The Billings Aquifer

MBMG Ground Water Investigation Program

Zimmerman Trail
(1983)
Oil. Chuck Forsman

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Ground Water Investigation Program

Elizabeth Meredith
AWRA
October 11, 2024

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Zimmerman Trail
(2024)
Google Earth

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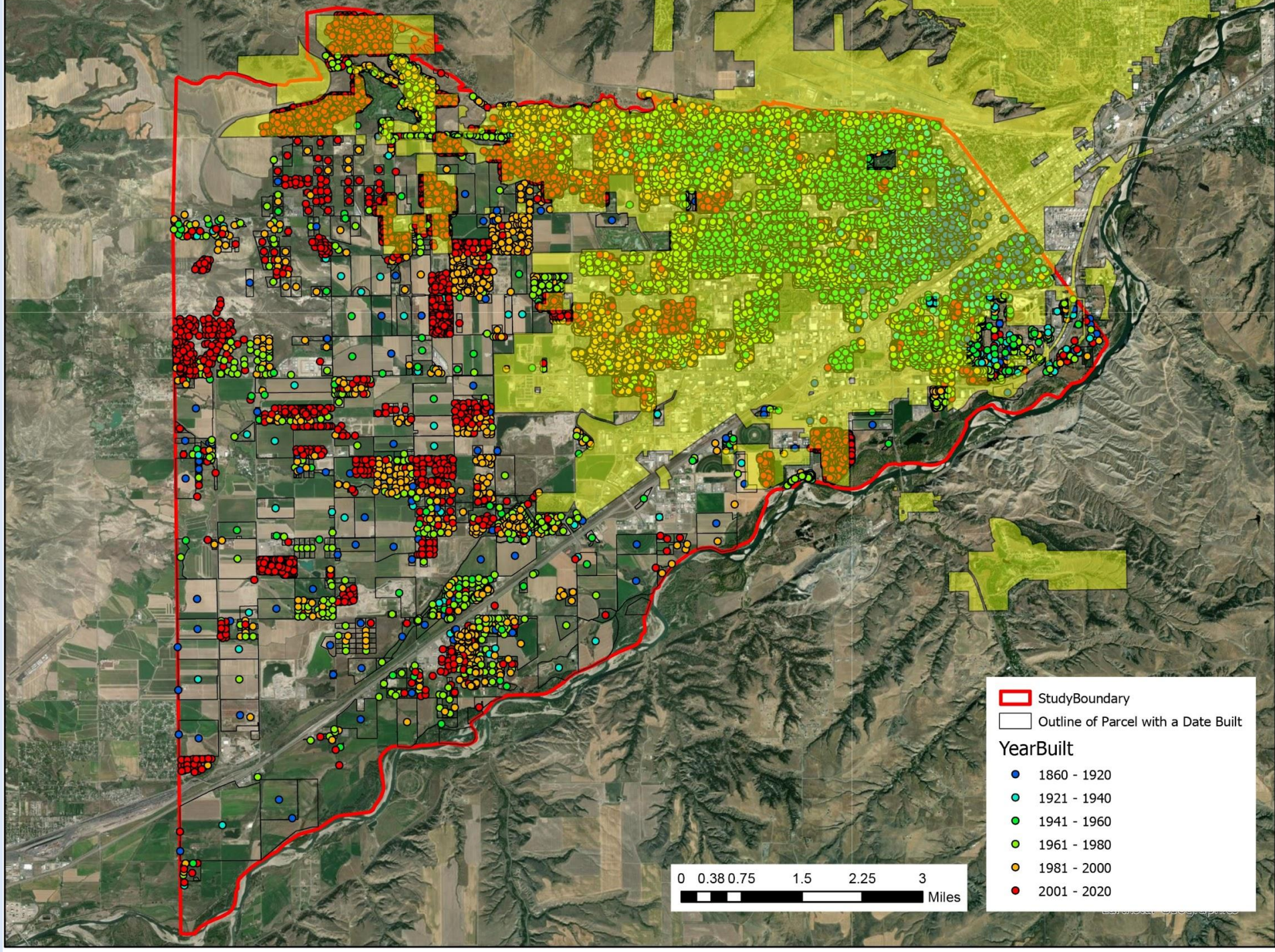
October 11, 2024

Purpose

Nominated by the City of Billings

- Evaluate the ability of the aquifer to sustain future groundwater development

- Identify the extent and source of nitrates in the study area.



Purpose

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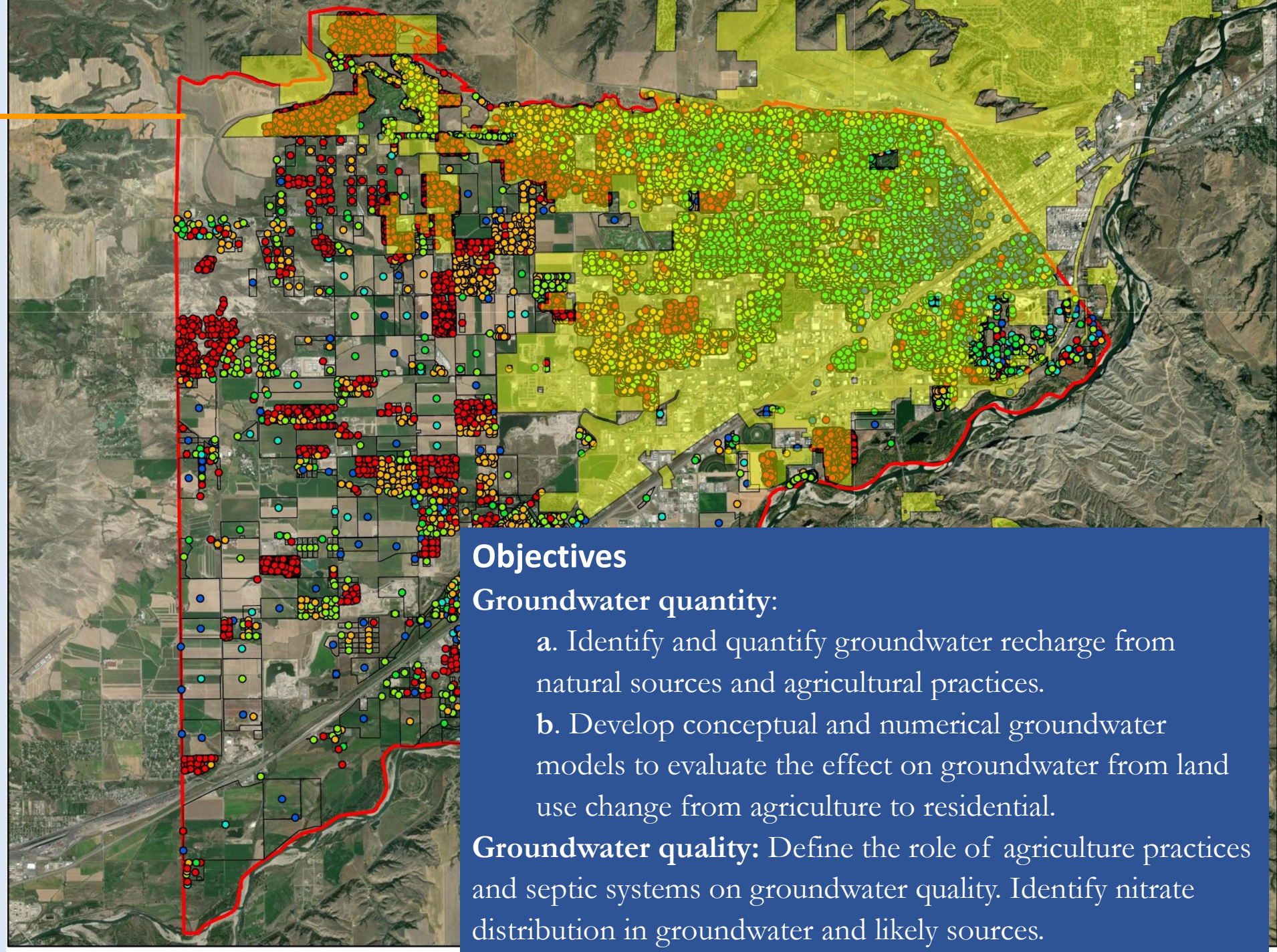

Objectives

Groundwater quantity:

a. Identify and quantify groundwater recharge from natural sources and agricultural practices.

b. Develop conceptual and numerical groundwater models to evaluate the effect on groundwater from land use change from agriculture to residential.

Groundwater quality: Define the role of agriculture practices and septic systems on groundwater quality. Identify nitrate distribution in groundwater and likely sources.

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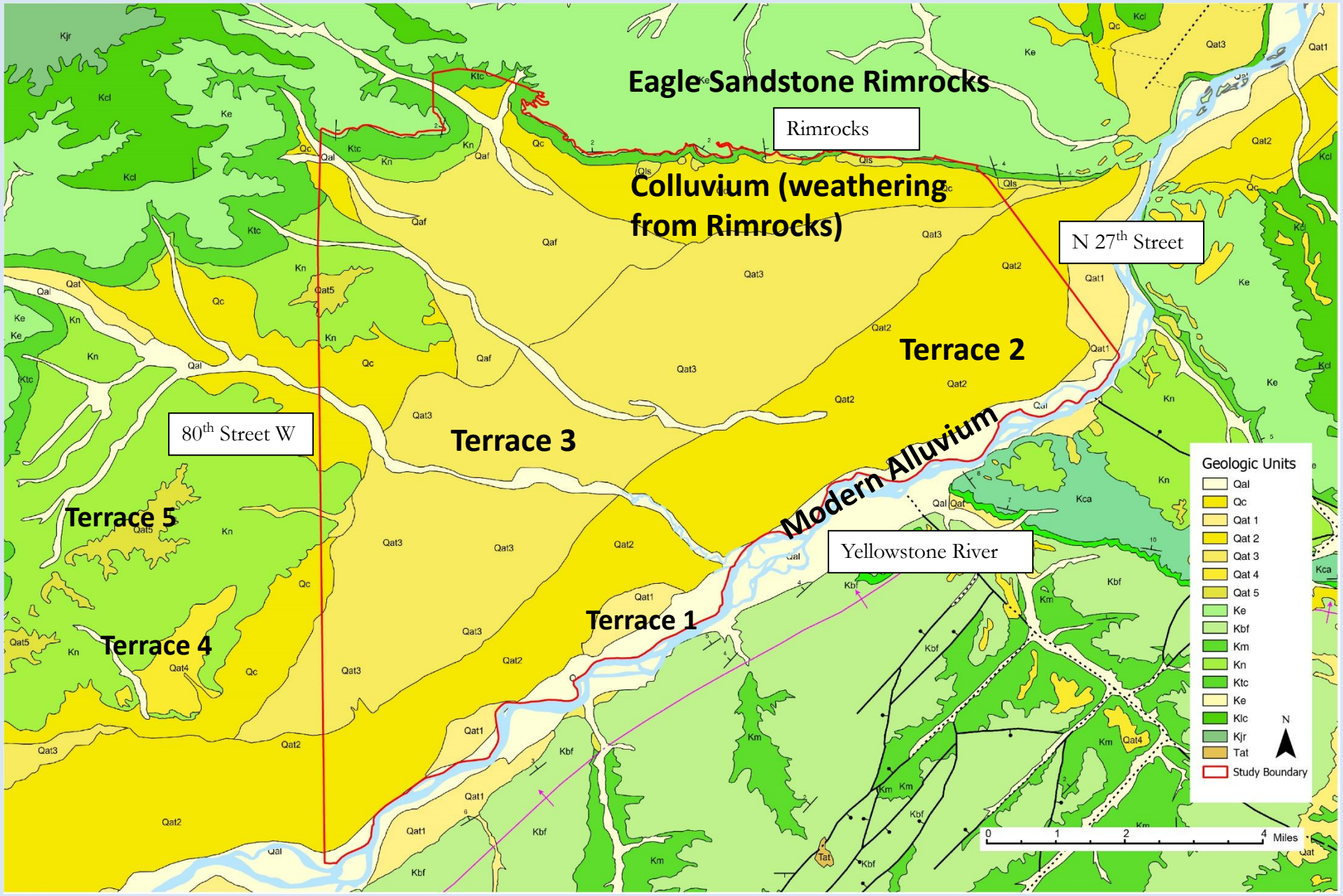
Billings Area Geology



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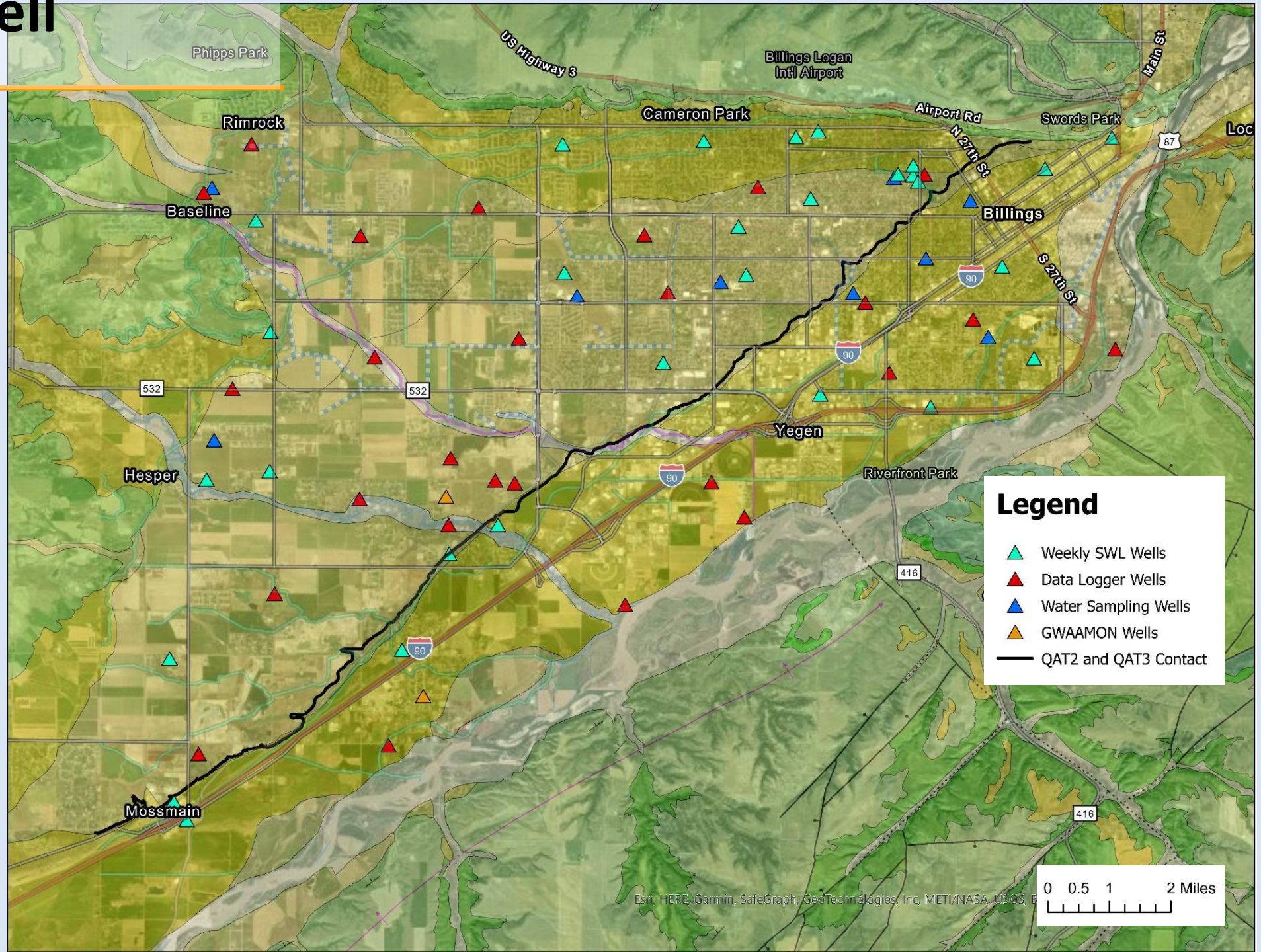
Monitoring Well Network

- **79 Wells**

Water level monitoring measures groundwater response to a variety of land uses



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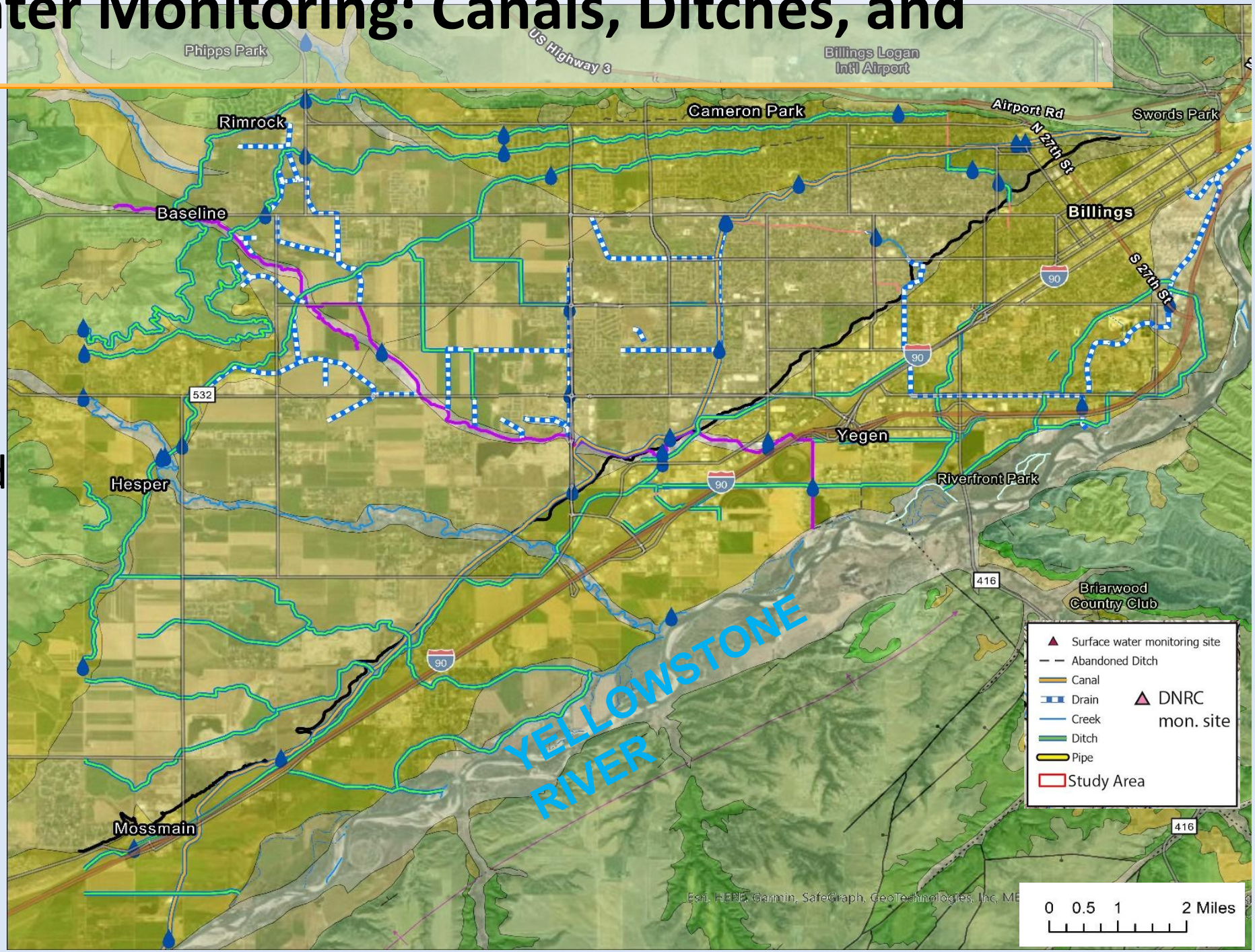
Surface Water Monitoring: Canals, Ditches, and Drains

- **42 Surface Water Sites:**

Capture stream, canal and drain elevations and gain/loss



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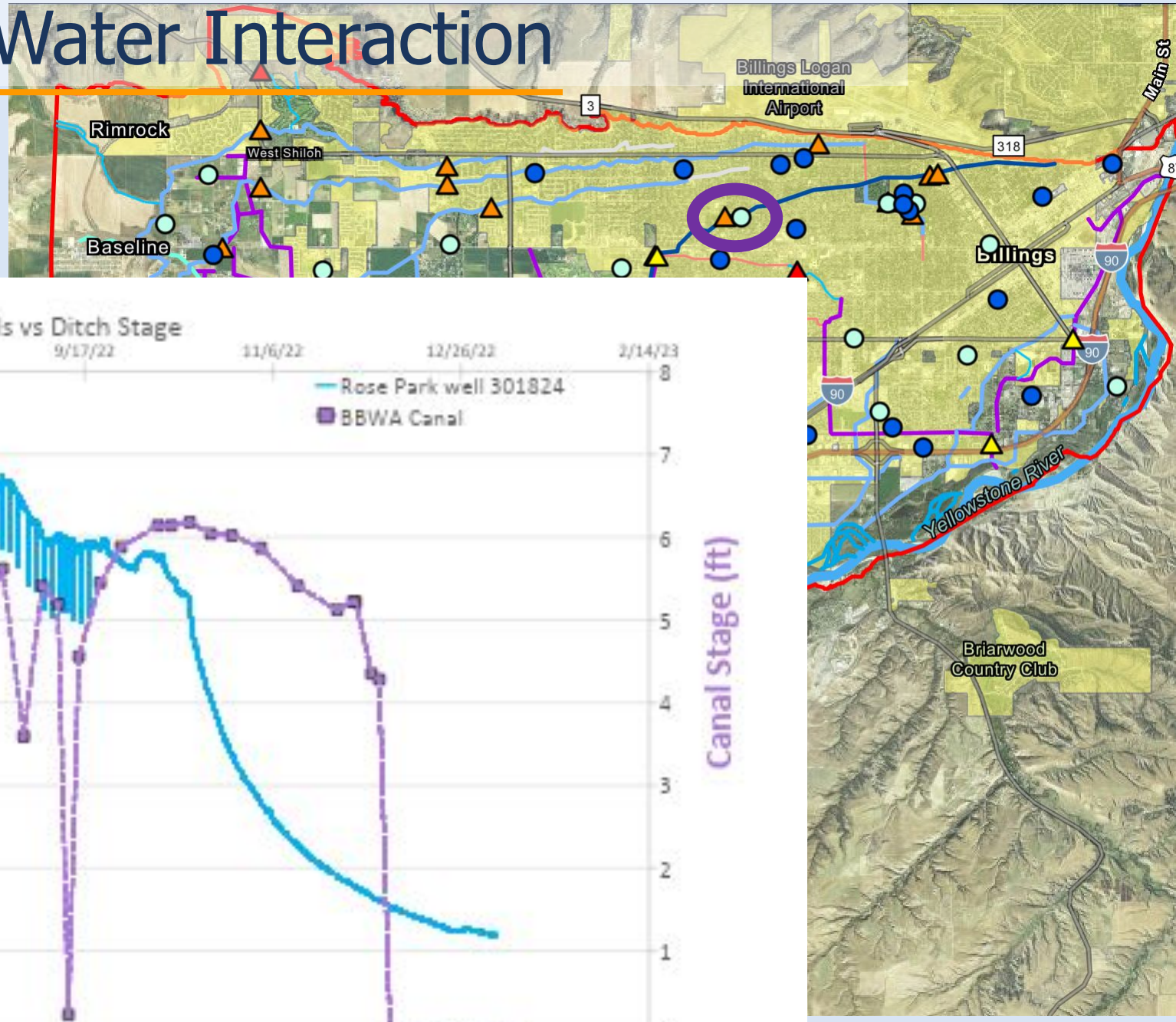
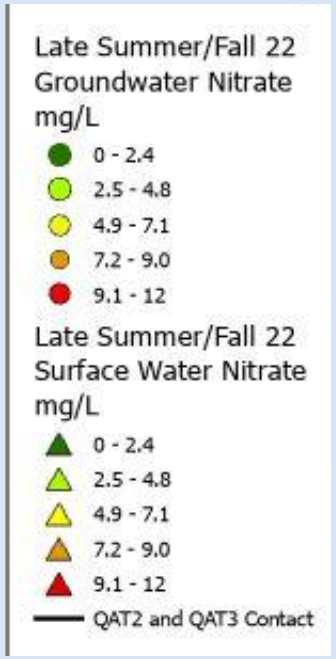
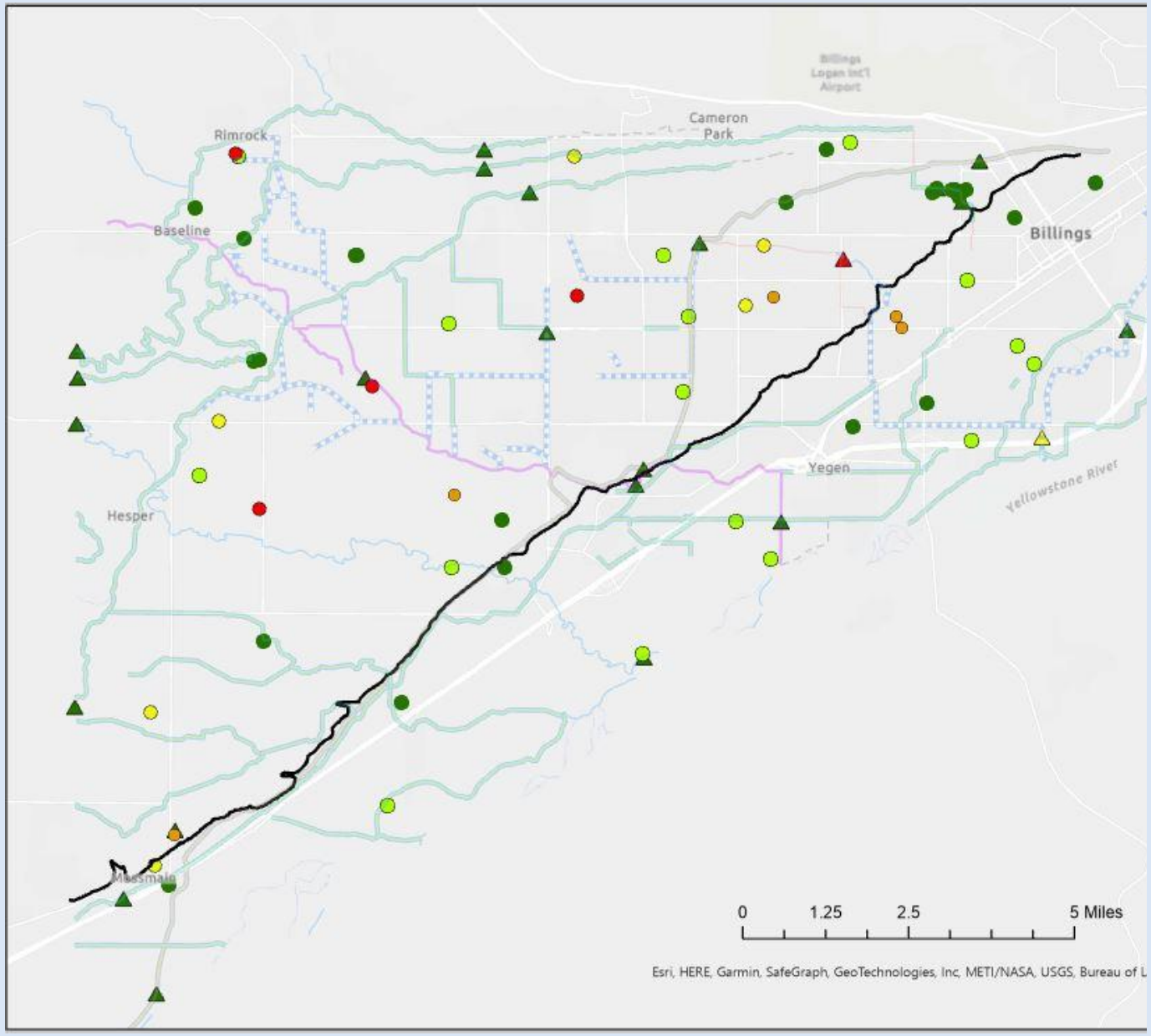
Groundwater / Surface Water Interaction



Nitrate Concentrations

- **Over 100 nitrate measurements show local influences on groundwater quality**
- **Sources will be investigated through halogen ratios (Cl/Br) and nitrate isotope signatures**





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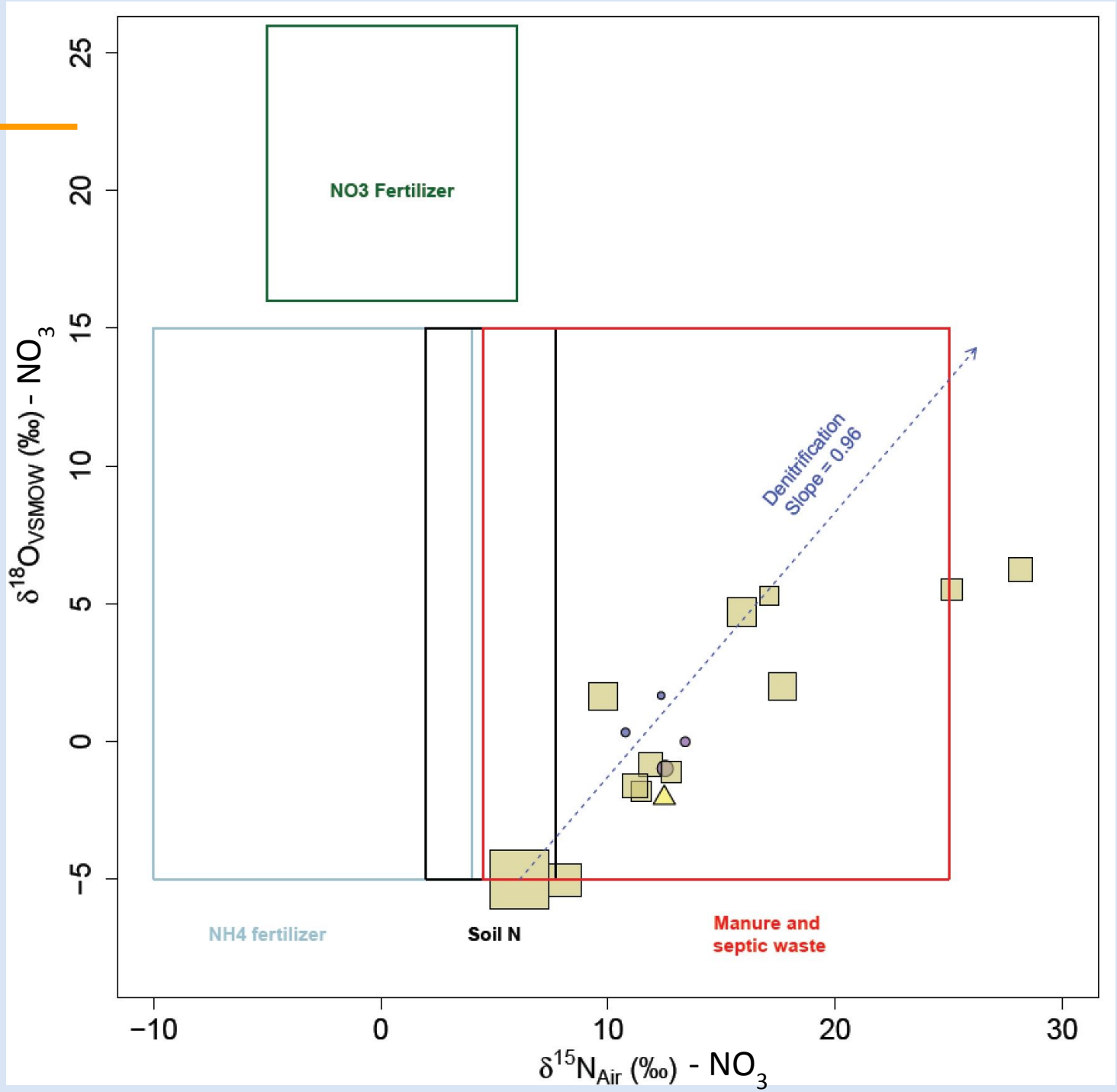
Nitrate Isotopes



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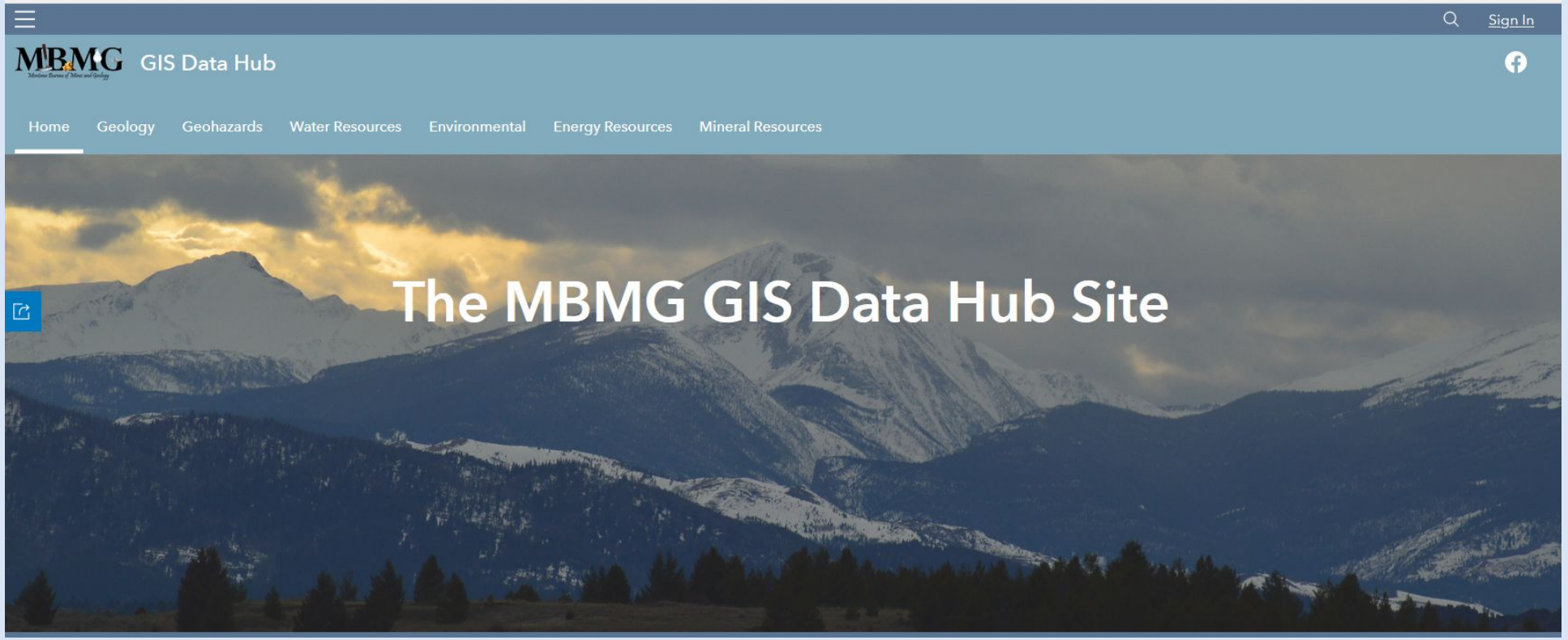
Online Data



(Authored by Ann Hanson, Hydrogeologist MBMG)

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

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Online Data

MBMG GIS Data Hub

Home | Geology | Geohazards | Water Resources | Environmental | Energy Resources | Mineral Resources

GWIP - Billings Groundwater Investigation Project

This web app provides collated groundwater and surface-water monitoring, water quality, and hydrogeological map data for Billings, MT by the Ground Water Investigations Program (GWIP). The Billings area has experienced sustained, consistent growth and urbanization for the last 60 years. To forecast the need for future city services (water, sewer, and storm), city and county officials must have a better understanding of the replenishment of water to the local aquifer contributed by agricultural irrigation and canal seepage, in addition to how land use change will affect the shallow aquifer.

GWIP - Billings Groundwater Investigation Project

Locations and details about groundwater and surface-water monitoring sites, water quality data, and hydrogeologic map data in Billings, MT.

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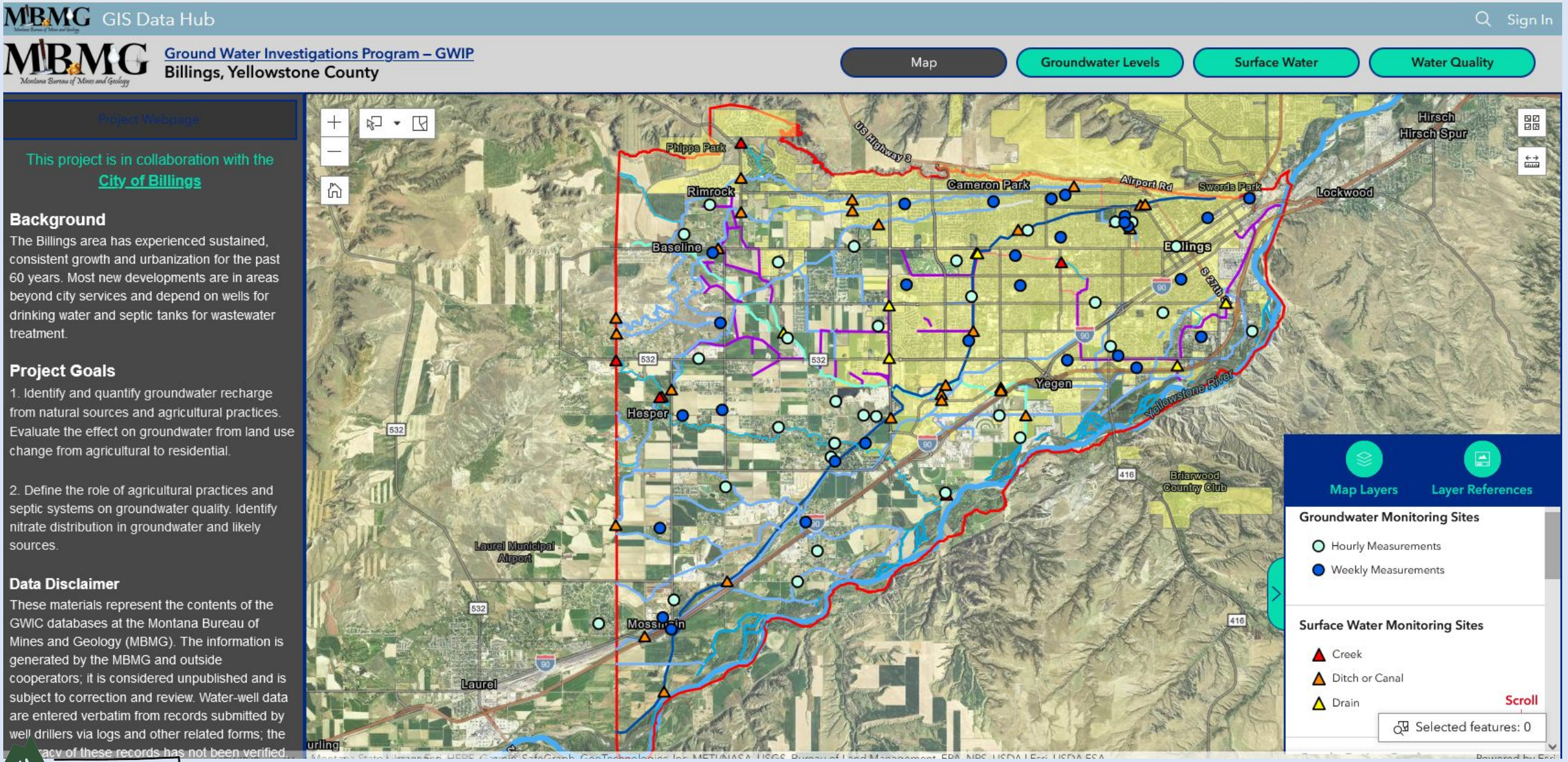

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https://gis-data-hub-mbmg.hub.arcgis.com/apps/52ea3f7210344db98fb5e1a9c
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MBMG GIS Data Hub

Sign In

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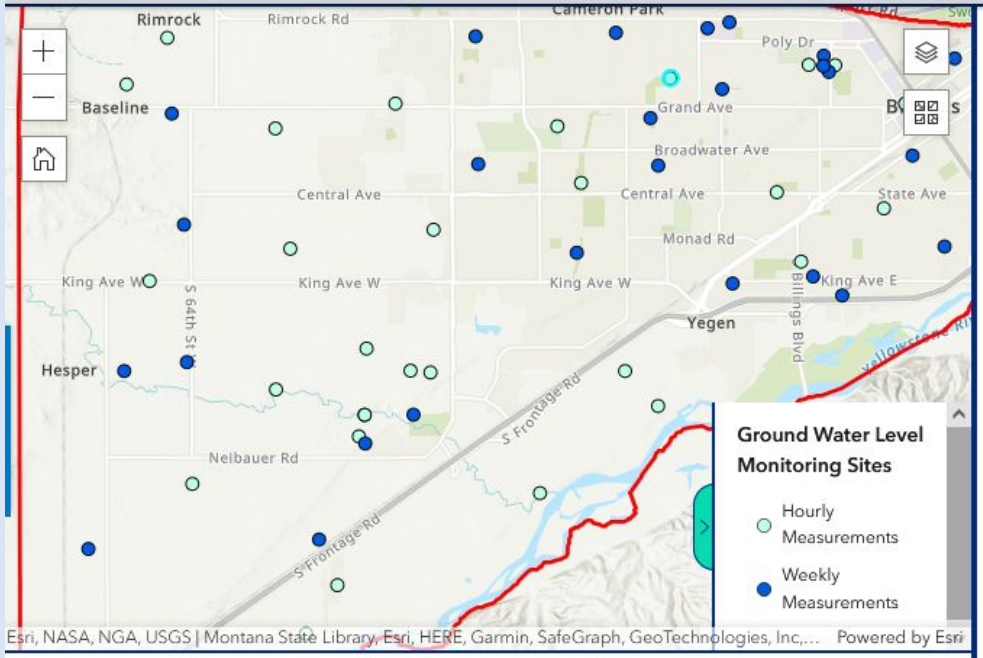
Ground Water Investigations Program – GWIP

Billings, Yellowstone County

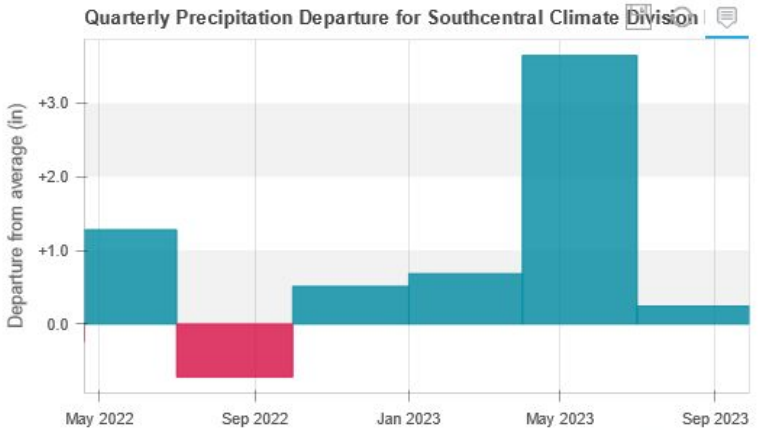
Map | Groundwater Levels | Surface Water | Water Quality

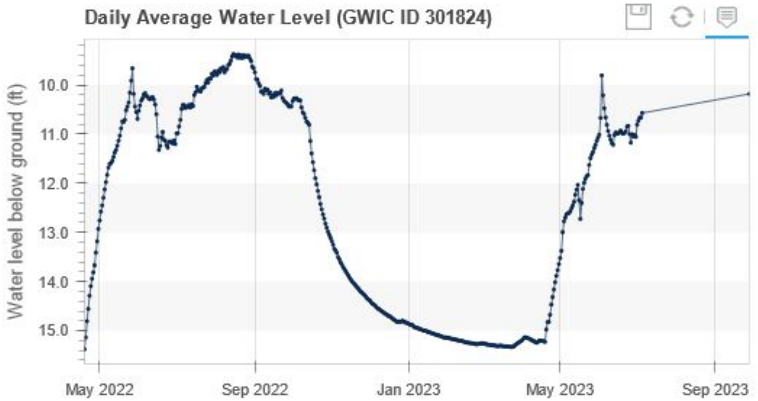


Ground Water Level Monitoring Sites

Site Name	Monitoring Type
SCHOOL DISTRICT #2 * ROSEPARK SCHOOL	Hourly Measurements

Hydrograph and Precipitation Display





GWIC ID 301824

Aquifer
112YRT3 — YELLOWSTONE RIVER TERRACE-3

Name
SCHOOL DISTRICT #2 ROSEPARK SCHOOL

Location

Legal Description	01N25E36CB
Latitude	45.78887
Longitude	-108.56593
Geomethod	SUR-GPS
Datum	NAD83

Total Depth 40 feet

Water Level Range 8 to 17 feet below ground

Measurements 10619

Period of Record
4/19/2022 1:37:00 PM - 9/28/2023 9:30:00 AM

Data reported are water levels in feet below ground

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Ground Water Investigations Program – GWIP

Billings, Yellowstone County

Map | Groundwater Levels | Surface Water | Water Quality

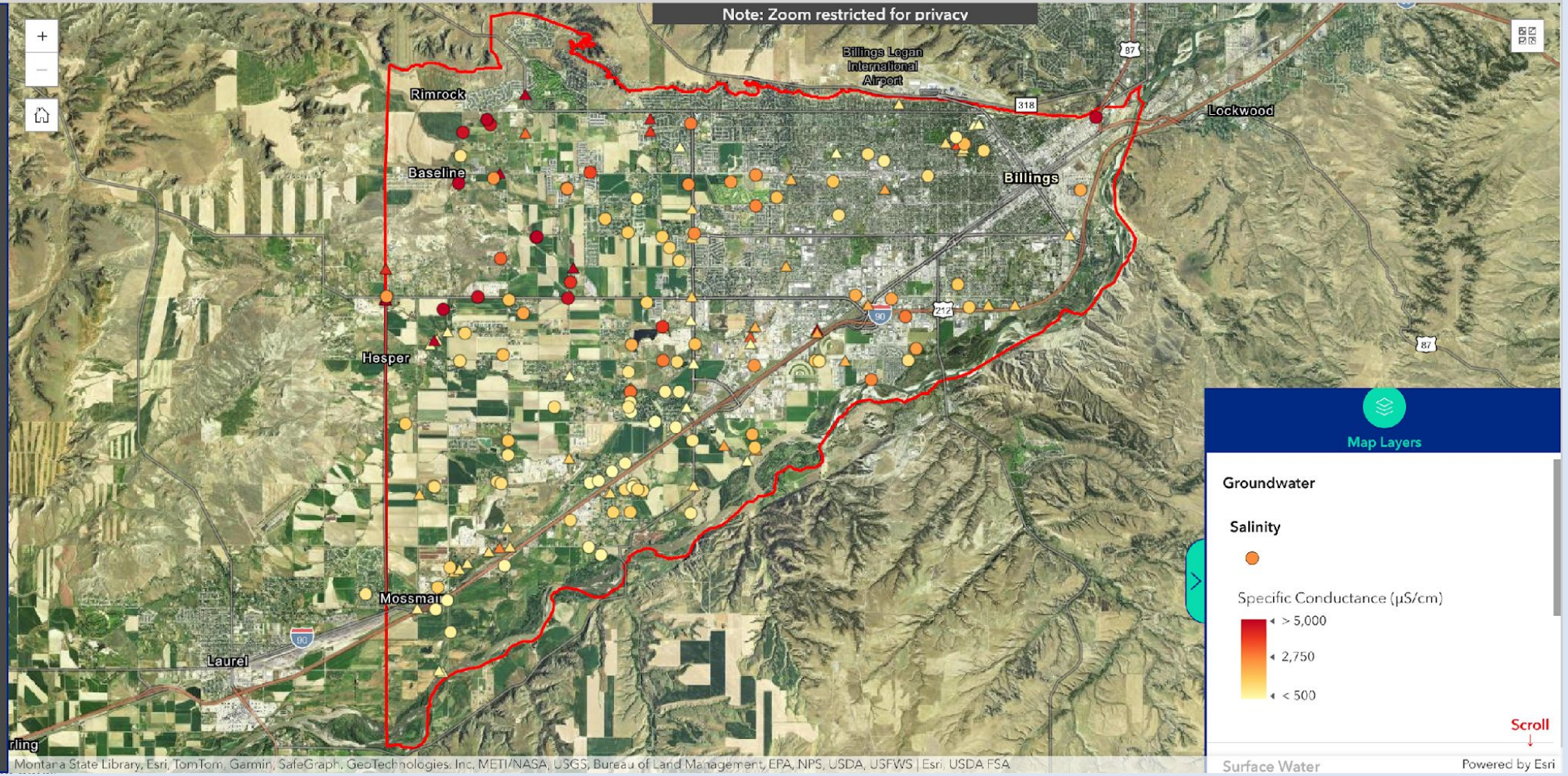
General Water Chemistry:

- Dominant Cations/Anions
- Salinity
- Field pH

Drinking Water Concerns:

- Arsenic
- Fluoride
- Manganese
- Nickel
- Nitrate
- Selenium
- Strontium
- Sulfate
- Uranium

Need information on drinking water standards?
EPA's National Primary Drinking Water Regulations



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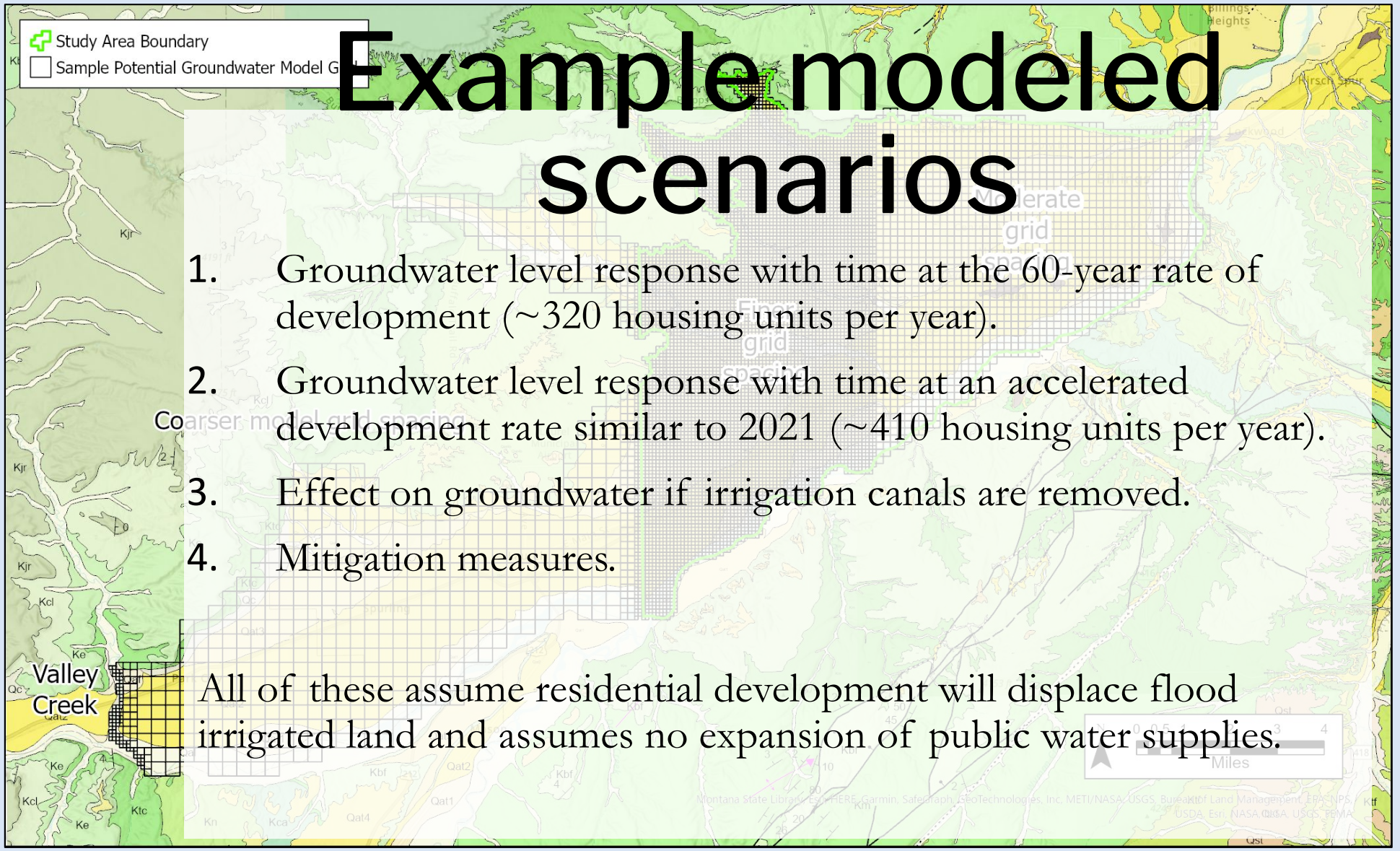
Model Construction



Example modeled scenarios

1. Groundwater level response with time at the 60-year rate of development (~320 housing units per year).
2. Groundwater level response with time at an accelerated development rate similar to 2021 (~410 housing units per year).
3. Effect on groundwater if irrigation canals are removed.
4. Mitigation measures.

All of these assume residential development will displace flood irrigated land and assumes no expansion of public water supplies.

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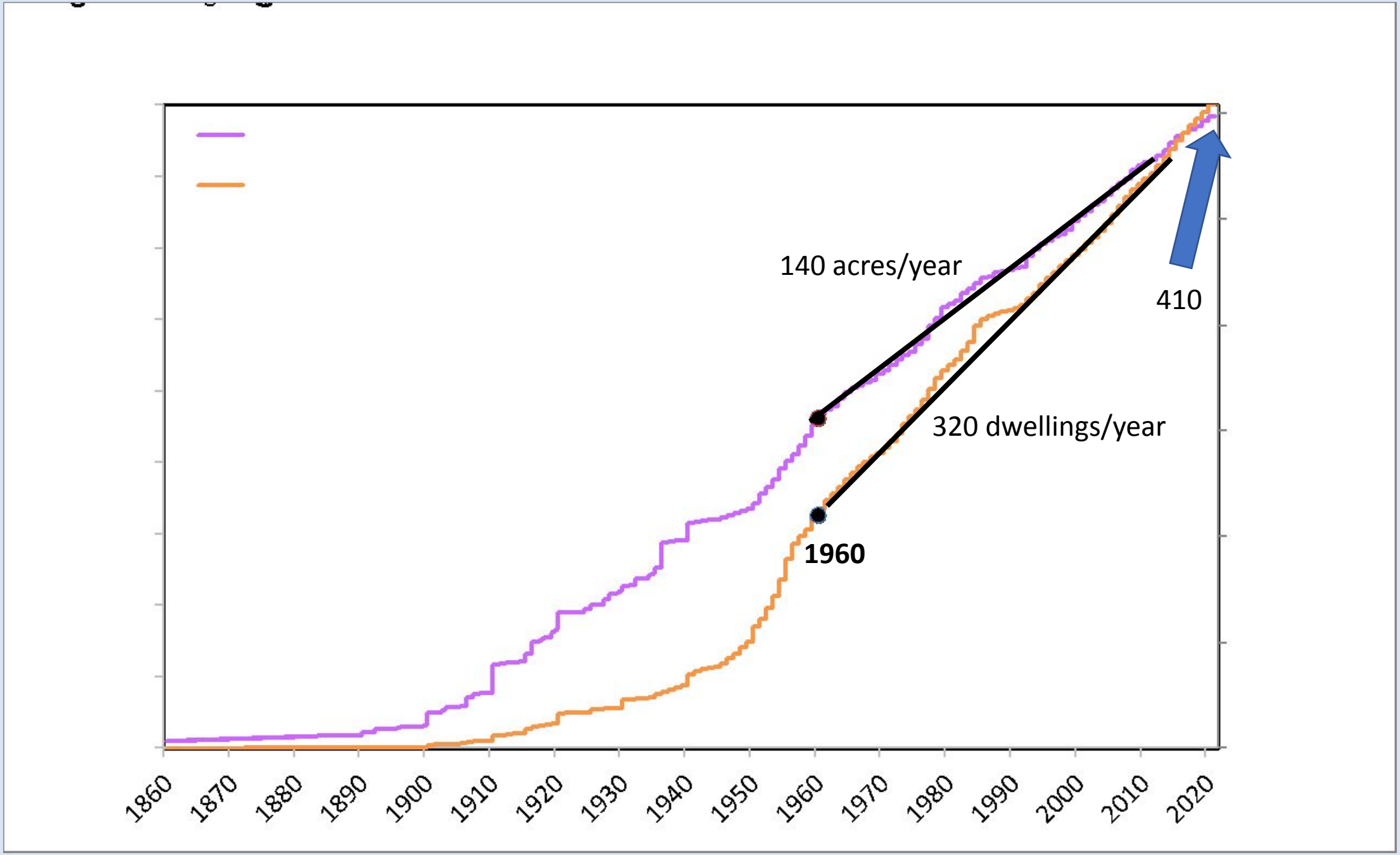
140 acres/year
410
320 dwellings/year
1960
1860
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020

For more on Billings:

- Brett Oliver
  - 10:20 The Billings Water Budget
- Kurt Zeiler
  - 12:40 Soil-Water Balance

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Thanks to our neighborhood partners:

- Irrigation Canal Companies
- Numerous private well owners and businesses

Contact:
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