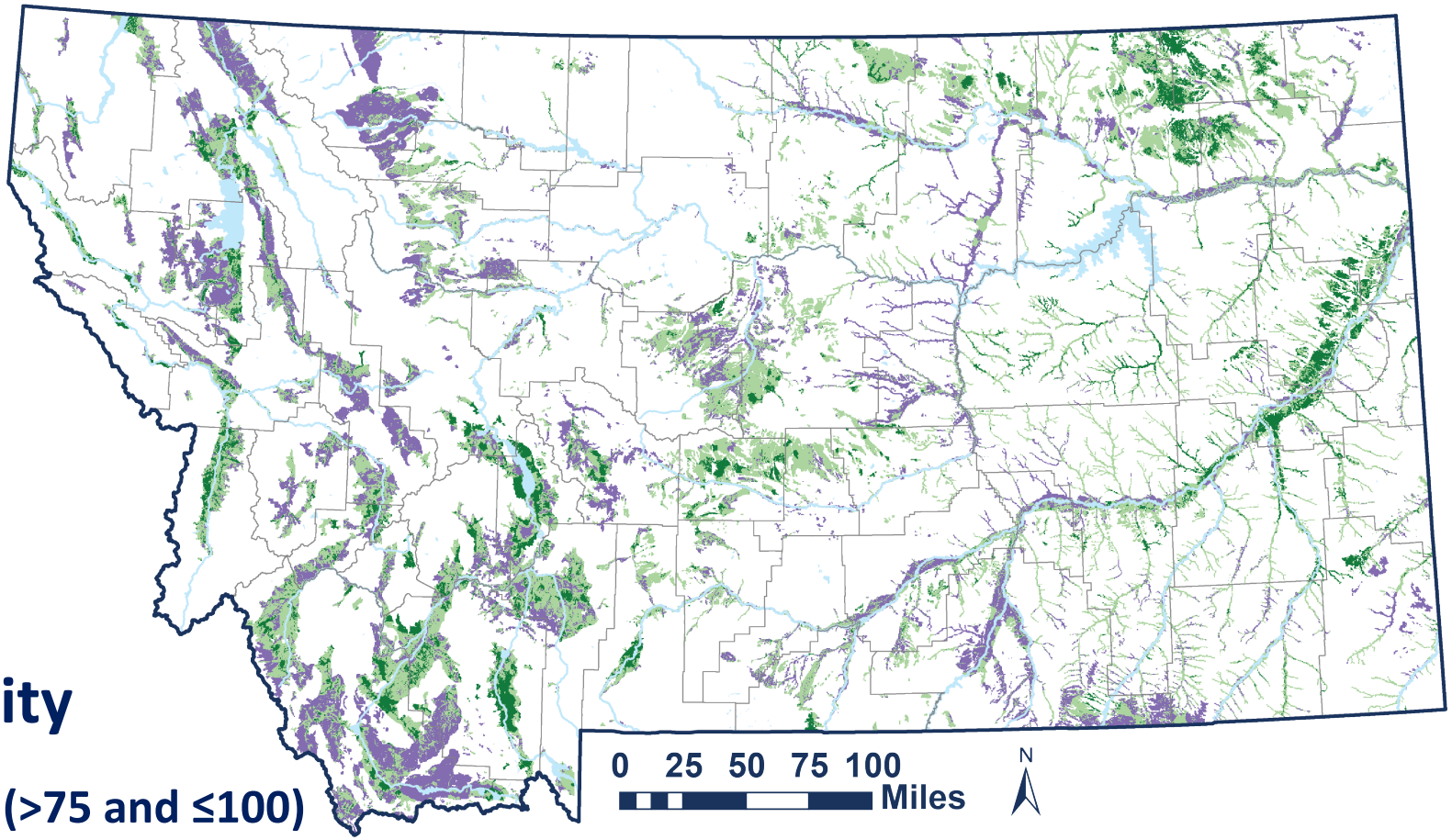
Depth to groundwater (MBMG)

Slope (USGS DEM)

**Weight and combine criteria**

MBMG
Montana Bureau of Mines and Geology

# Statewide Surface Infiltration Suitability Map




## Suitability

**High (>75 and ≤100)**
15% 2.3 million acres

**Medium (>50 and ≤ 75)**
53% 8.3 million acres

**Low (≤ 50)**
32% 5.0 million acres

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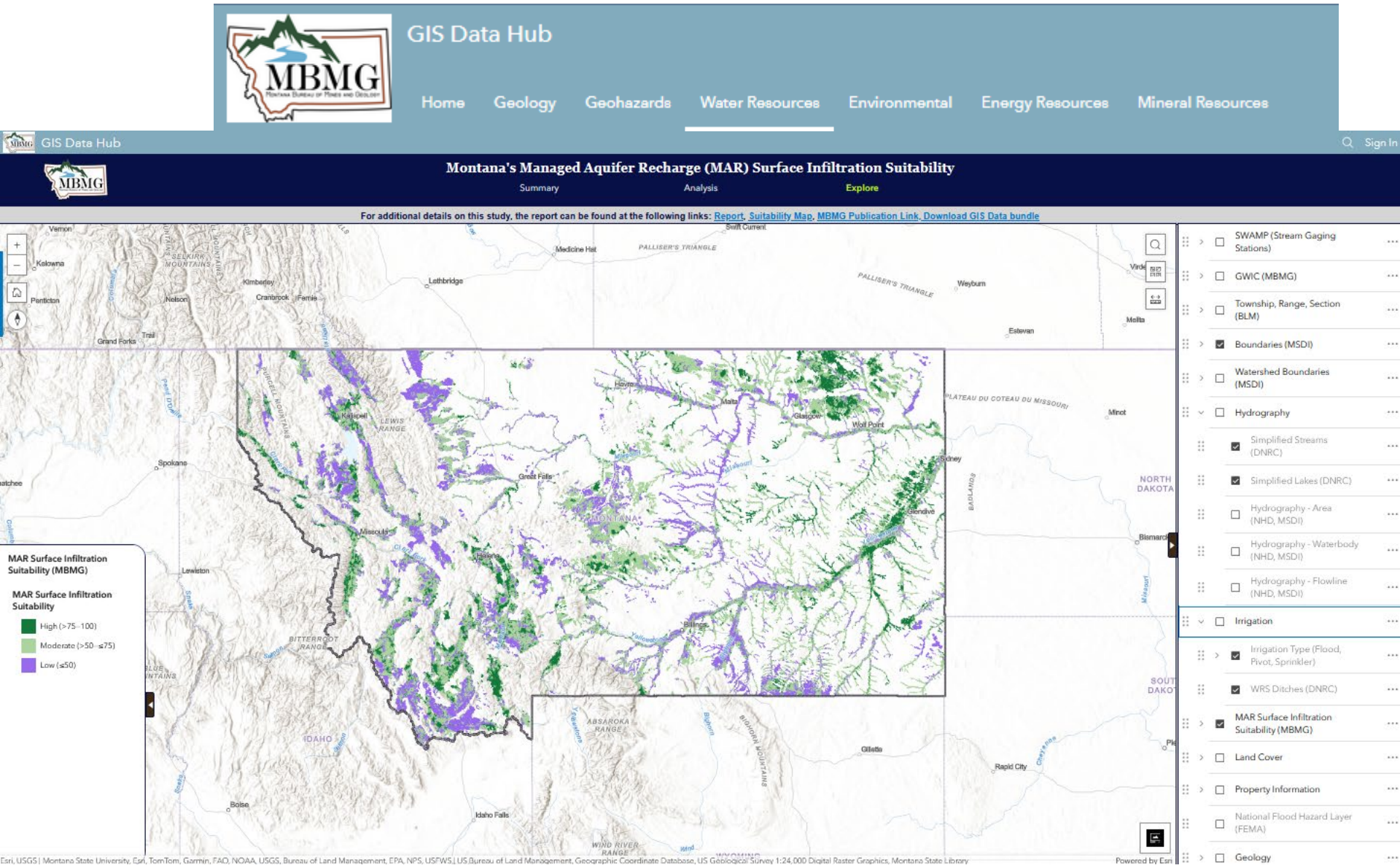
Montana Bureau of Mines and Geology




mbmg.mtech.edu

https://gis-data-hub-mbmg.hub.arcgis.com/

# Wisdom area, Upper Big Hole River

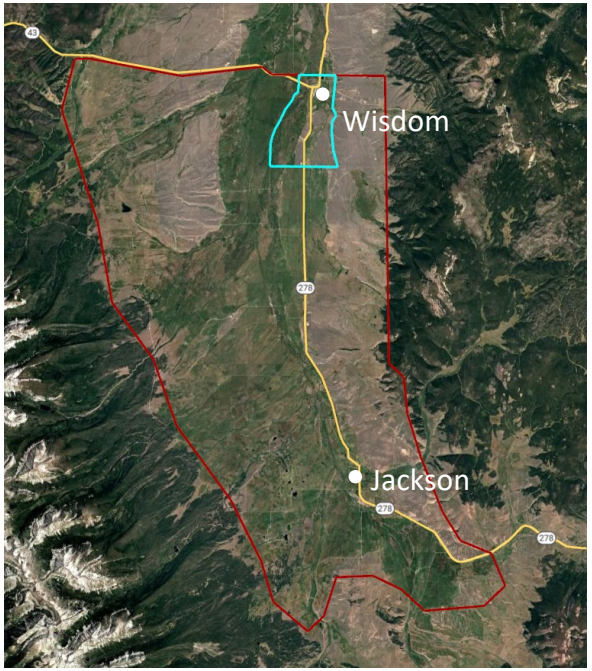
## Ground Water Investigation Program

### Proposed by the Big Hole Watershed Committee

### Purpose:

Evaluate managed aquifer recharge (MAR) options for mitigating low late-summer stream flows in the Big Hole River at Wisdom.

*Drilling exploratory wells for ASR.*

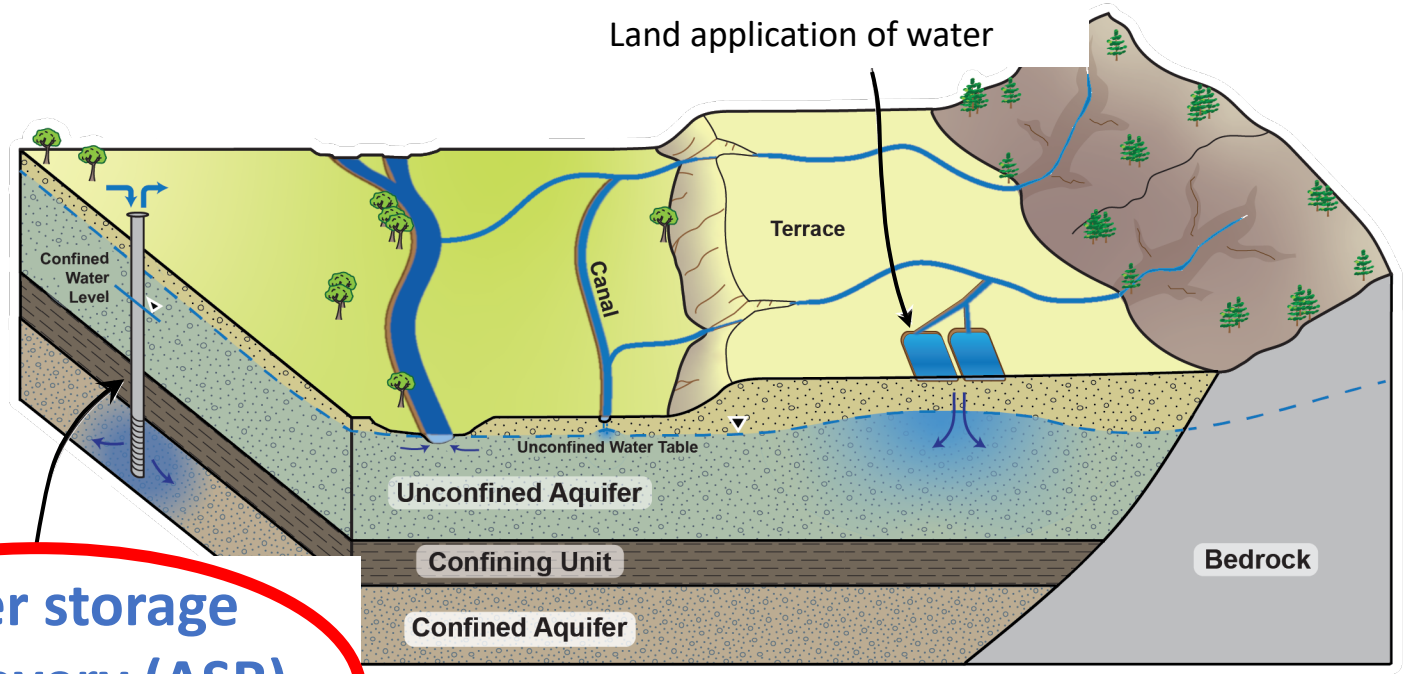


# Managed Aquifer Recharge (MAR)

**MAR** supplements water supplies by intentionally recharging aquifers; it is a method to **"slow water down"** or store water with the intent of recovering water later during times of need or to achieve an ecological benefit (NGWA, 2024).

## Surface infiltration

Land application of water




## Aquifer storage and recovery (ASR)

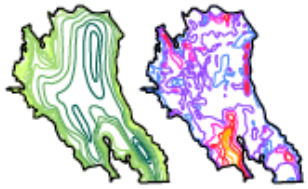
Uses wells to inject and extract water

# Aquifer Storage and Recovery

## Choosing Hydrogeologic Criteria

**How rechargeable is the aquifer?**

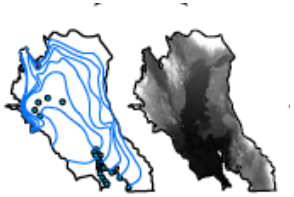
Thickness of sediments beneath the confining layer



- Bedrock depth
- Depth of aquifer

**Is their room to store water?**

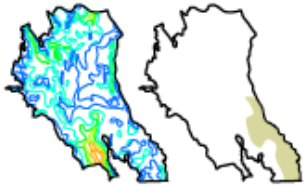
Available drawup



- Water elevation
- Land elevation

**Can the recharged water be recovered?**

Vertical confinement



- Confining unit thickness
- Presence of intermediate aquifers

**Rate Criteria**

| Unconsolidated Thickness (ft) | Rating |
|---|---|
| ≤100 | 0 |
| >100 and ≤300 | 50 |
| >300 | 100 |

| Available Drawup (ft) | Rating |
|---|---|
| ≤35 | 0 |
| >35 and ≤70 | 50 |
| >70 | 100 |

| Vertical Confinement | Rating | |
|---|---|---|
| | I | NI |
| ≤100 ft | 0 | 0 |
| >100 ft and ≤200 ft | 25 | 50 |
| >200 ft | 50 | 100 |

**Weight and combine criteria**

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# Aquifer Storage and Recovery (ASR)
## Flathead Valley

- ✓ Evaluate the hydrogeologic potential to use ASR wells completed in the Deep Aquifer in the Flathead Valley
- ✓ First-level screening tool to identify areas that merit a more detailed site-specific investigation.
- ✓ More suited for confined/semi-confined aquifers

*Photo credit: Texas Water Resources Institute*

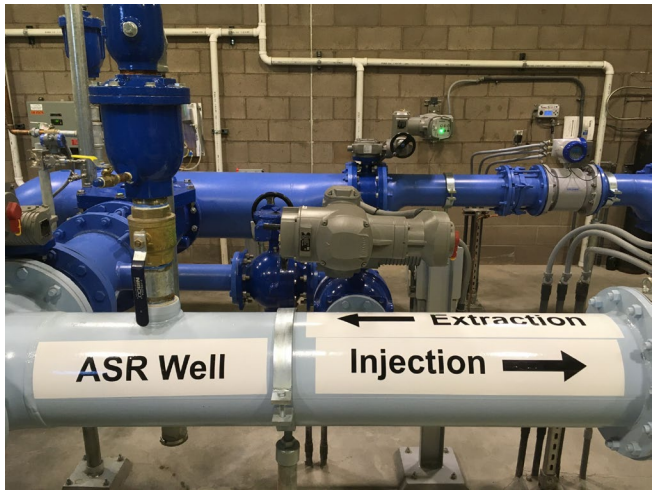


*Photo credit: https://summitwr.com/services/aquifer-storage-and-recovery/*

# ASR Suitability

## Flathead Valley

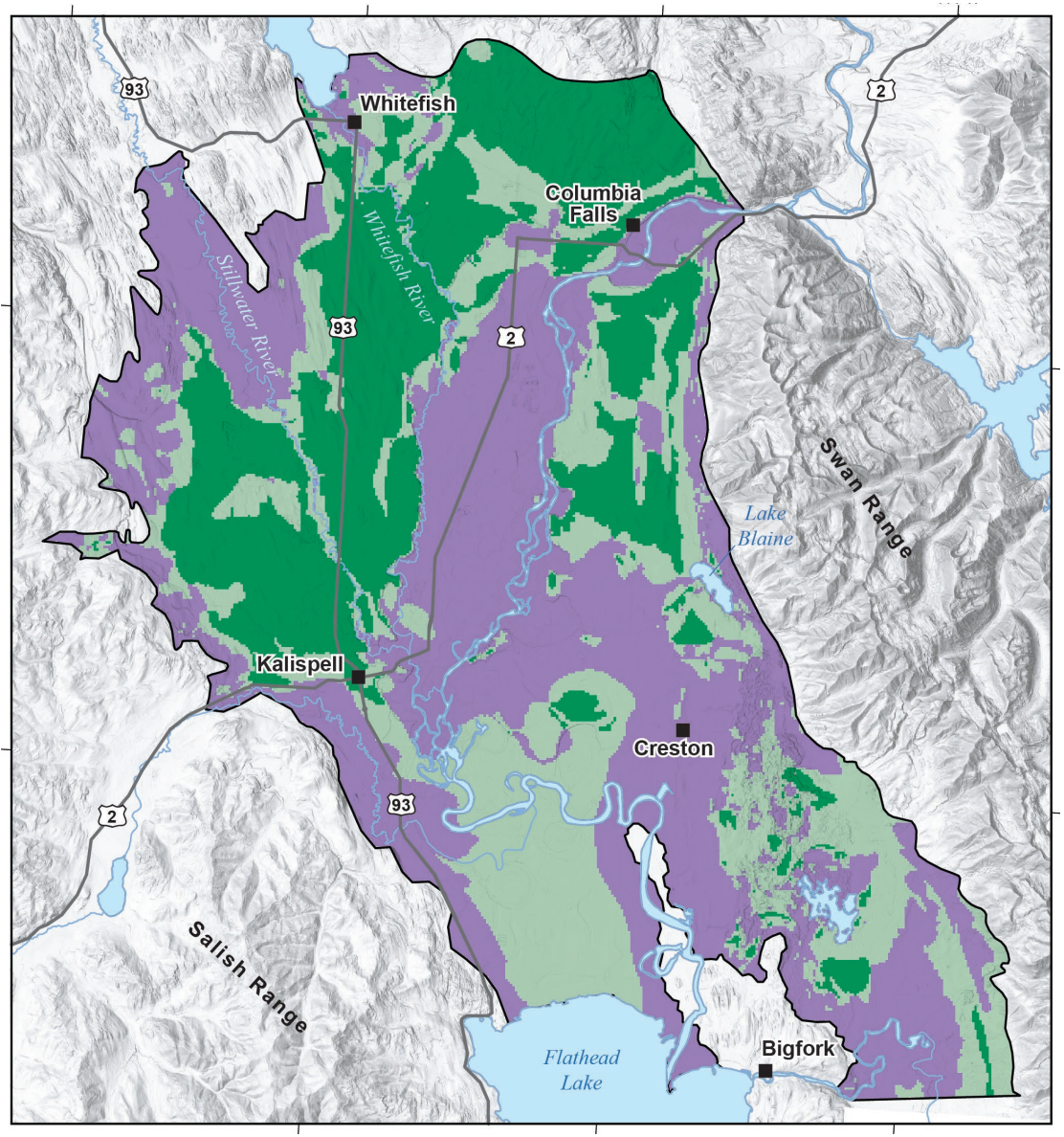


*Photo credit: Headwaters Economics*

## Suitability

- High (>75 and ≤100)
- Medium (>50 and ≤ 75)
- Low (≤ 50)

*Preliminary results*
*Report in review*

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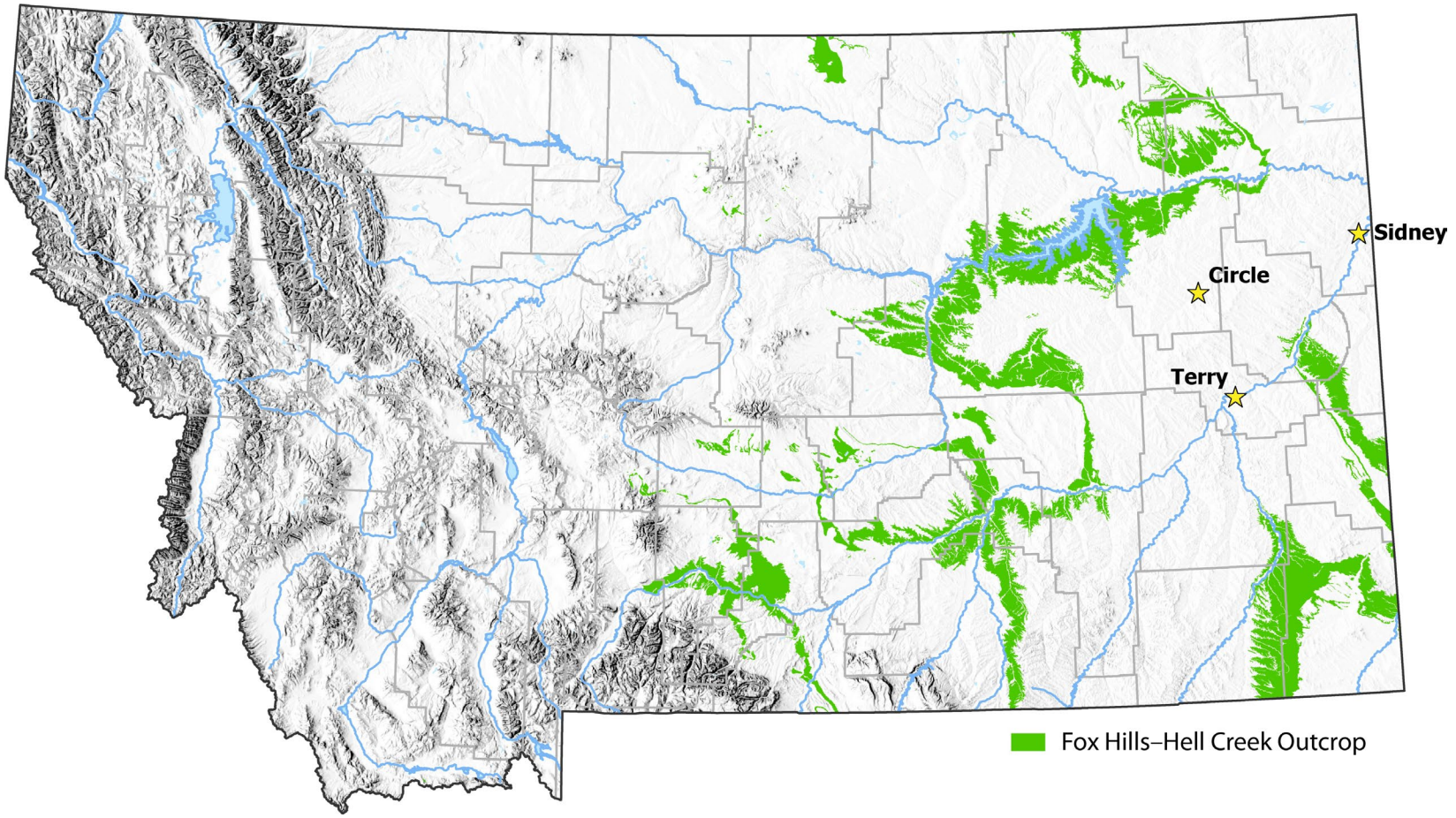
# Ground Water Assessment Program

*Fox Hills – Hell Creek Aquifer: Study Bill HB935*

## Fox Hills – Hell Creek Aquifer

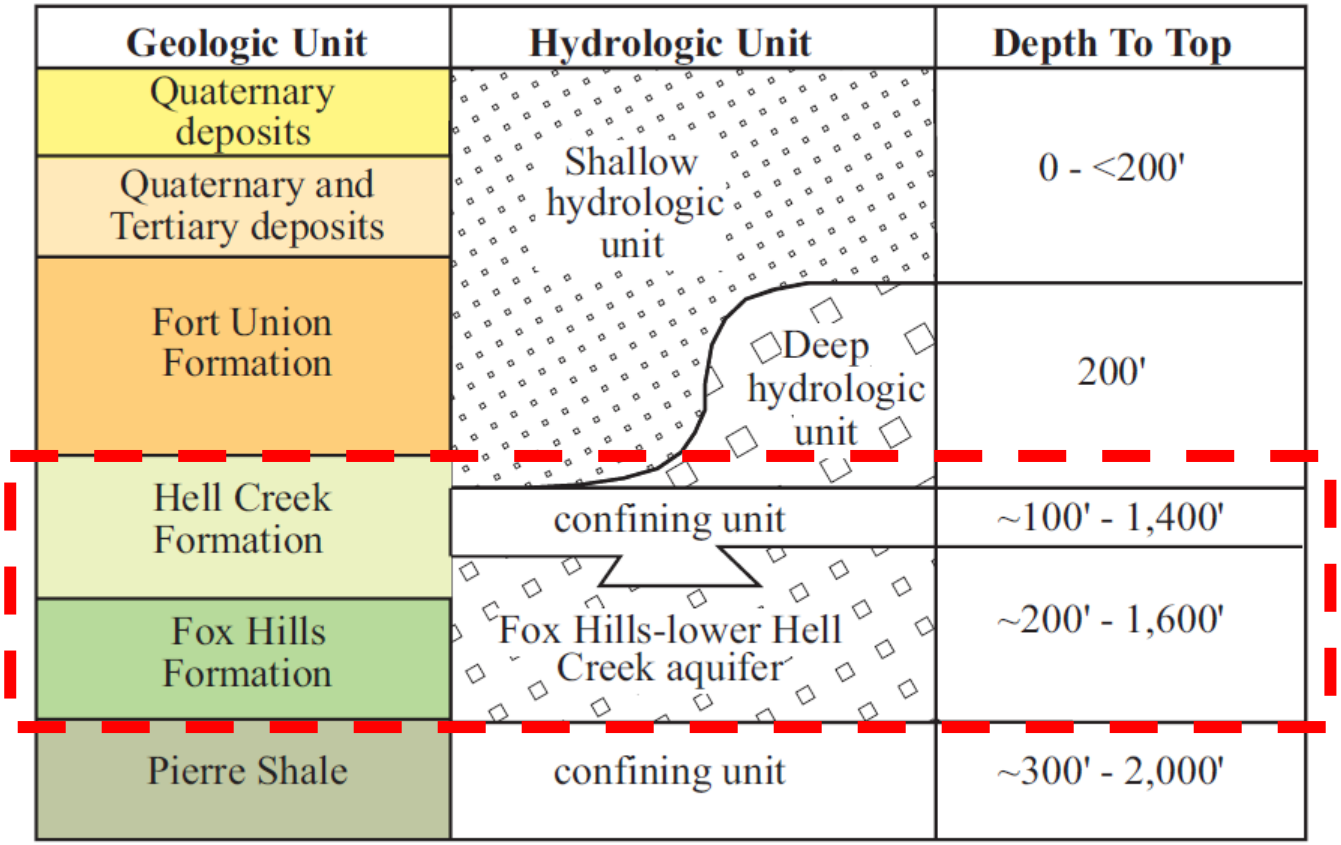
- "Confined" sandstone aquifer that underlies the eastern third of Montana
- Vital source of domestic, stock, industrial, and municipal water



# Ground Water Assessment Program

*Fox Hills – Hell Creek Aquifer: Study Bill HB935*

## Principal Aquifers of Eastern Montana



# Ground Water Assessment Program

*Fox Hills – Hell Creek Aquifer: Study Bill HB935*

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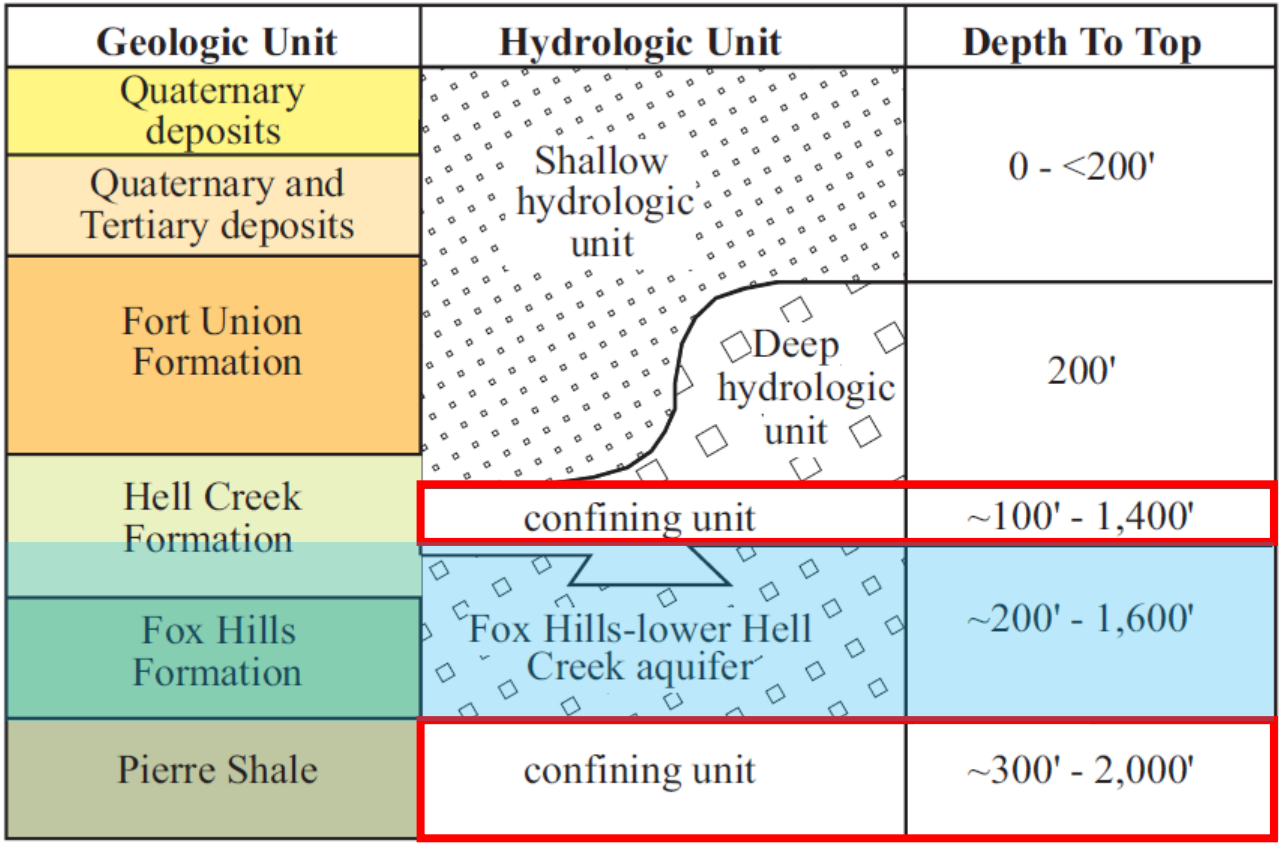
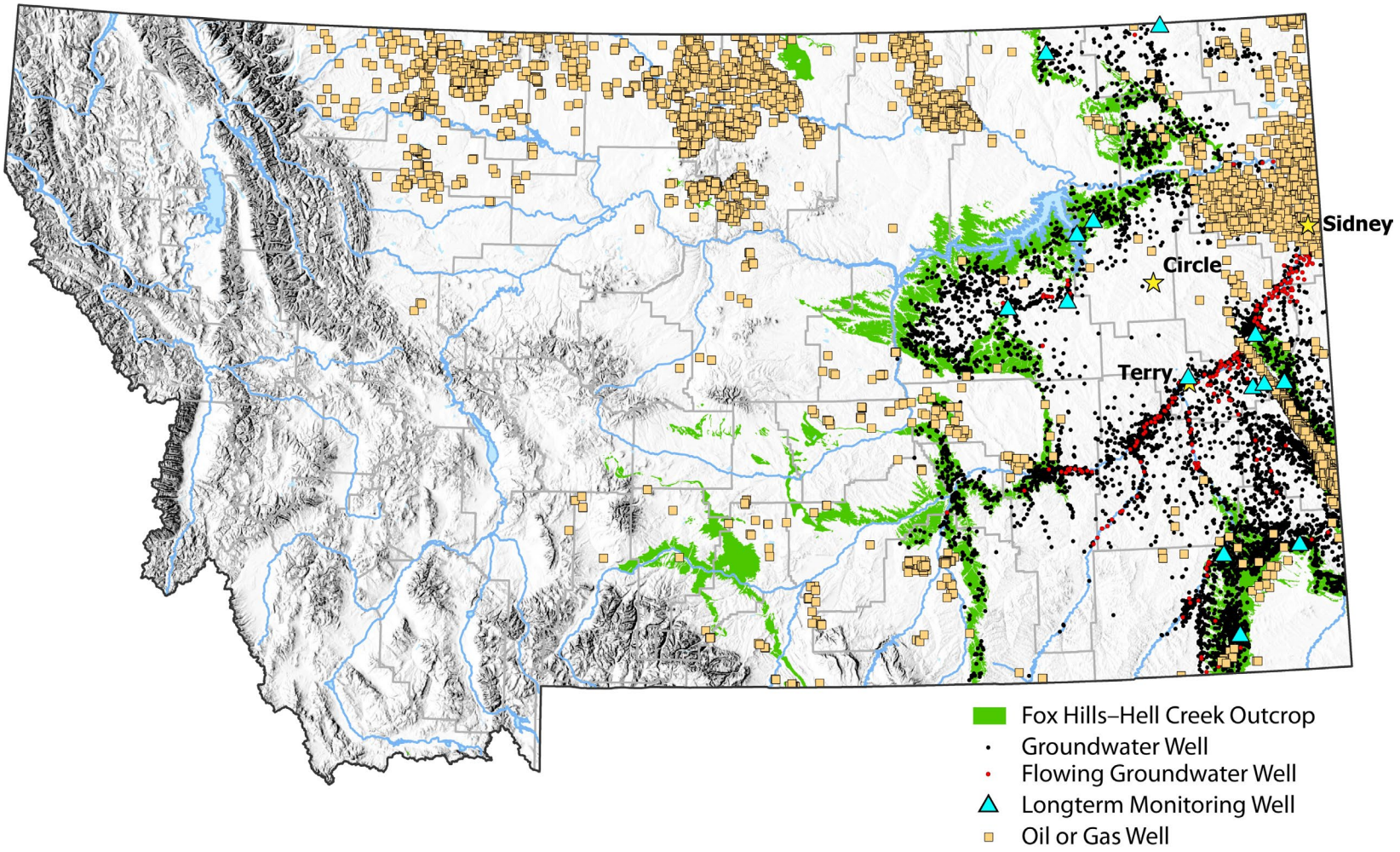


# Ground Water Assessment Program

*Fox Hills – Hell Creek Aquifer: Study Bill HB935*

## Fox Hills – Hell Creek Aquifer

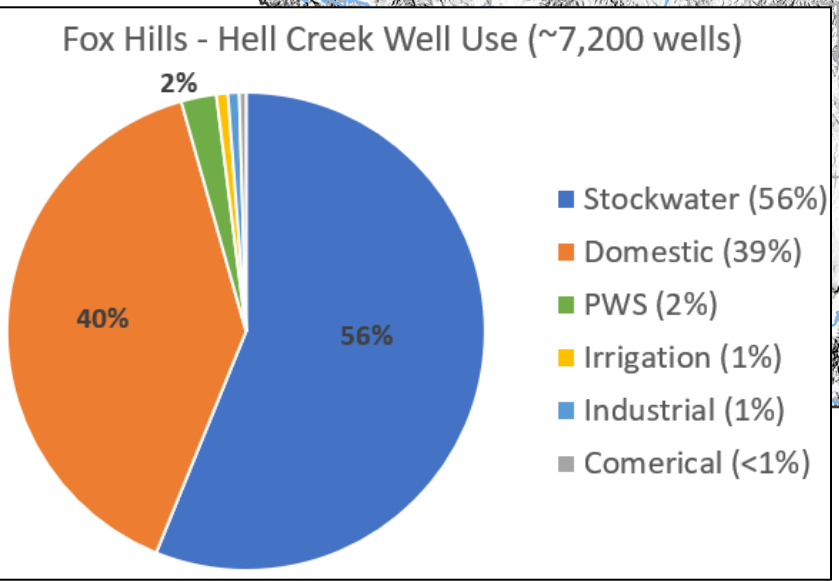


# Ground Water Assessment Program

*Fox Hills – Hell Creek Aquifer: Study Bill HB935*

## Fox Hills – Hell Creek Aquifer

- Records of more than 7,200 wells completed in the aquifer – near outcrop and lower Yellowstone river valley
- Most of the wells are used for stock and domestic uses

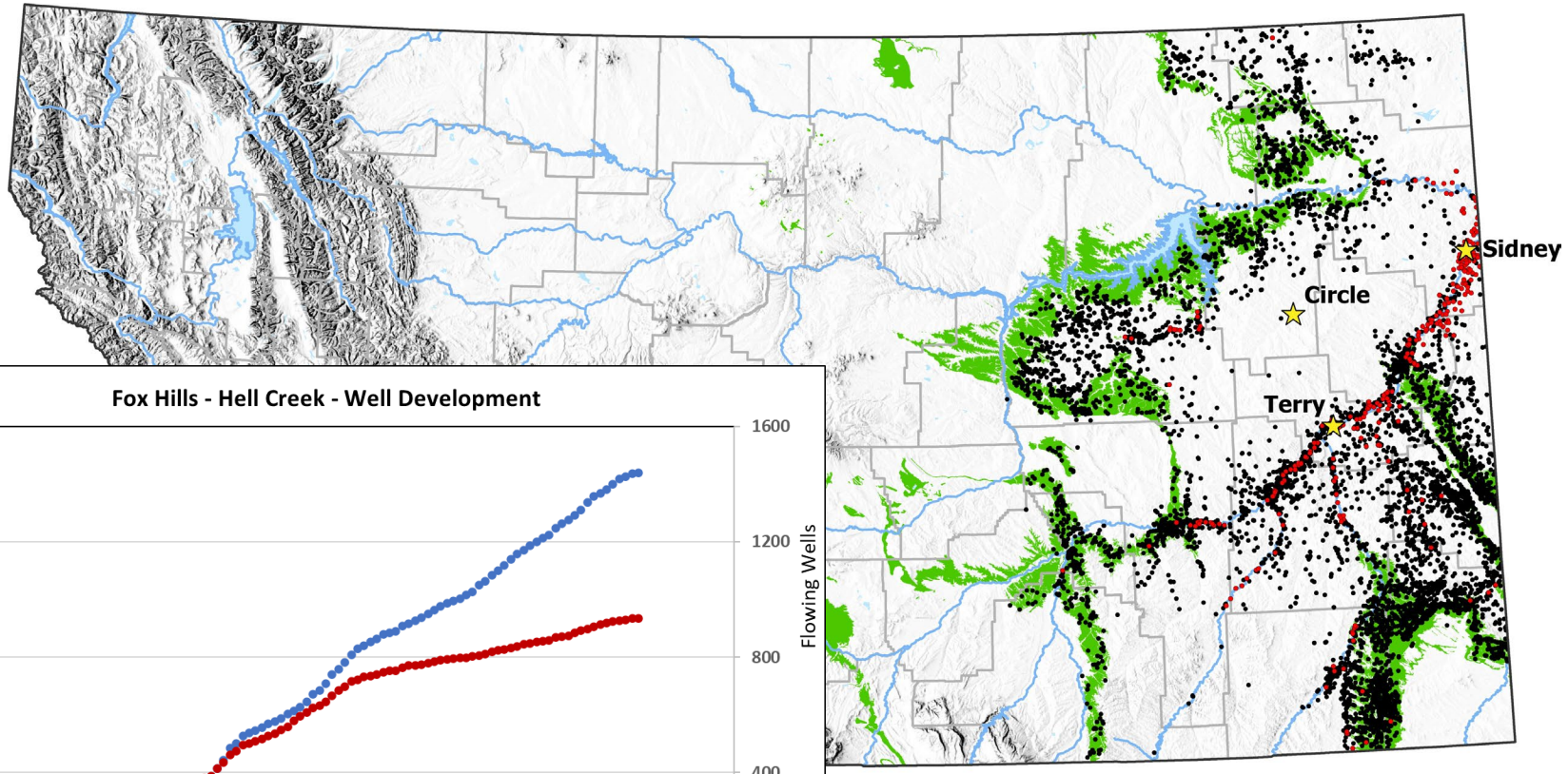


# Ground Water Assessment Program

*Fox Hills – Hell Creek Aquifer: Study Bill HB935*

## Fox Hills – Hell Creek Aquifer

- There are many "flowing" wells – primarily in the Yellowstone River valley
- Most were drilled before 1980, many flow unrestricted

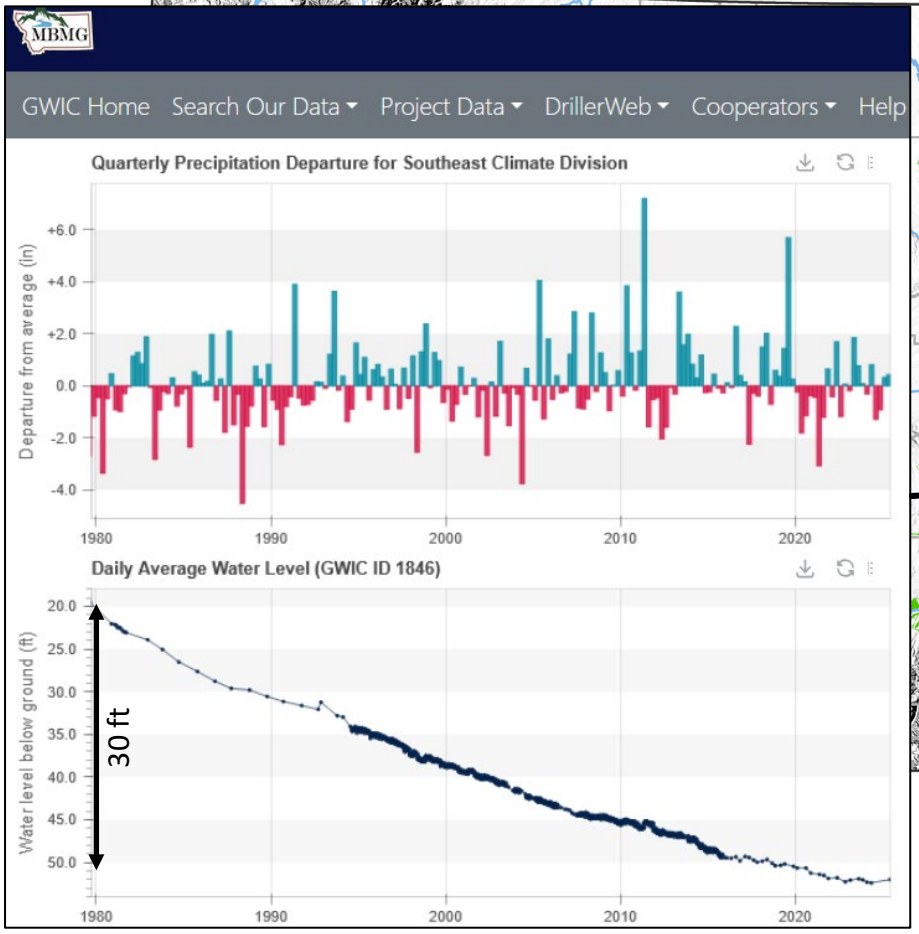


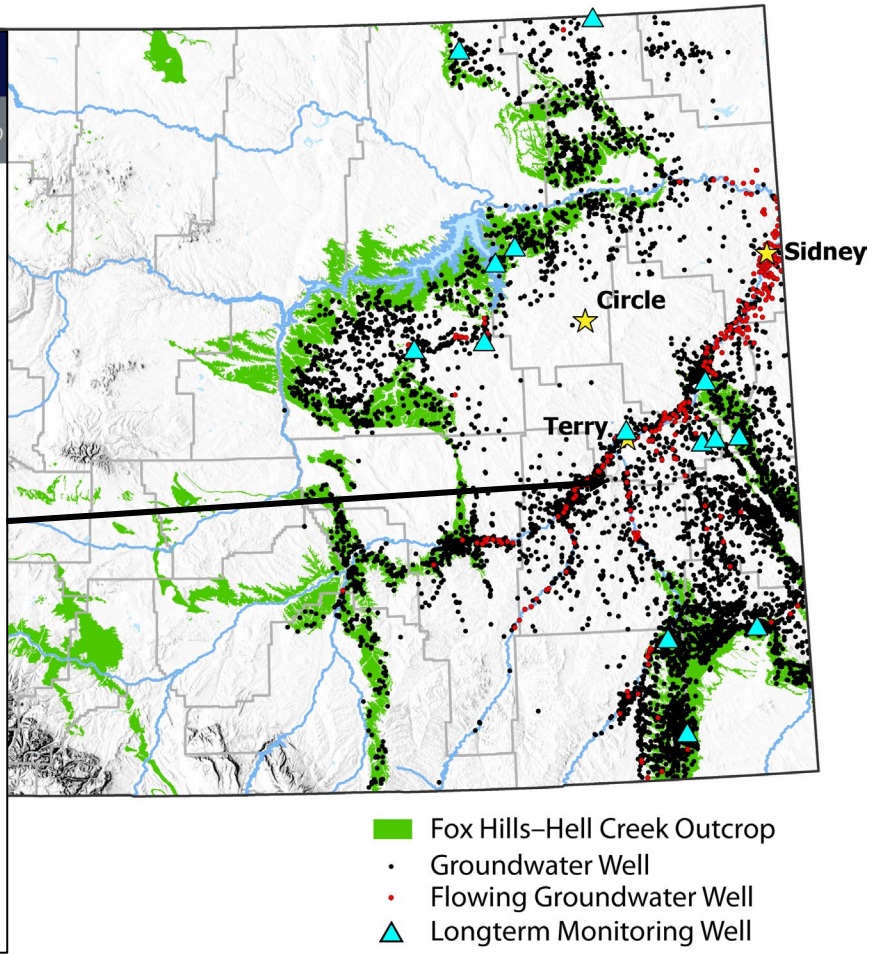
# Ground Water Assessment Program

*Fox Hills – Hell Creek Aquifer: Study Bill HB935*

## Fox Hills – Hell Creek Aquifer

- There is limited long-term monitoring, mostly in outcrop areas
- Unrestricted flow and high-capacity withdrawals resulting in persistent declines



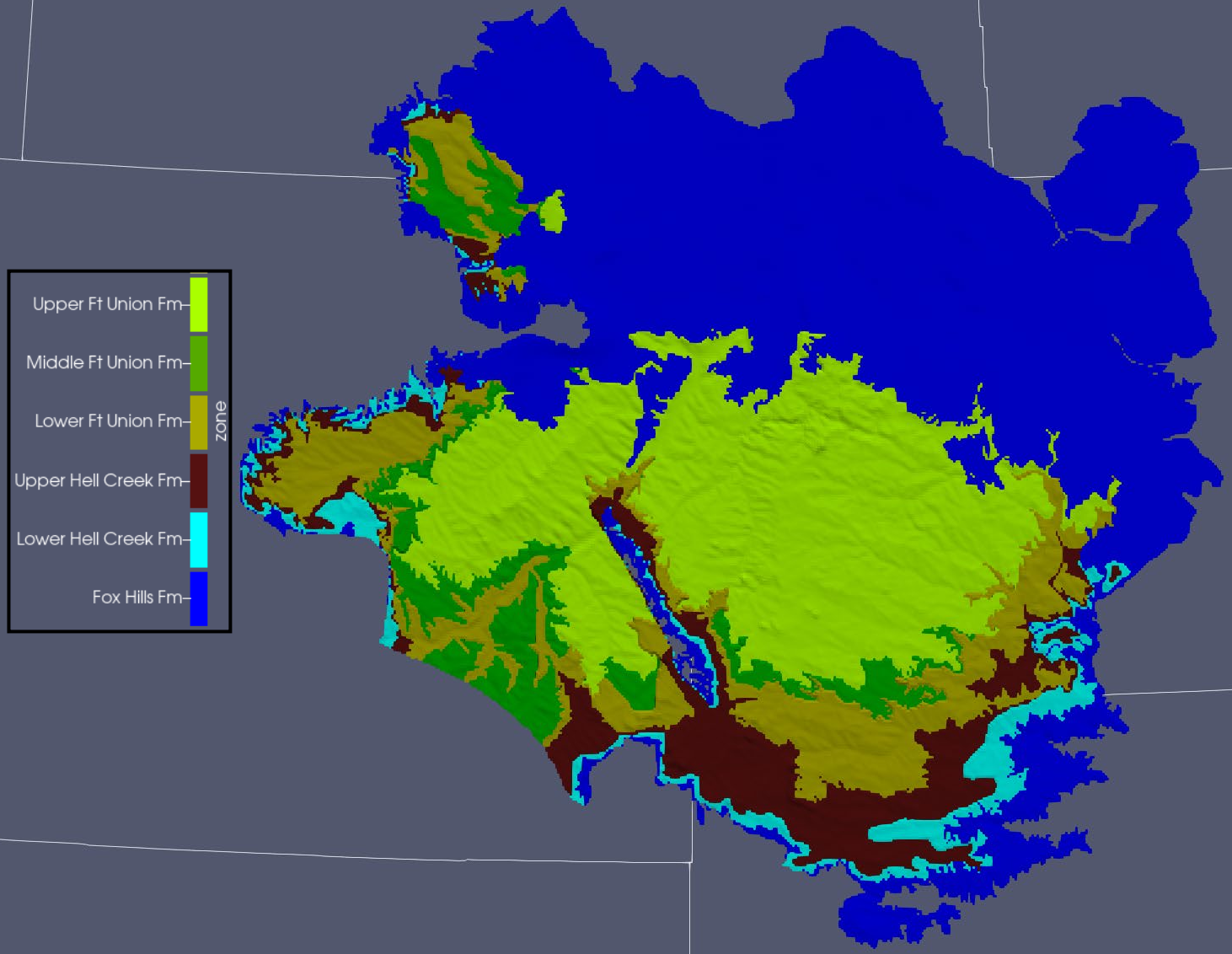



# Ground Water Assessment Program

*Fox Hills – Hell Creek Aquifer: Study Bill HB935*

## Fox Hills – Hell Creek Aquifer – Study Plan

- Assess extent and magnitude of water-level declines
  - Characterize historical water-level fluctuations and trends
- Develop potentiometric surface and regional groundwater flow maps
  - Assess recharge and discharge areas
- Refine the extent and thickness of the aquifer
  - Determine structural controls on aquifer geometry
- Compile Hydraulic Properties
  - Transmissivity and Storativity – Well Yields and Specific Capacity
- Develop numerical groundwater flow model
  - Run predictive scenarios to assess groundwater availability


Upper Ft Union Fm
Middle Ft Union Fm
Lower Ft Union Fm
Upper Hell Creek Fm
Lower Hell Creek Fm
Fox Hills Fm
zone