Big Hole Watershed Committee

Monthly Meeting Minutes

November 15, 2023 – 6:00 pm at the Divide Grange

Zoom option also provided

In Attendance

In-person: Pedro Marques, BHWC; Tana Nulph, BHWC; Ben LaPorte, BHWC; Tom Bowler, Resident; Betty Bowler, Resident; John Reinhardt, Rancher/BHWC; Liz Jones, Rancher/BHWC; Wade Fellin, Big Hole Lodge; Tim Fay, Resident; Mary Sutherland, MBMG; Zach Owen, Beaverhead CD/Watershed Committee; Chris Edgington, Montana Trout Unlimited; Dean Peterson, Rancher/BHWC; JM Peck, Rancher/BHWC; Kim Giannone, UMW; Charlie Ivor, Elkhorn Ranch; Ginette Abdo, MBMG; Jenna Dohman, MBMG; Ann Hanson, MBMG; Diane Hutton, Resident/BHWC; Kaitlin Boren, DNRC; Roy Morris, GGTU/BHWC; Cass Kohler, MFWP; Jim Hagenbarth, Rancher/BHWC; Craig Fellin, Big Hole Lodge; Jim Griffin, Resident; Jacob Smith, Rancher; and Randy Smith, Rancher/BHWC.

Zoom: Brian Wheeler, BHRF/BHWC; Peter Frick, Rancher/BHWC; Paul Siddoway, Resident; and Atilla Folnagy, DNRC.

Meeting Minutes

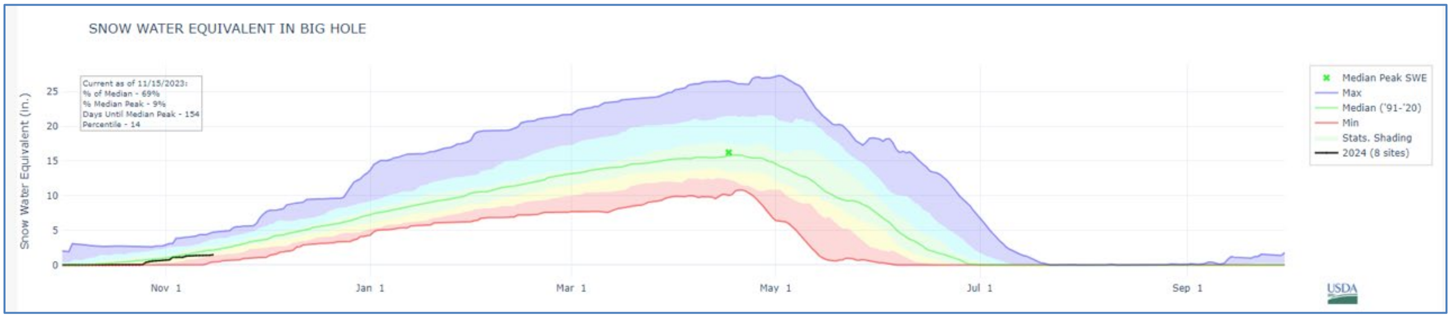
BHWC monthly meetings are held at the Divide Grange with a virtual (Zoom) option provided thanks to Southern Montana Telephone Company, who donated the internet service. Meeting minutes and recordings are available at https://bhwc.org/monthly-meetings/ (scroll down for meeting minutes archive). Printed copies are available during in-person meetings. Contact Tana Lynch, BHWC Associate Director, at tlynch@bhwc.org or (406) 267-3421 to suggest additions or corrections.

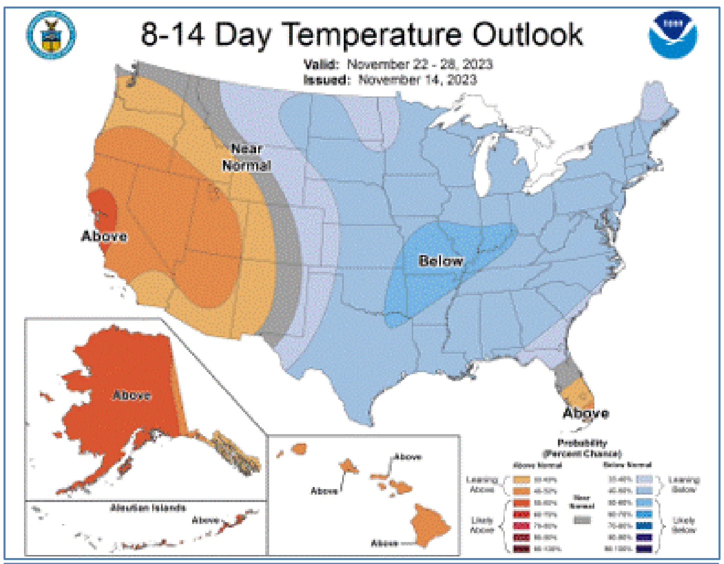
Reports

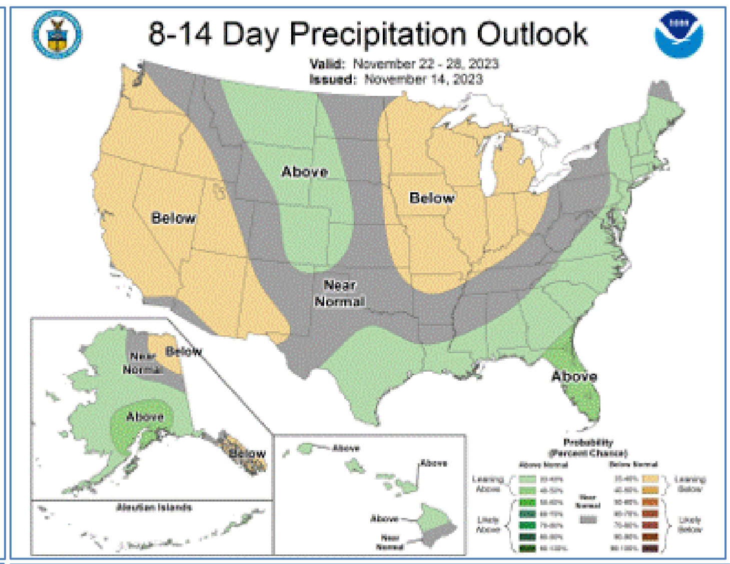
Streamflow and Snowpack Report – Kaitlin Boren, Department of Natural Resources and Conservation

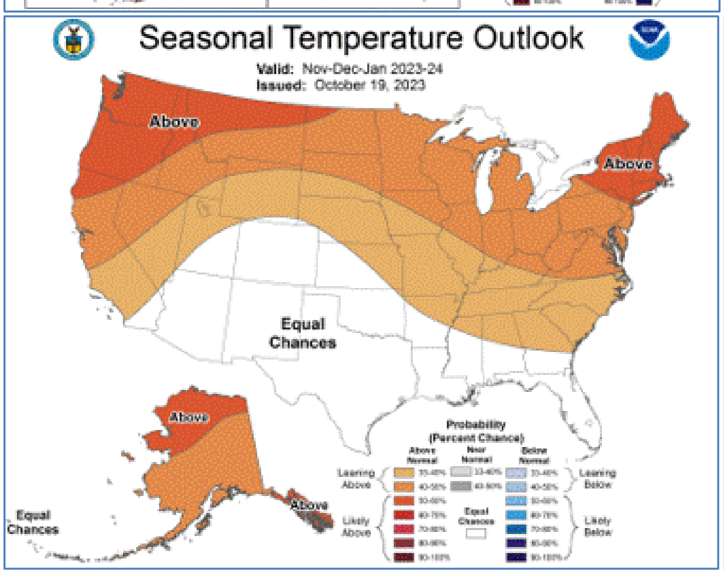
- All the seasonal loggers were collected in the Upper Big Hole and Wise River sites. Should see that data going up on StAGE here in the next month. *Streamflows:* All stream gages on the Big Hole River are either reporting ice conditions or are in seasonal status.
- *Precipitation:* Currently 81% of median.
- *Snowpack*: 2024 Water Year is at 69% of median, sitting at about 5 inches of Snow Water Equivalent (SWE) from the 8 SNOTEL sites.
- *Outlook*: The 8-14 day outlook predicts near normal temperatures and near normal precipitation.
- *Seasonal Outlook*: The three-month outlook (Nov-Dec-Jan) predicts above normal temperatures and below normal chances for average precipitation.
    - *ENSO Alert System Status (from NOAA)*: El Niño Advisory

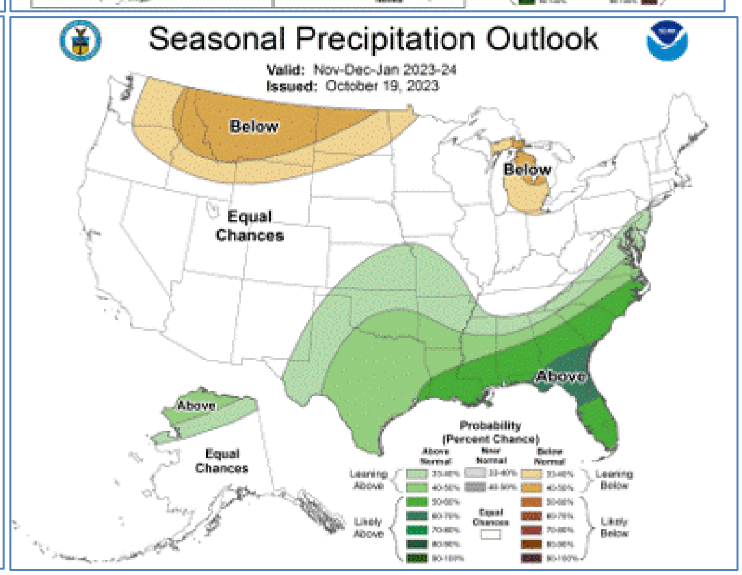
- *Synopsis:* El Niño is anticipated to continue through the Northern Hemisphere spring (with a 62% chance during April-June 2024).



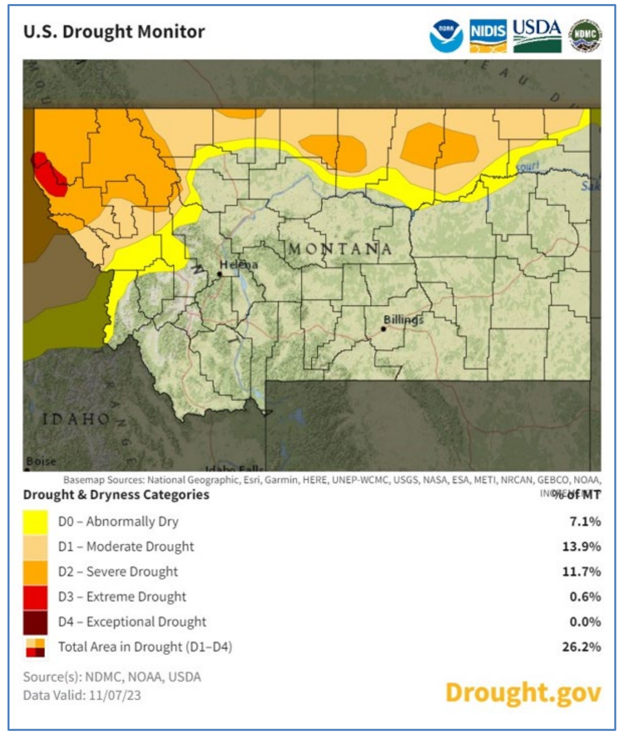








- *Drought Status:* Big Hole is currently not in drought, but northern reaches of the watershed may be abnormally dry.



Director's Report – Pedro Marques, Executive Director

- Newsletter and annual appeal
- DEQ TMDL review
    - Algae/silica discussion upcoming
- Wild Rockies Field Institute partner organization
- Water Storage subcommittee:
    - Proposal for storage planning to BoR Watershed Capacity
- Sign-ons:
    - America's Conservation Enhancement (ACE) Act: Increase wildlife conflict funding
    - Montana Nonprofit Association: Streamlining Federal Grants Act
- Army Corps Permitting language:
    - "In reviewing the PCN for a NWP27 proposed activity at a site, the district engineer will determine that the activity authorized by NWP27 is anticipated to result in an increase in aquatic function and services comparted to pre-project conditions at the site."

Steering Committee Report – Randy Smith, Chair; Jim Hagenbarth, Vice-Chair; Roy Morris, Secretary

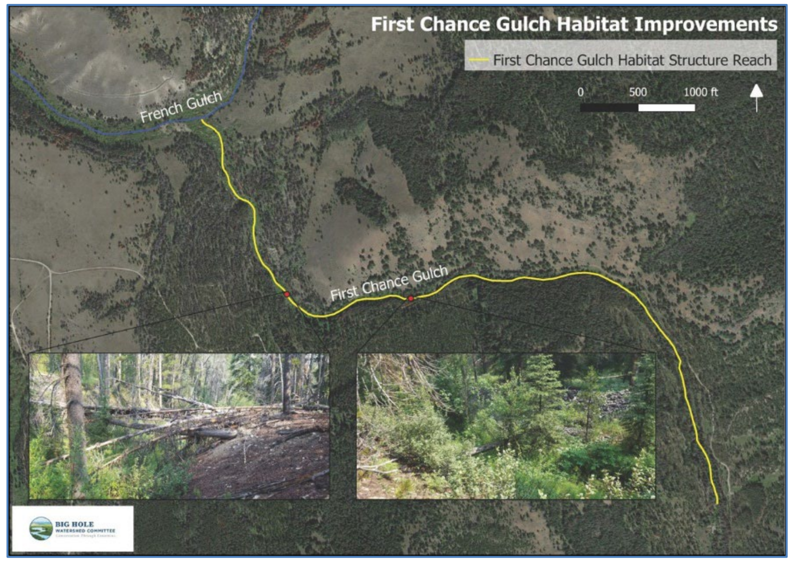
- The steering committee met recently but had nothing to report.

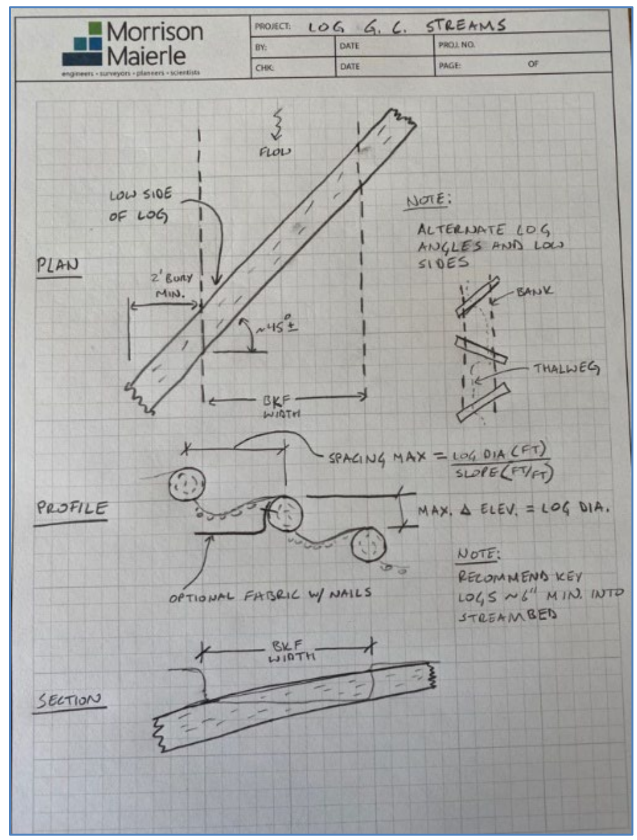
Communications and Wildlife Report – Tana Nulph, Associate Director

- Wildlife funding!
    - Regional Conservation Partnership Preogram (NRCS) – secured through HoTR
    - America the Beautiful Challenge (NFWF) – secured through HoTR
    - Livesotck Loss Board '24 – proposal submitted by BHWC
- Carcass Removal – spring 2024
    - Dump truck from Red Rock Lakes NWR (working on getting it moved to the Big Hole ASAP)
    - Wood chips – delivered to site
    - Carcass removal will be offered free-of-charge to local ranchers March-May
    - Call John to schedule pick-up: (209) 628-2225

Restoration Report – Ben LaPorte, Program Manager

- Future Fisheries Improvement Program Grant: First Chance Gulch
    - Proposed 50-80 log step habitat structures to be installed within 1.5 miles
- Other happenings:
    - Anaconda Uplands
        - 2023 reporting and future project planning
    - Trail Creek LTPBR meeting with USFS
    - Grant writing and reporting season





New Business

- UMW Water Conversation
    - December 7th, 4-6 PM
    - Topic: Water rights and exempt wells
    - Doing a series to get more people involved in an open conversation about water.
    - Kim Giannone, student at UMW
        - Trying to make agricultural perspectives available to students
- Jim attended weather modification webinar put on by Boise State University.
    - Montana DNRC attended.
    - DNRC will be doing pilot feasibility study on cloud seeding in Montana.
    - This is a BIG DEAL.

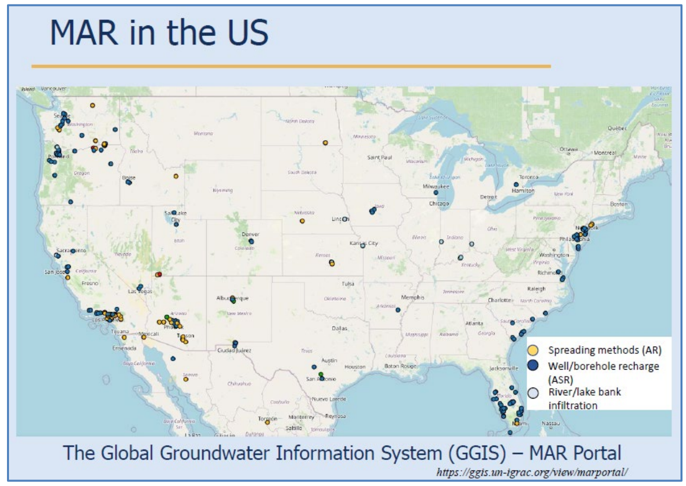
Break – 10 minutes

Meeting Topic:
Managed Aquifer Recharge

Presented by: Ginette Abdo
Montana Bureau of Mines and Geology

<u>Outline</u>

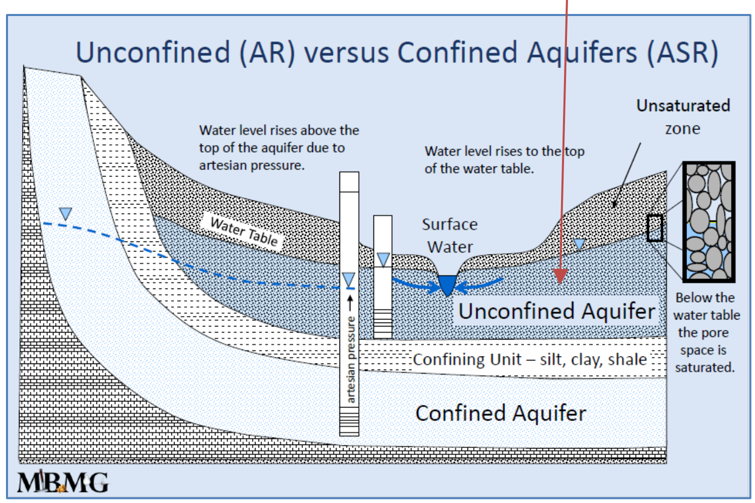
- Terminology
    - Managed Aquifer Recharge
    - Types of aquifers
- Aquifer storage and recovery
    - The process
- Aquifer recharge
    - Examples of methods
- The Big Hole
    - Glimpse at what you have



<u>Terminology</u>

- Managed Aquifer Recharge (MAR): intentional banking or storing of water in aquifers. (Inject water into the ground, store it, and pump it back out when you need it.)
    - Aquifer Storage and Recovery (ASR): recharge and recovery using water wells to increase off peak storage.
    - Aquifer Recharge (AR): Surface techniques that involved land application including infiltration galleries.
    - Hybrids: Aquifer Recharge → Aquifer Storage and Recovery
    - Unconfined (AR) versus confined aquifers (ASR)

Unconfined aquifers: The type of aquifer that is ideal if you want to use surface infiltration techniques. Minimal clay, very permeable, good infiltration.



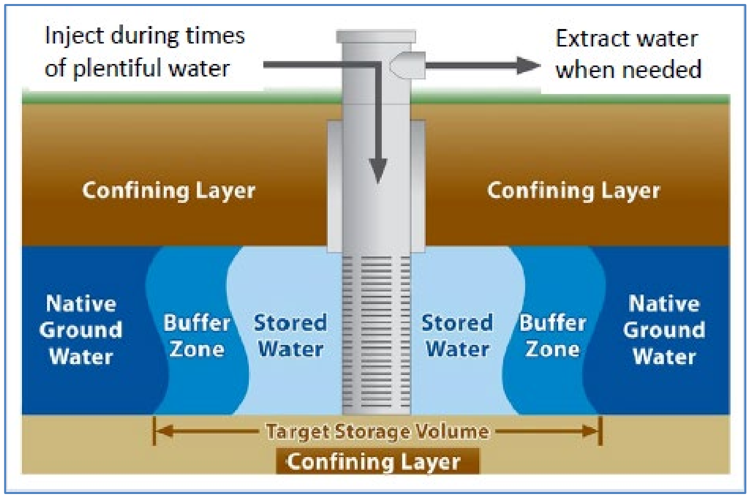
<u>Suitability of MAR sites</u>

- Aquifer Storage and Recovery:
    - Storage zone depth
    - Horizontal hydraulic conductivity
    - Aquifer dominant lithology
    - Aquifer thickness
    - Aquifer storage
    - Confinement
    - Groundwater quality
    - Drift velocity
    - Drawup/drawdown
- Aquifer Recharge:
    - Vertical hydraulic conductivity (infiltration rate)
    - Horizontal hydraulic conductivity
    - Aquifer dominant lithology
    - Aquifer thickness
    - Aquifer storage
    - Groundwater quality
    - Depth to water table

<u>Aquifer Storage and Recovery (ASR)</u>

- Water moved into an aquifer by well injection

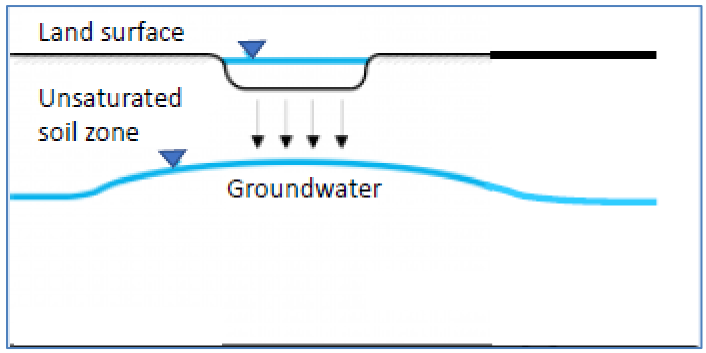
- Recovered from the same well (or nearby well)
- To do this …
    - Hydrogeology
    - Engineering
    - Permitting
    - Infrastructure
- Target storage volume = stored water and buffer zone
- Feasibility Study:
    - Defines the objectives – If you have the info, narrow your options.
        - Timeframe of need
        - Volume of water to meet needs
    - Source of recharge water:
        - Average flow, monthly variability
        - Proximity to aquifer
        - Hydrogeology
        - Overall site stratigraphy
        - Lithology
        - Well inventory
        - Aquifer properties
        - Water quality
        - Storage capacity
        - Groundwater velocity and direction
        - Distance to water source
        - Identify data gaps
    - Engineering aspects
    - Financial considerations
        - Cost benefit analyses
    - Regulatory
    - Feasibility Assessment Report
- Field study and conceptual design:
    - Field study (more detailed hydrogeology):
        - Test drilling
        - Geophysics?
        - Monitoring network
        - ASR well?
        - Aquifer tests
        - Chemistry
        - Engineering
        - Cost
    - Pilot project:
        - Implementation and testing
        - Test equipment
        - Well efficiency
    - End game:
        - System feasibility analysis → System expansion
        - Design of pilot project
        - Operating ASR well
    - Conceptual design:
        - Based on detailed information
- Hydrogeologic Modeling:
    - Is data available to support this?
        - Yes → Prior to pilot project
        - No → End of pilot project
    - Data for literature sources, not likely:
        - Hydraulic analysis of wellfield design and operations
        - Analyze groundwater flow



    - Geochemical simulation to evaluate interactions between native groundwater and stored water, changes in chemistry?

- Pros:
  - More protected than alternative storage technologies such as reservoirs or surface impoundment
  - Sored water protected from evaporation, pollutants, and extreme weather events
  - No potential for levee failure and downstream flooding
  - Proven success
  - Small storage footprint
  - Minimal effect on fisheries (does not affect fish passage)
  - Phased implementation
- Cons:
  - Initial characterization – will it work
  - Reduced storage control
  - Extractions limitation (regulatory)
  - More energy intensive
  - Chemistry/treatment issues (clogging)
  - Maintenance and monitoring
  - Expense

- ASR Operating Ranges
  - Well depths: 150-2,700 ft
  - Storage interval thickness: 20 – 400 ft
  - Storage volumes: 100 – 270,000 acre-ft
  - Buffer radius: <1,000 ft
  - Well capacity:
    - Up to 8 MGD (25 acre-ft/day) (individual wells)
    - Up to 157 MGD (490 acre-ft/day) (well field)
  - 2023:
    - At least 600 ASR wells
    - In at least 140 ASR well fields
    - 25 states
    - Many different types of aquifers

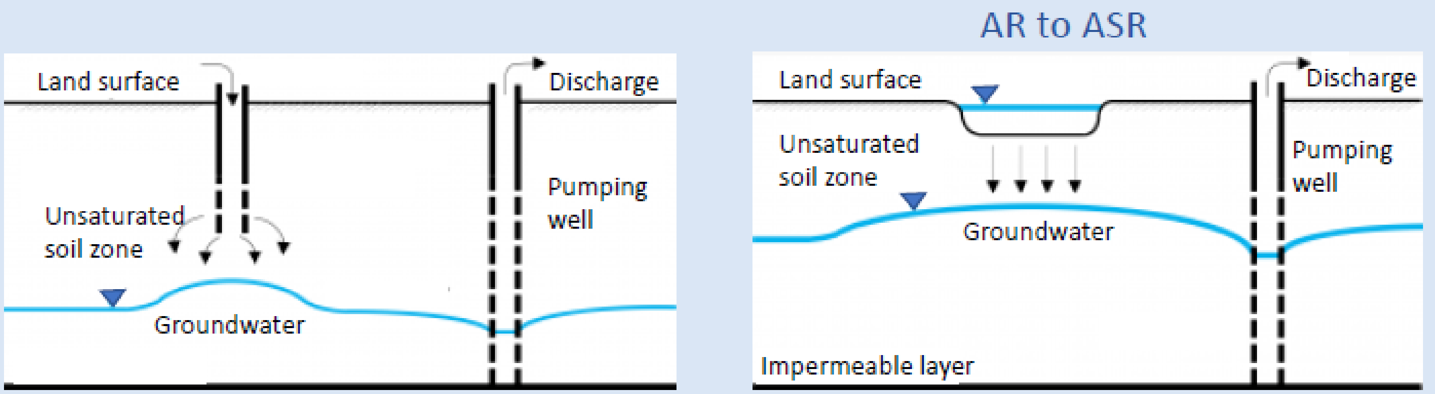


<u>Aquifer Recharge (AR)</u>

- Unconfined aquifer, continuous water release
- Captures water quickly BUT:
  - Expensive
  - Requires a lot of land
  - Evaporation
  - Sediment issues
  - Can have environmental opposition
- Site screening considerations
  - Location
    - Land ownership
    - Distance of site to:
      - Water source
      - Service area – where do you need the water?
      - Three phase power
      - Environmental issues
  - Surface conditions

        - Topography
        - Surficial geology
        - Soil permeability
        - Engineering and cost related issues
    - Sub-surface conditions:
        - Depth to groundwater (potential storage)
        - Aquifer permeability
        - Groundwater quality
- Infiltration basins:
    - Boulder River Watershed:
        - Appropriations exceed physical supply in most years. Boulder River runs dry in the late irrigation season – just when water is needed most.
        - Infiltration basin simulations:
            - 3.1 acres
            - Water added for 55 days (Mar 15 – May 9)
            - Total flux infiltrated 691,200 cfd (8 cfs)
        - Model year 20
            - Predicted Boulder River flow increased by an average annual rate of 103,380 cfd (1.2 cfs)
            - Size and location determine amount of recharge and timing effects on surface water.
- In-channel modifications - options for in-channel capture and storing of water during high flow periods:
    - Dam structures: sand storage, wadi-recharge, rubber, debris or leaky dams
    - In-channel Infiltration Basins
    - Natural Flood Management
    - Beavers

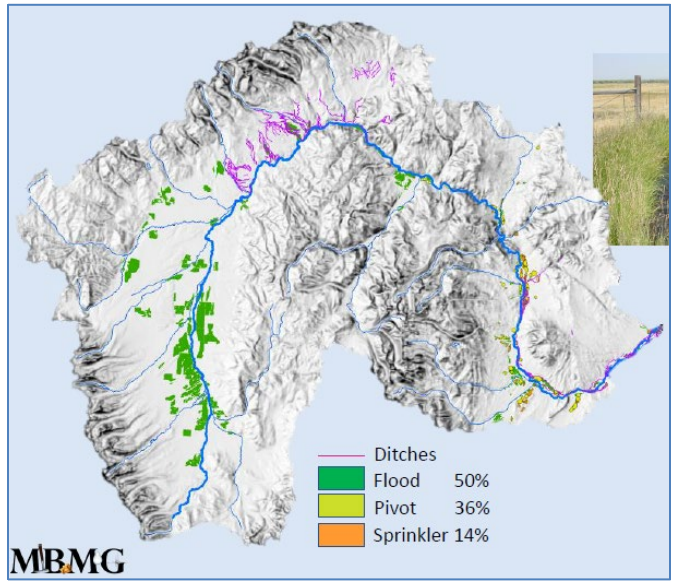
<u>Hybrid Approach</u>



Innovative Groundwater Solutions [*Managed aquifer recharge – INOWAS (tu-dresden.de)*]

- Vadose zone injection well:
    - Useful if there are low permeability surface layers
    - Possible water treatment to prevent clogging
- Infiltration Basin:
    - Most applied

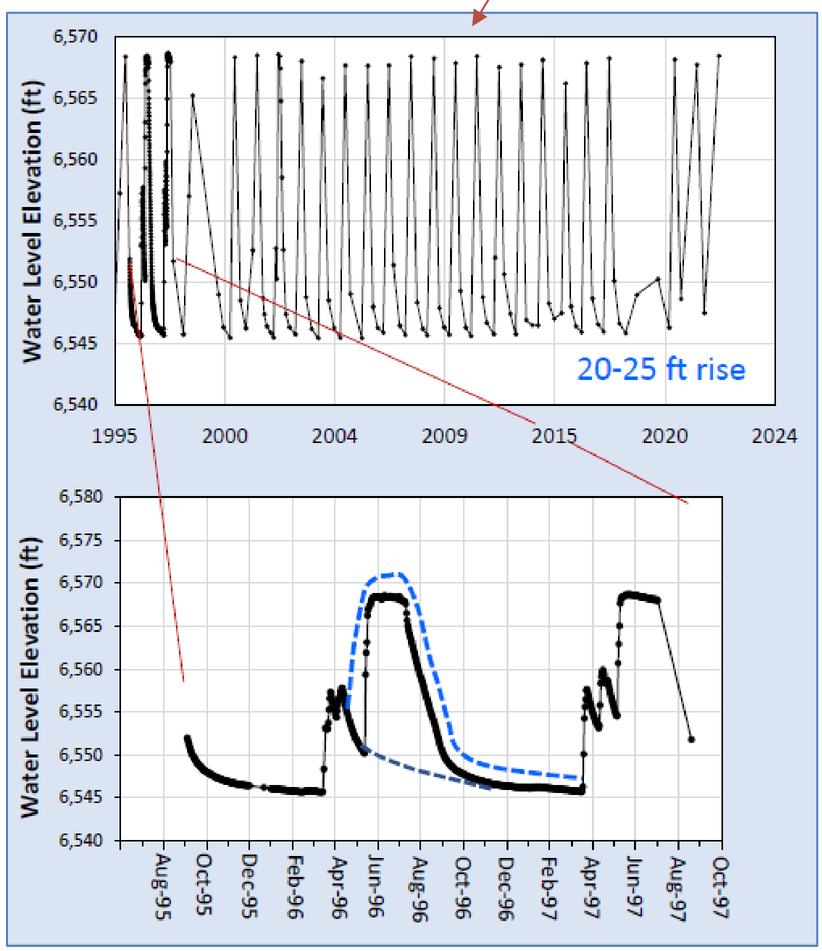
- Unconfined aquifer
- Possible water treatment to prevent clogging



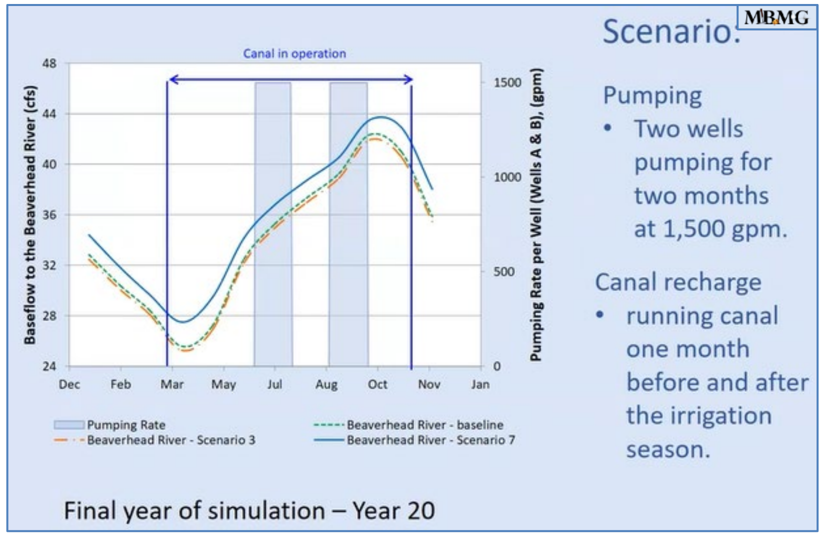
Agricultural MAR (Ag-Mar): utilizes agricultural land and infrastructure to augment groundwater recharge

- Relies on water conveyance through existing canals, ditches, creeks, turnouts, and agricultural fields.
- Water available for recharge depends on climatic conditions and site-specific regulations such as minimum in-stream flow requirements or surface-water rights.
- Big Hole River watershed:
  - Total irrigated acres: 3,177 square miles
  - Ditches: 257 miles (excluding Beaverhead County – database is from a water resource survey in the 1950s-1960s - but Beaverhead County didn't complete survey, so the number is inaccurate.)
  - Ditch leakage:
    - Marvin and Voeller, 1997
    - 0.6 cfs/mile (average loss)
    - 0.05 to 3.4 cfs/mile (range)
- Irrigation recharge – unintentional recharge
- Beaverhead River – an example:
  - Purpose: determine if high capacity irrigation wells were depleting surface water.
  - MBMG collected data and created ground water model
  - Modeling scenario: two hypothetical pumping wells.
    - In the baseline scenario: no wells pumping
    - Then started pumping; model showed depletion (though minimal) over 20 years. MBMG investigated methods to mitigate depletion.
    - Then ran water in the west side canal one month earlier and one month later than usual.

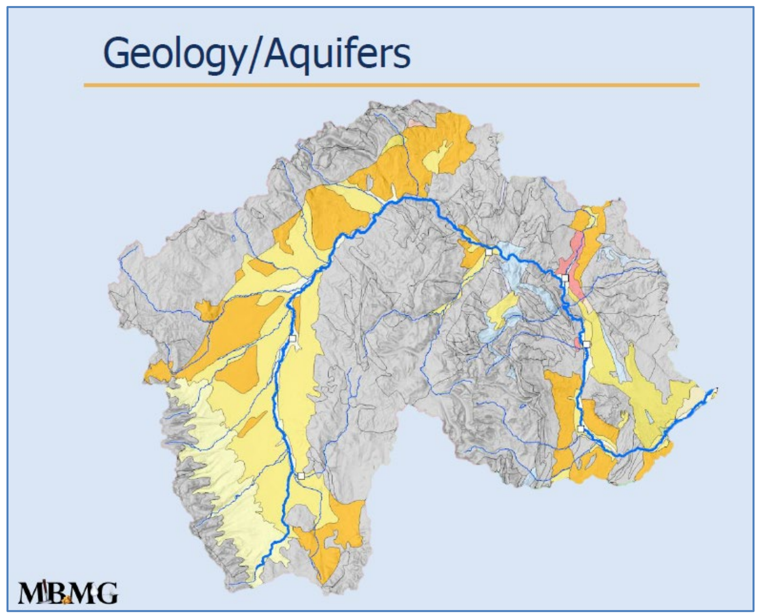
This is a well by Glen that MBMG has monitored for the last 30 years. Every year, there is a 20-25 rise in ground water during the irrigation season. An unintentional consequence of flood irrigation in the upper Big Hole = irrigation recharge for the lower Big Hole!



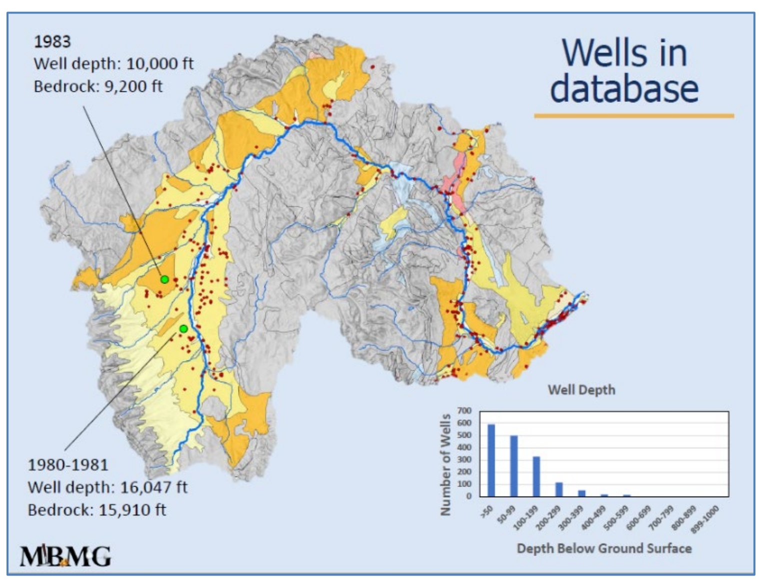
Showed that it would not only offset the water depletion over 20 years but would actually increase the Beaverhead River's baseline flow.



- Considerations:
  - Source water: water availability, quality, microbiology, nutrient loads to groundwater
  - Conveyance structures
  - Soil and unsaturated zone processes
    - Soil properties, infiltration rates, soil clogging
    - High sediment loading in river
    - Soil leaching (i.e., nitrates, salts)
    - Potential anoxic (low oxygen) conditions with extended flooding
    - Inorganic contaminates such as arsenic
    - Potential lower soil fertility
  - Crop suitability
  - Impact on groundwater
  - Regulatory
  - Economic costs



- Suitability of MAR sites:
  - Multicriteria decision analysis
  - Hydrogeologic parameters
  - Aquifer Storage and Recovery:
    - Storage zone depth
    - Horizontal hydraulic conductivity
    - Aquifer dominant lithology
    - Aquifer thickness
    - Aquifer storage
    - Confinement
    - Groundwater quality
    - Drift velocity
    - Drawup/drawdown
  - Aquifer Recharge:



- Vertical hydraulic conductivity (infiltration rate)
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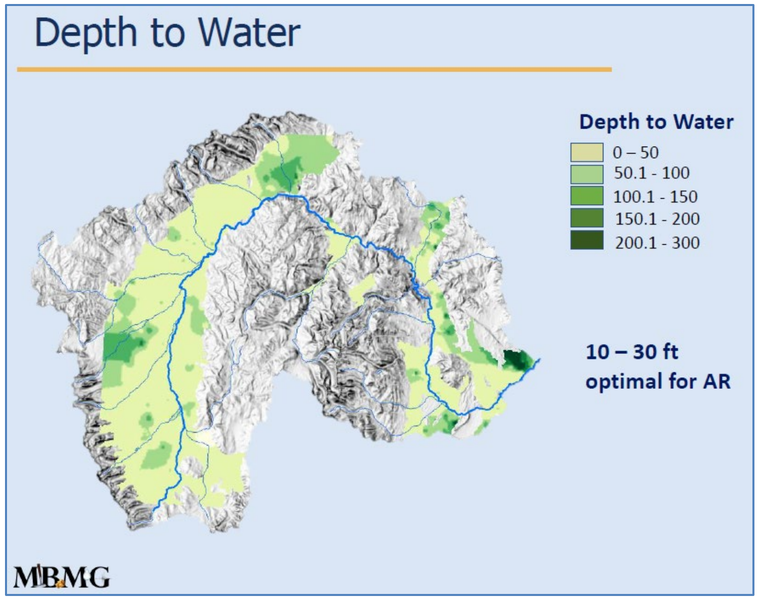
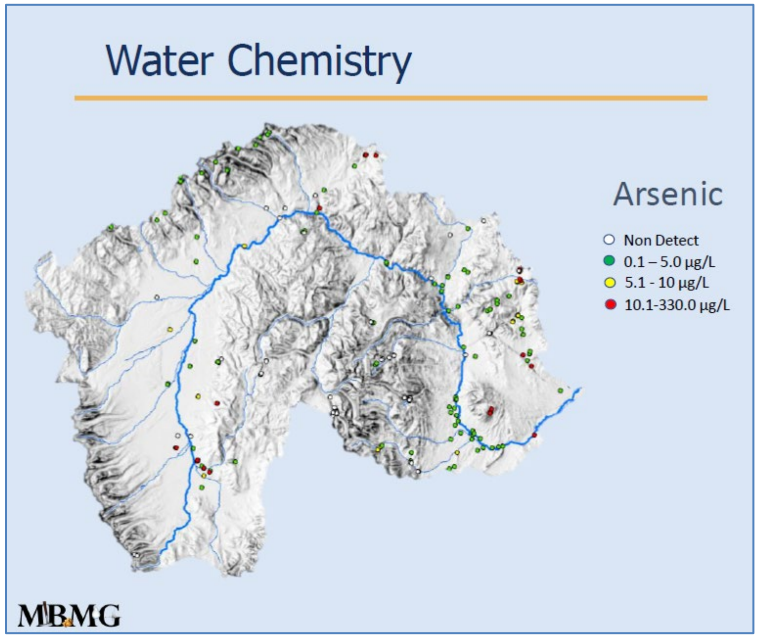
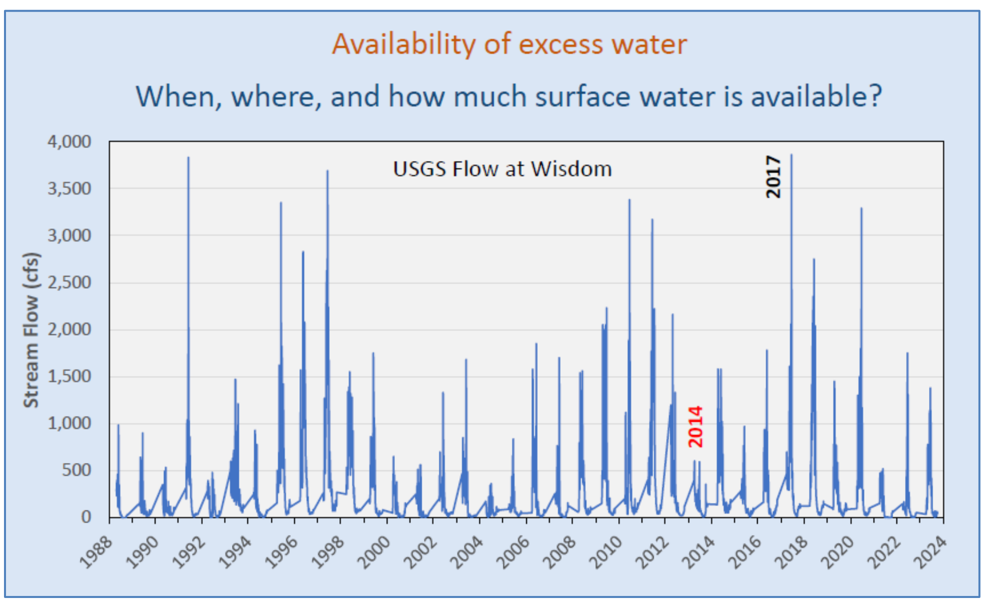


<u>Legal, Regulatory, Institutional Considerations</u>

- Montana Code Annotated
  - Title 85, Chapter 2, part 3: An aquifer storage and recovery project may be authorized in a closed basin.
  - 85-2-402: Changes in appropriation rights.
  - 75-5-410: Minimum requirements for water quality.
  - 85-2-360: A ground water appropriation right must be accompanied by a hydrogeologic report, an aquifer recharge or mitigation plan if required, and an application for a change in appropriation right or rights if necessary.
  - 85-2-361: Minimum requirements for a hydrogeologic report.
  - 85-2-362: Aquifer recharge or mitigation plans in closed basins – minimum requirements.
  - 85-2-364: Department permit coordination (DNRC and DEQ).





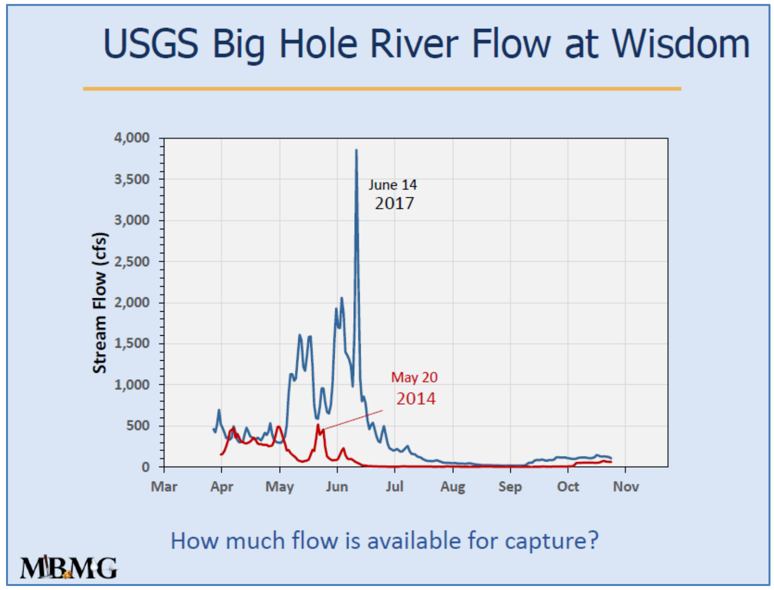
<u>Maintenance</u>

- Needed in all MAR methods

- Infrastructure maintenance (pumps, electrical, etc.)
- Monitoring (groundwater, surface water, system efficiency)
- Sediment control, well clogging

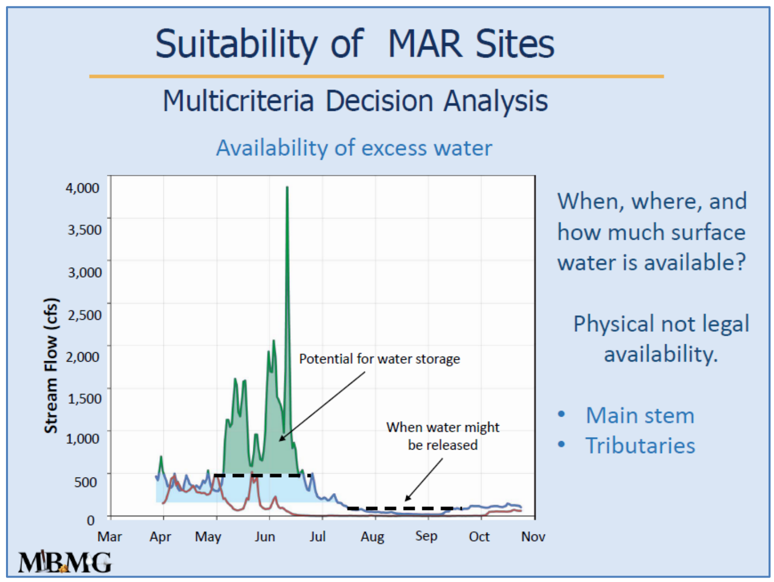
<u>Moving Forward</u>

- Be strategic
  - Suitability mapping
  - Select potential sites
  - Feasibility study
  - Pilot project(s)
- Work in tandem
  - Low hanging fruit (Ag-Mar)
  - More technical (ASR)
- Capitalize on getting MAR going
  - Political impetus to see the Big Hole fishery improve
  - Maintain the culture of the valley



Upcoming Meetings

- BHWC does not meet in December
- January 17, 2024: **Annual Business Meeting**
  - 11:00 AM at Fairmont Hot Springs Resort
    - *For Board and Staff only.*
- February 21, 2024: **Reclamation, Cheat Grass, and Water Conservation**
  - 6:00 PM at the Divide Grange Hall



Adjourn