



Stratigraphic Characterization of the Birds Nest Aquifer in the Uinta Basin, Utah: Updated Research Regarding the Aquifer's Potential as a Significant Saline Water Disposal Zone

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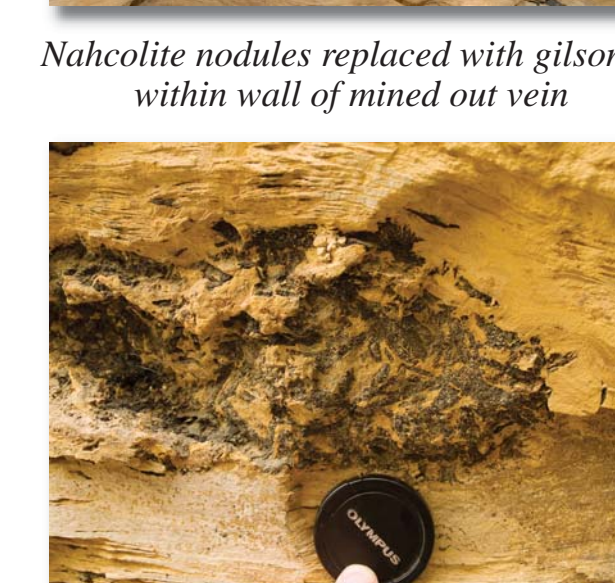
RESULTS: INFLUENCE OF GILSONITE VEINS

Gilsonite (a solid hydrocarbon) occurs in veins ranging in thickness from a couple inches to tens of feet and originates in the rich oil shale beds of the upper Green River Formation, continuing up to the surface, cross-cutting the Birds Nest aquifer. Questions remain as to how these veins might affect groundwater movement through the Birds Nest aquifer; whether they act as barriers to flow or whether they create vertical and/or horizontal pathways for water transmission.

Core evaluation, evidence for barrier:

Near the basin's depocenter, several cores exist that recovered the entire Saline zone. Most of these cores (e.g., 13X-2) show significant saline mineral dissolution, in fact, Anadarko has begun disposing saline water into the Birds Nest in this area. However, there is one well (Utah State 1) with core slightly to the north, which shows no signs of saline mineral dissolution. This core is separated from the others by a gilsonite vein. With the beds dipping to the northwest, water generally travels from southeast to northwest. Water within the Birds Nest has dissolved the saline minerals to the south of the vein, but the gilsonite vein seems to stop water from reaching the area on its northern side, creating a zone of no dissolution. It is assumed that similar areas of no saline mineral dissolution exist throughout the Birds Nest aquifer, but it is difficult to quantify these areas without core.

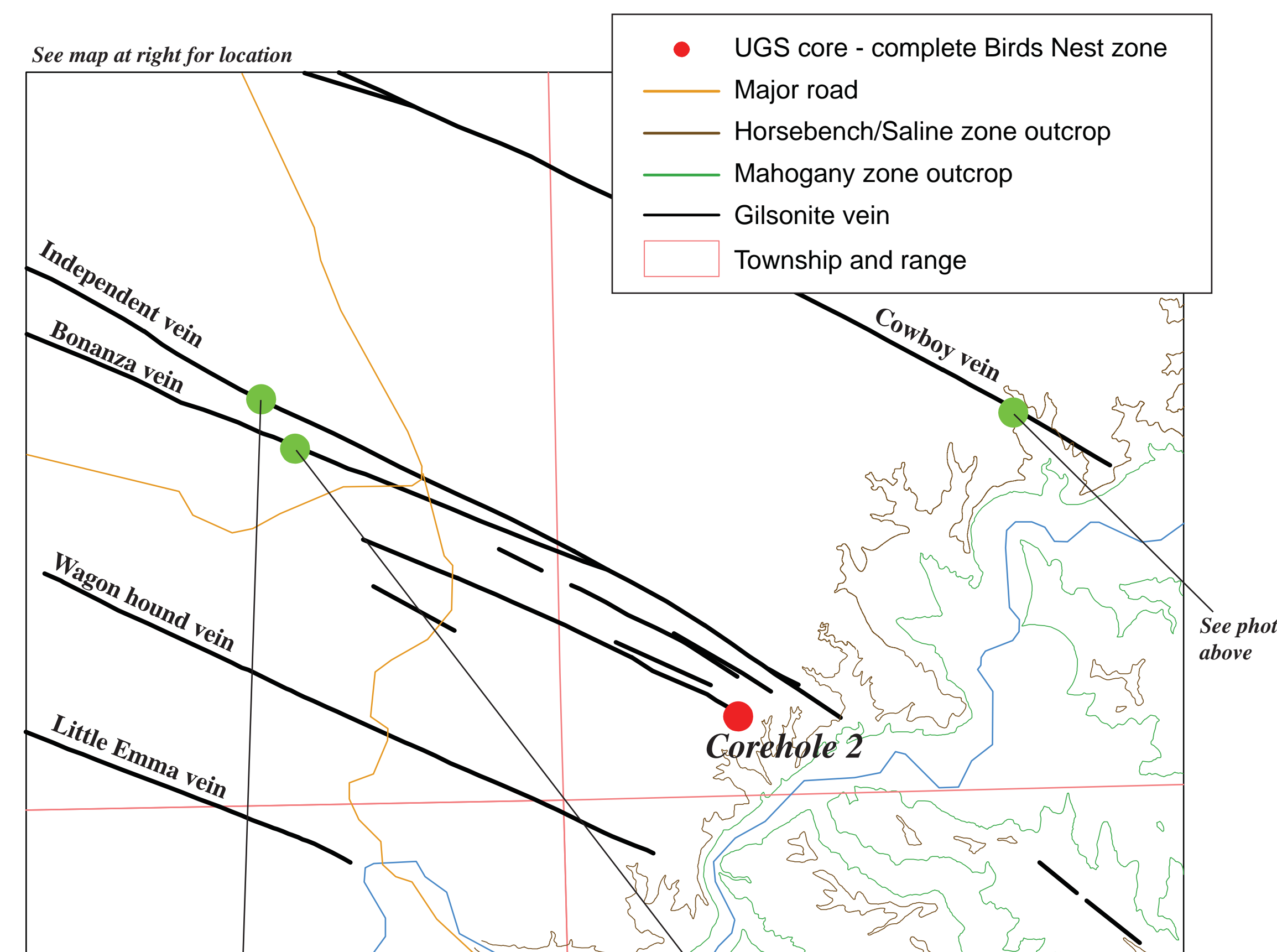
Within the mined out Cowboy vein which cross cuts the Birds Nest aquifer (red circles indicate saline nodules)



Cowboy vein

Gilsonite mine tour, evidence for both transmission and barrier:

UGS geologists toured two mines in different gilsonite veins to assess how groundwater interacts with the veins. The first mine contained a highly fractured type of gilsonite which easily transmitted water through the vein. The second mine contained a type of gilsonite that was very solid and transmitted no water. These observations suggest that gilsonite veins could act as both barriers or conduits for water depending on the type of gilsonite in the vein. However, gilsonite type at depth is nearly impossible to identify in the absence of an actual mine.



Independent vein mine
- "Solid" gilsonite
- 230 ft depth (Uinta Fm.)
- Minor water infiltration (from wall rock)

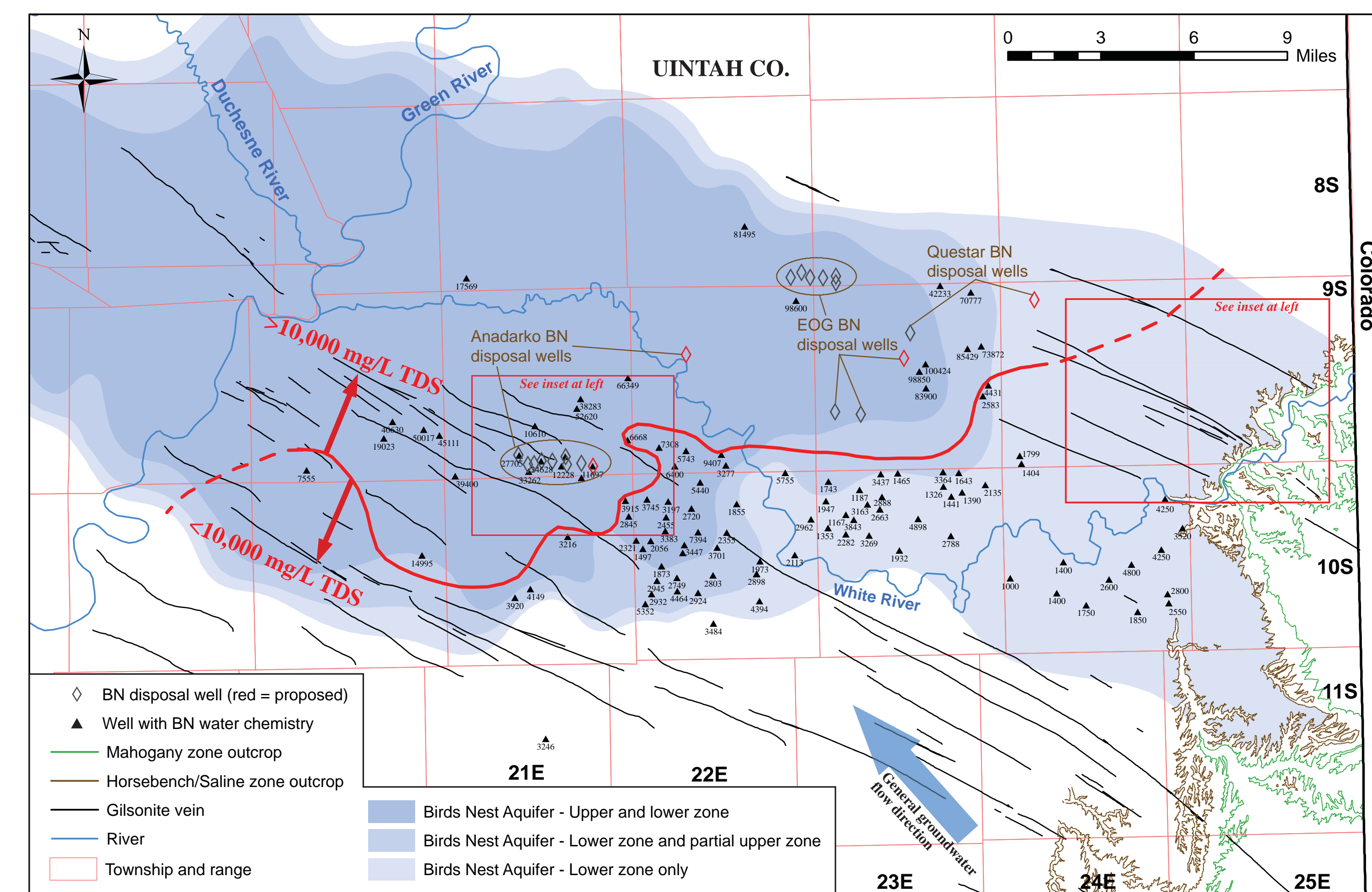


Bonanza vein mine
- Highly fractured gilsonite
- 630 ft depth (Uinta Fm.)
- Lots of water infiltration (from wall rock and vein)



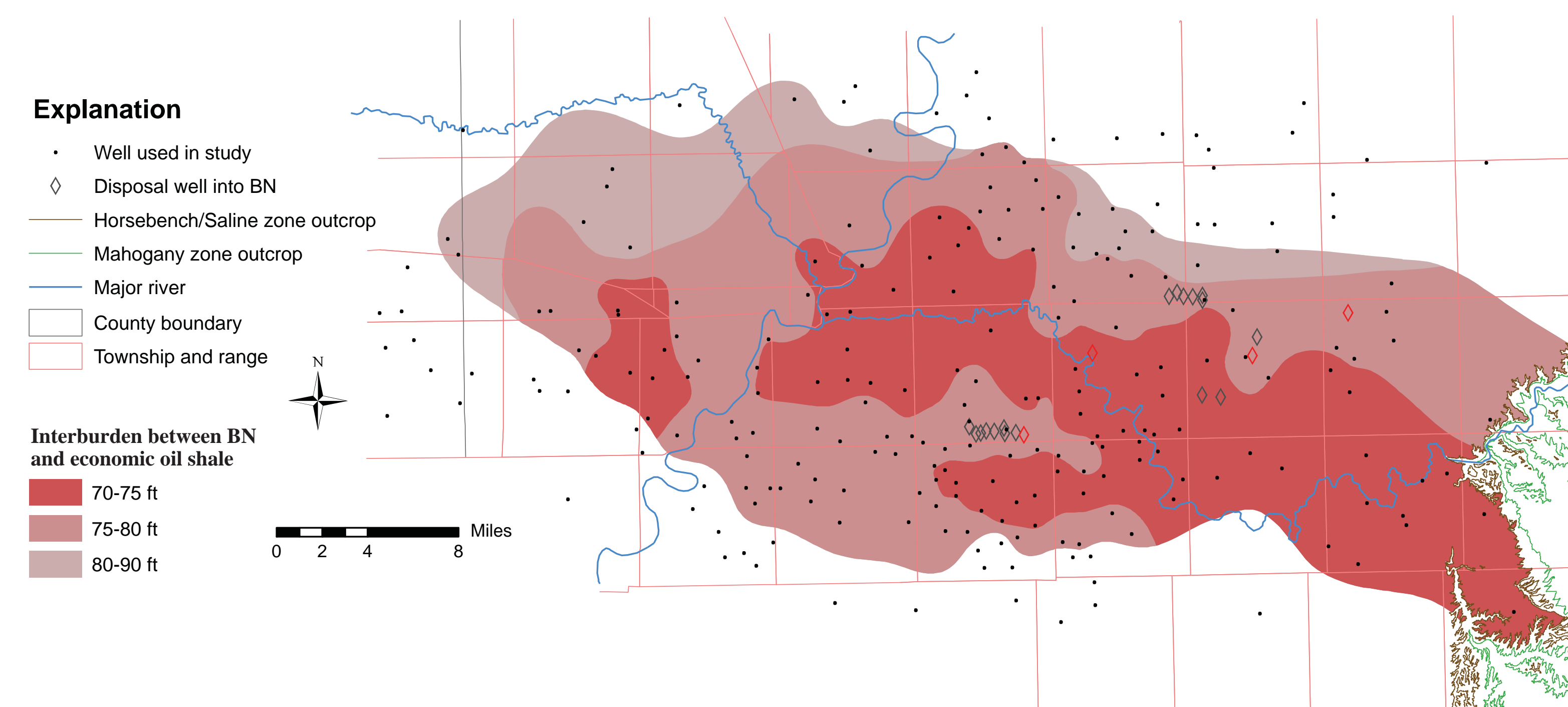
RESULTS: WATER CHEMISTRY

Chemistry of Birds Nest water (mostly acquired by Anadarko) in the north (averaging >10,000 mg/L TDS and as high as 100,000 mg/L TDS) is distinct from that in the south (averaging <10,000 mg/L TDS and down to near 1000 mg/L TDS). This abrupt change in water chemistry is most likely due to the differing amounts of saline mineral dissolution in the two areas; the southern area may have been flushed clean, whereas saline minerals in the northern area are still actively dissolving. This transition is important because produced saline water can only be disposed into the aquifer where the water is currently 10,000 mg/L TDS and above (only north of the red line). In some areas, like near Anadarko's disposal wells, it seems that the presence of gilsonite veins has had an influence on the shape of the 10,000 mg/L TDS line. The gilsonite veins could be acting as barriers, creating underground channels of groundwater flow (see discussion at left).



RESULTS: INTERBURDEN - BIRDS NEST TO ECONOMIC OIL SHALE

The base of the Birds Nest aquifer is between 70 and 90 ft above the top of economic oil shale, picked at the top of the Big 3 oil shale beds (see panel 1). Saline water disposal could impact development of the underlying oil shale if vertical migration of water occurs via fractures or joints.



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Project Web site: http://geology.utah.gov/emp/UBwater_study



Panel 2

RESULTS: REGIONAL CROSS SECTIONS

Sections A-A' and B-B' are available on our AAPG 2010 poster and sections C-C' and D-D' are available on our AAPG 2011 poster, both of which can be downloaded from the UGS project website.

