Geologic Atlas of Renville County, Minnesota

County Atlas Series C-28

Part B, Hydrogeology

LOCATION DIAGRAM

Map Figures 1–27

To accompany these atlas components:

Report

Plate 6, Chemical Hydrogeology

Plate 7, Hydrogeologic Cross Sections, A–A′ through D–D′

Plate 8, Hydrogeologic Cross Sections, E–E′ through I–I′

DEPARTMENT OF NATURAL RESOURCES

St. Paul
2017

Map Figures

Maps were compiled and generated in a geographic information system. Digital data products are available on the DNR County Geologic Atlas Program page (mndnr.gov/groundwatermapping).

Maps were prepared from DNR and other publicly available information. Every reasonable effort has been made to ensure the accuracy of the factual data on which the report and map interpretations were based. However, the DNR does not warrant the accuracy, completeness, or any implied uses of these data. Users may wish to verify critical information; sources include both the references here and information on file in the offices of the Minnesota Geological Survey and the DNR. Every effort has been made to ensure the interpretations conform to sound geologic and cartographic principles. These maps should not be used to establish legal title, boundaries, or locations of improvements.

These bases were modified from Minnesota Geological Survey, Renville County Geologic Atlas, Part A, 2013. Universal Transverse Mercator projection, zone 15, North American Datum of 1983. North American Vertical Datum of 1988.

DEPARTMENT OF NATURAL RESOURCES

500 Lafayette Road
St. Paul, MN 55155-4025
888-646-6367 or 651-296-6157
mndnr.gov

This information is available in alternative format on request.

The Minnesota DNR prohibits discrimination in its programs and services based on race, color, creed, religion, national origin, sex, public assistance status, age, sexual orientation, or disability. Persons with disabilities may request reasonable modifications to access or participate in DNR programs and services by contacting the DNR ADA Title II Coordinator at info.dnr@state.mn.us or 651-296-6157. Discrimination inquiries should be sent to Minnesota DNR, 500 Lafayette Road, St. Paul, MN 55155-4049; or Office of Civil Rights, U.S. Department of the Interior, 1849 C Street NW, Washington, DC 20240.

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

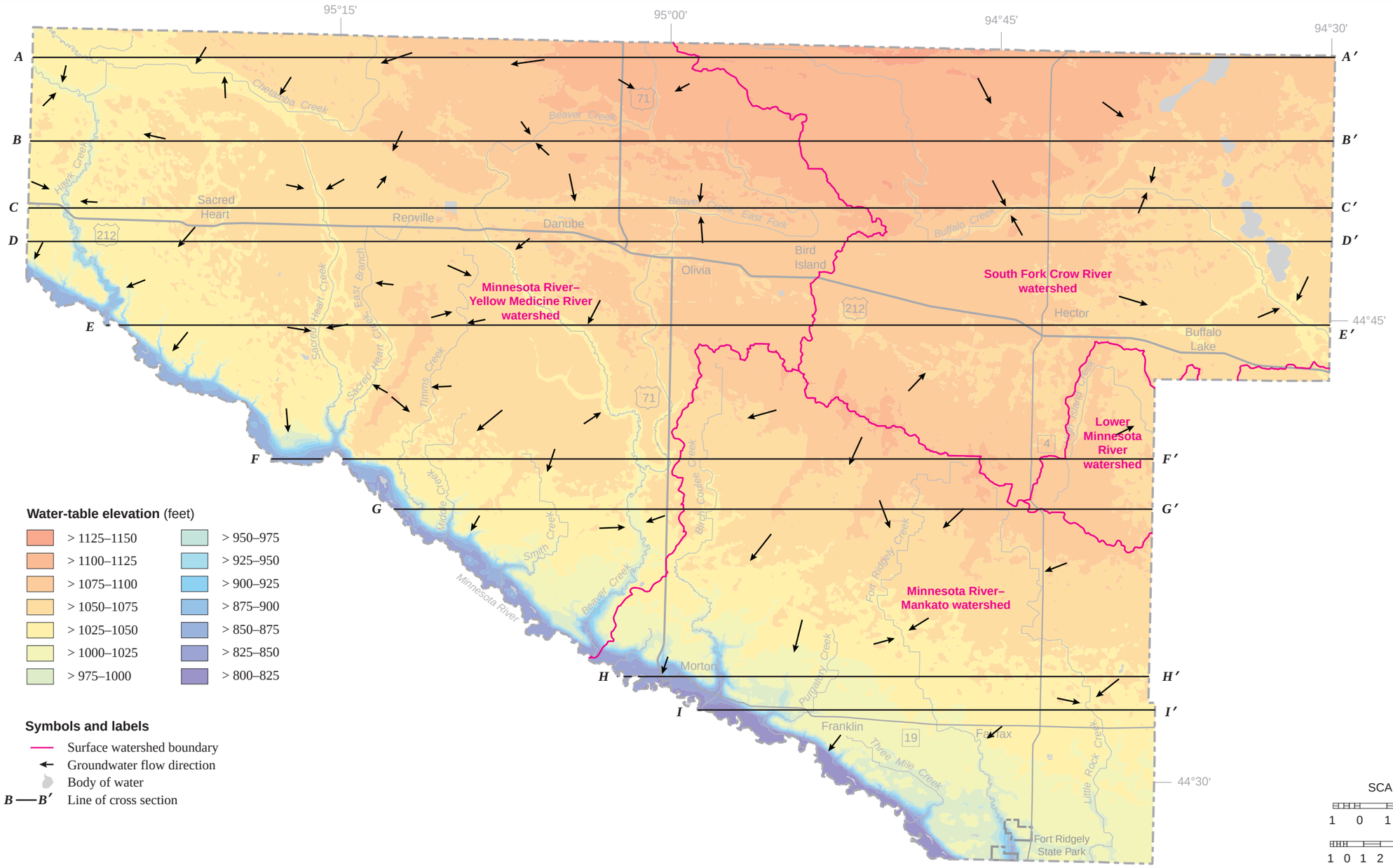
Funding for this project was provided by the following:

The Minnesota Environment and Natural Resources Trust Fund, as recommended by the Legislative Citizen Commission on Minnesota Resources (LCCMR).

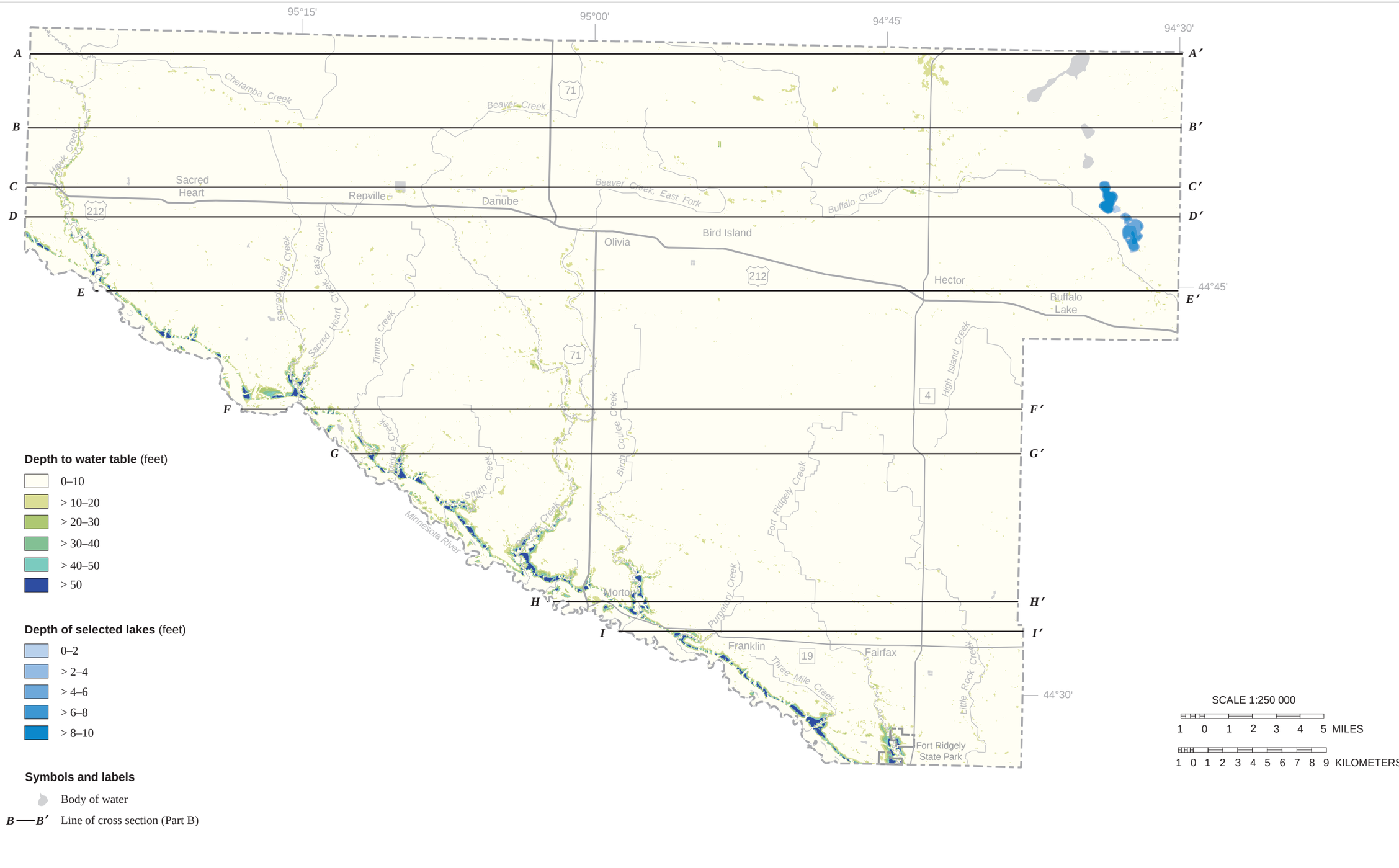
The Clean Water Fund, which receives 33 percent of the sales tax revenue from the Clean Water, Land and Legacy Amendment, approved by voters in November 2008.

CLEAN WATER LAND & LEGACY AMENDMENT

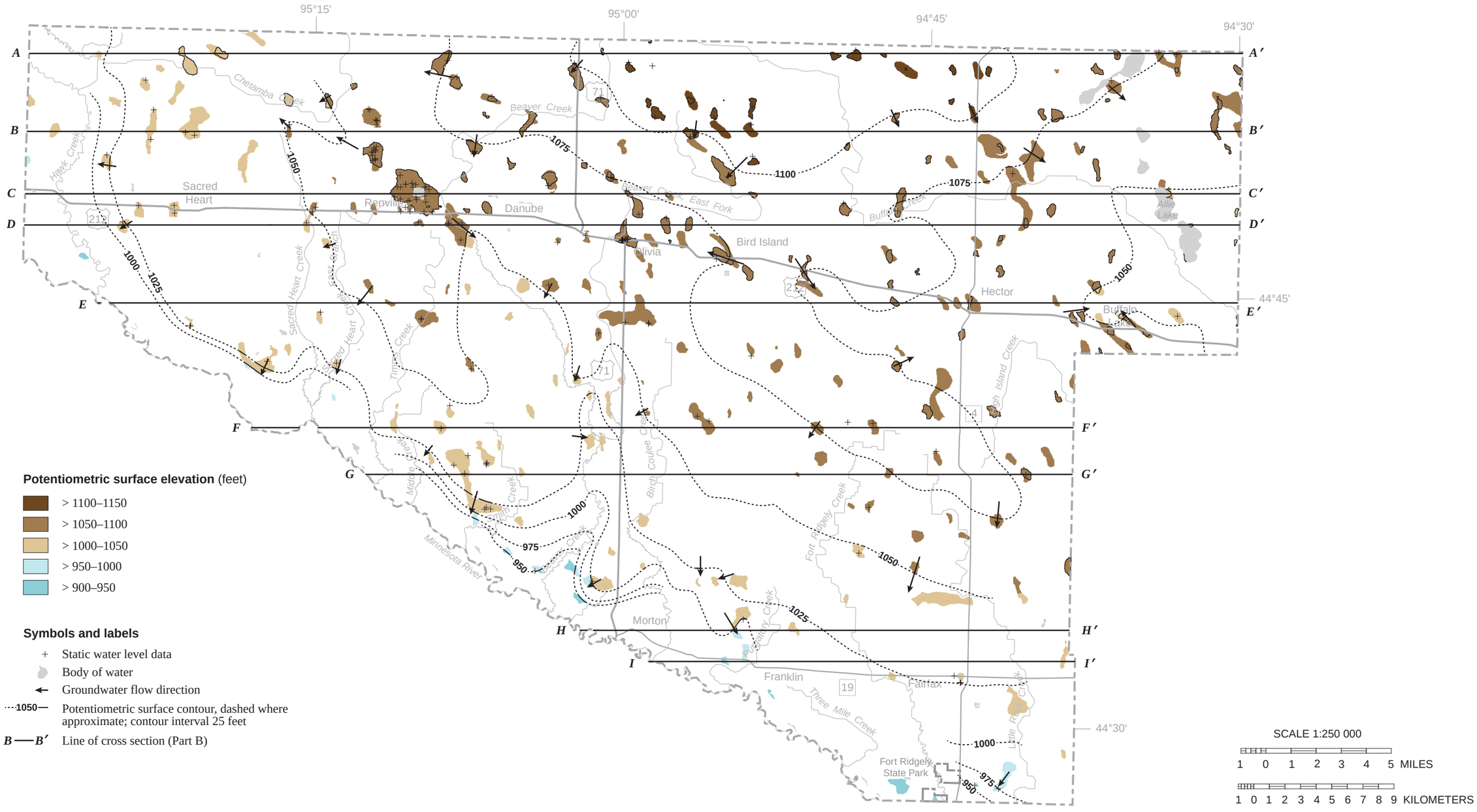
Map Figure 1. Renville County location map



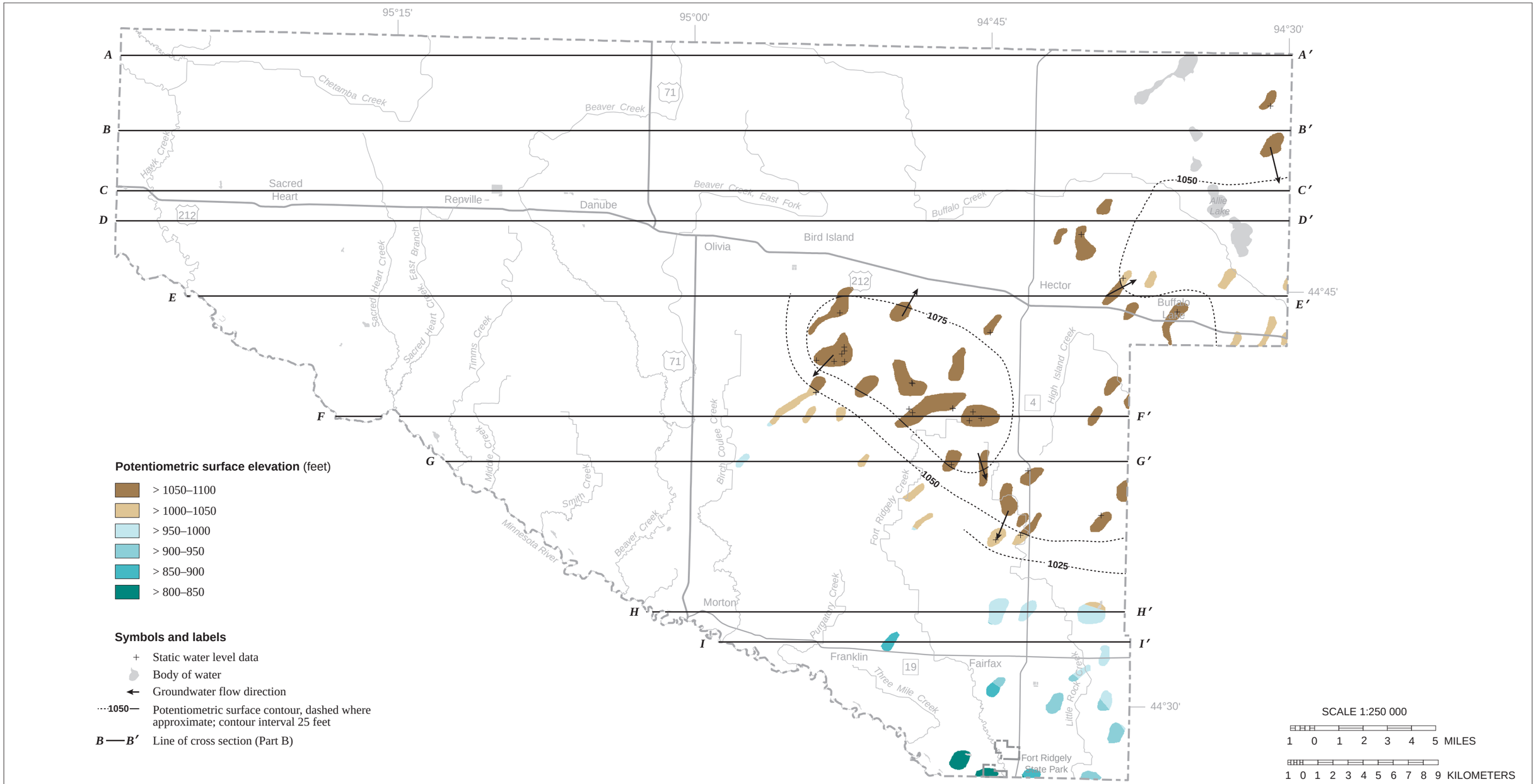
Map Figure 2. Water-table elevation
Four major watersheds are mapped in Renville County. Most groundwater flows toward the Minnesota River and its tributary streams, except in the northeast where flow is toward Buffalo Creek. Map modified from the Minnesota Hydrogeology Atlas HG-03 (Adams, 2016a).



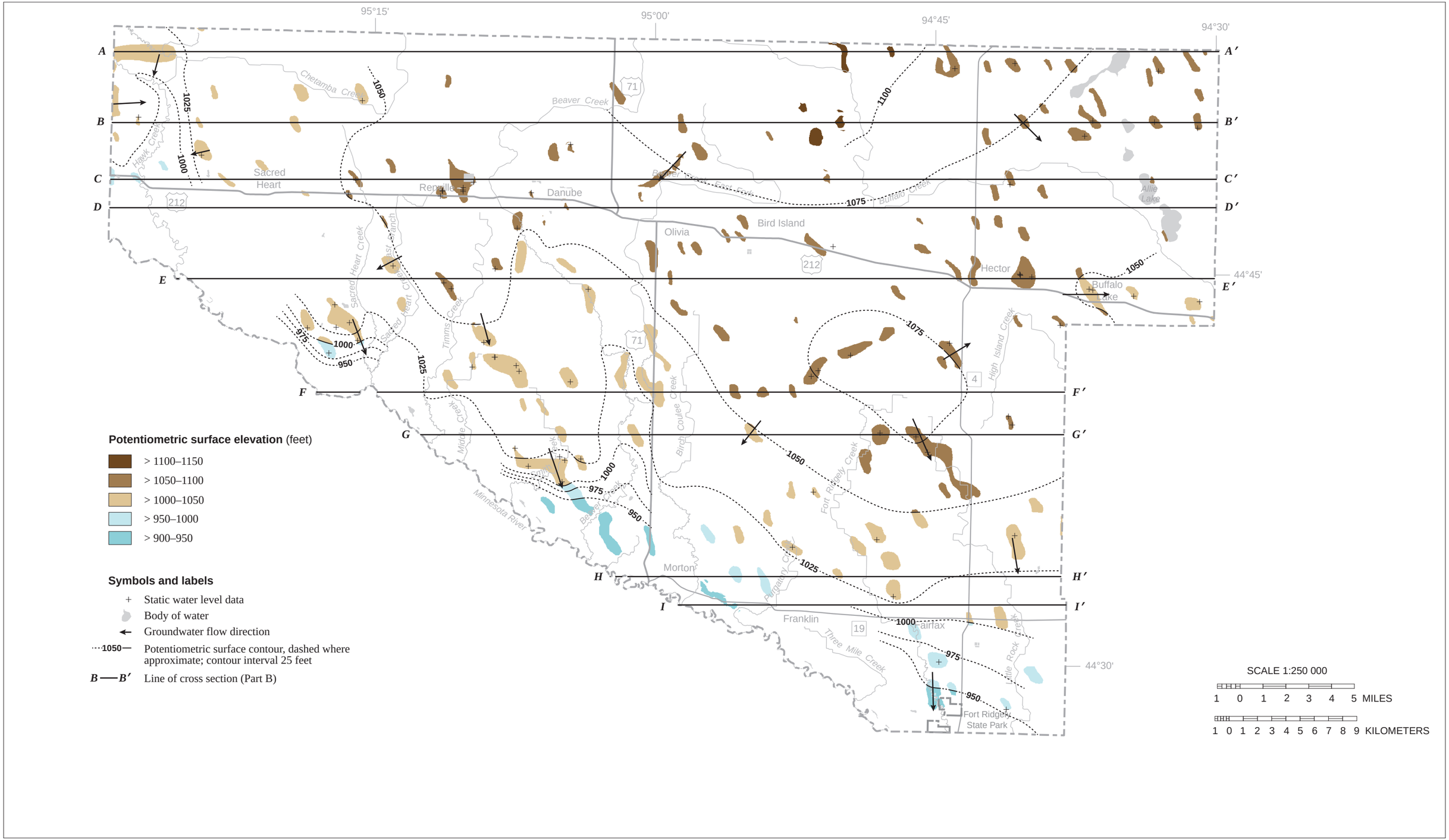
Map Figure 3. Depth to water table
The water table is within 10 feet of the land surface across the majority of Renville County, with the exception of the Minnesota River valley, its tributary valleys, and some of its large terrace deposits. Map modified from the Minnesota Hydrogeology Atlas HG-03 (Adams, 2016a).



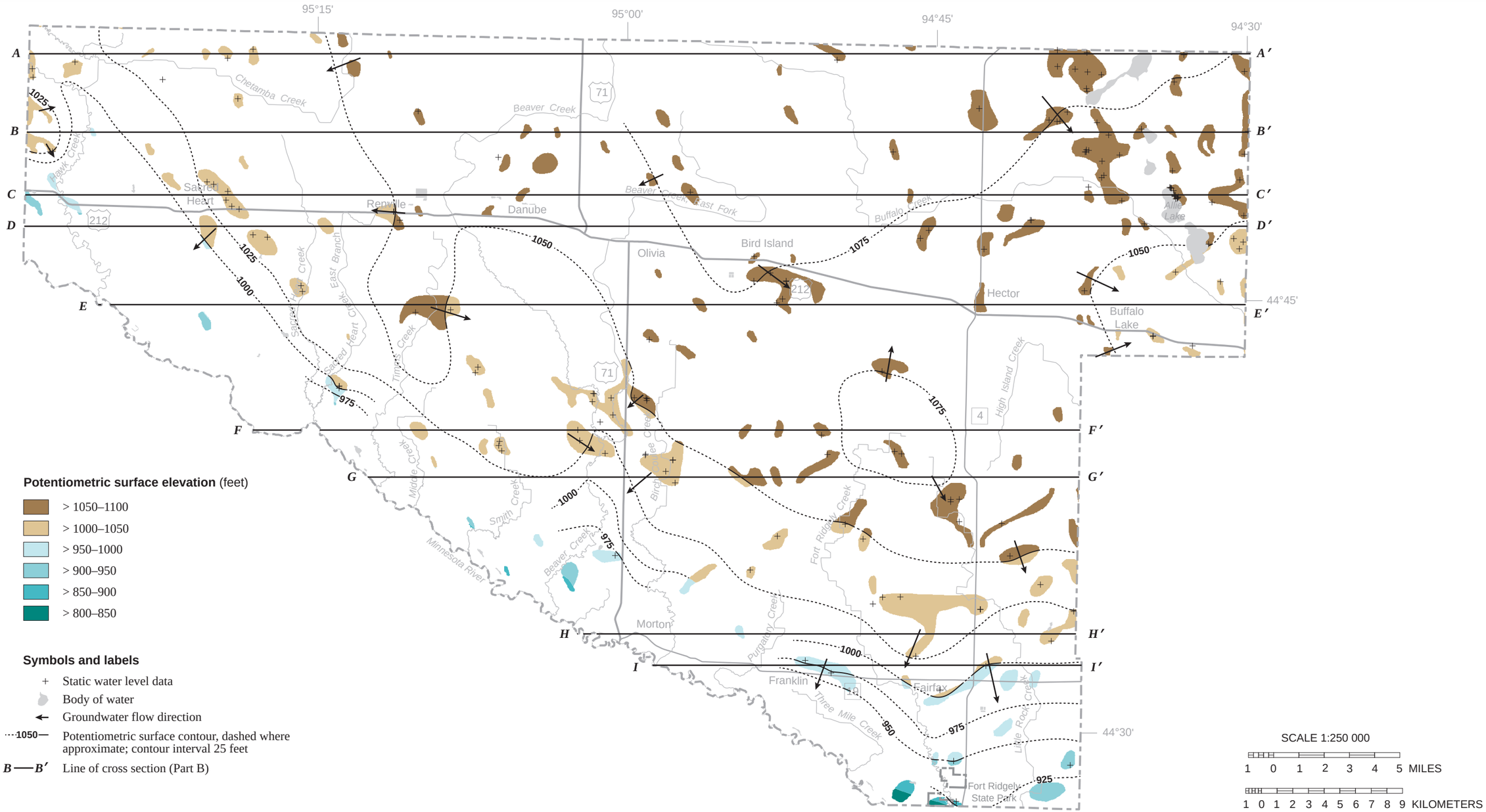
Map Figure 4. Potentiometric surface of si and sm buried sand aquifers
Elevation of the potentiometric surface for the combined si and sm aquifers. The si aquifer sand bodies are outlined in black to distinguish them from the stratigraphically lower sm aquifer units.



Map Figure 5. Potentiometric surface of st buried sand aquifer



Map Figure 6. Potentiometric surface of sg buried sand aquifer



Potentiometric surface elevation (feet)

- > 1050–1100
- > 1000–1050
- > 950–1000
- > 900–950
- > 850–900
- > 800–850

Symbols and labels

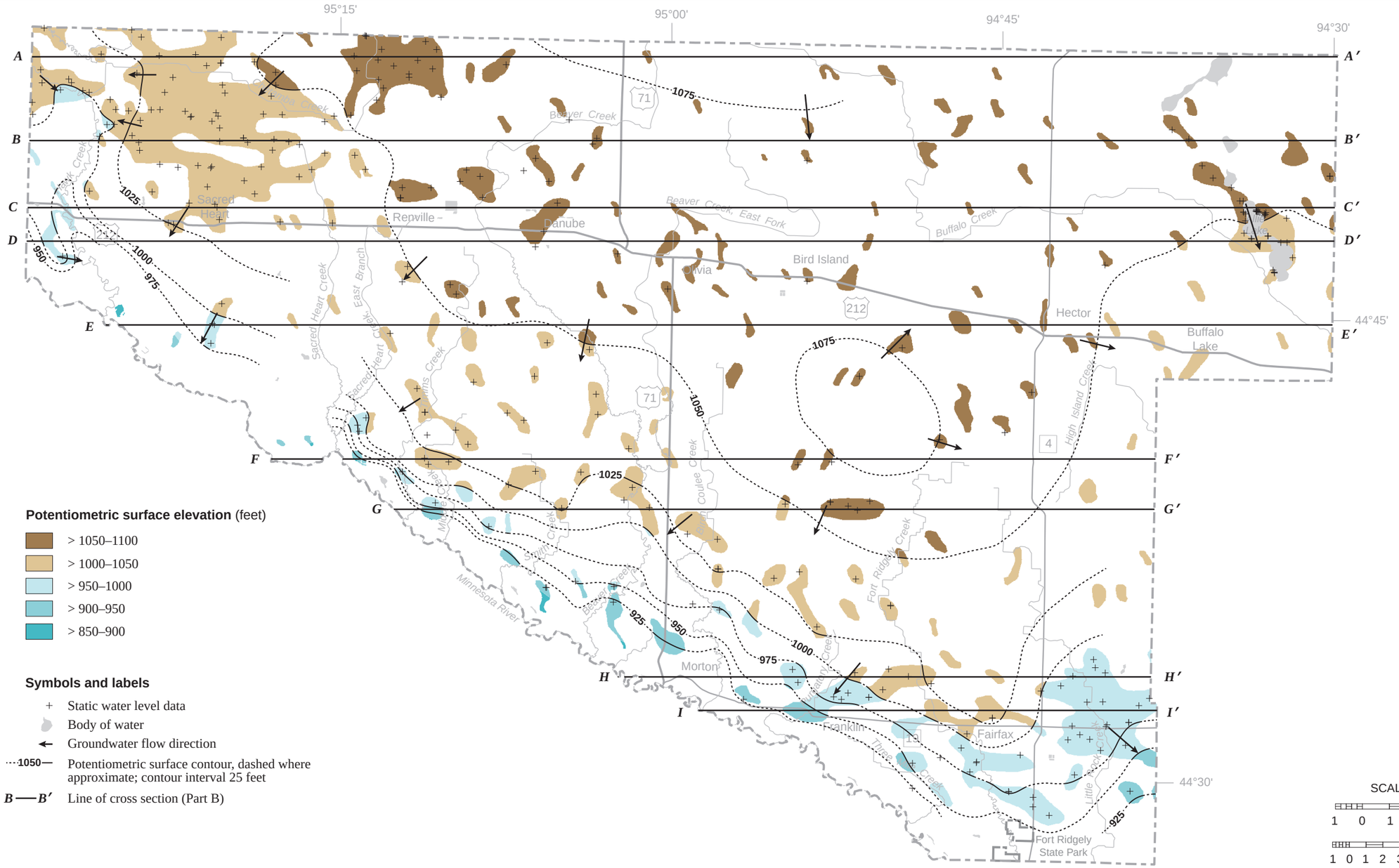
- \+ Static water level data
- Body of water
- ← Groundwater flow direction
- 1050 Potentiometric surface contour, dashed where approximate; contour interval 25 feet
- B — B′ Line of cross section (Part B)

SCALE 1:250 000

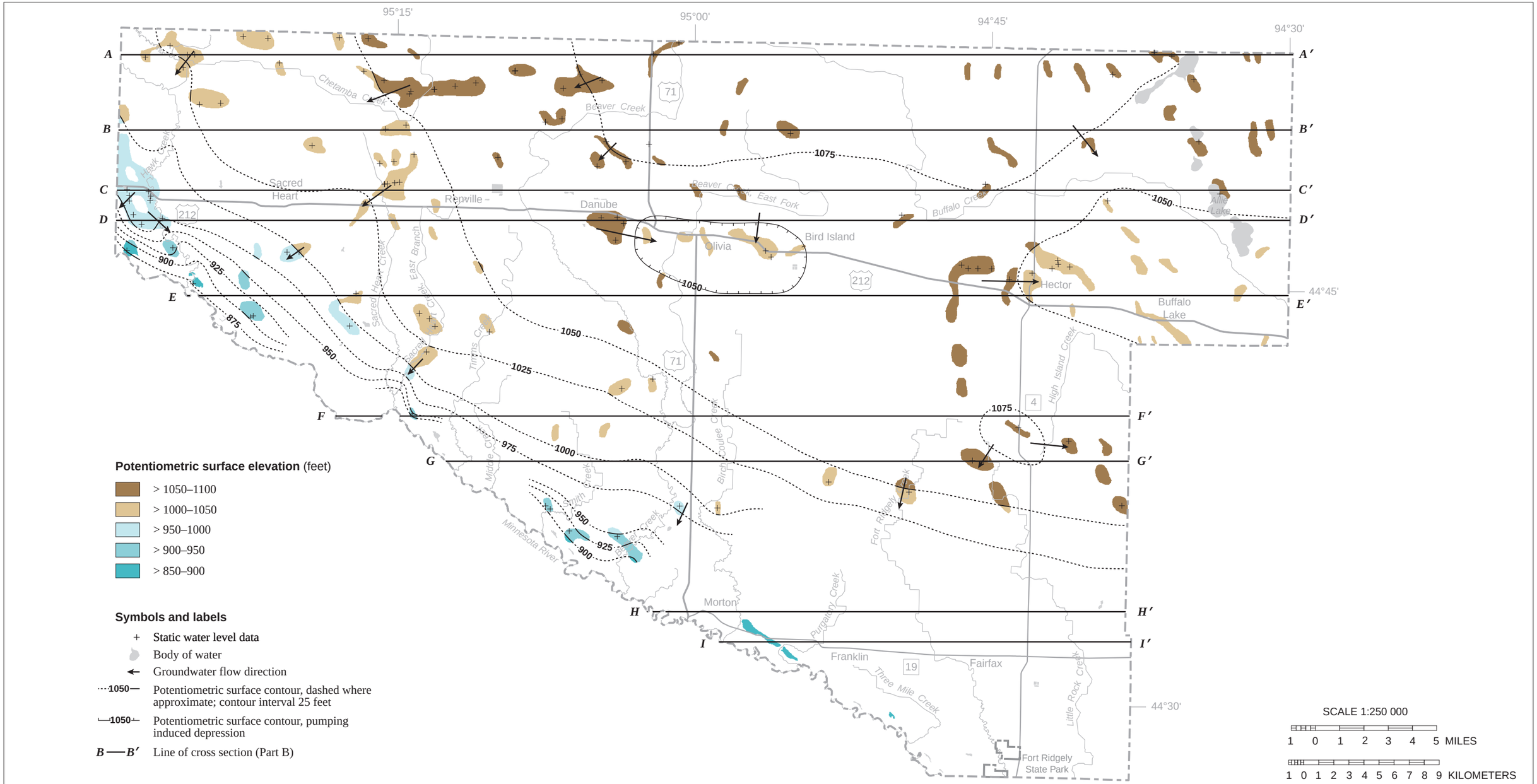
1 0 1 2 3 4 5 MILES

1 0 1 2 3 4 5 6 7 8 9 KILOMETERS

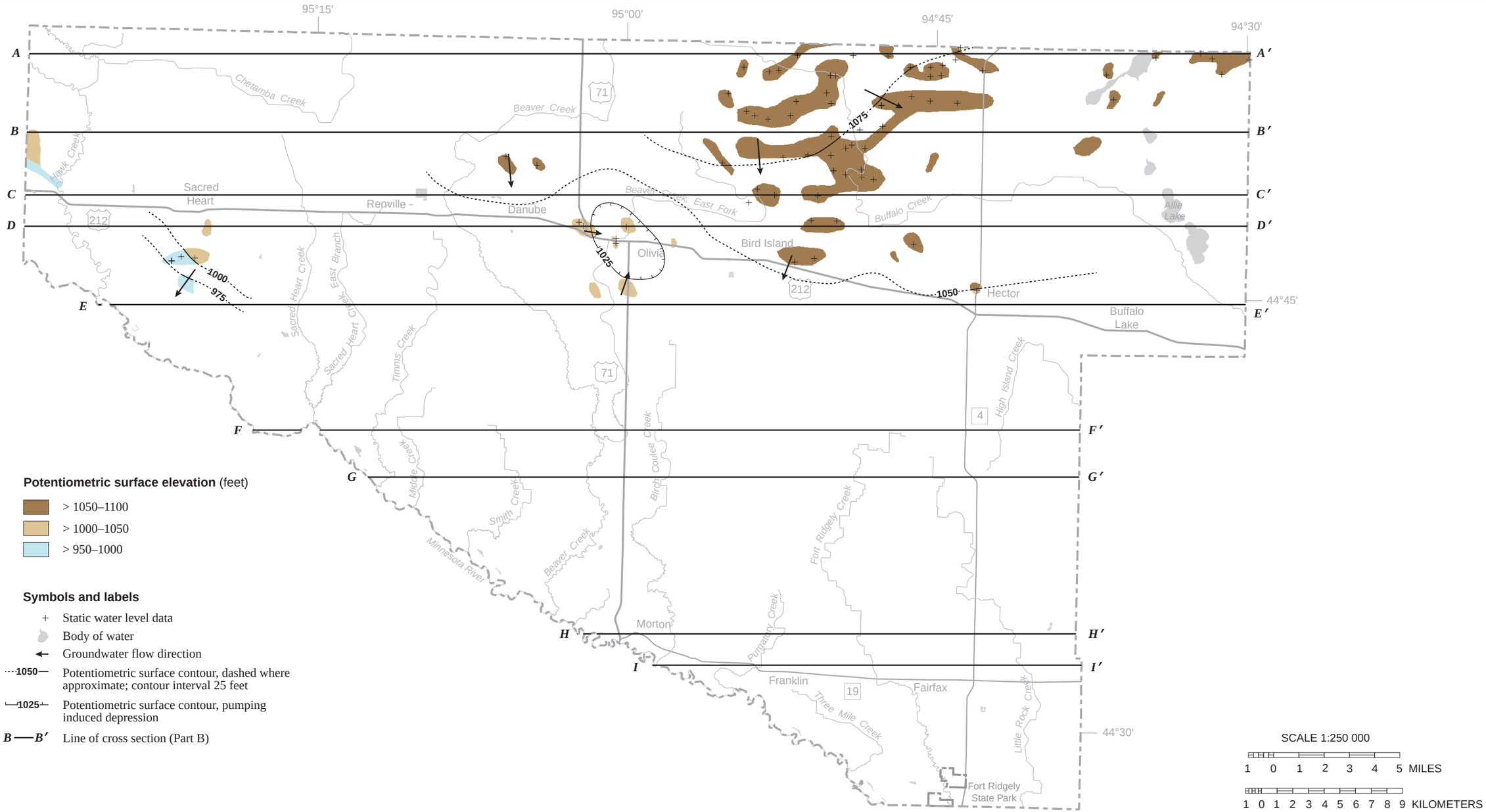
Map Figure 7. Potentiometric surface of s2 buried sand aquifer



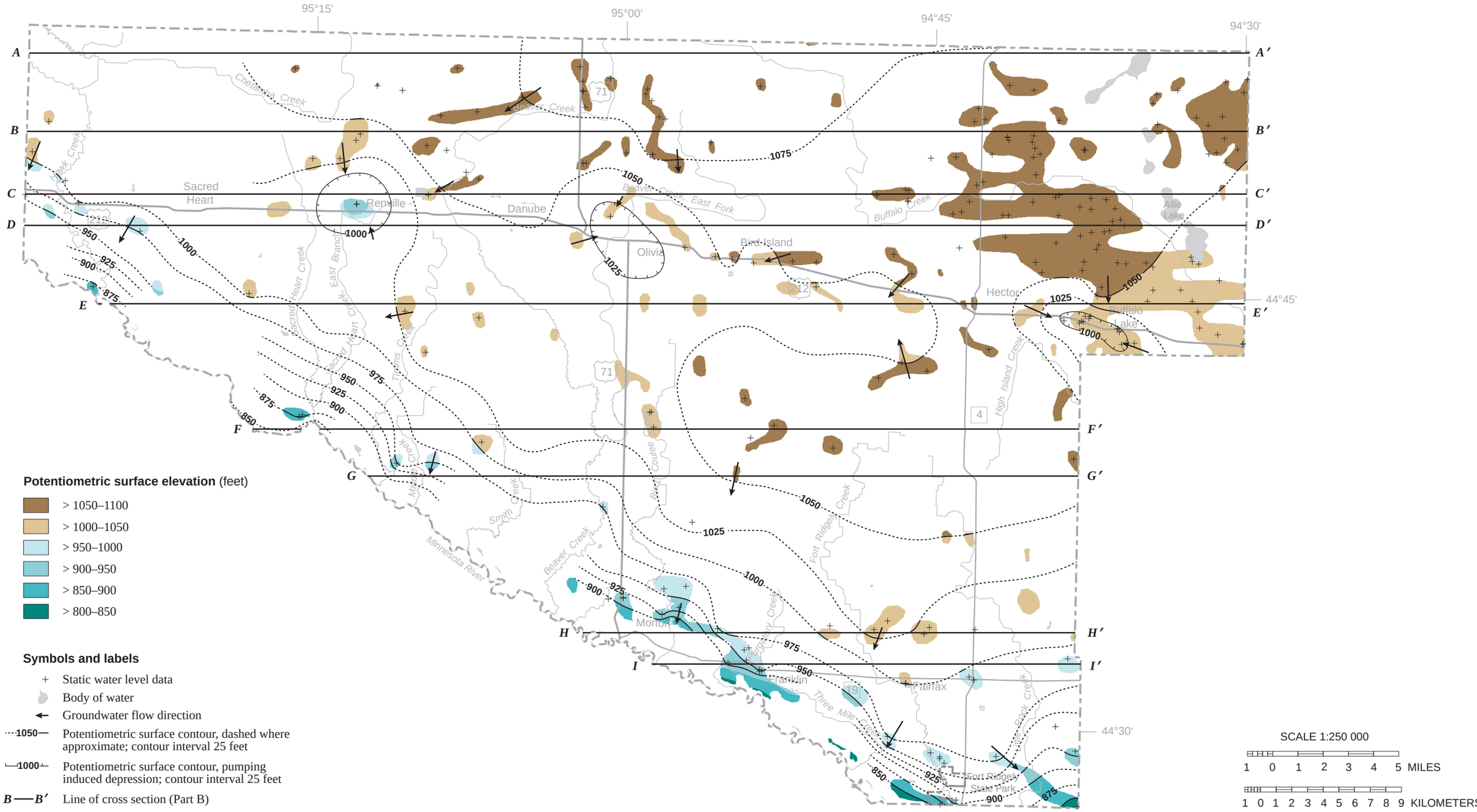
Map Figure 8. Potentiometric surface of s3 buried sand aquifer



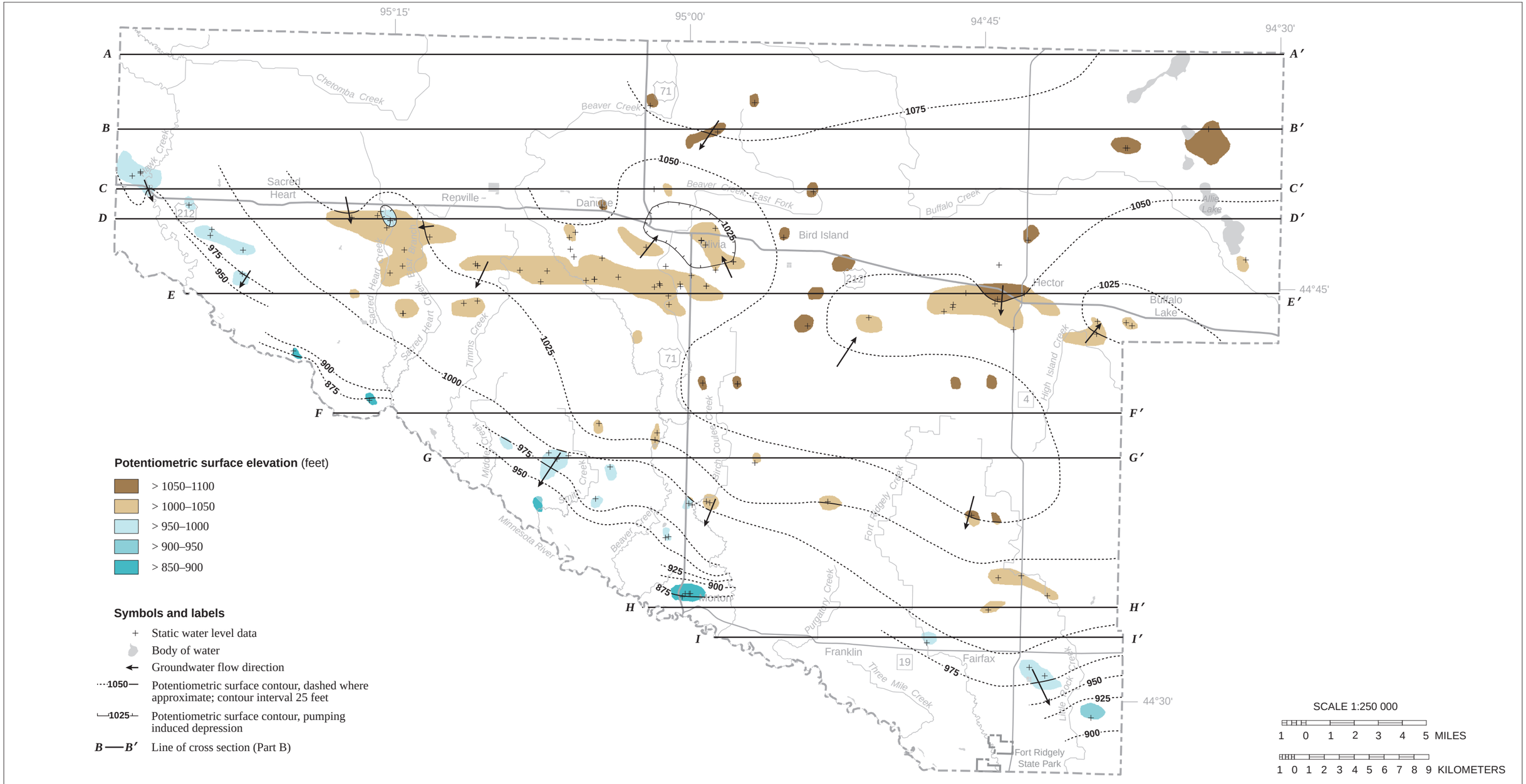
Map Figure 9. Potentiometric surface of s4 buried sand aquifer



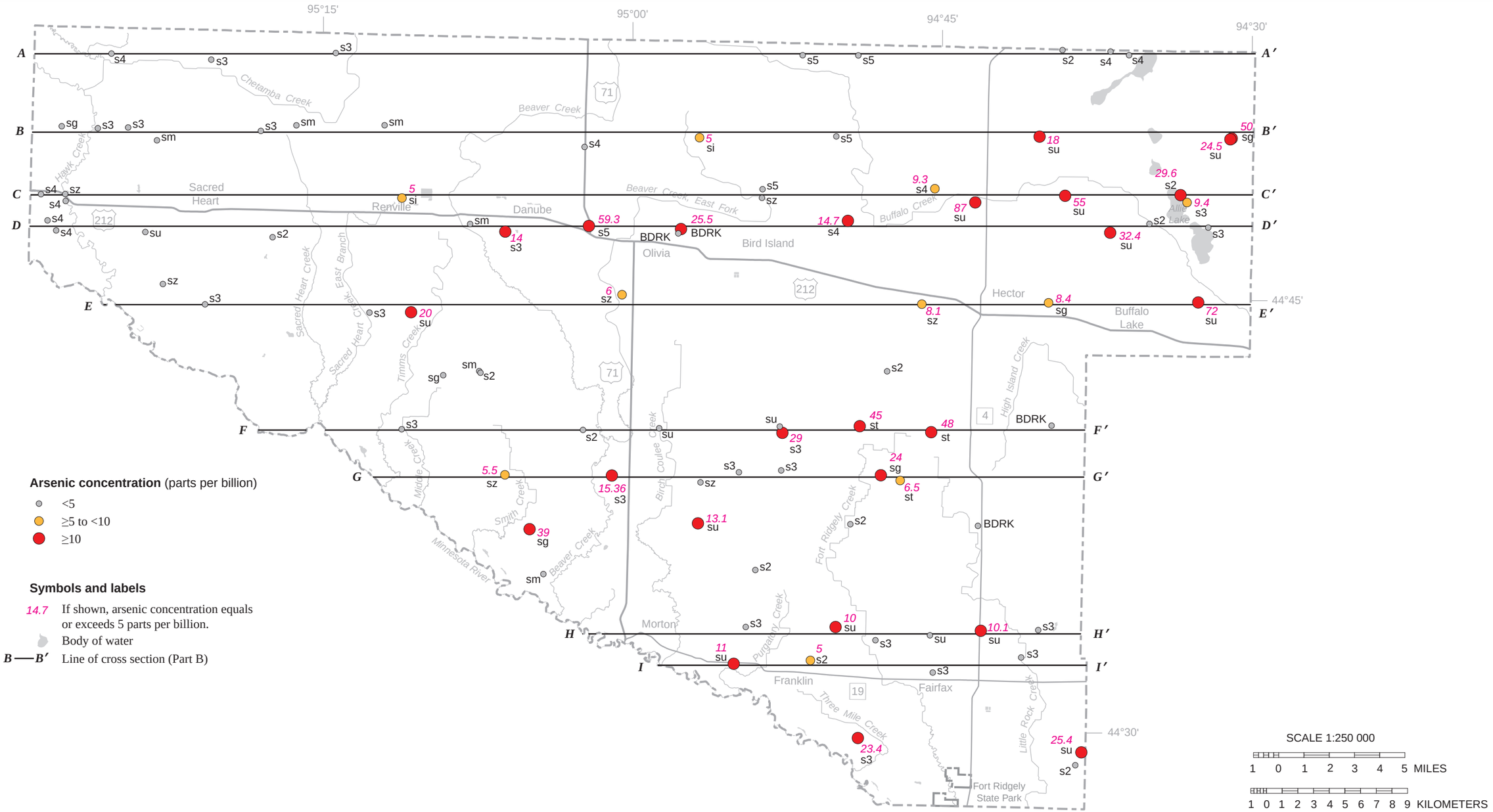
Map Figure 10. Potentiometric surface of s5 buried sand aquifer



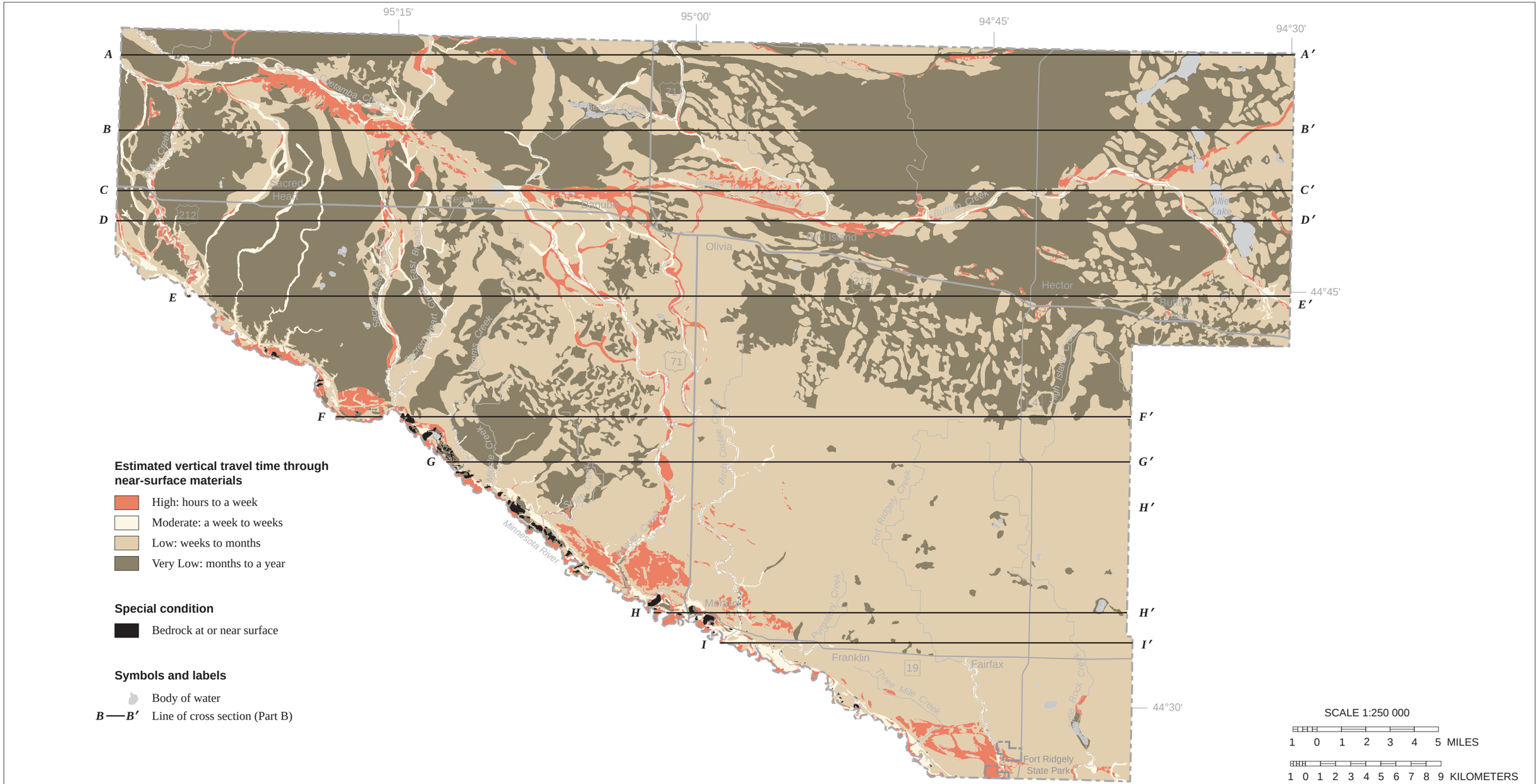
Map Figure 11. Potentiometric surface of su buried sand aquifer



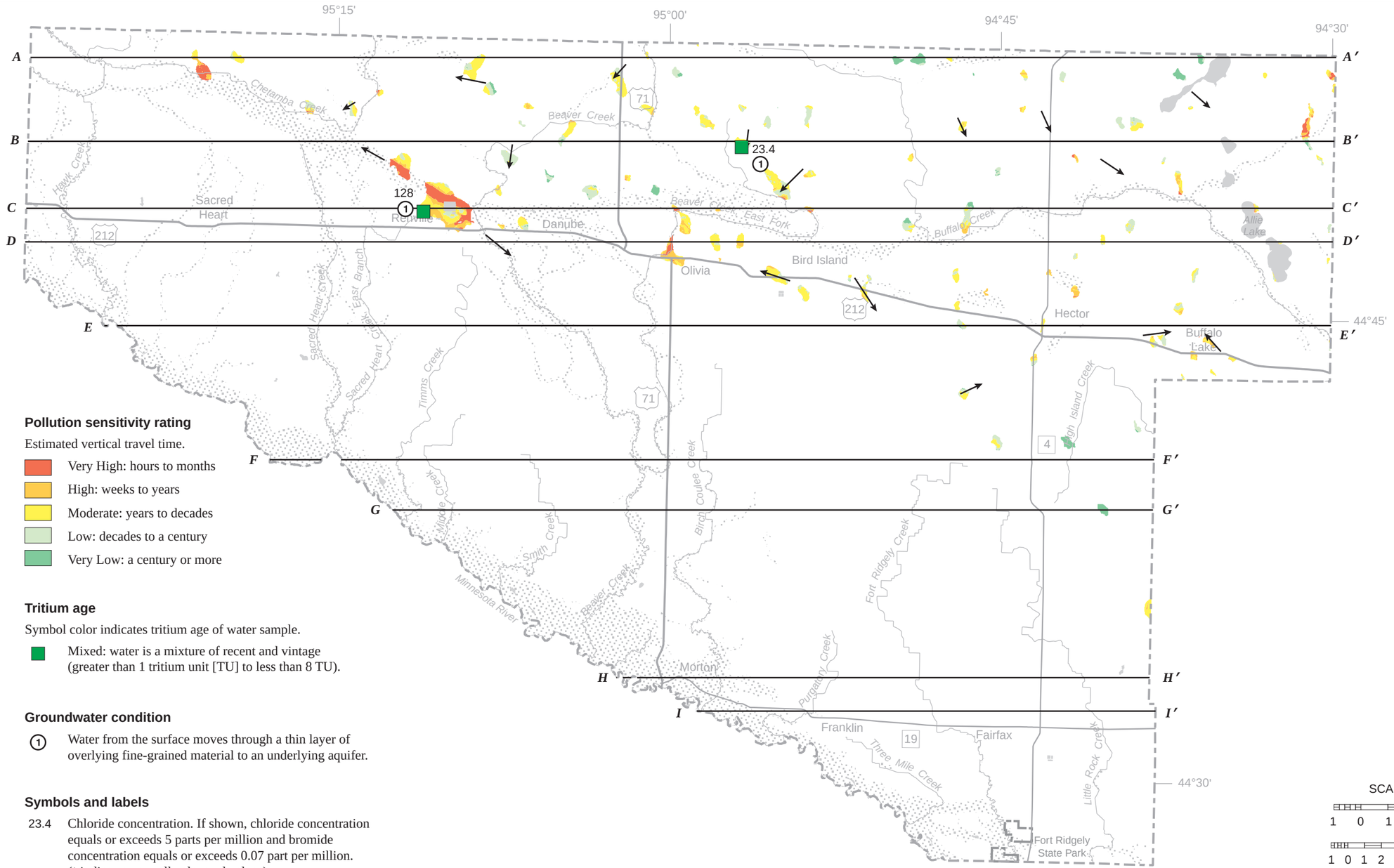
Map Figure 12. Potentiometric surface of sz buried sand aquifer



Map Figure 13. Arsenic concentration
Arsenic concentrations equaled or exceeded federal drinking water standards (10 ppb) in 25 groundwater samples collected from 87 buried sand and 4 bedrock aquifers.



Map Figure 14. Pollution sensitivity of near-surface materials
Very low to low pollution sensitivity ratings are common throughout most of the county. The exception is in river and stream valleys, where the ss surficial sand and gravel deposits are mapped. Map modified from the Minnesota Hydrogeology Atlas HG-02 (Adams, 2016b).



Pollution sensitivity rating

Estimated vertical travel time.

- Very High: hours to months
- High: weeks to years
- Moderate: years to decades
- Low: decades to a century
- Very Low: a century or more

Tritium age

Symbol color indicates tritium age of water sample.

- Mixed: water is a mixture of recent and vintage (greater than 1 tritium unit [TU] to less than 8 TU).

Groundwater condition

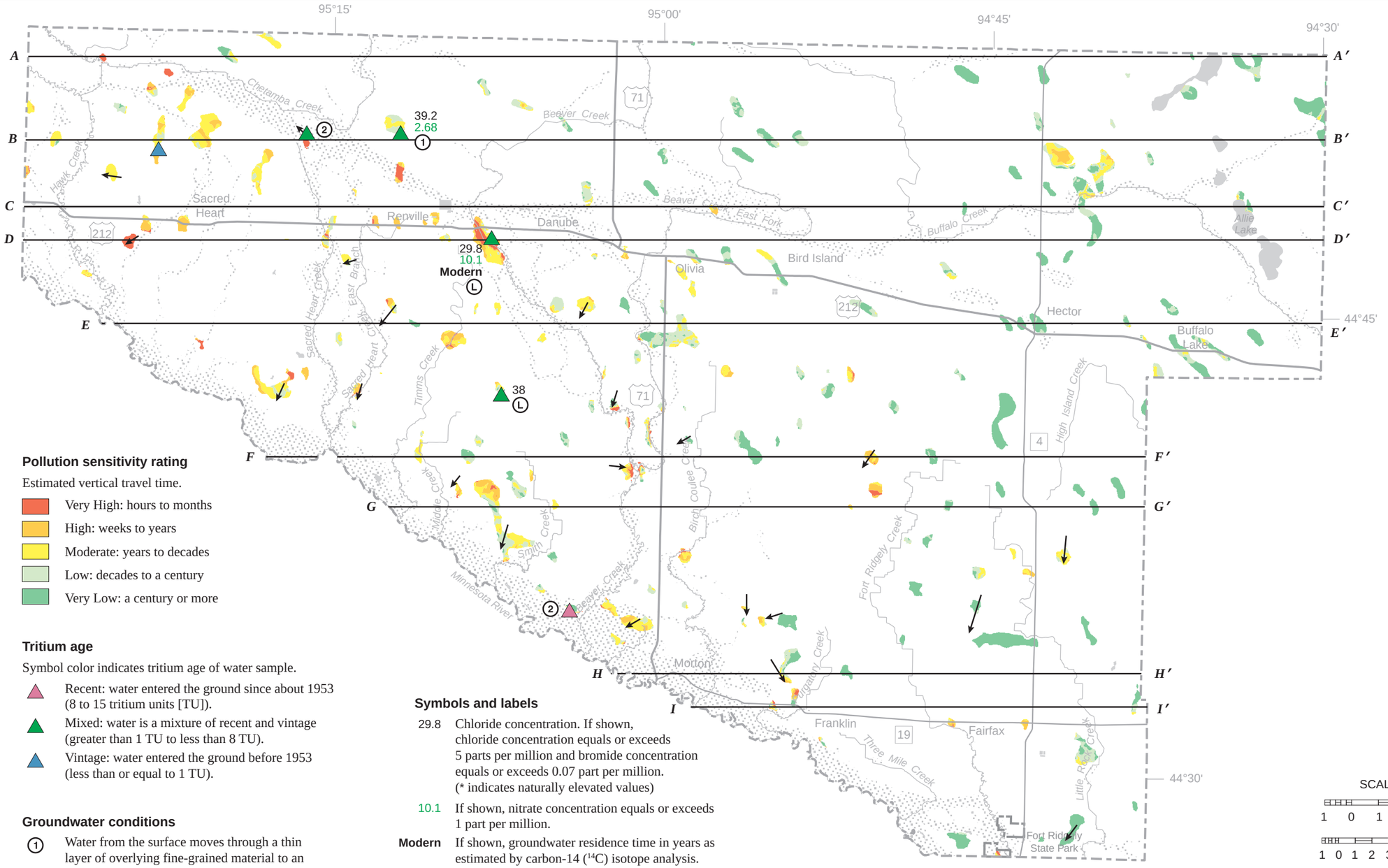
- ① Water from the surface moves through a thin layer of overlying fine-grained material to an underlying aquifer.

Symbols and labels

- 23.4 Chloride concentration. If shown, chloride concentration equals or exceeds 5 parts per million and bromide concentration equals or exceeds 0.07 part per million. (* indicates naturally elevated values)
- Body of water
- ← Groundwater flow direction
- B — B′ Line of cross section (Part B)
- Extent of surficial sand

Map Figure 15. Pollution sensitivity of si buried sand aquifer

The si aquifer is generally shallow (average 27 feet) and exhibits low to very high sensitivity.



Pollution sensitivity rating

Estimated vertical travel time.

- Very High: hours to months
- High: weeks to years
- Moderate: years to decades
- Low: decades to a century
- Very Low: a century or more

Tritium age

Symbol color indicates tritium age of water sample.

- Recent: water entered the ground since about 1953 (8 to 15 tritium units [TU]).
- Mixed: water is a mixture of recent and vintage (greater than 1 TU to less than 8 TU).
- Vintage: water entered the ground before 1953 (less than or equal to 1 TU).

Groundwater conditions

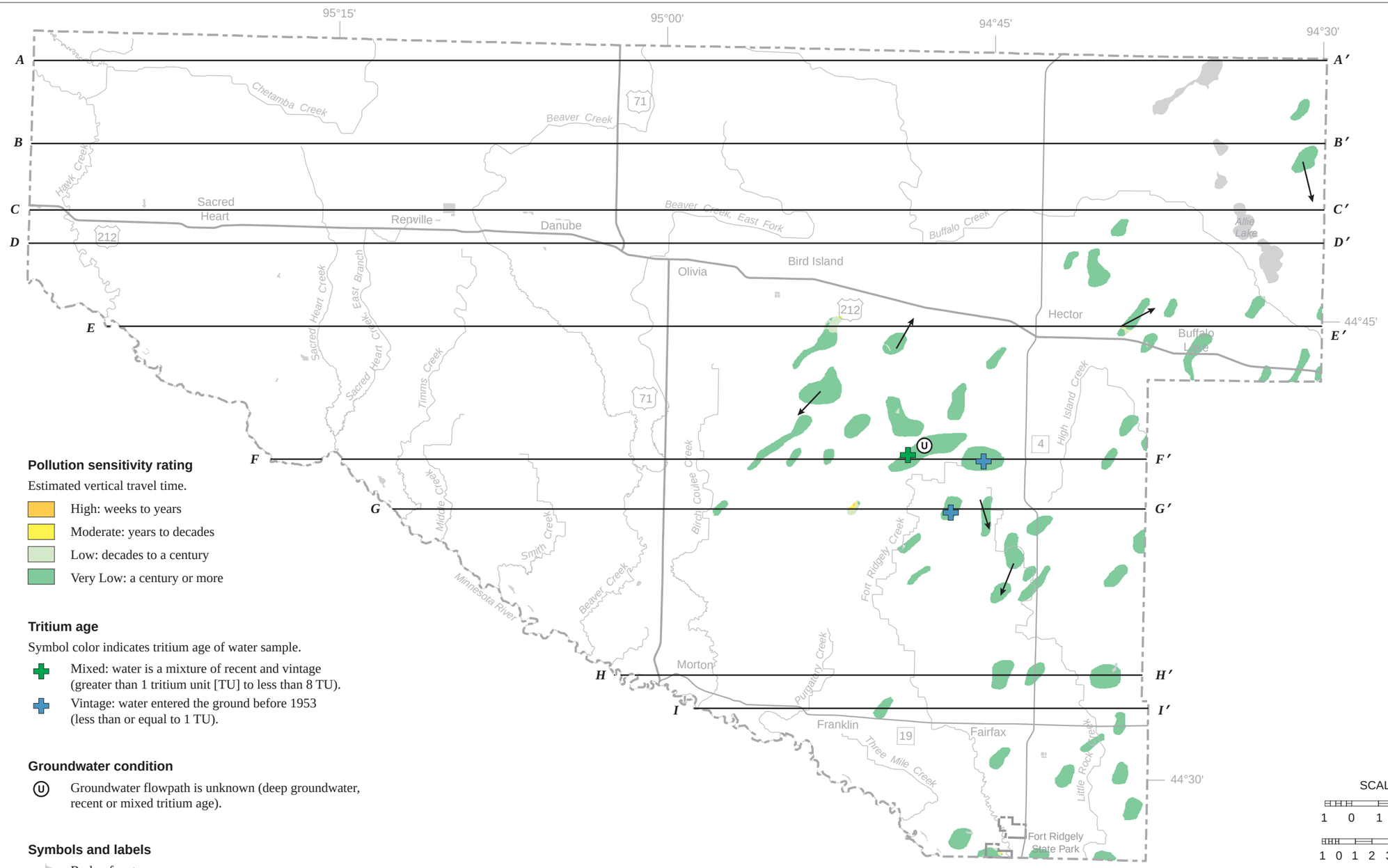
- (1) Water from the surface moves through a thin layer of overlying fine-grained material to an underlying aquifer.
- (2) Groundwater moves from an overlying surficial aquifer to a buried aquifer.
- (L) Groundwater flows laterally.

Symbols and labels

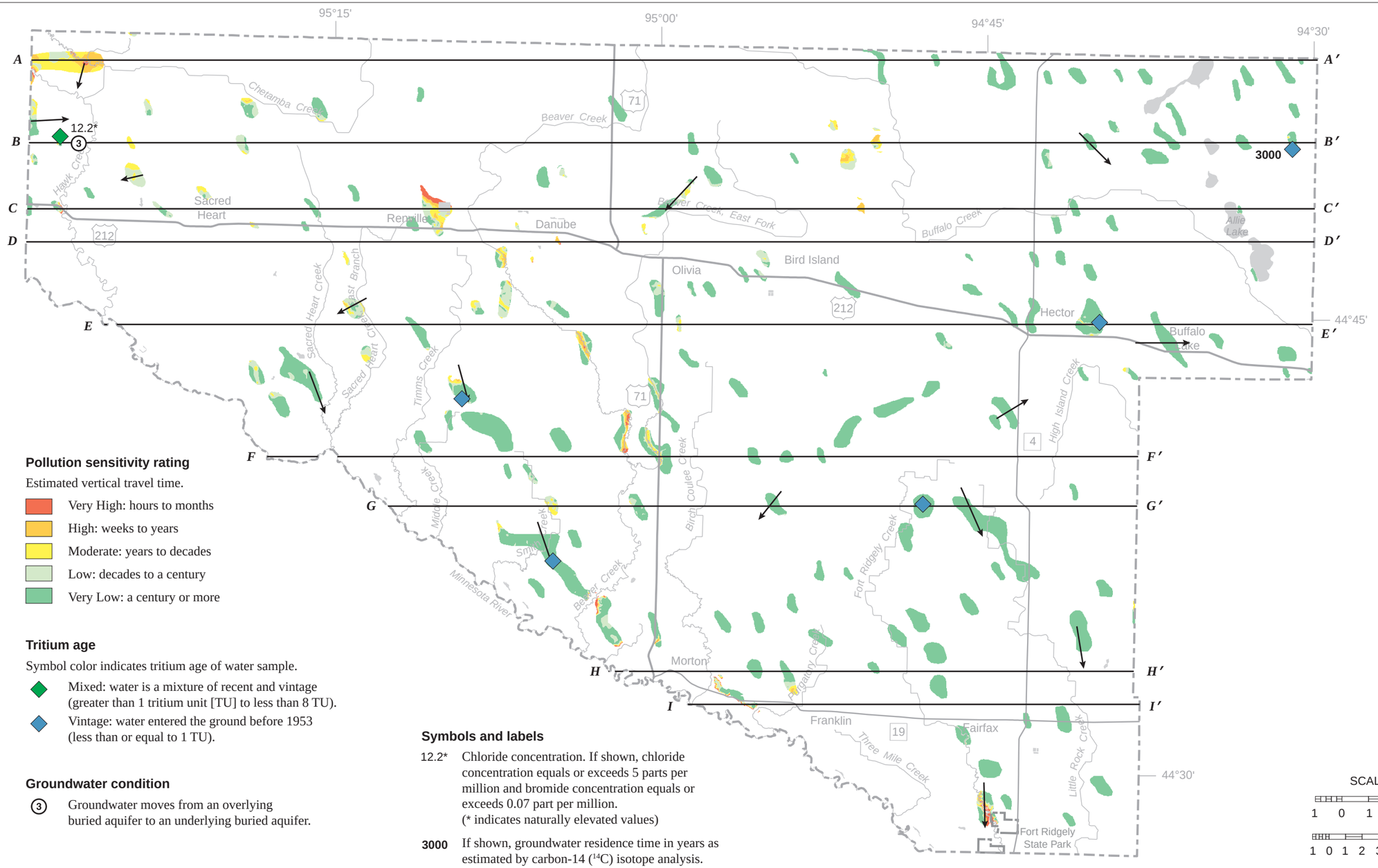
- 29.8 Chloride concentration. If shown, chloride concentration equals or exceeds 5 parts per million and bromide concentration equals or exceeds 0.07 part per million. (* indicates naturally elevated values)
- 10.1 If shown, nitrate concentration equals or exceeds 1 part per million.
- **Modern** If shown, groundwater residence time in years as estimated by carbon-14 (^{14}C) isotope analysis.
- Body of water
- Groundwater flow direction
- B—B′ Line of cross section (Part B)
- Extent of surficial sand

Map Figure 16. Pollution sensitivity of sm buried sand aquifer

The sm aquifer is shallow (average 38 feet) and exhibits very low to very high sensitivity. The few locations with a very low sensitivity rating are mostly in the eastern portion of the county where the aquifer is more deeply buried.



Map Figure 17. Pollution sensitivity of st buried sand aquifer
The st aquifer typically has a very low pollution sensitivity rating, with a few minor exceptions.



Pollution sensitivity rating

Estimated vertical travel time.

- Very High: hours to months
- High: weeks to years
- Moderate: years to decades
- Low: decades to a century
- Very Low: a century or more

Tritium age

Symbol color indicates tritium age of water sample.

- Mixed: water is a mixture of recent and vintage (greater than 1 tritium unit [TU] to less than 8 TU).
- Vintage: water entered the ground before 1953 (less than or equal to 1 TU).

Groundwater condition

- (3) Groundwater moves from an overlying buried aquifer to an underlying buried aquifer.

Symbols and labels

- 12.2* Chloride concentration. If shown, chloride concentration equals or exceeds 5 parts per million and bromide concentration equals or exceeds 0.07 part per million. (* indicates naturally elevated values)
- 3000 If shown, groundwater residence time in years as estimated by carbon-14 (^{14}C) isotope analysis.
- Body of water
- ← Groundwater flow direction
- B—B′ Line of cross section (Part B)

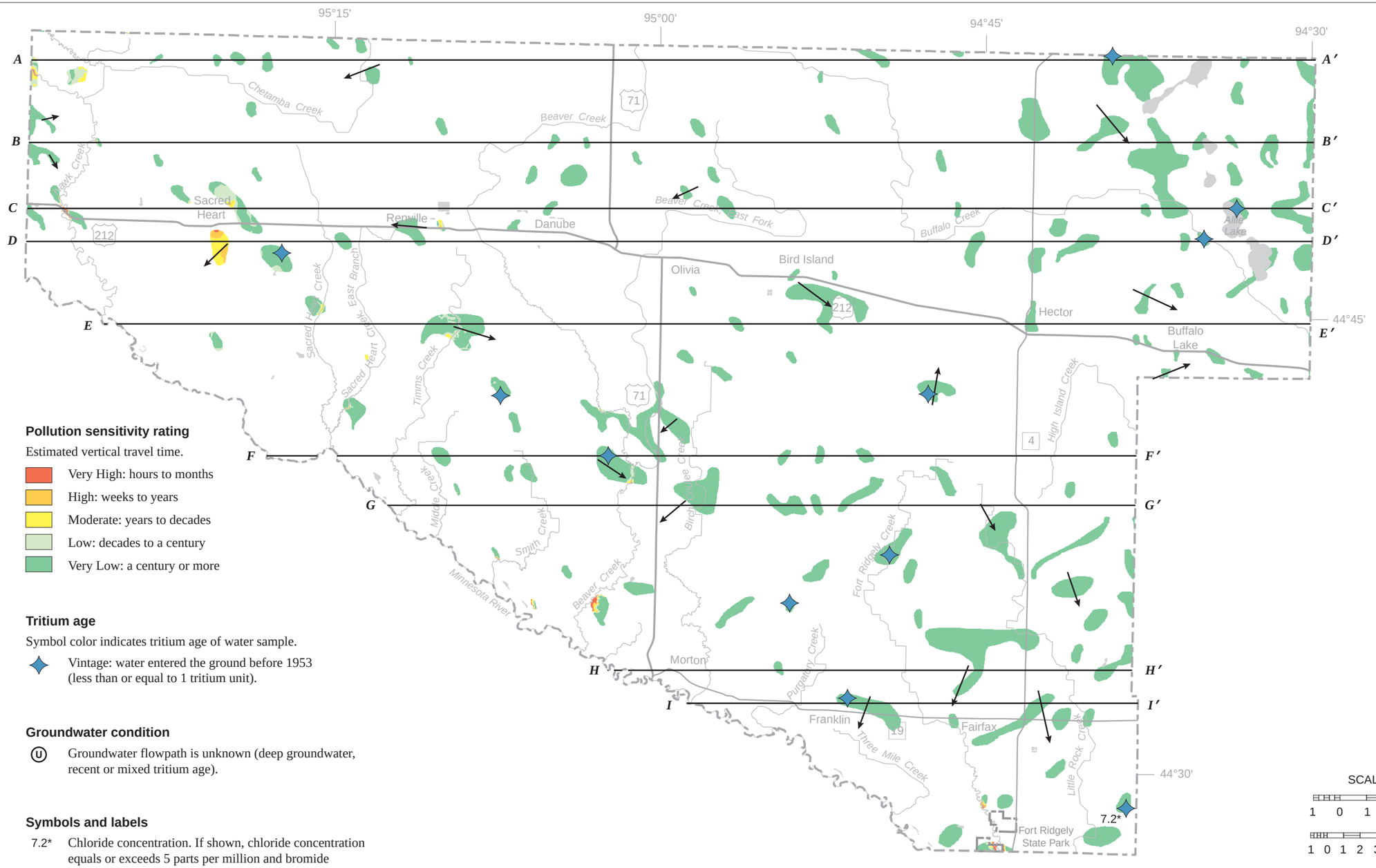
SCALE 1:250 000

1 0 1 2 3 4 5 MILES

1 0 1 2 3 4 5 6 7 8 9 KILOMETERS

Map Figure 18. Pollution sensitivity of sg buried sand aquifer

The sg aquifer has a very low pollution sensitivity rating except for shallower occurrences in the north-central and northwestern portions of the county and in river valleys.



Pollution sensitivity rating

Estimated vertical travel time.

- Very High: hours to months
- High: weeks to years
- Moderate: years to decades
- Low: decades to a century
- Very Low: a century or more

Tritium age

Symbol color indicates tritium age of water sample.

- Vintage: water entered the ground before 1953 (less than or equal to 1 tritium unit).

Groundwater condition

- (U) Groundwater flowpath is unknown (deep groundwater, recent or mixed tritium age).

Symbols and labels

- 7.2* Chloride concentration. If shown, chloride concentration equals or exceeds 5 parts per million and bromide concentration equals or exceeds 0.07 part per million. (* indicates naturally elevated values)
- Body of water
- ← Groundwater flow direction
- B — B′ Line of cross section (Part B)

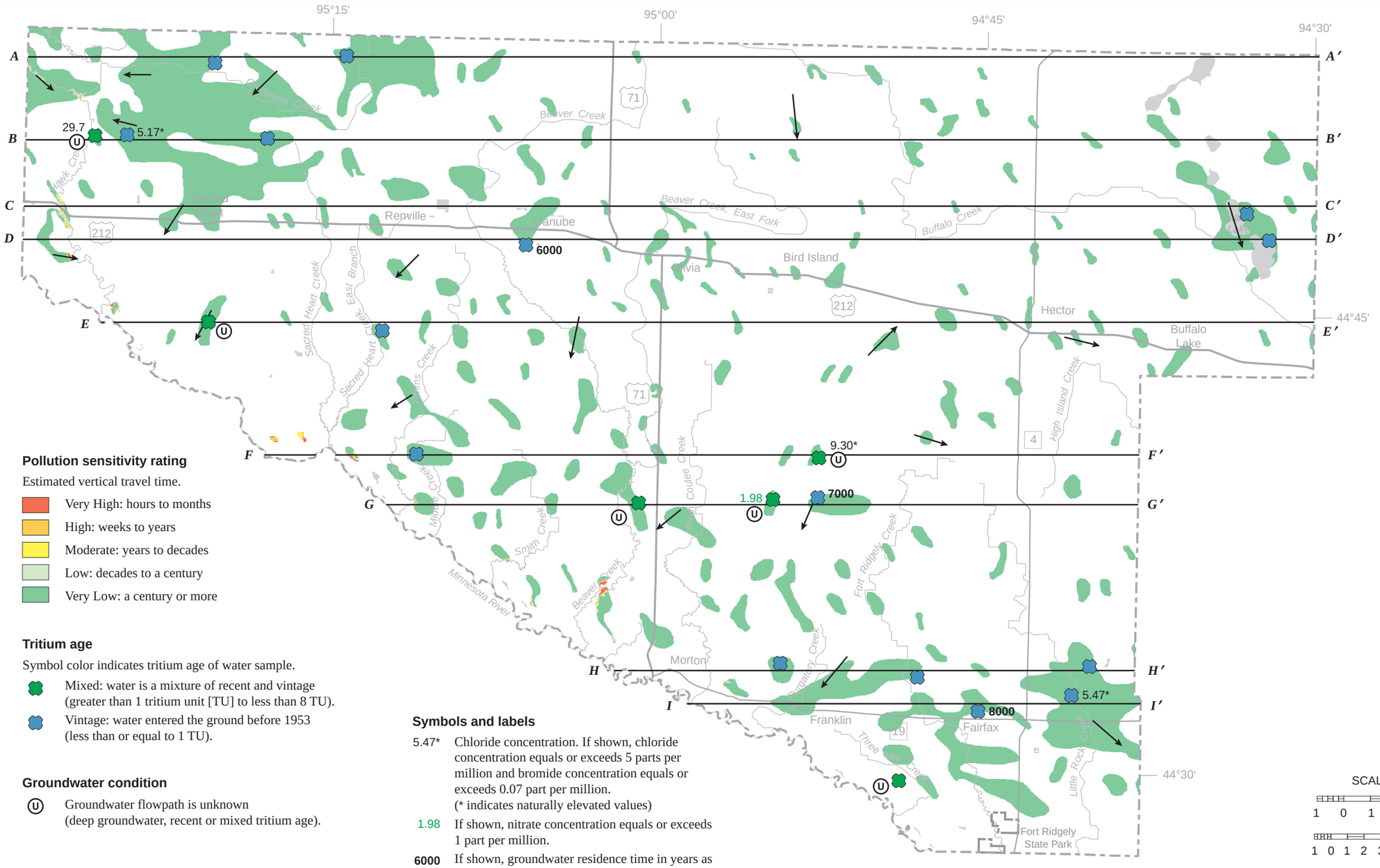
SCALE 1:250 000

1 0 1 2 3 4 5 MILES

1 0 1 2 3 4 5 6 7 8 9 KILOMETERS

Map Figure 19. Pollution sensitivity of s2 buried sand aquifer

The s2 aquifer has a very low pollution sensitivity rating except for shallower occurrences in the northwest part of the county, and in some river valleys.



Pollution sensitivity rating

Estimated vertical travel time.

- Very High: hours to months
- High: weeks to years
- Moderate: years to decades
- Low: decades to a century
- Very Low: a century or more

Tritium age

Symbol color indicates tritium age of water sample.

- Mixed: water is a mixture of recent and vintage (greater than 1 tritium unit [TU] to less than 8 TU).
- Vintage: water entered the ground before 1953 (less than or equal to 1 TU).

Groundwater condition

- (U) Groundwater flowpath is unknown (deep groundwater, recent or mixed tritium age).

Symbols and labels

- 5.47* Chloride concentration. If shown, chloride concentration equals or exceeds 5 parts per million and bromide concentration equals or exceeds 0.07 part per million. (* indicates naturally elevated values)
- 1.98 If shown, nitrate concentration equals or exceeds 1 part per million.
- 6000 If shown, groundwater residence time in years as estimated by carbon-14 (^{14}C) isotope analysis.
- Body of water
- ← Groundwater flow direction
- B — B′ Line of cross section (Part B)

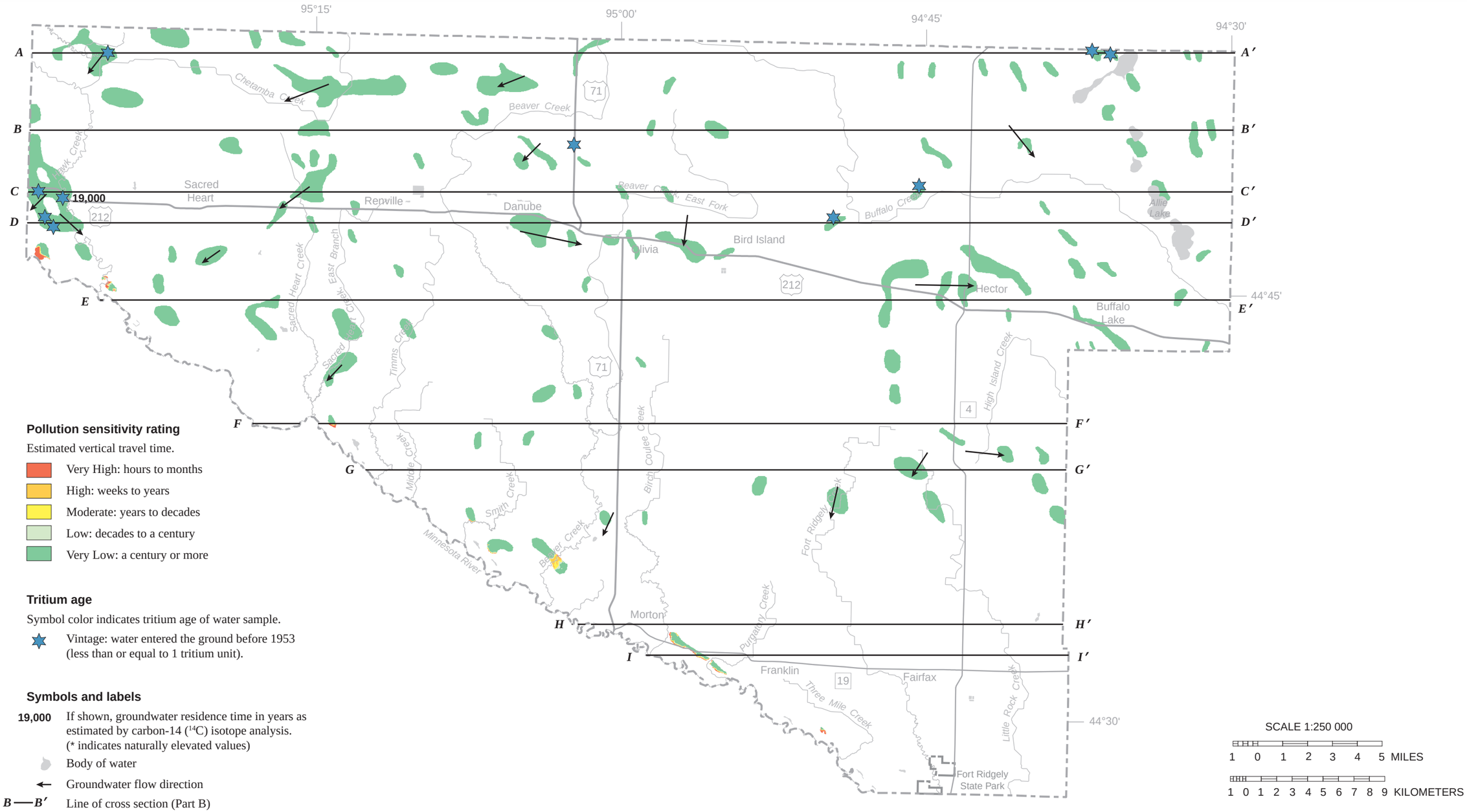
SCALE 1:250 000

1 0 1 2 3 4 5 MILES

1 0 1 2 3 4 5 6 7 8 9 KILOMETERS

Map Figure 20. Pollution sensitivity of s3 buried sand aquifer

The s3 aquifer has a very low pollution sensitivity rating except for a few locations along the Minnesota River valley and lower portions of its tributaries, where the top of the aquifer is closer to the land surface.



Pollution sensitivity rating

Estimated vertical travel time.

- Very High: hours to months
- High: weeks to years
- Moderate: years to decades
- Low: decades to a century
- Very Low: a century or more

Tritium age

Symbol color indicates tritium age of water sample.

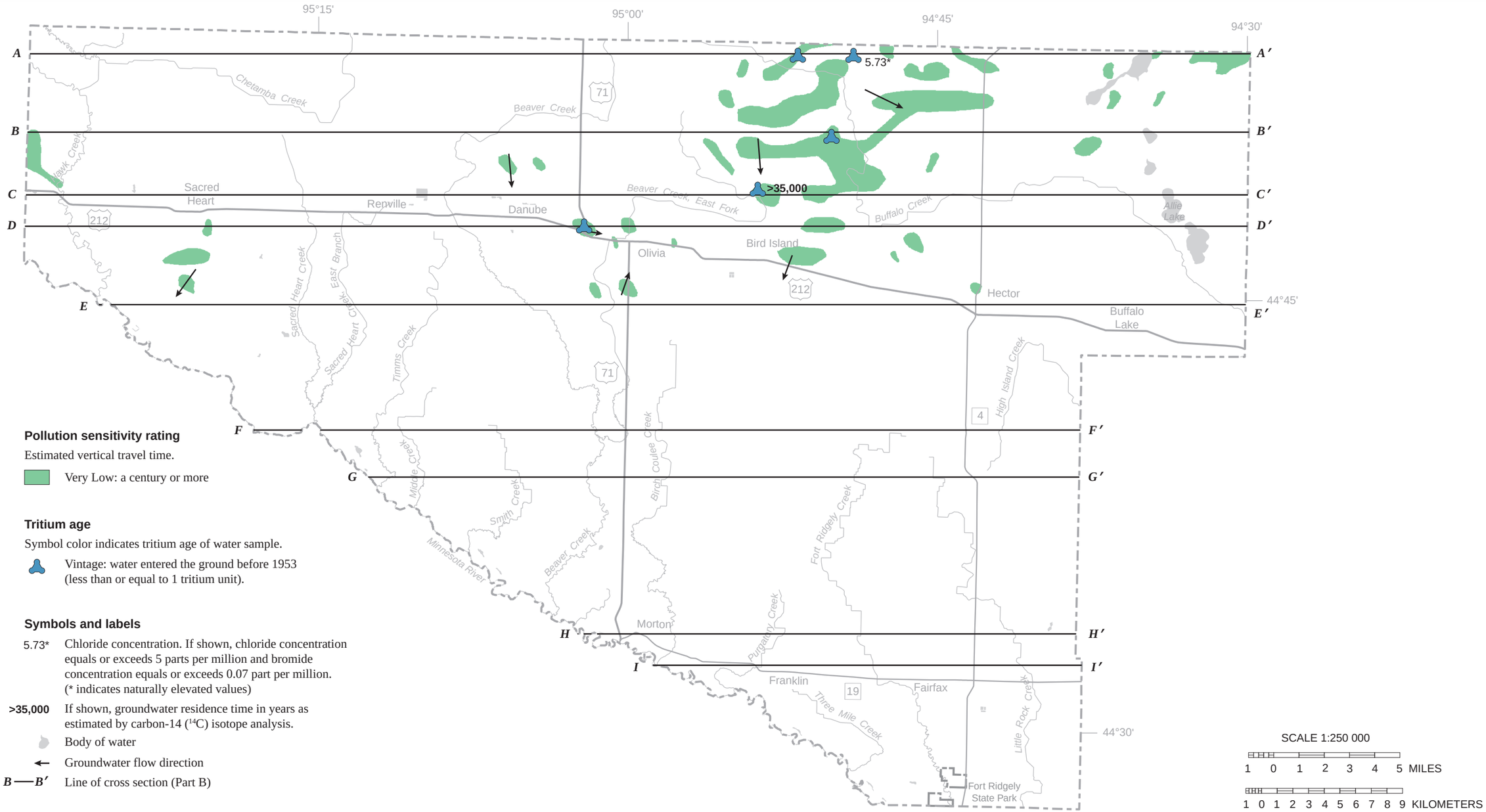
- Vintage: water entered the ground before 1953 (less than or equal to 1 tritium unit).

Symbols and labels

- **19,000** If shown, groundwater residence time in years as estimated by carbon-14 (^{14}C) isotope analysis. (* indicates naturally elevated values)
- Body of water
- Groundwater flow direction
- *B* — *B′* Line of cross section (Part B)

Map Figure 21. Pollution sensitivity of s4 buried sand aquifer

The s4 aquifer has a very low pollution sensitivity rating except for a few locations along the Minnesota River valley and lower portions of its tributaries.



Pollution sensitivity rating

Estimated vertical travel time.

Very Low: a century or more

Tritium age

Symbol color indicates tritium age of water sample.

Vintage: water entered the ground before 1953 (less than or equal to 1 tritium unit).

Symbols and labels

5.73* Chloride concentration. If shown, chloride concentration equals or exceeds 5 parts per million and bromide concentration equals or exceeds 0.07 part per million. (* indicates naturally elevated values)

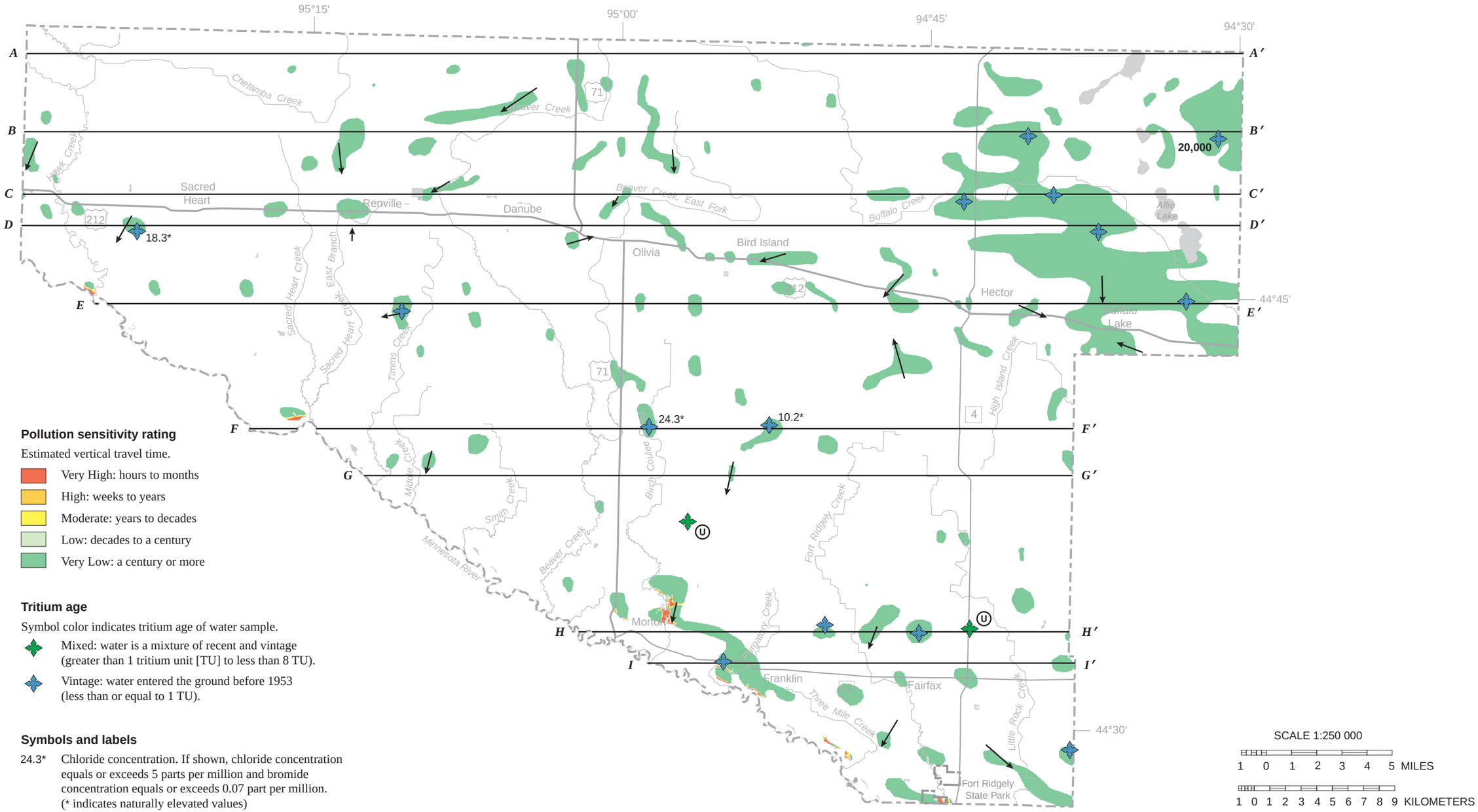
>35,000 If shown, groundwater residence time in years as estimated by carbon-14 (^{14}C) isotope analysis.

Body of water

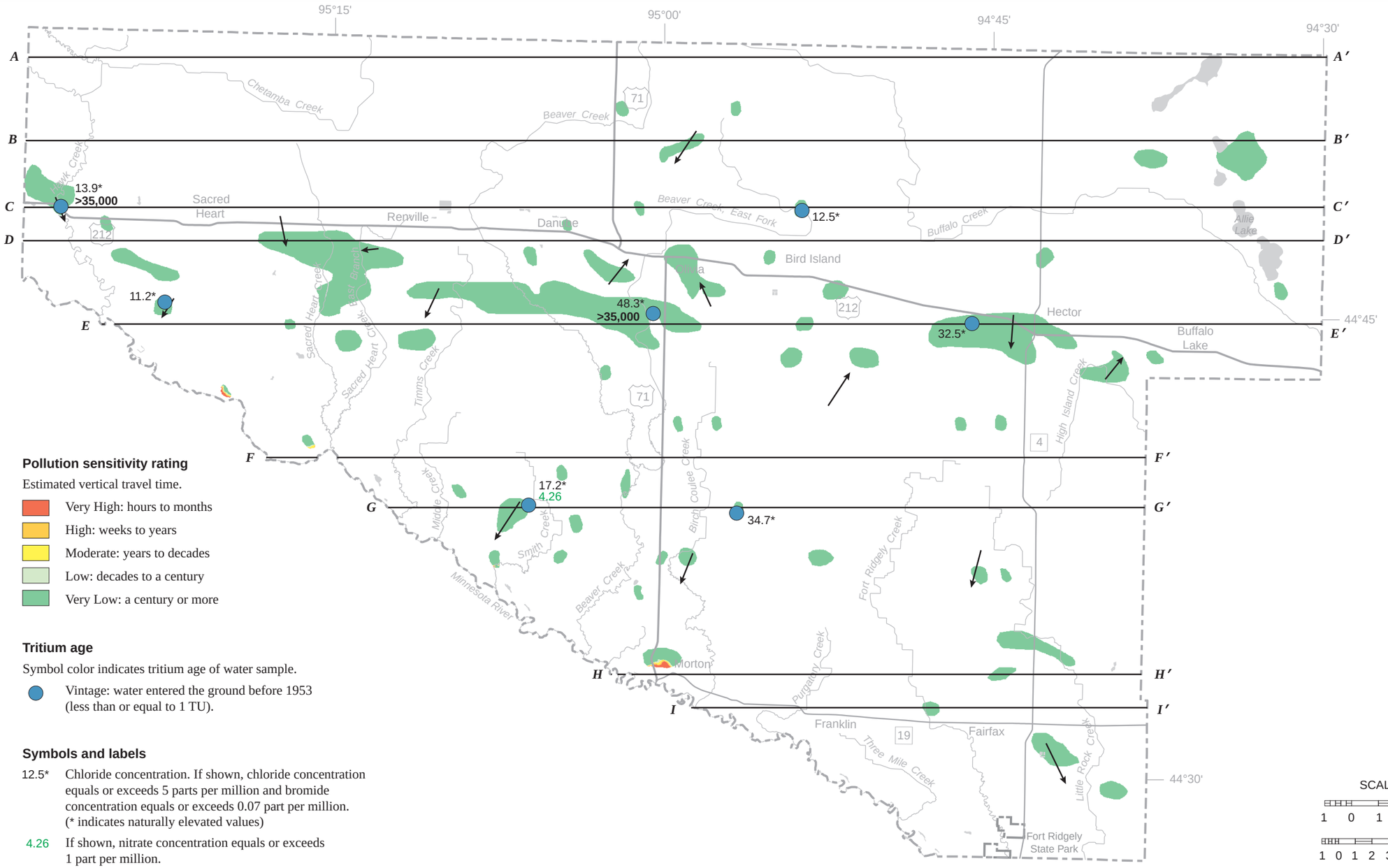
Groundwater flow direction

B — B′ Line of cross section (Part B)

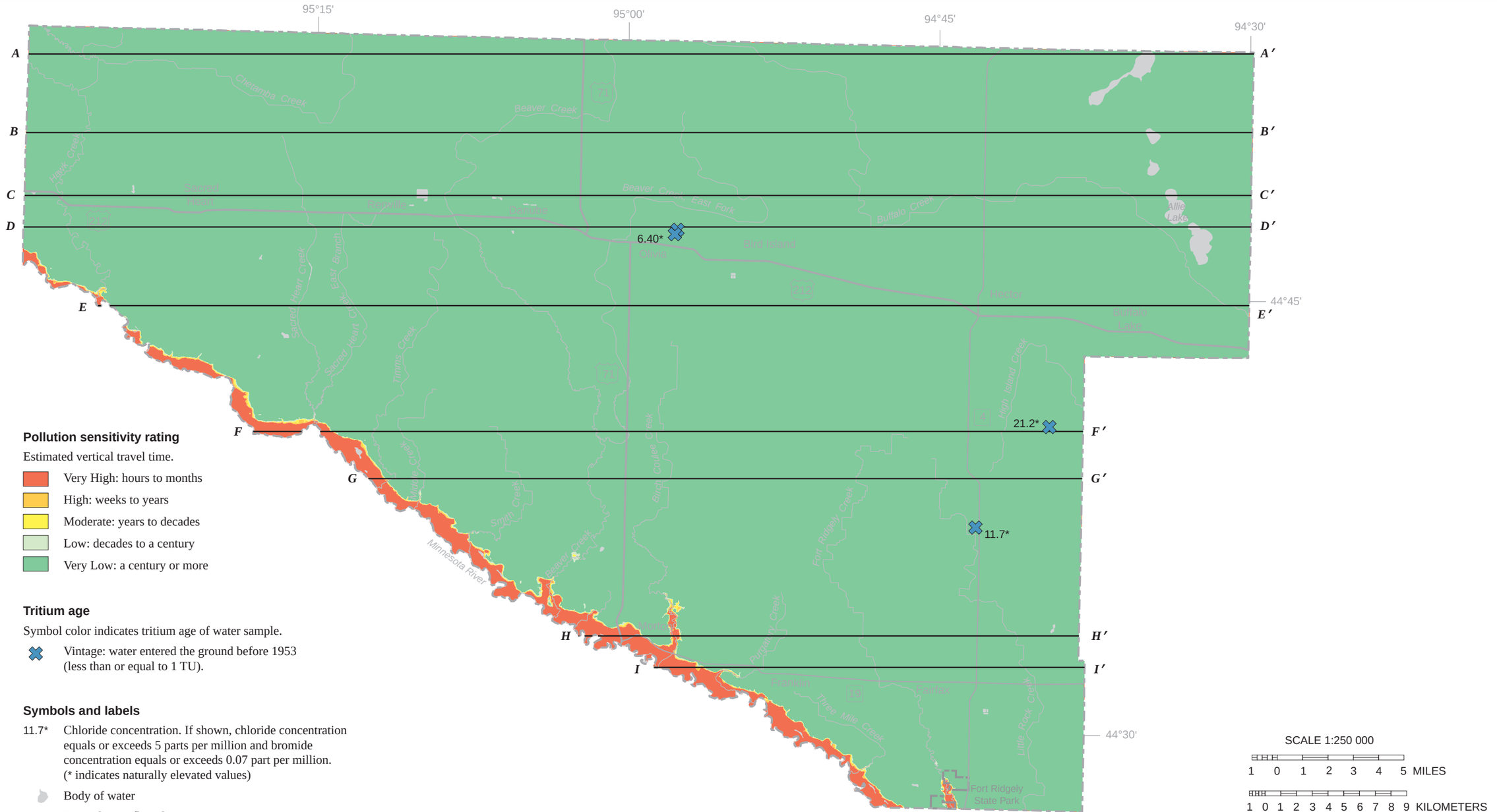
Map Figure 22. Pollution sensitivity of s5 buried sand aquifer
The s5 aquifer generally has a very low pollution sensitivity rating.



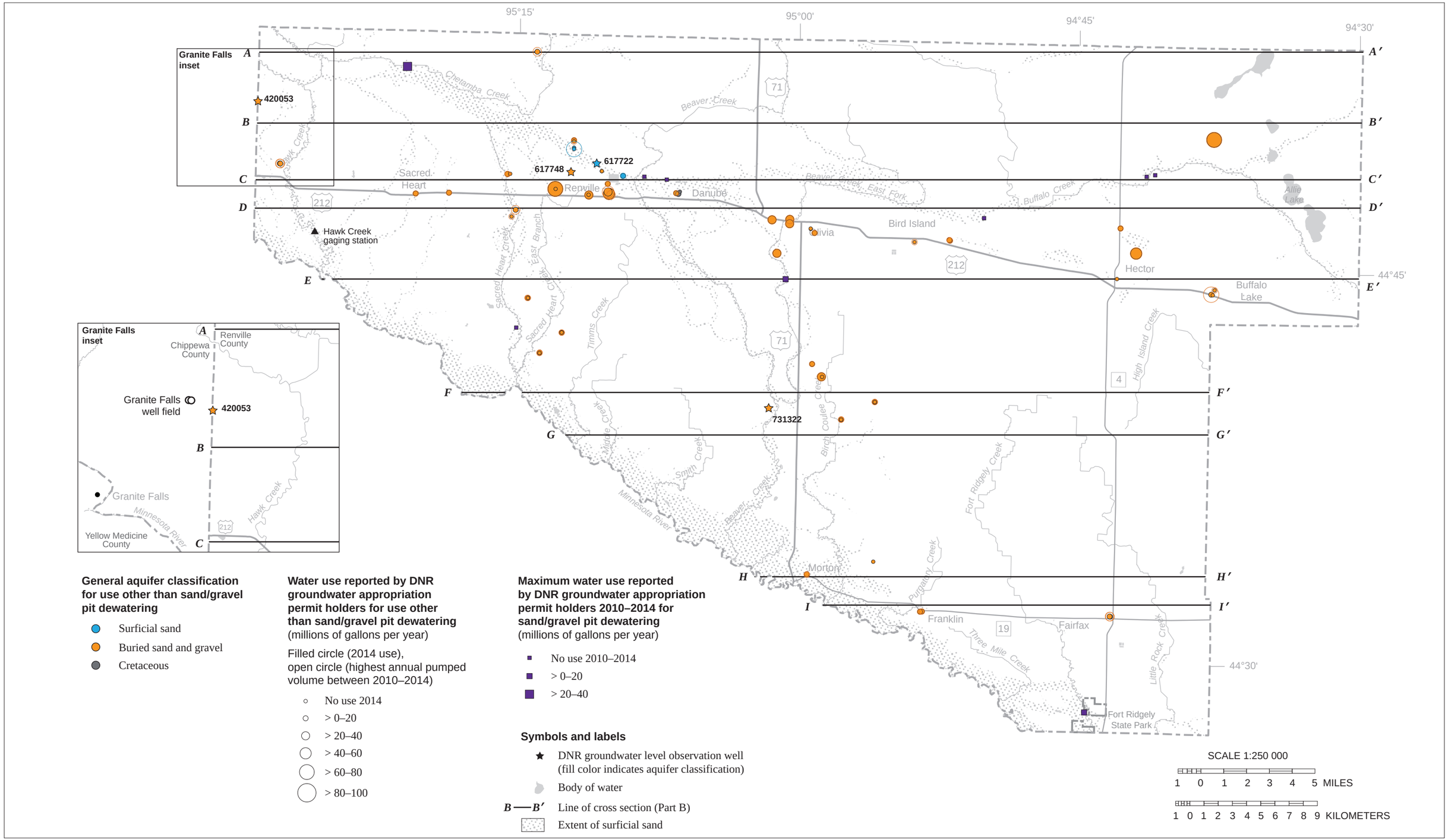
Map Figure 23. Pollution sensitivity of su buried sand aquifer
The su aquifer has a very low pollution sensitivity rating except for a few locations along the Minnesota River valley and lower portions of its tributaries.



Map Figure 24. Pollution sensitivity of sz buried sand aquifer
The sz aquifer has a very low pollution sensitivity rating except for a few locations along the Minnesota River valley and lower portions of its tributaries.



Map Figure 25. Pollution sensitivity of bedrock surface
The pollution sensitivity of the bedrock surface is very low except in the Minnesota River valley where the bedrock is locally exposed or overlain by sand and gravel deposits and in the lower reaches of major tributaries.



General aquifer classification for use other than sand/gravel pit dewatering

- Surficial sand
- Buried sand and gravel
- Cretaceous

Water use reported by DNR groundwater appropriation permit holders for use other than sand/gravel pit dewatering
(millions of gallons per year)

Filled circle (2014 use),
open circle (highest annual pumped volume between 2010–2014)

- No use 2014
- > 0–20
- > 20–40
- > 40–60
- > 60–80
- > 80–100

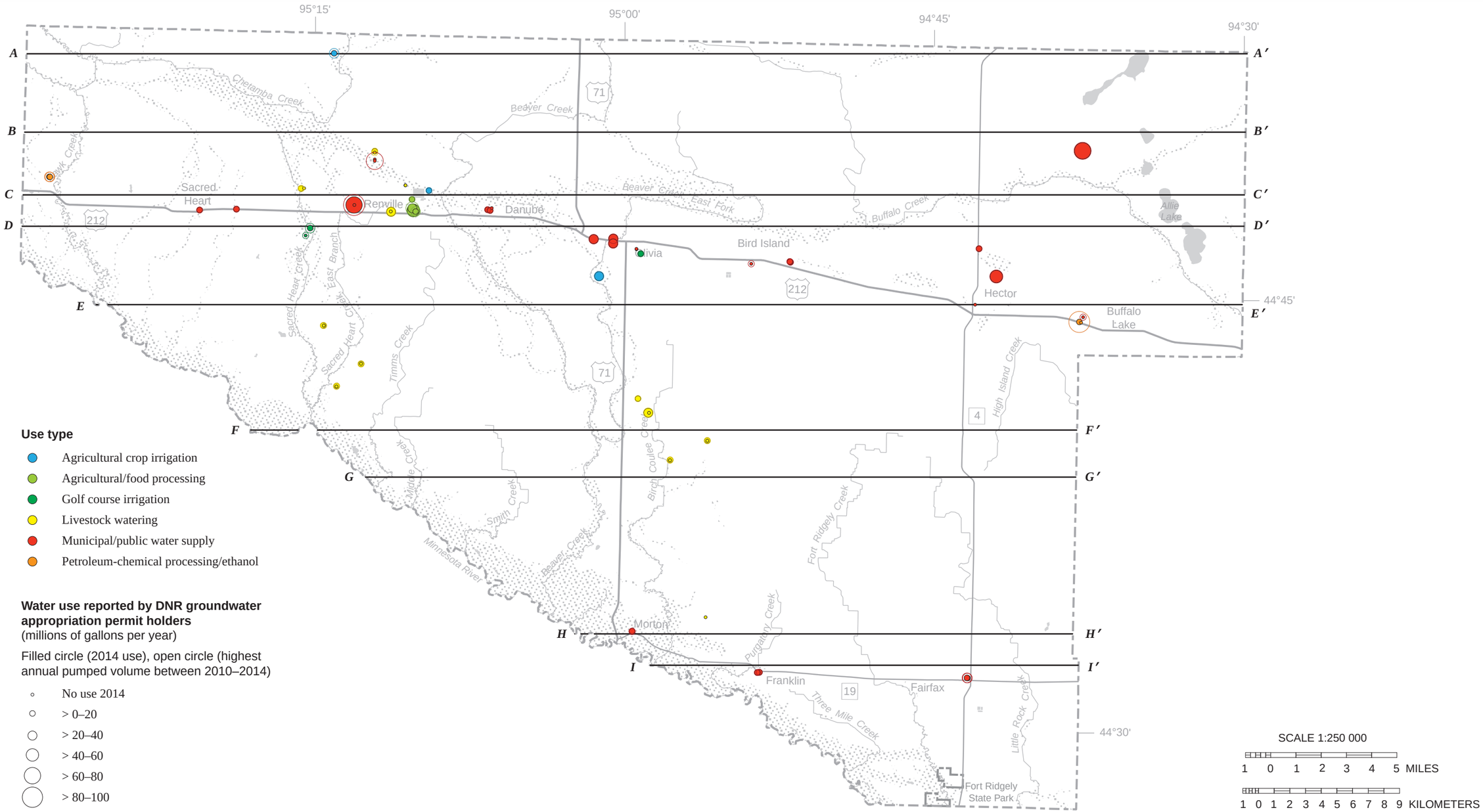
Maximum water use reported by DNR groundwater appropriation permit holders 2010–2014 for sand/gravel pit dewatering
(millions of gallons per year)

- No use 2010–2014
- > 0–20
- > 20–40

Symbols and labels

- DNR groundwater level observation well (fill color indicates aquifer classification)
- Body of water
- B — B′ Line of cross section (Part B)
- Extent of surficial sand

Map Figure 26. Groundwater appropriation by general aquifer type
The majority of water appropriation is from confined sand and gravel aquifers. Four DNR observation wells are located in western Renville County.



Use type

- Agricultural crop irrigation
- Agricultural/food processing
- Golf course irrigation
- Livestock watering
- Municipal/public water supply
- Petroleum-chemical processing/ethanol

Water use reported by DNR groundwater appropriation permit holders
(millions of gallons per year)

Filled circle (2014 use), open circle (highest annual pumped volume between 2010–2014)

- No use 2014
- > 0–20
- > 20–40
- > 40–60
- > 60–80
- > 80–100

Symbols and labels

- Body of water
- B — B′ Line of cross section (Part B)
- Extent of surficial sand

Map Figure 27. Groundwater appropriation by water use category
The primary use type for the permitted water is municipal/public water supply.