

DNRC Criteria for Green, Yellow, Red Area Designation

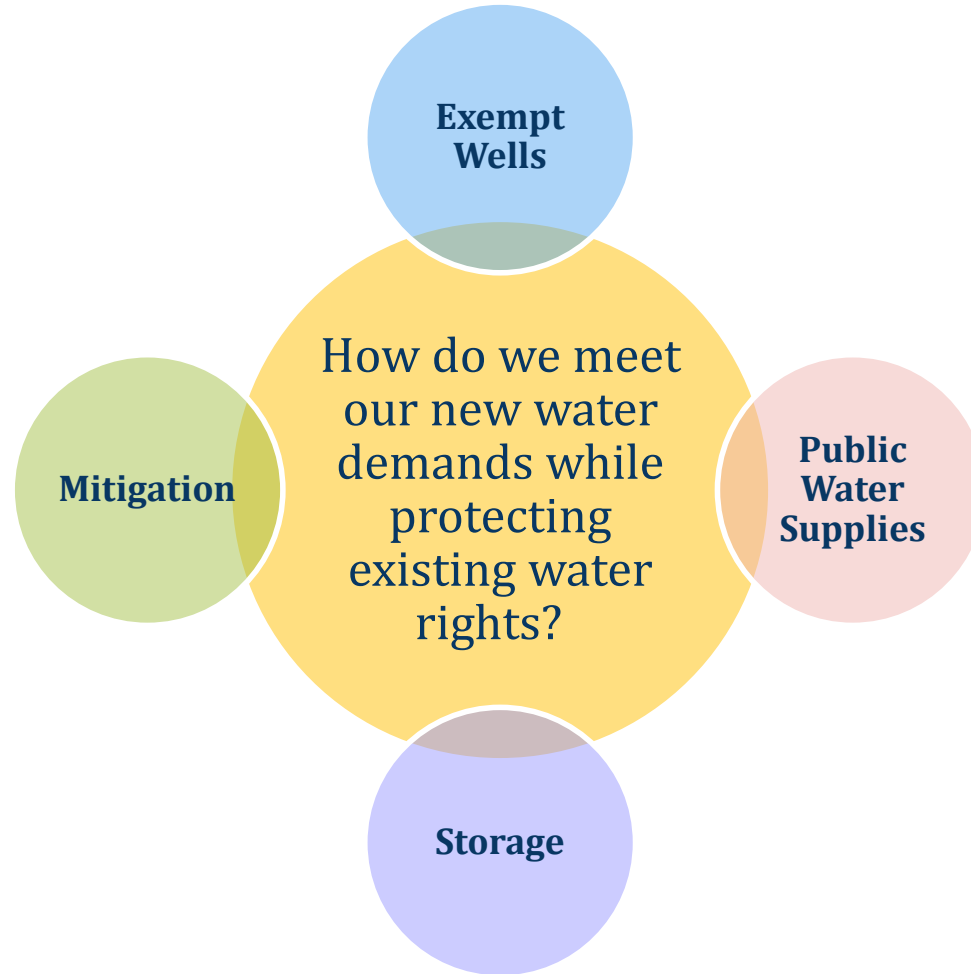


Water Planning and Growth and Exempt Wells
Stakeholder Working Group

Kalispell, MT

March 13, 2024

Recall



Not Discussing: Draft Policy Framework

Critical GW Areas (Red)

- Metering & measurement requirements
- No exceptions: permitting process or hook up to public water and sewer
- Exigent circumstances: What if you cannot get mitigation, cannot hook up, the real one-offs, what do you do?
- Enforcement requirements

Managed GW Areas (Yellow)

- Metering & measurement requirements
- Study only
- Could turn into red or green based on study
- Enforcement requirements
- Incentives (PWS, funding, mitigation)

Statewide (Green)

- Metering & measurement requirements
- Status quo for exempt wells
- Address phased development loophole and combined appropriation challenges
- Consider reducing volumes down to what is reasonable and necessary for domestic use
- Stock tank carveout
- Evaluate DNRC standards and update them for accuracy
- Enforcement requirements



Overview: Science

Water Quality

Groundwater quantity
limitations metrics

Groundwater connection
to surface water with
physical/legal availability
limitations metrics

Measurement,
Monitoring, and Studies



Categories for designation of red and yellow areas

Water Quality

Groundwater quantity
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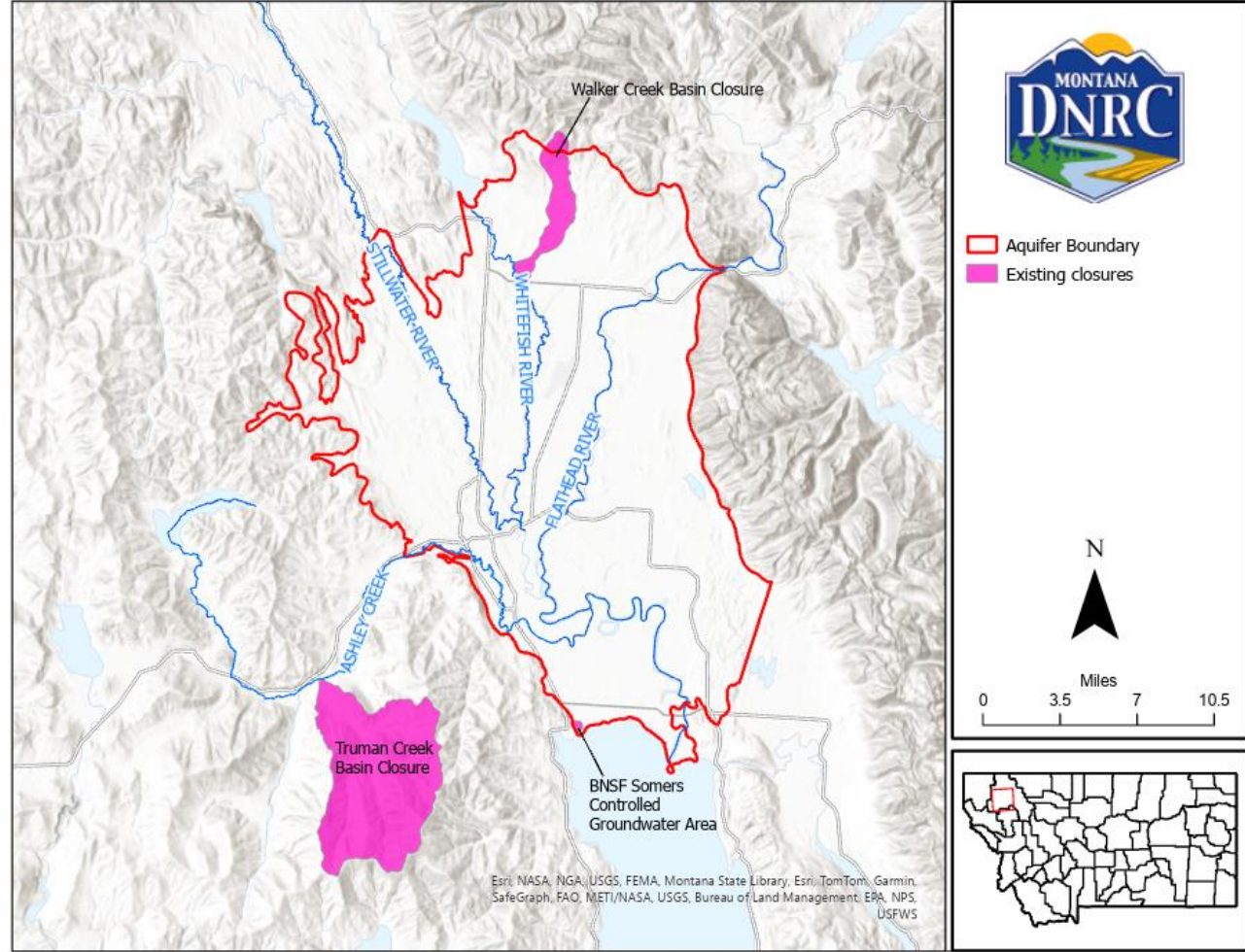


Category: Water Quality

Existing Controlled Groundwater Areas (CGWA)

CGWA have traditionally been used for groundwater **quality** issues and will continue to be a tool to address these issues on a case-by-case basis.

Each unique CGWA would have controls that are tailored to the issue.



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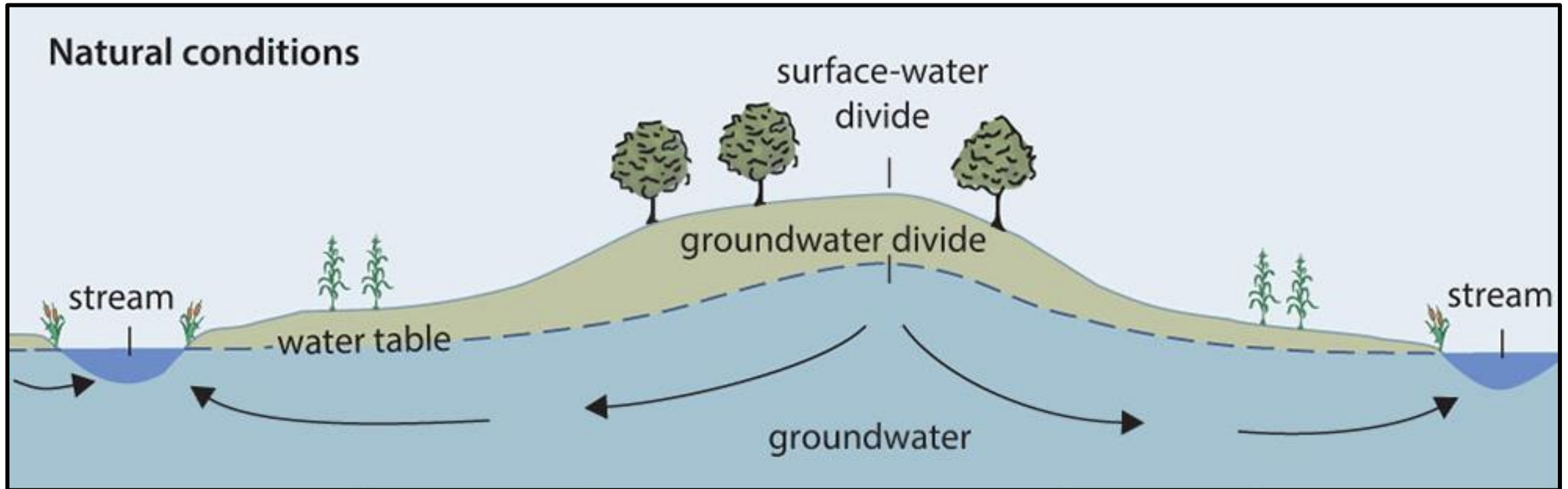


Understanding Groundwater Quantity

Water Budget (Inputs = Outputs)

All sources of recharge +/- change in storage = all sources of discharge

Physical availability of groundwater or the annual flux



Category: GW Quantity Limitation Metrics

Metric	<ul style="list-style-type: none"> No Documented Problem Statewide scale monitoring Least restrictive controls 	<ul style="list-style-type: none"> Moderate documented problem Enhanced study/monitoring needs Some restrictions or controls may be needed to reduce or reverse problem 	<ul style="list-style-type: none"> Significant documented problem Enhanced study/monitoring needs Restrictive controls are necessary to stop expansion of the problem
Groundwater Level Trends	- No decreasing trend	- A trend is observed but is statistically insignificant	- A statistically significant decreasing water level trend has been documented
Groundwater discharge to hydrologically connected sources	- No known information exists about decreasing groundwater discharge trend	<ul style="list-style-type: none"> Groundwater discharge trend is documented but is statistically insignificant Reductions in groundwater discharge may have a moderately negative impact on surface water features 	<ul style="list-style-type: none"> A statistically significant decrease in groundwater discharge has been documented Reductions in groundwater discharge will have a significant negative impact on surface water features
Recharge and Regional Groundwater flow	- Recharge is predominately from natural sources, is consistent or increasing, unaffected by extraction	- Natural or artificial recharge is decreasing or, recharge is reliant on induced infiltration	
Aquifer storage potential	- Geologic formation or structure has large storage capacity or high potential for storage (e.g. alluvial aquifers)	- Formation or structure with limited storage or potential for storage (e.g., bedrock aquifers, perched or shallow aquifers)	



Category: GW Quantity Limitation Metrics

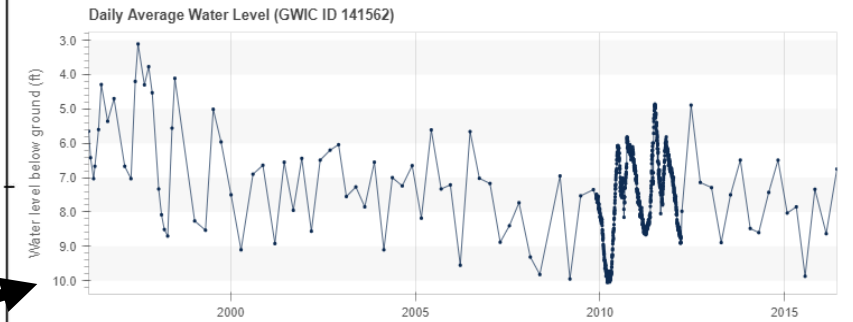
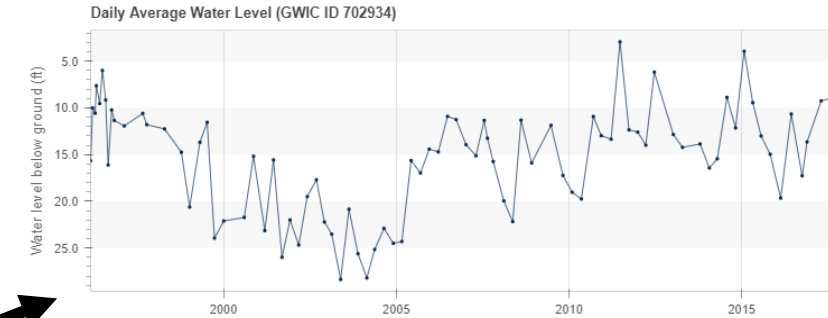
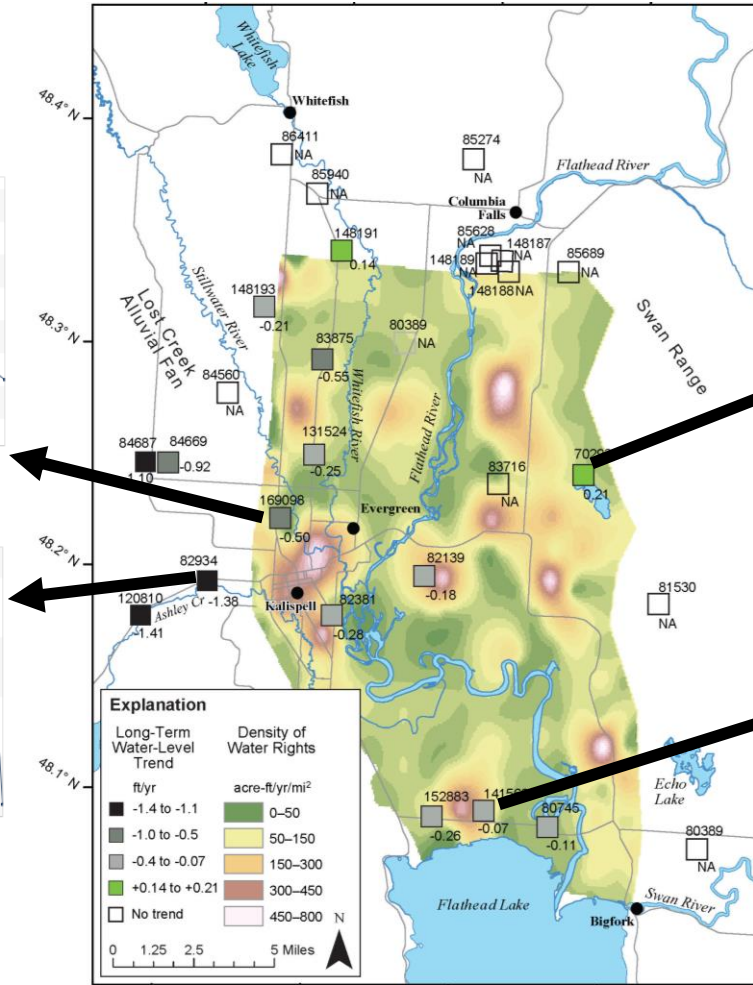
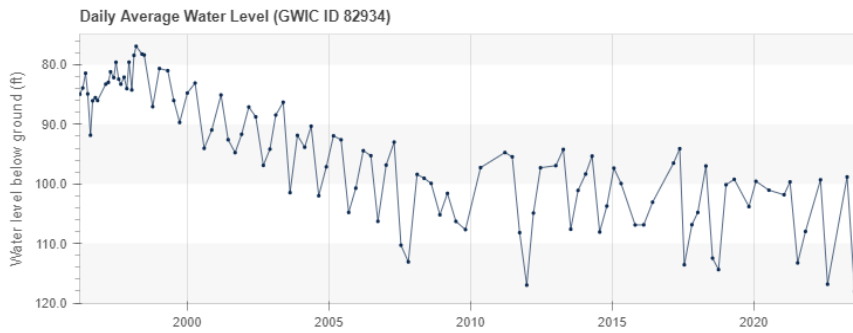
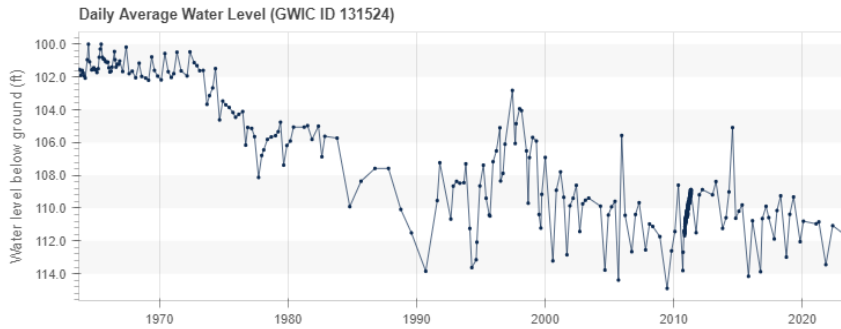
Groundwater Quantity Metrics	Science to Quantify Metrics	Time and Investment
Groundwater Level Trends	<ul style="list-style-type: none"> • Monitoring <ul style="list-style-type: none"> ✓ Non-real-time water levels ✓ Real-time water levels 	Low to medium
Recharge and Regional Groundwater Flow (basin wide water budgets)	<ul style="list-style-type: none"> • Precipitation gages • Long-term water level data analysis • Basin water balance study • 3D regional groundwater models 	Medium to high
Groundwater discharge to surface water	<ul style="list-style-type: none"> • Measurement (ex. springs, gaining streams) • Hydrograph separation techniques • 2D hydraulic modeling 	Low to medium
Aquifer storage potential	<ul style="list-style-type: none"> • Aquifer Pumping Tests Well drilling and logging • Geophysical methods • 3D regional groundwater models 	Medium to high



GW Quantity Limitations: Flathead Aquifer

Groundwater level trends

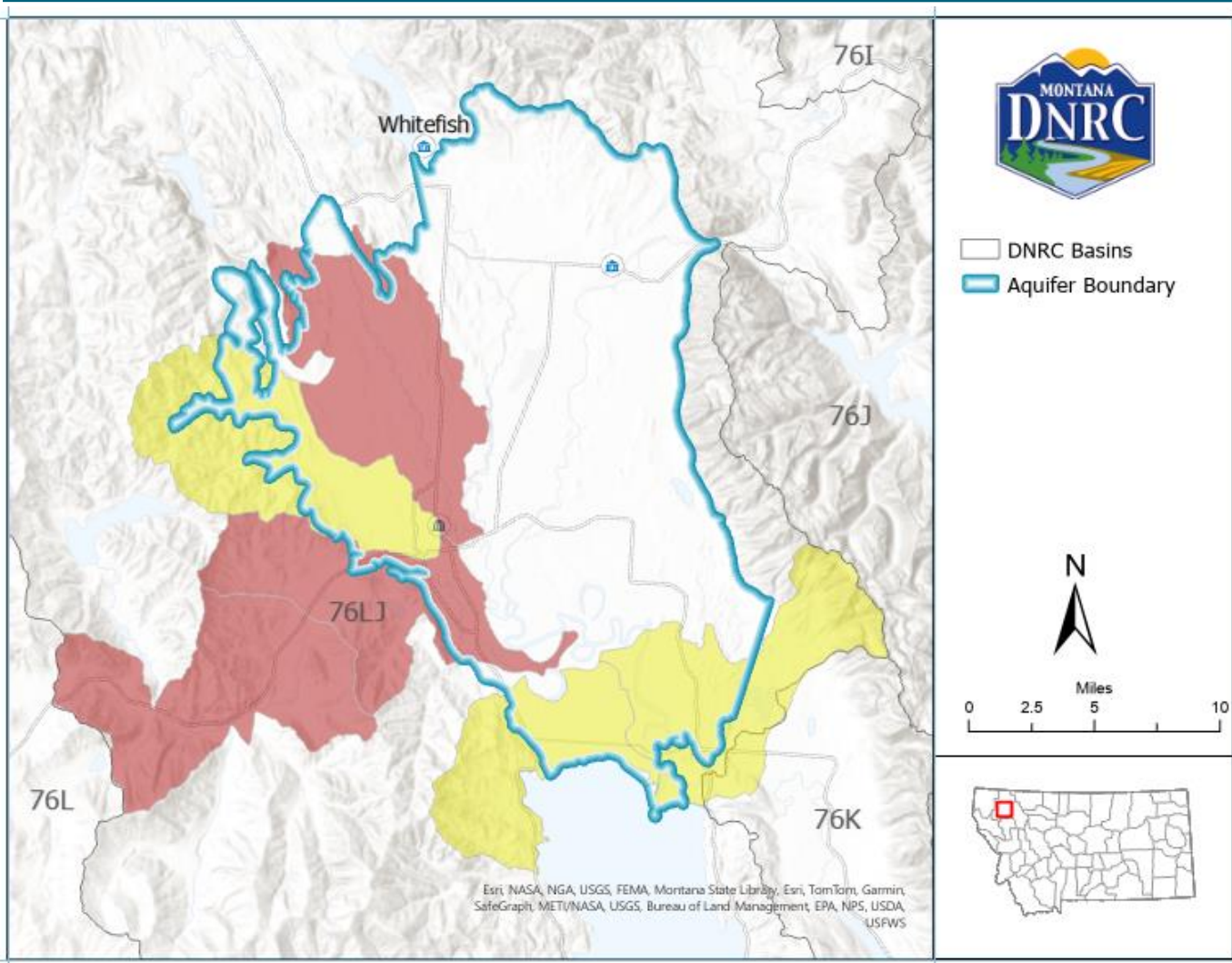
- ✓ A significant decreasing water level trend has been documented (in some areas)



*Map modified from MBMG Report of Investigation 32 (Rose et al. 2022)



GW Quantity Limitations: Flathead Aquifer



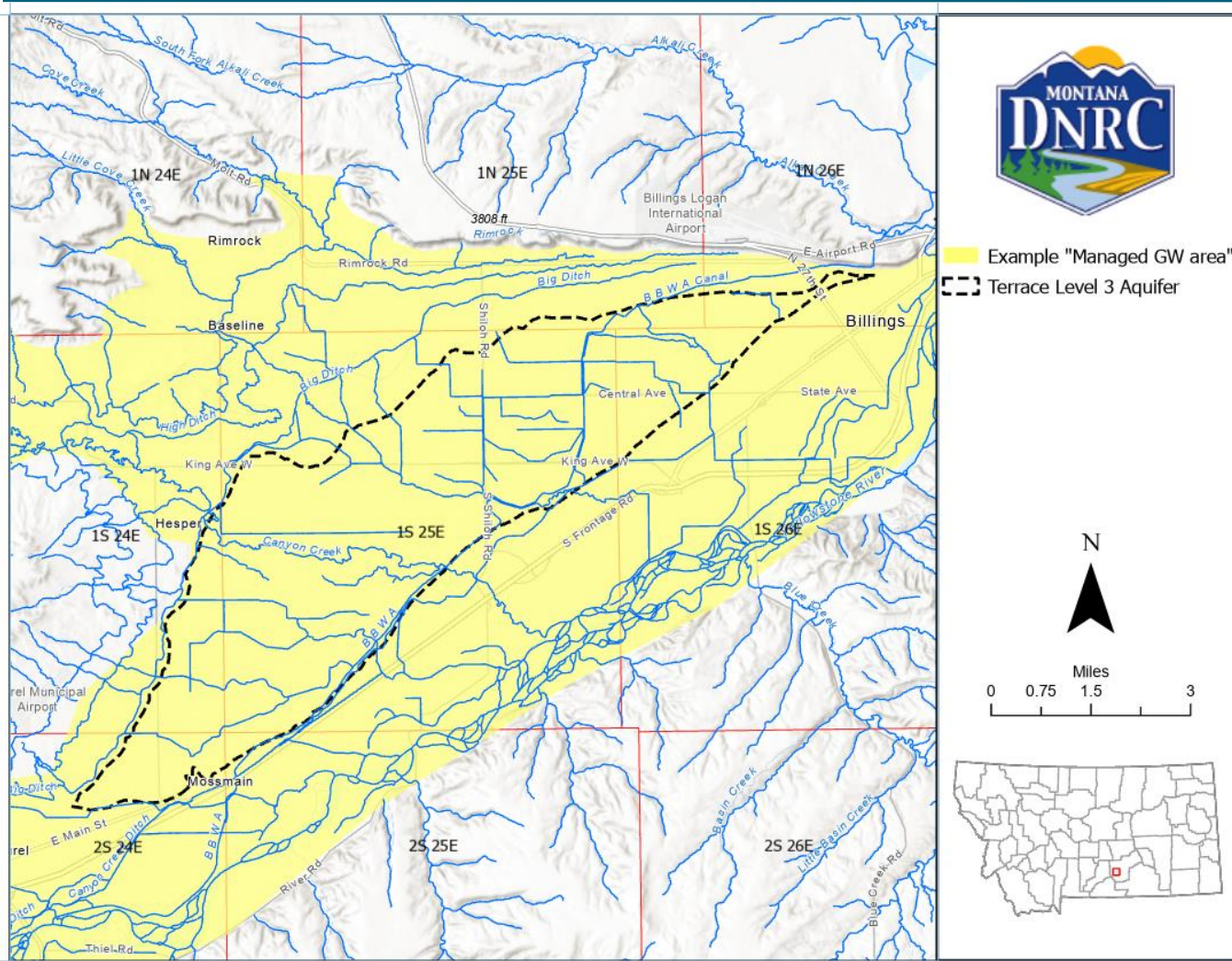
Groundwater Level Trends

- ✓ A trend is observed but is statistically insignificant.
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Metric	<ul style="list-style-type: none"> • No Documented Problem • Statewide scale monitoring • Least restrictive controls 	<ul style="list-style-type: none"> • Moderate documented problem • Enhanced study/monitoring needs • Some restrictions or controls may be needed to reduce or reverse problem 	<ul style="list-style-type: none"> • Significant documented problem • Enhanced study/monitoring needs • Restrictive controls are necessary to stop expansion of the problem
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GW Quantity Limitations: Billings Aquifer



Recharge and Regional Groundwater flow

- ✓ Aquifer is dependent on artificial recharge and is vulnerable to land-use changes

Aquifer storage potential

- ✓ Aquifer has low to moderate storage

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GW Quantity Limitation Metrics: Discussion & Next Steps

SWG - Do these metrics seem reasonable?

DNRC action items & SWG will provide feedback

- Developing basin studies and long-term monitoring plan for all focus aquifers (in collaboration with MBMG & USGS)
- Creating a systematic analysis plan:
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Categories for designation of red and yellow areas

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Category: GW/SW Connection Physical/Legal Availability Limitations

“After sufficient time has elapsed for the cone (of depression) to reach the areas of natural discharge, further discharge by wells will be made up in part by a diminution in the natural discharge. If this natural discharge fed surface streams, **prior rights to the surface water may be injured**” USGS, 1940

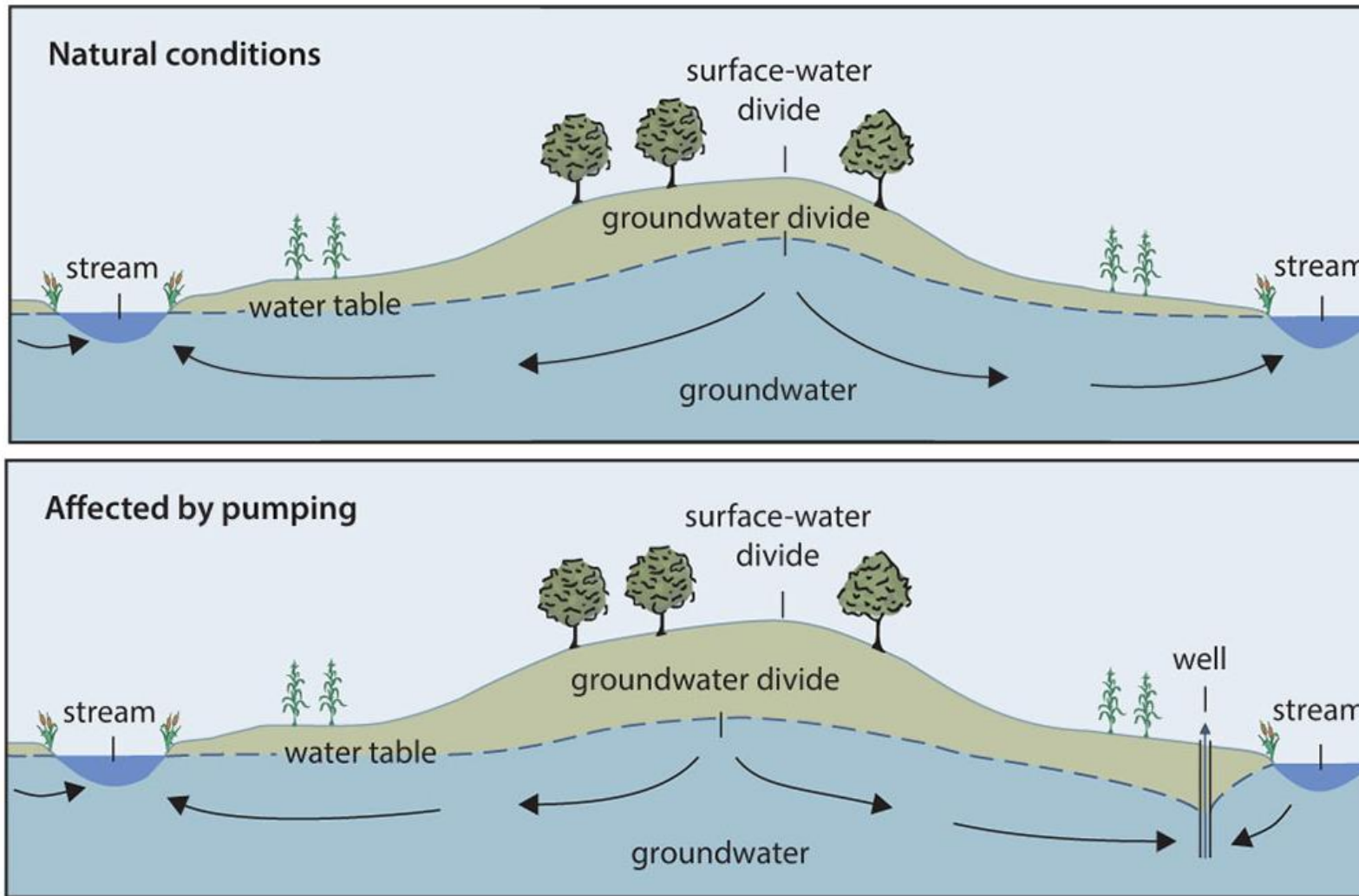
Groundwater consumption results in **capture** of discharge to surface water USGS, 1972

Trout Unlimited vs. DNRC, 2006 affirmed that pre-stream **capture of groundwater depletes surface water** and may harm senior rights

(order No 05-069)



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Surface Water Legal Availability	Legal demand on connected surface water is at least 10% below the median of the mean monthly flow rate (physical availability) for all months	Legal demand on connected surface water is within 10% above or below the median of the mean monthly flow rate (physical availability) for all months.	Legal demand on connected surface water exceeds 10% of the median of the mean monthly flow rate (physical availability) for any month

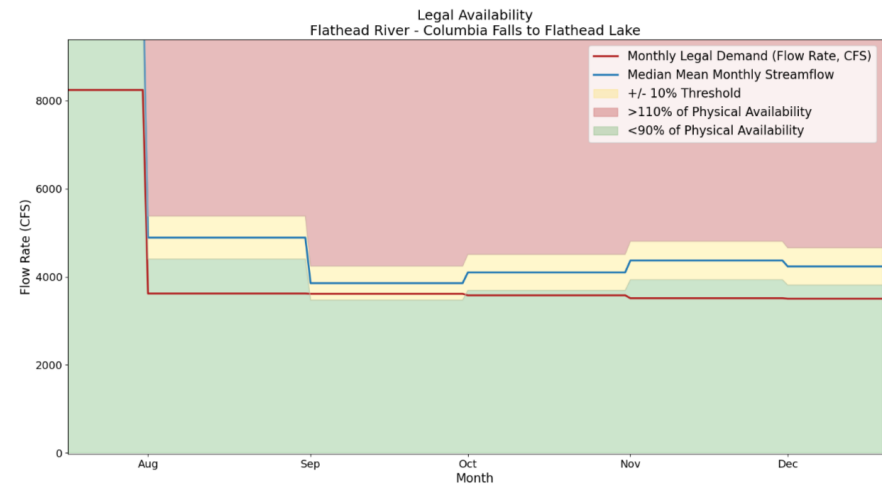
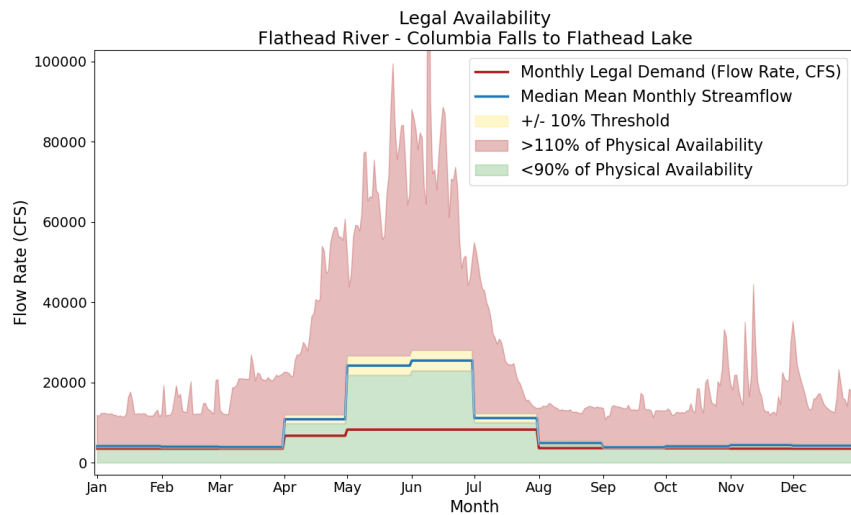
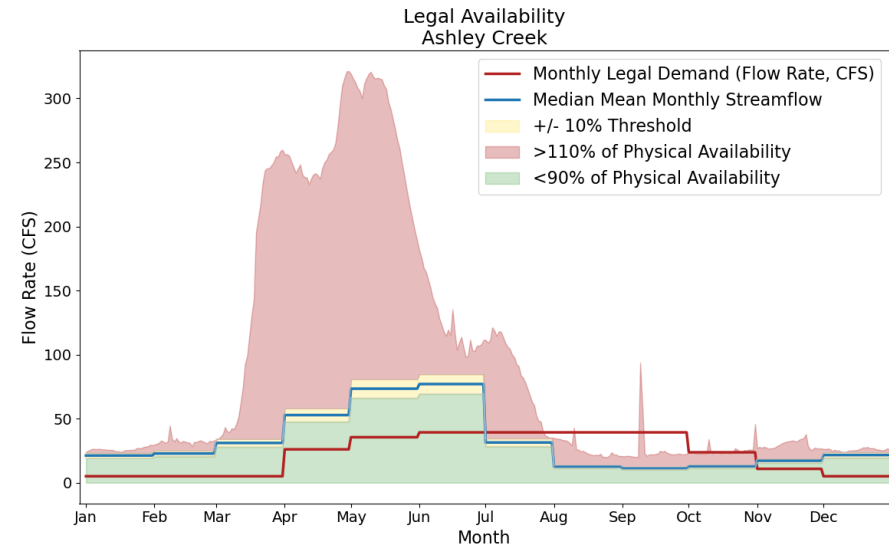
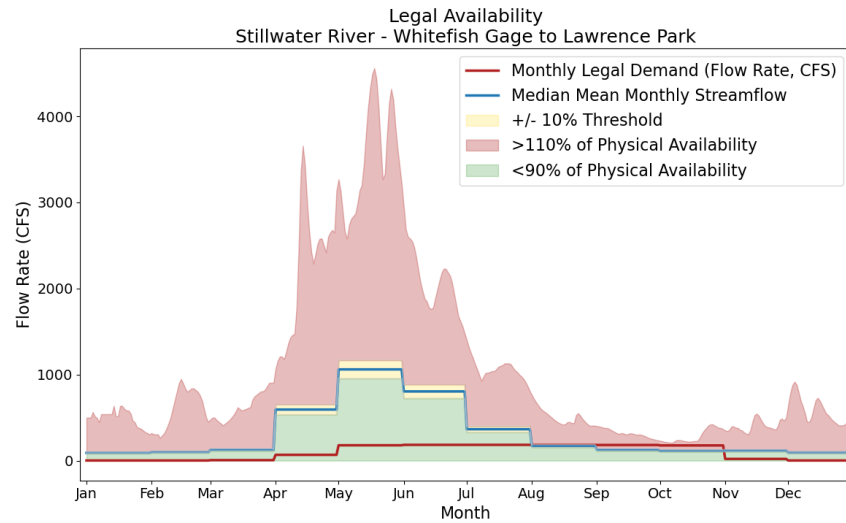


Category: GW/SW Connection Physical/Legal Availability Limitations

Groundwater Connection to Surface Water with limited Physical/Legal Availability Metric	Science to Quantify Metrics	Time and Investment
Surface Water Flow	<ul style="list-style-type: none"> • Monitoring <ul style="list-style-type: none"> ✓ Real-time Stream Gages • Basin Study <ul style="list-style-type: none"> ✓ Mapping and Measuring ✓ River System Modeling 	<ul style="list-style-type: none"> • Low to medium • Medium to high
DNRC Legal Demand Calculation	<ul style="list-style-type: none"> • Quantify the Legal Water Rights • Measurement <ul style="list-style-type: none"> ✓ Reduce assumptions and uncertainties 	<ul style="list-style-type: none"> • Low to medium



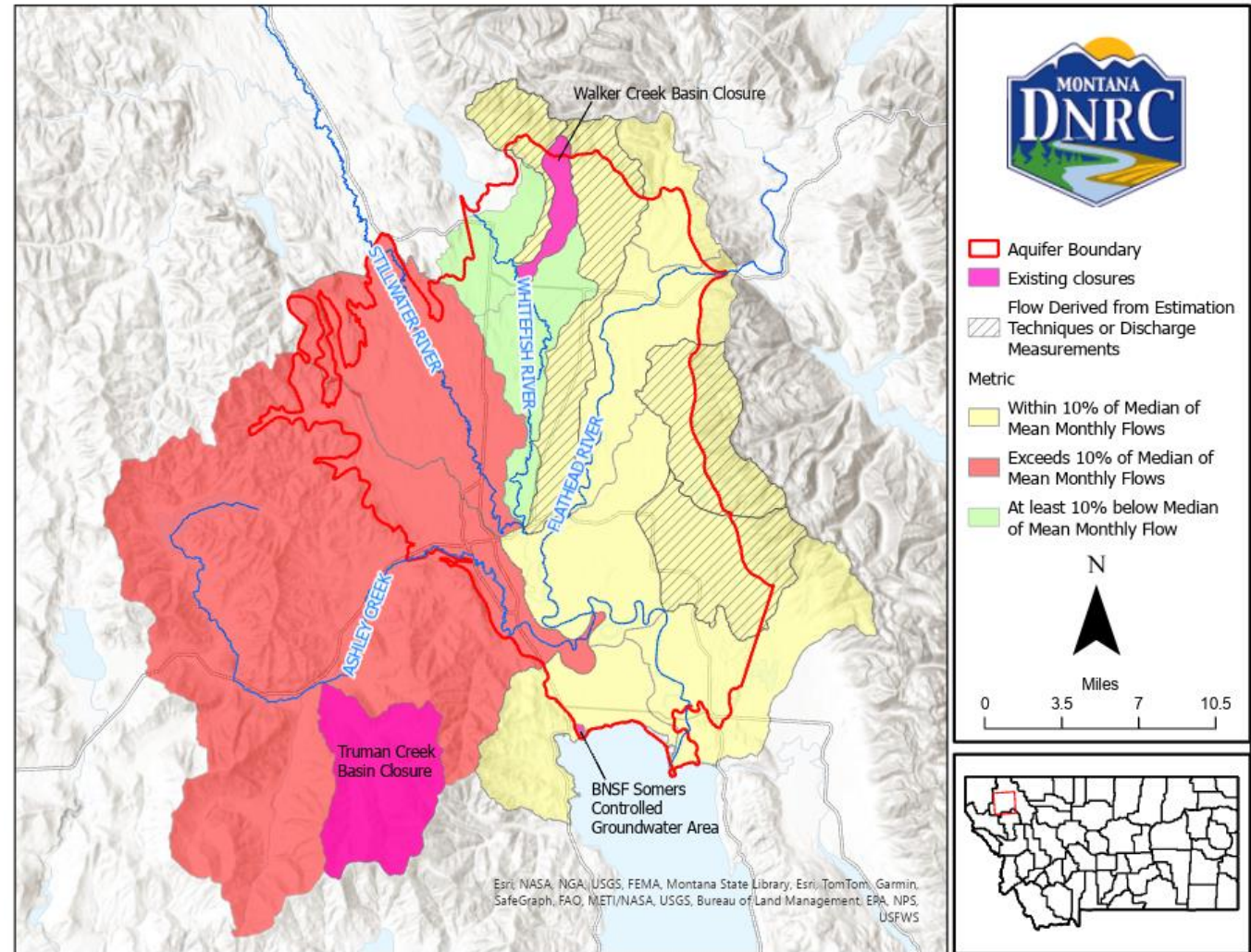
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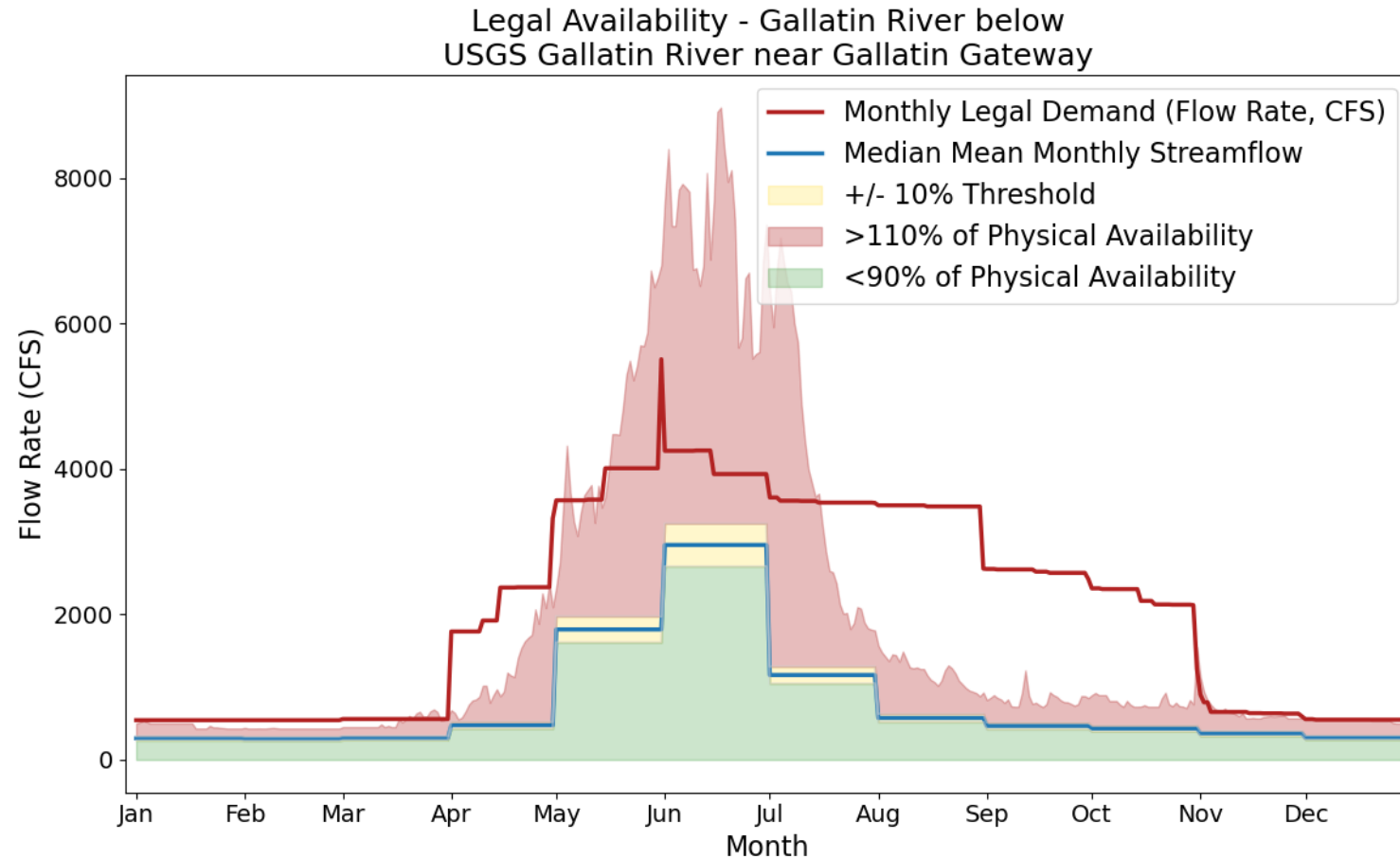
Category: GW/SW Connection Physical/Legal Availability Limitations

Flathead Aquifer - Deep and Shallow Aquifer's Connection to Surface Water with Limited Legal Availability

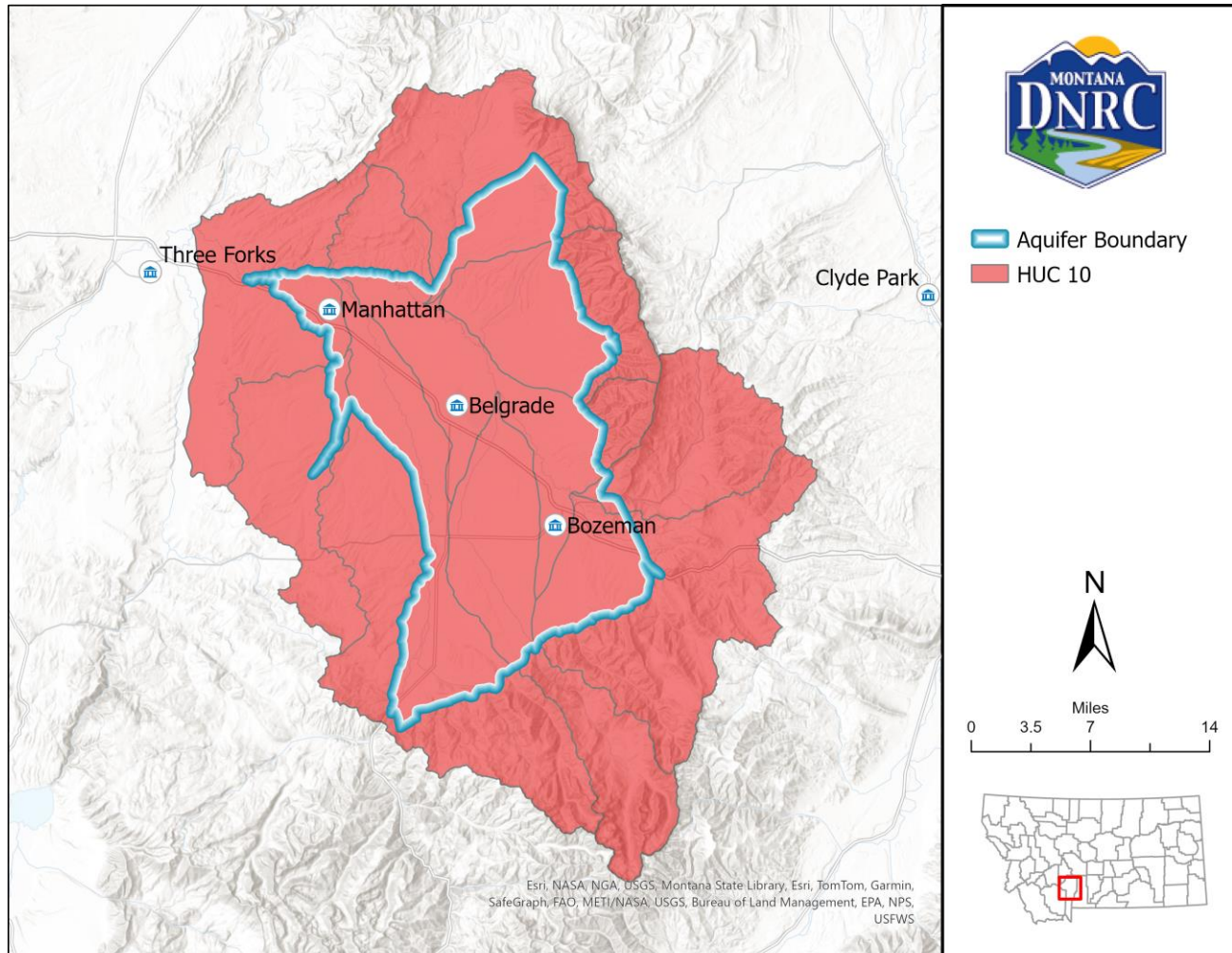
*Boundaries are snapped to HUC 12



Category: GW/SW Connection Physical/Legal Availability Limitations



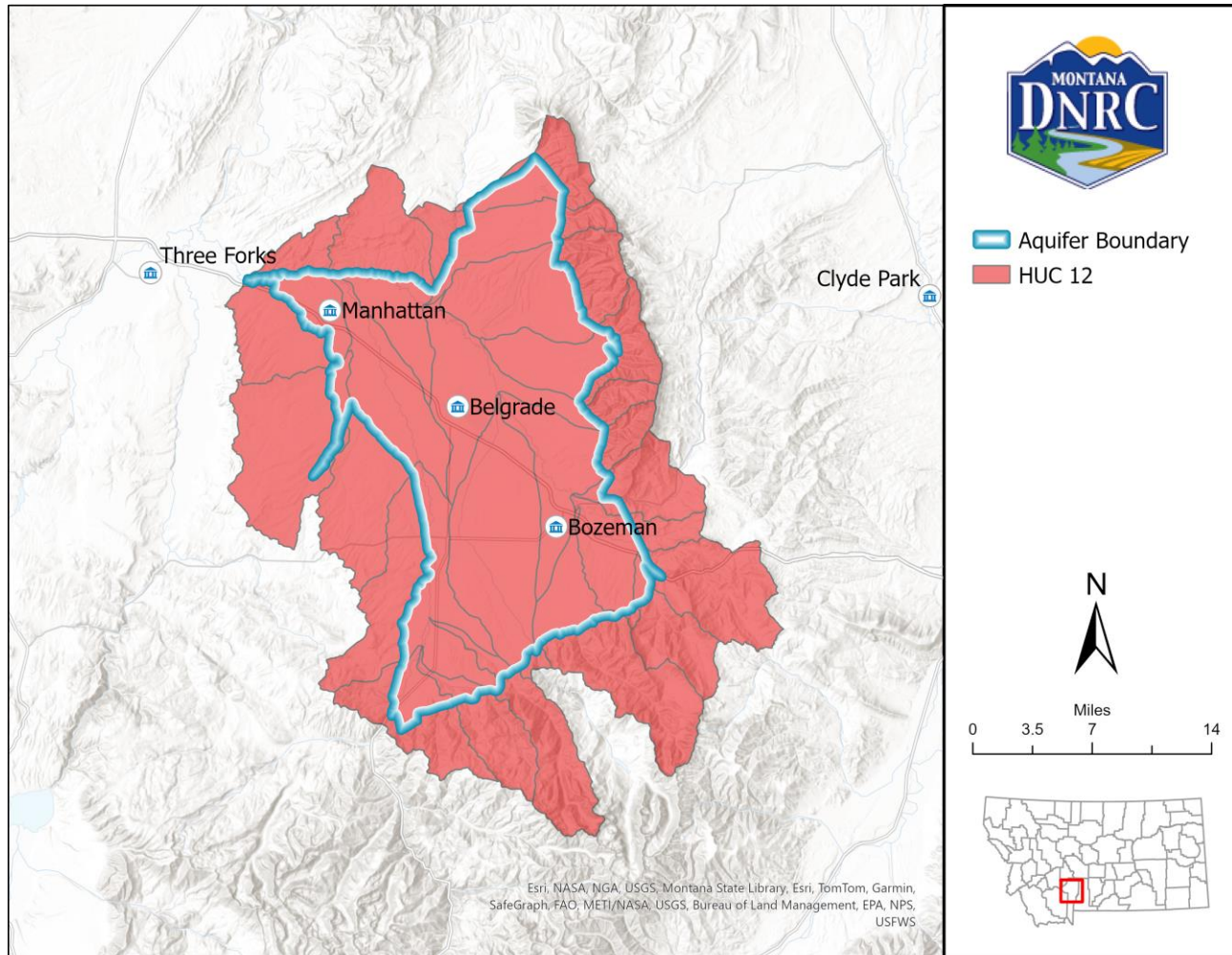
Surface Water Legal Availability: Gallatin Focus Aquifer (HUC 10)



- ✓ Legal demand on connected surface water exceeds 10% of the median of the mean monthly flow rate (physical availability) for any month



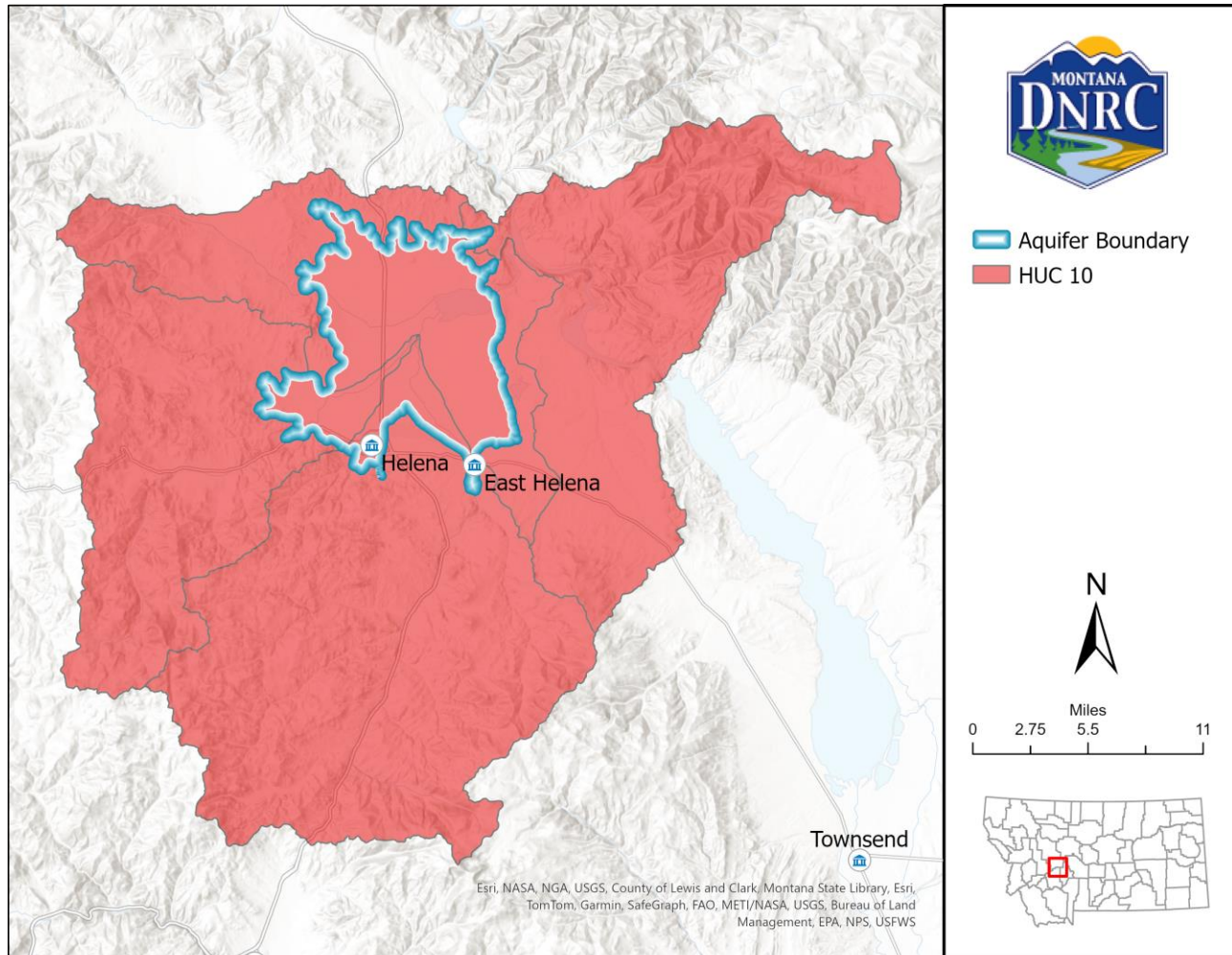
Surface Water Legal Availability: Gallatin Focus Aquifer (HUC 12)



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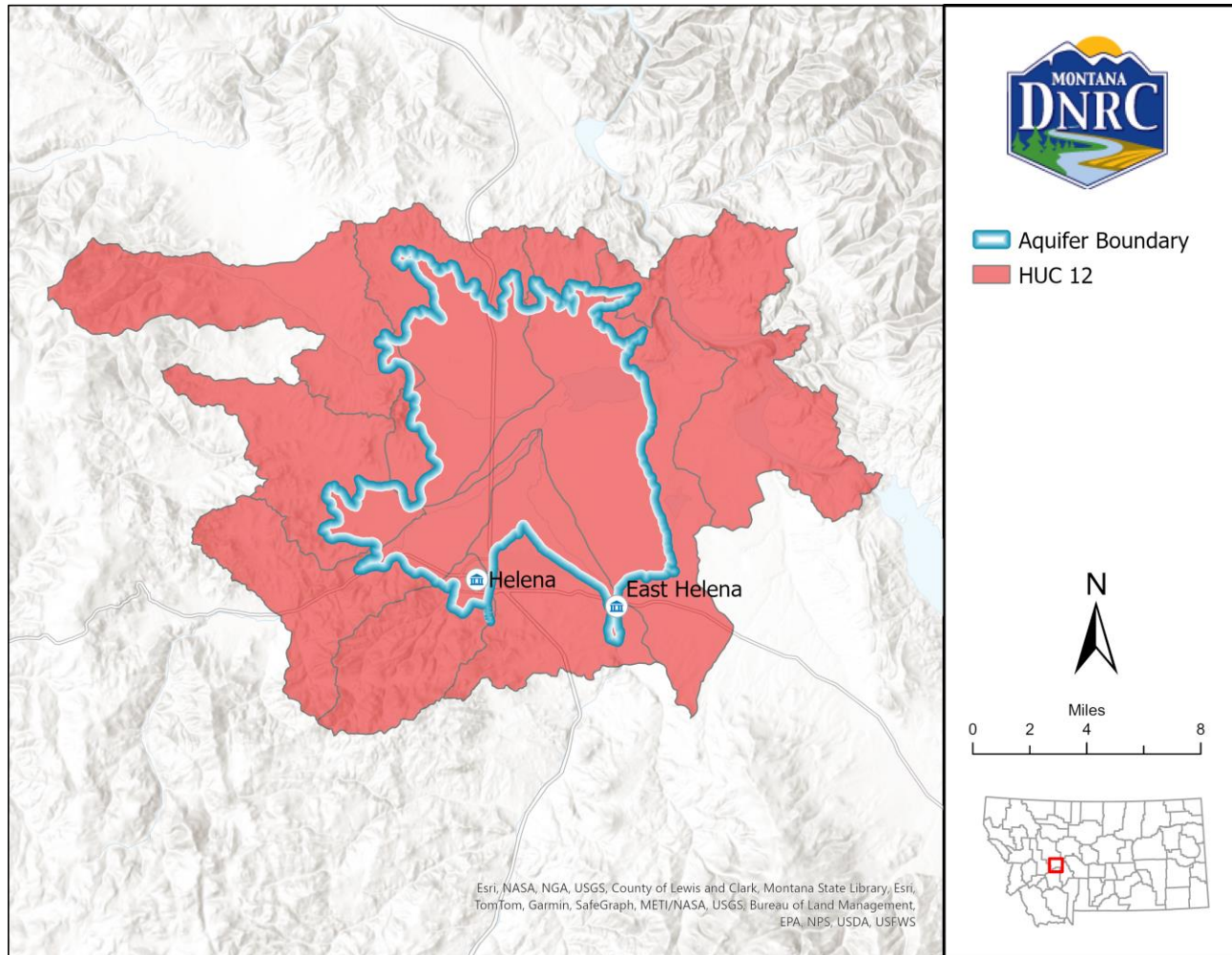
Surface Water Legal Availability: Helena Focus Aquifer (HUC 10)



- ✓ Legal demand on connected surface water exceeds 10% of the median of the mean monthly flow rate (physical availability) for any month



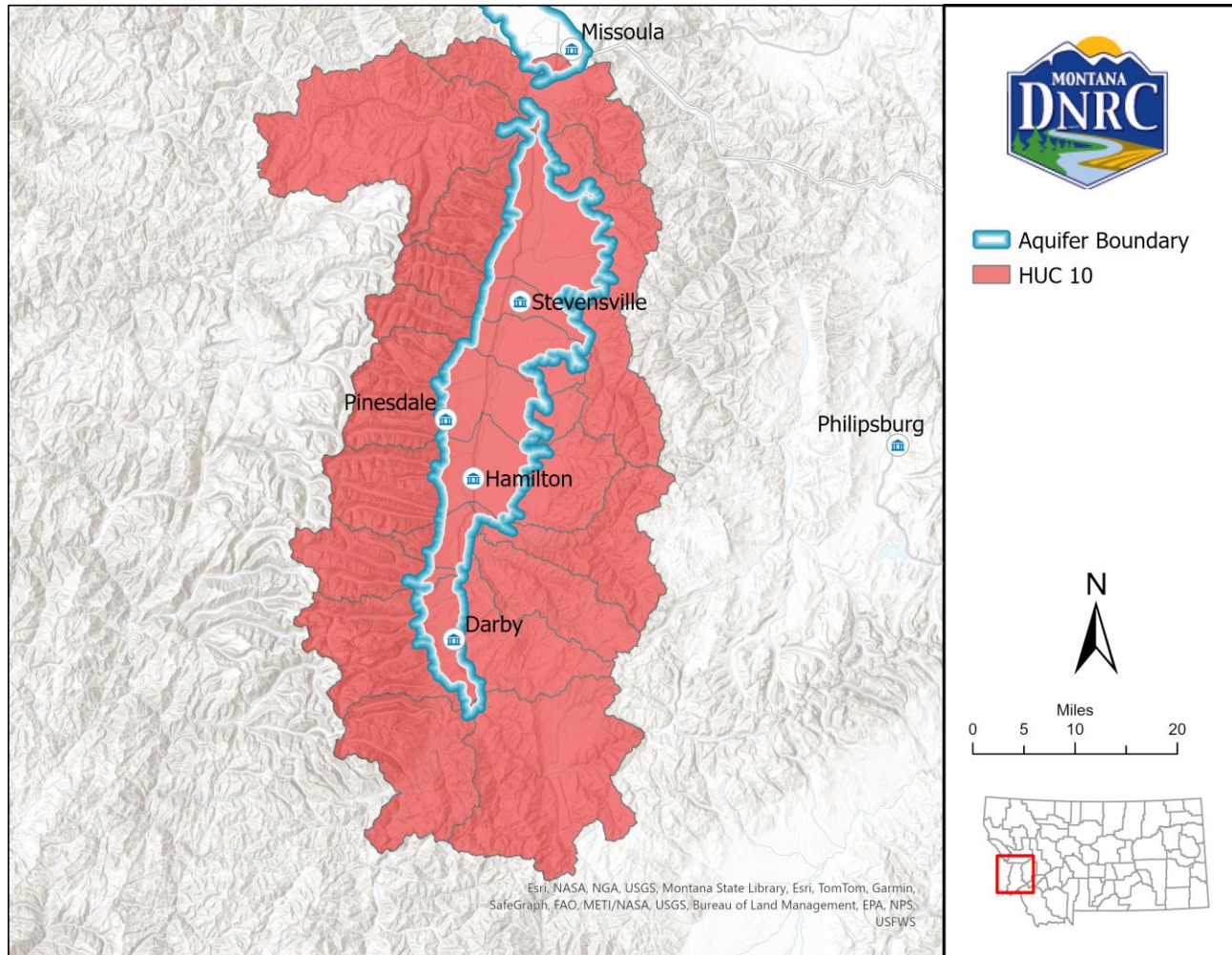
Surface Water Legal Availability: Helena Focus Aquifer (HUC 12)



- ✓ Legal demand on connected surface water exceeds 10% of the median of the mean monthly flow rate (physical availability) for any month



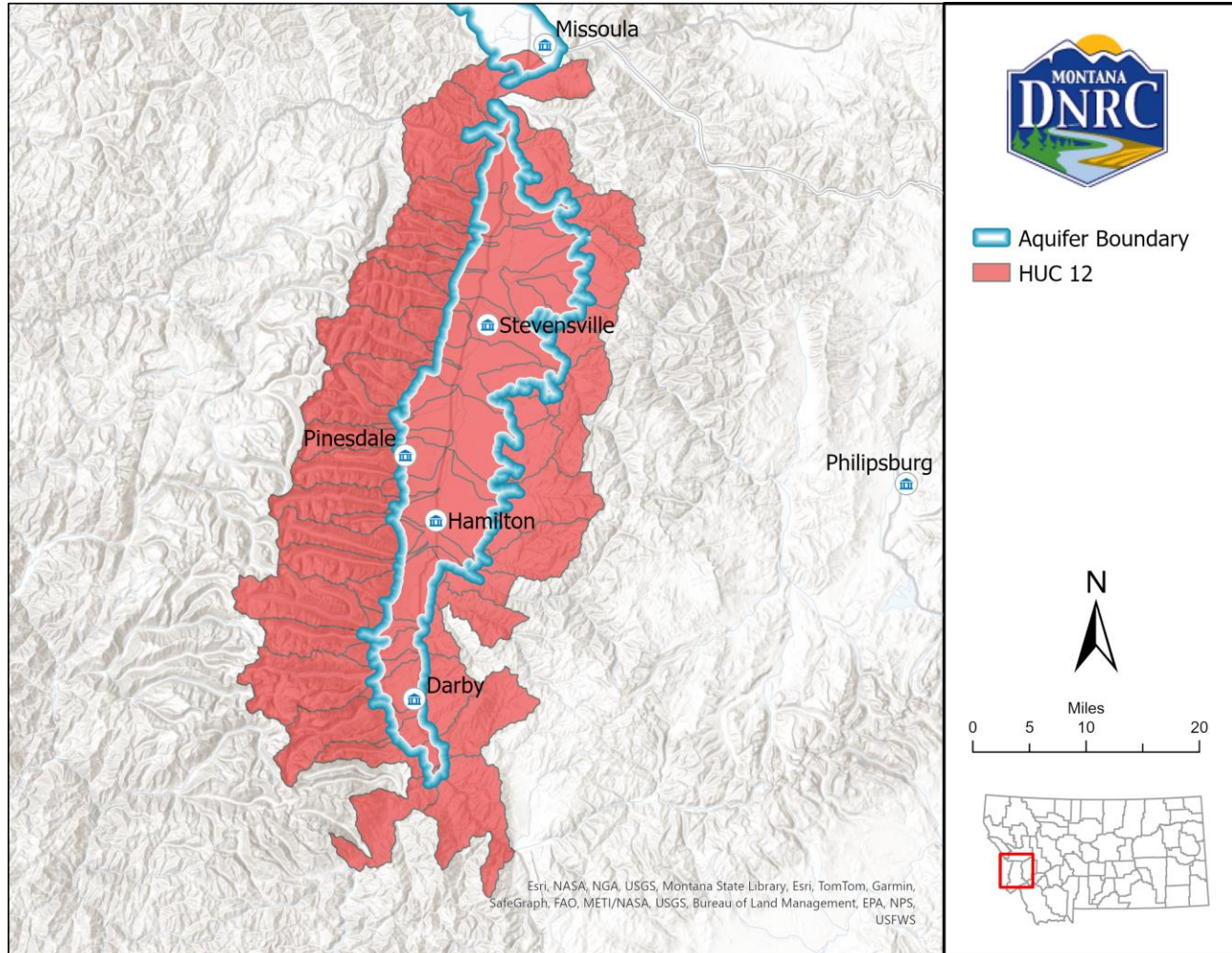
Surface Water Legal Availability: Bitterroot Focus Aquifer (HUC 10)



- ✓ Legal demand on connected surface water exceeds 10% of the median of the mean monthly flow rate (physical availability) for any month



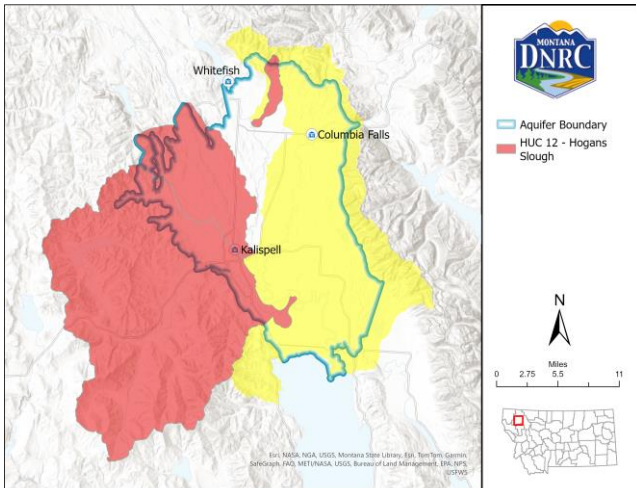
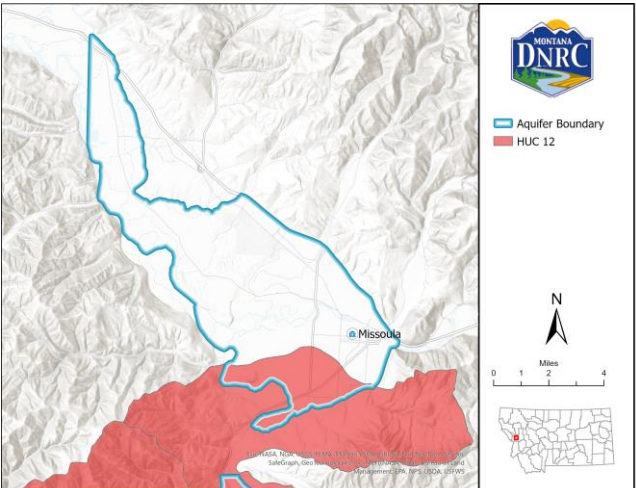
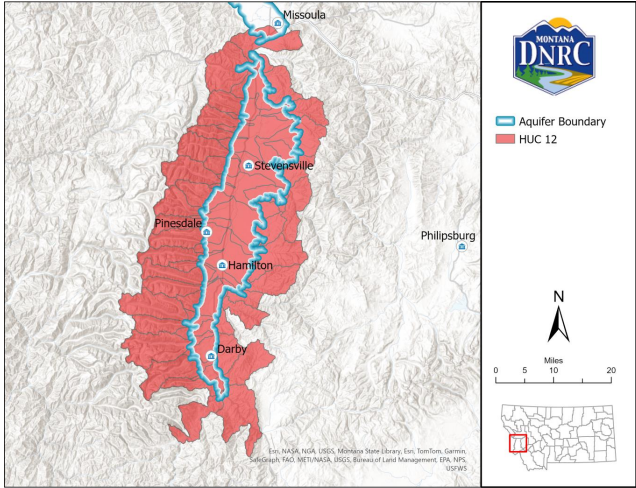
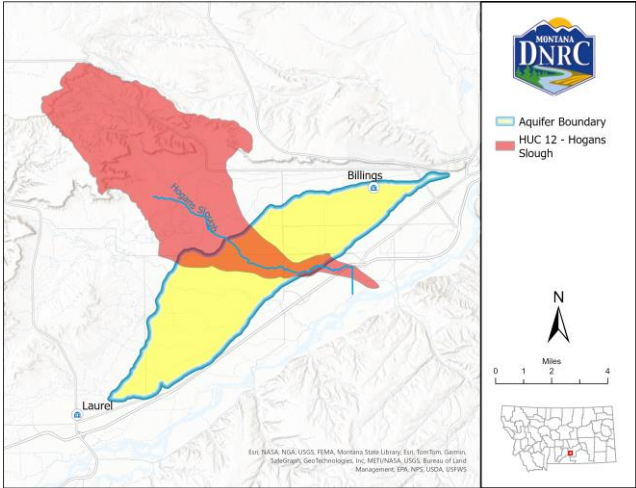
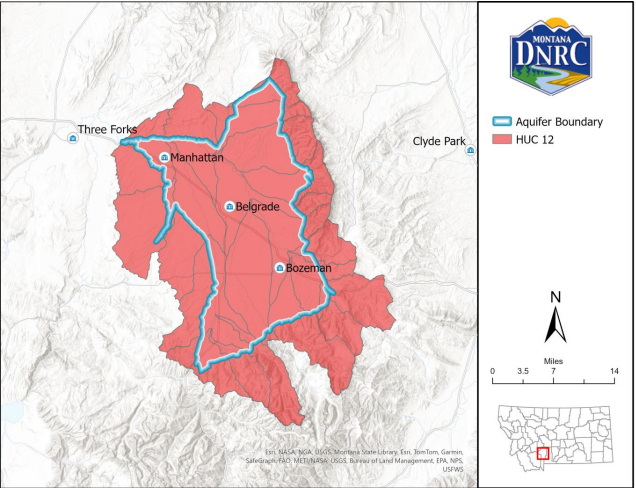
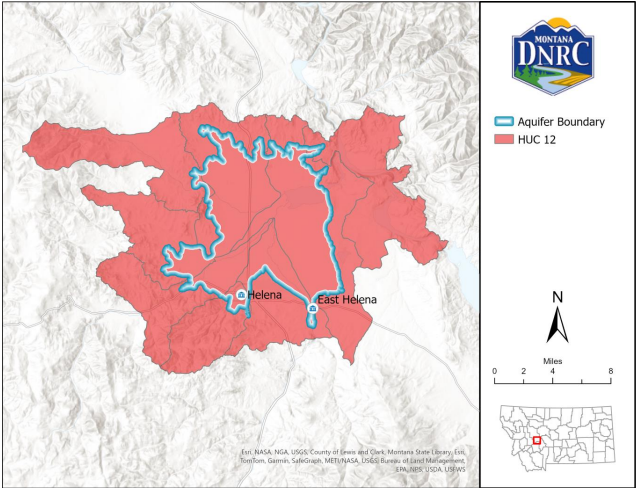
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Surface Water Legal Availability: Statewide Map Recap



GW/SW Connection Physical/Legal Availability: Discussion & Next Steps

SWG – Does the metric seem reasonable?

- HUC sizes decision (both are hydrologically connected, how immediate)
 - HUC – 10 WATERSHED or Typically from 40k to 250k acres (62 to 390 mi²)
 - HUC - 12 SUBWATERSHED Typically from 10k to 40K Acres (15 to 62 mi²)

DNRC action items & SWG will provide feedback

- Developing a usable measurement database
- Developing basin studies and long-term monitoring plan for all focus aquifers (in collaboration with MBMG & USGS)
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Categories for designation of red and yellow areas

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Groundwater quantity
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Measurement,
Monitoring, and Studies



Category: Measurement vs. Monitoring vs. Studies

What does it mean
and what does this
look like?

What is the data
used for?



Category: Measurement vs. Monitoring vs. Study

Measurement

- Point in time: flow rate or discharge or water level or water use, e.g., Water commissioner records and other discrete measurements
- Think “data points”

Monitoring

- Time-series: flow rate or discharge or water level or water use
- Think “period of record”

Study

- Water balance analysis at scale, analyzing how every drop moves around, gets used, and returned
- Incorporates both discrete measurements and monitoring data



Category: Measurement

- Discrete data and water use data
- Accounting for all the water put to beneficial use
- Water use data is used for a variety of reasons
 - Accurate accounting of the water balance
 - Reduce assumptions and uncertainties to refine CGWAs
 - Forecast water use trends and patterns
 - Increase efficiency and help manage the resource
 - Water rights compliance
- Approximately 2% of water rights are required to report annual water use



Category: Measurement

Water Use Measurement

What this looks like for groundwater uses:

- Flow meters and/or totalizers + some way to transmit information to database
- Cost is around \$300 per meter

What this looks like for surface water uses:

- Weirs/Flumes/Meters
- Discrete flow measurements
- Costs can range for a few hundred to several thousand dollars, depending on size



Category: Monitoring

Groundwater Monitoring:

- Water level data collection with short or long period of record, depending on the need
- Groundwater level is measured with pressure transducers and recorded with data loggers
- Cost is about \$1,000 each + computer & software & expertise
- Long Term: static “regional” groundwater levels
- Short Term: Individual pumped well + obs. well



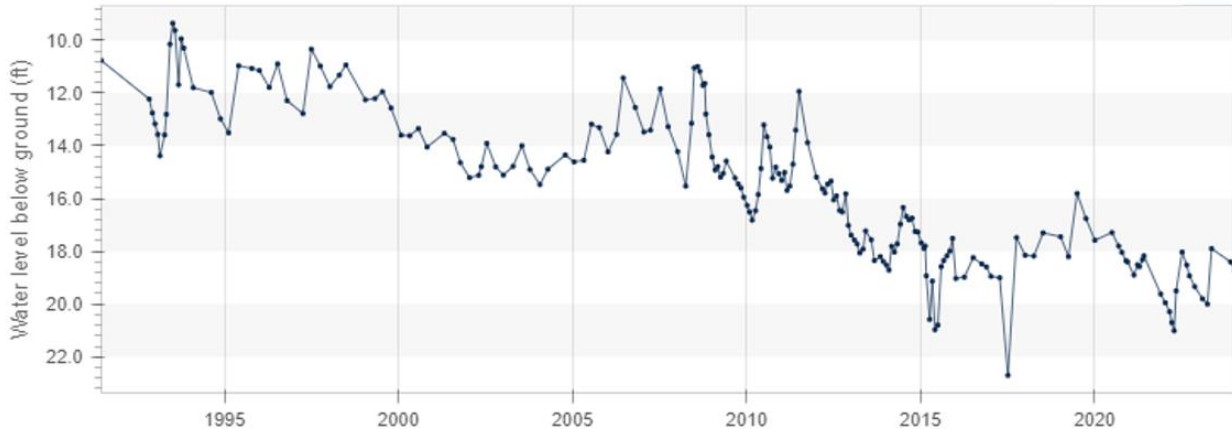
Category: Monitoring

Groundwater Monitoring

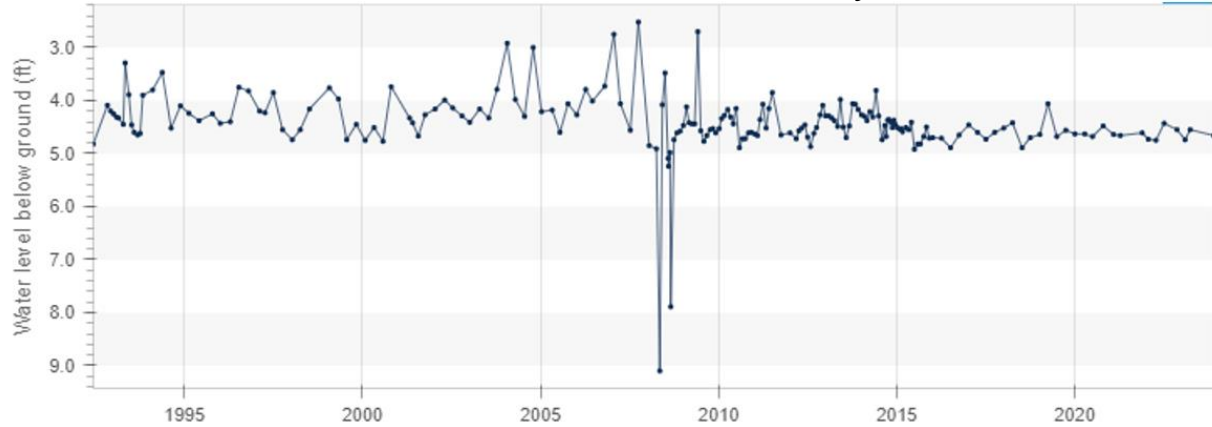
Long-term regional aquifer water levels are used to:

- Monitor seasonal and long-term trends
- Establish safe yield amounts that an aquifer could produce without long term degradation

Daily Average Water Level (GWIC ID 9858) Springhill (N. of Bozeman)



Daily Average Water Level (GWIC ID 133165) Bozeman Valley Area



Category: Monitoring

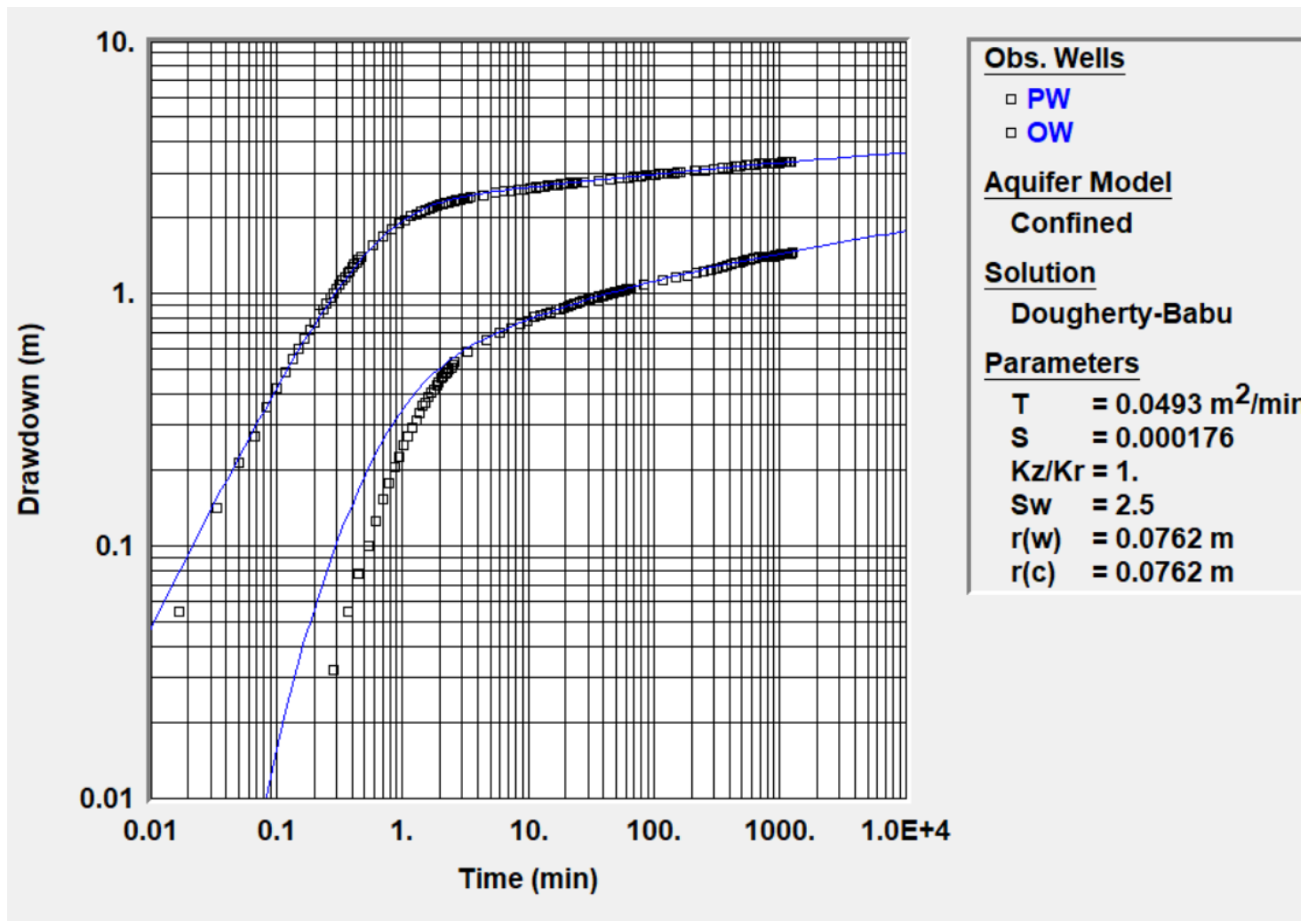
Groundwater Monitoring

Short-term data used to:

- Model local aquifer properties and conditions
- Model local impacts from pumping
- Model individual well properties

Think individual Aquifer Tests

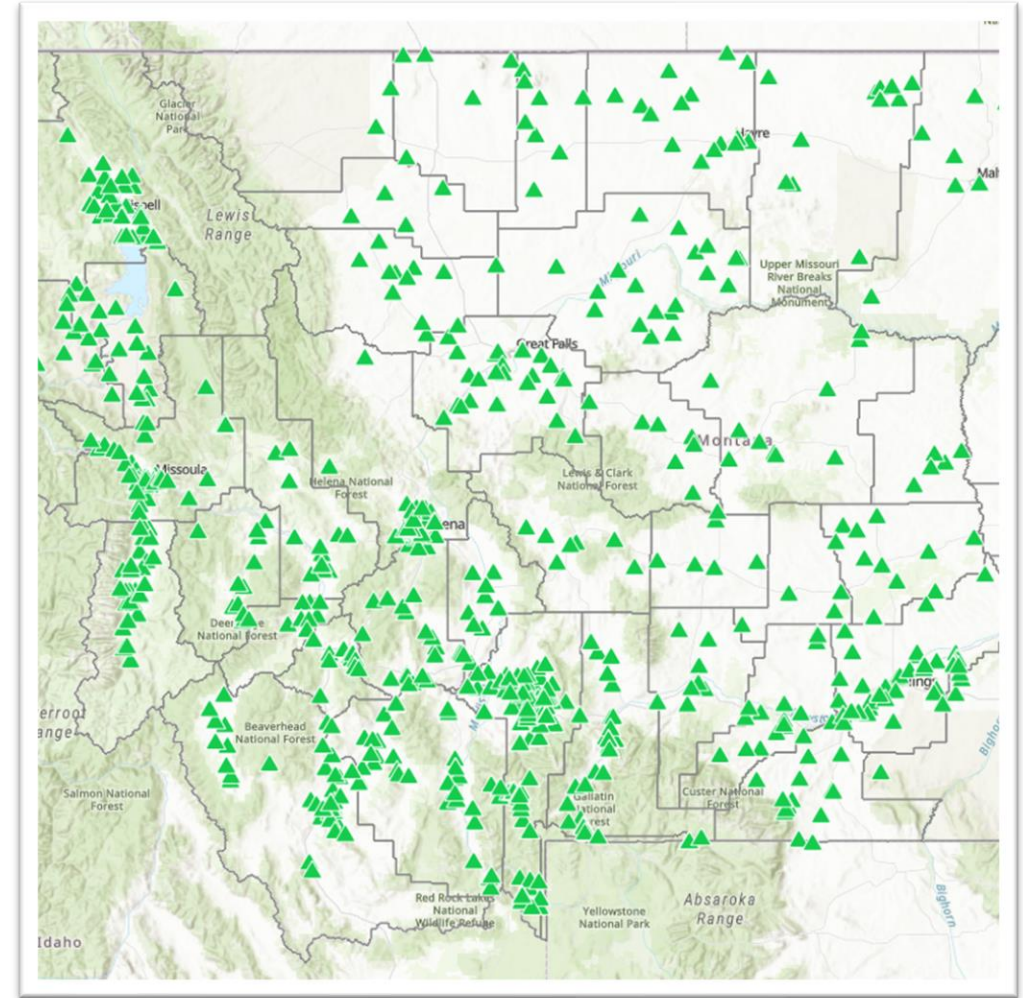
DNRC receives 30-40+ form 633 each year – Shared with MBMG. Modeling results are retained in a geodatabase.



Category: Monitoring

Groundwater Monitoring

- 820 wells in the state are actively being monitored – these cover every principal aquifer
- Most are monitored by MBMG, Cooperators also contribute data: DNRC, Water Quality and Conservation Districts, Tribes and other Agencies
- About 150 are equipped with transducers for continual monitoring
 - Downloaded quarterly
- About 30 transmit in real-time



Category: Monitoring

Real-Time Groundwater Monitoring Network

- The Montana real-time groundwater monitoring network is expanding
 - DNRC currently has installed 3 of 12 stations
 - MBMG currently has installed 3 of 7 stations
 - USGS has 9 real-time stations
 - Dept of Ag. has 16 real-time stations
- Real-time data can:
 - Improve water users' awareness of groundwater availability
 - Inform local groundwater management plans
 - Promote proactive management of groundwater



Category: Monitoring

Surface Water Monitoring

Montana Stream Gage Network

USGS – 223 real-time gages, both seasonal and year-round

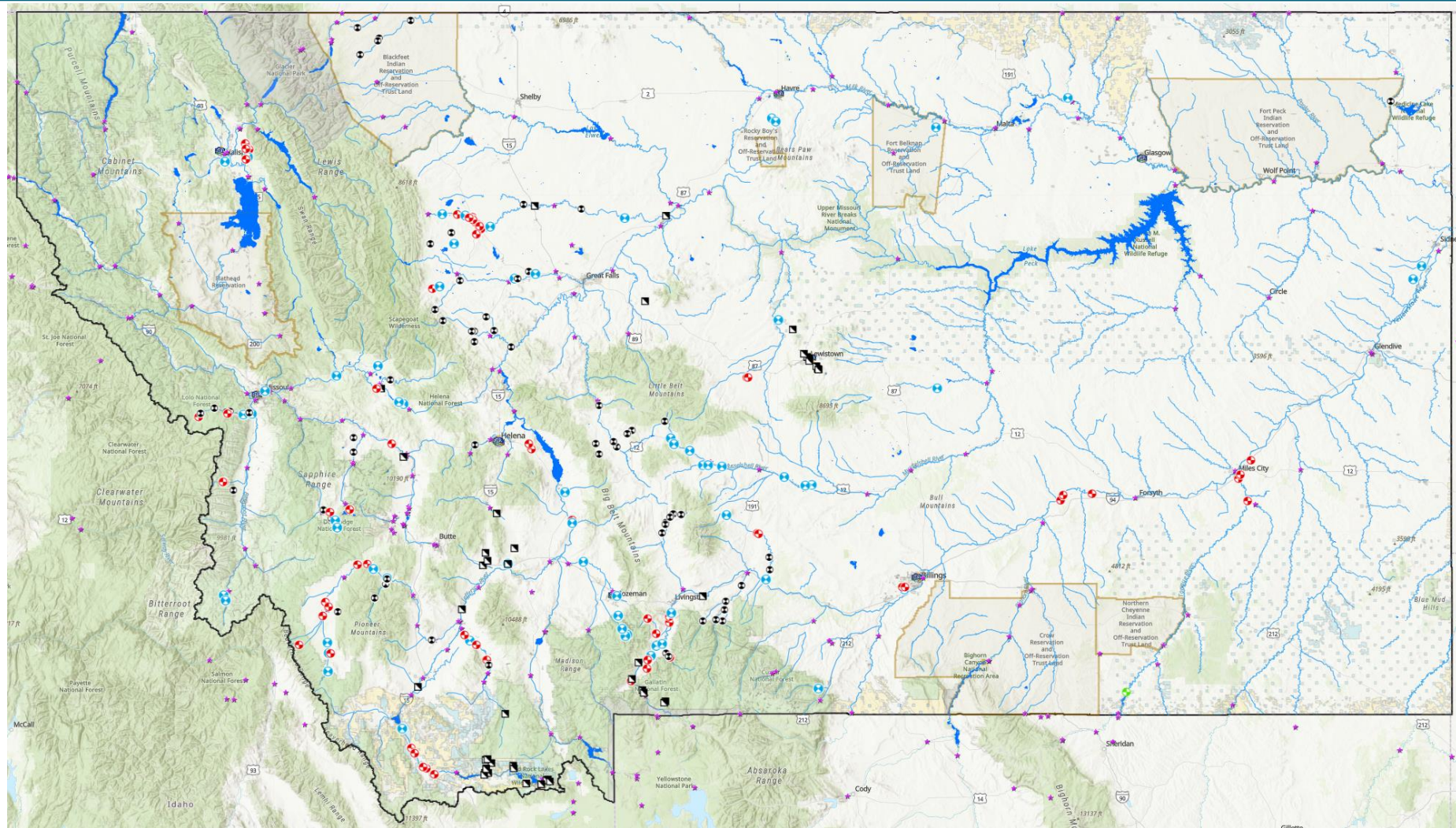
MT DNRC – 42 real-time gages + 34 more on the way, both seasonal and year-round

Tribal Nations – several networks online throughout the state



Category: Monitoring

Surface Water Monitoring StAGE Stream Gage Viewer



<https://gis.dnrc.mt.gov/apps/StAGE/>



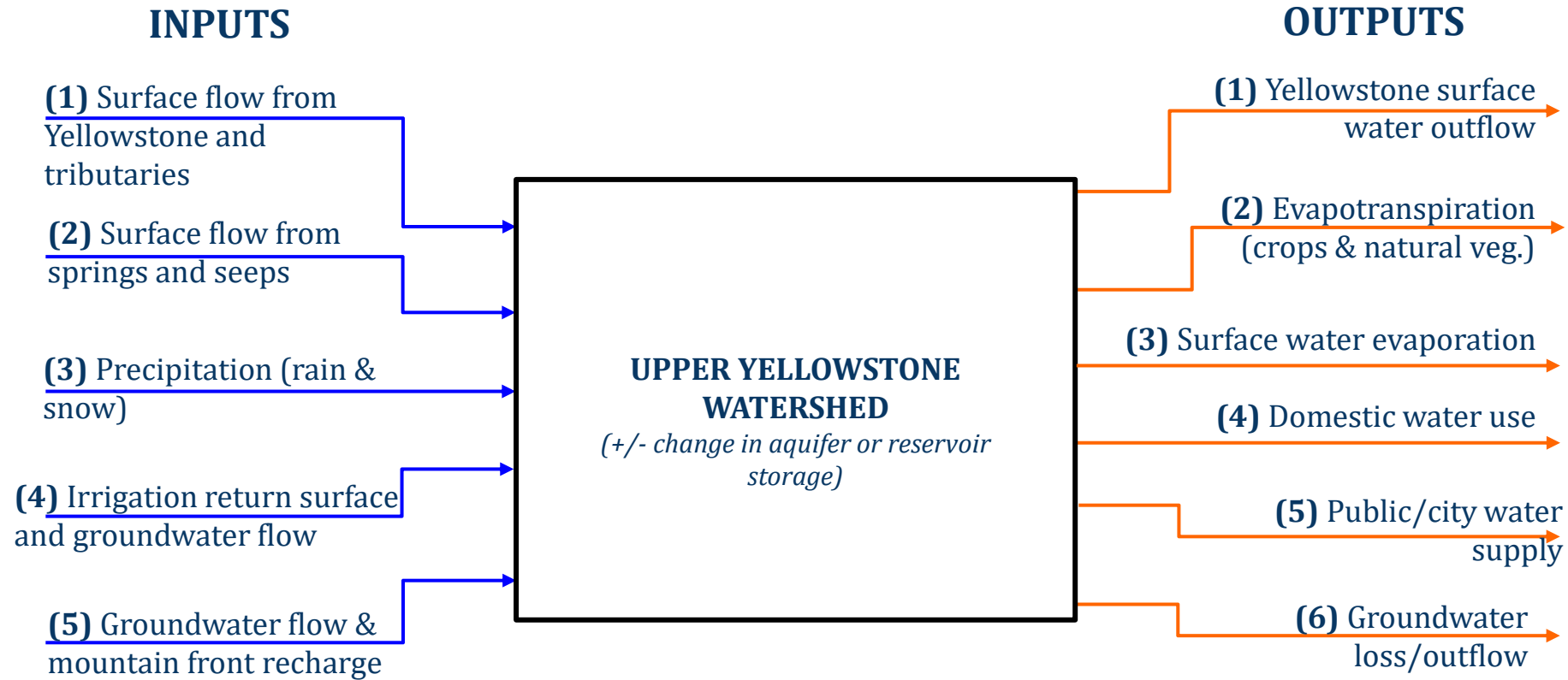
Montana Department of
Natural Resources & Conservation
Water Resources Division

Planning, Growth, Exempt Wells
Stakeholder Working Group
March 13, 2024

Category: Basin Studies

Water Balance Study at Basin Scale

Seeks to quantify all the inputs and outputs for a given watershed



Measuring and Monitoring

- Yellowstone river flow
- Major tributary flows
- Springs/seeps
- Surface water diversions
- Irrigation return flows
- Groundwater
- Rainfall
- Snow
- Domestic water use
- Public/city water supply
- Evapotranspiration
- Soil moisture



Local and State-Wide Benefit

- Early flood and drought warning
- Drought planning
- Identify priority infrastructure improvement projects
- Assessment tools for management practices
- Modeling of possible future conditions
- On-going tool development to fit changing group needs
- Increased irrigation efficiency
- Improve fishery
- Streamflow forecasting for recreationalists
- Early warning for river restrictions/closures
- Improves State-Wide water availability modeling



Measurement, Monitoring, Studies: Focus Aquifer Summary

Statewide (Green); Monitoring/Study (Yellow); Critical Groundwater (Red)

	Helena	Gallatin	Bitterroot	Flathead	Missoula	Billings
Preliminary Management Status	Red	Red	Red	Green/Yellow/Red	Green/ Yellow /Red	Yellow
Measurement	Yes	Yes	Yes	Yes	Yes	Yes
Monitoring and Rational	Yes –monitor long term trends and effectiveness of controls	Yes –monitor long term trends and effectiveness of controls	Yes –monitor long term trends and effectiveness of controls	Yes – monitor trends and project change in management status	Yes –monitor trends and project change in management status	Yes –monitor trends and project change in management status
Study and Rationale	Yes – to enhance opportunities for mitigation and identify opportunities for storage	Yes – to enhance opportunities for mitigation and identify opportunities for storage	Yes – to enhance opportunities for mitigation and identify opportunities for storage	Yes – To better understand connection between aquifers and identify opportunities for mitigation and storage	No – Missoula aquifer is well understood, but Bitterroot Study would help with mitigation options in Missoula aquifer as well	No – Aquifer is well understood, but is vulnerable to land use changes



Measurement, Monitoring, Study: Discussion & Next Steps

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Questions and Discussion



Jake Mohrmann
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