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DEPARTMENT OF WATER RESOURCES

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BEFORE THE IDAHO DEPARTMENT OF WATER RESOURCES

IN THE MATTER DESIGNATING THE EASTERN SNAKE PLAIN AQUIFER GROUND WATER MANAGEMENT AREA	Docket No. AA-GWMA-2016-001 **FREMONT MADISON IRRIGATION DISTRICT, MADISON GROUND WATER DISTRICT AND IDAHO IRRIGATION DISTRICT'S DISCLOSURE OF EXPERTS AND EXPERT REPORTS**

COMES NOW, Fremont Madison Irrigation District, Madison Ground Water District and Idaho Irrigation District (collectively hereinafter referred to as "UV"), acting for and on behalf of their members, by and through undersigned counsel, and pursuant to the Scheduling Order For Hearing contained in the Idaho Department of Water Resources' *Deadline for IDWR's Submittal of Materials; Order on Motion Practice; Notice of Hearing and Scheduling Order; Order*

Authorizing Discovery, dated September 25, 2019, UV hereby disclose the following experts and expert reports:

1. Bryce A. Contor, Senior Hydrologist at Rocky Mountain Environmental (see attached Bio)
   a. Report entitled *Technical Report Regarding Final Order Designating the ESPA GWMA*, dated December 5, 2019.
2. Roger Warner, at Rocky Mountain Environmental. (see attached Bio)

Dated this 9th day of December, 2019.

RIGBY, ANDRUS & RIGBY LAW, PLLC

By: ______________________
Jerry R. Rigby, Esq.

CERTIFICATE OF SERVICE BY MAIL, HAND DELIVERY OR FACSIMILE TRANSMISSION

I hereby certify that a true and correct copy of the foregoing document was on this date served upon the persons named below, at the addresses set out below their name, either by mailing, hand delivery or by telecopying to them a true and correct copy of said document in a properly addressed envelope in the United States mail, postage prepaid; by hand delivery to them; or by facsimile transmission.

DATED this 9th day of December, 2019.

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Bryce Contor, *Senior Hydrologist, RMEA Consultant (former staff)*

Mr. Contor has over 20 years of professional hydrologic experience, including nine years with the Idaho Water Resources Research Institute (IWRRI), a Division of the University of Idaho, where he served as a research hydrologist, and five years with Idaho Department of Water Resources where he served as a Senior Water Resource Agent. Prior to that he farmed and served on the board of directors of a regional irrigation company. After 10 years of service to RMEA, Mr. Contor took a position with the Henry's Fork Foundation, but he continues to frequently support RMEA on a part time basis. While working with IWRRI, Mr. Contor served as principal investigator on hydrologic projects as diverse as preparing water budgets for large scale numerical aquifer models, investigating remote sensing of evapotranspiration on irrigated lands, developing tools to calculate the economic demand for irrigation water, and investigating managed recharge of aquifers. He has published in national peer-reviewed scientific journals and has authored numerous technical completion reports for the Idaho Water Resources Research Institute. While with the Idaho Department of Water Resources, Mr. Contor measured flow in pipelines and open channels, investigated water-right claims and made water- right recommendations in the Snake River Basin Adjudication.

Mr. Contor holds an M.S. Degree in Hydrology from the University of Idaho. His hydrologic specialties include groundwater/surface-water interactions and MODFLOW aquifer modeling, water-budget analysis, pipeline and open-channel flow measurement, and statistics. GIS specialties include aerial photography interpretation and manipulation of remote-sensing data. Economics specialties are water banking and economic demand for irrigation water.

W. Roger Warner, *Senior Hydrologist, Vice President*

Mr. Warner's professional experience includes a wide range of geologic, environmental, and water-rights projects conducted since the late 1980's. His experience has included time in the consulting industry as an engineering geologist and Hydrologist, as a governmental agency representative at the Idaho Department of Water Resources, and in academia as a geology instructor at Brigham young University Idaho. Mr. Warner has managed and conducted numerous and varied projects over the course of his career, and he brings to the table a diverse working knowledge of environmental and geological issues.

Mr. Warner holds an MS Degree in Hydrology from the University of Idaho and BS in Geology from Brigham Young University.

Rocky Mountain
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Technical Report Regarding Final Order Designating the ESPA GWMA

Bryce A Contor, Sr. Hydrologist
RMEA Project # 19-0181
December 5, 2019

For Madison Ground Water District
c/o Jerry Rigby, Rigby, Andrus & Rigby Law, PLLC
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Introduction

On September 25, 2019, Idaho Department of Water Resources (IDWR) issued an "Order Authorizing Discovery and Scheduling Order" (Order) (Spackman 2019) regarding an earlier *Final Order Designating the ESPA GWMA* (Eastern Snake Plain Aquifer Ground Water Management Area). The Order establishes a single technical issue that may be heard in the hearing scheduled by the Order:

> *"Whether areas outside of the ESPA area of common ground water supply, as defined by CM Rule 50 (IDAPA 37.02.11.050), but included within the ESPA GMWA, are located in tributary basins and are otherwise sufficiently remote or hydrogeologically disconnected from the ESPA to warrant exclusion from the ESPA GWMA."*

The concepts of tributary basin status, remoteness and hydrogeologic disconnection are technical questions. The concept of sufficiency to warrant exclusion is fundamentally a policy question. As this document is a technical and not a policy report, it relies on the core policy document, the code establishing the ability to create Ground Water Management Areas (Idaho Statutes 42-233b). The statute provides that such an area may be established in "any ground water *basin*" (emphasis added) meeting certain criteria. It is clear that the legislature intended the distinction between singular and plural, as the phrase "*basin or basins*" (emphasis added) is used later for a different provision in the same statute. As the plain-language interpretation is the most likely, the question of sufficiency for this report is phrased as: "Do the Rexburg Bench and the Eastern Snake Plain Aquifer (ESPA) comprise a single groundwater basin?" If "no," then the Bench is sufficiently remote or disconnected to warrant exclusion.

The concept of a groundwater basin is so basic and intuitive that often it is not defined formally, and has not been legally defined in Idaho (Spackman 2016). As not all Idaho legislators are hydrogeologists, the statutory meaning of "ground water basin" must be a plain-language meaning understood by lay persons. A definition cited by the Director in the order creating the GWMA (Spackman 2016) is compatible with this lay understanding, and indicates that a groundwater basin is a unit with "reasonably well-defined boundaries." The American Geological Institute echoes this criterion (Bates and Jackson 1984). Another source adds the refinement that these boundaries are discernable "in a lateral direction," and that lateral boundaries can be "features... such as rock or sediments with very low permeability or a geologic structure such as a fault" (California Department of Water Resources 2003). It also clarifies that basins can be "open at one or more places to other basins," underscoring that the separation does not have to be total to establish a different basin. A third source indicates that "groundwater basin" is "a rather vague designation pertaining to a groundwater reservoir which is more or less separate from neighboring groundwater reservoirs. A groundwater basin could be separated from adjacent basins by geologic boundaries or by hydrologic boundaries" (Fetter 1994).

Consistent with the clear legislative distinction between singular and plural and the definitions above, this report considers whether the Rexburg Bench is separate from the ESPA based on whether there are discrete and distinct differences over short lateral distances in any of the following:

- Topography
- Geology and Hydrogeology
- Static water levels in wells

It also considers:

- Representation of the ESPA in numerical groundwater flow models
- Comparison to basins not included in the GWMA

Topography

Topography per se is not a defining characteristic of a groundwater-basin boundary. However, topography is generally driven by underlying geologic structures, such as faults or the terminations of sedimentary facies against rock. These often comprise bounding features that affect groundwater flow. Figure 1 shows a hillshade depiction of land surface elevations in the Rexburg Bench vicinity, with the CM Rule 50 boundary and the Enhanced Snake Plain Aquifer Model Version 2.1 (ESPAM2.1) boundary. In the vicinity of the Rexburg Bench, the ESPAM2.1 boundary is identical to the Enhanced Snake Plain Aquifer Model Version 1.1 (ESPAM1.1) boundary and equivalent to the GWMA boundary.

A clear distinction in topography is readily apparent. It corresponds approximately to the CM Rule 50 boundary and separates the Rexburg Bench from the Snake River Plain.

Geology and Hydrogeology

The Geologic Map of the Rexburg Quadrangle, Madison County, Idaho (Phillips et al 2016) indicates that the surface geology of the plain is dominated by alluvial materials and the surface geology of the Bench is dominated by wind-blown deposits. Two cross sections are mapped. Both show hundreds of feet of sedimentary materials at surface on the plain, with an abrupt transition to volcanic materials extending nearly to land surface on the Rexburg Bench. The map shows the Rexburg Bench entirely bounded on the west by faults, and transected by numerous faults that do not extend into the surrounding plain. The primary separating fault between the Bench and the plain is the Rexburg Fault, which is mapped extending along the margin of the Bench from near

Newdale to near Ririe. Overlapping the Rexburg Fault slightly and extending south and east to the canyon of the South Fork of the Snake is the Heise Fault, also closely following the margin of the Bench.

Phillips et all describe the structure of the Rexburg Bench as follows:

> *"The map area lies on the eastern margin of the Snake River Plain near the termination of the Grand Valley normal fault* [This fault is aligned with the South Fork of the Snake River extending in a southeast direction from near Heise]. *As this major fault approaches the Snake River Plain it divides into NE-stepping splays that become increasingly N-S oriented....* [one of these is the] *Rexburg fault* [which] *is an arcuate normal structure along the boundary between the between the Snake River Plain and the Rexburg Bench. A 15 to 30 m ((50 to 100 ft) scarp in unit Tbr* [Basalt of Rexburg (Pliocene)] *is present along much of its trace. The Huckleberry Ridge Tuff is offset as much as 100 m (328 ft) across the structure."*

In 1972, US Bureau of Reclamation published a report on groundwater conditions in the Rexburg Bench (Haskett 1972). It describes the Bench as "part of a 15-mile wide rectangular structural block trending northwest between the Teton and Snake River valleys." It indicates that "the subsurface geology of the Rexburg Bench is unusually complex." In general terms it describes three areas of subsurface clay that support "perched water table[s] whose surface is 100 feet or more above the regional water table." Haskett indicates that "the various rock types which surround or extend beneath the clay pods act as a common reservoir," though "the performance of wells varies considerably in different rocks." Within this common reservoir, a basalt aquifer and three different rhyolite aquifers are specifically described.

Using data from the fall of 1970 "where available," Haskett concluded: "Regionally, the ground-water gradient is in a general west-southwest direction as it is across much of the Snake River Plain. Locally, under the Rexburg Bench the slope is to the northwest at approximately 5-½ feet per mile."

Static Water Levels in Wells

Figure 2 shows static water levels in wells, expressed as feet of depth to water below land surface. Static water levels were obtained from IDWR (2013-2), from a data set largely compiled from driller's logs. Locations are generally mapped to the center of the Public Land Survey System quarter-quarter or quarter-quarter-quarter section. This introduces some imprecision in depths-to-water derived for wells in areas of greater topographic variation in elevation.

Figure 2 is difficult to interpret because of the differences in elevation of land surface across the Bench and surrounding plain. It does show the Bench having more variability in depth to water than does the plain, and additionally having disparate depths to water in adjacent wells. These observations are consistent with Haskett's description of the Bench as geologically complex, and his indication of perched aquifer(s) on the Bench associated with "clay pods."

Figure 3 shows depth to water relative to a projected surface that represents the topography of the plain extended beneath the Bench. In Figure 3, negative numbers are depicted by warm-colored triangles. These indicate static water levels above the extended surface of the plain. Positive values are depicted by cool-colored circles and represent water levels below the extended surface of the plain.

If the Snake Plain groundwater basin likewise continued uninterrupted beneath the Bench, the expectation would be a continuation of trends of depths to water relative to this surface across the geographic boundary between the Bench and plain. Instead, the data generally indicate uniform gradation and transitions across the plain, and heterogeneity across the Bench. The change in character of depths relative to the projected surface is abrupt across the topographic divide between the Bench and the plain.

The extreme negative value is a well in the southeast part of the Bench that is indicated to have a static water level 935 feet above the extended surface. No negative values are observed on the plain. The extreme positive value is a well in the northeast corner of the group of wells considered, with a water surface indicated to be 590 feet below the extended surface. All wells shown with a water surface indicated greater than 200 feet below the extended surface are outside the CM Rule 50 boundary. In contrast, the greatest depth below the extended surface within the CM Rule 50 boundary is 159 feet.

Representation of the ESPA in Numerical Groundwater Flow Models

There is no reason that a numerical groundwater flow model must include an entire groundwater basin in its spatial extent. Likewise, there is no reason that adjacent basins with hydraulic communication cannot be included in the same model. Nevertheless, the boundaries selected and the descriptions given can be informative.

The U.S. Geological Survey groundwater flow model (Garabedian 1992) was part of the Regional Aquifer System Analysis program and consequently is known as the RASA Model. Its boundary is depicted in Figure 4. The RASA boundary in the figure was hand digitized from a paper copy of the report, and it is likely that minor deviations of the RASA boundary from the CM Rule 50 boundary are artifacts of georeferencing. Whitehead (1992) described the aquifer boundary for the RASA model, and focused primarily on describing the vertical extent of the aquifer. Whitehead indicates that the eastern margin is bounded by faults, and that the "areal extent of the Snake River Plain [as modeled] is based on geology and topography."

Figure 5 is a georeferenced excerpt from Figure 11 from the report describing the Snake River Plain Aquifer Model (SRPAM) (Cosgrove et al 1999) with the CM Rule 50 boundary superimposed. Slight discrepancies between the SRPAM aquifer depiction and the CM Rule 50 boundary likely are artifacts of georeferencing. Figure 6 shows the SRPAM active cells. The aquifer boundary is mapped as a smooth curve, representing the underlying geologic definition, while the selection of active cells must conform to the geometry of the model grid.

The developers' descriptions of the model extent and basin boundary are limited to "The Snake River Plain aquifer, underlying the eastern Snake River Plain, is hosted in layered basalts and interbedded sediments and is an integral part of the basin water resources.... The eastern plain is bounded structurally... by faulting on the southeast.... Specified flux boundaries are used to represent underflow from surrounding tributary valleys including... the Rexburg Bench."

ESPAM1.1 and ESPAM2.1 share a common boundary in the vicinity of the Rexburg Bench, illustrated in Figure 1. It is different from prior work and from all descriptions of the ESPA boundary. Neither report suggests that the model boundary represents the boundary of the ESPA groundwater basin; instead, both indicate the model boundary was expanded "to include irrigated acreage in the Kilgore, Rexburg Bench, American Falls and Oakley areas" (Cosgrove et al 2006, IDWR 2013-1). Project design documents clarify that this decision was taken "to support later administrative decisions," and indicated an "added advantage would be that these hydrologically connected areas can be administered similarly if necessary" (Wylie 2004, Wylie 2009). This writer distinctly recalls attending a meeting in his role as a member of the ESPAM1.1 modeling team, where IDWR personnel expressed in strong language a desire to have the Rexburg Bench included in the model purely for administrative reasons.

Comparison to Basins Not Included in the GWMA

This report is not intended to be an exhaustive evaluation of all the groundwater basins tributary and/or bordering the ESPA basin. The comparisons here are based on sources already cited and upon the understanding that topography is generally an expression of underlying structure. The division into classes could be refined, but it provides a general indication of the Bench's similarities to and differences from excluded basins.

The first general class of non-included basins is basins that are less distinct or different from the ESPA than is the Rexburg Bench. These are basins where alluvial valley fill likely grades into the interleaved sedimentary materials within the ESPA proper, without the distinct structural boundary that characterizes the Bench. These excluded basins include:

- Birch Creek
- The Little Lost River north of the main block of irrigated lands
- Raft River
- Rock Creek
- Lincoln & Ross Creeks

The second class is basins that share with the Rexburg Bench a similar degree of distinction from the ESPA. These are basins where the intersection of the basin with the ESPA is characterized by more abrupt topographic differences than the first class of basins. These include:

- Camas and Beaver Creeks
- Medicine Lodge Creek
- Little Wood River
- Thorn Creek
- Clover Creek
- Goose Creek
- Blackfoot River
- Willow Creek
- Snake River at Heise
- Teton River canyon area
- Henry's Fork (including Fall River)

The third class is basins whose separations from the ESPA groundwater basin include a horizontal-distance separation. These appear to be more distinctly separate from the ESPA than is the Rexburg Bench and include:

- Silver Creek
- Big Wood River
- Portneuf River
- Teton valley
- Big Lost River (above Mackay Dam)

Discussion

Groundwater basins are structurally and/or hydrologically delineated. Basins can be adjacent and partly open to one another without being the same basin, as long as they are more or less separate.

Topography is generally an expression of structure. The Rexburg Bench is topographically distinct from the adjacent plain.

Formal geologic work indicates that the geology of the Bench is distinct from the plain, and that the Bench is structurally separated from the plain by faults along its entire shared margin with the ESPA. Faults that transect the Bench are not mapped as extending into the plain.

The Bench exhibits complex geology with apparent multiple aquifers. Its general groundwater gradient is in a direction approximately at right angles to the gradient on the adjacent plain. Static groundwater elevations on the Bench generally are either much lower or much higher relative to an extrapolated surface consistent with the adjacent plain than are the static elevations within the plain itself.

Modeling documents that mention the Rexburg Bench explicitly describe it as a tributary basin. The only numerical groundwater flow models that include the Rexburg Bench within the model domain do so for administrative reasons, and written modeling documents never suggest that it is part of the same groundwater basin as the ESPA.

This report identifies 21 tributary basins that are not included in the GWMA and therefore are presumably sufficiently distinct from the ESPA to warrant exclusion. Sixteen of these are less or similarly distinct from the ESPA than is the Rexburg Bench.

Based on the combined weight of the information presented here, it is my professional opinion that *the Rexburg Bench is located within a tributary basin.* Because the Rexburg Bench and the Eastern Snake Plain Aquifer do not comprise a single groundwater basin, it is my professional opinion that *the Rexburg Bench is sufficiently remote or hydrogeologically disconnected from the ESPA to warrant exclusion from the ESPA GWMA.*

Bryce A. Contor

Bryce A. Contor

December 5, 2019

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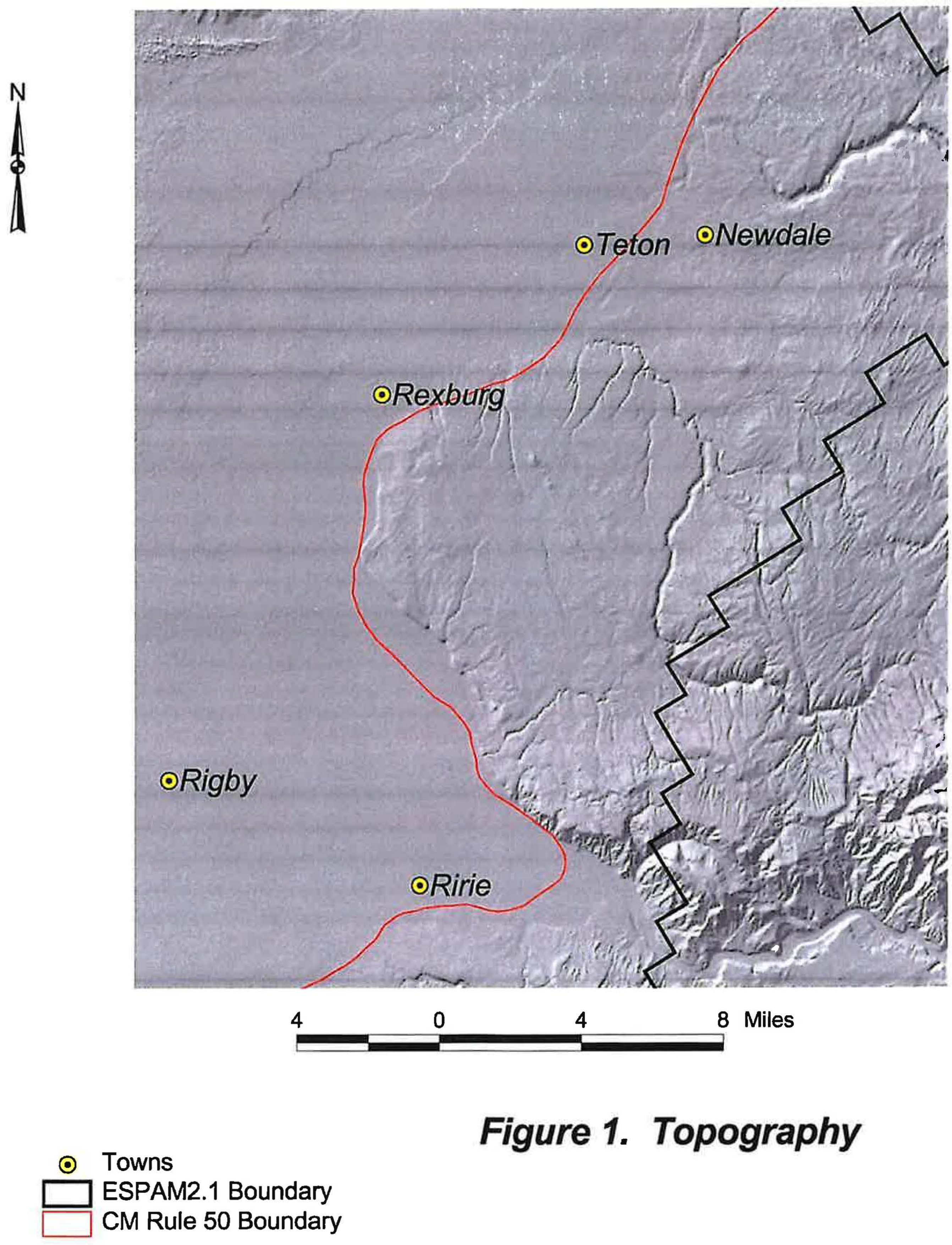

Figure 1. Topography

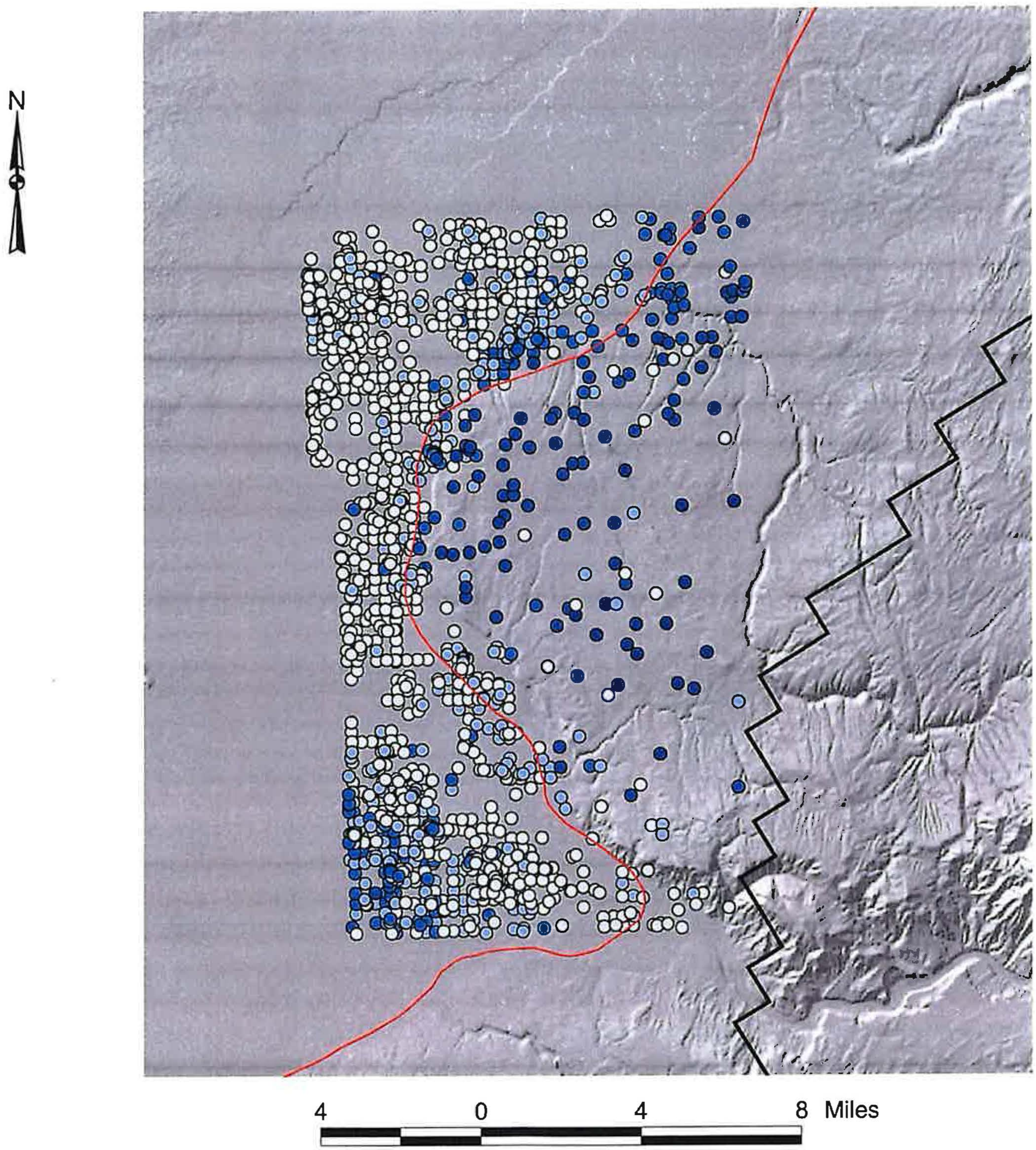

Figure 2. Static Water Levels Relative to Land Surface

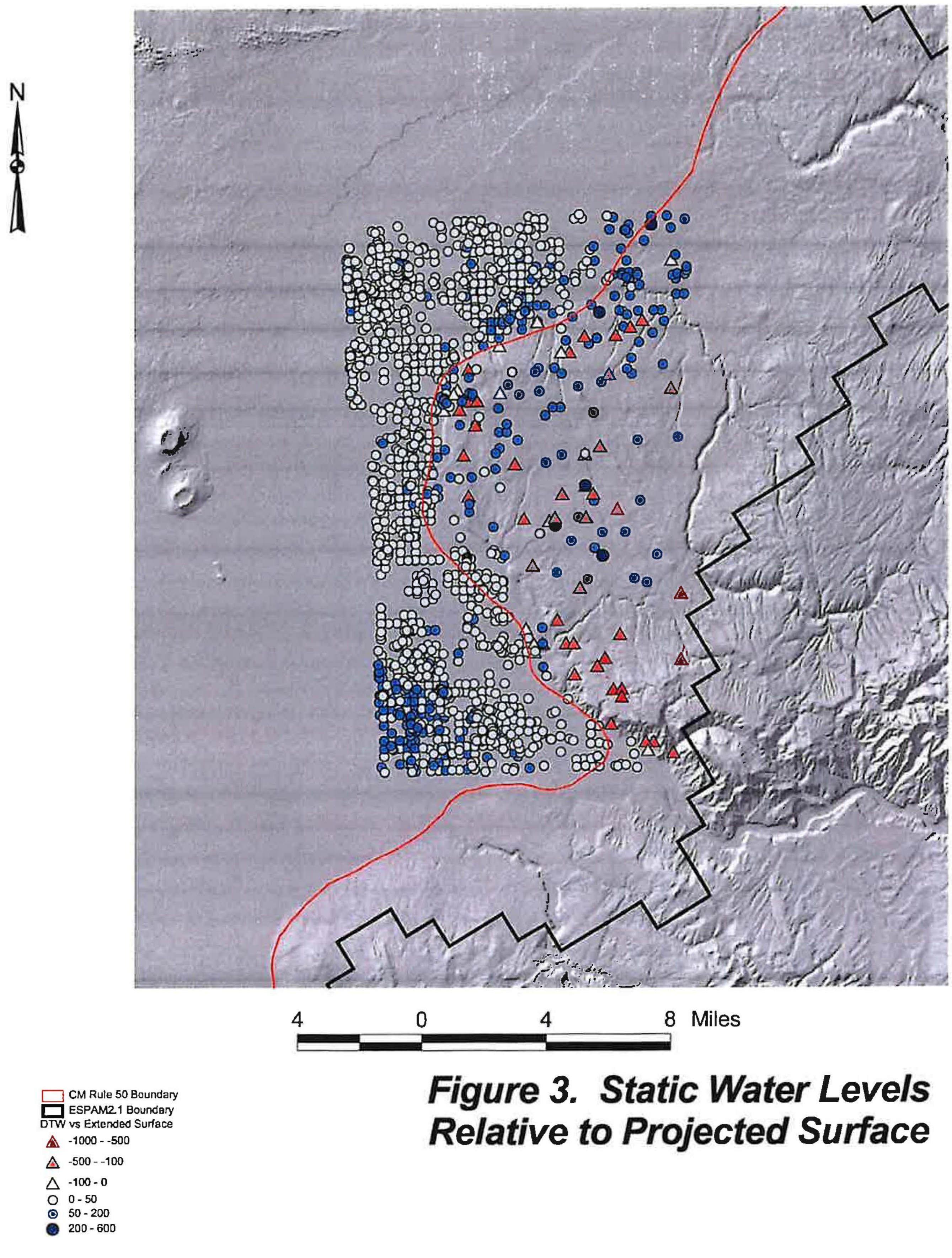

Figure 3. Static Water Levels Relative to Projected Surface

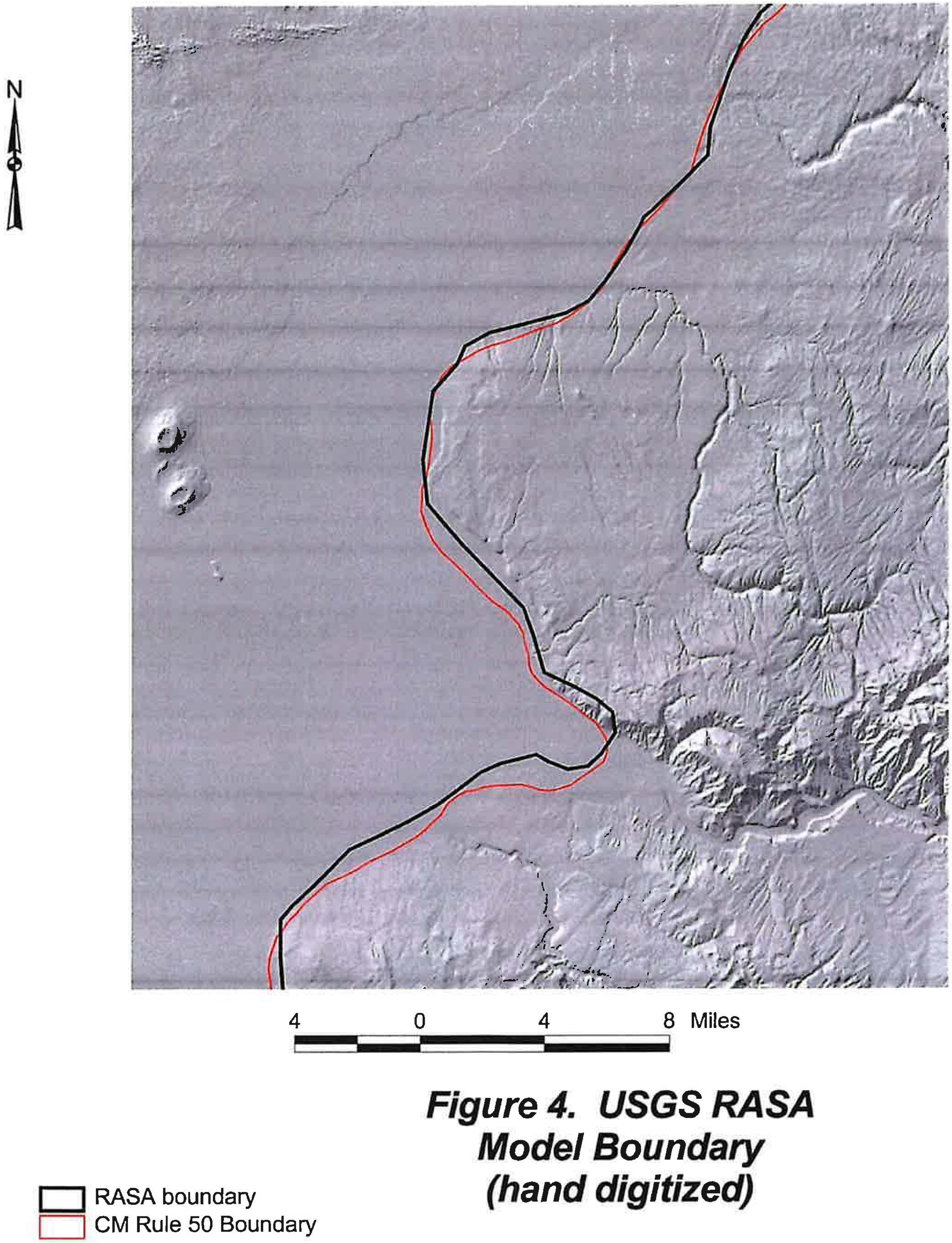

Figure 4. USGS RASA Model Boundary (hand digitized)

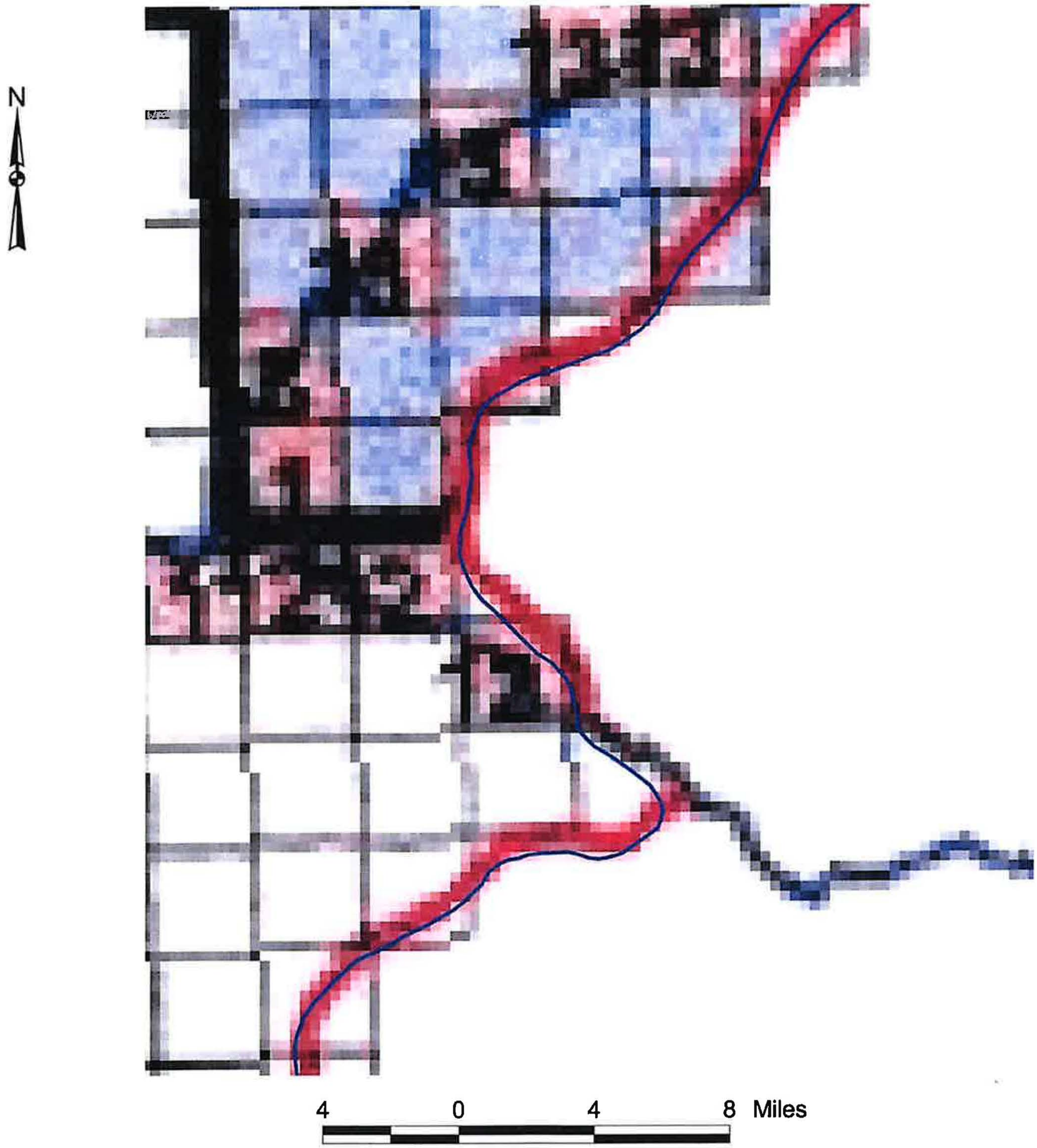

Figure 5. SRPAM Figure 11 Georeferenced, with CM Rule 50 Boundary

CM Rule 50 Boundary

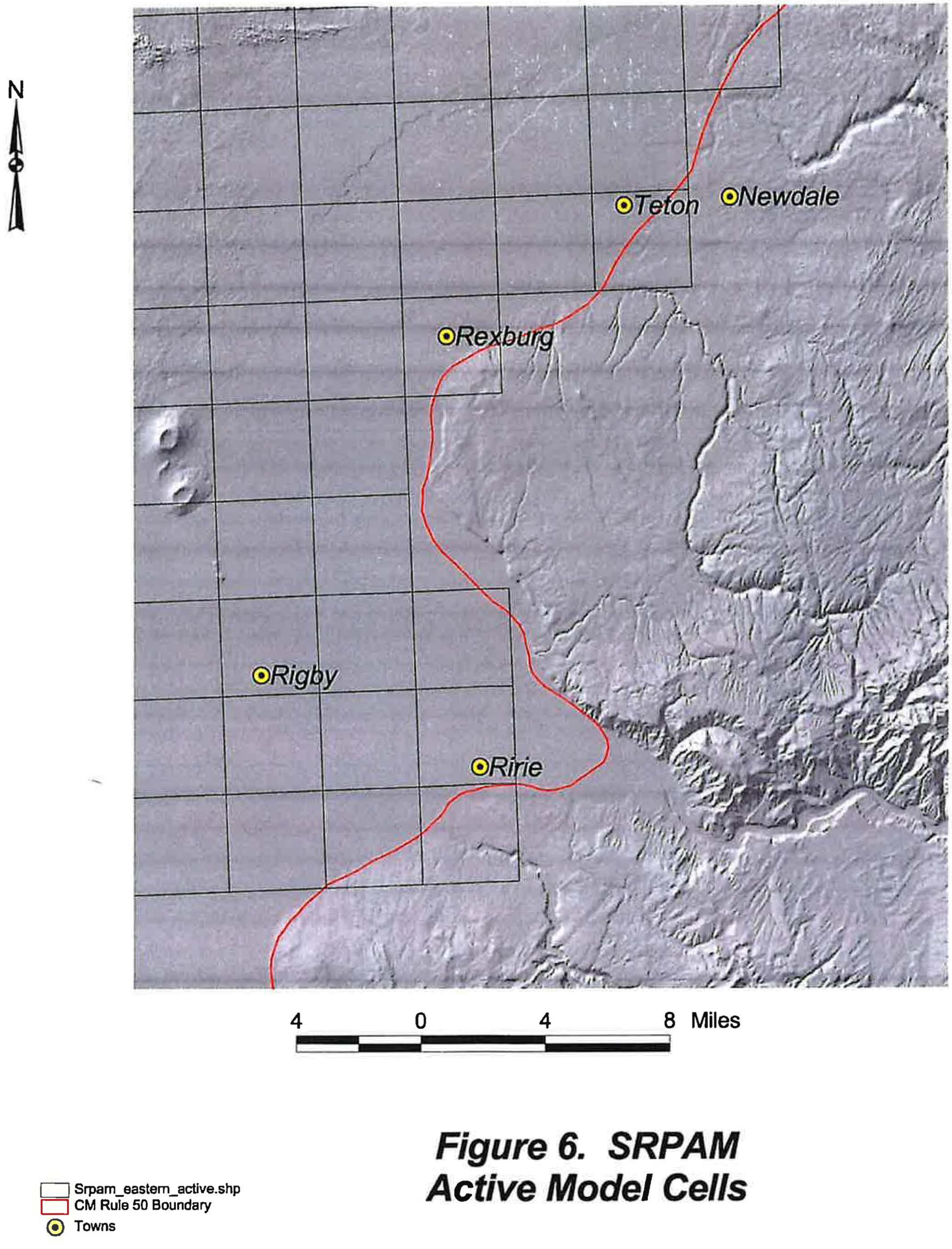

Figure 6. SRPAM Active Model Cells