The Clear Lake Aquifer

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1. Sheridan County Conservation District 2. Montana Bureau of Mines and Geology

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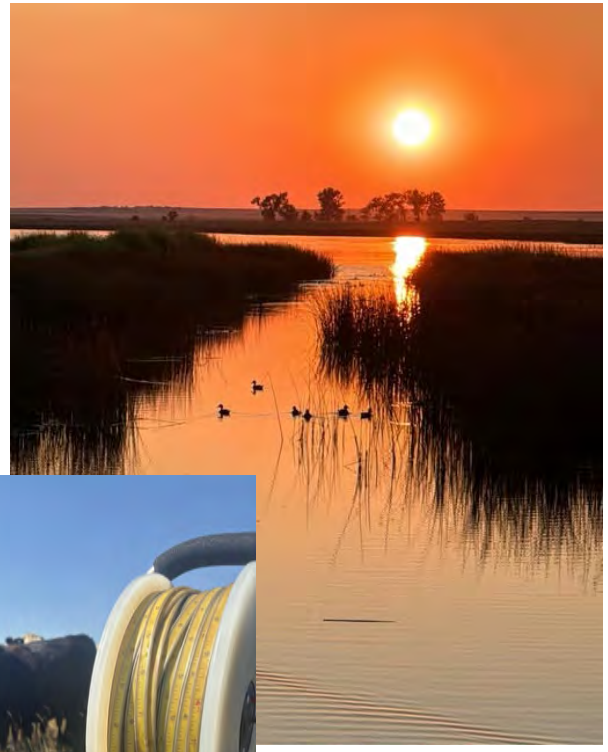
What is special about the Clear Lake Aquifer?

- Supports agricultural irrigation, livestock, and domestic water
- Ecological / habitat support
- Critical during drought periods



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Origins: Geologic & Hydrologic

- Deposits from the ancestral Missouri River
- Glacial meltwater & sedimentation
- Sand, gravel, coarse sediment — good permeability

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Reiten and Chandler, 2021

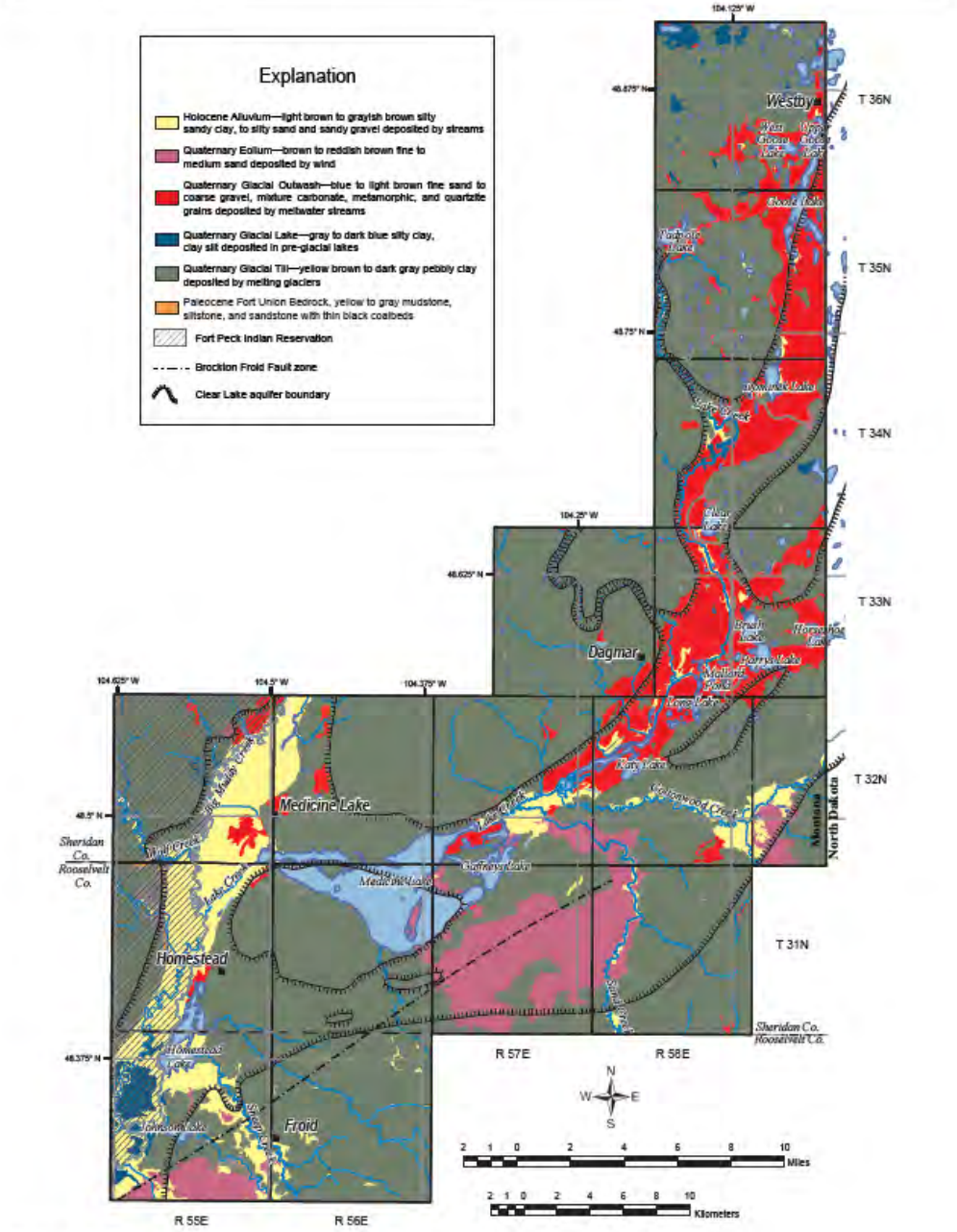

Figure 8. Surficial geology of the Clear Lake aquifer.

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Historical Exploration

- Surficial Geologic mapping (MBMG and USGS)
- Detailed Hydrogeology data and Interpretation
  - Donovan and Bergantino (1987)
  - Donovan (1988)
- Ground Water Information Center (GWIC)
- Reiten (2002)

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Early Wells

- 1974: Marlowe Onstad's first production well
- 2025: 56 production wells

Spatial Extent & Physical Dimensions

- The aquifer spans from Westby to Homestead, MT
- Width: ~1 to 6 miles
- Depth: 10 - 200+ feet in many areas

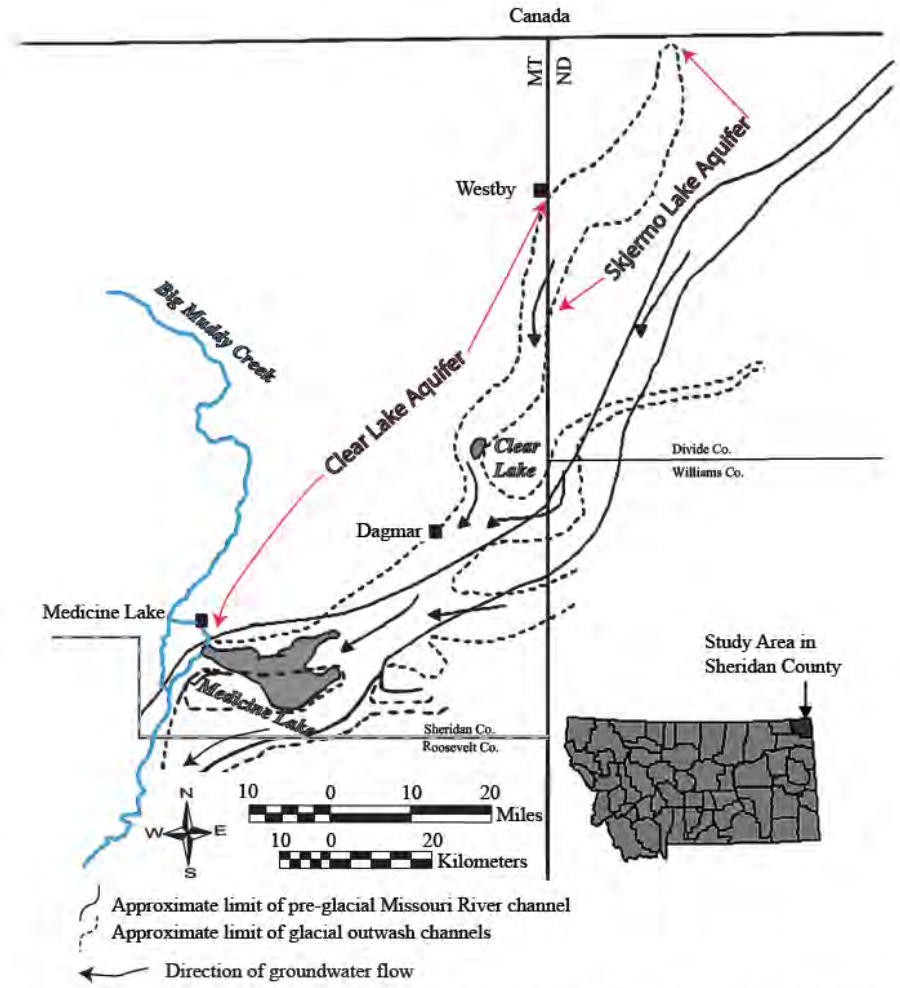

Figure 1. Sand and gravel deposits in buried valleys of the ancestral Missouri River and glacial outwash channels form the Clear Lake aquifer in Montana. The outwash part of the aquifer is called the Skjermo Lake aquifer in North Dakota (modified from Donovan, 1988).

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Agricultural & Community

- Irrigation of alfalfa, wheat, pulses, and forage
- Livestock watering
- Domestic wells tapping the system
- Reduces dependence on rainfall

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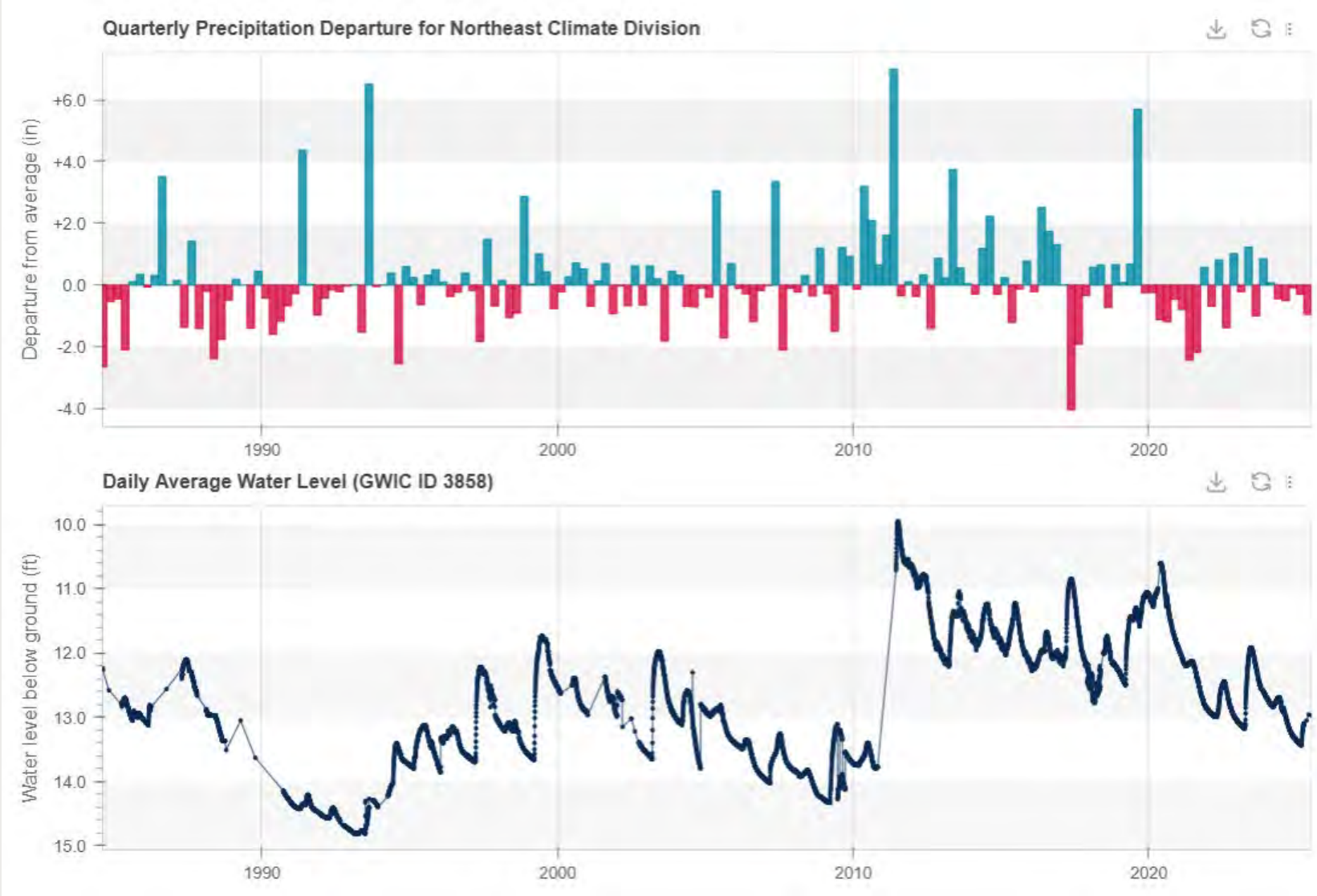
Historic Droughts

- Historical droughts (1930s, 1980s, recent)
- Increased drawdowns during dry periods



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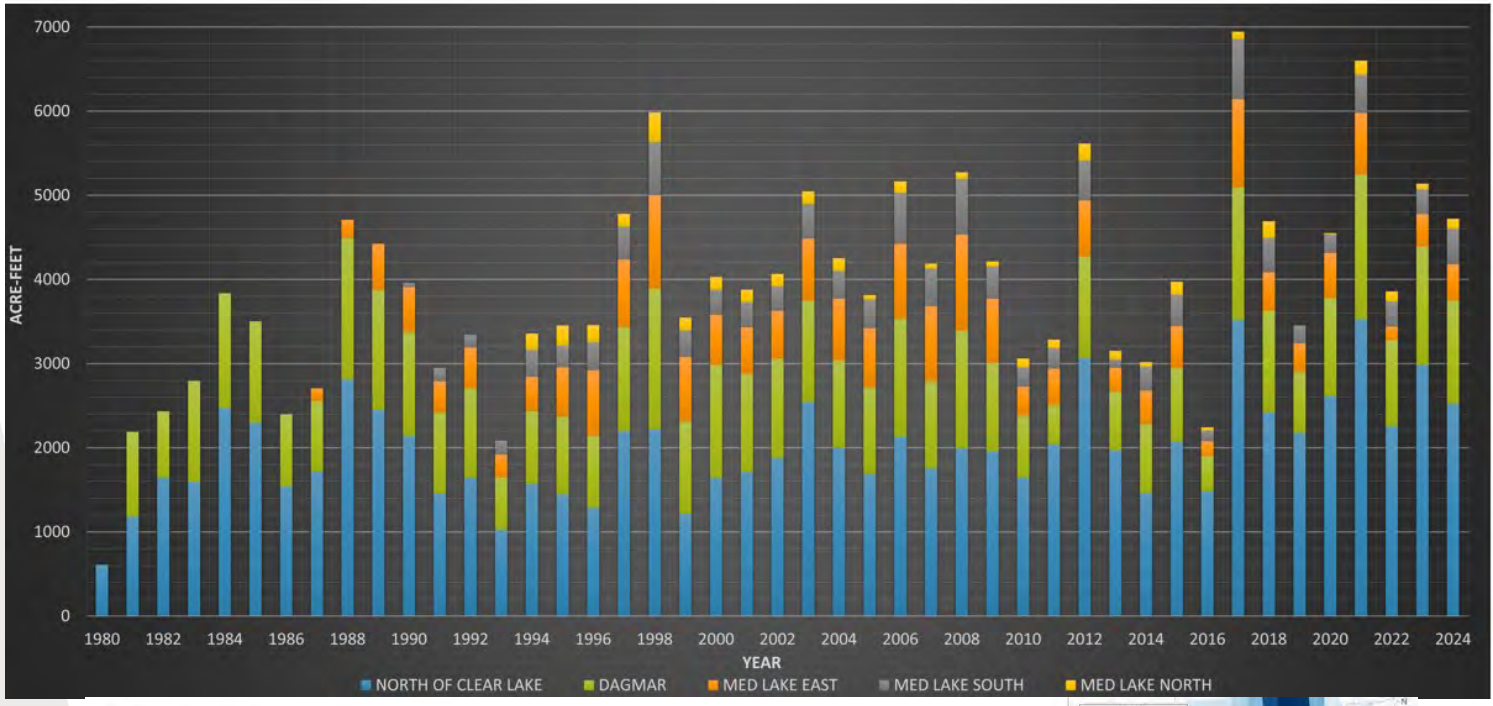
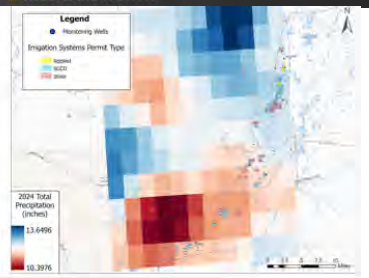
Historic Recharge

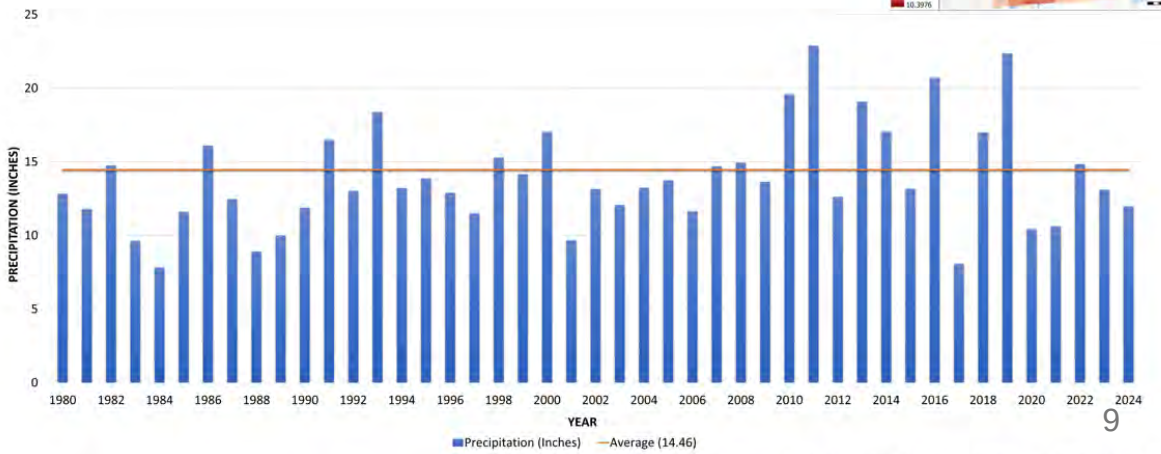
- Historical recharge is relatively stable
- Sensitivity to precipitation, temperature, and recharge variability



Precipitation

- Sheridan County 2024 Total Precipitation= 11.99 inches
- 2.47 inches below 30 year average
- 1.12 inches less than 2023



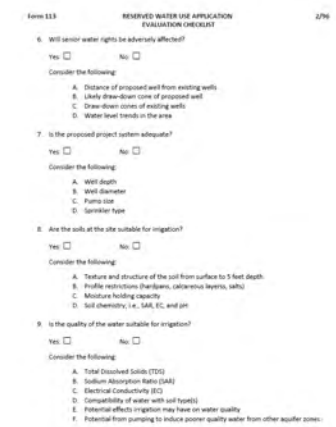


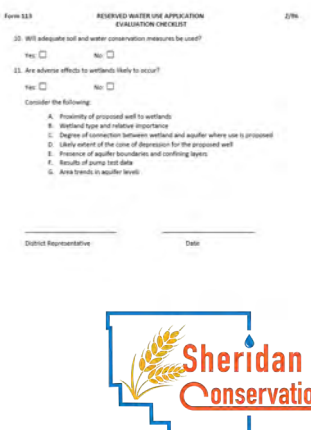
Sources: Western Regional Climate Center, gridMET

Managing the Resource

Technical Advisory Committee (TAC)

- Local city/county planner
- U.S. Fish & Wildlife Service (USFW)
- U.S. Geological Survey (USGS)
- Montana Bureau of Mines and Geology (MBMG)
- USDA Natural Resources Conservation Service (NRCS)
- Montana Department of Natural Resources and Conservation (DNRC)
- Assiniboine & Sioux Fort Peck Tribes - Water Resources





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To Meet Regulatory Guidelines

- Managed by Sheridan County Conservation District
- Tracked metrics: water depth, water quality, usage trends
- Purpose: inform allocation and sustainability decisions

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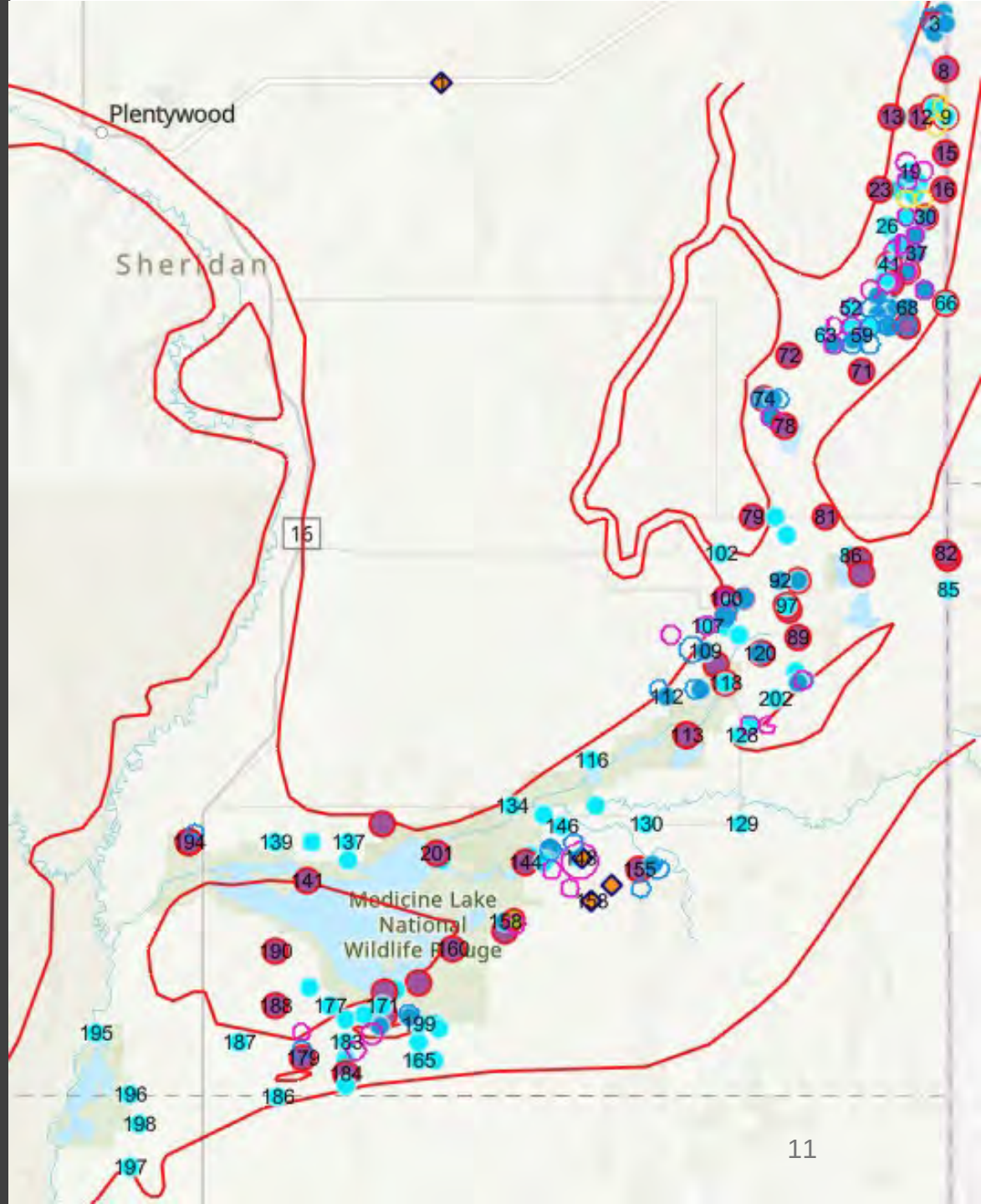

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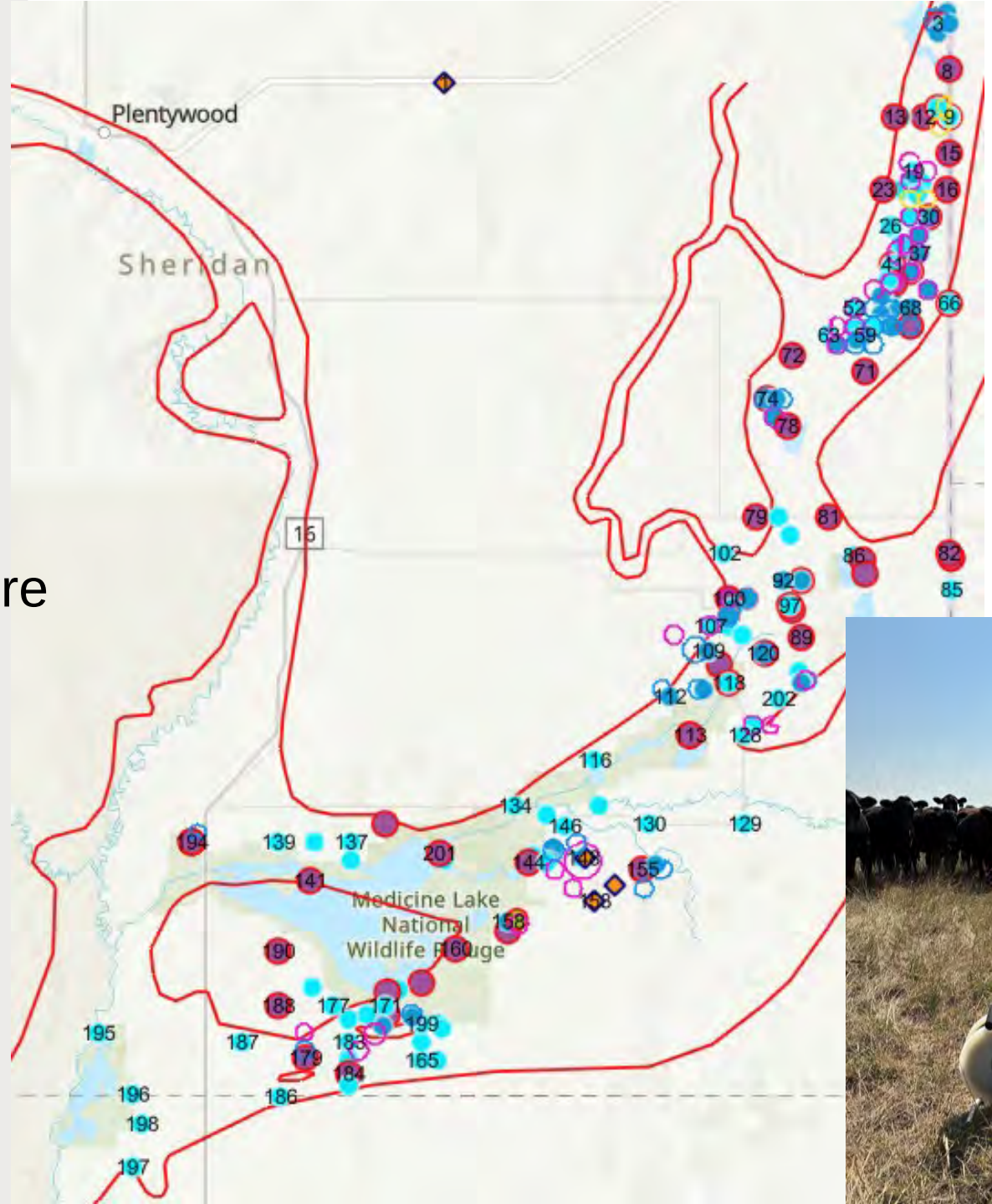
Starts with Monitoring

- 79 monitor wells + 5 lakes monitored hourly (using pressure transducers)
- 66 wells manually measured
- Data collected monthly
- 65 additional wells manually measured semiannually



Challenges & Uncertainties

- Recharge limitations and slow refilling
- Cumulative drawdowns and well interference
- Parameter sensitivity
- Conflicts between agricultural use and ecological / wetland demands
- Climate change reducing precipitation or altering timing

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Data is used to ensure sustainable use, as the resource is allocated.

- The State set the water reservation at 15,549 acre-feet annually
- The SCCD holds the authority to distribute 10,000 acre-feet
- Currently, 9,418 acre-feet are allocated
- Increases are allowed only if monitoring shows aquifer capacity is not compromised

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Resource Allocation is Controlled

- All new production wells require application & review
- Required steps: aquifer test, water sampling, impact evaluation
- Reviewed by Technical Advisory Committee (TAC)

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Future Directions & Sustainability

- Enhanced groundwater modeling and scenario testing.
- Adaptive management: periodic review of allocation rules.
- Public outreach, stakeholder engagement, and conservation incentives.

- Utilize buffers or conservative thresholds to protect against surprises.
- Continue expanding and maintaining the monitoring network.

Key Takeaways

1. The Clear Lake Aquifer is foundational to Sheridan County's water security.

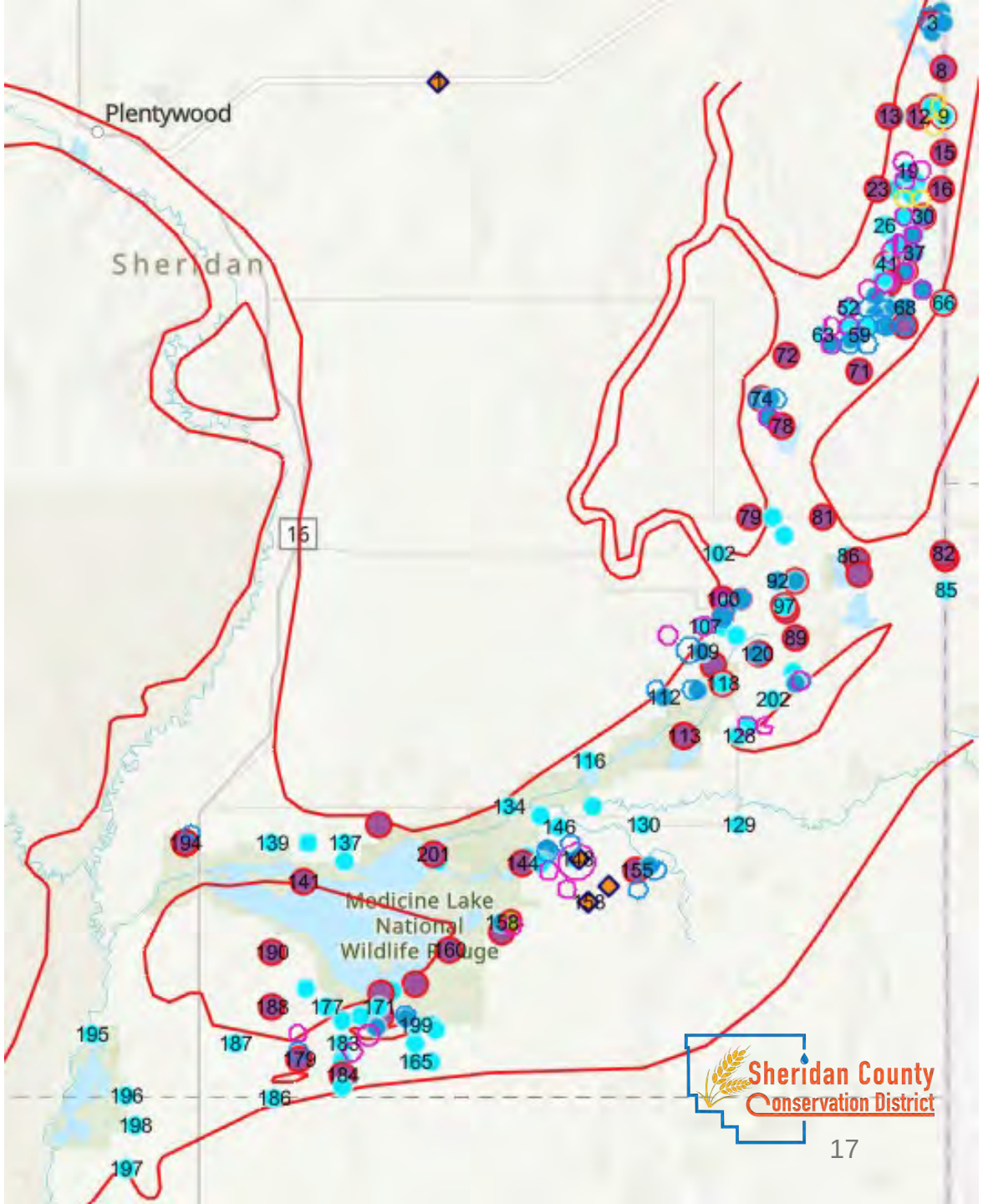
1. Its geologic origin is tied to the ancestral Missouri River and continental glaciation.

1. Agricultural, domestic, and ecological uses rely heavily on it.

1. A layered monitoring program gives insight into its dynamics.

1. Institutional rules, TAC review, and the Sheridan County Conservation District support managed development.

1. Challenges include recharge limits, drawdowns, model uncertainty, ecological trade offs, and climate change.



The Clear Lake Aquifer

Thank you!

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