Appendix C: Environmental Scan

Environmental Scan

(Preliminary Draft-not for public distribution)

Winifred – Big Sandy Corridor Study

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Abbreviations and Acronyms

BMPs	Best Management Practices
BOR	Bureau of Reclamation
CAA	Clean Air Act
CECRA	Comprehensive Environmental Cleanup and Responsibility Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CWA	Clean Water Act
DNRC	Department of Natural Resources and Conservation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Maps
FPPA	Farmland Protection Policy Act
GIS	Geographic Information System
LUST	Leaking Underground Storage Tank
LWCF	Land and Water Conservation Funds
LWQD	Local Water Quality District
MCA	Montana Code Annotated
MDEQ	Montana Department of Environmental Quality
MDT	Montana Department of Transportation
MEPA	Montana Environmental Policy Act
MFWP	Montana Department of Fish, Wildlife, and Parks
MNHP	Montana Natural Heritage Program
MP	Milepost
MPDES	Montana Pollutant Discharge Elimination System
MSAT	Mobile Source Air Toxics
NAC	Noise Abatement Criteria
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHP	Natural Heritage Program
NHPA	National Historic Preservation Act
NPL	National Priority List
NPS	National Park Service
NRC	National Response Center
NRHP	National Register of Historic Places
NRIS	Natural Resource Information System
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
RCRA	Resource Conservation and Recovery Act
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TRI	Toxics Release Inventory
USACOE	U.S. Army Corps of Engineers

USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UST	Underground Storage Tank
Section 4(f)	Section 4(f) of the 1966 Department of Transportation Act
Section 6(f)	Section 6(f) of the National Land and Water Conservation Funds Act

1 Introduction

1.1 Background

The primary objective of this Environmental Scan Report is to determine the potential impacts or constraints and opportunities for the Winifred-Big Sandy Corridor Study (Study). The study encompasses the Montana Secondary Highway 236 (S-236) corridor from Winifred (RP 24) to Big Sandy (RP 90). As a planning level scan, the information is obtained from various reports, websites and documentation. This scan is not a detailed environmental investigation.

If any improvement option(s) are moved forward from the Study into project development, a NEPA/MEPA analysis will be completed as part of the normal project development process. The information obtained from the Study may be forwarded into the NEPA/MEPA analysis and does not need to be repeated.

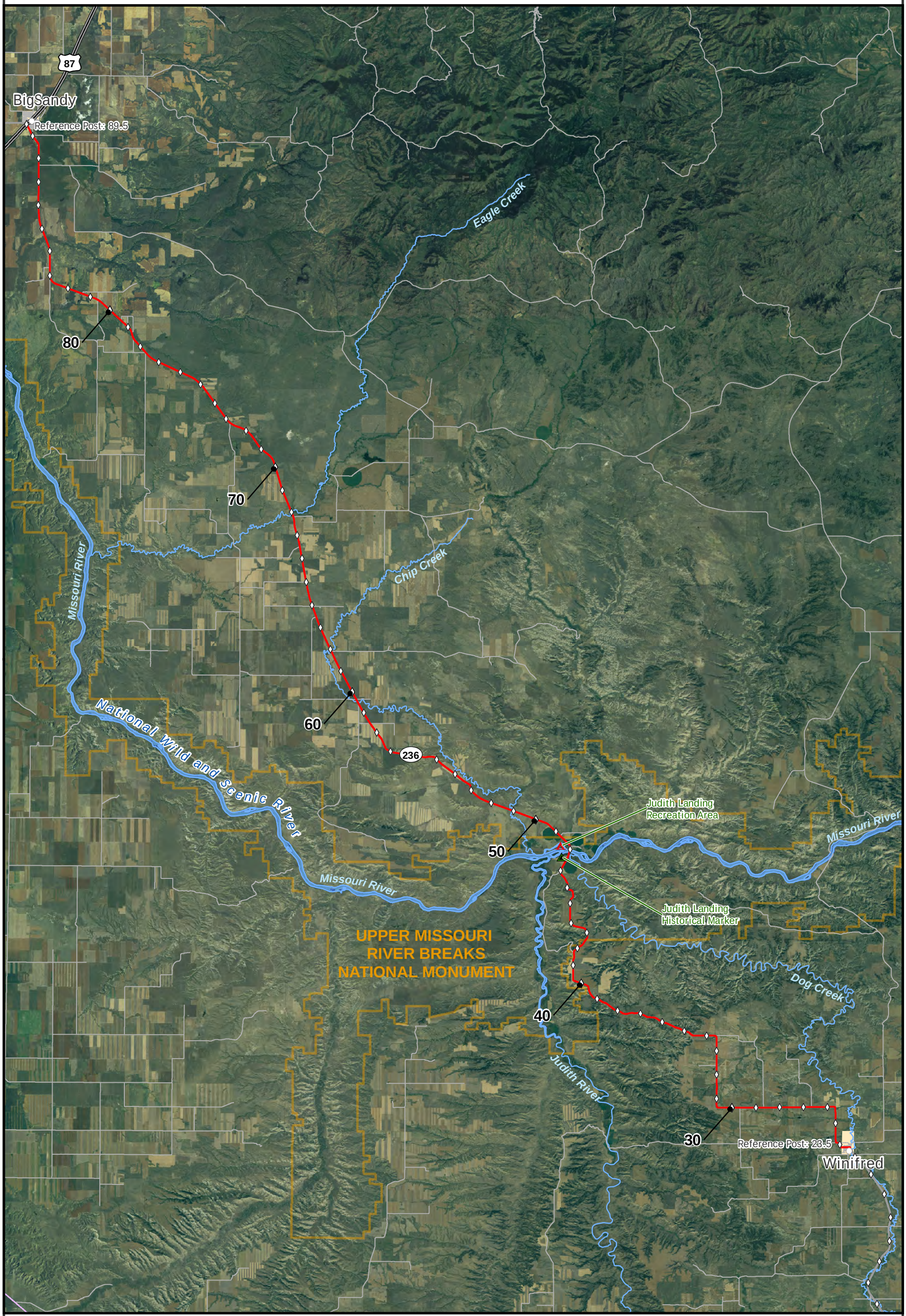
1.2 Organization of Report

This report goes on to describe the geographic setting of the existing Study corridor. The document continues with descriptions of environmental scan methodologies and results for the geographic area for physical resources and water resources (Section 3), visual resources (Section 4), biological resources (Section 5), cultural and archaeological resources (Section 6), and social (Section 7). A list of tables and appendices is on page 1. A list of abbreviations and acronyms is defined on page 2 and page 3.

2 Geographic Setting

The Study corridor is located in north central Montana. The land use within the corridor is predominantly for agricultural and ranch purposes. The majority of the land within the corridor is undeveloped. S-236 is a major collector on the Secondary Highway System and serves as a north-south corridor between Winifred and Big Sandy. The Study area is located within Fergus and Chouteau Counties. The Study will cover the gravel section from Winifred (Reference Post 24) to Big Sandy (Reference Post 90). The corridor consists of gravel roadway of varying widths, from 21 feet to 38 feet. The roadway was constructed or improved at various times, as early as 1945 to 2007. A section of the roadway is located within the Upper Missouri River Breaks Monument. Please refer to Figure 1 below for the corridor location.

Winifred - Big Sandy Corridor Study



MONTANA MDT DEPARTMENT OF TRANSPORTATION

◊ Reference Markers

Secondary 236

Miles

0 1 2 3 4 5

The following sections will describe the Study corridor for the purpose of environmental discussions in this document. They are not necessarily indicative of proposed improvement option(s), but rather a collection of geographic areas by which environmental discussions can be grouped.

3 Physical Resources

3.1 Land Ownership

Geographic Information System (GIS)-based information was reviewed to assess the amount of area in the study corridor that is public versus privately owned.

Reviews were also conducted to determine the presence of Section 4(f) and Section 6(f) properties along the corridor. Section 4(f) refers to the original section within the Department of Transportation Act of 1966 (49 U.S.C. 303), which set the requirement for consideration of park and recreational lands, wildlife and waterfowl refuges, and historic sites in transportation project development. Prior to approving a project that "uses" a Section 4(f) resource, FHWA must find that there is no prudent or feasible alternative that completely avoids 4(f) resources. "Use" can occur when land is permanently incorporated into a transportation facility or when there is a temporary occupancy of the land that is adverse to a 4(f) resource. Constructive "use" can also occur when a project's proximity impacts are so severe that the protected activities, features, or attributes that qualify a resource for protection under 4(f) are "substantially impacted". Section 4(f) resource information was gathered by field observation and review of the National Register of Historic Places (NRHP) list for Fergus County and Chouteau County.

Section 6(f) of the Land and Water Conservation Funds Act applies to all projects that impact recreational lands purchased or improved with land and water conservation funds. The Secretary of the Interior must approve any conversion of property acquired or developed with assistance under this act to other than public, outdoor recreation use. At this time, there are no 6(f) resources identified in the study corridor.

3.1.1 Fergus County/Chouteau County

The land within the Study corridor in Fergus County and Chouteau County is predominantly agricultural and ranch land. The majority of the land within the Study corridor is undeveloped. Public land ownership maps for the Study corridor are contained in Appendix A.

4(f) resources within the Study corridor are summarized in Table 1.

Table 1. 4(f) Resources within the Project Area

Name	Type of 4(f) Resource	Town (Specific Location Relative to Corridor)
Judith Landing Historic District (also known as Judith Landing)	Historic District	From Winifred is 23 miles. From Big Sandy is 44 miles.
Upper Missouri River Breaks National Monument	National Monument	Monument spans 149 miles of the Upper Missouri River

The Judith Landing area was placed on the National Register of Historic Places as a Historic District in 1975. Among the many events identified within this Historic District are a Corps of Discovery campsite, May 28, 1805; Fort Chardon Trading Post, 1844-1845; Isaac Stevens 1855 Lame Bull Treaty; Camp Cooke (first military post in Montana), 1866-1870; PN Cable Ferry, 1880-1908. The Judith Landing campground and recreation area, on the north bank of the Missouri River, is located in a grassy, shaded cottonwood grove. Judith Landing is the common take-out point for many boaters coming through the White Cliffs section of the Missouri River.

Additional information on the Upper Missouri River Breaks National Monument is provided below in Section 3.7.

3.2 Soil Resources and Prime Farmland

Information was obtained on soils to determine the presence of prime and unique farmland in the corridor study areas.

The Farmland Protection Policy Act of 1981 (Title 7 United States Code, Chapter 73, Sections 4201-4209) has as its purpose "to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses, and to assure that federal programs are administered in a manner that, to the extent practicable, will be compatible with State, unit of local government, and private programs and policies to protect farmland."

Farmland is defined by the act in Section 4201 as including prime farmland, unique farmland, and farmland, other than prime or unique farmland, that is of statewide or local importance.

Prime farmland soils are those that have the best combination of physical and chemical characteristics for producing food, feed, and forage; the area must also be available for these uses. Prime farmland can be either non-irrigated or lands that would be considered prime if irrigated. Farmland of statewide importance is land, in addition to prime and unique farmlands, that is of statewide importance for the production of food, feed, fiber, forage, and oilseed crops.

The following paragraphs describe the farmland soils findings for the corridor.

3.2.1 Existing Winifred to Big Sandy Corridor

Soil surveys are available (Chouteau and Fergus Counties) in the Winifred to Big Sandy Planning Corridor area. Information regarding areas of prime farmland in the corridor area was compiled from the US Department of Agriculture, Natural Resource Conservation Service (NRCS).

The CPA-106 Farmland Conversion Impact Rating Form for Linear Projects is a way for the NRCS to keep inventory of the Prime and Important farmlands within the state. Soil map units found within the project area have been classified as prime and important farmlands. Project activities associated with the construction of the Winifred to Big Sandy Corridor will likely create impacts to the soil map units with prime and important farmland status, thus it is likely required that a CPA-106 Farmland Conversion Impact Rating Form for Linear Projects be completed. The process for completing this form requires mapping of the prime and important

farmlands to be converted to non-farmable land, coordination with the NRCS, and final completion of the conversion form.

Appendix B contains maps and descriptions of the farmland classification types found in the Study corridor.

3.3 Geologic Resources

Information was obtained on geology in the corridor Study areas. Seismic information was reviewed for fault lines and seismic hazard areas. This geologic information can help determine any potential design and construction issues related to embankments and road design. The following paragraphs describe the seismicity present in Montana and geology present along the Study area.

Appendix C contains a map showing a belt of seismicity known as the Intermountain Seismic Belt that extends through western Montana, from the Flathead Lake region in the northwest corner of the state through Idaho, Wyoming, Utah, and into southern Nevada. In western Montana, the Intermountain Seismic Belt is up to 100 kilometers (62 miles) wide and parallels the Rocky Mountains. The Centennial Tectonic Belt, a branch of the Intermountain Seismic Belt, includes at least eight major active faults. It has been the site of the two largest historic earthquakes in the northern Rocky Mountains: the Hebgen Lake, Montana, earthquake (magnitude of 7.5 on the Richter scale) on August 18, 1959; and the Borah Peak, Idaho, earthquake (magnitude of 7.3 on the Richter scale) on October 28, 1983. Small earthquakes are common in the region, occurring at an average rate of seven to ten earthquakes per day (MBMG 2002).

The state of Montana adopted the seismic standards set by the Uniform Building Code (which establishes building design standards used by architects and engineers) to assess the seismic risk in Montana. These standards were adopted in order to provide earthquake design standards for regional construction.

When shaken by an earthquake, certain soils are susceptible to liquefaction; that is, they lose strength and temporarily behave like liquids. The seismically induced loss of strength can result in failure of the ground surface, most typically expressed as lateral spreads, surface cracks, settlement, or sand boils. Structures, including roadways, can sustain substantial damage during a large seismic event if they are supported in or on a soil susceptible to liquefaction. Seismically induced liquefaction typically occurs in loose, saturated, sandy material commonly associated with recent river, lake, and beach sedimentation. In addition, seismically induced liquefaction can be associated with areas of loose, saturated fill (USGS 1992). Several areas along the Study corridor are underlain by alluvium and consequently susceptible to liquefaction (See Appendix D for alluvium geologic maps and descriptions of the geologic maps of the Study area).

3.4 Water Resources

3.4.1 Surface Water

Maps and GIS data were reviewed to identify the location of surface water bodies within the Study area, including rivers, streams, lakes, or reservoirs.

The Study corridor travels through the Middle Missouri Watershed (Hydrologic Unit Code: 10040101). Information on the Missouri River and its tributaries within the study area was obtained from MDEQ's website. Section 303, subsection "d" of the Clean Water Act requires the State of Montana to develop a list, subject to USEPA approval, of water bodies that do not meet water quality standards. When water quality fails to meet state water quality standards, MDEQ determines the causes and sources of pollutants in a sub-basin assessment and sets maximum pollutant levels, called total maximum daily loads (TMDL).

A TMDL sets maximum pollutant levels in a watershed. The TMDLs become the basis for implementation plans to restore the water quality to a level that supports its designated beneficial uses. The implementation plans identify and describe pollutant controls and management measures to be undertaken (such as best management practices), the mechanisms by which the selected measures would be put into action, and the individuals and entities responsible for implementation projects.

The Middle Missouri watershed is listed in the 2008 Integrated 303(d)/305(b) Water Quality Report for Montana by MDEQ. The water bodies within the Middle Missouri Watershed that are located in the study area are Category 5 and Category 4C. Category 5 water bodies are waters where one or more applicable beneficial use has been assessed as being impaired or threatened, and a TMDL is required to address the factors causing the impairment or threat. Category 4C water bodies are waters where TMDLs are not required as no pollutant-related use impairment is identified. TMDLs have not yet been written for water bodies in this watershed. When TMDLs are prepared and implementation plans are in place, any construction practices would have to comply with the requirements set forth in the plan.

303(d) listed water bodies within the Middle Missouri Watershed that are located in the Study area are summarized in Table 2. Appendix E contains the MDEQ's 2008 Water Quality Information from the Clean Water Act Information Center.

Table 2. 303(d) Listed Water Bodies in Study Area

Water Body	Beneficial Use	Probable Cause of Impairment	Probable Source of Impairment
Missouri River (Marias River to Bullwhacker Creek)	Aquatic Life, Primary Contact Recreation, and Warm Water Fishery	Alteration in stream-side or littoral vegetative covers	Agriculture Grazing in riparian or shoreline zones
		Copper	Source unknown
		Lead	Source unknown
		Physical substrate habitat alterations	Agriculture Grazing in riparian or shoreline zones
Judith River (Big Spring Creek to the Missouri River)	Aquatic Life and Warm Water Fishery	Alteration in stream-side or littoral vegetative covers	Agriculture Grazing in riparian or shoreline zones Loss of riparian habitat Rangeland grazing

Water Body	Beneficial Use	Probable Cause of Impairment	Probable Source of Impairment
		Physical substrate habitat alterations	Agriculture Grazing in riparian or shoreline zones Loss of riparian habitat Rangeland grazing
Eagle Creek (Dog Creek to Missouri River)	Fully Supporting	NA	NA
Dog Creek (Cutbank Creek to Missouri River)	Aquatic Life	Nitrate/Nitrite (Nitrite + Nitrate as N)	Grazing in riparian or shoreline zones
	Warm Water Fishery	Sedimentation/Siltation	Grazing in riparian or shoreline zones

3.4.2 Groundwater

Groundwater data, such as well and geologic source information, for Fergus County and Chouteau County are provided in Appendix F.

Fergus County and Chouteau County have not developed Local Water Quality District's (LWQD). LWQD's are established to protect, preserve, and improve the quality of surface water and groundwater within the district. Currently there are four in Montana. LWQD's are formed pursuant to 701304501 et. Seq., MCA by county governments. MDEQ provides support to LWQD programs, but does not have an active management role in their activities. LWQD serve as local government districts with a governing board of directors, and funding obtained from fees collected annually with county taxes. A significant component of selected district programs is the ability to participate in the enforcement of the Montana Water Quality Act and related rules.

If a LWQD is developed for Fergus County or Chouteau County, water quality protection measures may have to be addressed at the local level, in addition to the federal level and state level.

3.4.3 Irrigation

Irrigated farmland exists in Fergus County and Chouteau County adjacent to the Study corridor. Impacts to irrigation facilities should be avoided to the greatest extent practicable. However, depending on the improvement option(s) proposed during the corridor Study, there is a potential to impact lateral and longitudinal irrigation facilities. To mitigate lateral impacts, MDT will likely reconstruct existing culverts to maintain existing size and flow requirements. Operators of irrigation facilities will be contacted for flow requirements during final design. To mitigate longitudinal impacts, MDT will need to make reasonable efforts to relocate the facilities along the new roadway embankment and maintain capacity of the original ditch. Impacted irrigation canals and ditches will need to be relocated in consultation with ditch owners to minimize impacts to farming operations.

Any potential impacts to irrigation facilities will need to be examined to determine if the irrigation facilities are considered waters of the U.S. and subject to jurisdiction by the U.S. Army Corps of Engineers (USACOE).

Irrigation maps for Fergus County and Chouteau County are provided in Appendix G.

3.5 Wetlands (EO 11988)

The USACOE defines wetlands as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

National Wetland Inventory (NWI) Mapping is available for this area, and the maps for the area were reviewed for general wetland locations; however, they were not used in the preparation of this report. NWI maps are generated by the USFWS, and are based on the USFWS definition of wetlands, which does not follow the USACOE definition that MDT uses in wetland identification and delineation. NWI maps are typically generated based on aerial and satellite imagery, and are not accurate or detailed enough for MDT project wetland identification and/or delineation.

The Study area encompasses portions of the Missouri River, and several other drainages, which have wetland areas associated with them. This is not intended to be a complete determination and/or delineation of wetlands in the project area. Formal wetland delineations will need to be conducted according to standard USACOE defined procedures if a project is forwarded from the Study during the project development process. Wetland jurisdictional determinations will also need to be done during the project development process.

Wetland impacts should be avoided to the greatest extent practicable. All unavoidable wetland impacts will be mitigated as required by the USACOE and in accordance with FHWA and MDT policies.

3.6 Wild and Scenic Rivers

The Wild and Scenic Rivers Act, created by Congress in 1968, provided for the protection of certain selected rivers, and their immediate environments, that possess outstandingly remarkable

scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values. The U.S. National Park Service (NPS) website was accessed for information on river segments that may be located within the study area with wild and scenic designation. The Missouri River (Fort Benton to Charles M. Russell National Wildlife Refuge) is designated as a Wild and Scenic River within the Study corridor. If a project is forwarded from the improvement option(s), coordination with the NPS will need to be conducted as necessary through the project development process.

3.7 Upper Missouri River Breaks National Monument

On January 17, 2001, the Upper Missouri River Breaks National Monument was officially added to the Department of the Interior's National Landscape Monument System. See Appendix H for the Proclamation by the President (January 17, 2001). Much of the land in this area (375,000 acres) is public land managed by the Bureau of Land Management. A portion of the Study corridor is located within the Upper Missouri River Breaks National Monument. The Upper Missouri River Breaks National Monument Record of Decision and Approved Resource Management Plan December 2008 is available at the following website: http://www.blm.gov/mt/st/en/fo/lewistown_field_office/um_rmp_process/rod.html.

3.8 Floodplains (EO 11988) and Floodways

Executive Order (EO) 11988, Floodplain Management, requires federal agencies to avoid direct or indirect support of floodplain development whenever a practicable alternative exists. EO 11988 and 23 CFR 650 Part A requires an evaluation of project alternatives to determine the extent of any encroachment into the base floodplain. The base flood (100-year flood) is the regulatory standard used by federal agencies and most states to administer floodplain management programs. A "floodplain" is defined as lowland and relatively flat areas adjoining inland and coastal waters, including flood-prone areas of offshore islands, with a one percent or greater chance of flooding in a given year. As described in FHWA's floodplain regulation (23 CFR 650 Part A), floodplains provide natural and beneficial values serving as areas for fish, wildlife, plants, open space, natural flood moderation, water quality maintenance, and groundwater recharge.

Within the Study corridor, there are no 100-year floodplains delineated by the Federal Emergency Management Agency (FEMA). There are no FEMA issued flood maps for Chouteau County. If a project is forwarded from the improvement option(s), coordination with Fergus and Chouteau counties should be conducted during the project development process to verify no floodplain permits are necessary.

3.9 Hazardous Substances

The Montana Natural Resource Information System (NRIS) database was searched for underground storage tank (UST) sites, leaking underground storage tank (LUST) sites, abandoned mine sites, remediation response sites, landfills, National Priority List (NPL) sites, hazardous waste, crude oil pipelines, and toxic release inventory sites in the vicinity of the Study corridor.

Two petroleum release sites were identified in or near the town of Winifred. There are several abandoned mines in the general corridor area. Most appear to be coal mines. Some may be gravel pits. Given the lack of location precision in the NRIS database, a ground review along the corridor will be necessary to determine if any of these sites are in close proximity to the road.

After the alignment has been selected and the conceptual design has been completed, further evaluation may be needed at specific sites to determine if contamination will be encountered during construction. This may include reviewing MDEQ files and conducting subsurface investigation activities to determine the extent of soil and groundwater contamination. If contaminated soils or groundwater is encountered during construction, handling and disposing of the contaminated material will be conducted in accordance with State, Federal, and local laws and rules.

3.10 Air Quality

The Study corridor is not in or adjacent to a non-attainment area and is exempt from a Mobile Source Air Toxics Analysis under the Conformity exemption for planning studies.

3.11 Noise

A Preliminary Noise Screening Analyses may be needed in or near Winifred and Big Sandy and near residences along the corridor.

4 Visual Resources

Visual resources refer to the landscape character (what is seen), visual sensitivity (human preferences and values regarding what is seen), scenic integrity (degree of intactness and wholeness in landscape character), and landscape visibility (relative distance of seen areas) of a geographically defined view shed.

The landscape throughout the Study corridor contains an array of biological, scientific, historic, wildlife, ecological, and cultural resources mixed with a remote location. The Upper Missouri River Breaks National Monument was officially added to the Department of Interior's National Landscape Monument System. The center of this monument is the 149-mile long Upper Missouri National Wild and Scenic River. The remote nature of this segment of the Upper Missouri River has buffered the area from most human influence. This area has maintained the same vistas that awed the Lewis and Clark Expedition in 1805 and 1806.

5 Biological Resources

Biological resources in the Study corridor were identified using maps, aerial photographs, the endangered, threatened, proposed, and candidate species list for Montana counties (May 2009) from the USFWS, Montana Natural Heritage Program data, and windshield surveys of the project site. This limited survey is in no way intended to be a complete and accurate biological survey of the study area. If a project is forwarded from the improvement option(s), a complete biological survey of the Study area will be completed in accordance with accepted MDT practices during the project development process.

5.1 Fish and Wildlife

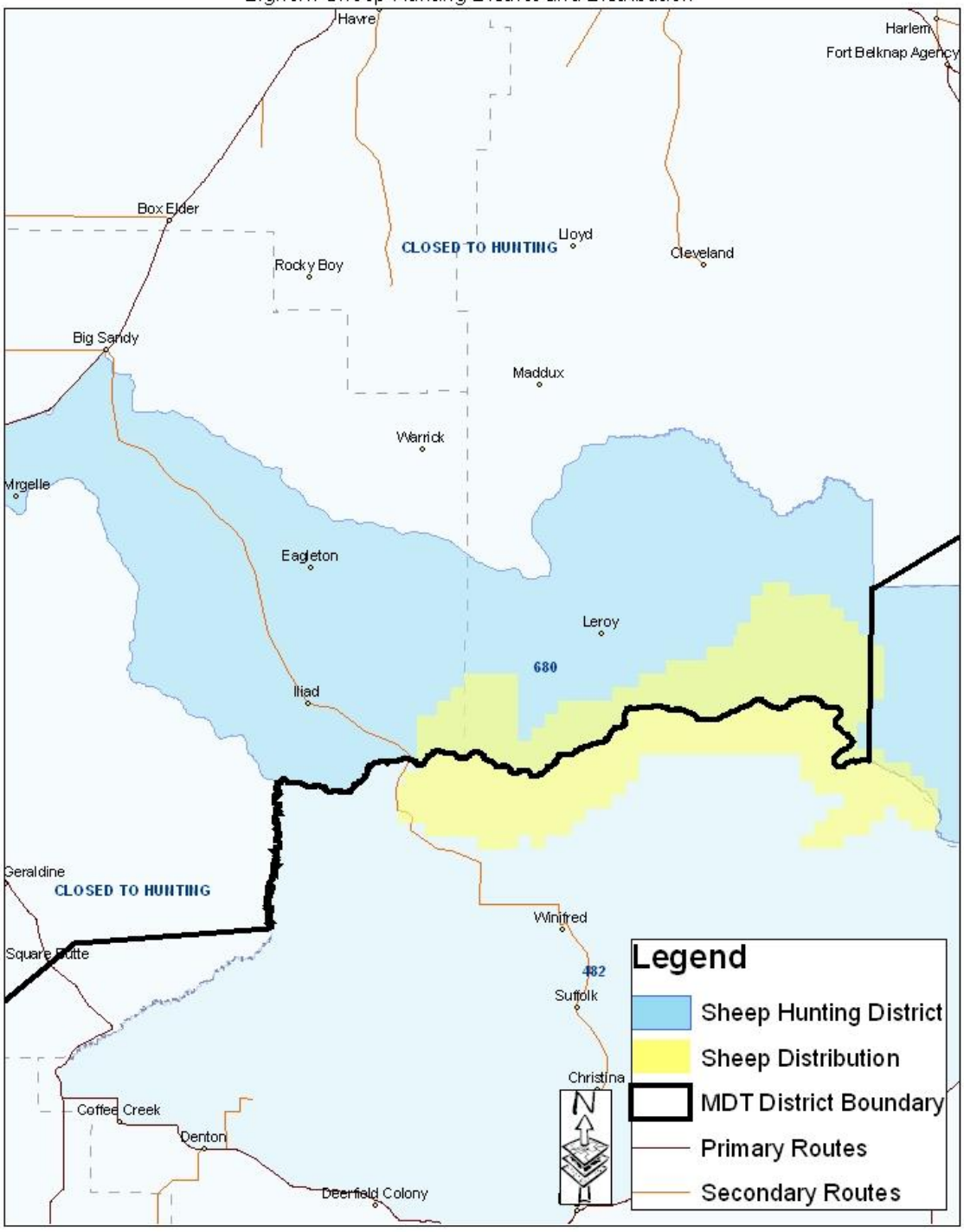
General Fish and Wildlife

General fish and wildlife resources in the Study area will need to be surveyed during the project development process. FWP should be contacted during the project development process for local expertise of the study area. Riparian and river, stream or creek habitats should be avoided to the greatest extent practicable, including but not limited to, the Missouri River riparian and river habitat. Fish and wildlife species use waterway corridors during all life stages. If a project

is forwarded from the improvement option(s), encroachment into the wetted width and waterway and the associated riparian habitat should be limited to the absolute minimum necessary. It is recommended that a riparian corridor remain on both sides of waterways to facilitate wildlife movement along the river corridor.

A large bighorn sheep herd exists in this corridor study area. A map showing the bighorn sheep distribution near the Study area is provided below. FWP's bighorn sheep hunting districts 482 and 680 overlap this Study area. Bighorn sheep occur on both the north and south sides of the Missouri River. Bighorn sheep are attracted to the salt in de-icing material used on highways. The paving of this road and the subsequent use of de-icing material in winter may cause bighorn sheep to concentrate on and adjacent to the roadway increasing incidents of vehicle collisions with bighorn sheep. Many parts of Montana currently experience high bighorn sheep/vehicle collision rates due to the use of salt on roadways. If a project is forwarded from the improvement option(s), mitigation measures should be explored during the project development process to reduce the potential for bighorn sheep/vehicle collisions during the winter months. Potential options include, but are not limited to: 1) variable message signing during the winter months, 2) reduced speed limits during winter, and 3) public education campaigns. FWP's area wildlife biologist should be contacted for local expertise on the bighorn sheep herd in the Study area.

Winnifred to Big Sandy Corridor
Bighorn Sheep Hunting District and Distribution



5.1.1 Threatened and Endangered Species

The federal list of endangered and threatened species is maintained by the USFWS. Species on this list receive protection under the Endangered Species Act (ESA). An 'endangered' species is one that is in danger of extinction throughout all or a significant portion of its range. A 'threatened' species is one that is likely to become endangered in the foreseeable future. The USFWS also maintains a list of species that are candidates or proposed for possible addition to the federal list.

The endangered, threatened, proposed, and candidate species list for Montana counties (May 2009) was downloaded from the USFWS website on July 28, 2009. This list generally identifies the counties where one would reasonably expect the species to occur, not necessarily every county where the species is listed.

There are two endangered, threatened, proposed, or candidate animal species listed for Chouteau and Fergus Counties; the Black-footed Ferret (*Mustela nigripes)* and the Pallid Sturgeon (*Scaphirhynchus albus*). The Pallid Sturgeon occurs within the Missouri River which lies within the Study area.

If a project is forwarded from the improvement option(s), an evaluation of potential impacts to all endangered, threatened, proposed, or candidate species will need to be completed during the project development process.

5.1.2 Species of Concern

Montana Species of Concern are native animals breeding in the state that are considered to be "at risk" due to declining population trends, threats to their habitats, and/or restricted distribution. Designation of a species as a Montana Animal Species of Concern is not a statutory or regulatory classification. Instead, these designations provide a basis for resource managers and decision-makers to direct limited resources to priority data collection needs and address conservation needs proactively. Each species is assigned a state rank that ranges from S1 (greatest concern) to S5 (least concern). Other state ranks include SU (unrankable due to insufficient information), SH (historically occurred), and SX (believed to be extinct). State ranks may be followed by modifiers, such as B (breeding) or N (non-breeding).

Tables 3 lists the animal species of concern that the Montana Heritage Program has records of in Chouteau and Fergus Counties. The results of a data search by the Montana Natural Heritage Program reflect the current status of their data collection efforts. These results are not intended as a final statement on sensitive species within a given area, or as a substitute for on-site surveys. If a project is forwarded from the improvement option(s), on-site surveys will need to be completed during the project development process.

Table 3. Montana Animal Species of Concern Noted in Chouteau and Fergus Counties

	Scientific Name	Common Name	State Rank	County
Amphibians	Bufo cognatus	Great Plains Toad	S2	Chouteau
	Rana pipiens	Northern Leopard Frog	S1	Chouteau, Fergus
	Spea bombifrons	Plains Spadefoot	S3	Fergus
	Bufo boreas	Western Toad	S2	Chouteau
Birds	Ammodramus bairdii	Baird's Sparrow	S3B	Chouteau, Fergus
	Haliaeetus leucocephalus	Bald Eagle	S3	Chouteau, Fergus
	Chlidonias niger	Black Tern	S3B	Chouteau
	Nycticorax nycticorax	Black-crowned Night-Heron	S3B	Chouteau
	Dolichonyx oryzivorus	Bobolink	S3B	Chouteau, Fergus
	Spizella breweri	Brewer's Sparrow	S3B	Chouteau, Fergus
	Athene cunicularia	Burrowing Owl	S3B	Chouteau, Fergus
	Calcarius ornatus	Chestnut-collared Longspur	S2B	Chouteau, Fergus
	Sterna hirundo	Common Tern	S3B	Chouteau
	Buteo regalis	Ferruginous Hawk	S3B	Chouteau, Fergus
	Sterna forsteri	Forster's Tern	S3B	Chouteau
	Leucophaeus pipixcan	Franklin's Gull	S3B	Chouteau
	Ammodramus savannarum	Grasshopper Sparrow	S3B	Chouteau, Fergus
	Centrocercus urophasianus	Greater Sage-Grouse	S2	Chouteau, Fergus
	Lanius ludovicianus	Loggerhead Shrike	S3B	Chouteau, Fergus
	Numenius americanus	Long-billed Curlew	S3B	Chouteau, Fergus
	Calcarius mccownii	McCown's Longspur	S3B	Chouteau
	Charadrius montanus	Mountain Plover	S2B	Fergus
	Accipiter gentilis	Northern Goshawk	S3	Fergus
	Anthus spragueii	Sprague's Pipit	S3B	Chouteau, Fergus
	Plegadis chihi	White-faced Ibis	S3B	Chouteau
Fish	Cycleptus elongatus	Blue Sucker	S2S3	Chouteau, Fergus
	Phoxinus eos x phoxinus neogaeus	Northern Redbelly X Finescale Dace	S3	Fergus
	Polyodon spathula	Paddlefish	S1S2	Chouteau, Fergus
	Scaphirhynchus albus	Pallid Sturgeon	S1	Chouteau, Fergus
	Sander canadensis	Sauger	S2	Chouteau, Fergus
	Macrhybopsis meeki	Sicklefin Chub	S1	Fergus
	Macrhybopsis gelida	Sturgeon Chub	S2S3	Chouteau, Fergus
	Oncorhynchus clarkii lewisi	Westslope Cutthroat Trout	S2	Chouteau, Fergus
Inverte brates	Oreohelix strigosa berryi	Berry's Mountainsnail	S1S2	Fergus
	Euphydryas gillettii	Gillette's Checkerspot	S2	Fergus
Mammals	Cynomys ludovicianus	Black-tailed Prairie Dog	S3	Chouteau, Fergus
	Sorex nanus	Dwarf Shrew	S2S3	Chouteau, Fergus
	Lasiurus borealis	Eastern Red Bat	S2S3	Chouteau
	Myotis thysanodes	Fringed Myotis	S3	Fergus
	Sorex merriami	Merriam's Shrew	S3	Chouteau
	Sorex preblei	Preble's Shrew	S3	Fergus
	Corynorhinus townsendii	Townsend's Big-eared Bat	S2	Chouteau, Fergus
Reptiles	Sceloporus graciosus	Common Sagebrush Lizard	S3	Chouteau, Fergus
	Phrynosoma hernandesi	Greater Short-horned Lizard	S3	Chouteau
	Lampropeltis triangulum	Milksnake	S2	Fergus
	Apalone spinifera	Spiny Softshell	S3	Chouteau, Fergus

Table 4 lists the animal species of concern that the Montana Heritage Program has records of within three miles of the Study area. The results of a data search by the Montana Natural Heritage Program reflect the current status of their data collection efforts. These results are not intended as a final statement on sensitive species within a given area, or as a substitute for on-site surveys. If a project is forwarded from the improvement option(s), on-site surveys will need to be completed during the project development process.

Table 4. Montana Animal Species of Concern Documented within 3 miles of the project.

	Scientific Name	Common Name	State Rank
Mammals	*Cynomys ludovicians*	Black-tailed Prairie Dog	S3
	Myotis thysanodes	Fringed Myotis	S3
	Corynorhinus townsendii	Townsend's Big-eared Bat	S2
Birds	*Centrocercus urophasianus*	Greater Sage Grouse	S2
	Haliaeetus leucocephalus	Bald Eagle	S3
	Aquila chrysaetos	Golden Eagle	S3
	Athene cunicularia	Burrowing Owl	S3B
	Buteo regalis	Ferruginous Hawk	S3B
	Lanius ludovicianus	Loggerhead Shrike	S3B
Amphibians	*Rana pipiens*	Northern Leopard Frog	S1
Fish	*Sander canadensis*	Sauger	S2
	Cycleptus elongatus	Blue Sucker	S2S3
	Polyodon spathula	Paddlefish	S1S2
	Macrhybopsis gelida	Sturgeon Chub	S2S3

5.1.3 Wildlife and Traffic Concerns

During the project development process, MDT should work with FWP Wildlife Biologists for the area to determine what measures, if any, are needed to address wildlife crossings along the corridor improvements. To facilitate wildlife movement and migrations through the project area, right of way fencing should be designed with a maximum of 4 strands of barbed wire, and it is preferable to install wildlife friendly fence along the project.

5.2 Vegetation

Native vegetation in the study area generally consists of wetland and riparian areas along waterways and forest/sagebrush/grasslands in the upland areas. The remaining vegetation consists of cultivated crop land.

5.2.1 Threatened and Endangered Species

The federal list of endangered and threatened species is maintained by the USFWS. Species on this list receive protection under the Endangered Species Act (ESA). An 'endangered' species is one that is in danger of extinction throughout all or a significant portion of its range. A 'threatened' species is one that is likely to become endangered in the foreseeable future. The USFWS also maintains a list of species that are candidates or proposed for possible addition to the federal list.

The endangered, threatened, proposed, and candidate plant species list for Montana counties (May 2009) was downloaded from the USFWS website on July 28, 2009. This list generally

identifies the counties where one would reasonably expect the species to occur, not necessarily every county where the species is listed.

There are no endangered, threatened, proposed, or candidate plant species listed for Chouteau or Fergus Counties, and none are currently expected to occur in the Study area. If a project is forwarded from the improvement option(s), an evaluation of potential impacts to all endangered, threatened, proposed, or candidate species will need be done during the project development process.

5.2.2 Species of Concern

Montana Species of Concern are native plants in the state that are considered to be "at risk" due to declining population trends, threats to their habitats, and/or restricted distribution. Designation of a species as a Montana Plant Species of Concern is not a statutory or regulatory classification. Instead, these designations provide a basis for resource managers and decision-makers to direct limited resources to priority data collection needs and address conservation needs proactively. Each species is assigned a state rank that ranges from S1 (greatest concern) to S5 (least concern). Other state ranks include SU (unrankable due to insufficient information), SH (historically occurred), and SX (believed to be extinct). State ranks may be followed by modifiers, such as B (breeding) or N (non-breeding).

Table 5 lists the plant species of concern that the Montana Heritage Program has records of in Chouteau and Fergus Counties. The results of a data search by the Montana Natural Heritage Program reflect the current status of their data collection efforts. These results are not intended as a final statement on sensitive species within a given area, or as a substitute for on-site surveys. If a project is forwarded from the improvement option(s), on-site surveys will need to be completed during the project development process.

Table 5. Plant State Species of Concern Noted in Chouteau and Fergus Counties

Scientific Name	Common Name	State Rank	County
Psoralea hypogaea	Little Indian Breadroot	S2S3	Chouteau, Fergus
Ranunculus pedatifidus	Northern Buttercup	S1	Chouteau
Mimulus ringens	Square-stem Monkeyflower	S1	Chouteau, Fergus
Dryas integrifolia	Entire-leaved Avens	S1	Fergus
Phacelia thermalis	Hot Spring Phacelia	S1	Fergus
Cirsium longistylum	Long-styled Thistle	S3	Fergus
Goodyera repens	Northern Rattlesnake-plantain	S2S3	Fergus
Bacopa rotundifolia	Roundleaf Water-hyssop	S1	Fergus

Data from the Natural Heritage Program shows that one plant species of concern has been documented within 3 miles of the Study area; Little Indian Breadroot (*Psoralea hypogaea*). If a project is forwarded from the improvement option(s), on-site surveys will need to be completed during the project development process to determine any potential impacts to this species.

5.2.3 Noxious Weeds

Noxious weeds degrade habitat, choke streams, crowd native plants, create fire hazards, poison and injure livestock and humans, and foul recreation sites. Areas with a history of disturbance are at particular risk of weed encroachment. There are 32 noxious weeds in Montana, as designated by the Montana Statewide Noxious Weed List (effective April 15, 2008). If a project is forwarded from the improvement option(s), the Study area will need be surveyed for noxious weeds during the project development process.

To reduce the spread and establishment of noxious weeds and to re-establish permanent vegetation, disturbed areas will be seeded with desirable plant species as recommended by the MDT Reclamation specialist.

If a project is forwarded from the improvement option(s), construction activities in the Study Area should also abide by the MDT "Roadside Vegetation Management Plan – Integrated Weed Management Component", dated April 2006. County Weed Control Supervisors should be contacted prior to any construction activities regarding specific measures for weed control.

6 Cultural and Archaeological Resources

If MDT projects forwarded from the Study are federally-funded, MDT would need to conduct a cultural resource survey of the Area of Potential Effect for this project as specified in Section 106 of the National Historic Preservation Act (36 CFR 800). Section 106 requires Federal agencies to "take into account the effects of their undertakings on historic properties." The purpose of the Section 106 process is to identify historic properties that could be affected by the undertaking, assess the effects of the project and investigate methods to avoid, minimize or mitigate any adverse effects on historic properties. Special protections to these properties are afforded protection under Section 4(f) of the Transportation Act.

The Study corridor can be expected to contain a large number of cultural resources. Cultural resources within this Study corridor will likely be a significant issue, and potentially a very costly one.

This Study covers a lot of ground, both north and south of the Missouri River; an area that is known to be rich in cultural resources. A brief file search reveals Chouteau County to have 997 recorded archaeological sites and historic properties, while Fergus County contains 839 historic properties and archaeological sites. The rural nature of the landscape and size of the current road suggest that there are probably dozens of unrecorded sites within the Study corridor. There are very likely significant archaeological sites within the existing right of way itself.

One can expect to encounter historic ranches and/or ranch buildings, historic bridges, tipi ring sites, lithic scatters, and pre-contact buried campsites within the Study corridor. There may be a bison kill or two somewhere along the route.

Alluvial terraces adjacent to perennial streams are particularly prone to harboring buried campsites. South of the Missouri River, where the road crosses or nears Dog Creek, Flax Coulee, the Judith and of course, the Missouri River itself, there is a high likelihood of encountering buried archaeological sites. Likewise north of the Missouri, Chip Creek, Eightmile Coulee, Sandstone Coulee, Eagle Creek, Sheep Coulee, Alkali Coulee, and Little Sandy Creek,

all have the potential to harbor buried archaeological deposits. Buried archaeological sites are often costly to test and excavate.

Where the roadway crosses flats, and especially ridge-tops, one can expect to find tipi ring sites. These sites may be located at or near the ground surface, which generally makes them less costly to test and/or excavate than more deeply buried sites.

Most of the sites in the Study corridor will not be identified until an intensive pedestrian cultural resource inventory is completed for this route. This means that cultural resource professionals will need to physically walk several 30 meter transects on either side of the proposed route to look for artifacts, particularly high-probability landforms, and historic structures. Some alluvial or colluvial landforms may require backhoe testing to determine the presence or absence of deeply buried archaeological deposits. There is no way to determine the real scope of cultural resources within the Study corridor without significant fieldwork, time and expense.

If a project is forwarded from the improvement option(s), a cultural resource survey for unrecorded historic properties within the Area of Potential Effect will need to be completed during the project development process. Flexibility in design will be key to avoiding and/or minimizing impact to significant sites in the Study corridor.

7 Social

To provide a context in which to evaluate social impacts, characteristics of the existing population are presented in Table 6 and Table 7.

Table 6: Demographic Information

Area	Population (2008 Estimate)	Population % Change (4/1/00 thru 7/1/08)	Median Household Income (2007)	Persons Below Poverty (2007)	Persons per Square Mile (2000)
Fergus County	11,195	-5.9%	$37,259	15.2%	2.7
Chouteau County	5,225	-12.5%	$37,229	18.1%	1.5
State of Montana	967,440	7.2%	$43,000	14.1%	6.2
USA	304,059,724	8.0%	$50,740	13.0%	79.6

As shown in the table, generally the project area population has declined overall since 2000. Residents in the project area tend to be higher in age and lower in median household income compared to Montana as a whole. These differences can be generally attributed to the rural nature and relatively low population of the area.

Table 7: Population Data

	Fergus County	Chouteau County	State of MT	USA
Total Population [a]	11,195	5,225	967,440	304,059,724
White [b] (%)	96.7	82.0	90.5	79.8
African American [b] (%)	0.1	0.1	0.7	12.8
American Indian/Alaska Native [b] (%)	1.7	16.6	6.4	1.0
Asian [b] (%)	0.3	0.3	0.6	4.5

	Fergus County	Chouteau County	State of MT	USA
Native Hawaiian/Pacific Islander [b] (%)	0.0	0.1	0.1	0.2
Hispanic/Latino[b] (%)	1.2	0.8	3.0	15.4
2 or more races [b] (%)	1.3	1.0	1.7	1.7

Source: US Census Bureau

a. 2008 Estimate

b. 2007 Data in Percent (%)

In general the ethnic makeup of the project area is primarily white, which is consistent with the state as a whole.

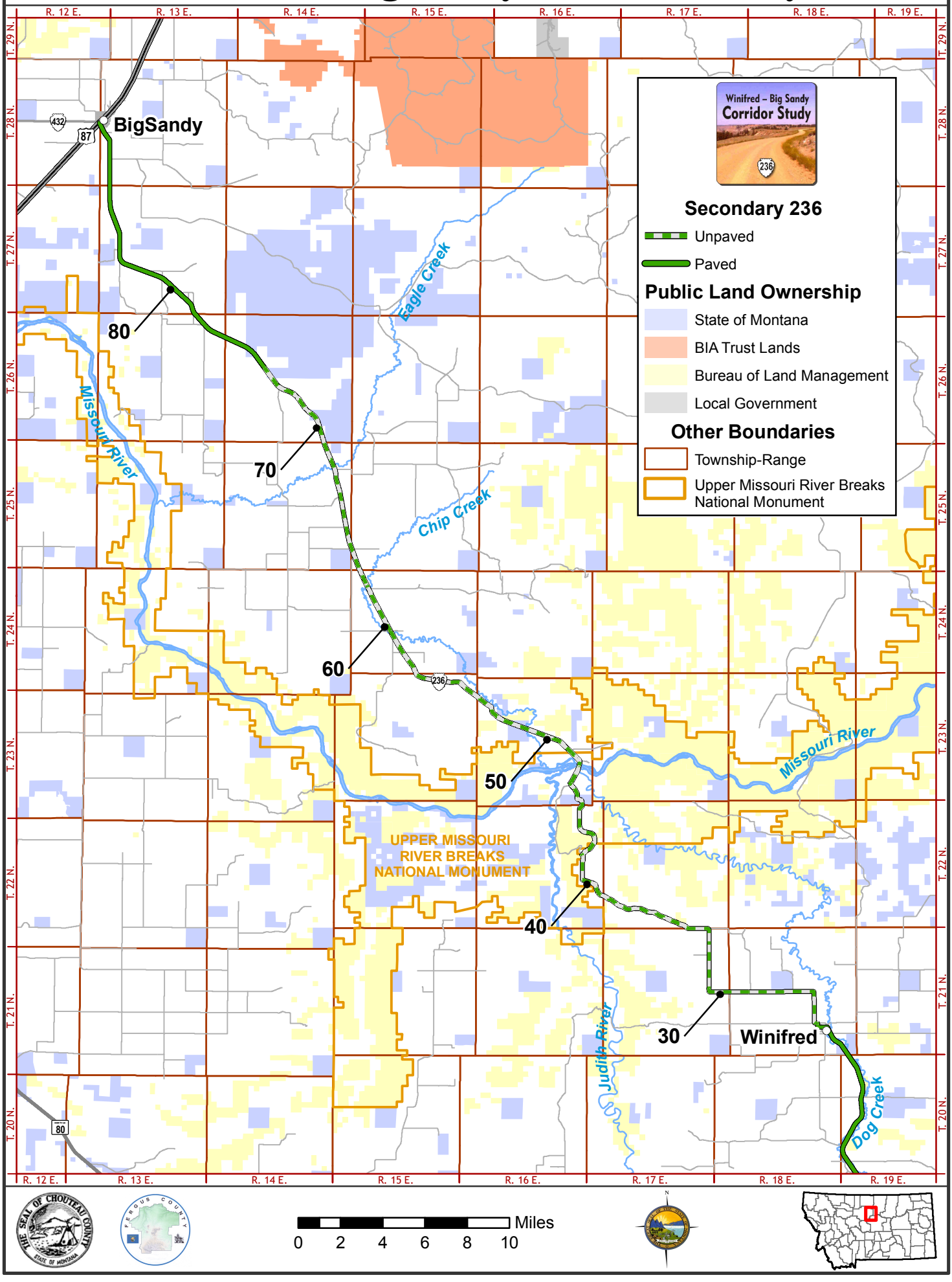
7.1 Environmental Justice

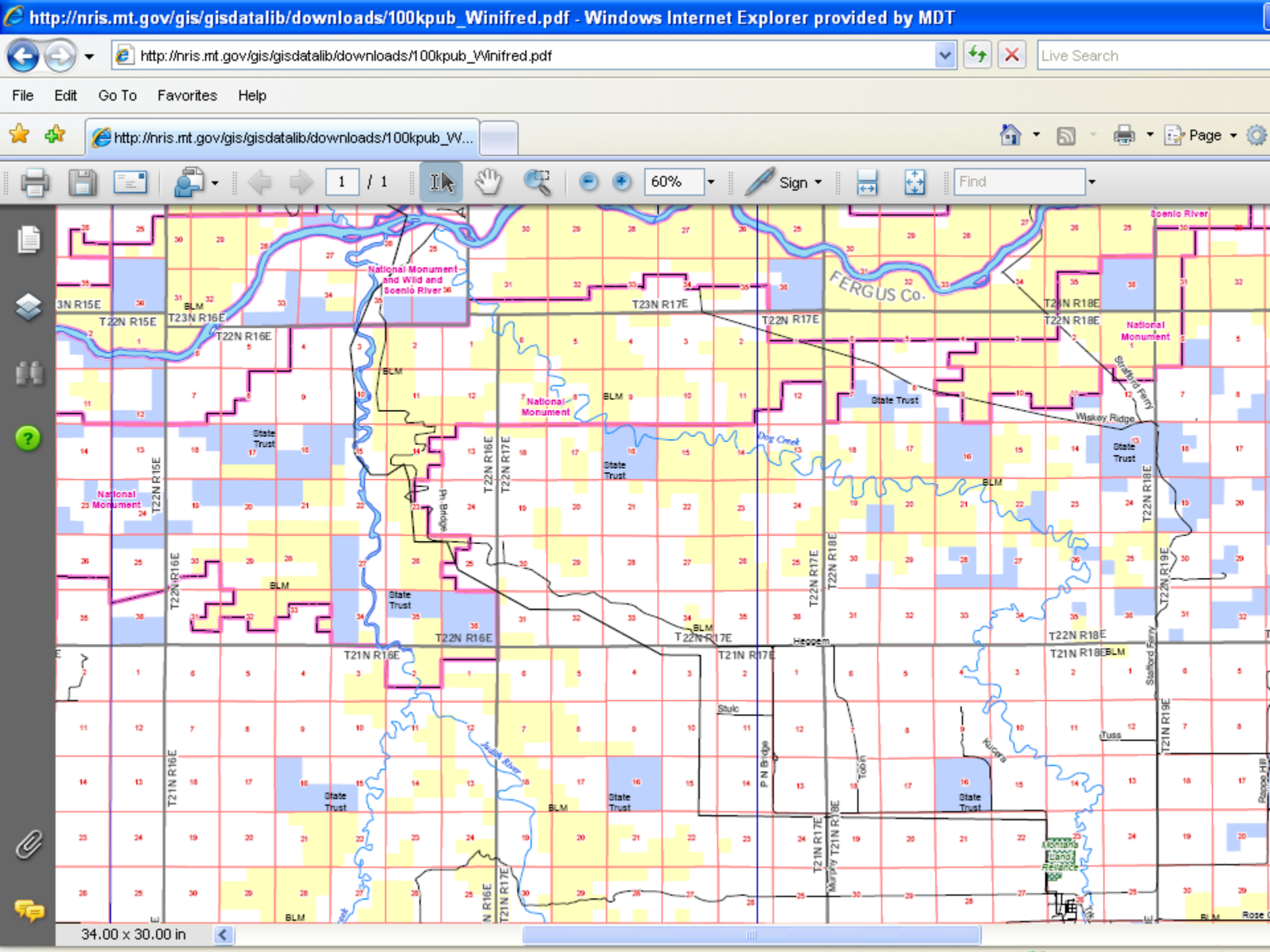
Title VI of the US Civil Rights Act of 1964, as amended (USC 2000(d)) and Executive Order (EO) 12898 require that no minority, or, by extension, low-income person shall be disproportionately adversely impacted by any project receiving federal funds. For transportation projects, this means that no particular minority or low-income person may be disproportionately isolated, displaced, or otherwise subjected to adverse effects.

If a project is forwarded from the improvement option(s), Environmental Justice will need to be further evaluated during the project development process.

Appendix A:
Public Land Ownership Maps

Winifred - Big Sandy Corridor Study

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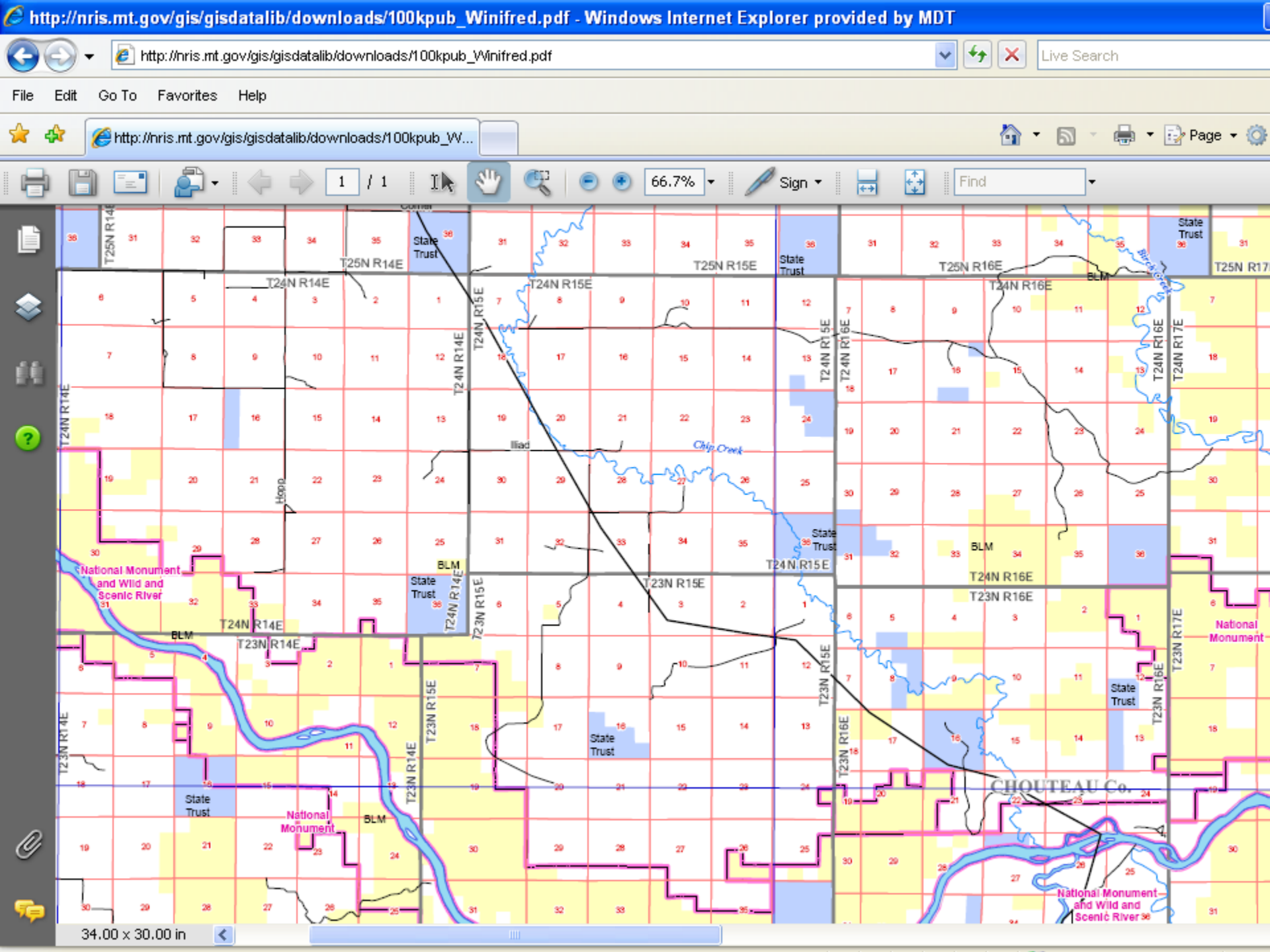
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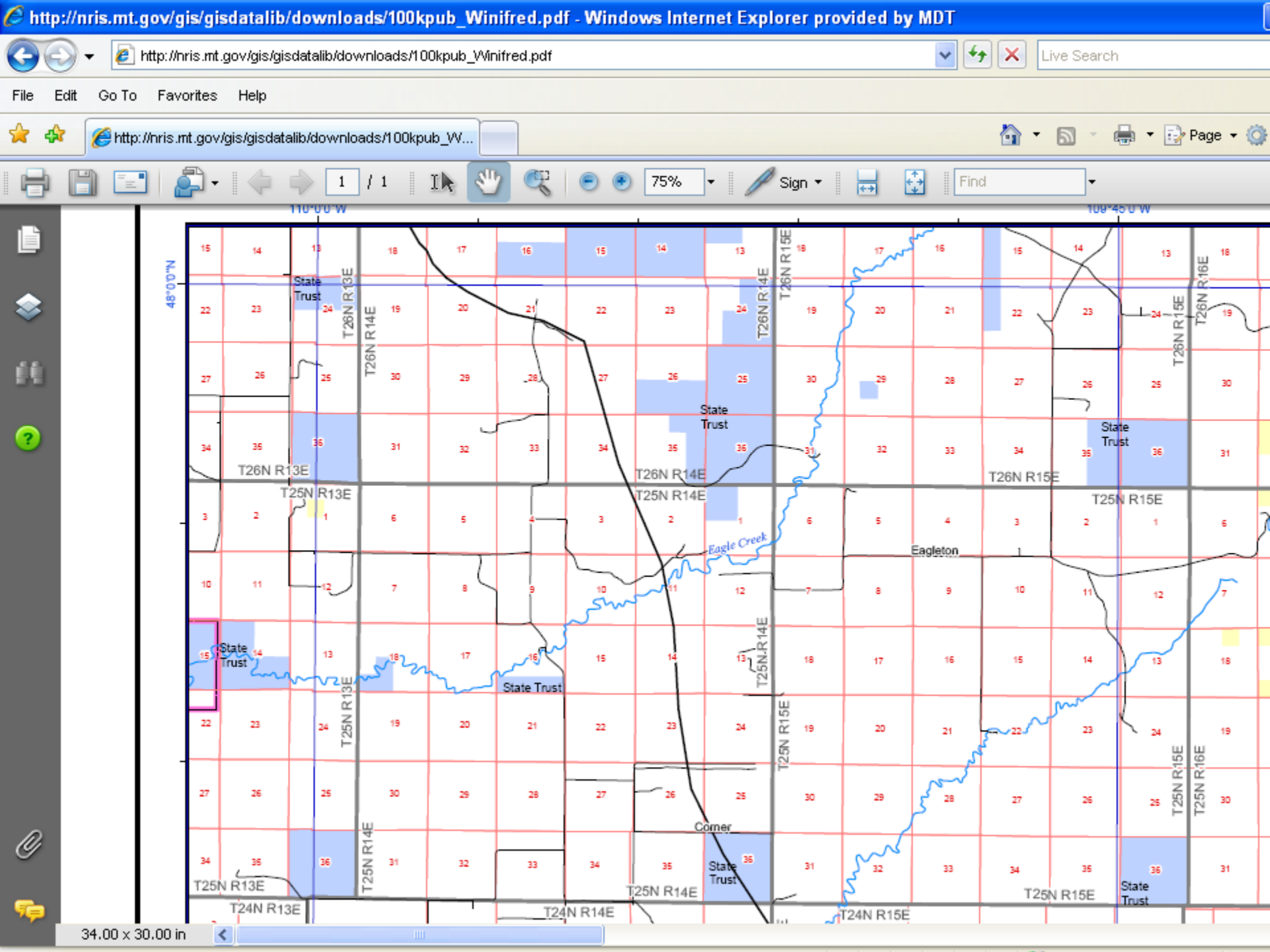
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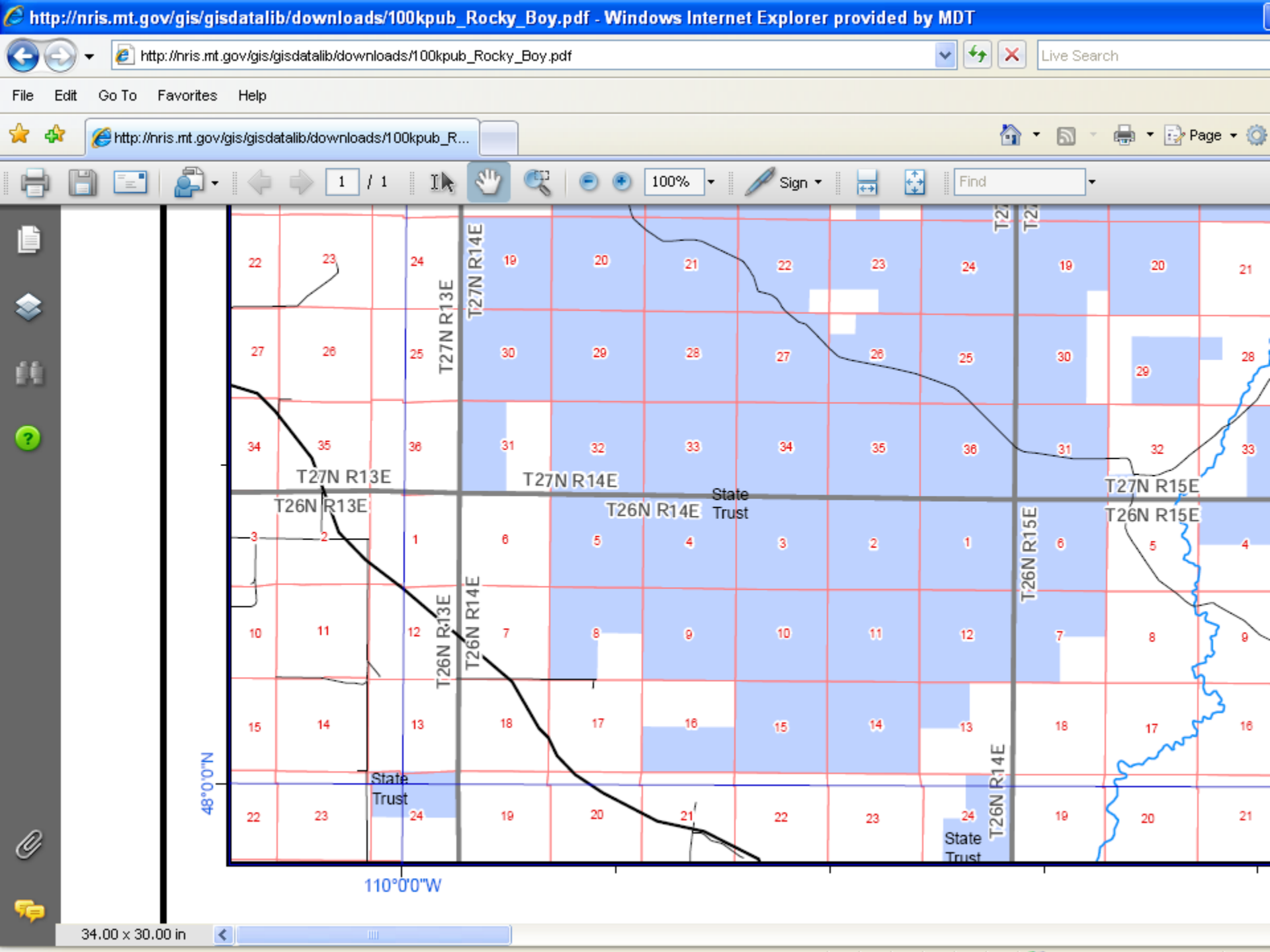
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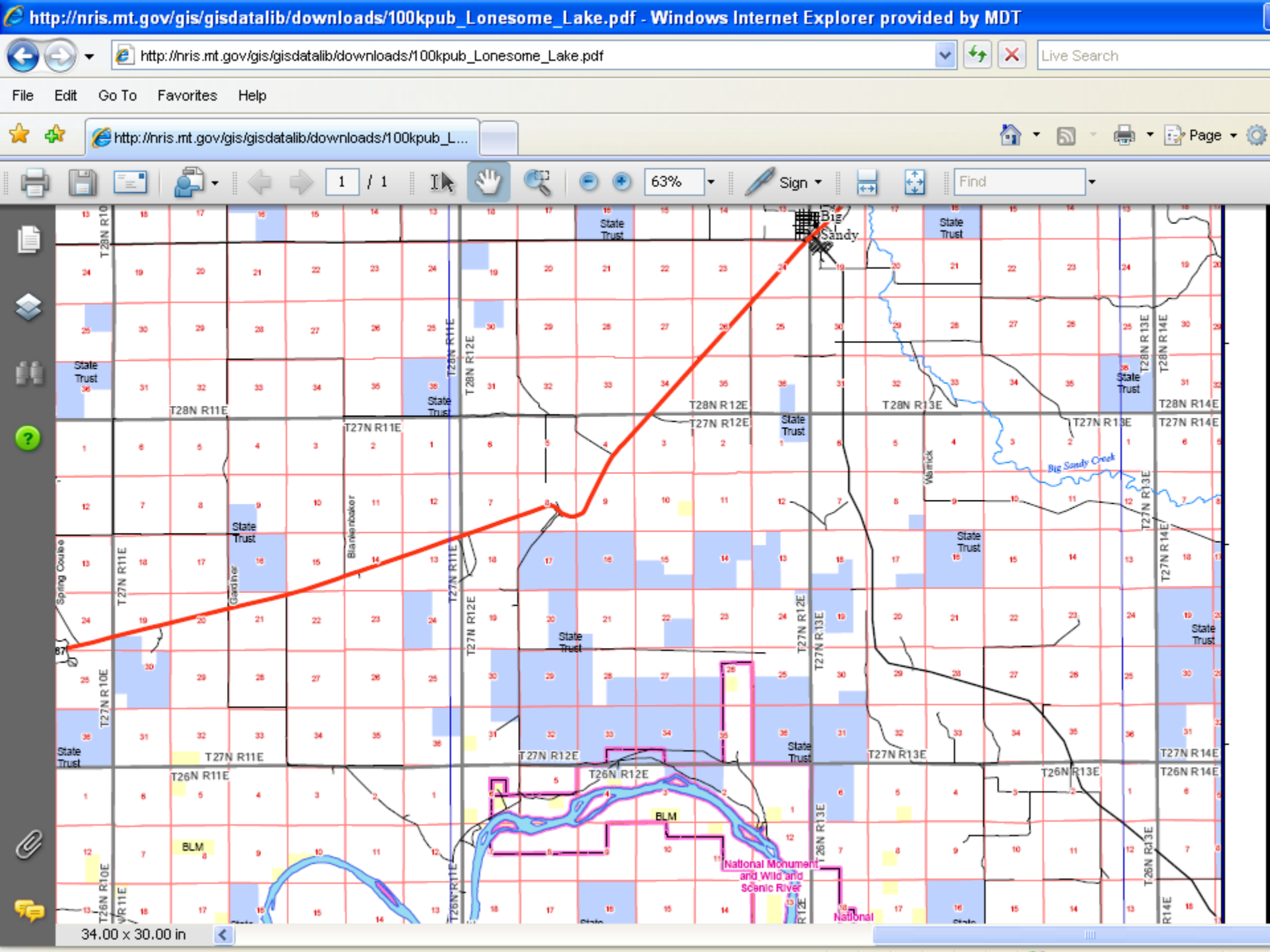
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Warnick
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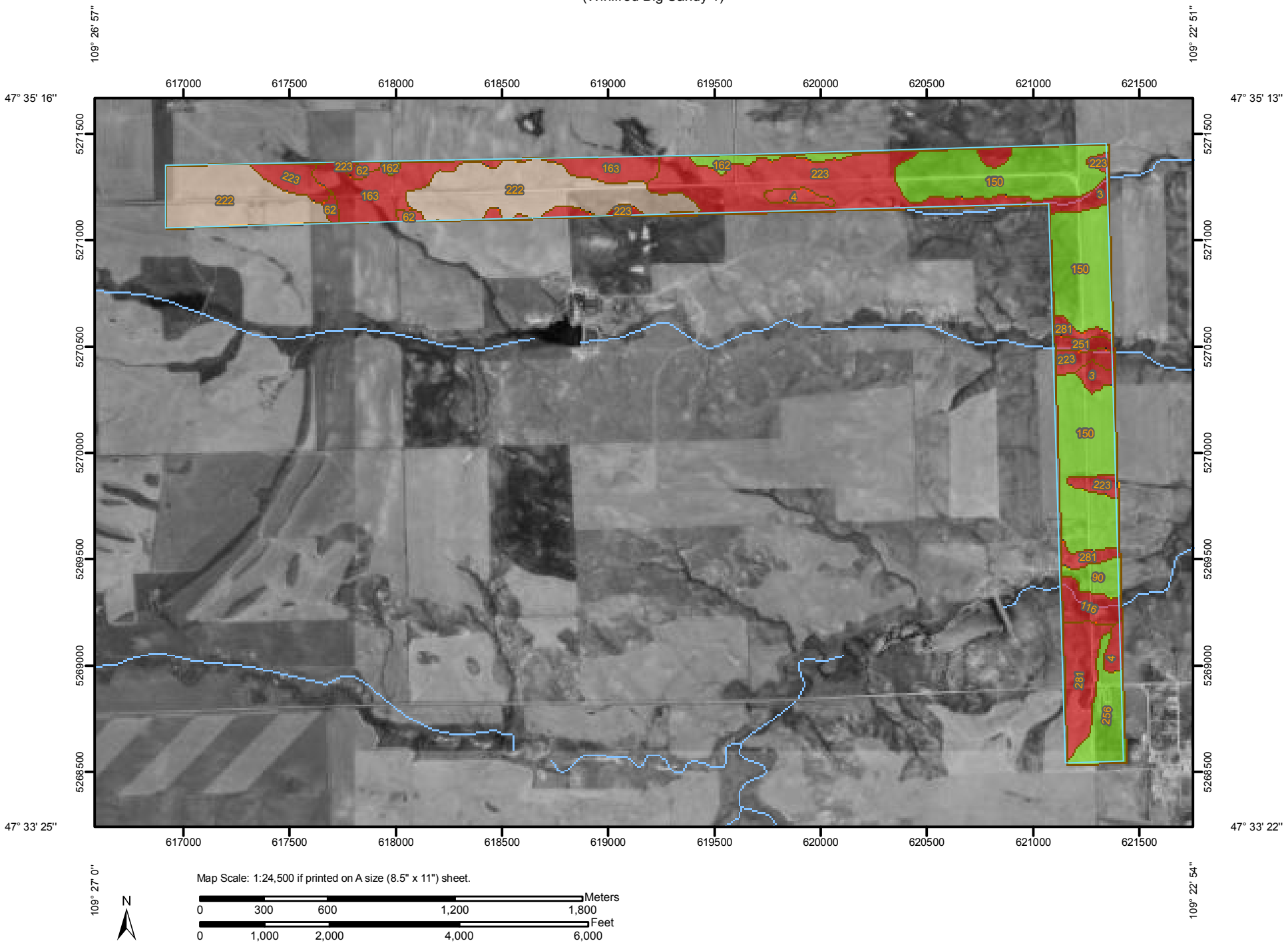
Ownership/Management

- Private
- Bureau of Land Management
- Bureau of Reclamation
- US Fish and Wildlife Service
- National Park Service
- US Forest Service
- Other USDA (Ag Research Stations)
- Army Corps of Engineers
- Other Department of Defense
- Undifferentiated State Lands
- DNRC (State Trust Lands)
- Montana Fish, Wildlife & Parks
- University, Institutions, MDT
- DNRC (Water Project Lands)
- Local Government
- Bureau of Indian Affairs Trust
- Tribal Lands
- Plum Creek
- Private Land Trusts
- Conservation Easements
- Special Designations

- Township/Ran
- Section
- County
- Interstate
- US Route
- Secondary
- Montana Rou
- Local Road

Appendix B:
Maps and descriptions of the farmland classification types

Farmland Classification—Fergus County, Montana
(Winifred Big Sandy 1)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:24,500 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Fergus County, Montana
Survey Area Data: Version 11, Jan 6, 2010

Date(s) aerial images were photographed: 9/22/1997; 7/23/1998

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Farmland Classification

Farmland Classification— Summary by Map Unit — Fergus County, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
3	Abor-Thebo-Crago complex, 15 to 45 percent slopes	Not prime farmland	11.2	2.3%
4	Abor-Yawdim silty clay loams, 4 to 15 percent slopes	Not prime farmland	8.0	1.6%
62	Delpoint-Yawdim complex, 4 to 8 percent slopes	Not prime farmland	5.4	1.1%
90	Evanston loam, 0 to 2 percent slopes	Farmland of statewide importance	8.3	1.7%
116	Havre loam	Not prime farmland	10.6	2.2%
150	Linnet clay loam, 2 to 8 percent slopes	Farmland of statewide importance	138.4	28.5%
162	Marmarth loam, 2 to 8 percent slopes	Farmland of statewide importance	8.1	1.7%
163	Marmarth-Cabbart loams, 4 to 8 percent slopes	Not prime farmland	40.1	8.3%
222	Tanna silty clay loam, 0 to 4 percent slopes	Prime farmland if irrigated	103.2	21.3%
223	Tanna-Abor complex, 2 to 8 percent slopes	Not prime farmland	99.1	20.4%
251	Typic Ustifluvents, saline	Not prime farmland	3.9	0.8%
256	Verson-Linnet clay loams, 2 to 8 percent slopes	Farmland of statewide importance	19.9	4.1%
281	Yawdim-Abor-Rentsac complex, 8 to 60 percent slopes	Not prime farmland	29.4	6.1%
Totals for Area of Interest			**485.5**	**100.0%**

Description

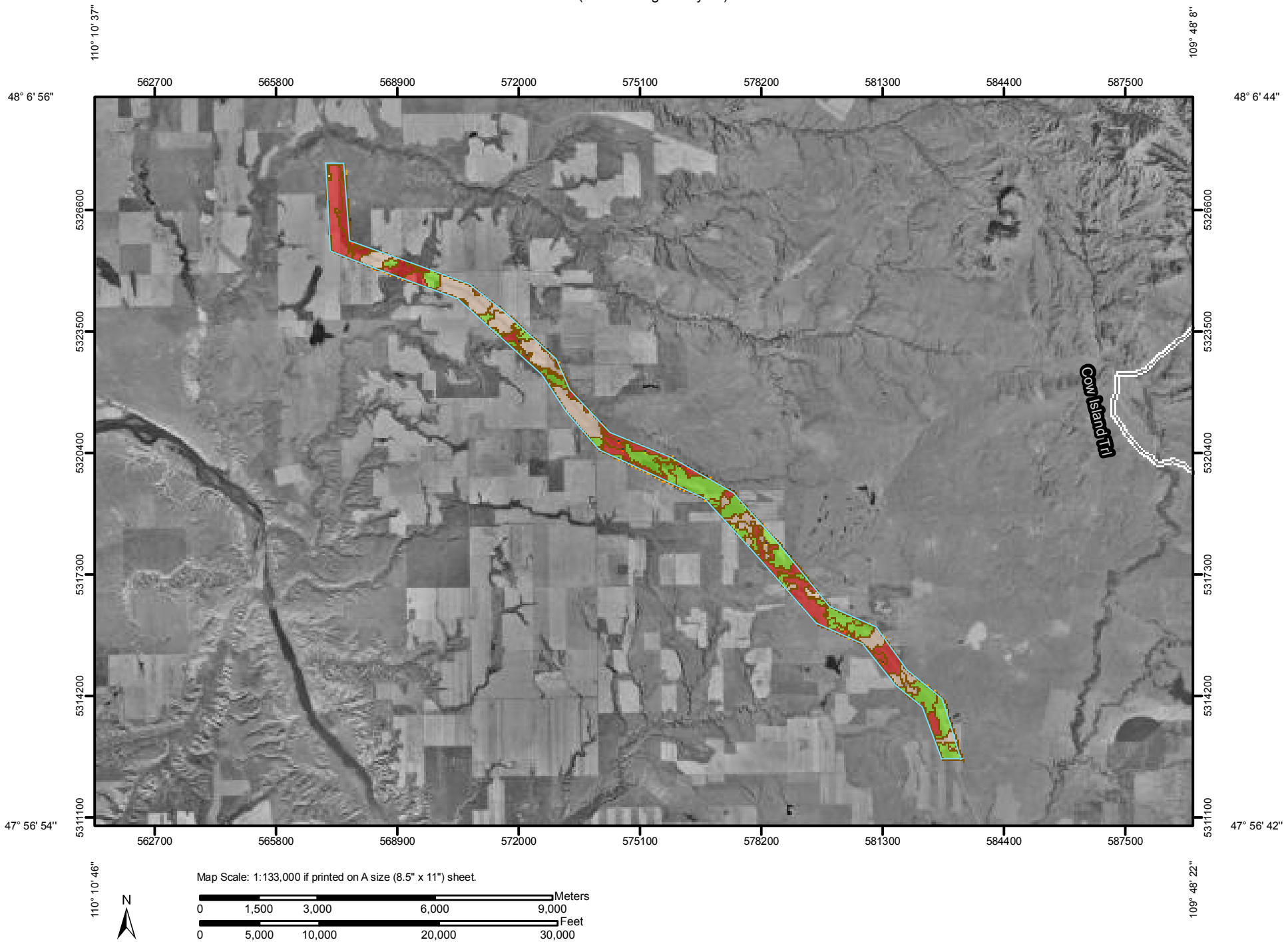
Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

Farmland Classification—Chouteau County Area, Montana
(Winifred Big Sandy 10)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- Not prime farmland
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- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:133,000 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Chouteau County Area, Montana
Survey Area Data: Version 8, Jan 21, 2010

Date(s) aerial images were photographed: 9/4/1997; 7/29/1996; 9/23/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Farmland Classification

Farmland Classification— Summary by Map Unit — Chouteau County Area, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
16B	Degrand loam, 0 to 4 percent slopes	Prime farmland if irrigated	12.4	0.4%
22F	Hillon loam, 25 to 60 percent slopes	Not prime farmland	54.9	1.8%
28	Nishon clay loam, 0 to 1 percent slopes	Prime farmland if drained	12.5	0.4%
31A	Ferd loam, 0 to 2 percent slopes	Not prime farmland	6.0	0.2%
37B	Evanston loam, 0 to 4 percent slopes	Prime farmland if irrigated	148.2	5.0%
92E	Sunburst-Bascovy complex, 8 to 25 percent slopes	Not prime farmland	62.1	2.1%
98B	Kremlin loam, 0 to 4 percent slopes	Prime farmland if irrigated	25.1	0.8%
224E	Hillon-Joplin loams, 8 to 25 percent slopes	Not prime farmland	333.4	11.2%
251E	Bascovy-Neldore silty clays, 8 to 25 percent slopes	Not prime farmland	42.4	1.4%
252C	Bascovy-Marvan silty clays, 2 to 8 percent slopes	Not prime farmland	2.3	0.1%
265B	Absher-Gerdrum complex, 0 to 4 percent slopes	Not prime farmland	28.5	1.0%
301A	Marvan-Vanda clays, 0 to 2 percent slopes	Not prime farmland	0.7	0.0%
331B	Phillips-Elloam complex, 0 to 4 percent slopes	Not prime farmland	246.2	8.3%
334B	Phillips-Kevin complex, 0 to 4 percent slopes	Farmland of statewide importance	17.7	0.6%
402A	Gerdrum-Absher-Creed complex, 0 to 2 percent slopes	Not prime farmland	84.8	2.9%
421C	Joplin-Hillon loams, 2 to 8 percent slopes	Farmland of statewide importance	169.9	5.7%
442C	Kevin-Elloam clay loams, 2 to 8 percent slopes	Not prime farmland	21.9	0.7%
503B	Telstad-Joplin loams, 0 to 4 percent slopes	Prime farmland if irrigated	577.5	19.4%
503C	Telstad-Joplin loams, 4 to 8 percent slopes	Farmland of statewide importance	546.0	18.4%
521B	Thoeny-Elloam-Absher complex, 0 to 4 percent slopes	Not prime farmland	133.6	4.5%

Farmland Classification— Summary by Map Unit — Chouteau County Area, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
561B	Scobey-Kevin clay loams, 0 to 4 percent slopes	Prime farmland if irrigated	121.2	4.1%
561C	Scobey-Kevin clay loams, 4 to 8 percent slopes	Farmland of statewide importance	276.0	9.3%
605C	Yamacall-Havre loams, 0 to 8 percent slopes	Farmland of statewide importance	50.7	1.7%
Totals for Area of Interest			**2,973.8**	**100.0%**

Description

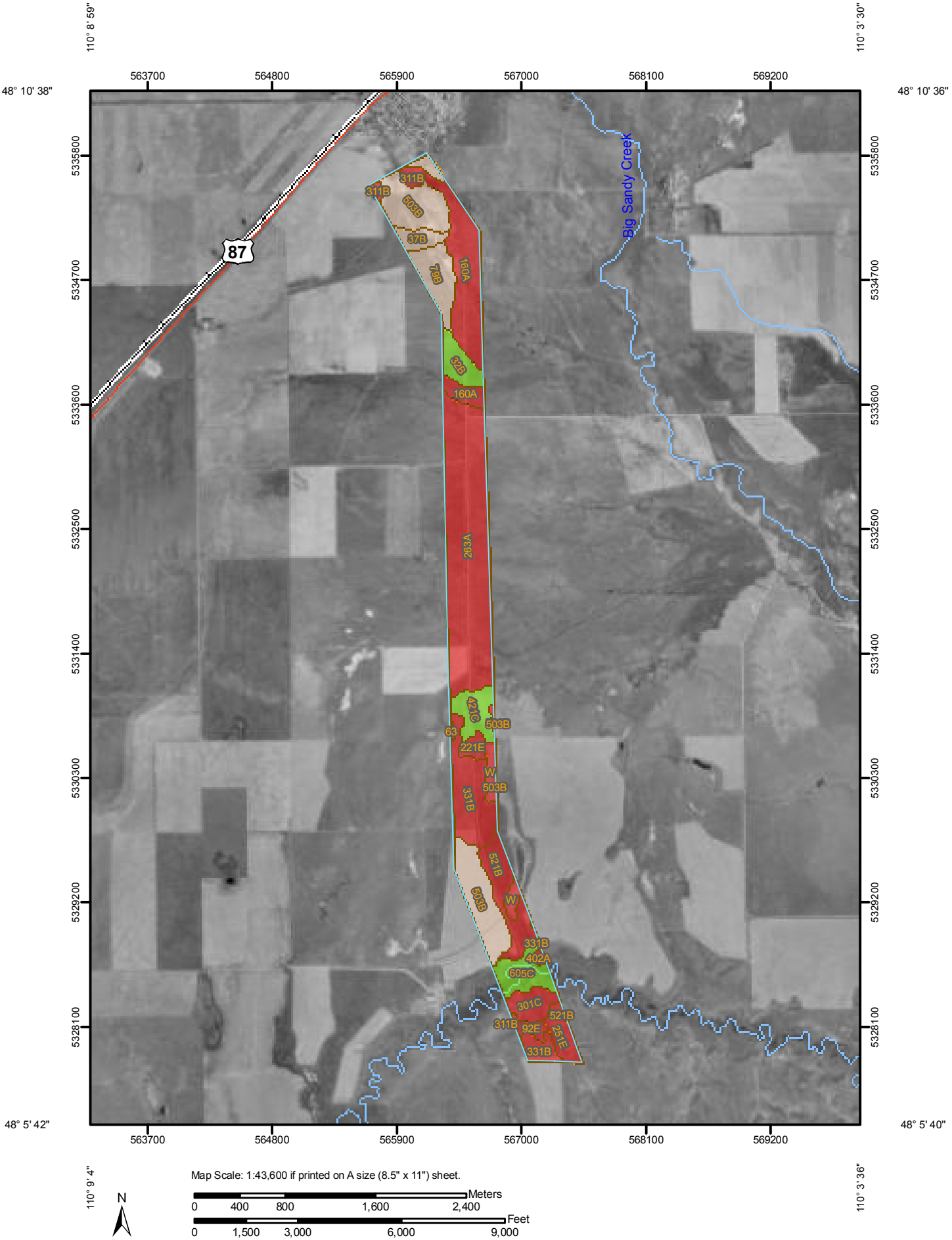
Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

Farmland Classification—Chouteau County Area, Montana
(Winifred Big Sandy 11)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:43,600 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Chouteau County Area, Montana
Survey Area Data: Version 8, Jan 21, 2010

Date(s) aerial images were photographed: 9/4/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Farmland Classification

Farmland Classification— Summary by Map Unit — Chouteau County Area, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
32B	Kobase silty clay loam, 0 to 4 percent slopes	Farmland of statewide importance	26.8	3.1%
37B	Evanston loam, 0 to 4 percent slopes	Prime farmland if irrigated	16.0	1.8%
63	Lardell silty clay, 0 to 1 percent slopes	Not prime farmland	0.9	0.1%
79B	Yamacall loam, 0 to 4 percent slopes	Prime farmland if irrigated	40.6	4.7%
92E	Sunburst-Bascovy complex, 8 to 25 percent slopes	Not prime farmland	8.4	1.0%
160A	Bigsandy loam, 0 to 1 percent slopes	Not prime farmland	106.5	12.3%
221E	Hillon-Kevin clay loams, 8 to 25 percent slopes	Not prime farmland	10.2	1.2%
251E	Bascovy-Neldore silty clays, 8 to 25 percent slopes	Not prime farmland	23.3	2.7%
263A	Toston clay loam, 0 to 1 percent slopes	Not prime farmland	236.7	27.3%
301C	Marvan-Vanda clays, 2 to 8 percent slopes	Not prime farmland	25.4	2.9%
311B	Ferd-Creed-Gerdrum complex, 0 to 4 percent slopes	Not prime farmland	12.1	1.4%
331B	Phillips-Elloam complex, 0 to 4 percent slopes	Not prime farmland	87.9	10.1%
402A	Gerdrum-Absher-Creed complex, 0 to 2 percent slopes	Not prime farmland	2.7	0.3%
421C	Joplin-Hillon loams, 2 to 8 percent slopes	Farmland of statewide importance	33.3	3.8%
503B	Telstad-Joplin loams, 0 to 4 percent slopes	Prime farmland if irrigated	129.0	14.9%
521B	Thoeny-Elloam-Absher complex, 0 to 4 percent slopes	Not prime farmland	52.0	6.0%
605C	Yamacall-Havre loams, 0 to 8 percent slopes	Farmland of statewide importance	35.6	4.1%
W	Water	Not prime farmland	19.9	2.3%
Totals for Area of Interest			**867.3**	**100.0%**

Description

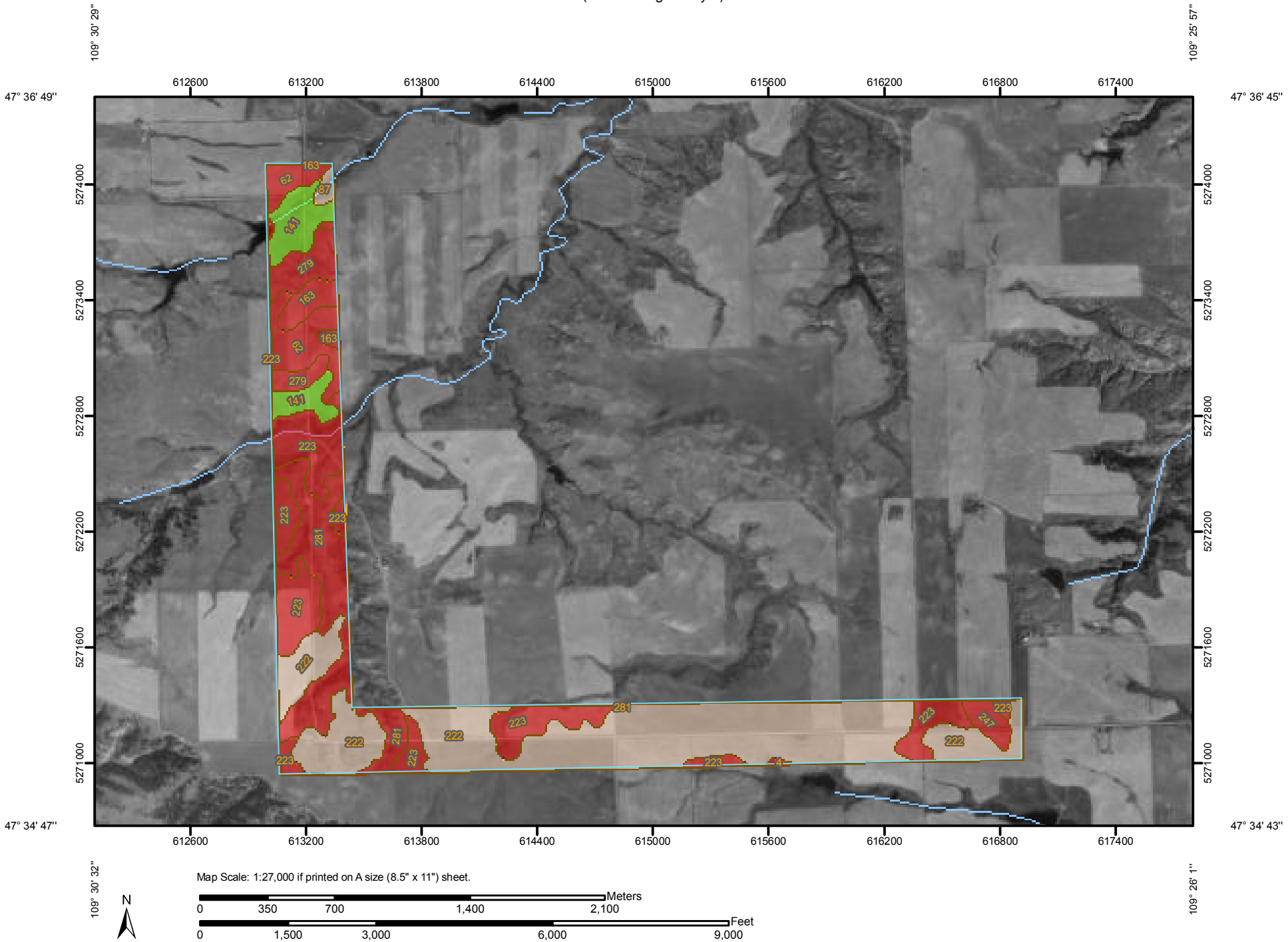
Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

Farmland Classification—Fergus County, Montana
(Winifred Big Sandy 2)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:27,000 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Fergus County, Montana
Survey Area Data: Version 11, Jan 6, 2010

Date(s) aerial images were photographed: 9/22/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Farmland Classification

Farmland Classification— Summary by Map Unit — Fergus County, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
4	Abor-Yawdim silty clay loams, 4 to 15 percent slopes	Not prime farmland	1.0	0.2%
62	Delpoint-Yawdim complex, 4 to 8 percent slopes	Not prime farmland	36.3	6.4%
87	Ethridge silty clay loam, 0 to 2 percent slopes	Prime farmland if irrigated	3.6	0.6%
141	Kobar silty clay loam, 2 to 8 percent slopes	Farmland of statewide importance	32.8	5.8%
163	Marmarth-Cabbart loams, 4 to 8 percent slopes	Not prime farmland	14.0	2.5%
222	Tanna silty clay loam, 0 to 4 percent slopes	Prime farmland if irrigated	252.8	44.5%
223	Tanna-Abor complex, 2 to 8 percent slopes	Not prime farmland	115.2	20.3%
247	Typic Albaqualfs, level	Not prime farmland	9.2	1.6%
279	Yamac-Delpoint-Yawdim complex, 4 to 25 percent slopes	Not prime farmland	26.5	4.7%
281	Yawdim-Abor-Rentsac complex, 8 to 60 percent slopes	Not prime farmland	76.3	13.4%
Totals for Area of Interest			**567.6**	**100.0%**

Description

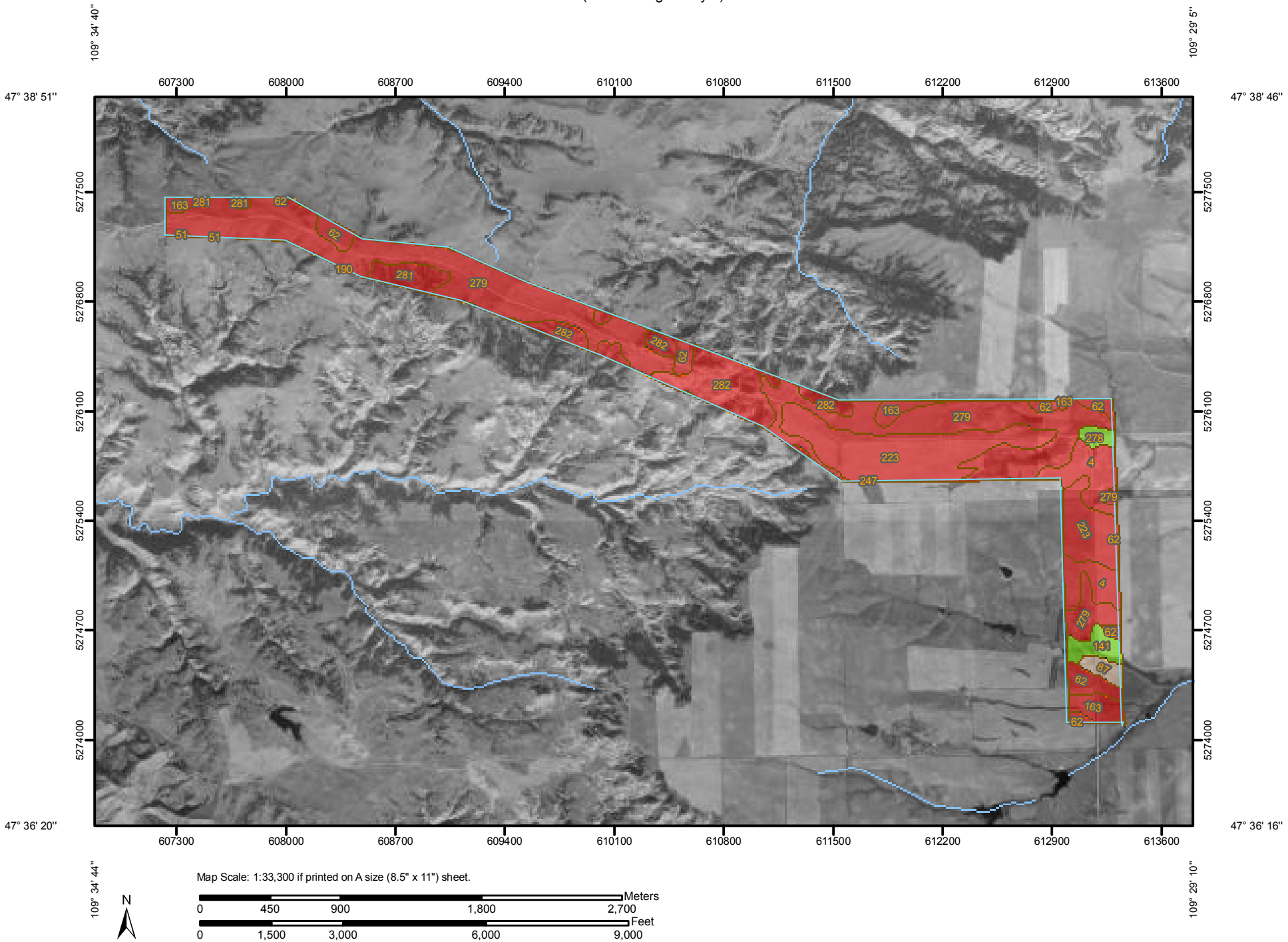
Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

Farmland Classification—Fergus County, Montana
(Winifred Big Sandy 3)



Map Scale: 1:33,300 if printed on A size (8.5" x 11") sheet.

N

Meters
0 450 900 1,800 2,700

Feet
0 1,500 3,000 6,000 9,000

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:33,300 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Fergus County, Montana
Survey Area Data: Version 11, Jan 6, 2010

Date(s) aerial images were photographed: 9/22/1997; 8/29/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Farmland Classification

Farmland Classification— Summary by Map Unit — Fergus County, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
4	Abor-Yawdim silty clay loams, 4 to 15 percent slopes	Not prime farmland	49.2	7.2%
51	Creed-Gerdrum complex, 0 to 2 percent slopes	Not prime farmland	1.0	0.1%
62	Delpoint-Yawdim complex, 4 to 8 percent slopes	Not prime farmland	38.7	5.7%
87	Ethridge silty clay loam, 0 to 2 percent slopes	Prime farmland if irrigated	8.1	1.2%
141	Kobar silty clay loam, 2 to 8 percent slopes	Farmland of statewide importance	13.7	2.0%
163	Marmarth-Cabbart loams, 4 to 8 percent slopes	Not prime farmland	24.9	3.7%
190	Rock outcrop	Not prime farmland	0.1	0.0%
223	Tanna-Abor complex, 2 to 8 percent slopes	Not prime farmland	133.5	19.7%
247	Typic Albaqualfs, level	Not prime farmland	0.4	0.1%
278	Yamac loam, 2 to 8 percent slopes	Farmland of statewide importance	6.5	1.0%
279	Yamac-Delpoint-Yawdim complex, 4 to 25 percent slopes	Not prime farmland	306.1	45.1%
281	Yawdim-Abor-Rentsac complex, 8 to 60 percent slopes	Not prime farmland	20.2	3.0%
282	Yawdim-Delpoint-Rock outcrop complex, 25 to 50 percent slopes	Not prime farmland	76.5	11.3%
Totals for Area of Interest			**678.8**	**100.0%**

Description

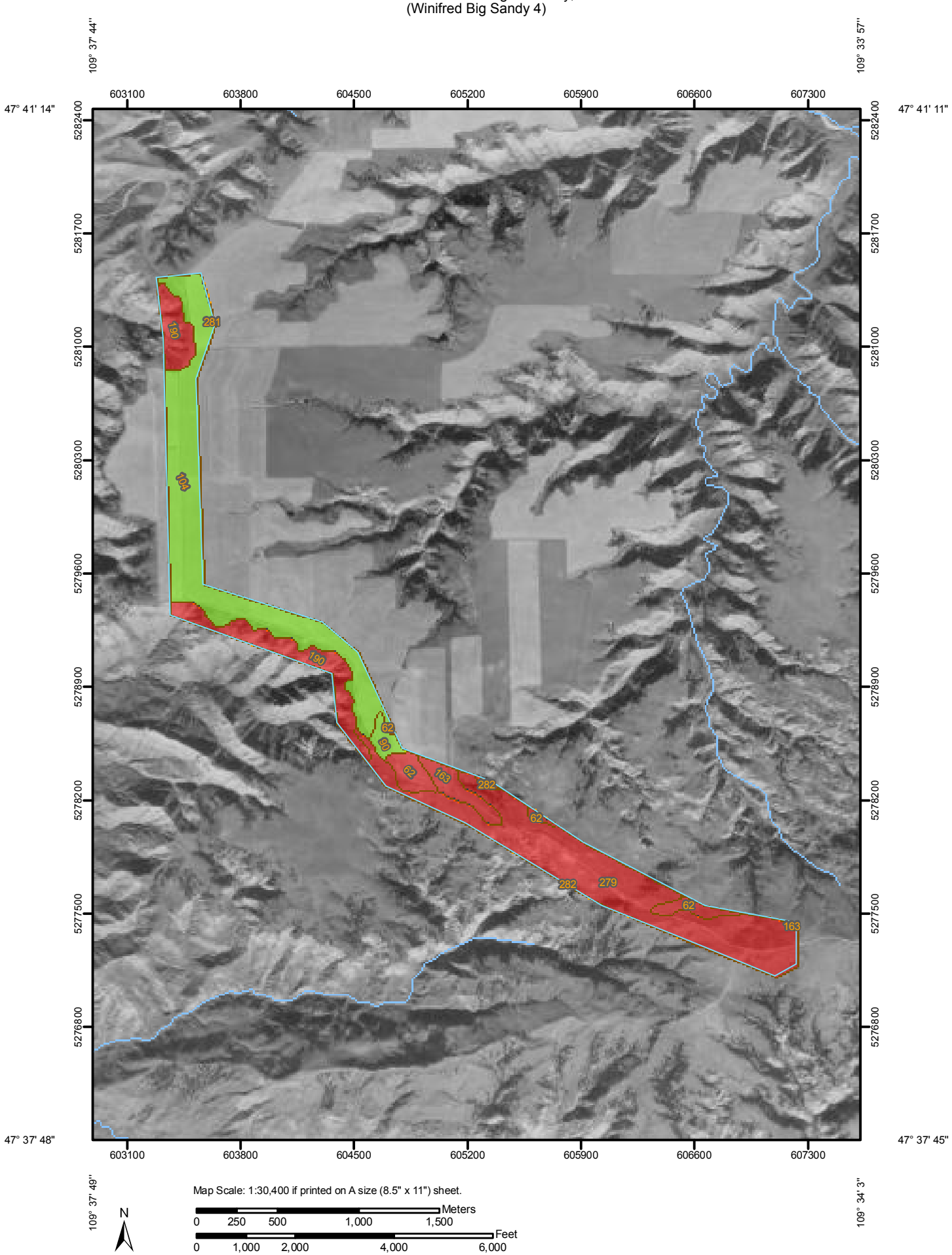
Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

Farmland Classification—Fergus County, Montana
(Winifred Big Sandy 4)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:30,400 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Fergus County, Montana
Survey Area Data: Version 11, Jan 6, 2010

Date(s) aerial images were photographed: 9/22/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Farmland Classification

Farmland Classification— Summary by Map Unit — Fergus County, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
62	Delpoint-Yawdim complex, 4 to 8 percent slopes	Not prime farmland	23.1	5.6%
90	Evanston loam, 0 to 2 percent slopes	Farmland of statewide importance	7.5	1.8%
104	Floweree silt loam, 2 to 8 percent slopes	Farmland of statewide importance	147.5	35.6%
163	Marmarth-Cabbart loams, 4 to 8 percent slopes	Not prime farmland	15.8	3.8%
190	Rock outcrop	Not prime farmland	60.4	14.6%
279	Yamac-Delpoint-Yawdim complex, 4 to 25 percent slopes	Not prime farmland	158.6	38.2%
281	Yawdim-Abor-Rentsac complex, 8 to 60 percent slopes	Not prime farmland	0.1	0.0%
282	Yawdim-Delpoint-Rock outcrop complex, 25 to 50 percent slopes	Not prime farmland	1.6	0.4%
Totals for Area of Interest			**414.7**	**100.0%**

Description

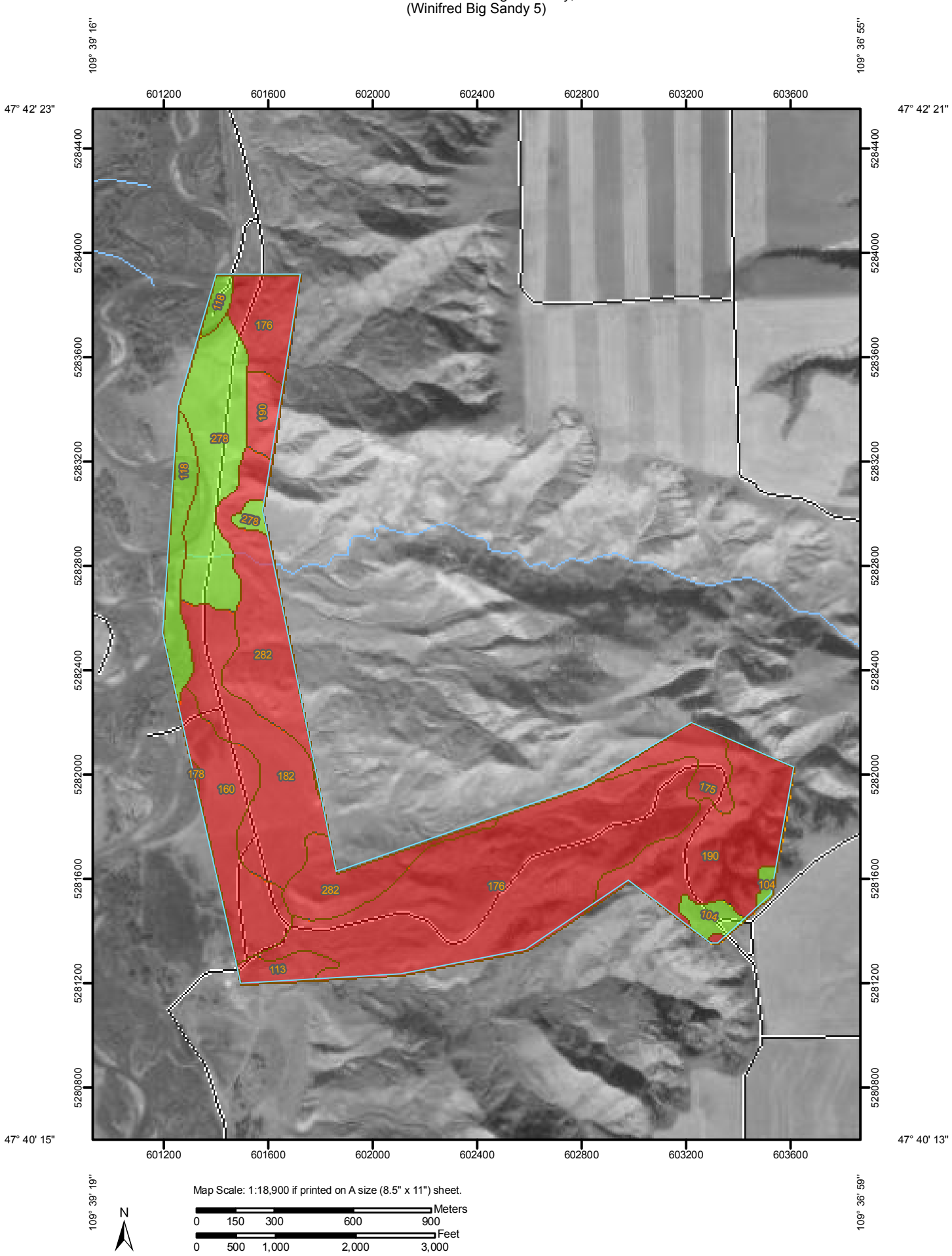
Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

Farmland Classification—Fergus County, Montana
(Winifred Big Sandy 5)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:18,900 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Fergus County, Montana
Survey Area Data: Version 11, Jan 6, 2010

Date(s) aerial images were photographed: 9/22/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Farmland Classification

Farmland Classification— Summary by Map Unit — Fergus County, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
104	Floweree silt loam, 2 to 8 percent slopes	Farmland of statewide importance	8.6	1.7%
113	Gerdrum-Absher complex, 2 to 8 percent slopes	Not prime farmland	8.3	1.6%
118	Havre and Harlem soils, occasionally flooded	Farmland of statewide importance	22.3	4.4%
160	Marias silty clay, 0 to 2 percent slopes	Not prime farmland	42.6	8.3%
175	Neldore-Thebo clays, 25 to 60 percent slopes	Not prime farmland	15.7	3.1%
176	Neldore-Rock outcrop complex, 15 to 60 percent slopes	Not prime farmland	167.7	32.8%
178	Nesda-Sudworth complex, occasionally flooded	Not prime farmland	0.4	0.1%
182	Pendroy clay, 0 to 4 percent slopes	Not prime farmland	56.5	11.0%
190	Rock outcrop	Not prime farmland	67.0	13.1%
278	Yamac loam, 2 to 8 percent slopes	Farmland of statewide importance	53.0	10.4%
282	Yawdim-Delpoint-Rock outcrop complex, 25 to 50 percent slopes	Not prime farmland	69.7	13.6%
Totals for Area of Interest			**511.8**	**100.0%**

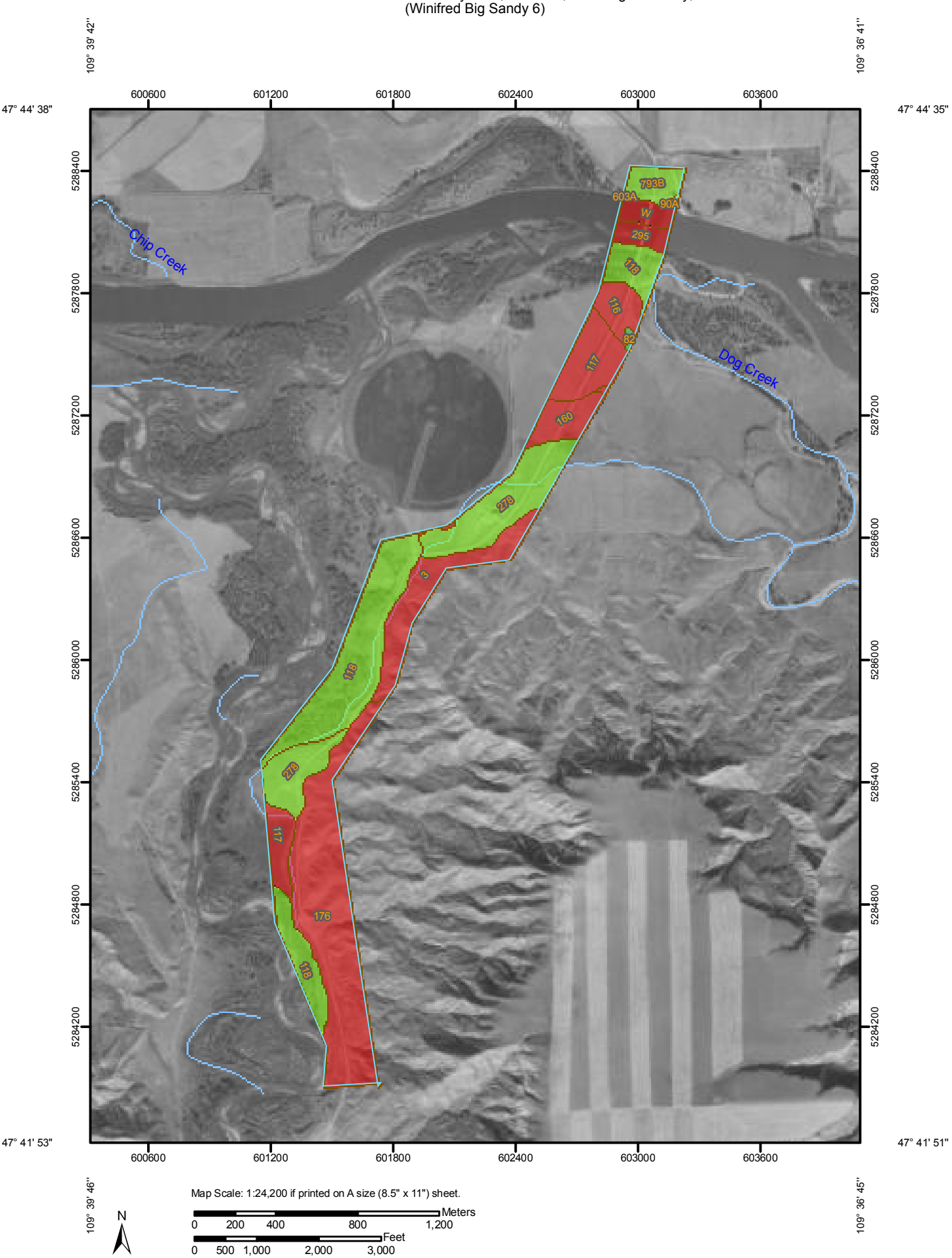
Description

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower


109° 39' 42"
109° 36' 41"
600600
601200
601800
602400
603000
603600
47° 44' 38"
47° 44' 35"
5288400
5287800
5287200
5286600
5286000
5285400
5284800
5284200
Chip Creek
Dog Creek
793B
603A
90A
W
295
118
116
82
117
160
278
3
118
278
117
176
118
47° 41' 53"
47° 41' 51"
109° 39' 46"
109° 36' 45"
Map Scale: 1:24,200 if printed on A size (8.5" x 11") sheet.
N
Meters
0 200 400 800 1,200
Feet
0 500 1,000 2,000 3,000

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:24,200 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Chouteau County Area, Montana
Survey Area Data: Version 8, Jan 21, 2010

Soil Survey Area: Fergus County, Montana
Survey Area Data: Version 11, Jan 6, 2010

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Date(s) aerial images were photographed: 9/22/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Farmland Classification

Farmland Classification— Summary by Map Unit — Chouteau County Area, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
90A	Harlake silty clay, 0 to 1 percent slopes	Farmland of statewide importance	0.9	0.2%
603A	Havre-Glendive complex, 0 to 2 percent slopes, occasionally flooded	Farmland of statewide importance	0.2	0.0%
793B	Yamacall clay loam, 0 to 4 percent slopes	Farmland of statewide importance	10.7	2.9%
W	Water	Not prime farmland	7.2	2.0%
Subtotals for Soil Survey Area			**18.9**	**5.2%**
Totals for Area of Interest			**363.9**	**100.0%**

Farmland Classification— Summary by Map Unit — Fergus County, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
3	Abor-Thebo-Crago complex, 15 to 45 percent slopes	Not prime farmland	32.4	8.9%
82	Enbar loam, 0 to 2 percent slopes	All areas are prime farmland	1.1	0.3%
116	Havre loam	Not prime farmland	11.9	3.3%
117	Havre silty clay loam	Not prime farmland	33.9	9.3%
118	Havre and Harlem soils, occasionally flooded	Farmland of statewide importance	89.2	24.5%
160	Marias silty clay, 0 to 2 percent slopes	Not prime farmland	14.0	3.9%
176	Neldore-Rock outcrop complex, 15 to 60 percent slopes	Not prime farmland	95.1	26.1%
278	Yamac loam, 2 to 8 percent slopes	Farmland of statewide importance	60.1	16.5%
295	Water	Not prime farmland	7.2	2.0%
Subtotals for Soil Survey Area			**345.0**	**94.8%**
Totals for Area of Interest			**363.9**	**100.0%**

Description

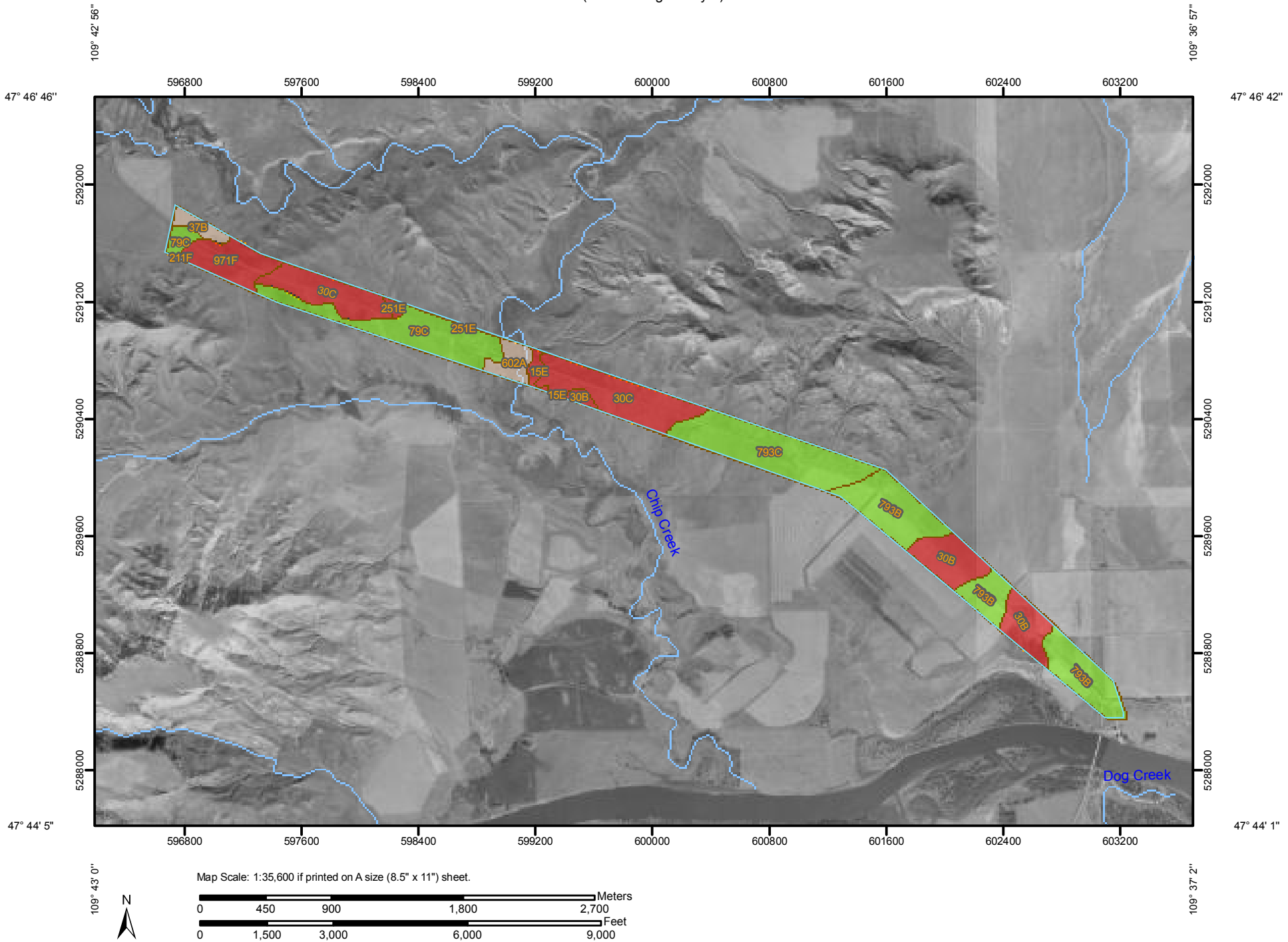
Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

Farmland Classification—Chouteau County Area, Montana
(Winifred Big Sandy 7)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:35,600 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Chouteau County Area, Montana
Survey Area Data: Version 8, Jan 21, 2010

Date(s) aerial images were photographed: 9/22/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Farmland Classification

Farmland Classification— Summary by Map Unit — Chouteau County Area, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
15E	Lambeth silt loam, 8 to 25 percent slopes	Not prime farmland	6.1	1.2%
30B	Marvan clay, 0 to 4 percent slopes	Not prime farmland	61.0	12.2%
30C	Marvan clay, 4 to 8 percent slopes	Not prime farmland	101.5	20.3%
37B	Evanston loam, 0 to 4 percent slopes	Prime farmland if irrigated	9.7	1.9%
79C	Yamacall loam, 4 to 8 percent slopes	Farmland of statewide importance	74.7	15.0%
211F	Cabbart-Yawdim-Rock outcrop complex, 25 to 70 percent slopes	Not prime farmland	0.7	0.1%
251E	Bascovy-Neldore silty clays, 8 to 25 percent slopes	Not prime farmland	3.2	0.7%
602A	Havre silty clay loam, 0 to 1 percent slopes	Prime farmland if irrigated	15.7	3.1%
793B	Yamacall clay loam, 0 to 4 percent slopes	Farmland of statewide importance	110.8	22.2%
793C	Yamacall clay loam, 4 to 8 percent slopes	Farmland of statewide importance	82.1	16.5%
971F	Neldore-Bascovy silty clays, 25 to 60 percent slopes	Not prime farmland	33.1	6.6%
Totals for Area of Interest			**498.8**	**100.0%**

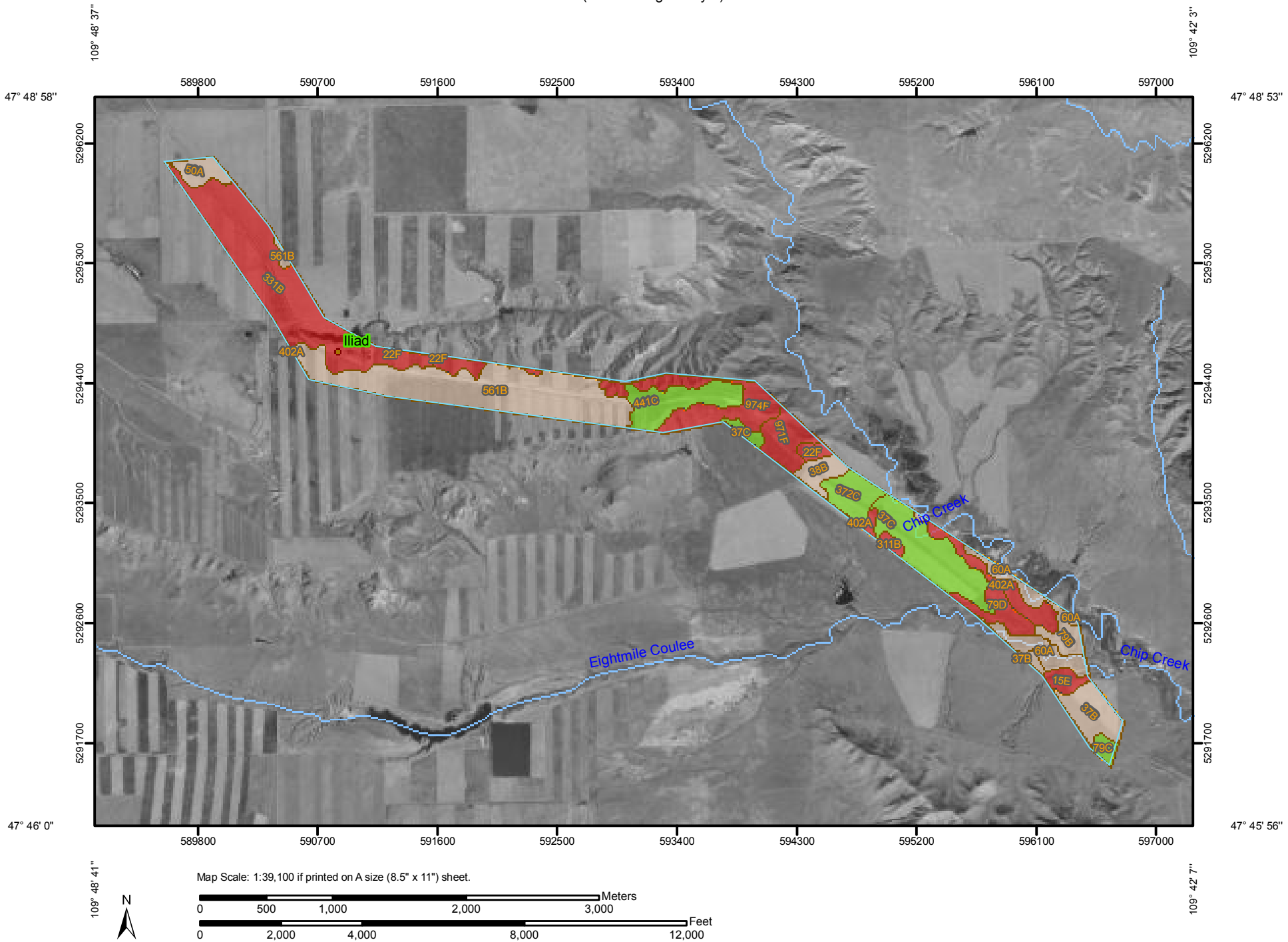
Description

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower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109° 42' 7"
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561B
331B
402A
Iliad
22F
561B
441C
974F
971F
37C
22F
38B
372C
57C
402A
311B
Chip Creek
60A
402A
79D
60A
79B
37B
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15E
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Chip Creek
Eightmile Coulee
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MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:39,100 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Chouteau County Area, Montana
Survey Area Data: Version 8, Jan 21, 2010

Date(s) aerial images were photographed: 7/29/1996; 9/22/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Farmland Classification

Farmland Classification— Summary by Map Unit — Chouteau County Area, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
15E	Lambeth silt loam, 8 to 25 percent slopes	Not prime farmland	10.7	1.4%
22F	Hillon loam, 25 to 60 percent slopes	Not prime farmland	7.9	1.0%
37B	Evanston loam, 0 to 4 percent slopes	Prime farmland if irrigated	36.7	4.7%
37C	Evanston loam, 4 to 8 percent slopes	Farmland of statewide importance	75.9	9.7%
38B	Ethridge silty clay loam, 0 to 4 percent slopes	Prime farmland if irrigated	16.8	2.2%
50A	Telstad loam, 0 to 2 percent slopes	Prime farmland if irrigated	16.1	2.1%
60A	Havre loam, 0 to 2 percent slopes	Prime farmland if irrigated	39.7	5.1%
79B	Yamacall loam, 0 to 4 percent slopes	Prime farmland if irrigated	17.1	2.2%
79C	Yamacall loam, 4 to 8 percent slopes	Farmland of statewide importance	7.3	0.9%
79D	Yamacall loam, 8 to 15 percent slopes	Not prime farmland	22.6	2.9%
311B	Ferd-Creed-Gerdrum complex, 0 to 4 percent slopes	Not prime farmland	4.6	0.6%
331B	Phillips-Elloam complex, 0 to 4 percent slopes	Not prime farmland	168.7	21.6%
372C	Evanston-Yamacall loams, 2 to 8 percent slopes	Farmland of statewide importance	26.6	3.4%
402A	Gerdrum-Absher-Creed complex, 0 to 2 percent slopes	Not prime farmland	30.7	3.9%
441C	Kevin-Hillon clay loams, 2 to 8 percent slopes	Farmland of statewide importance	45.5	5.8%
561B	Scobey-Kevin clay loams, 0 to 4 percent slopes	Prime farmland if irrigated	166.9	21.4%
971F	Neldore-Bascovy silty clays, 25 to 60 percent slopes	Not prime farmland	29.1	3.7%
974F	Neldore-Hillon complex, 25 to 70 percent slopes	Not prime farmland	57.7	7.4%
Totals for Area of Interest			**780.4**	**100.0%**

Description

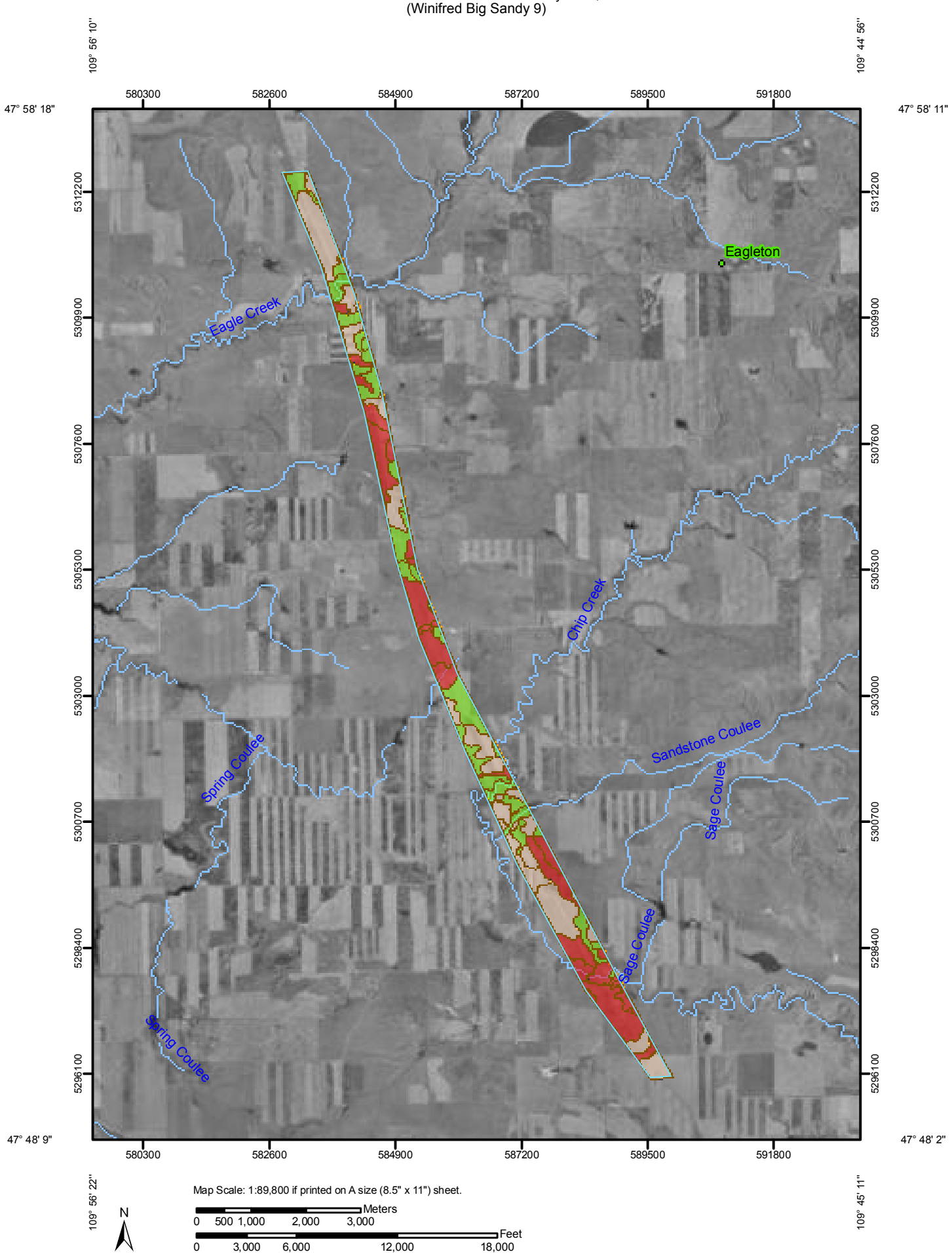
Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

Farmland Classification—Chouteau County Area, Montana
(Winifred Big Sandy 9)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- Not prime farmland
- All areas are prime farmland
- Prime farmland if drained
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated
- Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if irrigated and drained
- Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season
- Prime farmland if subsoiled, completely removing the root inhibiting soil layer
- Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60
- Prime farmland if irrigated and reclaimed of excess salts and sodium
- Farmland of statewide importance
- Farmland of local importance
- Farmland of unique importance
- Not rated or not available

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads

MAP INFORMATION

Map Scale: 1:89,800 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Chouteau County Area, Montana
Survey Area Data: Version 8, Jan 21, 2010

Date(s) aerial images were photographed: 9/4/1997; 7/29/1996; 9/23/1997; 9/22/1997

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Farmland Classification

Farmland Classification— Summary by Map Unit — Chouteau County Area, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
22F	Hillon loam, 25 to 60 percent slopes	Not prime farmland	11.5	0.5%
33A	Phillips loam, 0 to 2 percent slopes	Farmland of statewide importance	83.1	3.9%
36B	Chinook fine sandy loam, 0 to 4 percent slopes	Farmland of statewide importance	42.7	2.0%
37B	Evanston loam, 0 to 4 percent slopes	Prime farmland if irrigated	102.1	4.8%
37C	Evanston loam, 4 to 8 percent slopes	Farmland of statewide importance	13.9	0.7%
38B	Ethridge silty clay loam, 0 to 4 percent slopes	Prime farmland if irrigated	12.0	0.6%
50A	Telstad loam, 0 to 2 percent slopes	Prime farmland if irrigated	43.6	2.1%
58B	Lonna silty clay loam, 0 to 4 percent slopes	Farmland of statewide importance	9.1	0.4%
63	Lardell silty clay, 0 to 1 percent slopes	Not prime farmland	9.1	0.4%
79B	Yamacall loam, 0 to 4 percent slopes	Prime farmland if irrigated	121.0	5.7%
98B	Kremlin loam, 0 to 4 percent slopes	Prime farmland if irrigated	24.8	1.2%
224E	Hillon-Joplin loams, 8 to 25 percent slopes	Not prime farmland	50.9	2.4%
272C	Attewan-Tinsley complex, 2 to 8 percent slopes	Not prime farmland	13.1	0.6%
311B	Ferd-Creed-Gerdrum complex, 0 to 4 percent slopes	Not prime farmland	39.7	1.9%
331B	Phillips-Elloam complex, 0 to 4 percent slopes	Not prime farmland	246.7	11.7%
331C	Phillips-Elloam complex, 4 to 8 percent slopes	Not prime farmland	0.8	0.0%
351B	Kenilworth-Fortbenton fine sandy loams, 0 to 3 percent slopes	Farmland of statewide importance	25.3	1.2%
362C	Chinook-Yetull complex, 2 to 10 percent slopes	Not prime farmland	5.8	0.3%
363B	Cozberg-Chinook fine sandy loams, 0 to 4 percent slopes	Farmland of statewide importance	20.4	1.0%
402A	Gerdrum-Absher-Creed complex, 0 to 2 percent slopes	Not prime farmland	135.2	6.4%
421C	Joplin-Hillon loams, 2 to 8 percent slopes	Farmland of statewide importance	55.3	2.6%

Farmland Classification— Summary by Map Unit — Chouteau County Area, Montana				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
422C	Marmarth loam, 2 to 8 percent slopes	Farmland of statewide importance	6.5	0.3%
442C	Kevin-Elloam clay loams, 2 to 8 percent slopes	Not prime farmland	95.2	4.5%
503B	Telstad-Joplin loams, 0 to 4 percent slopes	Prime farmland if irrigated	344.6	16.4%
503C	Telstad-Joplin loams, 4 to 8 percent slopes	Farmland of statewide importance	204.8	9.7%
521B	Thoeny-Elloam-Absher complex, 0 to 4 percent slopes	Not prime farmland	158.7	7.5%
561B	Scobey-Kevin clay loams, 0 to 4 percent slopes	Prime farmland if irrigated	104.7	5.0%
605C	Yamacall-Havre loams, 0 to 8 percent slopes	Farmland of statewide importance	126.2	6.0%
Totals for Area of Interest			**2,106.9**	**100.0%**

Description

Farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops. NRCS policy and procedures on prime and unique farmlands are published in the "Federal Register," Vol. 43, No. 21, January 31, 1978.

Rating Options

Aggregation Method: No Aggregation Necessary

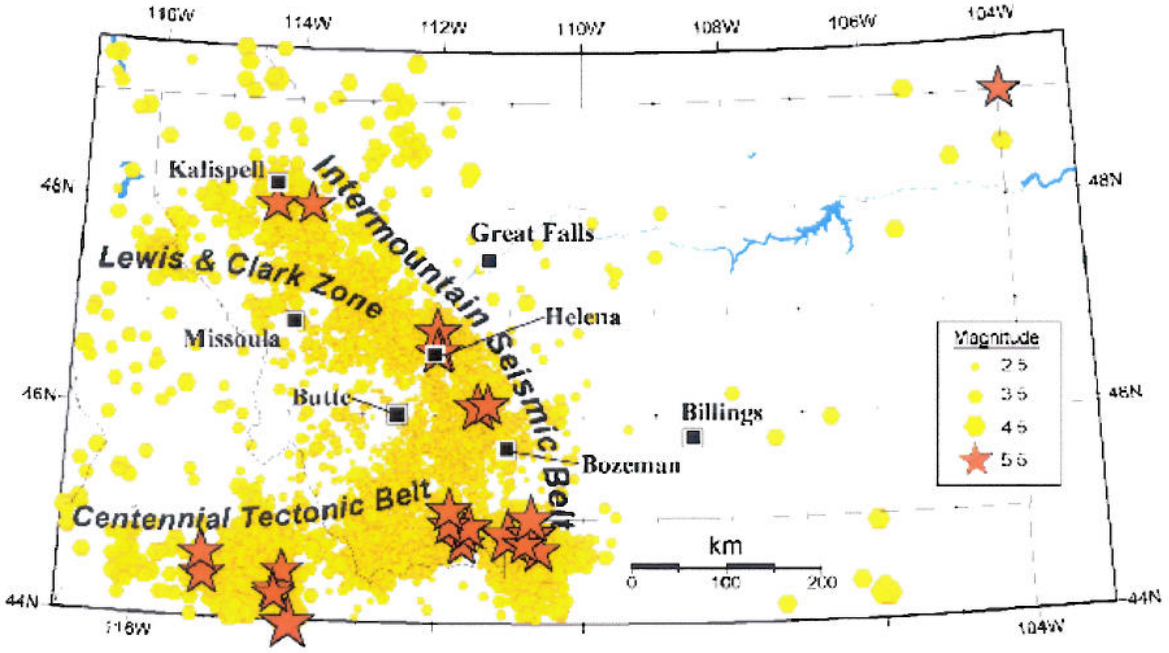
Tie-break Rule: Lower

Appendix C:
Intermountain Seismicity Belt Map

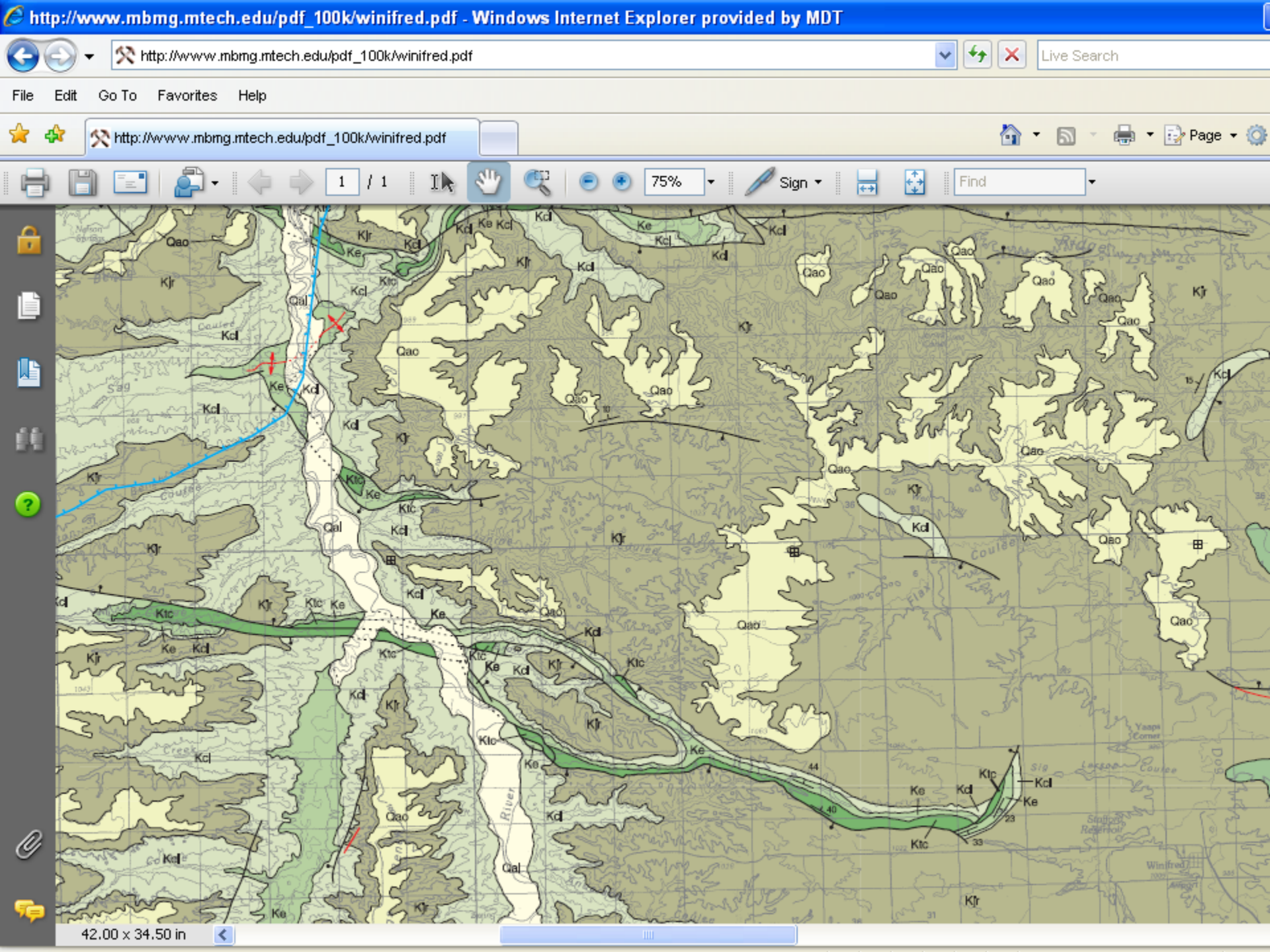
Seismicity in Montana

Intermountain Seismicity Belt: This section covers the geology and history behind the seismicity present in western Montana.

A belt of seismicity known as the Intermountain Seismic Belt extends through western Montana, from the Flathead Lake region in the northwest corner of the state to the Yellowstone National Park region where the borders of Montana, Idaho, and Wyoming meet. The Intermountain Seismic Belt continues southward through Yellowstone Park, along the Idaho-Wyoming border, through Utah, and into southern Nevada. In western Montana, the Intermountain Seismic Belt is up to 100 km wide. A branch of the Intermountain Seismic Belt extends west from the northwest corner of Yellowstone Park, through southwestern Montana, into central Idaho. This so called Centennial Tectonic Belt includes at least eight major active faults and has been the site of the two largest historic earthquakes in the northern Rocky Mountains, the August 18, 1959 Hebgen Lake, Montana, earthquake (M 7.5), and the October 28, 1983 Borah Peak, Idaho, earthquake (M 7.3). Although it has been over four decades since the last destructive earthquake in Montana, small earthquakes are common in the region, occurring at an average rate of 7-10 earthquakes per day.



Appendix D:
Alluvium geologic maps and descriptions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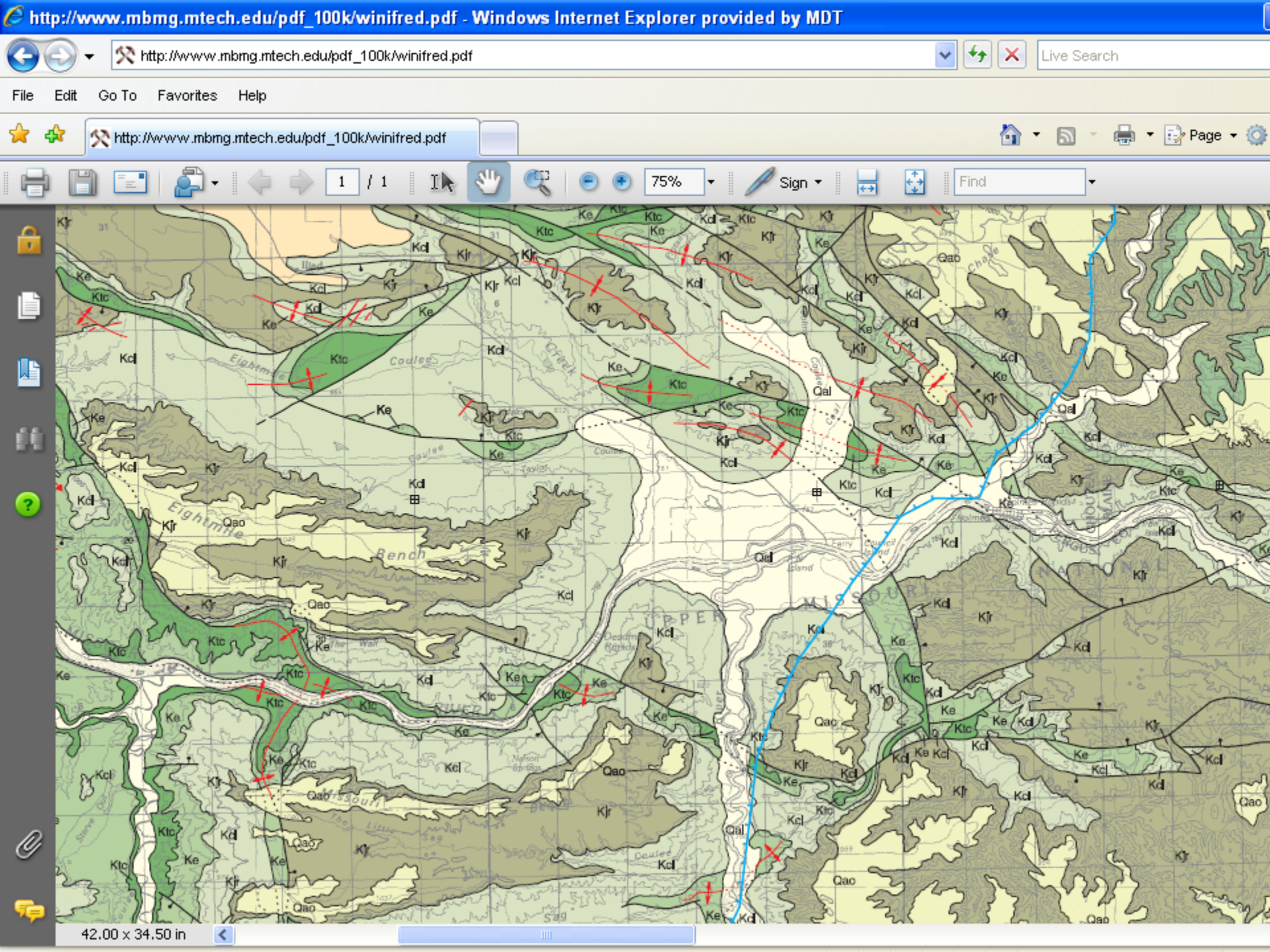
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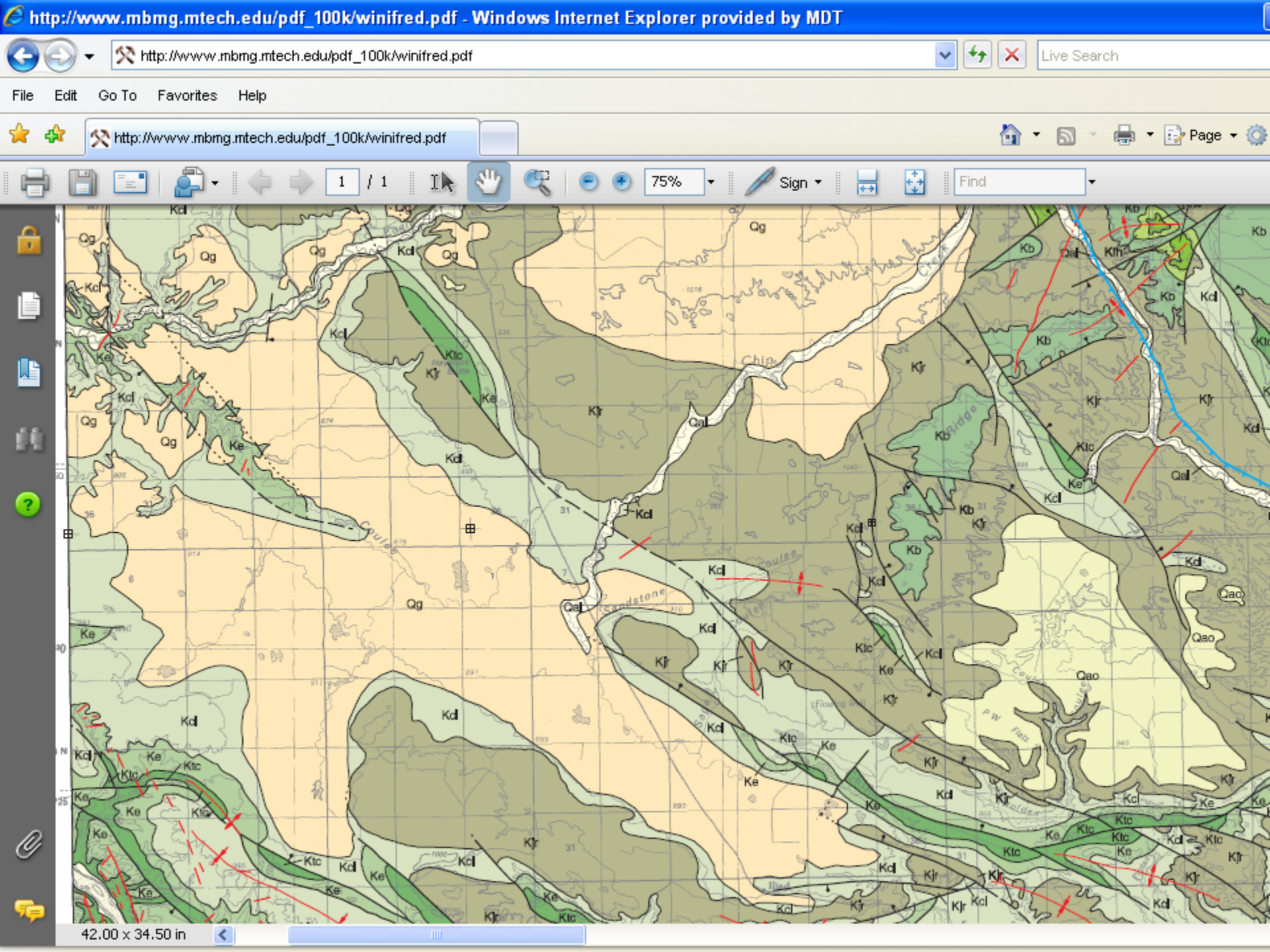
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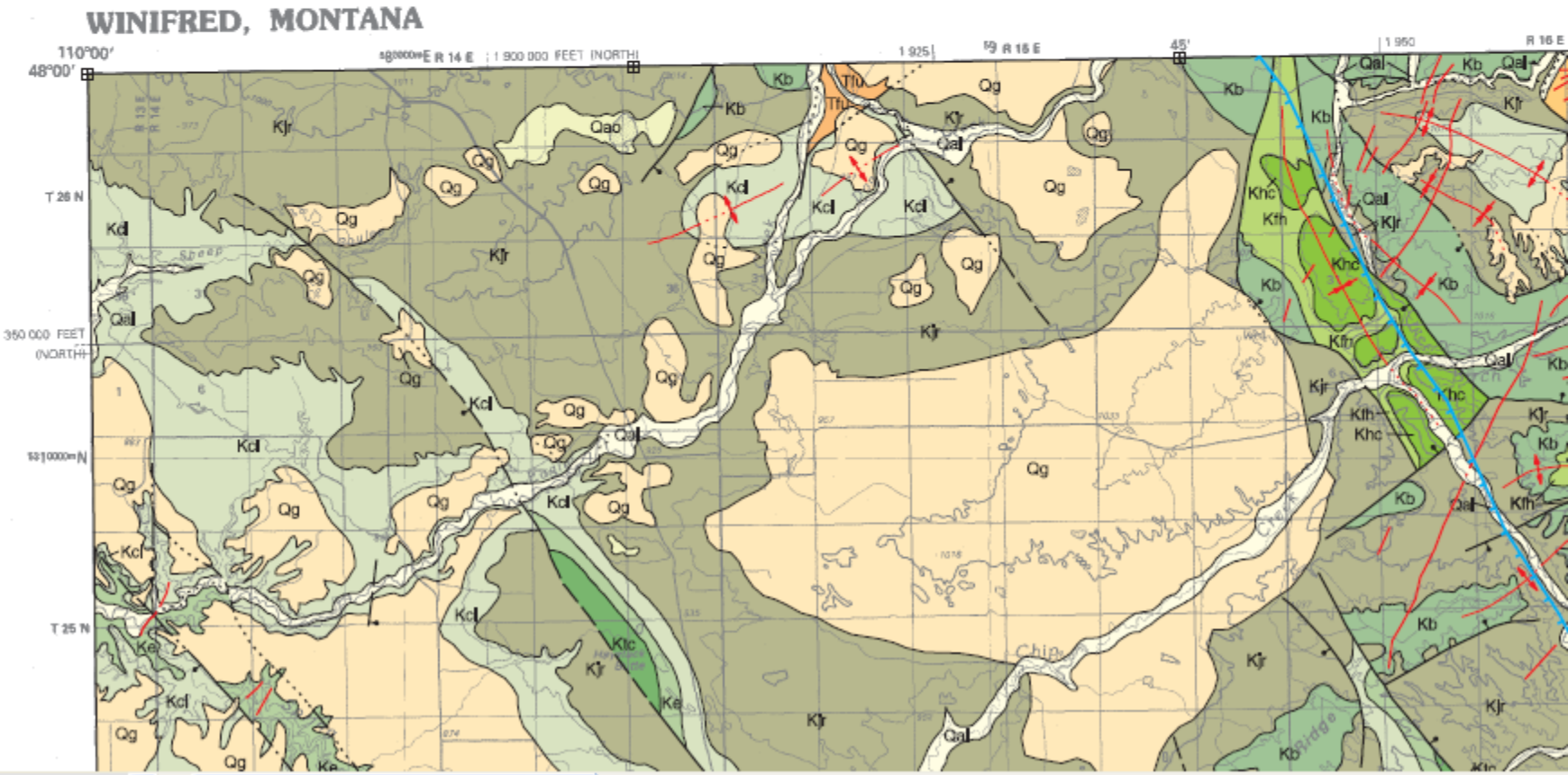
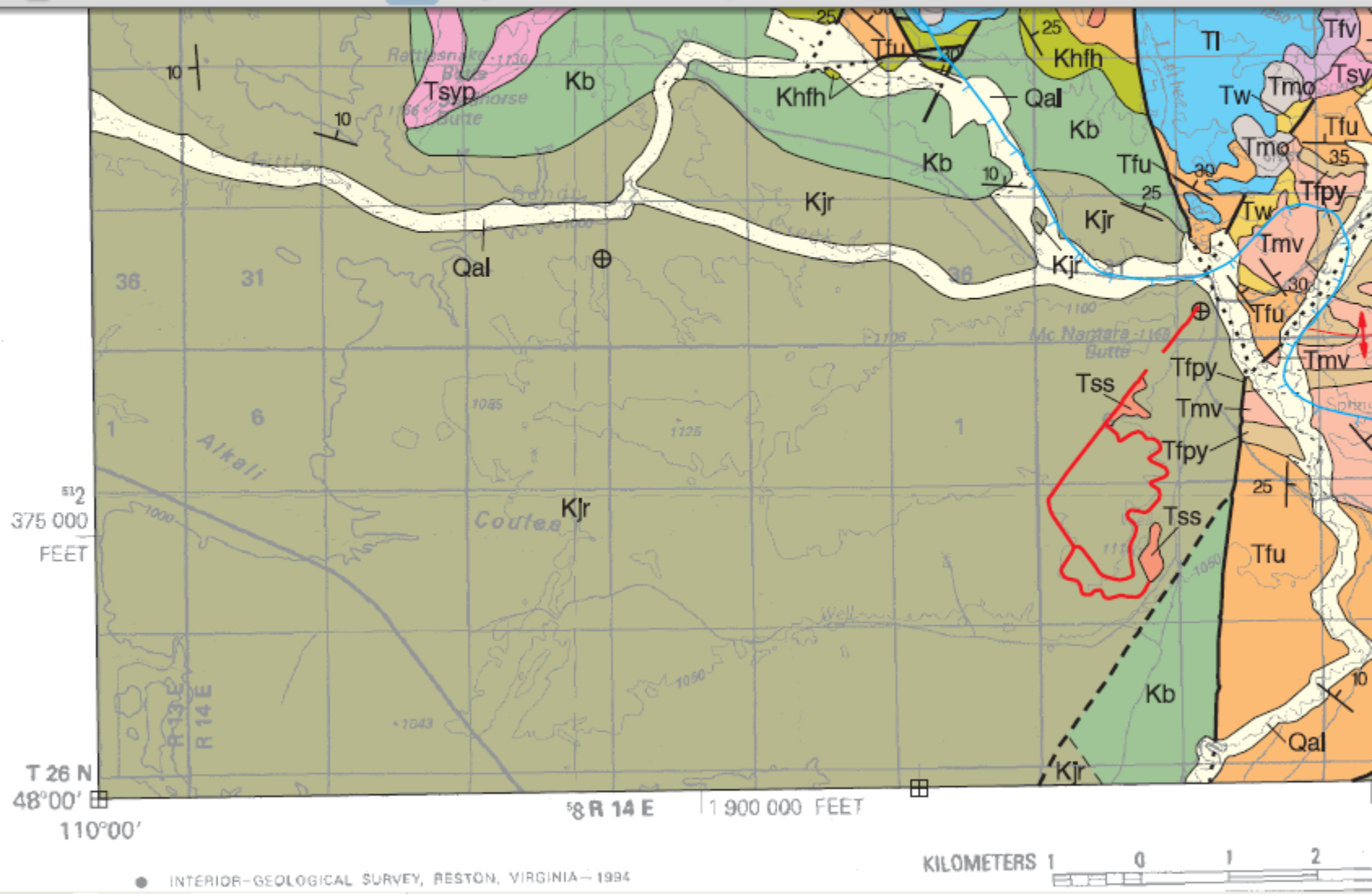
Open File MBMG 437, Plate 1 of 1
Geologic Map, Winifred 30'x60' Quadrangle





GEOLOGIC MAP OF THE

LONESOME LAKE 30' x 60' QUADRANGLE

NORTH-CENTRAL MONTANA

by

David A. Lopez

Montana Bureau of Mines and Geology

Open File Report MBMG 446

2002

This map has had preliminary reviews for conformity with technical and editorial standards of the Montana Bureau of Mines and Geology.

Partial support has been provided by the STATEMAP component of the National Cooperative Geologic Mapping Program of the U. S. Geological Survey under Contract Number 01-HQ-AG-0096.

INTRODUCTION AND DISCUSSION

The Lonesome Lake 30' X 60' Quadrangle lies within the area that was covered by Pleistocene continental glaciers. Thus, glacial deposits cover much of the bedrock in the area. Glacial deposits are depicted by a stippled pattern, and buried bedrock units are identified by letter symbols in parentheses (see Map Symbols, p.8). The bedrock geology depicted here is based on limited exposure and on oil and gas drill-hole data. Because of the lack of sufficient data, buried contacts beneath glacial deposits are approximate and appear rather stylized.

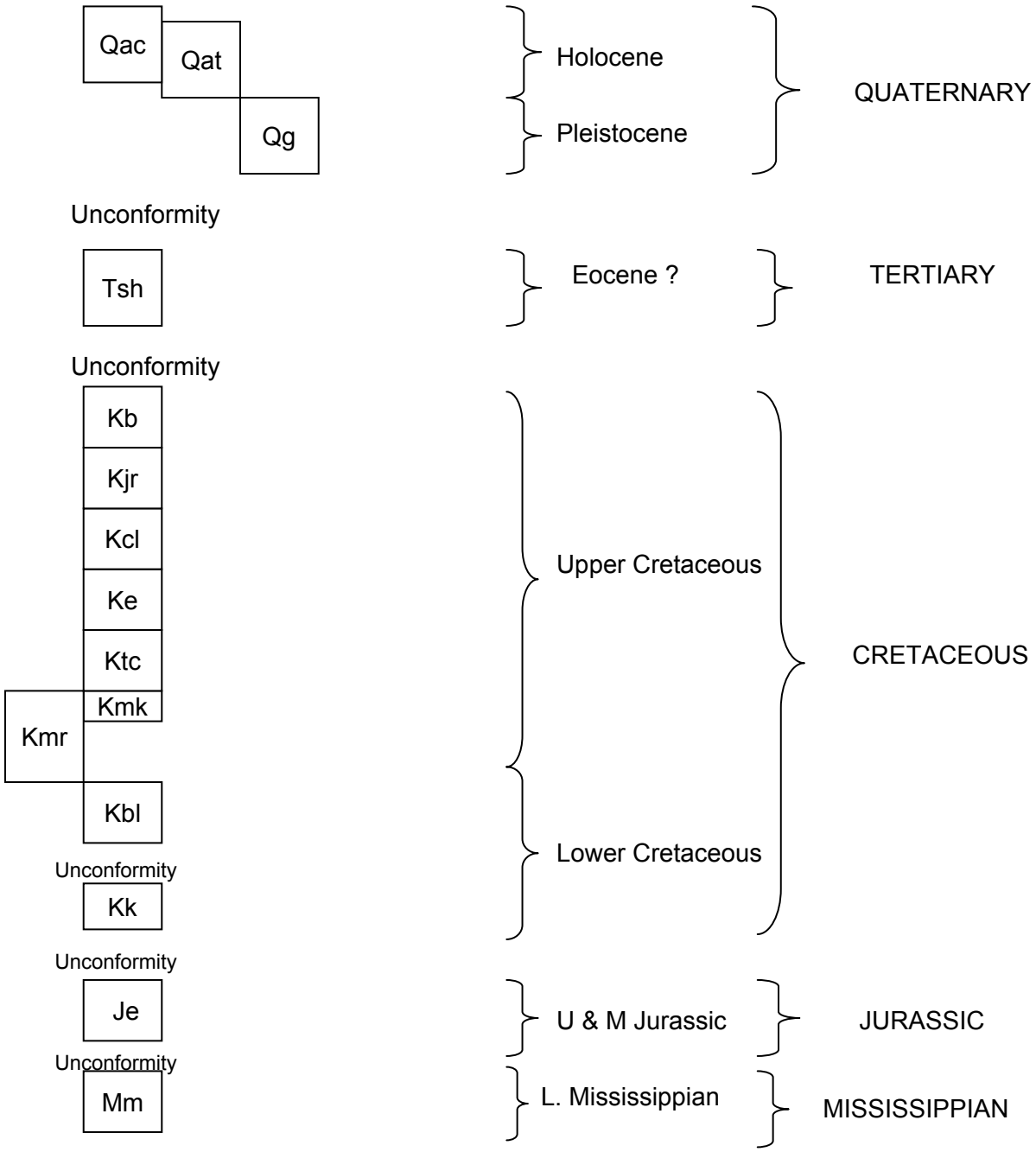
The northeast-trending Great Falls Tectonic Zone is a broad zone that passes beneath most of the area of this quadrangle (Lopez, 1995; O'Neill and Lopez, 1985). Its effect on bedrock geology in this area could not be determined because of the limited amount of bedrock exposure and detailed subsurface mapping is beyond the scope of this report. In the areas covered by glacial deposits, the bedrock structure must be much more complicated than shown on this map, as is the case in the nearby Sweet Grass Hills (Lopez, 1995). Limited available gravity and aeromagnetic data, as well as unpublished proprietary data, show the structure in the area is dominated by a northeast-striking basement faults that are part of the Great Falls Tectonic Zone and that are known to affect the Paleozoic and Mesozoic rocks in the area (Lopez, 1995; O'Neill and Lopez, 1985).

Significantly, thrust sheets that have been gravitationally emplaced off of the Bearspaw uplift (Reeves, 1924a, 1924b, 1946) appear in a few places on

this quadrangle. There undoubtedly are many more of these structural features buried beneath glacial deposits. These thrust sheets appear to sole in, and glide on, two horizons about in the middle of the Marias River section (Baker and Johnson, 2000) The thrusts therefore, effect rocks younger than the Marias River Formation. Structure below the thrust sheets is unrelated to, and does not reflect, the thrusted geometry. These thrust features are important structural traps for natural gas in the region surrounding the Bearspaw uplift.

This map is based on, and supersedes an earlier compilation of the geology of the Lonesome Lake Quadrangle, published as Open-File Report MBMG-314 (Lopez and Sholes, 1994)

CORRELATION OF UNITS
LONESOME LAKE 30'X 60' QUADRANGLE



DESCRIPTION OF UNITS
LONESOME LAKE 30'X 60' QUADRANGLE

Qac **Alluvium and colluvium, undivided (Holocene) –** Alluvial deposits in active streams and rivers, consisting mainly of locally derived sand and gravel and reworked material from glacial till. Coarser material, as large as boulder size, can be present close to mountainous areas. Locally includes colluvium, glacial outwash, and glacial lake deposits.

Qat **Alluvial terrace deposits, undivided (Holocene ?) –** Alluvium composed mainly of gravel and sand underlying terraces at varying levels above present-day river elevations. Gravel is rounded, ranges from cobble to pebble size, and is 10 to 20 ft thick.

Qg **Glacial deposits, undivided (Pleistocene) –** Unsorted deposits of clay- to boulder-size material. Clast composition is anomalous relative to local bedrock; predominant lithologies are pink granite, quartz-biotite schist, granite gneiss, and quartzite. Locally, cobbles and boulders of ultramafic rocks have been observed. Areas underlain by these deposits display characteristic hummocky topography. Roger Colton (written communication, 1994), on unpublished mapping of quaternary deposits, divides these deposits in greater detail, but is not included here because of the bedrock emphasis of this map.

Tsh **Shonkinite (Eocene)** – Dark-gray, porphyritic, composed of hornblende, olivine, pyroxene, biotite, and orthoclase. Resistant dikes and sills. Dikes average 4 ft wide; sills 4-20 ft thick (Lindvall, 1956b).

Kb **Bearpaw Shale (Upper Cretaceous)**—Dark-gray shale; upper 100 ft contain brownish sandy beds. Thin bentonite beds throughout formation. Numerous gray and dark-reddish gray calcareous concretions. About 700 ft thick (Lindvall, 1956b).

Kjr **Judith River Formation (Upper Cretaceous)** – Interbedded deposits of fluvial sandstone, shale, mudstone, siltstone, and coal. Forms rounded light-colored outcrops. Sandstones are lenticular, trough cross-bedded, fine to coarse grained, light gray to yellow-brown, and nearly white to brown weathering. Mudstones are commonly carbonaceous. Fossil plant debris is common. A complete section is not exposed in the area, but the total thickness is reported to be about 750 ft (Erdmann, 1942).

Kcl **Claggett Shale (Upper Cretaceous)** – Brownish gray, silty and sandy shale with thin interbeds of argillaceous and calcareous sandstone. Brown septarian concretions and *Inoceramus* prisms are common. The lower part contains beds of bentonite. The Claggett is typically very poorly exposed. Cobban (1955) reported a thickness of 420 ft at Goosebill Butte, 30 miles south of Chester.

Ke **Eagle Sandstone (Upper Cretaceous)** – Upper part is generally poorly exposed and is characterized by thin sandstone beds interbedded with brown and olive mudstones and less abundant bentonite, bentonitic mudstone, carbonaceous shale, and coal. Fossilized plant debris is common in this part of the section. The lower part is light-brown- to buff-weathering, thick-bedded to massive sandstone that forms rounded rims and bluffs. Sandstones are fine grained, light gray to light brownish gray,

limonite speckled, and well indurated to friable. Ripples, low-angle cross-bedding, and burrowing are common. This lower part of the section is commonly referred to as the Virgelle Member. The Eagle Sandstone is about 350 ft in total thickness in the area.

Ktc **Telegraph Creek Formation (Upper Cretaceous)** – Interbedded medium-brownish gray, sandy shale and brown, fine-grained, thin-bedded, argillaceous sandstone. Proportion of sandstone relative to shale increases upward. Total thickness is about 150 ft.

Kmr **Marias River Formation, undivided (Upper Cretacous) –** used only on cross section.

Kmk **Kevin Member, Marias River Formation (Upper Cretaceous)** – Medium-dark-gray to brownish gray, calcareous, fissile shale. In the subsurface the informal name, First White Specks, is commonly applied because of the characteristic white specks (calcite) visible on shale partings. Thin, light-gray bentonite beds, gray limestone septarian concretions, and *Inoceramus* prisms are common in this member. At the type section on the Kevin-Sunburst Dome, it is 620 ft thick (Cobban and others, 1976).

Kmf **Ferdig Member, Marias River Formation (Upper Cretaceous)** – Dark-gray fissile shale, with scattered laminae and very thin beds of sandstone and siltstone in the lower part. Reddish brown, gray, and brownish gray septarian concretions usually less than 1 ft in diameter are common. At the type section on the Kevin-Sunburst Dome the Ferdig is 224 ft thick (Cobban and others, 1976).

Kbl **Blackleaf Formation (Lower and Upper Cretaceous) –** used only on cross section.

Kk **Kootenai Formation (Lower Cretacous) –** used only on cross Section.

Je **Ellis Group (Upper and Middle Jurassic) –** used only on cross section.

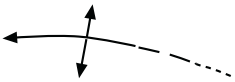
Mm **Madison Group (Upper Mississippian) –** used only on cross section.

Map Symbols

Contact; dotted where concealed.

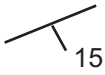
Fault; dotted where concealed; bar and ball on down-thrown side.

Thrust fault; queried where uncertain, dotted where condealed: teeth on upper plate



Anticline; dotted where concealed, arrow denotes direction of plunge.

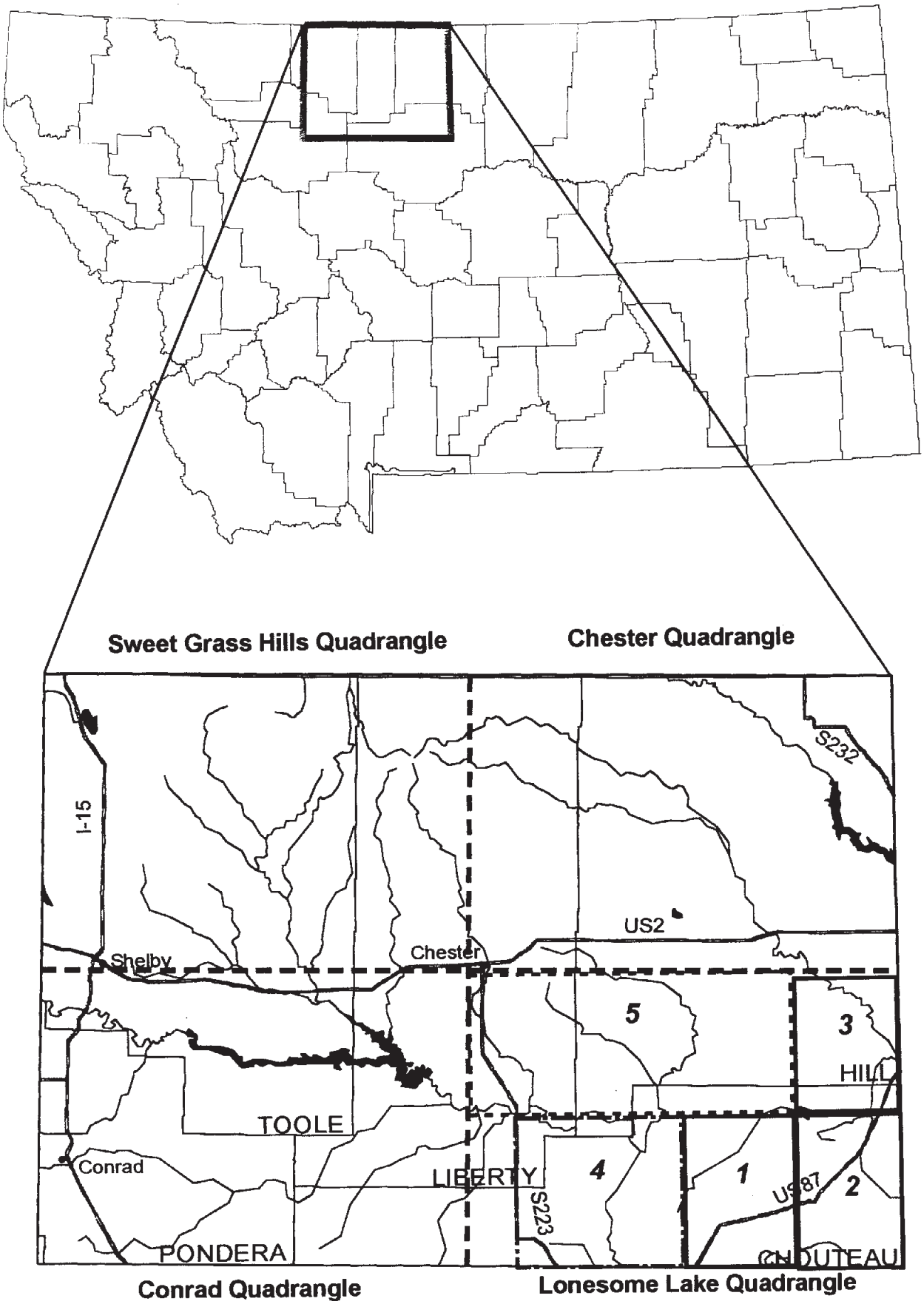
Dikes and sills (red on map)



Strike an dip of bedding

(Kjr)

Unit symbol in parentheses denotes that the unit is concealed by glacial deposits



Index map and sources of geologic mapping for the Lonesome Lane 30’ x 60’ quadrangle.

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GEOLOGIC MAP OF THE ROCKY BOY 30' x 60' QUADRANGLE

NORTH-CENTRAL MONTANA

Digital map compilation and mapping of Quaternary deposits
Robert N. Bergantino[1], Karen W. Porter[1],

Original bedrock compilation
B. Carter Hearn, Jr.[2]

Montana Bureau of Mines and Geology
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1 Montana Bureau of Mines and Geology
2 U. S. Geological Survey

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Introduction

This geologic map of the Rocky Boy 30' x 60' quadrangle is intended as a digitally produced reproduction of the 1976 map titled “Geologic and Tectonic Maps of the Bearpaw Mountains Area, North-central Montana” by B. Carter Hearn, Jr., published by the U. S. Geological Survey as Miscellaneous Investigations Map I-919, scale 1:125,000. Dr. Hearn has graciously agreed to be an author on this new version of his earlier map. The I-919 map of the bedrock geology by Hearn (1976) was compiled from original mapping by W. T. Pecora, B. C. Hearn, Jr., D. B. Stewart, J. H. Kerr, R. G. Schmidt, B. Bryant, W. C. Swadley, and others.

Our objective in producing this map is to provide the originally published geologic data in a digital form that is as faithful as possible to the original map, with the following exceptions: (1) two kinds of data have been omitted from this digital version, (a) strike and dip data for volcanic flows, and (b) oil and gas well locations (except that those along cross section X-X’ are retained) and producing field areas; (2) new data have been added by R. N. Bergantino for the Quaternary deposits within the quadrangle. Additionally, a few stratigraphic contacts have been adjusted, based upon subsurface data that postdate the original map, and minimal new field data have been added along both the western and eastern map borders in the process of edge-matching with adjacent quadrangles. Cross section X-X’ is taken directly from Hearn’s (1976) cross section A-D; it has been scaled to fit the present map at the 1:100,000 scale. Figure 2, Correlation Chart of Map Units, is taken substantially from the Hearn (1976) map.

Geologic Setting

The Rocky Boy 30' x 60' quadrangle is located in north-central Montana, between the Milk and the Missouri Rivers (figure 1). The quadrangle is dominated by the Bears Paw Mountains. The southernmost part of the mountains lies within the south-adjacent Winifred 30’ x 60’ quadrangle (Wilde and Porter, 2002).

The following discussion is taken nearly verbatim from Hearn (1976):

> The area of this map includes the northern and southern volcanic fields, the Bearpaw Mountain arch, and part of the surrounding plains. The arch is a composite anticlinal uplift in the center of the mountains that contains abundant intrusions and exposes sedimentary rocks of Cretaceous, Jurassic, and Mississippian age. Drill-hole data indicate that the plainsward slope of deeper horizons continues beneath the volcanic fields, so that the Bearpaw Mountains uplift is considerably broader than the central arch. Deep drill-hole data also suggest that Precambrian crystalline basement is uplifted as much as 5,000 feet above its regional level 7,000 feet beneath the plains.
>
> The volcanic fields consist of interlayered flows and fragmental volcanic material of middle Eocene age inclined predominantly toward the arch at an average angle of 35 degrees. The youngest volcanics, of local extent, rest unconformably on the older, tilted volcanics. The volcanic fields contain numerous shallow intrusions. Prevolcanic sedimentary formations of Late Cretaceous, Paleocene, and early Eocene age, which have been eroded from the plains, are preserved in down-faulted blocks along the borders of the volcanic fields.
>
> In the plains, gentle regional eastward dip off the Sweetgrass arch to the west exposes Claggett Shale, Judith River Formation, and Bearpaw Shale of Late Cretaceous age successively from west to east. Near the Bearpaw Mountains these formations are disrupted by a network of narrow faulted folds in which beds as old as the base of the Carlile Shale Member [Carlile Formation][...] are exposed and in which down-faulting has preserved rocks as young as the Fort Union Formation.
>
> About 11,500 feet of sedimentary formations were deposited in north-central Montana in

Paleozoic, Mesozoic, and early Cenozoic time. This long interval of sedimentation was followed by intrusive igneous activity and uplift in the Bearpaw [Bears Paw] Mountains area in late early Eocene or in middle Eocene time. Large-scale gravity slides then carried the volcanic deposits and parts of the underlying sedimentary section away from the central uplift. Extensive rifting, tilting, and collapse of the sedimentary and volcanic rocks occurred in the slide sheets. The youngest volcanic rocks, of middle Eocene age, were subsequently deposited on tilted older volcanic rocks. Erosion in post-middle Eocene time removed the distal portions of the volcanic fields, stripped away formations of early Eocene, Paleocene, and Late Cretaceous age in the plains, and produced pediment and terrace deposits of Miocene to Pleistocene age. In Pleistocene time a continental ice sheet advanced from the northwest and covered the western, northern, and eastern sides of the Bearpaw [Bears Paw] Mountains with glacial deposits.

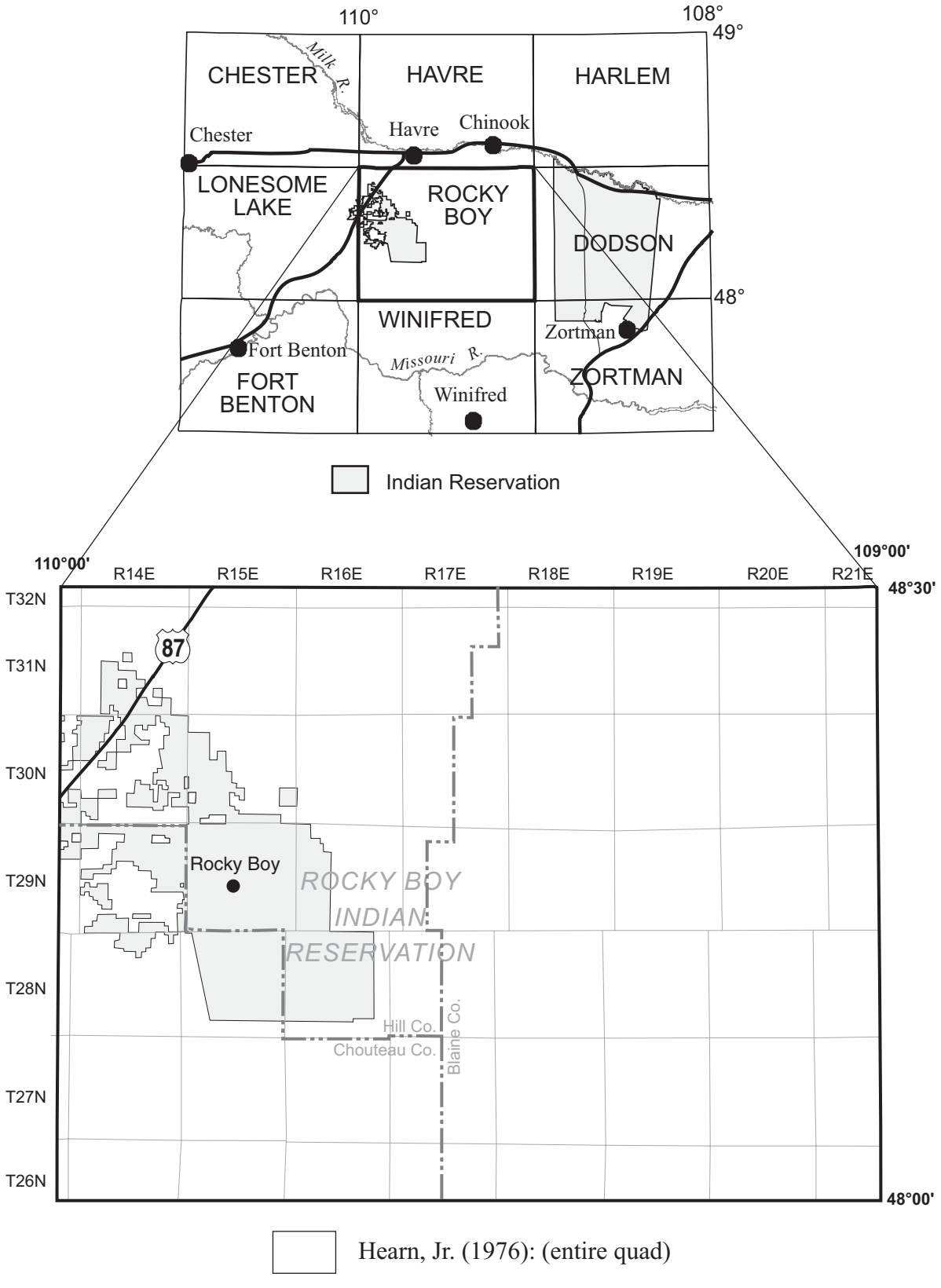


Figure 1. Location map for Rocky Boy 30' x 60' quadrangle. Geologic map based on Hearn, Jr. (1976) (see References). Also shown are locations of adjacent geologic maps published or in progress by MBMG.

Correlation Chart of Map Units
Rocky Boy 30' x 60' Quadrangle

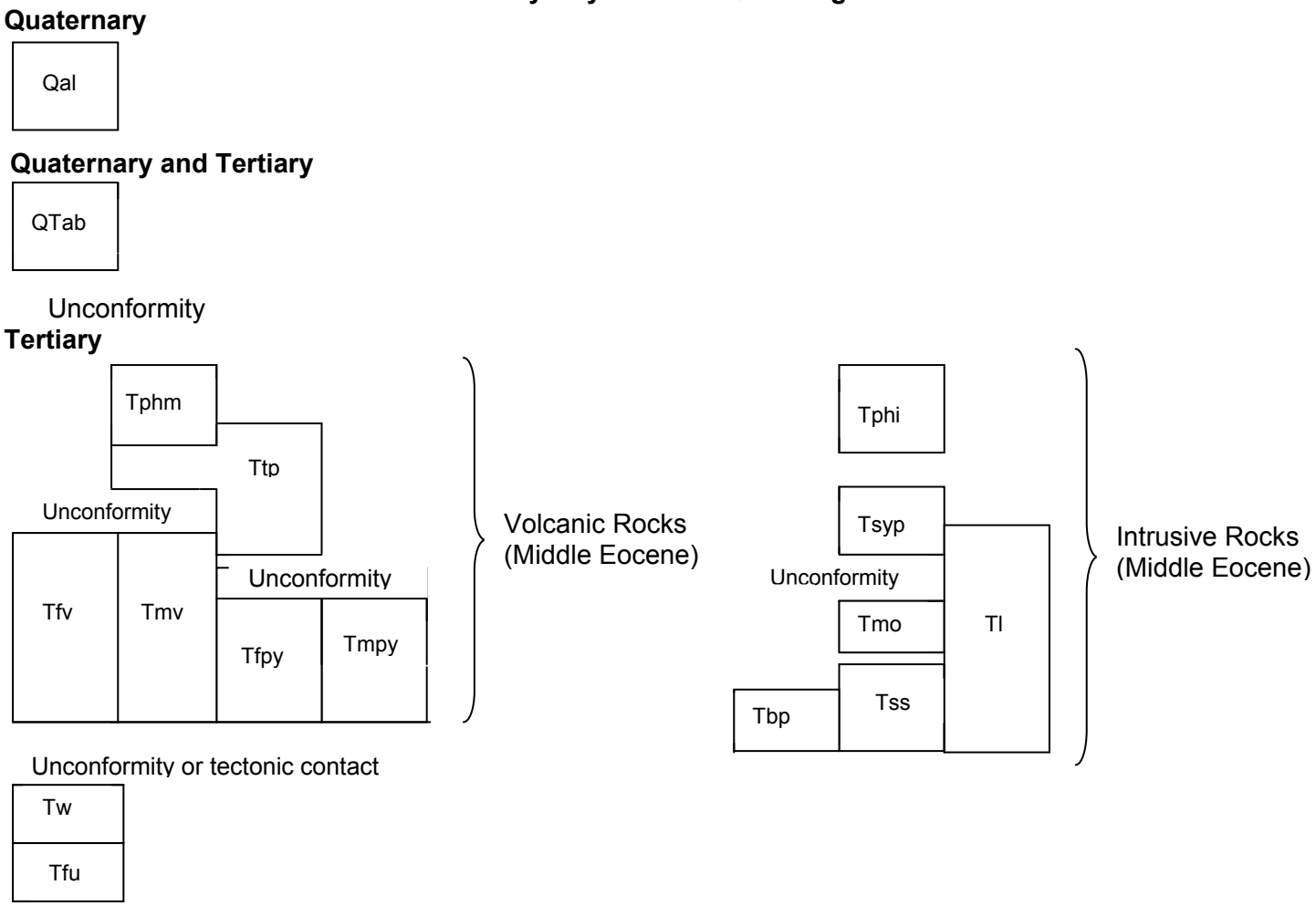


Figure 2. Correlation chart of map units.

Description of Map Units

NOTE: Descriptions of map units are extensively taken from Hearn, Jr. (1976). Original thickness data given in English measurement; conversion of feet to meters in this report: ft/3.28 = [m], assuming ending zeros of feet measurements to be nonsignificant figures

Quaternary

Qal — ALLUVIUM — Deposits of modern streams and associated flood plains; includes colluvium, modern terrace deposits; locally includes some slightly older Holocene terrace alluvium. Equivalent to Qsg unit mapped on east-adjacent Dodson quadrangle (Bergantino, 2001). Thickness not measured.

Quaternary and Tertiary

QTab — ALLUVIUM OF DISSECTED BRAID PLAINS — Described by Knechtel (1959) as “older alluvium of gravel benches”, and by Alverson (1965) as “terrace deposits.” Following from Knechtel (1959), these deposits may represent remnants of alluvial braid-plain sedimentation across broad surfaces flanking the Bears Paw Mountains and other mountain uplifts of central Montana. Unit mapped only in easternmost part of quadrangle. Thickness not measured.

Tertiary

Volcanic rocks (Middle Eocene)

Tphm — MAFIC PHONOLITE, ANALCIME-RICH — (from Hearn, 1976) Occurs as flows, flow breccias, agglomerate, and thin plant-bearing, water-laid volcanic sediments; red, green, and gray; phenocrysts of analcime, augite, biotite, and rare sanidine; occurs only in southwestern Bears Paw Mountains where it forms topographic highs; rests unconformably on older volcanic rocks, but lower part may be interlayered with porphyritic analcime trachyte. Fossil plants indicate middle Eocene age. Maximum thickness about 1,500 ft [460 m] on Mt. Bearpaw.

Ttp — TRACHYTE PORPHYRY, ANALCIME-RICH — (from Hearn, 1976) Occurs as flows and flow breccias; greenish gray to light gray; phenocrysts of analcime and sanidine; pronounced trachytic texture of sanidine in groundmass; youngest felsic volcanic rock, in part unconformable over older volcanic rocks and in part interlayered with the uppermost older mafic and felsic volcanic flows; extrusive equivalent of porphyritic potassic syenite (Tsyp). Maximum thickness about 1,500 ft [460 m].

Tfv FELSIC VOLCANIC FLOW ROCKS, UNDIVIDED (MIDDLE EOCENE) — (from Hearn, 1976) Flows and flow breccias of porphyritic latite and quartz latite; light-gray, gray, and brown; green celadonitic alteration is common; phenocrysts of potassium feldspar, plagioclase, augite, hornblende, and biotite; quartz in groundmass only; interlayered with mafic and felsic pyroclastic rocks and mafic flows; as mapped includes some felsic pyroclastic rocks; extrusive equivalent of porphyritic latite (Tl). Maximum thickness about 5,000 ft [1,500 m].

Tfpy FELSIC PYROCLASTIC ROCKS (MIDDLE EOCENE) — (from Hearn, 1976) Agglomerate, tuff-breccia, lapilli tuff, tuff, water-laid volcanic sediments, and coarse mudflow deposits; contains more than 50 percent fragments of felsic volcanic rocks; inclusions of biotite pyroxenite and Precambrian basement rocks locally abundant; commonly forms lowermost volcanic unit, particularly in northwestern part of Bears Paw Mountains; in part deposited in local early collapse basins; fossil plants and fish indicate middle Eocene age. Maximum thickness about 3,000 ft [900 m].

Tmv MAFIC VOLCANIC ROCKS (MIDDLE EOCENE) — (from Hearn, 1976) Flows and flow breccias of phonolite and mafic phonolite; brown, red, and purple; phenocrysts of olivine, augite, biotite, analcime, and rare leucite in groundmass of augite, potassium feldspar, and analcime; natrolite, analcime, and calcite are common alteration products; interlayered with felsic flows and felsic and mafic pyroclastic rocks; as mapped includes some mafic pyroclastic rocks; extrusive equivalent of shonkinite and syenite (Tss), and possibly of monzonite (Tmo). Maximum thickness about 5,000 ft [1,500 m].

Tmpy MAFIC PYROCLASTIC ROCKS — (from Hearn, 1976) Agglomerate, tuff-breccia, lapilli tuff, tuff, water-laid volcanic sediments and mudflow deposits; contains more than 50 percent fragments of mafic volcanic rocks; inclusions of biotite pyroxenite and Precambrian basement rocks locally abundant; commonly forms lowermost volcanic unit, particularly in southeastern part of Bears Paw Mountains; in part deposited in local early collapse basins; fossil plants and fish indicate middle Eocene age. Maximum thickness about 3,000 ft [900 m].

<u>Intrusive rocks (Middle Eocene)</u>

Tphi MAFIC PHONOLITE, ANALCIME-RICH — (from Hearn, 1976) Occurs as dikes and plugs; gray to greenish gray; fine grained, porphyritic; phenocrysts of analcime, augite, biotite, and rare sanidine; occurs only in western Bears Paw Mountains; youngest intrusive rock; intrudes part of extrusive equivalent (mafic phonolite,Tphm).

Tsyp SYENITE PORPHYRY, POTASSIUM-RICH — (from Hearn, 1976) Occurs as dikes, sills, plugs, and stocks; light gray to green; fine to coarse grained; as mapped includes a wide variety of subsilicic-alkalic

rocks (pseudoleucite-sodalite tinguaite, nepheline tinguaite, aegirine-nepheline syenite, all restricted to the central and western Bears Paw Mountains) and silicic-alkalic rocks (porphyritic syenite, the only variety of this rock type in the eastern Bears Paw Mountains); fine-grained varieties commonly have phenocrysts of tabular zoned potassium feldspar, and aegirine, with or without psuedoleucite, nepheline, and sodalite, in a fine-grained green or gray groundmass; rock type associated with most sulfide deposits; plug in Rocky Boy stock contains carbonatite vein-dikes; cut by mafic analcime phonolite in western Bears Paw Mountains; in eastern Bears Paw Mountains, generally the youngest rock type with exception of one dike of porphyritic latite.

Tl LATITE, PORPHYRITIC — (from Hearn,1976) Occurs as dikes, sills, laccoliths and stocks; light gray to brown; fine grained, felsic, porphyritic; most contains less than 20 percent mafic minerals; phenocrysts of augite ubiquitous; phenocrysts of potassium feldspar, plagioclase, biotite, and hornblende in varying amounts characterize separate varieties; groundmass of feldspar, augite, and quartz; may represent several episodes of intrusion, and postdates most but not all shonkinite-syenite intrusions.

Tmo MONZONITE — (from Hearn, 1976) Occurs as dikes, sills, plugs, and stocks; light to dark gray; fine to medium grained, locally porphyritic; predominantly mafic; felsic varieties rare; contains potassium feldspar and plagioclase in varying ratio, augite, and subordinate olivine, biotite, and hornblende; lacks quartz, feldspathoidal varieties rare; occurs only in western half of Bears Paw Mountains; postdates most porphyritic latite and shonkinite intrusions, and is cut by porphyritic potassic syenite; fine-grained dikes not mapped separately from porphyritic latite.

Tpb PYROXENITE, BIOTITE-RICH — (from Hearn, 1976) Occurs as small stocks; dark green to black; coarse grained; contains augite and biotite in ratios from 10:1 to 1:1, less than 10 percent total of apatite, potassium feldspar, plagioclase, olivine, and sulfides; transitional to mafic varieties of shonkinite; occurs only in Rocky Boy stock in western Bears Paw Mountains where it is the earliest intrusion; similar biotite pyroxenites with less apatite occur as inclusions in other igneous rocks.

Tss SHONKINITE AND SYENITE — (from Hearn, 1976) Occurs as dikes, sills, laccoliths, plugs, and stocks; gray to black; fine to coarse grained, porphyritic and equigranular; mafic mineral content of shonkinite more than 40 percent, mafic syenite 20 to 40 percent, and syenite less than 20 percent; includes subsilicic-alkalic and silicic-alkalic varieties; contains augite, biotite, and dominantly potassic feldspar, with or without olivine, plagioclase, nepheline, pseudoleucite, apatite, and analcime or interstitial quartz; many

varieties weather to biotite-rich soil with no outcrop; represents several episodes of intrusion, and is the earliest intrusive rock in the eastern Bears Paw Mountains.

Sedimentary Rocks (Lower Eocene through Paleocene)

Tw WASATCH FORMATION (LOWER EOCENE) — (modified from Hearn, 1976) Variegated red, pink, lavender, light-green, yellow-gray, and white shale, bentonitic claystone, and siltstone with small calcareous concretions; interbedded light-gray, brown and green, fine- to coarse-grained, cross-bedded sandstones with lenses of boulder conglomerate in upper part of formation containing clasts derived from mountain uplifts to the west or southwest including argillite and quartzite from Proterozic Belt Supergroup rocks, porphyritic igneous rocks, and limestone and dolomite; clasts locally crushed, fractured, and recemented; nonmarine; fossil plants and vertebrates indicate early Eocene age; top of formation missing due to pre-volcanic erosion or tectonic disruption or both. Maximum measured thickness 800 ft [240 m]; original maximum thickness probably exceeded 1,000 ft [300 m].

Tfu FORT UNION FORMATION, UNDIVIDED (PALEOCENE) — (modified from Hearn, 1976) Light-brown to light-yellow, thin-bedded to thick-bedded or massive sandstone with brown sandstone concretions; interbedded with light-colored to greenish siltstone, claystone, and shale; contains carbonaceous shale and coal, locally mined; nonmarine; fossil plants and vertebrates indicate Paleocene age. Maximum thickness about 1,300 ft [400 m].

Cretaceous

Khfh HELL CREEK FORMATION AND FOX HILLS SANDSTONE, UNDIVIDED (UPPER CRETACEOUS) — (modified from Hearn, 1976) Combined thickness 480 to 600 ft [146 to 597 m]. Includes, in descending order: Hell Creek Formation composed of interbedded gray to light-brown, locally massive sandstone with brown sandstone concretions, and white to light-colored to drab siltstone, claystone and shale locally calcareous with abundant small calcareous concretions; brownish-gray carbonaceous bentonitic claystone also interbedded; persistent beds of carbonaceous shale and lenticular coal near base of formation, locally mined; nonmarine; rare fossil plants and vertebrates indicate latest Cretaceous age; thickness 420 to 500 ft [130 to 150 m]; Fox Hills Formation composed of light-yellowish-gray, light-brown, and yellow, thin-bedded to massive sandstone, commonly concretionary; minor interbeds of brown and gray siltstone and shale; locally contains diagnostic marine fossils. Thickness 60 to 100 ft [20 to 30 m].

Kb BEARPAW SHALE (UPPER CRETACEOUS) — (modified from Hearn,

1976) Medium-gray, fissile shale and silty shale weathering to steel gray or rarely brownish-gray; light-gray to cream-colored bentonite beds prominent in lower one-third; numerous horizons of ovoid, gray, massive or septarian, commonly fossiliferous, limestone concretions; also several horizons of reddish-brown iron-manganese-rich claystone concretions; diagnostic species of *Baculites* define 5 faunal zones; upper 70 to 200 ft [20 to 60 m] are brown to brownish gray, thin-bedded sandstone, siltstone, and dark shale, transitional into overlying Fox Hills Sandstone; bentonite beds in lower one-third allow good subsurface correlation of resistivity well logs, but general absence of bentonites and occurrence of tectonic disruption make well-log correlation of upper two-thirds less reliable. Total thickness approximately 1,000 to 1,200 ft [300 to 370 m], but uncertain because of lack of complete undisturbed section.

Kjr JUDITH RIVER FORMATION (UPPER CRETACEOUS) — (modified from Hearn, 1976) Light-brown to yellow sandstone, locally gas-bearing, siltstone, and white, yellow, greenish, and light-gray claystone and shale; near top commonly are one or more horizons of oyster-shell coquina in dark shale, and several carbonaceous shales and thin coals that have been locally mined; locally, uppermost beds are white, clay-rich marine sandstone; locally, lowermost sandstone is burrowed by marine organisms (Parkman Sandstone of subsurface usage); vertebrate fossils locally common; on resistivity well logs correlation of nonmarine sandstones is uncertain because of lateral lensing, but correlation of basal marine sandstone is reliable over 5 to 10 miles [8 to 15 km] of distance. Thickness 540 to 670 ft [160 to 200 m].

Kcl CLAGGETT SHALE (UPPER CRETACEOUS) — (modified from Hearn, 1976) Dark gray or grayish brown on fresh surfaces, commonly weathered to soft brown; blocky to fissile; characteristic dull-orange-weathering, smooth, ovoid, calcareous concretions in middle and upper part of unit; concretions commonly contain yellow calcite vein filling and are commonly highly fractured, forming mounds of small, sharp-edged orange-brown fragments; numerous grayish white bentonite layers (1 to 5 inches thick [2.5 to 12.5 cm]) in lower 80 ft [20 m] of unit; upper 30 to 200 ft [10 to 60 m] contain laterally persistent sandstone beds forming transitional base with overlying Judith River Formation and are locally gas-bearing; resistivity logs 1 to 3 miles [2 to 5 km] apart are nearly identical, and many markers can be correlated in wells 10 to 20 miles [15 to 30 km] apart; total thickness 400 to 680 ft [120 to 200 m].

Ke EAGLE SANDSTONE (UPPER CRETACEOUS) — (modified from Hearn, 1976) Light-brown to white sandstone with interbedded gray shale, siltstone, and carbonaceous mudstone and shale; contains as many as 3 massive sandstones, some or all of which may be gas-bearing; lowest sandstone (Virgelle Sandstone) is 70 to 170 ft [20 to 50 m] thick in southwest part of map area; upper 20 to 130 ft [6 to 40 m] are

alternating thin glauconitic sandstone, chert-pebble conglomerate, siltstone, and shale; sandstone units and shaly interbeds can be carried laterally in subsurface with electric well logs over distances of 5 to 10 miles [8 to 15 km]. Total thickness 140 to 300 ft [40 to 90 m].

Ktca TELEGRAPH CREEK FORMATION THROUGH CARLILE FORMATION (UPPER CRETACEOUS) — (modified from Hearn, 1976) Total thickness 750 to 870 ft [230 to 260 m]; major gravity-slide planes are near base and near a bentonite bed about 550 ft [170 m] above base. Includes, in descending order: Telegraph Creek Formation, composed of alternating thin-bedded sandstone, siltstone, and shale weathering gray to brownish gray, with increasing sandstone upward in transition to overlying Eagle Sandstone; locally massive sandstone up to 50 ft [15 m] thick may be gas-bearing; thickness varies from 0 to 170 ft [0 to 50 m]; Niobrara Formation and Carlile Formation together composed of dark-gray to brownish-gray marine shale with minor siltstone, and bentonite beds, septarian calcareous claystone concretions, and concretionary limestone lenses; lower 100 to 200 ft [30 to 60 m] (Carlile Formation) are black shale with distinctive rusty-weathering iron-rich claystone concretions; resistivity logs 1 to 3 miles [2 to 5 km] apart are nearly identical, and many markers can be correlated in wells 10 to 20 miles [15 to 30 km] apart; thickness 610 to 850 ft [190 to 260 m].

Kgfr GREENHORN FORMATION THROUGH FALL RIVER FORMATION (UPPER AND LOWER CRETACEOUS) — (from Hearn, 1976) On cross section A-D only.

Kgrb GREENHORN FORMATION AND BELLE FOURCHE SHALE (UPPER CRETACEOUS) — (modified from Hearn, 1976) Total thickness 170 to 290 ft [50 to 90 m]. Includes, in descending order: Greenhorn Formation composed of gray, sandy, thin-bedded limestone, calcareous and noncalcareous siltstone, dark shale, and bentonite; marine fossils abundant; thickness 10 to 50 ft [3 to 15 m]; Belle Fourche Shale, composed of black shale, minor gray sandstone and siltstone, bentonite; distinctive sandstone bed about 100 ft [30 m] above base contains black chert grit; iron-manganese claystone concretions near base; resistivity logs 1 to 3 miles [2 to 5 km] apart are nearly identical, and many markers can be correlated in wells 10 to 20 miles [15 to 30 km] apart; thickness 140 to 270 ft [40 to 80 m].

Kmfr MOWRY FORMATION THROUGH FALL RIVER FORMATION (UPPER AND LOWER CRETACEOUS) — (modified from Hearn, 1976) Total thickness 740 to 800 ft [230 to 240 m]. Includes, in descending order: Mowry Shale, composed of light-silvery bluish-gray-weathering, siliceous shale with prominent bentonite beds near top, and locally abundant fish scales; thickness 60 to 110 ft [20 to 35 m]; Thermopolis Formation, equivalent to combined Shell Creek, Cyprian (Newcastle/Muddy), and Skull Creek intervals recognized to south

and east (Porter and Wilde, 2001; Bergantino, 2001; Alverson, 1965; Knechtel, 1959); composed of gray to black shale with common drab to rusty iron-rich concretionary claystone nodules and lenses throughout, and abundant thin beds of sandstone and siltstone in middle part; thickness 270 to 360 ft [80 to 110 m]; Fall River Sandstone (First Cat Creek Sandstone), composed, in upper part, of 40 to 70 ft [12 to 21 m] of light-yellowish-brown-weathering quartzose, extensively burrowed sandstone with prominent chert-pebble conglomerate, and, in lower part, of 300 to 430 ft [90 to 130 m] of black shale with minor thin sandstone and siltstone beds, and phosphatic nodules in lower 30 ft [9 m]. Resistivity logs 1 to 3 miles [2 to 5 km] apart are nearly identical, and many markers can be correlated in wells 10 to 20 miles [15 to 30 km] apart.

Kk KOOTENAI FORMATION (LOWER CRETACEOUS) — (modified from Hearn, 1976) Nonmarine sandstone and mudstone; upper half is variegated dark-red, purple, green, and brown mudstone and siltstone locally interbedded with light-gray to light-brown sandstone; lower half is massive light-gray to light-brown, cross-bedded, chert-bearing “salt-and-pepper” sandstone with interbedded, light-colored siltstone and variegated mudstone; prominent massive, cross-bedded, coarse-grained sandstone at base (Third Cat Creek Sandstone) is locally conglomeratic, containing cobbles and pebbles of quartzite, chert, silicified limestone, and vein quartz. Total thickness 290 to 400 ft [90 to 120 m].

Jurassic

Je ELLIS GROUP (UPPER AND MIDDLE JURASSIC) — (extensively modified from Hearn, 1976) Total thickness 280 to 550 ft [85 to 170 m]. Includes, in descending order: Swift Formation, composed of light-brown, massive to thin-bedded marine sandstone, brown siltstone, and dark-gray shale; common brown-weathering concretionary limestone lenses; uppermost 20 to 40 ft [6 to 12 m] may be Morrison Formation equivalent (Hearn, 1976); thickness 70 to 230 ft [21 to 70 m]; Rierdon Formation, composed of massive to thin-bedded, light-gray limestone, and light-gray- to yellowish-gray-weathering, thin-bedded argillaceous limestone and calcareous shale; thickness 70 to 190 ft [20 to 60 m]; Sawtooth Formation, composed of (a) upper, Bowes Member (after Nordquist, 1955), interbedded thin- to medium-bedded, medium-gray, quartz-sandy limestone, oolitic limestone, cross-bedded bioclastic limestone, and calcareous sandstone; minor thin beds of light-gray, mud-cracked limestone, and some wavy-bedded algal limestone; about 27 ft [8 m] thick (Porter, 1996); (b) middle, Firemoon Member (after Nordquist, 1955), massive medium-gray-weathering, dark-gray fossiliferous limestone; and (c) lower, Tampico Member (after Nordquist, 1955), white-weathering, calcareous, quartzose sandstone, siltstone, and shale, with small white quartz pebbles locally. Bowes and Firemoon Members contain

oil in Bowes Field in northern part of map area. Sawtooth Member is stratigraphically equivalent to redbeds and limestones of Piper Formation farther south and east in central Montana and Willison basin (Porter, 1996, p. 7); Porter (1998) concludes that the term Sawtooth is preferable in north-central Montana because of lithologic similarities with the type sections of the Sawtooth in western Montana (Cobban, 1945). Hearn (1976) reports that the Piper [Sawtooth] Formation thins southward and eastward, and gives a total thickness of 0 to 260 ft [0 to 80 m].

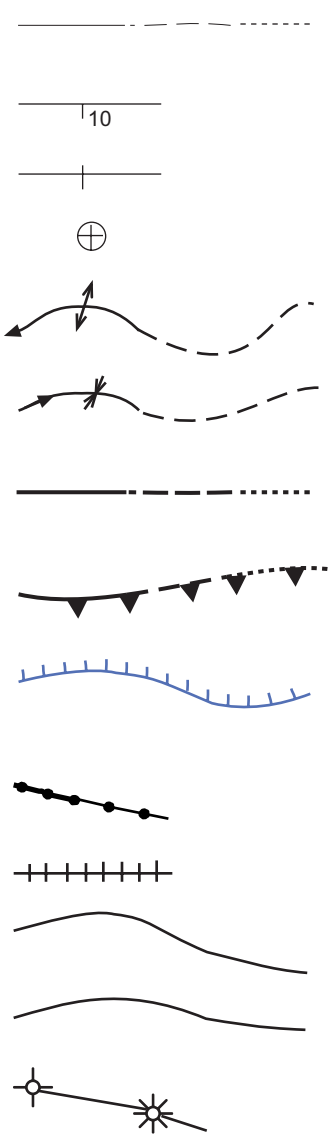
Mississippian

Mm MADISON GROUP, UNDIVIDED (UPPER MISSISSIPPIAN) — (modified from Hearn, 1976) Includes, in descending order: Mission Canyon Limestone and Lodgepole Limestone, mapped together; exposures limited to uppermost 200 ft [60 m] of Mission Canyon Limestone composed of massive, light-gray to dark-gray limestone with abundant lenses and nodules of gray chert; crinoidal and coralline fossils abundant. Total thickness of 650 to 1,050 ft [200 to 320 m], based on subsurface data; thickness variability reflects regional pre-Middle Jurassic erosion.

Paleozoic (on cross sections only)

PZs PALEOZOIC SEDIMENTARY ROCKS, UNDIVIDED (UPPER MISSISSIPPIAN THROUGH CAMBRIAN) — On cross section only (from Hearn, Jr., 1976). Includes, in descending order: Mission Canyon and Lodgepole Formations of Madison Group (Mississippian), Three Forks Shale, Jefferson Limestone and Maywood Formation (Devonian), Bighorn Dolomite (Ordovician), Emerson Formation and Flathead Sandstone (Cambrian). Total thickness of 3,000 to 3,400 ft [910 to 1,040 m].

Map Symbols



Contact; dashed where approximate or inferred; dotted where concealed

Strike and dip of bedding; degrees of dip indicated

Strike of vertical beds

Horizontal bedding

Anticlinal fold shown by trace of axial plane; dotted where concealed; arrow indicates direction of plunge where known

Synclinal fold shown by trace of axial plane; dotted where concealed; arrow indicates direction of plunge where known

Fault, normal; dashed where approximate or inferred; dotted where concealed

Fault, reverse or thrust; dashed where approximate or inferred; dotted where concealed; teeth on upper plate

Approximate limit of undifferentiated glacial deposits; hachures toward glacial deposits (blue line on map)

Dikes, sills:

Mafic analcime-rich phonolite dikes (red line on map)

Potassium-rich syenite porphyry dikes and sills (red line on map)

Shonkinite and syenite dikes and sills (red line on map)

Porphyritic latite dikes and sills (blue line on map)

Line of cross section X-X'; line passes through or close to locations of petroleum wells, indicated by ⊹ (dry hole) or ☼ (gas well)

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GEOLOGIC MAP OF THE WINIFRED 30' x 60' QUADRANGLE

CENTRAL MONTANA

Compiled and Mapped

by

Edith M. Wilde and Karen W. Porter

Montana Bureau of Mines and Geology
Open File Report MBMG 437

2002

Revised
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SUMMARY

Structural and Stratigraphic Setting

The Winifred quadrangle is located in central Montana (figure 1). It includes the southern part of the Bears Paw Mountains and a large area to the south that is bisected by the east-flowing Missouri River. This broad area both north and south of the river is dominated by relatively shallow faults that apparently originated from the gravity-slide movement of very large fold- and fault-bounded blocks off the Bears Paw Mountains (Reeves, 1924; Hearn, Jr., 1976). Strata involved in gravity-slide displacement have formed steep-sided asymmetric anticlinal folds that commonly are broken by steep compressional faults. Many of these faults subsequently underwent back-sliding of the hanging wall under tension. Gravity-slide-faults and folds encircle the Bears Paw Mountain uplift at distances as much as 30 or more miles away from the mountain front. Surface and subsurface data (Hearn, Jr., 1976) indicate that thick shale in the Upper Cretaceous sedimentary section, particularly within the Carlile Formation, is the principal interval within which the bedrock failure has occurred; older strata appear essentially unfaulted.

According to Hearn (1976), the timing of this gravity sliding apparently was closely associated with the late early Eocene and middle Eocene uplift of the Bearpaw Arch and with the synchronous widespread deposition of very thick volcanic flows and pyroclastics (as much as 6,000 ft thick - Hearn, Jr., 1976; Marvin and others, 1980). The greatly overweighted sedimentary layers failed, causing large blocks of strata and volcanics to be transported down-slope onto the surrounding plains. These detached blocks left graben structures along the margins of the central Bearpaw Arch into which the volcanic fields collapsed and have been preserved, while volcanic rocks on slabs carried onto the plains have been eroded away. A variety of intrusive rocks, also emplaced during this middle Eocene time, have been preserved in the central arch graben area and on the arch flanks as well as in the adjacent plains. Both the intrusive and volcanic rocks of the Bears Paw region are associated with the middle Eocene phase of intrusion and volcanism in the Central Montana Alkalic Province.

Figure 2 provides a correlation of units mapped in the quadrangle. Within the southern Bears Paw Mountains, intrusive and extrusive rocks are commonly fault-bounded against each other and against Upper Cretaceous and Tertiary sedimentary rocks. On the southern flanks of the mountains a thick Upper Cretaceous section is exposed that flattens to an essentially horizontal orientation south of the mountains except where these beds are involved in faulting along the leading edges or lateral margins of gravity-slide fault blocks. In the Winifred quadrangle area the exposed bedrock involved in these faults includes, in ascending order, the Telegraph Creek, Eagle, Claggett, Judith River, and Bearpaw Formations. Shale below the Telegraph Creek Formation crops out in only one small area along Arrow Creek in the southwest part of the quadrangle where it is designated as the Kevin Member of the Marias River Formation. This designation follows the work of Cobban (1976) for Upper Cretaceous marine rocks below the Telegraph Creek in the Great Falls area. It also follows the mapping in the south-adjacent Lewistown quadrangle by Porter and Wilde (1993; revised 1999) where the west side of the Judith Mountains was chosen as the transition area for the terminology of the eastern and western Cretaceous sedimentary basin facies. In the eastern part of the Winifred quadrangle, however, shale units below the Telegraph Creek Formation, known only in the subsurface (see Cross Section A-A'), are assigned to the Niobrara and Carlile Formations in

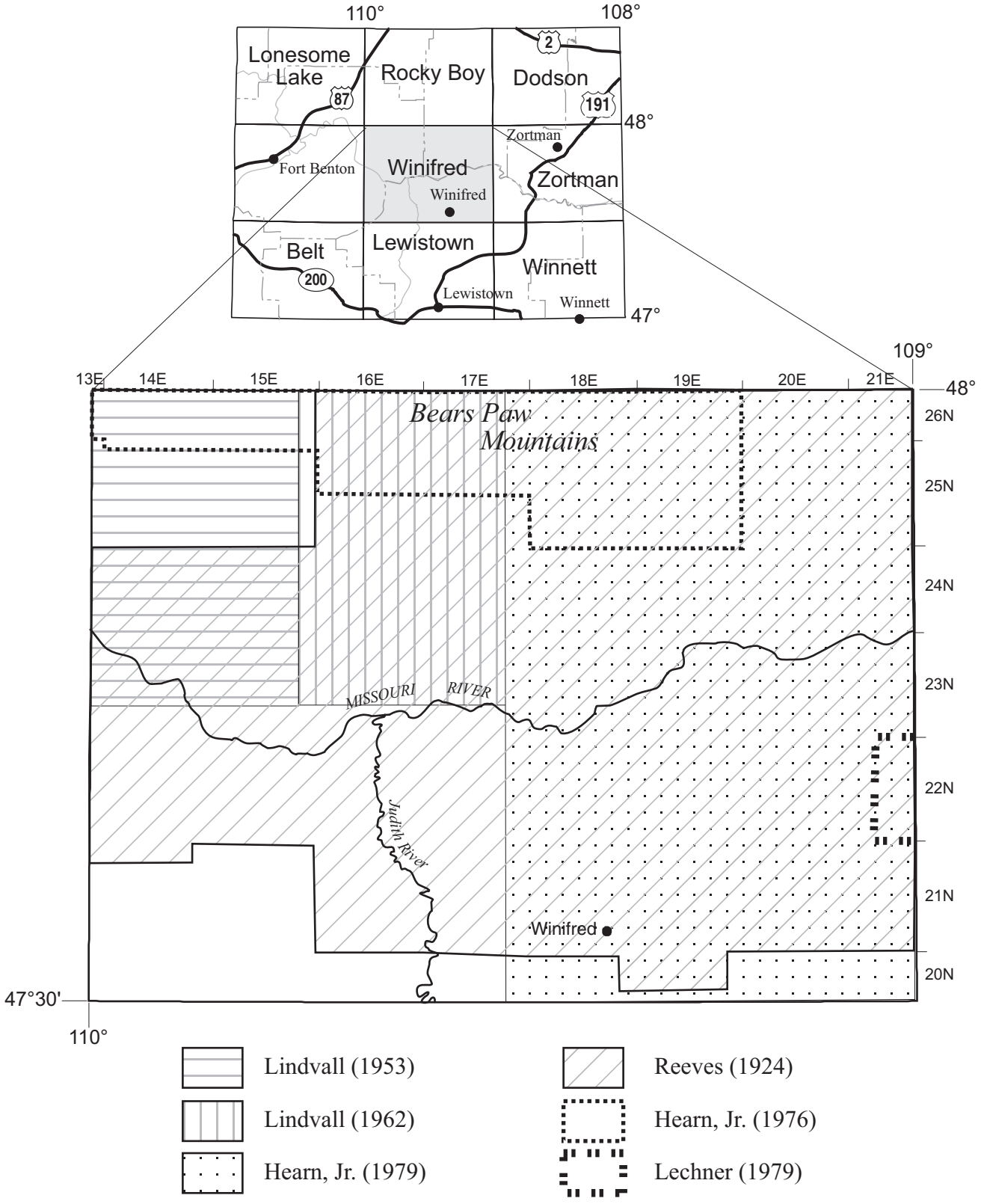


Figure 1. Location map for Winifred quadrangle showing areas covered by earlier geologic maps within the quadrangle (see Sources of Previous Geologic Mapping), and location of adjacent geologic maps published by MBMG.

keeping with the similarity of the units to the eastern sedimentary basin facies.

Landslide deposits are extensively developed within the Claggett Formation where often most or all of the outcrop is slumped and contorted. These massive landslides, not separately mapped, are readily recognized across the slopes beneath broad benches developed on the Judith River Formation such as Eightmile and Evers Benches in the northwest part of the map area.

Glacial deposits of several different origins occur but are not extensive nor thick across the map area. They have generally not been mapped. A hachured blue line on the map indicates the extent of continental glaciation across the quadrangle area.

This report combines the mapping of Reeves (1924), Lindvall (1953; 1962), and Hearn, Jr. (1976; 1979) within the quadrangle with new mapping by the authors. Mapped units have been integrated with recent work completed by MBMG in adjacent 1:100,000-scale quadrangles (figure 1).

Cross Section A-A'

Cross section A-A' crosses a number of folds and faulted folds in the southeast area of the map. The overall tectonic regime for these presumed gravity-slide-generated features is one of tension at the point of separation from the Bears Paw Mountains, but of compression within the very large blocks that slid southeastward onto the adjacent plains within the map area. Drill-hole data confirm that the glide planes for this movement occur almost entirely within the Upper Cretaceous shales of the Niobrara and Carlile Formations (the Kn + Kca unit on the cross section; the Niobrara is approximately stratigraphically equivalent to the Kevin Member mapped at the surface in the southwest map area). In this compressional regime, strata within a slide block were commonly folded, and apparently asymmetric folds frequently failed, forming shallow thrust faults.

The planes of these thrust faults dip back toward the mountain front, in this case northward. The dips of fault planes intersected along cross section A-A' are conjectural only; no data have been reported by us or by previous authors. However, faults exposed along the Missouri River appear to dip as much as 40 degrees or more. Many of the observed faults in the region now express a normal-fault relationship that presumably reflects a relaxation of the compressional stress (see cross section A-A'). This relaxation allowed many hanging-wall fault blocks to slide back along the fault plane. In the east-adjacent Zortman quadrangle area (Porter and Wilde, 2001), most of the faults intersected along cross section A-A' have retained their compressional geometry.

Similarly, around the entire Bears Paw Mountains, the horizontal displacement created by the plainsward translation of huge gravity-slide blocks apparently has been accommodated by (1) "wrinkling" of broad areas into long, subparallel folds, and (2) northward extensional backsliding of the hanging-walls of many faults when the compressional stress field relaxed. Within a discrete gravity-slide block, these two features are intermixed with the reverse faults that that reflect the original compressional regime. Another possible mechanism for accommodating the horizontal displacement would be the up-ramping of strata over a stable block at the distal edge of the slide block, in the manner of a landslide. No such deformation is recognized at the distal edge of the gravity slide features in this map area. Possibly this

deformation occurs within the ductile Bearpaw Shale and is not readily observed beneath the clayey soil and cover.

The gradient of the glide planes beneath the gravity slide blocks has been investigated based on drill hole data (Hearn,1976): structure contours on the top of the Greenhorn limestone that lies just beneath the deepest known glide plane (in the lower Carlile Formation) indicate a gradient of 150 to 200 feet per mile (1.75 degrees) within 10 miles of the mountain front, and 30 to 60 feet per mile (0.5 degrees) farther away. Faults within the slide blocks presumably become subparallel with or merge with the glide plane at depth. On cross section A-A', the contact at the base of the Niobrara-Carlile interval (Kn + Kca) probably approximates the glide plane beneath the gravity-slide block traversed by the line of section.

ACKNOWLEDGMENTS

The authors wish to thank Dr. B. Carter Hearn, Jr. of the U. S. Geological Survey in Reston, VA for permission to include on the map his recently found Tertiary intrusive bodies, and some new bedrock mapping in the Ragland Bench area of the Winifred quadrangle.

Correlation Chart of Map Units
Winifred 30' x 60' Quadrangle

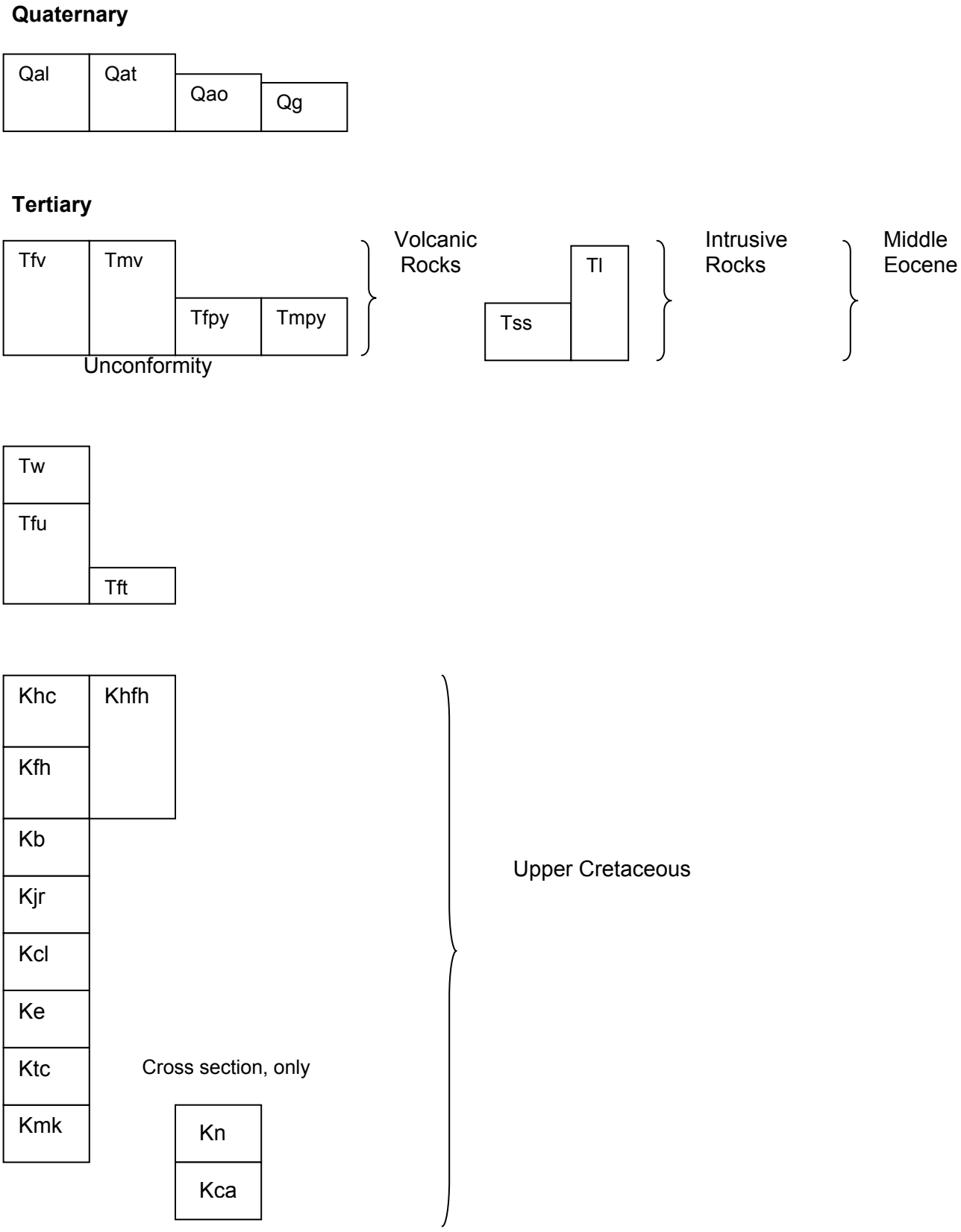


Figure 2. Correlation Chart of map units.

DESCRIPTION OF MAP UNITS

QUATERNARY

Qal — FLOOD PLAIN AND CHANNEL ALLUVIUM (HOLOCENE) — Yellowish tan and grayish tan, poorly to well stratified gravel, sand, silt, and clay deposited in flood plains and channels of modern streams. Locally includes some slightly older Holocene terrace alluvium, where terrace deposits not mapped separately. Thickness not measured.

Qat — ALLUVIAL TERRACE DEPOSITS (HOLOCENE) — Yellowish tan and grayish tan-weathering, unconsolidated clay, silt, sand, and some pebbles, generally well stratified; occurring on flat benches at slightly higher elevations than modern flood plain, and dissected by modern drainages; generally soil covered. Thickness not measured.

Qao — OLDER ALLUVIUM (HOLOCENE) — Light-yellowish gray-weathering deposits of unconsolidated clay, silt, sand, and some fine gravel; moderately to well sorted; unit occurs along modern drainages, generally slightly above modern alluvial flood plains; includes some terrace deposits not mapped separately, and deposits of glacial material presently being reworked by modern processes; poorly exposed except where cut by streams. Thickness not measured.

Qg — GLACIAL DEPOSITS, UNDIVIDED (PLEISTOCENE) — Light-colored sand, silt, and clay, including poorly sorted till with common cobble fraction and well sorted lake-bed(?) deposits. Thickness not measured.

TERTIARY

Volcanic rocks (Middle Eocene)

Tfv — FELSIC VOLCANIC ROCKS — (modified from Hearn, Jr., 1976) Flows and flow breccias of porphyritic latite and quartz latite; light-gray, gray and brown; phenocrysts of potassium feldspar, plagioclase, augite, hornblende, and biotite; interlayered with felsic and mafic pyroclastic rocks and mafic flows; extrusive equivalent of intrusive porphyritic latite. Maximum thickness about 5,000 ft.

Tfpy — FELSIC PYROCLASTIC ROCKS — (modified from Hearn, Jr., 1976) Agglomerate, tuff-breccia, lapilli tuff, tuff, water-laid volcanic sediments, and coarse mudflow deposits; contain more than 50 percent fragments of felsic volcanic rocks; inclusions of biotite pyroxenite and Precambrian basement rocks locally abundant; commonly form lowermost volcanic unit; in part deposited in local early collapse basins; fossil plants and fish indicate middle Eocene

age. Maximum thickness about 3,000 ft.

Tmv MAFIC VOLCANIC ROCKS — (modified from Hearn, Jr., 1976) Flows and flow breccias of phonolite and mafic phonolite; brown, red, and purple; phenocrysts of olivine, augite, biotite, analcime, and rare leucite; interlayered with felsic flows and felsic and mafic pyroclastic rocks; extrusive equivalent of shonkinite and syenite. Maximum thickness about 5,000 ft.

Tmpy MAFIC PYROCLASTIC ROCKS — (modified from Hearn, Jr., 1976) Agglomerate, tuff-breccia, lapilli tuff, tuff, water-laid volcanic sediments and mudflow deposits; contain more than 50 percent fragments of mafic volcanic rocks; inclusions of biotite pyroxenite and Precambrian rocks locally abundant; commonly form lowermost volcanic unit; in part deposited in local early collapse basins; fossil plants and fish indicate middle Eocene age. Maximum thickness about 3,000 ft.

Intrusive rocks (Middle Eocene)

Tl PORPHYRITIC LATITE — (modified from Hearn, Jr., 1976) Dikes, sill, lacoliths and stocks; light-gray to brown; fine-grained felsic porphyritic rocks; most contain less than 20 percent mafic minerals; phenocrysts of augite ubiquitous; may represent several episodes of intrusion, and post-date most but not all shonkinite-syenite intrusions.

Tss SHONKINITE AND SYENITE — (modified from Hearn, Jr., 1976) Dikes, sills, laccoliths, plugs, and stocks; fine- to coarse-grained, porphyritic to equigranular; mafic mineral content of shonkinite more than 40 percent, mafic syenite 20 to 40 percent, and syenite less that 20 percent; many varieties weather to biotite-rich soils with no outcrop; represent several episodes of intrusion, and are the earliest intrusive rocks in the eastern Bears Paw Mountains.

Tial INTRUSIVE ROCKS, ALKALIC, UNDIVIDED (see Map Symbols) — Medium-brown-weathering, coarsely crystalline; commonly weathers to crumbly, coarse rubble.

Sedimentary rocks

Tw WASATCH FORMATION (LOWER EOCENE) — (modified from Hearn, Jr., 1976) Variegated red, pink, lavender, light-green, yellowish gray, and white shale, bentonitic claystone, and siltstone; interbedded sandstones light-gray, brown and green, fine- to coarse-grained, cross-bedded, with lenses of boulder conglomerate in upper part of formation containing clasts derived from mountain uplifts to the west or southwest including argillite and quartzite from Proterozic Belt Supergroup rocks, porphyritic igneous rocks, and limestone and

dolomite; clasts locally crushed, fractured, and recemented. Nonmarine; fossil plants and vertebrates indicate early Eocene age. Top of formation missing due to pre-volcanic erosion or tectonic disruption or both. Maximum measured thickness 800 ft.

Tfu FORT UNION FORMATION, UNDIVIDED (PALEOCENE) — (modified from Hearn, Jr., 1976) Light-brown to light-yellow, thin- to thick-bedded sandstone with brown sandstone concretions; interbedded with light-colored to greenish siltstone, claystone and shale; locally contains carbonaceous shale and coal locally mined. Nonmarine; fossil plants and vertebrates indicate early Paleocene age. Maximum thickness about 1,300 ft.

Tft TULLOCK MEMBER OF FORT UNION FORMATION —

UPPER CRETACEOUS

Khc HELL CREEK FORMATION — (modified from Hearn, Jr., 1976) Interbedded gray to light-brown sandstone with brown sandstone concretions, and white to light-colored to drab siltstone, claystone and shale locally calcareous with abundant small calcareous concretions; brownish gray carbonaceous bentonitic claystone also interbedded; persistent beds of carbonaceous shale and lenticular coal near base of formation locally mined. Rare fossil plants and vertebrates indicate latest Cretaceous age. Thickness 400 to 500 ft.

Kfh FOX HILLS FORMATION — (modified from Hearn, Jr., 1976) Light-yellowish gray, light-brown, and yellow, thin-bedded to massive sandstone, commonly concretionary; minor interbeds of brown and gray siltstone and shale. Thickness 60 to 100 ft.

Khfh HELL CREEK AND FOX HILLS FORMATIONS, UNDIVIDED

Kb BEARPAW SHALE — Medium-gray, fissile shale weathering to steel-gray or rarely brownish gray, underlying low, sage-covered, gently rolling topography. Thin, greenish white bentonite layers common throughout and cause a characteristic gumbo soil. Base, where exposed, comprised of bentonite and gypsiferous clayey shale. Uppermost beds of formation silty and sandy in transition with overlying Fox Hills Formation. Large (as much as 1 ft diameter) ovoid, dark-reddish purple-weathering concretions common in lower part; gray-weathering, oval, calcareous concretions more common in upper part; both concretion types commonly very fossiliferous. Estimated thickness of 900 ft is given by Reeves (1924), although tectonic thinning and fault-repeated section are likely within the large fault blocks produced by gravity sliding. Formation thinned by erosion westward across map area, and is completely removed in western map area.

Kjr JUDITH RIVER FORMATION — Composed of three distinct intervals. *Lower sandstone unit:* light-yellowish gray-weathering, locally orange-stained, very fine- or fine-grained, quartzose, massive to poorly bedded, burrowed to bioturbated; uppermost beds light-brown, ferruginous, forms resistant ledges; Parkman Sandstone of subsurface usage. *Middle unit:* greenish gray-weathering, fine-grained sandstones, siltstones, mudstones, and brown carbonaceous shale typically with conspicuous banded appearance; numerous conspicuous rusty-brown to purplish black-weathering ironstone concretions; many beds bentonitic. *Upper unit*: composed of basal yellowish gray to yellowish brown-weathering fine-grained, quartzose sandstone overlain by sequence of interbedded sandstones, mudstones, and carbonaceous shale with common small ferruginous concretions; sandstones light-colored, cross-stratified, commonly discontinuous laterally, and have dark-brown ferruginous caps; top of unit locally contains a thin, dark, fissile, oyster-bearing shale overlain by Bearpaw Shale. Middle and upper units of formation typically form barren slopes and badlands topography. Thickness is approximately 500 feet in the map area (Reeves, 1924).

Kcl CLAGGETT SHALE — Dark-gray or grayish brown on fresh surfaces, commonly weathered to soft brown; blocky to fissile. Characteristic dull-orange-weathering, smooth, ovoid, calcareous concretions in middle and upper part of unit; concretions commonly contain yellow calcite vein filling and are commonly highly fractured, forming mounds of small, sharp-edged orange-brown fragments. Numerous grayish white bentonite layers (1 to 5 inches thick) in lower part of unit; base composed of thick bentonitic interval in which three white, slightly swelling bentonites are sometimes distinguishable. Upper part contains laterally persistent sandstone beds forming transitional base with overlying Judith River Formation. Exposed surfaces commonly bare to sparsely vegetated. Average thickness is approximately 550 ft (Reeves, 1924), but varies; thickness variations, particularly in the gravity-fault block structures, are likely caused by tectonic squeezing and/or fault repetition. Formation commonly is extensively disrupted by massive landslides not separately mapped, particularly across slopes of benches developed on the overlying Judith River Formation.

Ke EAGLE SANDSTONE — Composed of three distinct units. *Lower unit (Virgelle Member):* generally white-weathering, locally concretionary, fine- and medium-grained, friable to moderately hard, salt-and-pepper sandstone, generally massive and burrowed to locally cross-stratified; forms prominent cliff above underlying Telegraph Creek Formation; about 30 ft thick; commonly milky-white but occasionally yellowish brown and locally stained reddish. *Middle unit:* poorly exposed, thin sandstones and grayish green shale with thin, discontinuous lignite seams and some bentonitic intervals. *Upper unit:* yellowish tan-weathering, light-gray, fine-grained, salt-and-pepper sandstone, commonly cross-stratified, massive, cliff-forming, with thin to 2-ft-thick

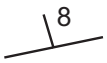
interval of black pebbles (from granule to 2 inches in diameter) at top of sandstone or in dark shale slightly above top of unit in lowest Claggett beds. Thickness of formation approximately 250 to 300 ft.

Ktc — TELEGRAPH CREEK FORMATION — Medium- to light-gray-weathering, interbedded, noncalcareous sandstone, siltstone, and fissile shale, sandier in upper part. Upper contact transitional, generally placed at base of lowest cliff-forming sandstone of overlying Eagle Formation. Only upper part exposed except along southwest border of map area. Estimated thickness 100-200 ft (Reeves, 1924).

Kmk — KEVIN MEMBER OF MARIAS RIVER FORMATION — Dark-gray-weathering, fissile, slightly calcareous shale. Uppermost beds exposed along Arrow Creek in southwest map area. Unit stratigraphically equivalent to Niobrara Formation in subsurface in eastern map area.

MAP SYMBOLS

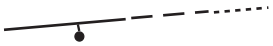
Contact; dotted where concealed



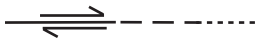
Strike and dip of bedding; degree of dip indicated

Anticlinal fold shown by trace of axial plane; dotted where concealed. Arrow indicates direction of plunge where known.

Synclinal fold shown by trace of axial plane; dotted where concealed. Arrow indicates direction of plunge where known.



Fault; dashed where inferred, dotted where concealed; ball and bar on downthrown side



Fault; dashed where inferred, dotted where concealed; arrows indicate apparent relative horizontal movement

Approximate limit of undifferentiated glacial deposits; hachures on side of glacial ice (blue line on map)

Igneous dikes, sills, and small plugs (red on map)

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Appendix E:
2008 Water Quality Information from DEQ's Clean Water Act Information Center

<<New Search

2008 Water Quality Information

Step 3

Select any combination of additional criteria (or none)

WaterBody Type
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TMDL Planning Area
<- TMDL_PA ->

County
FERGUS CO

Assessment Unit Name
<- WBName ->

Water Quality Category
<- WQCat ->

4th Field HUC
<- HUC ->

Designated Use
<- Uses ->

Use Support
<- Support ->

Probable Causes
<- Causes ->

Probable Sources
<- Sources ->

Submit | Show Map

<< < page 1 of 4 > >>

39 records selected

Armells Creek - MT40E002_021 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Armells Creek - MT40E002_022 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Arrow Creek - MT41R001_020 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Beaver Creek - MT41S004_030 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Big Spring Creek - MT41S004_010 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP

<- Uses ->
<- Support ->

Probable Causes

<- Causes ->

Probable Sources

<- Sources ->

Submit | Show Map

Armells Creek - MT40E002_021 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Armells Creek - MT40E002_022 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Arrow Creek - MT41R001_020 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Beaver Creek - MT41S004_030 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Big Spring Creek - MT41S004_010 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Big Spring Creek - MT41S004_020 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Blood Creek - MT40C004_030 - Musselshell Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Box Elder Creek - MT40B002_001 - Musselshell Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Casino Creek - MT41S004_040 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Chicago Gulch - MT40B002_020 - Musselshell Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP

<- Uses ->
<- Support ->

Probable Causes

<- Causes ->

Probable Sources

<- Sources ->

Submit | Show Map

<< < page 2 of 4 > >> 39 records selected

Chippewa Creek - MT40B002_040 - Musselshell Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Coffee Creek - MT41R001_010 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Collar Gulch - MT40B002_030 - Musselshell Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Cottonwood Creek - MT41S004_051 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Cottonwood Creek - MT41S004_052 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Dog Creek - MT41T002_020 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Dog Creek - MT41T002_021 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Dry Wolf Creek - MT41S002_010 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
East Fork Big Spring Creek - MT41S004_060 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Fargo Coulee - MT40E002_130 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP

<- Uses ->
<- Support ->

Probable Causes

<- Causes ->

Probable Sources

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Submit | Show Map

<< < page 3 of 4 > >> 39 records selected

Flatwillow Creek - MT40B001_021 - Musselshell Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Judith River - MT41S001_010 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Judith River - MT41S001_020 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Judith River Mainstem - MT41S001_030 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Last Chance Creek - MT41S002_100 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Little Dog Creek - MT41T002_022 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
McDonald Creek - MT40B002_010 - Musselshell Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Missouri River - MT40E001_010 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Missouri River - MT41T001_010 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
North Fork Flatwillow Creek - MT40B001_040 - Musselshell Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP

<- WQCat ->
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Designated Use
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Use Support
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Probable Causes
<- Causes ->

Probable Sources
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39 records selected

Ross Fork Judith River - MT41S002_070 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Sage Creek - MT41S002_050 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Snoose Creek - MT40B001_030 - Musselshell Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Sourdough Creek - MT40E002_120 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
South Fork Flatwillow Creek - MT40B001_050 - Musselshell Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Two Calf Creek - MT40E002_030 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Warm Spring Creek - MT41S002_030 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Wolf Creek - MT41S002_020 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Yellow Water Creek - MT40B001_010 - Musselshell Watershed		
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Live Search

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☐	☐	Major Lakes
☐	☐	Major Rivers
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☐	☐	USFS Roadless Areas
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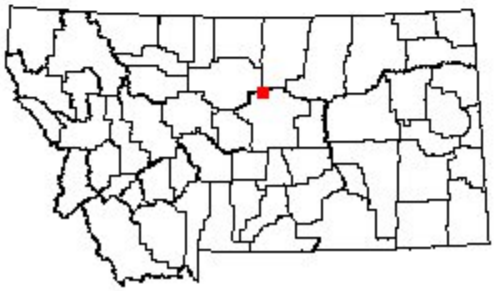
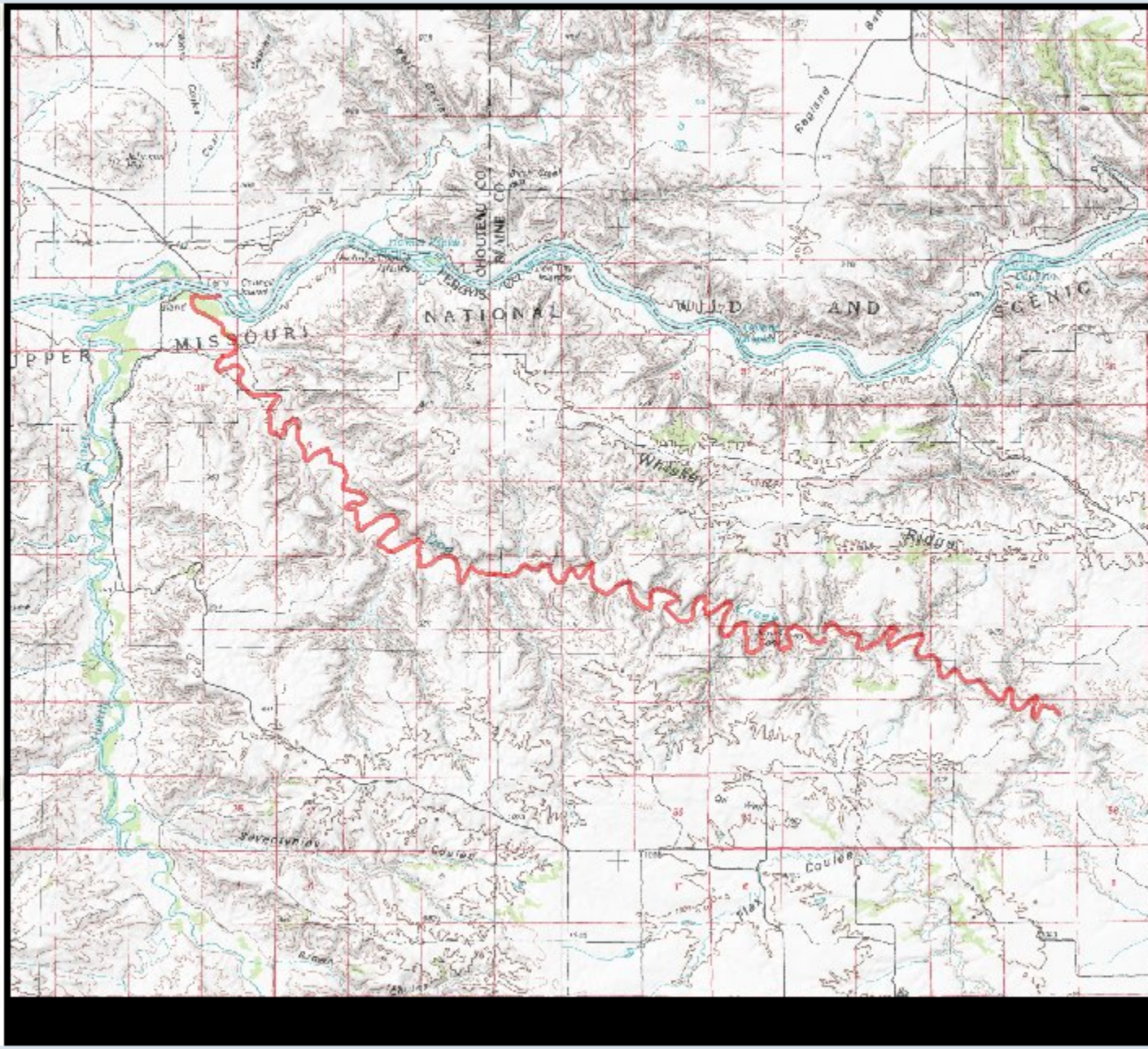
☑		Hillshade





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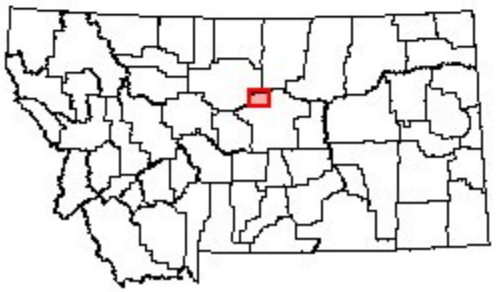

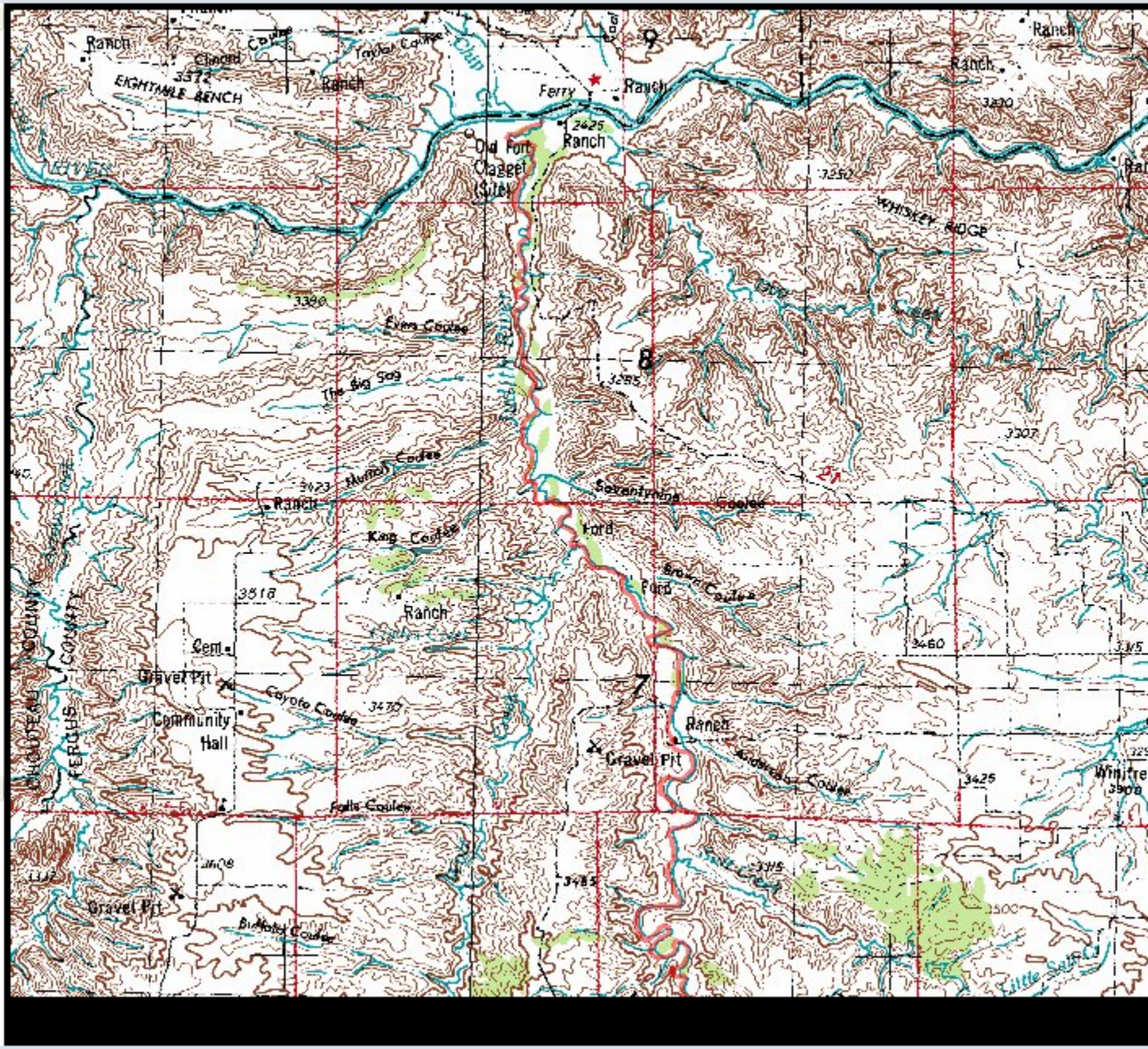

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2008 Water Quality Information

Step 3

Select any combination of additional criteria (or none)

WaterBody Type
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TMDL Planning Area
<- TMDL_PA ->

County
CHOUTEAU CO

Assessment Unit Name
<- WBName ->

Water Quality Category
<- WQCat ->

4th Field HUC
<- HUC ->

Designated Use
<- Uses ->

Use Support
<- Support ->

Probable Causes
<- Causes ->

Probable Sources
<- Sources ->

Submit | Show Map

<< < page 1 of 2 > >> 11 records selected

Arrow Creek - MT41R001_020 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Belt Creek - MT41U001_012 - Missouri-Sun-Smith Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Big Sandy Creek - MT40H001_010 - Milk Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Eagle Creek - MT41T002_030 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Lake Creek - MT41Q002_010 - Missouri-Sun-Smith Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP

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<- Support ->

Probable Causes

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Probable Sources

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Arrow Creek - MT41R001_020 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Belt Creek - MT41U001_012 - Missouri-Sun-Smith Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Big Sandy Creek - MT40H001_010 - Milk Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Eagle Creek - MT41T002_030 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Lake Creek - MT41Q002_010 - Missouri-Sun-Smith Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Marias River - MT41P001_022 - Marias Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Missouri River - MT41Q001_013 - Missouri-Sun-Smith Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Missouri River - MT41Q001_014 - Missouri-Sun-Smith Watershed		
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Missouri River - MT41T001_010 - Middle Missouri Watershed		
SUMMARY REPORT	ASSESSMENT RECORD	SHOW MAP
Pondera Creek/Coulee - MT41P002_030 - Marias Watershed		
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2008 Water Quality Information

Step 3

Select any combination of additional criteria (or none)

WaterBody Type
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County
CHOUTEAU CO

Water Quality Category
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Designated Use
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Probable Causes
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TMDL Planning Area
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Assessment Unit Name
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4th Field HUC
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Use Support
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Montana Clean Water Water Act Information Center Mapper

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☐	☐	4th Code HUCs
☐	☐	TMDL Planning Areas
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☐	☐	Land Management
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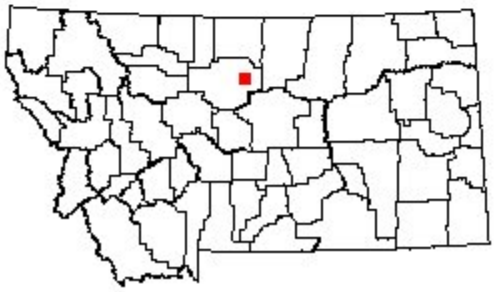
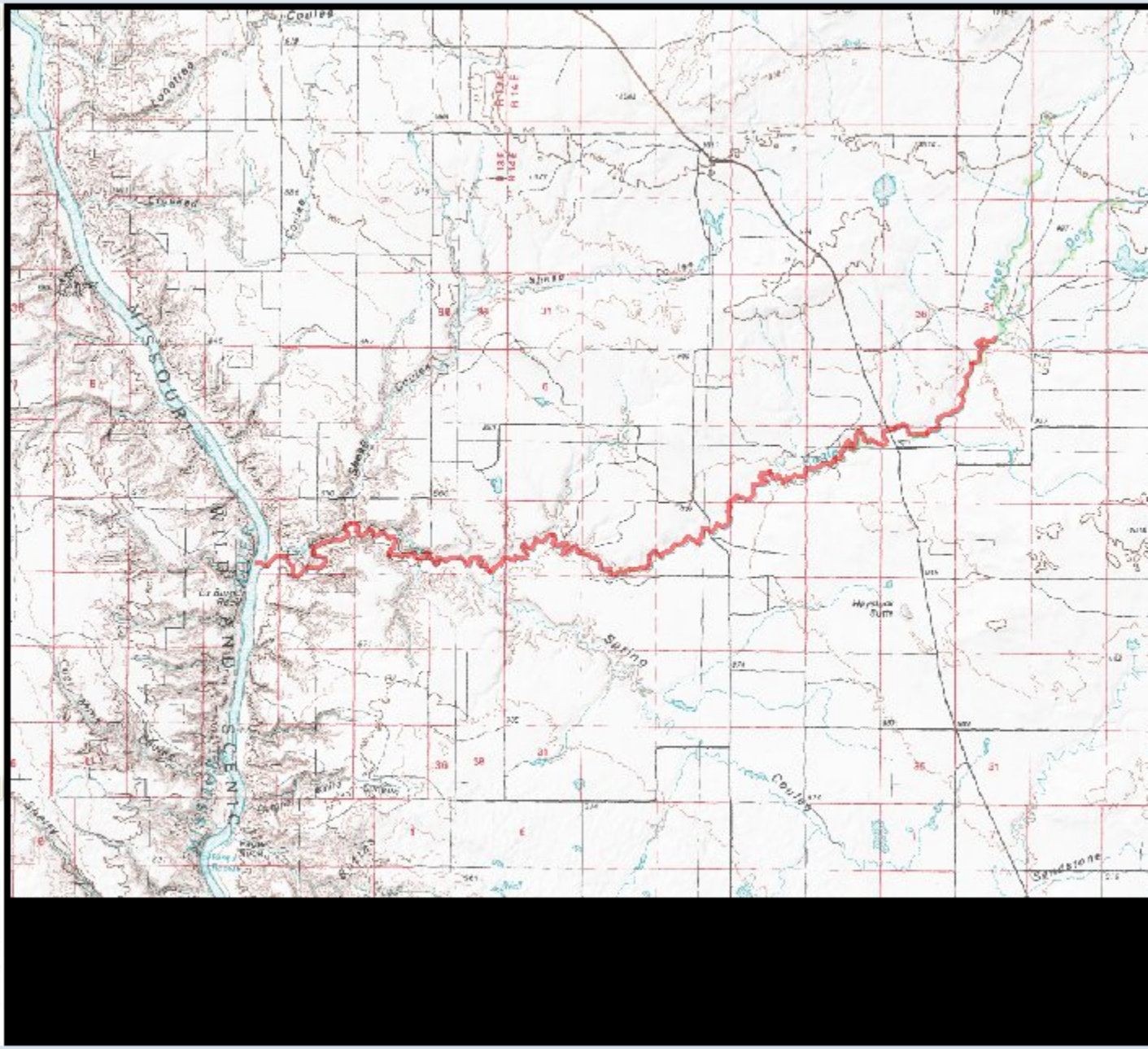
☑		250K DRG
☑		Hillshade





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Montana Clean Water Water Act Information Center Mapper

Control Legend | Identify Results

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☐	☐	USGS Guaging Stations
☐	☐	Places
☐	☐	Highways
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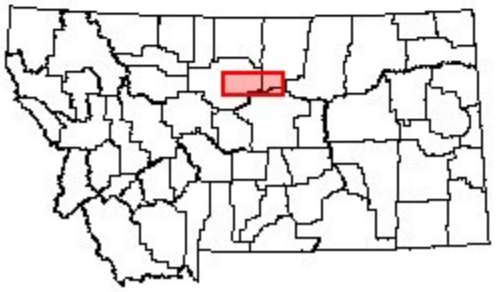
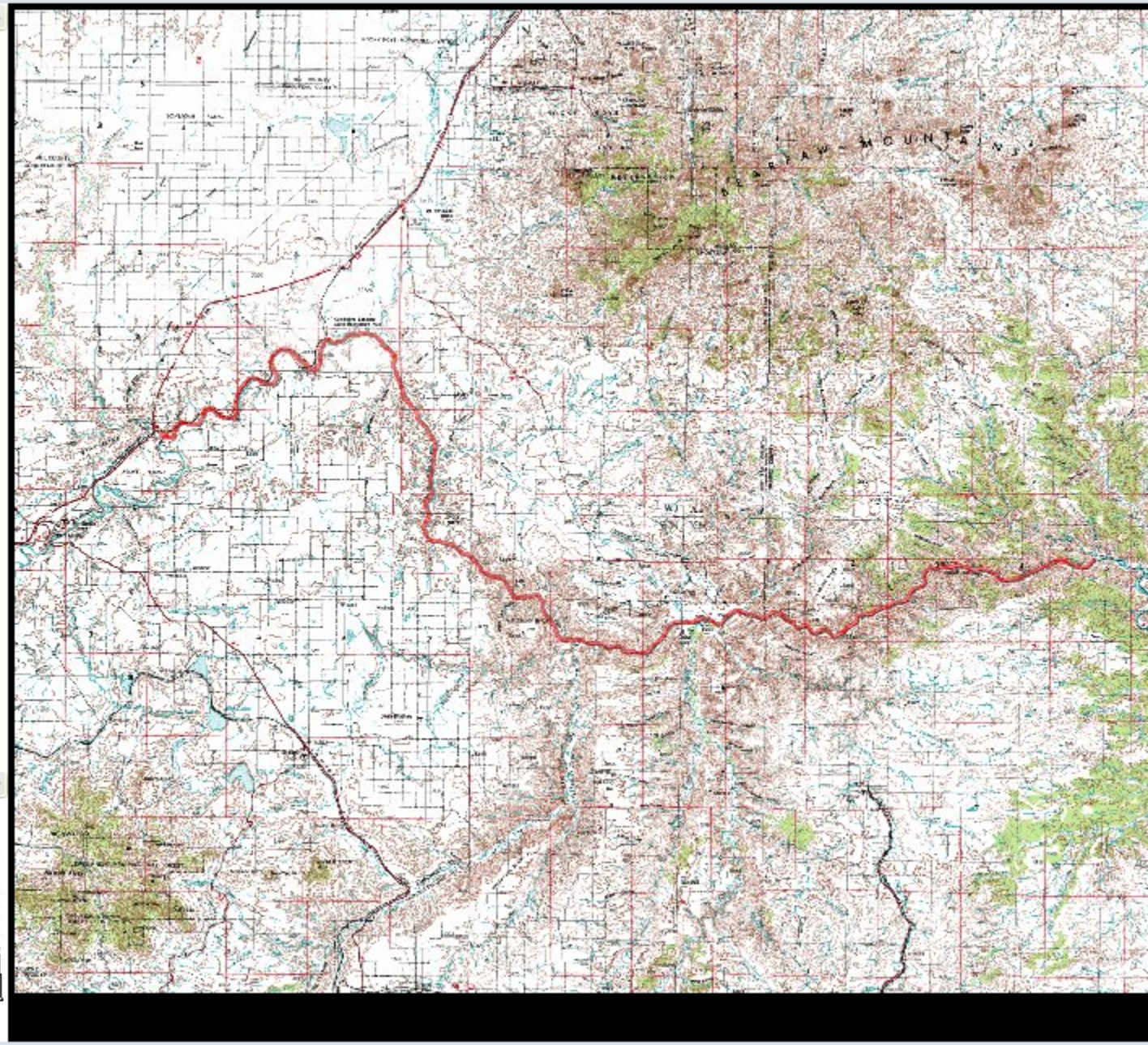




Close Window | Refresh Map

Current Tool:

Active Layer:

Approx. Scale 1:

Appendix F:
Groundwater data

Groundwater Information Center
Montana Bureau of Mines and Geology
Montana Tech of The University of Montana
1300 West Park Street - Natural Resources Building Room 329
Butte Montana 59701-8997

2/3/2010

Overview of FERGUS county

FERGUS get data

At-A-Glance

Number of wells in County	3051
Deepest well on record (feet)	2880
Shallowest well on record (feet)	2
Most recent well on record	12/18/2009
Oldest well on record	1/1/1865
Number of water quality samples	243
Number of measured water levels	26049
Statewide Monitoring Network wells	24

Other Reports

Use By Year View this report to see the number of wells and their reported water uses by year.

Histograms for FERGUS county

Wells by Year

The table below shows the breakdown of wells reportedly drilled in the county during the last 20 years. Click the "show all" link to display all data available.

2009	28
2008	29
2007	47
2006	88
2005	48
2004	99
2003	49
2002	83
2001	85
2000	54
1999	62
1998	44
1997	40
1996	46
1995	29
1994	34
1993	72
1992	64
1991	62

Show all years

Geologic Source

The table below shows the breakdown of geologic sources for wells in this county. Note that not all wells in a county necessarily have had the geologic source code assigned.

Wells by Depth

The table below shows the number of wells that fall between the depth ranges in the left hand column. All depths are listed in feet below ground surface.

0 - 99	1303
100 - 199	685
200 - 299	328
300 - 399	216
400 - 499	133
500 - 599	76
600 - 699	65
700 - 799	33
800 - 899	21
900 - 999	23
> 1000	168

Reported Water Use

The table below shows the number of each type of water use that has been reported for wells in this county.

UNKNOWN	139
RECREATION	1
INDUSTRIAL	29
OTHER	64
PUBLIC WATER SUPPLY	50
TEST WELL	5
UNUSED	12
WILDLIFE	3
FIRE PROTECTION	2
MEDICAL	1
MONITORING	158
COMMERCIAL	6
IRRIGATION	182
RESEARCH	19
GEOTECH	78
STOCKWATER	1440
DOMESTIC	1685
* Total	3874

* Number may differ from county total since one well may have several reported **water uses**.

KOOTENAI FORMATION (217KOTN)	118
EAGLE SANDSTONE (211EGLE)	92
JUDITH RIVER FORMATION (OF MONTANA GROUP) (211JDRV)	90
THIRD CAT CREEK SANDSTONE (BASAL KOOTENAI FM) (217TCCK)	29
COLORADO SHALE OR FM. (OF COLORADO GROUP) (211CLRD)	28
FIRST CAT CREEK SANDSTONE (BASE OF COLORADO GP) (217FCCK)	18
SECOND CAT CREEK SANDSTONE (OF KOOTENAI FM) (217SCCK)	16
MORRISON FORMATION (221MRSN)	12
SWIFT FORMATION (OF ELLIS GROUP) (221SWFT)	11
TERRACE DEPOSITS (PLEISTOCENE) (112TRRC)	9
TERRACE DEPOSITS (QUATERNARY) (110TRRC)	6
MADISON GROUP OR LIMESTONE (330MDSN)	6
CLAGGETT SHALE OR FORMATION (211CLGT)	4
ALLUVIUM (QUATERNARY) (110ALVM)	4
TERRACE DEPOSITS (HOLOCENE) (111TRRC)	3
TYLER FORMATION (OF AMSDEN GROUP) (320TYLR)	3
BEARPAW SHALE (211BRPW)	2
COLLUVIUM (HOLOCENE) (111CLVM)	2
ELLIS GROUP (221ELLS)	2
JURASSIC UNDIFFERENTIATED (220UDFD)	2
HEATH FORMATION OR SHALE OF BIG SNOWY GROUP (331HETH)	1
BELT SUPERGROUP (400BELT)	1
BIG SNOWY GROUP (331BGSN)	1
CARLILE SHALE (OF COLORADO GROUP) (211CRLL)	1
AMSDEN GROUP (320AMSD)	1
ALASKA BENCH LIMESTONE OF AMSDEN GROUP (320AKBC)	1

ALLUVIUM (HOLOCENE) (111ALVM)	1
TELEGRAPH CREEK FORMATION (OF MONTANA GROUP) (211TPCK)	1
OTTER FORMATION (OF BIG SNOWY GROUP) (331OTTR)	1
PIPER FORMATION (224PIPR)	1

Groundwater Information Center
Montana Bureau of Mines and Geology
Montana Tech of The University of Montana
1300 West Park Street - Natural Resources Building Room 329
Butte Montana 59701-8997

2/3/2010

Overview of CHOUTEAU county

CHOUTEAU get data

At-A-Glance

Number of wells in County	1978
Deepest well on record (feet)	2850
Shallowest well on record (feet)	3
Most recent well on record	9/12/2009
Oldest well on record	1/1/1885
Number of water quality samples	382
Number of measured water levels	39983
Statewide Monitoring Network wells	28

Other Reports

Use By Year View this report to see the number of wells and their reported water uses by year.

Histograms for CHOUTEAU county

Wells by Year

The table below shows the breakdown of wells reportedly drilled in the county during the last 20 years. Click the "show all" link to display all data available.

2009	1
2008	37
2007	27
2006	25
2005	14
2004	26
2003	30
2002	26
2001	61
2000	34
1999	50
1998	13
1997	10
1996	11
1995	4
1994	26
1993	19
1992	36
1991	35

Show all years

Wells by Depth

The table below shows the number of wells that fall between the depth ranges in the left hand column. All depths are listed in feet below ground surface.

0 - 99	1342
100 - 199	320
200 - 299	110
300 - 399	44
400 - 499	39
500 - 599	24
600 - 699	15
700 - 799	8
800 - 899	4
900 - 999	1
> 1000	71

Reported Water Use

The table below shows the number of each type of water use that has been reported for wells in this county.

UNKNOWN	50
WATERFLOOD	12
INDUSTRIAL	3
OTHER	4
PUBLIC WATER SUPPLY	48
TEST WELL	18
UNUSED	61
FIRE PROTECTION	3
MONITORING	424
COMMERCIAL	5
IRRIGATION	151
RESEARCH	37
GEOTECH	48
STOCKWATER	1000
DOMESTIC	804
* Total	2668

* Number may differ from county total since one well may have several reported **water uses**.

Geologic Source

The table below shows the breakdown of geologic sources for wells in this county. Note that not all wells in a county necessarily have had the geologic source code assigned.

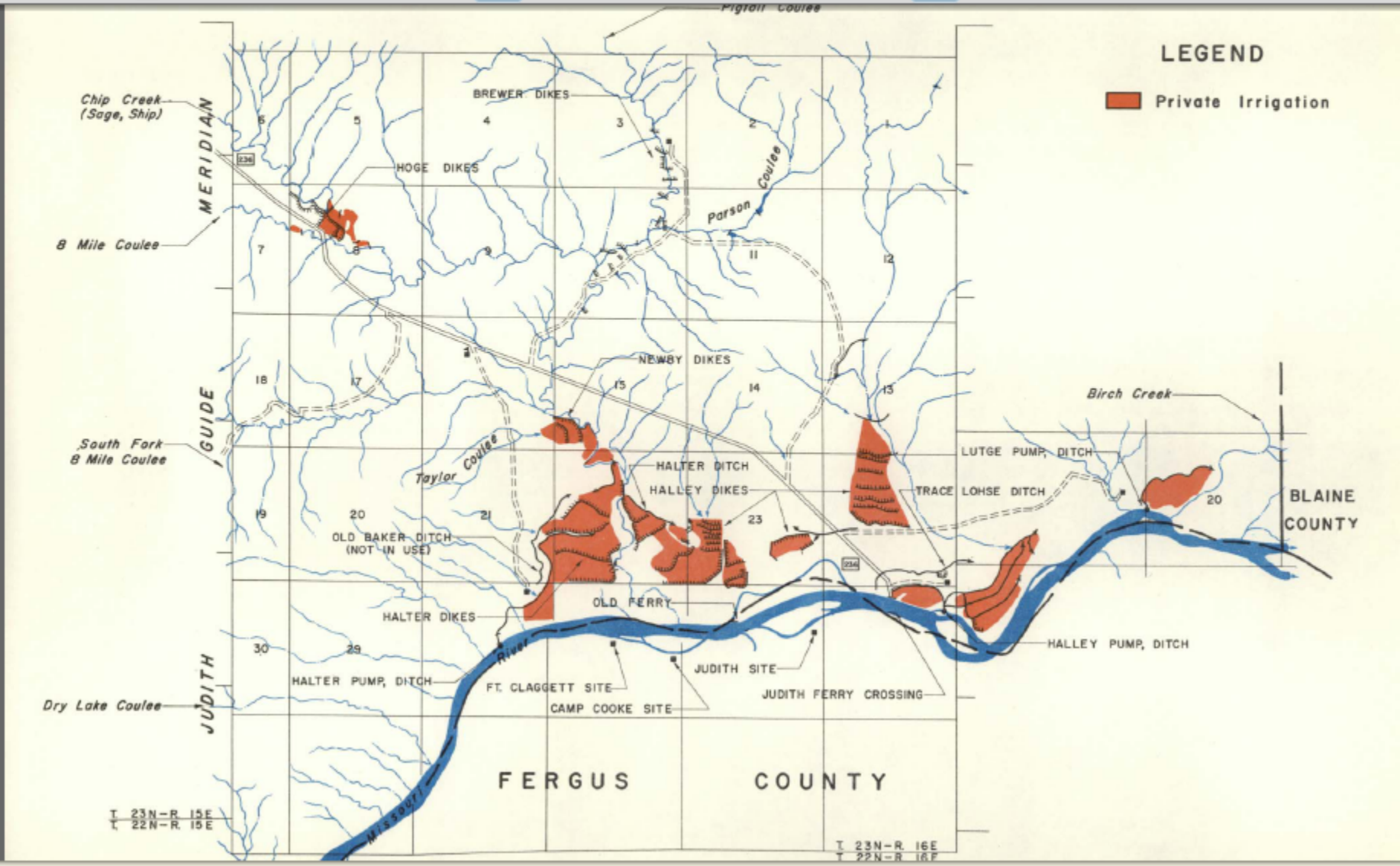
GLACIAL DRIFT (112DRFT)	179

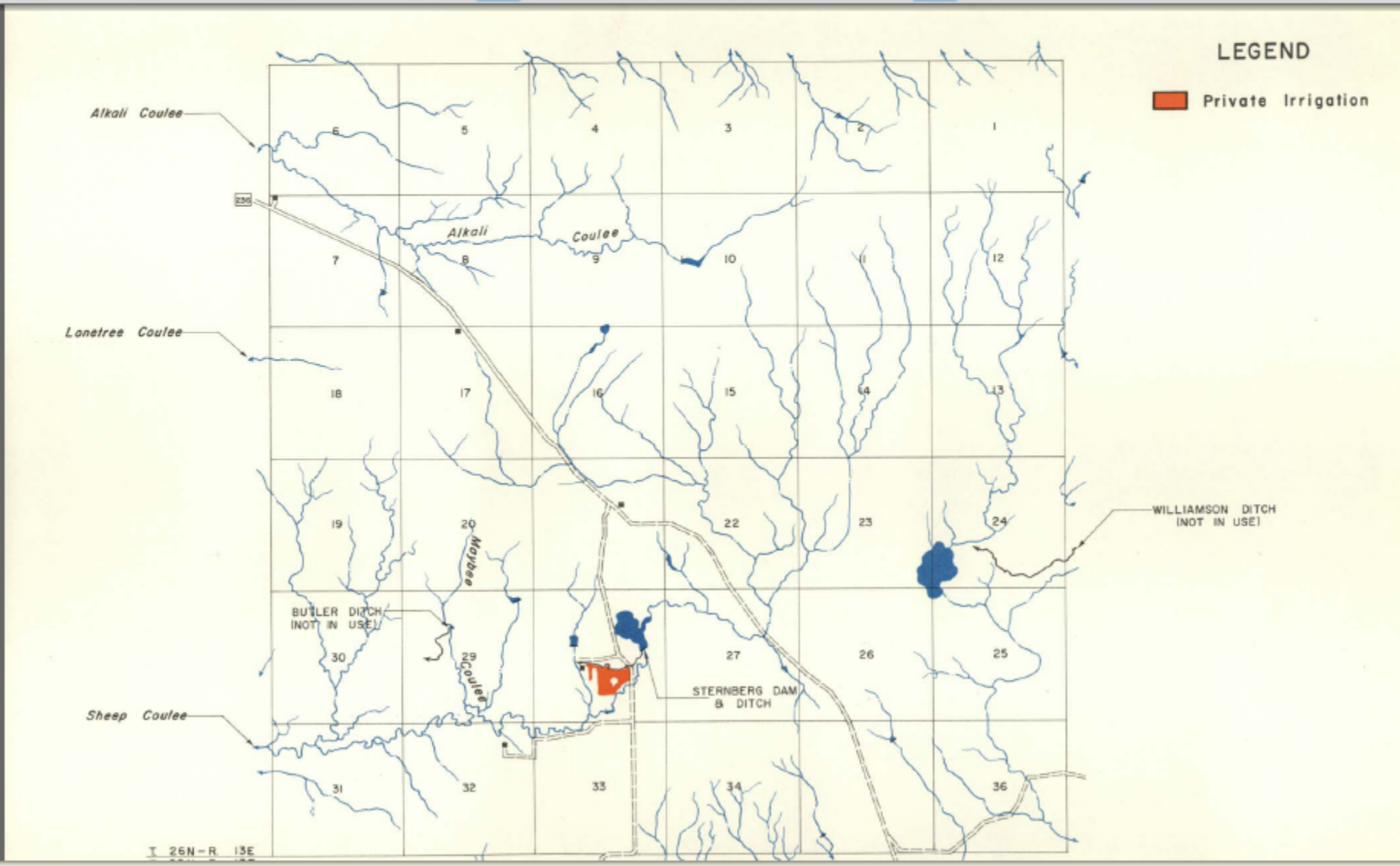
ALLUVIUM (QUATERNARY) (110ALVM)	83
EAGLE SANDSTONE (211EGLE)	76
JUDITH RIVER FORMATION (OF MONTANA GROUP) (211JDRV)	66
VIRGELLE SANDSTONE MEMBER (OF EAGLE SANDSTONE) (211VRGL)	27
COLORADO SHALE OR FM. (OF COLORADO GROUP) (211CLRD)	23
KOOTENAI FORMATION (217KOTN)	11
CLAGGETT SHALE OR FORMATION (211CLGT)	9
SUNBURST SANDSTONE (217SBRS)	8
MADISON GROUP OR LIMESTONE (330MDSN)	7
ALLUVIUM (HOLOCENE) (111ALVM)	6
SWIFT FORMATION (OF ELLIS GROUP) (221SWFT)	5
VOLCANICS (TERTIARY) (120VLCC)	3
SAND AND GRAVEL (PLEISTOCENE) (112SNGR)	3
GLACIAL OUTWASH (PLEISTOCENE) (112OTSH)	2
GLACIAL TILL (112TILL)	2
ALLUVIUM (PLEISTOCENE) (112ALVM)	2
FORT UNION FORMATION (125FRUN)	2
CUT BANK SANDSTONE (217CBNK)	1
DAKOTA SANDSTONE FORMATION OR GROUP (217DKOT)	1
BLACKLEAF FORMATION (OF COLORADO GROUP) (217BCKF)	1
MOSBY SANDSTONE MEMBER (OF WARM CREEK SHALE) (211MSBY)	1
PEDIMENT DEPOSITS (QUATERNARY) (110PDMN)	1
WASATCH FORMATION (124WSTC)	1
THIRD CAT CREEK SANDSTONE (BASAL KOOTENAI FM) (217TCCK)	1
TULLOCK MEMBER (OF FT UNION FM.) (125TLCK)	1

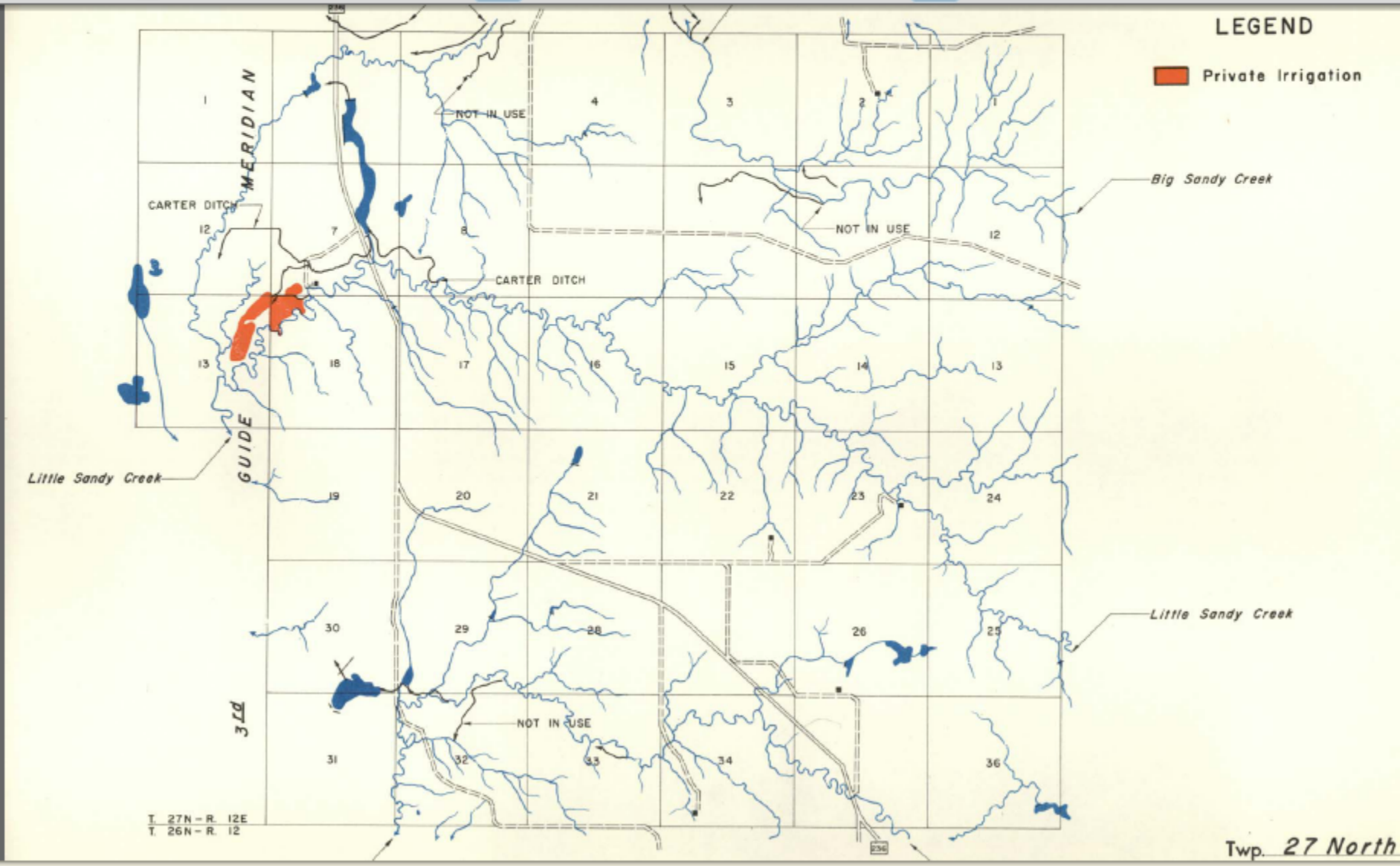
Appendix G:
Irrigation Maps

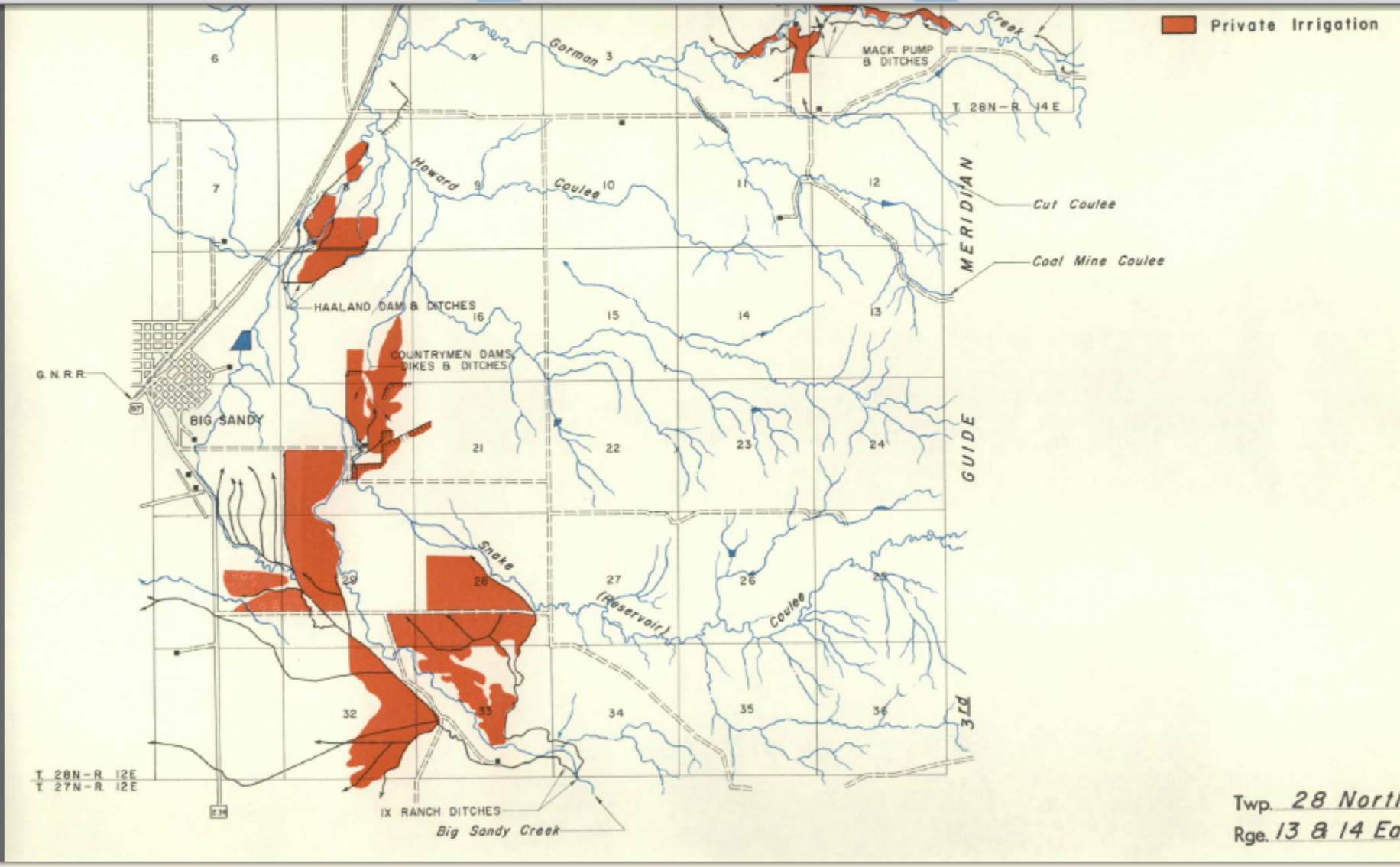
Montana Water Resources Survey

Maps showing irrigated areas in Chouteau County



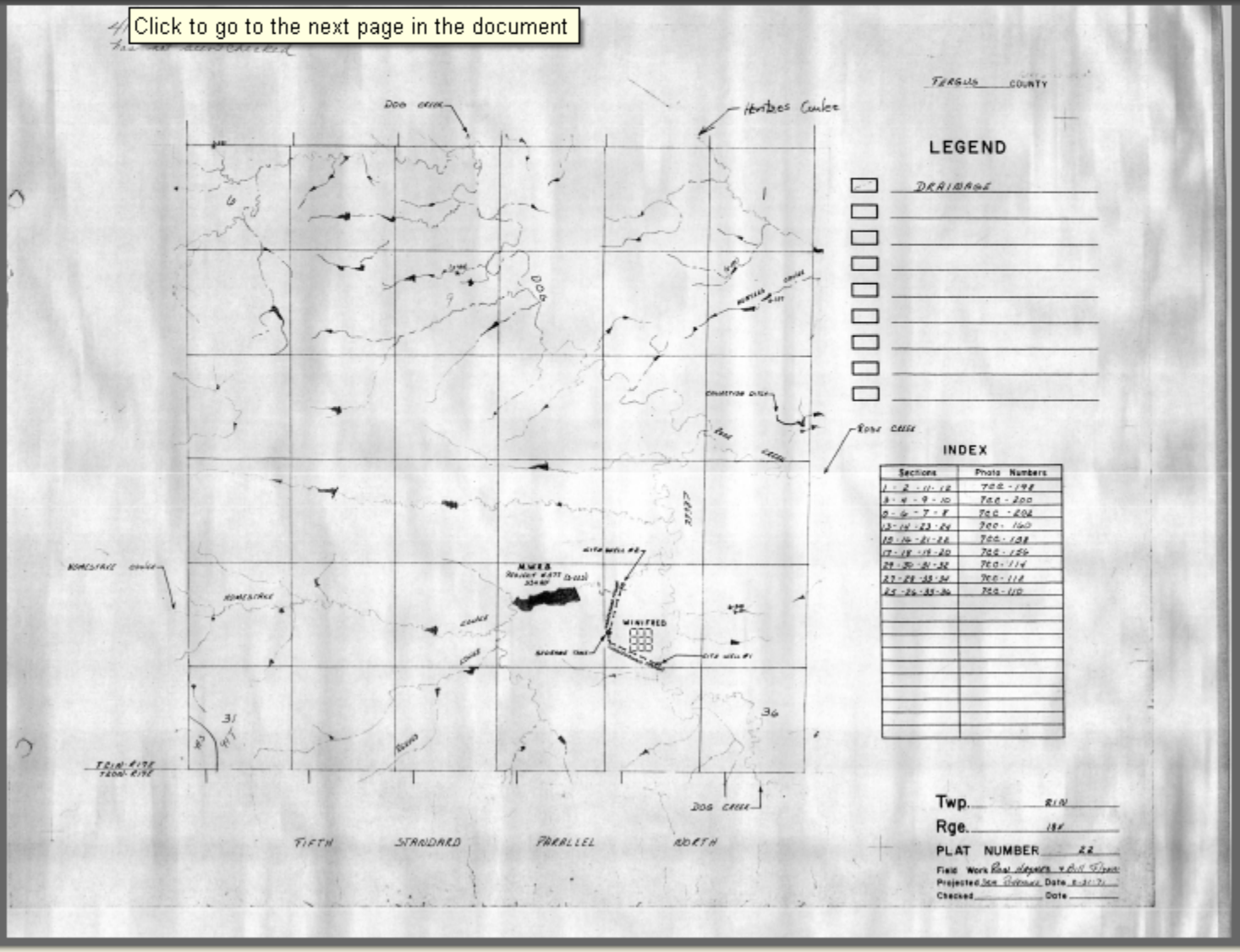


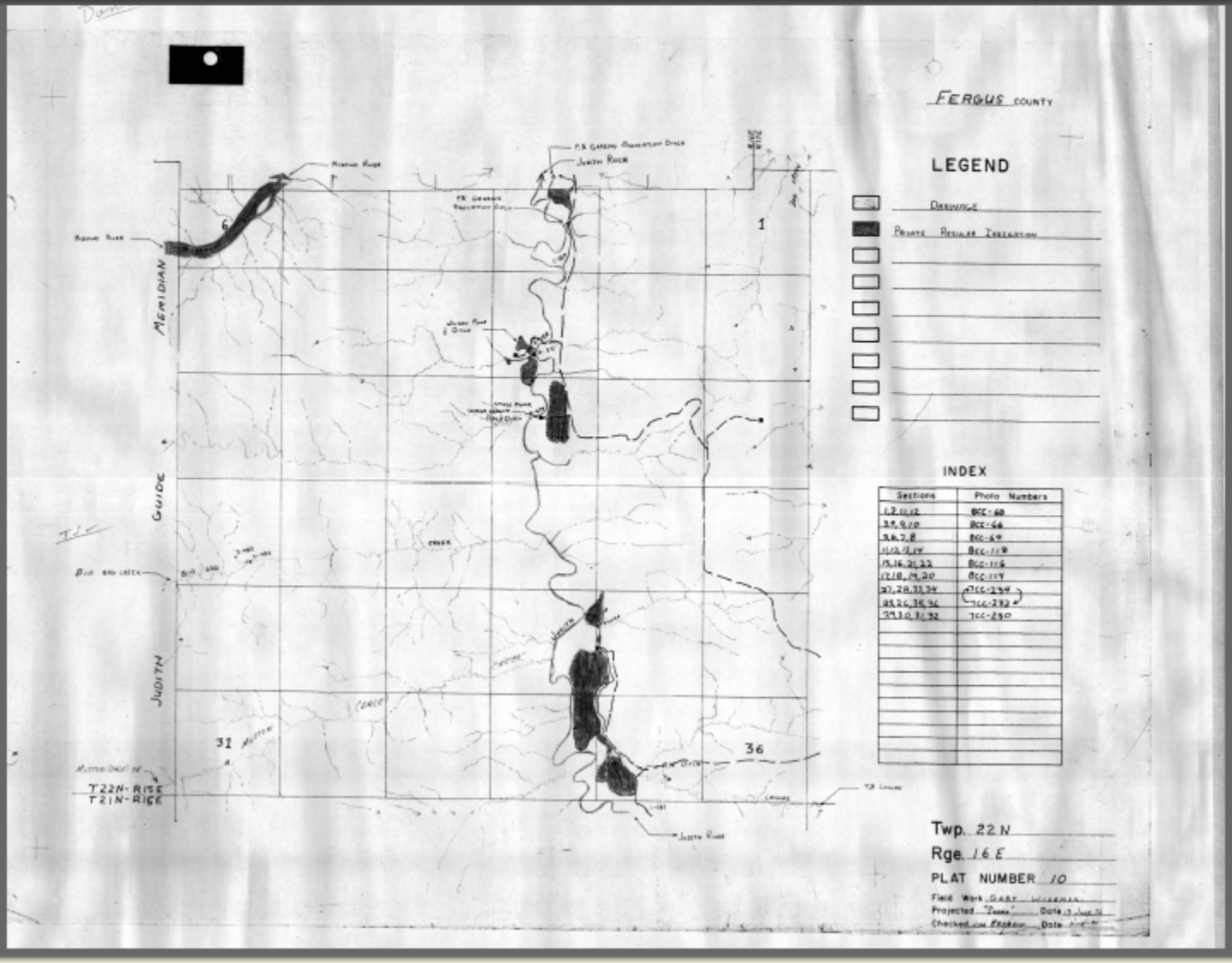




Montana Water Resources Survey

Maps showing irrigated areas in Fergus County





Appendix H:
Proclamation by the President (January 17, 2001)

U.S. DEPARTMENT OF THE INTERIOR **BUREAU OF LAND MANAGEMENT**
Montana/Dakotas

Print Page

<<Back to Upper Missouri River Breaks National Monument

Welcome to the Upper Missouri River Breaks National Monument

PROCLAMATION BY THE PRESIDENT (January 17, 2001)

The Upper Missouri River Breaks National Monument contains a spectacular array of biological, geological, and historical objects of interest. From Fort Benton upstream into the Charles M. Russell National Wildlife Refuge, the monument spans 149 miles of the Upper Missouri River, the adjacent Breaks country, and portions of Arrow Creek, Antelope Creek, and the Judith River. The area has remained largely unchanged in the nearly 200 years since Meriwether Lewis and William Clark traveled through it on their epic journey. In 1976, the Congress designated the Missouri River segment and corridor in this area a National Wild and Scenic River (Public Law 94-486, 90 Stat. 2327). The monument also encompasses segments of the Lewis and Clark National Historic Trail, the Nez Perce National Historic Trail, and the Cow Creek Island Area of Critical Environmental Concern.

Lewis and Clark first encountered the Breaks country of the monument on their westward leg. In his journal, Clark described the abundant wildlife of the area, including mule deer, elk, and antelope, and on April 29, 1805, the Lewis and Clark expedition recorded the first big horn sheep observation by non-Indians in North America. Lewis? description of the magnificent White Cliffs area on the western side of the monument is especially vivid, and not just for his sometimes colorful spellings:

"The hills and river Clifts which we passed today exhibit a most romantic appearance.... The bluffs of the river rise to hight of from 2 to 300 feet and in most places nearly perpendicular; they are formed of remarkable white sandstone which is sufficiently soft to give way readily to the impression of water...

"The water in the course of time ... has trickled down the soft sand clifts and woarn it into a thousand grotesque figures, which with the help of a little immagination and an oblique view, at a distance are made to represent eligant ranges of lofty freestone buildings, having their parapets well stocked with statuary; collumns of various sculptures both grooved and plain, are also seen supporting long galleries in front of these buildings; in other places on a much nearer approach and with the help of less immagination we see the remains or ruins of eligant buildings; some collumns standing and almost entire with their pedestals and capitals; others retaining their pedestals but deprived by time or accident of their capitals, some lying prostrate an broken othe[r]s in the form of vast pyramids of conic structure bearing a serees of other pyramids on their tops...

As we passed on it seemed as if those seens of visionary inchantment would never have and [an] end; for here it is too that nature presents to the view of the traveler vast ranges of walls of tolerable workmanship, so perfect indeed are those walls that I should have thought that nature had attempted here to rival the human art of masonry..."

The monument is covered with sedimentary rocks deposited in shallow seas that covered central and eastern Montana during the Cretaceous period. Glaciers, volcanic activity, and erosion have since folded, faulted, uplifted, and sculpted the landscape to the majestic form it takes today.

The area remains remote and nearly as undeveloped as it was in 1805. Many of the biological objects described in Lewis's and Clark's journals continue to make the monument their home. The monument boasts the most viable elk herd in Montana and one of the premier big horn sheep herds in the continental United States. It contains essential winter range for sage grouse as well as habitat for prairie dogs. Lewis sent Jefferson a prairie dog specimen which was, as Lewis noted at the time, "new to science." Abundant plant life along the River and across the Breaks country supports this wildlife. The lower reach of the Judith River, just above its confluence with the Missouri, contains one of the few remaining fully functioning cottonwood gallery forest ecosystems on the Northern Plains. Arrow Creek, originally called Slaughter River by Lewis and Clark, contains the largest concentration of antelope and mule deer in the monument as well as important spawning habitat for the endangered pallid sturgeon. An undammed tributary to the Missouri River, Arrow Creek is a critical seed source for cottonwood trees for the flood plain along the Missouri.

The cliff faces in the monument provide perching and nesting habitat for many raptors, including the sparrow hawk, ferruginous hawk, peregrine falcon, prairie falcon, and golden eagle. Several pairs of bald eagles nest along the River in the monument and many others visit during the late fall and early winter. Shoreline areas provide habitat for great blue heron, pelican, and a wide variety of waterfowl. The River and its tributaries in the monument host forty-eight fish species, including goldeye, drum, sauger, walleye, northern pike, channel catfish, and small mouth buffalo. The monument has one of the six remaining paddlefish populations in the United States. The River also supports the blue sucker, shovel nose sturgeon, sicklefin, sturgeon chub, and the endangered pallid sturgeon.

The Bullwacker area of the monument contains some of the wildest country on all the Great Plains, as well as important wildlife habitat. During the stress-inducing winter months, mule deer and elk move up to the area from the river, and antelope and sage grouse move down to the area from the benchlands. The heads of the coulees and breaks also contain archeological and historical sites, from teepee rings and remnants of historic trails to abandoned homesteads and lookout sites used by Meriwether Lewis.

Long before the time of Lewis and Clark, the area was inhabited by numerous native tribes, including the Blackfeet, Assiniboin, Gros Ventre (Atsina), Crow, Plains Cree, and Plains Ojibwa. The confluence of the Judith and Missouri Rivers was the setting for important peace councils in 1846 and 1855. In 1877, the Nez Perce crossed the Missouri and entered the Breaks country in their attempt to escape to Canada. The Cow Island Skirmish occurred in the Breaks and was the last encounter prior to the Nez Perce surrender to the U.S. Army at the Battle of Bear Paw just north of the monument. Pioneers and the Army followed Lewis and Clark in the 1830s establishing Fort Piegan, Fort McKenzie, and Fort Benton. Remnants of this rich history are scattered throughout the monument, and the River corridor retains many of the same qualities and much of the same appearance today as it did then.

Section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431), authorizes the President, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments, and to reserve as a part

thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected.

WHEREAS it appears that it would be in the public interest to reserve such lands as a national monument to be known as the Upper Missouri River Breaks National Monument:

NOW, THEREFORE, I, WILLIAM J. CLINTON, President of the United States of America, by the authority vested in me by section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431), do proclaim that there are hereby set apart and reserved as the Upper Missouri River Breaks National Monument, for the purpose of protecting the objects identified above, all lands and interests in lands owned or controlled by the United States within the boundaries of the area described on the map entitled "Upper Missouri River Breaks National Monument" attached to and forming a part of this proclamation. The Federal land and interests in land reserved consist of approximately 377,346 acres, which is the smallest area compatible with the proper care and management of the objects to be protected.

All Federal lands and interests in lands within the boundaries of this monument are hereby appropriated and withdrawn from all forms of entry, location, selection, sale, or leasing or other disposition under the public land laws, including but not limited to withdrawal from location, entry, and patent under the mining laws, and from disposition under all laws relating to mineral and geothermal leasing, other than by exchange that furthers the protective purposes of the monument. The estab-lishment of this monument is subject to valid existing rights. The Secretary of the Interior shall manage development on existing oil and gas leases within the monument, subject to valid existing rights, so as not to create any new impacts that would interfere with the proper care and management of the objects protected by this proclamation.

The Secretary of the Interior shall prepare a transportation plan that addresses the actions, including road closures or travel restrictions, necessary to protect the objects identified in this proclamation.

For the purpose of protecting the objects identified above, the Secretary shall prohibit all motorized and mechanized vehicle use off road, except for emergency or authorized administrative purposes.

Lands and interests in lands within the proposed monument not owned by the United States shall be reserved as a part of the monument upon acquisition of title thereto by the United States.

The Secretary of the Interior shall manage the monument through the Bureau of Land Management, pursuant to applicable legal authorities, including the National Wild and Scenic Rivers Act, to implement the purposes of this proclamation.

Because waters of the Upper Missouri River through the monument area have already been reserved through the Congress's designation of the area as a component of the National Wild and Scenic River System in 1976, this proclamation makes no additional reservation of water, except in two small tributaries, the Judith River and Arrow Creek. These tributaries contain outstanding objects of biological interest that are dependent on water, such as a fully functioning cottonwood gallery forest ecosystem that is rare in the Northern Plains. Therefore, there is hereby reserved, as of the date of this proclamation and subject to valid existing rights, a quantity of water in the Judith River and Arrow Creek sufficient to fulfill the purposes for which this monument is established. Nothing in this reservation shall be construed as a relinquishment or reduction of any water use or rights reserved or appropriated by the United States on or before the date of this proclamation.

Nothing in this proclamation shall be deemed to enlarge or diminish the jurisdiction of the State of Montana with respect to fish and wildlife management.

Nothing in this proclamation shall be deemed to enlarge or diminish the rights of any Indian tribe.

Laws, regulations, and policies followed by the Bureau of Land Management in issuing and administering grazing permits or leases on all lands under its jurisdiction shall continue to apply with regard to the lands in the monument.

Nothing in this proclamation shall be deemed to revoke any existing withdrawal, reservation, or appropriation; however, the national monument shall be the dominant reservation.

Warning is hereby given to all unauthorized persons not to appropriate, injure, destroy, or remove any feature of this monument and not to locate or settle upon any of the lands thereof.

IN WITNESS WHEREOF, I have hereunto set my hand this seventeenth day of January, in the year of our Lord two thousand one, and of the Independence of the United States of America the two hundred and twenty-fifth.

Signed:

____ WILLIAM J. CLINTON