A GEOGRAPHIC INFORMATION SYSTEM DATA BASE FOR COAL AND WATER RESOURCES OF THE POWDER RIVER COAL REGION, SOUTHEASTERN MONTANA

By M.R. Cannon

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U.S. DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR., Secretary

U.S. GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information
write to:

District Chief
U.S. Geological Survey
428 Federal Building
301 South Park, Drawer 10076
Helena, MT 59626-0076

Copies of this report can
be purchased from:

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CONVERSION FACTORS

Multiply	By	To obtain
British Thermal Unit (BTU)	1,055	joule
cubic foot per second (ft^3/s)	0.028317	cubic meter per second
foot (ft)	0.3048	meter
gallon per minute	0.06309	liter per second
inch (in.)	25.4	millimeter
mile	1.609	kilometer
square mile	2.59	square kilometer
ton (short)	0.9072	megagram

Additional units of measure used in this report:

meq/L	milliequivalents per liter
mg/L	milligrams per liter
µS/cm	microsiemens per centimeter at 25 degrees Celsius

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--A geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called "Sea Level Datum of 1929."

Water year: The 12-month period October 1 through September 30. It is designated by the calendar year in which it ends.

A GEOGRAPHIC INFORMATION SYSTEM DATA BASE FOR COAL AND WATER RESOURCES OF THE POWDER RIVER COAL REGION, SOUTHEASTERN MONTANA

By

M.R. Cannon

ABSTRACT

A computerized data base was developed, using Geographic Information System technology, for the coal and water resources of the Powder River coal region of southeastern Montana--an area with coal reserves of about 39.7 billion tons and 1989 coal production of 37.5 millon tons. This report describes the data base and documents its layers. The data base was developed to assist agencies having responsibilities relating to coal evaluation, leasing, and management to more efficiently access, display, and analyze spatial data.

The data base currently contains the following 23 data themes or layers: abandoned mines, aquifers, alluvial valley floors, boundaries, climate, coal reserves and chemistry, coal stratigraphy, drainage basins, flood plains, geographic names, geology, hydrography, land survey, land use and land cover, permit sites, railroads, roads, saturated paste, streamflow, templates, utilities, water quality, and wells. Each layer contains documentation consisting of an index map showing the geographic extent of coverages in the layer, coverage documentation, source-map information (where data were digitized from maps), and attribute information for the listed coverages.

INTRODUCTION

Background

The Powder River coal region in southeastern Montana encompasses the northern part of the Powder River structural basin (fig. 1). The area contains known reserves of about 39.7 billion tons of strippable coal in 39 coal fields (Bergantino and others, 1980; Bergantino and Cole, 1981). Surface coal mines (strip mines) in the area produced 37.5 million tons of coal in 1989 (Montana Department of Labor and Industry, 1990).

The Powder River coal region has been the focus of many studies related to coal and water resources or to the effects of large-scale coal mining on the water resources. These studies, along with data-collection programs of Federal and State agencies and private companies, have produced a vast array of information on coal and water resources. Data from many sources commonly are used by the Montana Department of State Lands in evaluating the effects of coal mining on the environment and by the U.S. Bureau of Land Management in making coal-leasing decisions and in managing the Federal coal resources on a long-term basis.

Because the Montana Department of State Lands and the U.S. Bureau of Land Management frequently need to access, display, and analyze coal and water data, the agencies expressed an interest in developing a computerized data base using GIS (Geographic Information System) technology. With such a data base containing pertinent coal and water-resource data, those agencies could better analyze and interpret data for solving complex water-resources problems, as well as streamline the routine input, storage, and retrieval of the data. In response to these needs for analyzing coal and water-resources data, the U.S. Geological Survey, in cooperation with the Montana Department of State Lands and the U.S. Bureau of Land Management, developed a computerized data base using GIS technology for the Powder River coal region of southeastern Montana.

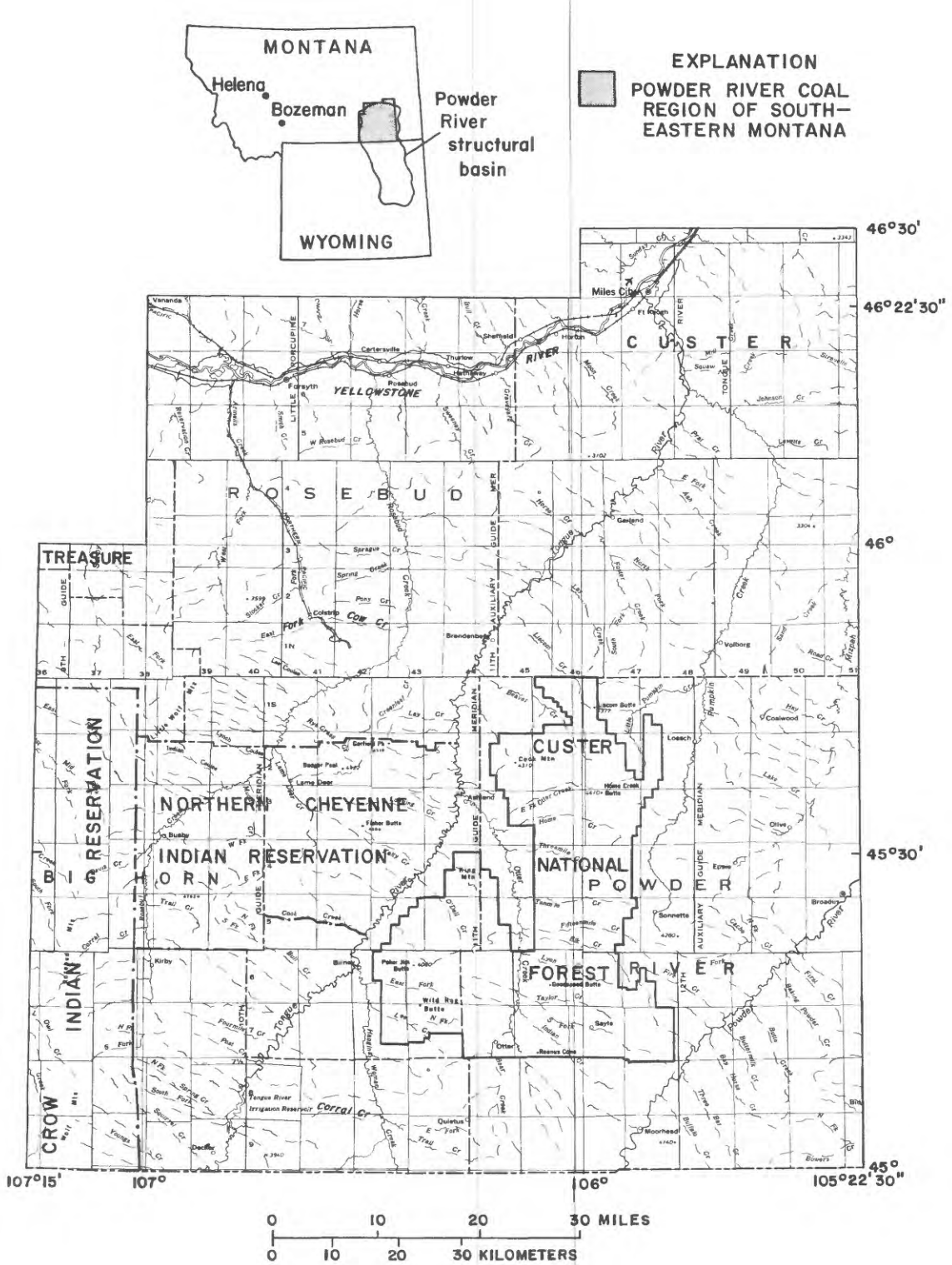

Figure 1.--Location of the study area.

Purpose and Scope

This report describes the GIS data base and documents the layers of the data base. Specific objectives for development of the data base were to: (1) enter coal and water-resource data that would be useful for evaluating cumulative hydrologic effects of coal mining in the region, and (2) document the contents of the data base, showing sources of data, scale of digitized maps, and data items contained within each digitized map.

Data for the 2-year project were obtained from the following agencies: Montana Bureau of Mines and Geology, Montana Department of Health and Environmental Sciences, Montana Department of State Lands, U.S. Bureau of Land Management, U.S. Geological Survey (Water Resources Division, National Mapping Division, and Geologic Division), U.S. Soil Conservation Service, and U.S. Office of Surface Mining Reclamation and Enforcement. Data also were obtained from published maps and documents.

GEOGRAPHIC INFORMATION SYSTEM

The GIS described in this report is ARC/INFO[1], which is proprietary software of Environmental Systems Research Institute, Inc. (ESRI) of Redlands, California. INFO, the relational data model used in ARC/INFO is a trademark of Henco Software, Inc. of Waltham, Massachusetts.

Description

A GIS is a spatial data base with a set of spatial operators (Morehouse, 1985). In general, a GIS performs functions of data input, management, analysis, and display. A spatial data base is derived from geographic information of a particular area, and the spatial data represent or model the geographic information. The spatial data base is analogous to a map, or a set of map overlays, wherein features of the map are represented by points, lines, or polygons (areas). Spatial operators, which are a collection of computer programs that operate in a given hardware environment, are used to manipulate the spatial data base.

In addition to being a spatial data base, a GIS can link several attributes to the spatial data. Attributes define the characteristics of the map features.

A vector-based GIS, such as ARC/INFO, can be used to digitally collect, manage, analyze, and display geographic data. ARC/INFO GIS is based on the concept that geographic information can be represented or modeled as a set of features having both locational and thematic data. Locational data describe the location and topology of point, line, and polygon features; thematic data describe the characteristics or attributes of these features. For example, point features such as wells can be represented by a latitude-longitude coordinate, and associated attributes could be well depth, depth to water, well yield, and geologic formation(s) penetrated by the well. Linear features such as roads can be represented by a series of latitude-longitude coordinates, and associated attributes could be road width, number of lanes, and route number.

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[1] The use of trade names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

Use

Although a GIS is useful for routine input, update, and output of digital map data, probably its most useful feature in scientific applications is the capability for complex spatial and attribute analysis. This capability makes the GIS an important tool for deriving new information or evaluating "what if" questions through interactive analysis of existing geographic information. Analysis capabilities of the GIS can provide solutions to questions such as "what areas of a proposed coal mine are within an alluvial valley floor and have a land use of cropland?" or "what volume of Anderson coal would be bypassed if the alluvial valley floor were not mined?"

Some of the functions in ARC/INFO for input, update, analysis, and output of geographic data are listed below (Environmental Systems Research Institute, Inc., 1987, 1989).

Input functions:
- digitize maps interactively,
- generate points and lines from coordinate files,
- convert U.S. Geological Survey DLG (Digital Line Graph) and GIRAS (Geographic Information Retrieval and Analysis System) files to ARC/INFO coverages,
- convert U.S. Bureau of the Census TIGER (Topologically Integrated Geographic Encoding and Referencing system) line files to ARC/INFO coverages,
- read text files into INFO feature attribute tables, and
- convert various types of GIS files into ARC/INFO coverages.

Update functions:
- create arc-node topology for line features and polygon topology for area features,
- add or delete items from INFO data files,
- update records in INFO data files,
- update features within a coverage using a cut-and-paste operation, and
- split a coverage into many coverages or join many coverages into a single coverage.

Analysis functions:
- clip and save coverage features that lie within the outer polygon of another coverage,
- create buffer zones of known radius around selected features,
- compute the geometric intersection of two coverages,
- compute the distance from each point in one coverage to nearest point or arc in another coverage,
- merge polygons having the same value for a specified item,
- select features based on a specified item,
- compute summary statistics for items in an INFO file,
- erase features in a coverage that overlap polygons in another coverage,
- relate data files on specified items, and
- change from one map projection to another.

Output functions:
- compose maps interactively; features from any number of maps can be selected and drawn on the basis of attribute values,
- send plot files to many different types of plotters or display devices,
- write spatial data and attributes to magnetic tape for input to other computers,
- create text file of X and Y coordinates from a coverage, and
- create text reports from INFO data files.

Terminology

Terms used in this report for describing the ARC/INFO GIS are defined below. For a more thorough description of ARC/INFO terminology, the reader can refer to the ARC/INFO users guide, volume 1 (Environmental Systems Research Institute, Inc., 1987, 1989).

Annotation: A secondary coverage feature used for labeling.

Arc: A primary coverage feature for representing linear features, the borders of polygons, or both. The location and shape of an arc are defined as a series of X,Y coordinates. Descriptive data about arcs are stored in an Arc Attribute Table (AAT), which is an INFO data file.

Coverage: The basic unit of storage in ARC/INFO. A coverage is analogous to a single map sheet or separation and generally describes one type of map feature such as streams, roads, or geology. A coverage contains both the locational data and the thematic attributes for map features in a given geographic area.

Coverage feature: A coverage may contain a number of features including arcs, nodes, label points, polygons, tics, and annotation. Each feature has a location; arcs and labels (for points or polygons) may have attributes that describe them.

Label point: A primary coverage feature that represents a point feature or that is used to assign user identifiers to polygons. The location of a label point is described by a single X,Y coordinate. Descriptive data about a label point are stored in a Point or Polygon Attribute Table (PAT), which is an INFO data file.

Layer: A logical collection of geographic features organized with a common data theme. Features from a typical U.S. Geological Survey topographic map can be organized into layers of roads, streams, land-survey lines, political boundaries, geographic names, and land-surface contour lines. A layer may contain many coverages, each having the same feature attributes, but different geographic areas.

Node: A primary coverage feature that represents arc endpoints and the location where line features connect. Node coordinates are stored as the beginning and ending points of each arc.

Polygon: A primary coverage feature for representing area features. A polygon is defined by the arcs that compose its border and by a label point located within the polygon. Descriptive data about a polygon are stored in a Polygon Attribute Table (PAT), which is an INFO data file.

Tic: A secondary coverage feature that is a registration or geographic control point for a coverage. Tics are used to register coverage features to a common coordinate system. Tic coordinates and identifiers are stored in the TIC file, which is an INFO data file.

Topology: A mathematical procedure for explicitly defining spatial relations of map features. Topology is used for defining areas and for representing connectivity and contiguity.

POWDER RIVER COAL REGION DATA BASE

Description of Data Base

The Powder River coal region data base contains information about the area bounded by latitudes 45° and 46° 30′ north and by longitudes 105° 22′ 30" and 107° 15′ west (fig. 1). These boundaries were chosen to include all coal-bearing areas within the Powder River structural basin in Montana.

Because of the large size of the study area, templates were used to divide the study area into 30 X 60 minute quadrangles or 7.5 X 7.5 minute quadrangles. The study area encompasses all or parts of eight 30 X 60 minute quadrangles (fig. 2) and 164 of the smaller 7.5 X 7.5 minute quadrangles (fig. 3).

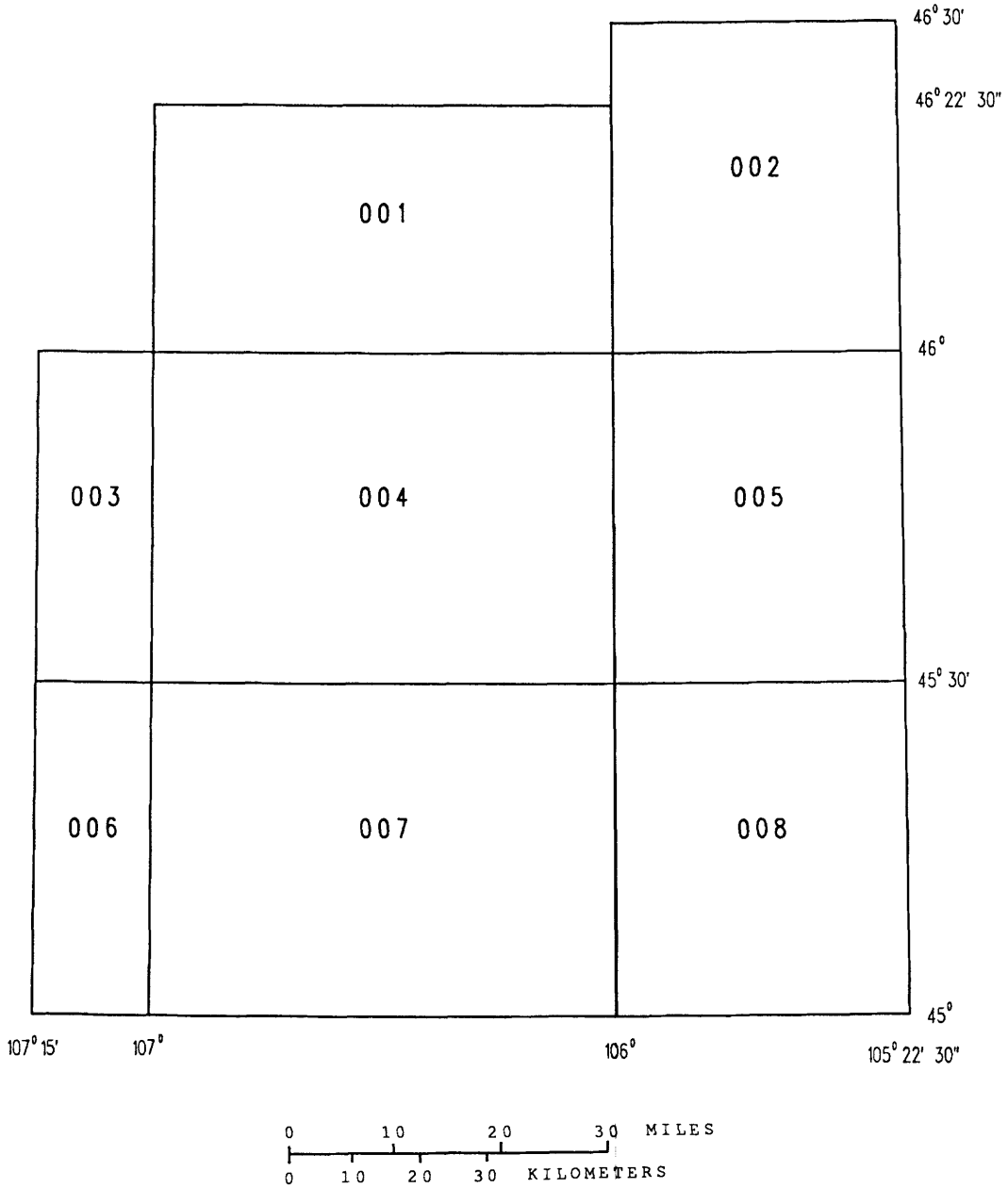

Figure 2.--Geographic extent of 30 X 60 minute quadrangles in the study area. Three-digit numerals are quadrangle numbers.

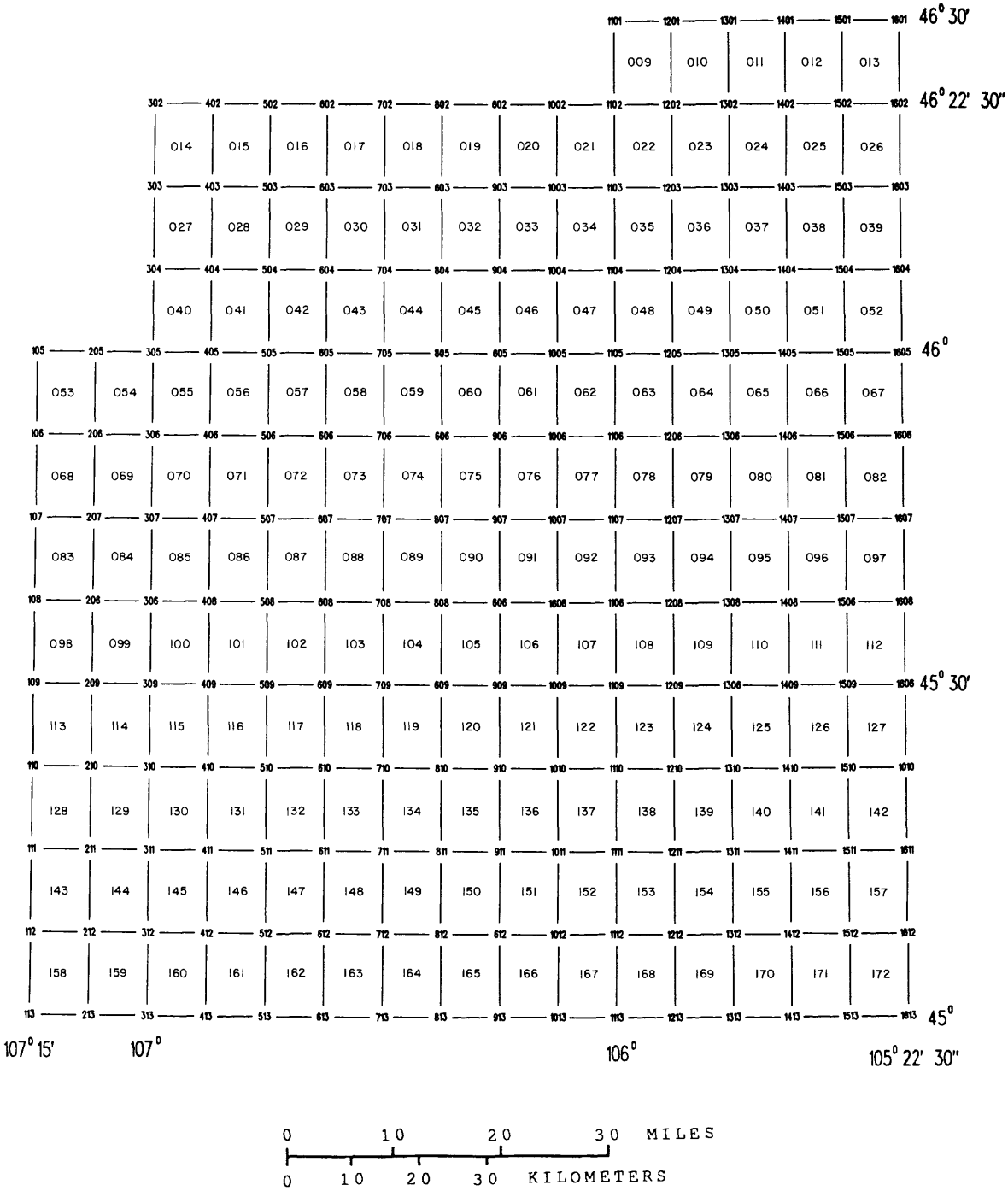

Figure 3.--Geographic extent of 7.5 X 7.5 minute quadrangles in the study area. Large 3-digit numerals are quadrangle numbers. Small 3- and 4-digit numerals are tic numbers.

A coverage-naming convention was devised using a seven-character code that uniquely identifies the data layer, feature type, and geographic extent of each coverage. The data-layer component of the coverage name consists of a three-letter abbreviation. The feature-type component is a 1-digit number--1 indicates a point coverage, 2 indicates a line coverage, and 3 indicates a polygon coverage (or polygons and lines in some coverages). The geographic-extent component of each coverage is a 3-digit number--numbers of 001 to 008 identify 30 X 60 minute quadrangles and numbers of 009 to 172 identify 7.5 X 7.5 minute quadrangles (figs. 2 and 3, table 1). Number 999 identifies the entire study area or all areas of available data. This naming convention was not strictly followed on some layers, such as aquifers and coal stratigraphy, because more detailed names were required to identify the coverage. For all layers, coverage names are given in the documentation and are listed in table 2. An example coverage name would be RDS2007, where RDS identifies the layer ROADS, 2 designates a line feature, and 007 indicates the Birney quadrangle. Thus, the name describes a line coverage of roads in the Birney 30 X 60 minute quadrangle.

All coverages in the data base are stored in UTM (Universal Transverse Mercator) zone 13 coordinates, which are in units of meters. Tics for registering coverages to the UTM coordinate system are located at the corners of all 7.5 X 7.5 minute quadrangles. The 192 tics are numbered using a column-row numbering system as shown in figure 3. Most coverages in the data base contain tics from this set of 192 tics.

Coverages in the data base are organized by layer. Each layer is a directory under the main directory PR.GIS, which represents the Powder River GIS. For example, the data layer coal reserves and chemistry (directory name COAL) contains eight coverages as sub-directories under the directory COAL. The organizational structure of the GIS data base is shown in figure 4.

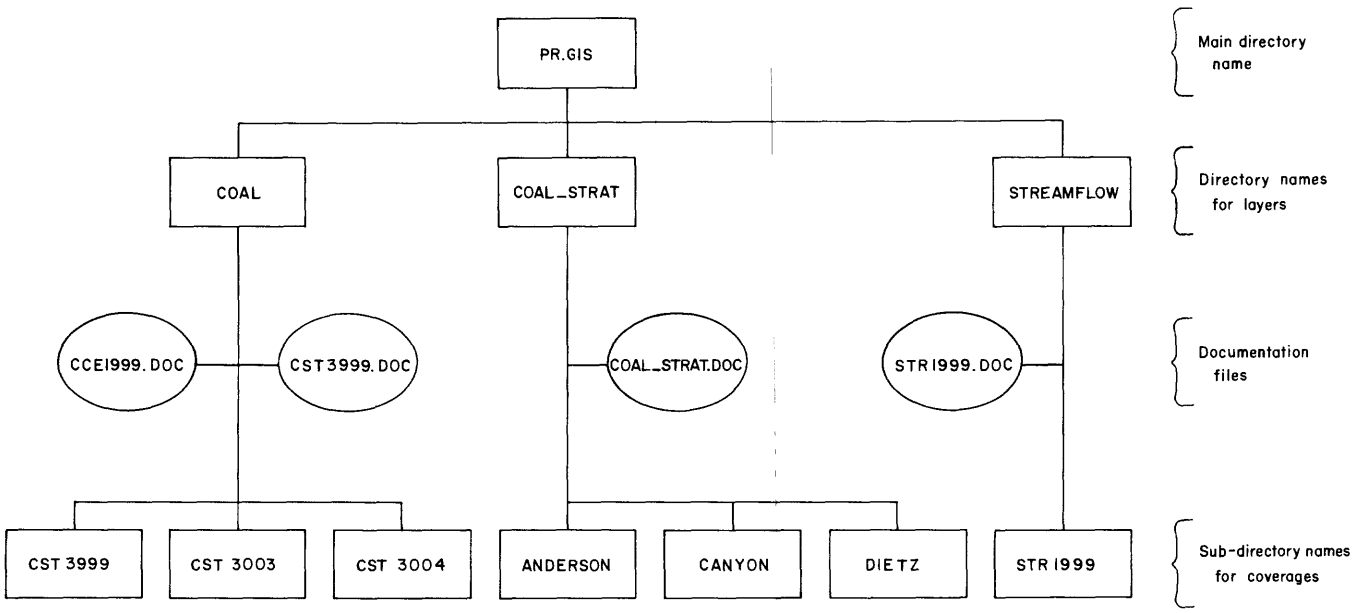

Figure 4.--Example organizational structure of the Powder River GIS data base. Diagram shows only selected coverages for each layer.

Table 1.--*Quadrangle names for 30 X 60 minute and 7.5 X 7.5 minute quadrangles in the Powder River coal region*

Quadrangle number	Quadrangle name	Quadrangle number	Quadrangle name
	30 X 60 minute quadrangles		
001	Forsyth	005	Powderville
002	Miles City	006	Lodge Grass
003	Hardin	007	Birney
004	Lame Deer	008	Broadus
	7.5 X 7.5 minute quadrangles		
009	Big Hill	055	McClure Creek
010	Miles City	056	Trail Creek School
011	Government Hill	057	Colstrip West
012	The Knob	058	Colstrip East
013	Buck Mountain	059	Hammond Draw NW
014	Finch	060	John Hen Creek
015	Nichols	061	Brandenberg NW
016	Forsyth	062	H S School
017	Orinoco	063	Fourmile Creek
018	Rosebud	064	Carey Malone School
019	Thurlow	065	Kirkpatrick Hill
020	Hathaway	066	Harris Buttes
021	Horton	067	Saddle Horse Butte
022	Lignite Creek	068	Iron Spring SW
023	Paddy Fay Creek	069	Wolf School
024	Whitney Creek	070	Sarpy School
025	Government Hill SE	071	Rough Draw
026	Locate SW	072	Colstrip SW
027	Griffin Coulee NW	073	Colstrip SE
028	Griffin Coulee NE	074	Hammond Draw SW
029	Smith Creek	075	Hammond Draw
030	Smith Creek NE	076	Brandenberg
031	Rosebud Buttes	077	Hayes Point
032	Indian Creek	078	North Stacey School
033	Miller Creek NW	079	Foster Creek School
034	Moon Creek School	080	Volborg
035	Jack Creek NW	081	Divide School
036	Circle L Creek	082	Witcher Reservoir
037	Horse Creek	083	Jeans Fork NW
038	First Creek	084	Jeans Fork NE
039	Loaf of Bread Butte	085	Chalky Point
040	Griffin Coulee SW	086	Black Spring
041	Griffin Coulee	087	Jimtown
042	Sheep Creek Camp	088	Badger Peak
043	McKerlich Creek	089	Garfield Peak
044	Mitchell Coulee	090	Ashland NE
045	Crain Place	091	Cook Creek Reservoir
046	Miller Creek SW	092	Beaver Creek School
047	Miller Creek	093	Stacey
048	Garland School	094	Elk Ridge
049	Jack Creek	095	Box Elder Creek
050	Beebe SW	096	Coalwood
051	Beebe	097	Johnnie Creek
052	Miles City Creek	098	Jeans Fork SW
053	Iron Spring	099	Jeans Fork SE
054	Minnehaha Creek South	100	Busby

Table 1.--*Quadrangle names for 30 X 60 minute and 7.5 X 7.5 minute quadrangles in the Powder River coal region*--Continued

Quadrangle number	Quadrangle name	Quadrangle number	Quadrangle name
	7.5 X 7.5 minute quadrangles		
101	Painted Hill	137	Goodspeed Butte
102	Lame Deer	138	Phillips Butte
103	Fisher Butte	139	Hodson Flats
104	Hollowwood Creek	140	Yarger Butte
105	Ashland	141	Lonesome Peak
106	Willow Crossing	142	Eldon Mountain
107	Coleman Draw	143	Kid Creek
108	Home Creek Butte	144	Bar V Ranch NE
109	Samuelson Ranch	145	Half Moon Hill
110	Leslie Creek	146	Tongue River Dam
111	Olive	147	Spring Gulch
112	Moonlight Creek	148	Lacey Gulch
113	Thompson Creek NW	149	Stroud Creek
114	Thompson Creek	150	Hamilton Draw
115	Birdseye Spring	151	Otter
116	Bull Creek Lookout	152	Reanus Cone
117	Cook Creek Butte	153	Sayle
118	Clubfoot Creek	154	Bloom Creek
119	Birney Day School	155	Huckins School
120	Green Creek	156	Baldy Peak
121	King Mountain	157	Bear Skull Mountain
122	Yager Butte	158	Little Bear Creek
123	Threemile Buttes	159	Bar V Ranch
124	Sonnette	160	Pearl School
125	Epsie	161	Decker
126	Epsie NE	162	Holmes Ranch
127	Broadus	163	Pine Butte School
128	Wolf Mountain Lookout	164	Forks Ranch
129	Spring Creek Ranch	165	Quietus
130	Kirby	166	Bear Creek School
131	Taintor Desert	167	Sayle Hall
132	Birney SW	168	Bradshaw Creek
133	Birney	169	Moorhead
134	Browns Mountain	170	Three Bar Ranch
135	Poker Jim Butte	171	Bay Horse
136	Fort Howes	172	Wild Bill Creek

Table 2.--*Description of coverages contained in the Powder River coal region GIS data base*

Directory name of data layer	Coverage name	Feature type	Description
ABANDONED_MINES	AML1999	Point	Abandoned mine land
AQUIFERS	AQB2FXH	Line	Configuration of base of Fox Hills-Hell Creek aquifer
AQUIFERS	AQB2TLK	Line	Configuration of base of Tullock aquifer
AQUIFERS	AQB2TRW	Line	Configuration of base of Tongue River-Wasatch aquifer
AQUIFERS	AQT2FXH	Line	Thickness of Fox Hills-Hell Creek aquifer
AQUIFERS	AQT2TLK	Line	Thickness of Tullock aquifer
AQUIFERS	AQT2TRW	Line	Thickness of Tongue River-Wasatch aquifer
AVF	AVF3999	Polygon	Potential alluvial valley floor
AVF	AVF3ARM	Polygon	Designated alluvial valley floor of East Fork Armells Creek
AVF	AVF3MNT	Polygon	Designated alluvial valley floor at proposed MONTCO mine
AVF	AVF3OTR	Polygon	Designated alluvial valley floor of Otter Creek
AVF	AVF3SPR	Polygon	Designated insignificant alluvial valley floor of South Fork Spring Creek
AVF	AVF3SQR	Polygon	Designated alluvial valley floor of Squirrel Creek
AVF	AVF3TRV	Polygon	Designated alluvial valley floor of Tongue River valley (Nance/Brown)
BOUNDARIES	BND3999	Polygon	County, national forest, and Indian reservation boundaries
CLIMATE	CLP1999	Point	Precipitation station data
CLIMATE	CLP2999	Line	Lines of equal precipitation
COAL	CST3999	Polygon	Area of strippable coal
COAL	CST3003	Polygon	Area of strippable coal
COAL	CST3004	Polygon	Area of strippable coal
COAL	CST3005	Polygon	Area of strippable coal
COAL	CST3006	Polygon	Area of strippable coal
COAL	CST3007	Polygon	Area of strippable coal
COAL	CST3008	Polygon	Area of strippable coal
COAL	CCE1999	Point	Coal ash, sulfur, and BTU data
COAL_STRAT	ANDERSON	Point	Stratigraphic data from drill holes and outcrops
COAL_STRAT	CANYON	Point	Stratigraphic data from drill holes and outcrops
COAL_STRAT	COOK	Point	Stratigraphic data from drill holes and outcrops
COAL_STRAT	DIETZ	Point	Stratigraphic data from drill holes and outcrops
COAL_STRAT	KNOBLOCH	Point	Stratigraphic data from drill holes and outcrops
COAL_STRAT	ROLAND	Point	Stratigraphic data from drill holes and outcrops
COAL_STRAT	ROSEBUD	Point	Stratigraphic data from drill holes and outcrops
COAL_STRAT	SAWYER	Point	Stratigraphic data from drill holes and outcrops
COAL_STRAT	WALL	Point	Stratigraphic data from drill holes and outcrops
DRAINAGE_BASINS	DRB3999	Polygon	Outline of major basins

Table 2.--*Description of coverages contained in the Powder River coal region GIS data base*--Continued

Directory name of data layer	Coverage name	Feature type	Description
DRAINAGE_BASINS	DRB2999	Line	Outline of major basins
FLOOD_PLAINS	FLD3001	Polygon	Area of 100-year flood
FLOOD_PLAINS	FLD3002	Polygon	Area of 100-year flood
FLOOD_PLAINS	FLD3003	Polygon	Area of 100-year flood
FLOOD_PLAINS	FLD3004	Polygon	Area of 100-year flood
FLOOD_PLAINS	FLD3005	Polygon	Area of 100-year flood
FLOOD_PLAINS	FLD3007	Polygon	Area of 100-year flood
FLOOD_PLAINS	FLD3008	Polygon	Area of 100-year flood
FLOOD_PLAINS	FLD3999	Polygon	Area of 100-year flood
GEOGRAPHIC_NAMES	GNS1999	Point	Geographic names
GEOLOGY	GLG3999	Polygon	Bedrock geology
GEOLOGY	GLG2999	Line	Fault lines
HYDROGRAPHY	HYD3001	Polygon, Line	Lakes, ponds, reservoirs, and streams
HYDROGRAPHY	HYD3002	Polygon, Line	Lakes, ponds, reservoirs, and streams
HYDROGRAPHY	HYD3003	Polygon, Line	Lakes, ponds, reservoirs, and streams
HYDROGRAPH	HYD3004	Polygon, Line	Lakes, ponds, reservoirs, and streams
HYDROGRAPHY	HYD3005	Polygon, Line	Lakes, ponds, reservoirs, and streams
HYDROGRAPHY	HDY3006	Polygon, Line	Lakes, ponds, reservoirs, and streams
HYDROGRAPHY	HYD3007	Polygon, Line	Lakes, ponds, reservoirs, and streams
HYDROGRAPHY	HYD3008	Polygon, Line	Lakes, ponds, reservoirs, and streams
LAND_SURVEY	PLS3033	Polygon	Public land survey of township, range, and section
LAND_SURVEY	PLS3034	Polygon	Public land survey of township, range, and section
LAND_SURVEY	PLS3040	Polygon	Public land survey of township, range, and section
(the LAND_SURVEY layer contains another 128 coverages)			
LAND_USE	LUC3002	Polygon	Land use and land cover
LAND_USE	LUC3003	Polygon	Land use and land cover
LAND_USE	LUC3004	Polygon	Land use and land cover
LAND_USE	LUC3005	Polygon	Land use and land cover
LAND_USE	LUC3006	Polygon	Land use and land cover
LAND_USE	LUC3007	Polygon	Land use and land cover
LAND_USE	LUC3008	Polygon	Land use and land cover
PERMIT_SITES	MPD1999	Point	MPDES[1] permit sites for all active coal mines
RAILROADS	RRD2999	Line	Railroads
ROADS	RDS2001	Line	Roads and trails
ROADS	RDS2002	Line	Roads and trails
ROADS	RDS2003	Line	Roads and trails
ROADS	RDS2004	Line	Roads and trails
ROADS	RDS2005	Line	Roads and trails
ROADS	RDS2006	Line	Roads and trails
ROADS	RDS2007	Line	Roads and trails
ROADS	RDS2008	Line	Roads and trails
SAT_PASTE	SPE1999	Point	Saturated-paste extracts from first coal overburden
SAT_PASTE	SPE1999.2	Point	Saturated-paste extracts from second coal overburden

Table 2.--*Description of coverages contained in the Powder River coal region GIS data base*--Continued

Directory name of data layer	Coverage name	Feature type	Description
SAT_PASTE	SPE1999.3	Point	Saturated-paste extracts from third coal overburden
STREAMFLOW	STR1999	Point	Flow statistics and data from streamflow-gaging stations
TEMPLATES	CUSTER_NF	Polygon	Outline of Custer National Forest
TEMPLATES	QUADS_24K	Polygon	Quadrangle outlines for 7.5 X 7.5 minute quadrangles
TEMPLATES	QUADS_100K	Polygon	Quadrangle outlines for 30 X 60 minute quadrangles
UTILITIES	UTL2999	Line	Pipelines, powerlines, and landing strips
WATER_QUALITY	QWS1999	Point	Quality of surface water
WATER_QUALITY	QWW1999	Point	Quality of ground water
WELLS	WLS1999	Point	Well construction, water levels, and well discharge

[1] Montana Pollutant Discharge Elimination System

Documentation of Data Layers

The Powder River coal region data base currently (1990) has 23 layers, or data themes. For each layer, this report contains a map of the study area showing the geographic extent of coverages in the layer, coverage documentation, source-map information (where data were digitized from maps), and attribute information for the listed coverages.

The coverage documentation identifies the data layer, coverage name(s) within the layer, coverage units, coverage projection, feature type, geographic extent, source of data, and data vintage. Documentation for each coverage is maintained as a computer file in the layer directory containing the coverages (see fig. 4). Documentation files have the identification "covername.DOC," where covername is the name of a coverage.

Source-map information is documented where data were digitized from maps. Source-map information consists of map type, scale of original map, scale of digitized map, map medium (such as paper or mylar), and map projection.

Attribute information consists of the INFO item description from the Point Attribute Table (PAT), Arc Attribute Table (AAT), or Polygon Attribute Table (PAT). The INFO item description lists the starting column (COL) for the item, the ITEM NAME, the field width (WDTH), the output width (OPUT), the item type (TYP), the number of decimals for numeric items (N.DEC), and a DESCRIPTION for all user-defined attributes. Valid item types for the TYP column are: B = binary; C = character; D = date; F = floating; I = integer; N = number with decimal. No DESCRIPTION is given for default items, which are common to all AAT or PAT files. For a full explanation of these items, the reader can consult the ARC/INFO users guides (Environmental Systems Research Institute, Inc., 1987, 1989).

With the INFO data structure used in the attribute tables, a value of zero and a null value for a numeric item cannot be conveniently distinguished. For example, in the well coverage, a value of zero for the item DEPTH indicates a missing value for well depth. To work around this limitation within INFO, some users insert an arbitrary constant of -99999 to represent a null value. In the Powder River coal region data base, an attempt was made to substitute -99999 for all null values in numeric fields. The documentation shows which numeric fields contain -99999 to indicate null values.

Abandoned Mines

The abandoned mines (directory name ABANDONED_MINES) layer contains information on the location, name, and status of abandoned coal mine sites. The geographic extent of this information is shown in figure 5, and the documentation is given in table 3.

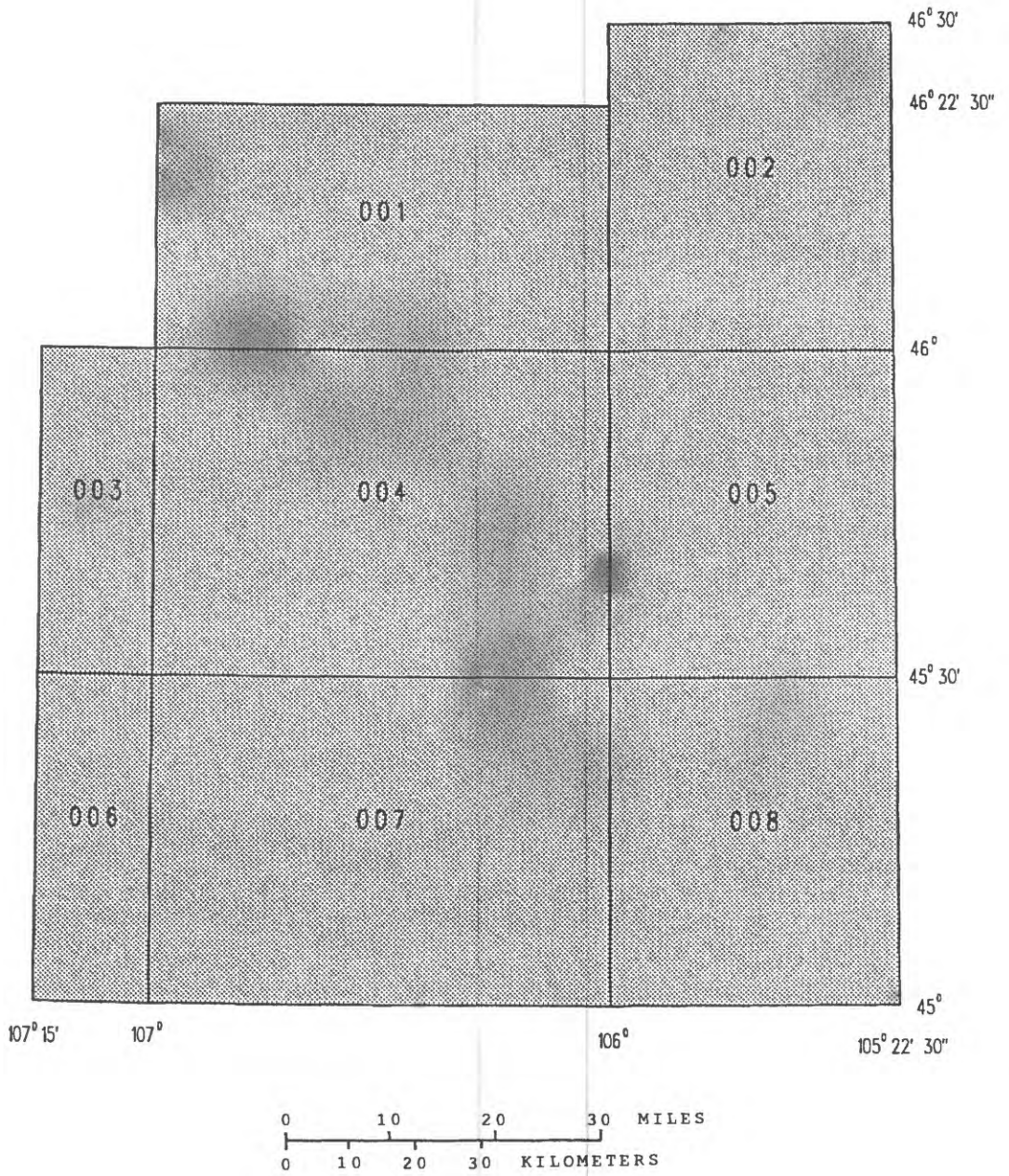

Figure 5.--Geographic extent of information for data layer: abandoned mines (directory name ABANDONED_MINES). Numbers identify 30 X 60 minute quadrangles.

Table 3.--*Documentation for the data layer: abandoned mines (directory name ABANDONED_MINES)*

COVERAGE DOCUMENTATION

DATA LAYER:	ABANDONED_MINES
COVERAGE NAME(S):	AML1999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Point
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	Montana Department of State Lands, Abandoned Mine Reclamation Bureau, Helena, Montana. Data were obtained in electronic format on a personal computer disk.
DATA VINTAGE:	Obtained May 1990 from latest update of Montana Department of State Lands data on abandoned mine lands.

ATTRIBUTE INFORMATION

DATAFILE NAME: AML1999.PAT
13 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	AML1999#	4	5	B	-	
13	AML1999-ID	4	5	B	-	
17	COUNTY	15	15	C	-	Name of county or Indian reservation
32	LOCATION	28	28	C	-	Township, range, section, and quarter section of mine
60	A5	6	6	C	-	Mine code
66	HISTORICAL-NAME	20	20	C	-	Historical name of site
86	STATUS	15	15	C	-	Status of mine site
101	QUADNAME	25	25	C	-	Name of U.S. Geological Survey quadrangle where mine is located
126	MINETYPE	1	1	C	-	Type of mine (U=underground; S=surface; B=both underground and surface; F=mine fire; ?=unknown)
127	DATA-SOURCE	10	10	C	-	Source of data
137	NOTES	30	30	C	-	Notes

Note: Some mine sites may not be accurately located; latitude and longitude for each site were computed from the township, range, section, and quarter section. Also, for large mines, the location is for an arbitrary point somewhere within the mine.

Aquifers

The aquifers (directory name AQUIFERS) layer contains information on the configuration of the base and thickness of three regional aquifers--the Fox Hills-Hell Creek aquifer, the Tullock aquifer, and the Tongue River-Wasatch aquifer. The geographic extent of this information is shown in figure 6, and the documentation is given in tables 4 and 5.

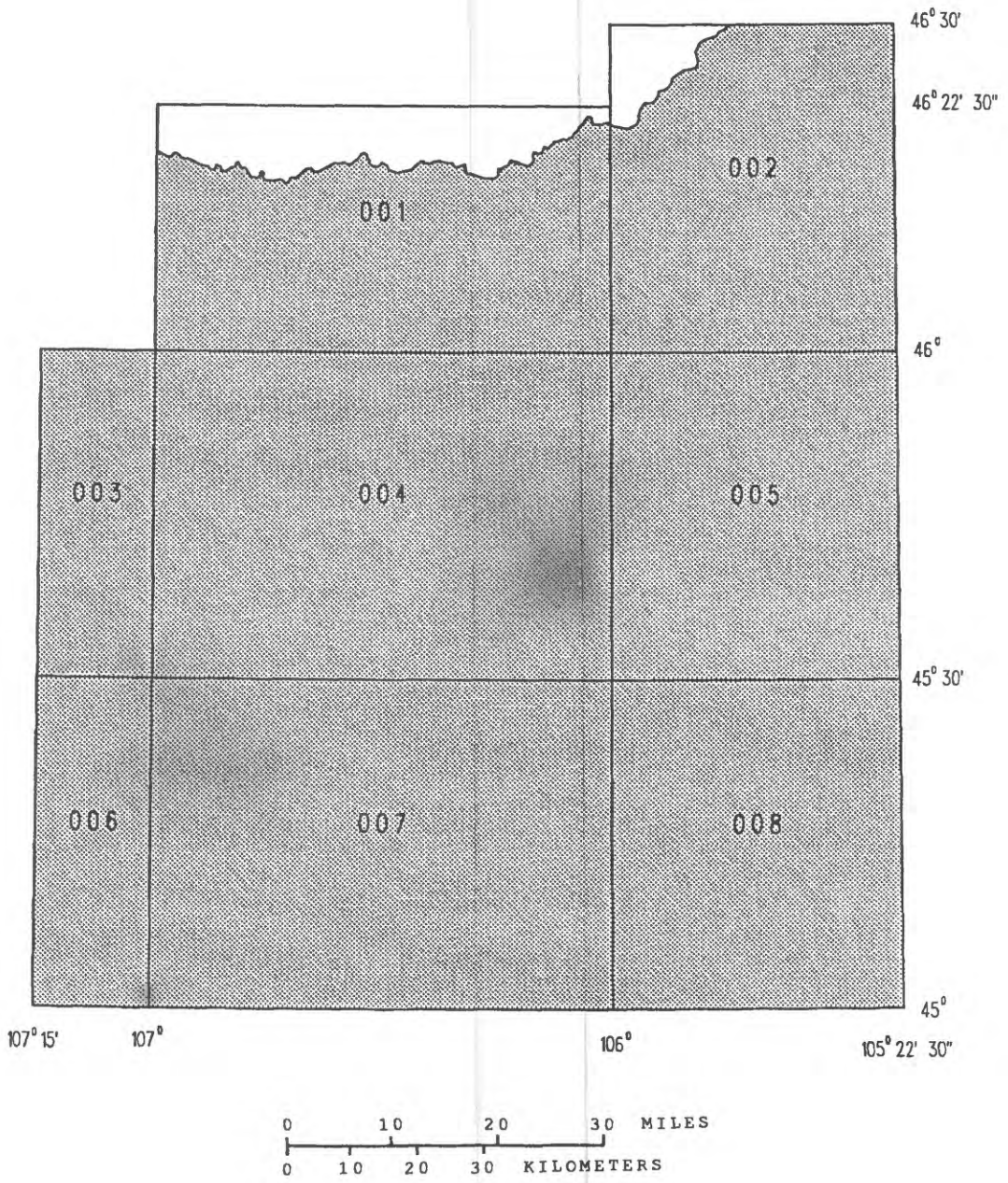

Figure 6.--Geographic extent of information for data layer: aquifers (directory name AQUIFERS). Numbers identify 30 X 60 minute quadrangles.

Table 4.--*Documentation for the data layer: aquifers (directory name AQUIFERS), coverages AQB2FXH, AQB2TLK, and AQB2TRW*

COVERAGE DOCUMENTATION

DATA LAYER:	AQUIFERS (configuration of base of aquifers)
COVERAGE NAME(S):	AQB2FXH, AQB2TLK, and AQB2TRW (see note)
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Line
GEOGRAPHIC EXTENT:	Entire area south of Yellowstone River
SOURCE OF DATA:	Lewis, B.D., and Hotchkiss, W.R., 1981, Thickness, percent sand, and configuration of shallow hydrogeologic units in the Powder River Basin, Montana and Wyoming: U.S. Geological Survey Miscellaneous Investigations Map I-1317, scale 1:1,000,000, 6 sheets.
DATA VINTAGE:	1981

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:1,000,000 (reduced from 1:500,000 base)
MAP SCALE-digitized:	1:1,000,000
MAP MEDIUM:	Mylar
MAP PROJECTION:	Lambert conformal conic

ATTRIBUTE INFORMATION

DATAFILE NAME: AQB2FXH.AAT
8 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	FNODE#	4	5	B	-	
5	TNODE#	4	5	B	-	
9	LPOLY#	4	5	B	-	
13	RPOLY#	4	5	B	-	
17	LENGTH	4	12	F	3	
21	AQB2FXH#	4	5	B	-	
25	AQB2FXH-ID	4	5	B	-	
29	ALTITUDE	5	5	N	0	Altitude of base of aquifer (feet above sea level)

Note: Coverage name indicates the regional aquifer. Coverage AQB2FXH is Fox Hills-Hell Creek aquifer (in Upper Cretaceous Fox Hills Sandstone and Hell Creek Formation), coverage AQB2TLK is Tullock aquifer (in Paleocene Tullock Member of Fort Union Formation), and coverage AQB2TRW is Tongue River-Wasatch aquifer (in Paleocene Tongue River Member of Fort Union Formation, and Paleocene-Eocene Wasatch Formation).

Table 5.--*Documentation for the data layer: aquifers (directory name AQUIFERS), coverages AQT2FXH, AQT2TLK, and AQT2TRW*

COVERAGE DOCUMENTATION

DATA LAYER:	AQUIFERS (thickness of aquifers)
COVERAGE NAME(S):	AQT2FXH, AQT2TLK, and AQT2TRW (see note)
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Line
GEOGRAPHIC EXTENT:	Entire area south of Yellowstone River
SOURCE OF DATA:	Lewis, B.D., and Hotchkiss, W.R., 1981, Thickness, percent sand, and configuration of shallow hydrogeologic units in the Powder River Basin, Montana and Wyoming: U.S. Geological Survey Miscellaneous Investigations Map I-1317, scale 1:1,000,000, 6 sheets.
DATA VINTAGE:	1981

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:1,000,000 (reduced from 1:500,000 base)
MAP SCALE-digitized:	1:1,000,000
MAP MEDIUM:	Mylar
MAP PROJECTION:	Lambert conformal conic

ATTRIBUTE INFORMATION

DATAFILE NAME: AQT2FXH.AAT
8 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	FNODE#	4	5	B	-	
5	TNODE#	4	5	B	-	
9	LPOLY#	4	5	B	-	
13	RPOLY#	4	5	B	-	
17	LENGTH	4	12	F	3	
21	AQT2FXH#	4	5	B	-	
25	AQT2FXH-ID	4	5	B	-	
29	THICKNESS	5	5	N	0	Thickness of aquifer (feet)

Note: Coverage name indicates the regional aquifer. Coverage AQT2FXH is Fox Hills-Hell Creek aquifer (in Upper Cretaceous Fox Hills Sandstone and Hell Creek Formation), coverage AQT2TLK is Tullock aquifer (in Paleocene Tullock Member of Fort Union Formation), and coverage AQT2TRW is Tongue River-Wasatch aquifer (in Paleocene Tongue River Member of Fort Union Formation, and Paleocene-Eocene Wasatch Formation).

Alluvial Valley Floors

The alluvial valley floors (directory name AVF) layer contains information on both potential and designated alluvial valley floors. Coverage AVF3999 contains all areas mapped as potential alluvial valley floors. Coverages AVF3ARM, AVF3MNT, AVF3OTR, AVF3SPR, AVF3SQR, and AVF3TRV each delineate areas of designated alluvial valley floors, as determined by the Montana Department of State Lands. The geographic extent of this information is shown in figure 7, and the documentation is given in tables 6-12.

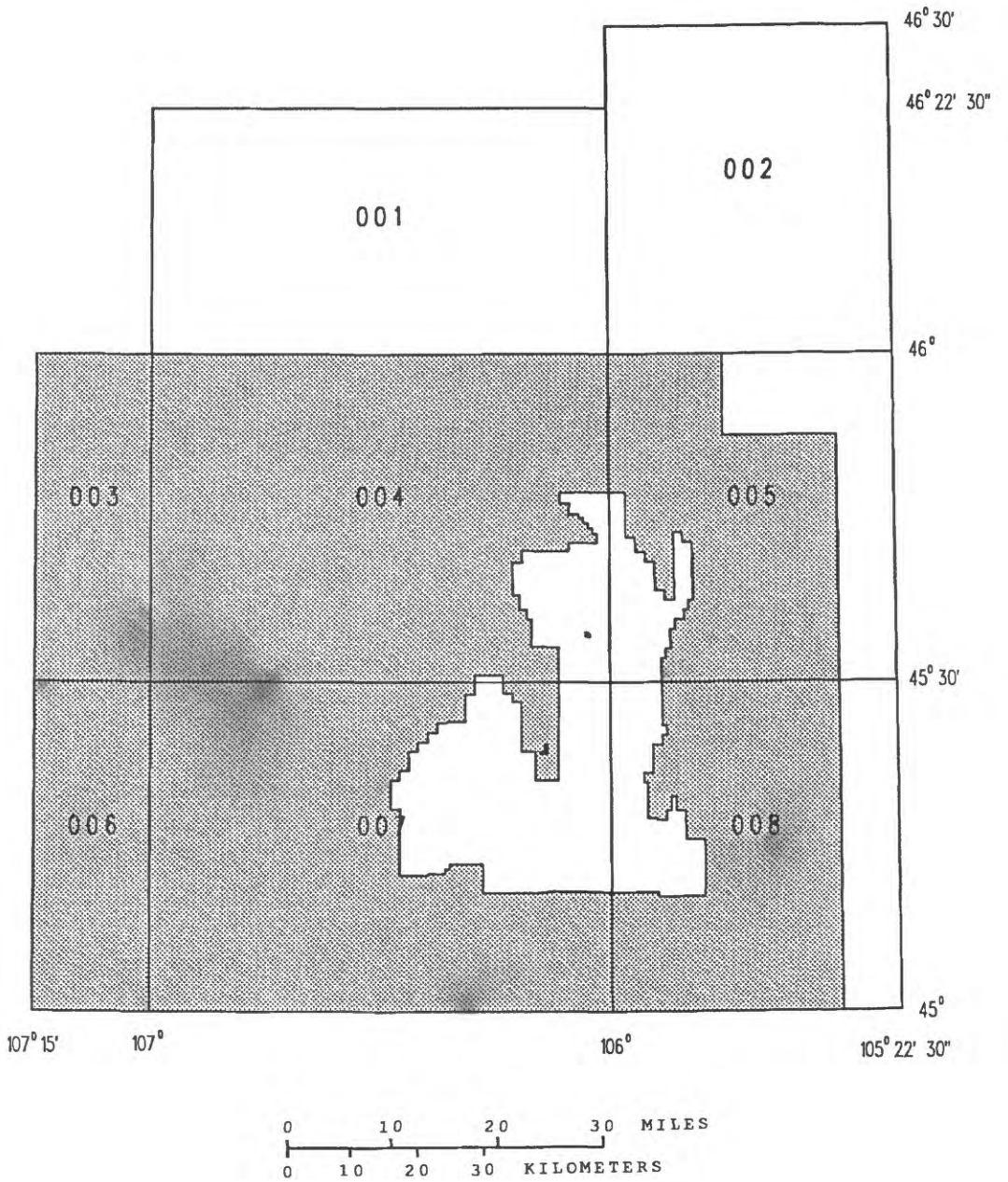

Figure 7.--Geographic extent of information for data layer: alluvial valley floors (directory name AVF). Numbers identify 30 X 60 minute quadrangles.

Table 6.--*Documentation for the data layer: alluvial valley floors (directory name AVF), coverage AVF3999*

COVERAGE DOCUMENTATION

DATA LAYER:	AVF (potential alluvial valley floor)
COVERAGE NAME(S):	AVF3999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	Quadrangles 003 through 008 (not available for 001 and 002)
SOURCE OF DATA:	U.S. Office of Surface Mining Reclamation and Enforcement, 1985, Reconnaissance maps to assist in identifying alluvial valley floors, Powder River Basin, Montana and Wyoming: U.S. Office of Surface Mining Reclamation and Enforcement Report OSM/TM-1/85, 42 p., 11 pl., scale 1:100,000.
DATA VINTAGE:	Mapping by Earth Resource Associates, Helena, Montana, 1982-83.

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:100,000
MAP SCALE-digitized:	1:100,000
MAP MEDIUM:	Paper
MAP PROJECTION:	Universal Transverse Mercator zone 13

ATTRIBUTE INFORMATION

DATAFILE NAME: AVF3999.PAT
5 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	AVF3999#	4	5	B	-	
13	AVF3999-ID	4	5	B	-	
17	AVF-CODE	1	1	I	-	Code of 1 indicates area of AVF

Note: The potential AVF areas on the original maps were subdivided into four map units: (1) surface irrigated sites with dependable water supply, (2) surface irrigated sites with undependable water supply, (3) subirrigated sites, and (4) potentially irrigable sites. The digitized maps show all potential AVF areas as one map unit instead of the separate units.

Table 7.--*Documentation for the data layer: alluvial valley floors, (directory name AVF), coverage AVF3ARM*

COVERAGE DOCUMENTATION

DATA LAYER:	AVF (designated alluvial valley floor)
COVERAGE NAME(S):	AVF3ARM (East Fork Armells Creek between Stocker Creek and Corral Creek)
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	Quadrangle 057
SOURCE OF DATA:	Hydrometrics, 1983, Hydrologic resource reports volume III--Reconnaissance level alluvial valley floor investigations, Western Energy Company, Colstrip, Montana. Digitized from: Exhibit 1 (sheet 1 of 2)--Delineation of alluvial aquifer and terrace levels along lower East Fork Armells, lower Stocker, Spring, Pony, and Cow Creeks. Map obtained from Montana Department of State Lands files, Helena, Montana.
DATA VINTAGE:	Map drawn October 24, 1983.

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:24,000
MAP SCALE-digitized:	1:24,000
MAP MEDIUM:	Paper (blueline print; good fit to mylar base map of area)
MAP PROJECTION:	Lambert conformal conic

ATTRIBUTE INFORMATION

DATAFILE NAME: AVF_ARM.PAT
6 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	AVF_ARM#	4	5	B	-	
13	AVF_ARM-ID	4	5	B	-	
17	AVF-CODE	1	1	I	-	Code of 1 indicates area of AVF (boundary of AVF drawn to include terraces 1, 2, and 3)
18	MAP-UNIT	30	30	C	-	Map unit from map explanation. Map unit indicates the name of the alluvial terraces in the AVF.

Table 8.--*Documentation for the data layer: alluvial valley floors (directory name AVF), coverage AVF3MNT*

COVERAGE DOCUMENTATION

DATA LAYER:	AVF (designated alluvial valley floor)
COVERAGE NAME(S):	AVF3MNT (MONTCO mine application, Tongue River valley)
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	Quadrangles 105, 119, and 120
SOURCE OF DATA:	MONTCO, 1981, Revised application for a surface mining permit; North King Mining Unit. Digitized from: Map C-1 (sheets 1, 2, 3, and supplement), Valley floor geomorphology, drawn September 1980. Map obtained from Montana Department of State Lands files, Helena, Montana.
DATA VINTAGE:	Map drawn September 1980.

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:4,800
MAP SCALE-digitized:	1;4,800
MAP MEDIUM:	Paper
MAP PROJECTION:	Unknown (transformed into Universal Transverse Mercator zone 13 with minimal error in positional accuracy).

ATTRIBUTE INFORMATION

DATAFILE NAME: AVF_MNT.PAT
6 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	AVF_MNT#	4	5	B	-	
13	AVF_MNT-ID	4	5	B	-	
17	AVF-CODE	1	1	I	-	Code of 1 indicates area of AVF (boundary of AVF drawn to include areas of subirrigation, T2 and T3 terraces, and alluvial fans and alluvial fan-remnants adjacent to subirrigated lands as shown on Map C-1)
18	SUBIRR-CODE	1	1	I	-	Subirrigated areas as shown on Map C-1 have a code of 1.

Note: This coverage shows all AVF areas shown on Map C-1. The Montana Department of State Lands has designated part of the area on Map C-1, in secs. 5, 7, 8, and 18, T. 4 S., R. 44 E., as an alluvial valley floor (Montana Department of State Lands; Alluvial Valley Decision Document for a portion of the Tongue River in the vicinity of MONTCO's proposed North King Mine, April 1, 1982.)

Table 9.--*Documentation for the data layer: alluvial valley floors (directory name AVF), coverage AVF3OTR*

COVERAGE DOCUMENTATION

DATA LAYER:	AVF (designated alluvial valley floor)
COVERAGE NAME(S):	AVF3OTR (Otter Creek)
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	Quadrangle 136
SOURCE OF DATA:	Petition from Michael J. Moses, October 4, 1984, for a declaratory ruling on part of the Otter Creek valley in secs. 6 and 7, T. 6 S., R. 46 E. Map obtained from Montana Department of State Lands files, Helena, Montana.
DATA VINTAGE:	Ruling made September 1985.

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:24,000
MAP SCALE-digitized:	1:24,000
MAP MEDIUM:	Paper
MAP PROJECTION:	Polyconic

ATTRIBUTE INFORMATION

DATAFILE NAME: AVF_OTR.PAT
5 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	AVF_OTR#	4	5	B	-	
13	AVF_OTR-ID	4	5	B	-	
17	AVF-CODE	1	1	I	-	Code of 1 indicates area of AVF (boundary of AVF drawn on section lines and fence lines)

Table 10.--*Documentation for the data layer: alluvial valley floors (directory name AVF), coverage AVF3SPR*

COVERAGE DOCUMENTATION

DATA LAYER:	AVF (designated insignificant alluvial valley floor)
COVERAGE NAME(S):	AVF3SPR (South Fork Spring Creek)
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	Quadrangles 160 and 161
SOURCE OF DATA:	Woodward-Clyde Consultants, 1980; Alluvial valley floor identification report, Spring Creek Mine, Big Horn County, Montana. Digitized from: Figure III-3, Geomorphic features map. Map obtained from Montana Department of State Lands files, Helena, Montana.
DATA VINTAGE:	Map drawn November 28, 1979.

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:4,800
MAP SCALE-digitized:	1:4,800
MAP MEDIUM:	Paper
MAP PROJECTION:	Unknown (transformed into Universal Transverse Mercator zone 13 with minimal error in positional accuracy)

ATTRIBUTE INFORMATION

DATAFILE NAME: AVF_SPR.PAT

6 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	AVF_SPR#	4	5	B	-	
13	AVF_SPR-ID	4	5	B	-	
17	AVF-CODE	1	1	I	-	Code of 1 indicates area of AVF (boundary of AVF includes terraces, alluvial fans, and stream channels through the terraces and fans)
18	MAP-UNIT	30	30	C	-	Map unit from explanation of geomorphic features map.

Table 11.--*Documentation for the data layer: alluvial valley floors (directory name AVF), coverage AVF3SQR*

COVERAGE DOCUMENTATION

DATA LAYER:	AVF (designated alluvial valley floor)
COVERAGE NAME(S):	AVF3SQR (Squirrel Creek)
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	Quadrangle 161
SOURCE OF DATA:	Hydrometrics, 1981, Final Report--Baseline hydrological investigaton for proposed CX Ranch Mine. Digitized from: Exhibit 1--Consolidation Coal Company CX Ranch Mine, Squirrel Creek alluvial isopach map, drawn July 8, 1980; revised March 3, 1981, December 16, 1982, and April 8, 1983. Map obtained from Montana Department of State Lands files, Helena, Montana.
DATA VINTAGE:	Map revised April 8, 1983.

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:4,800
MAP SCALE-digitized:	1:4,800
MAP MEDIUM:	Paper (blueline print)
MAP PROJECTION:	Unknown (transformed into Universal Transverse Mercator zone 13, transformation indicated as much as 30 meters of error in positional accuracy of section corners)

ATTRIBUTE INFORMATION

DATAFILE NAME: AVF_SQR.PAT
5 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	AVF_SQR#	4	5	B	-	
13	AVF_SQR-ID	4	5	B	-	
17	AVF-CODE	1	1	I	-	Code of 1 indicates area of AVF (boundary of AVF drawn on line of zero thickness of alluvium)

Table 12.--*Documentation for the data layer: alluvial valley floors (directory name AVF), coverage AVF3TRV*

COVERAGE DOCUMENTATION

DATA LAYER:	AVF (designated alluvial valley floor)
COVERAGE NAME(S):	AVF3TRV (Tongue River valley; Nance/Brown fee coal)
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	Quadrangles 119, 120, 133, 134
SOURCE OF DATA:	Nance/Brown fee coal properties alluvial valley floor study, Rosebud County, Montana, August 1985 (prepared by LETEC, Billings, Montana). Digitized from: Map 2, Nance/Brown fee coal properties, alluvial valley floor area and cross section index, Nance Cattle Company--north area, and Map 3, Nance/Brown fee coal properties, alluvial valley floor area and cross section index, Brown Cattle Company--south area. Maps obtained from Montana Department of State Lands files, Helena, Montana.
DATA VINTAGE:	Maps drawn August 1985.

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:12,000 (enlarged from 1:24,000 base)
MAP SCALE-digitized:	1:12,000
MAP MEDIUM:	Paper (blueline print)
MAP PROJECTION:	Polyconic

ATTRIBUTE INFORMATION

DATAFILE NAME: AVF_TRV.PAT
5 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	AVF_TRV#	4	5	B	-	
13	AVF_TRV-ID	4	5	B	-	
17	AVF-CODE	1	1	I	-	Code of 1 indicates area of AVF (boundary of AVF drawn on shaded areas of map)

Boundaries

The boundaries (directory name BOUNDARIES) layer contains information on boundaries of counties, national forests, Indian reservations, cities, and small parks. The geographic extent of this information is shown in figure 8, and the documentation is given in table 13.

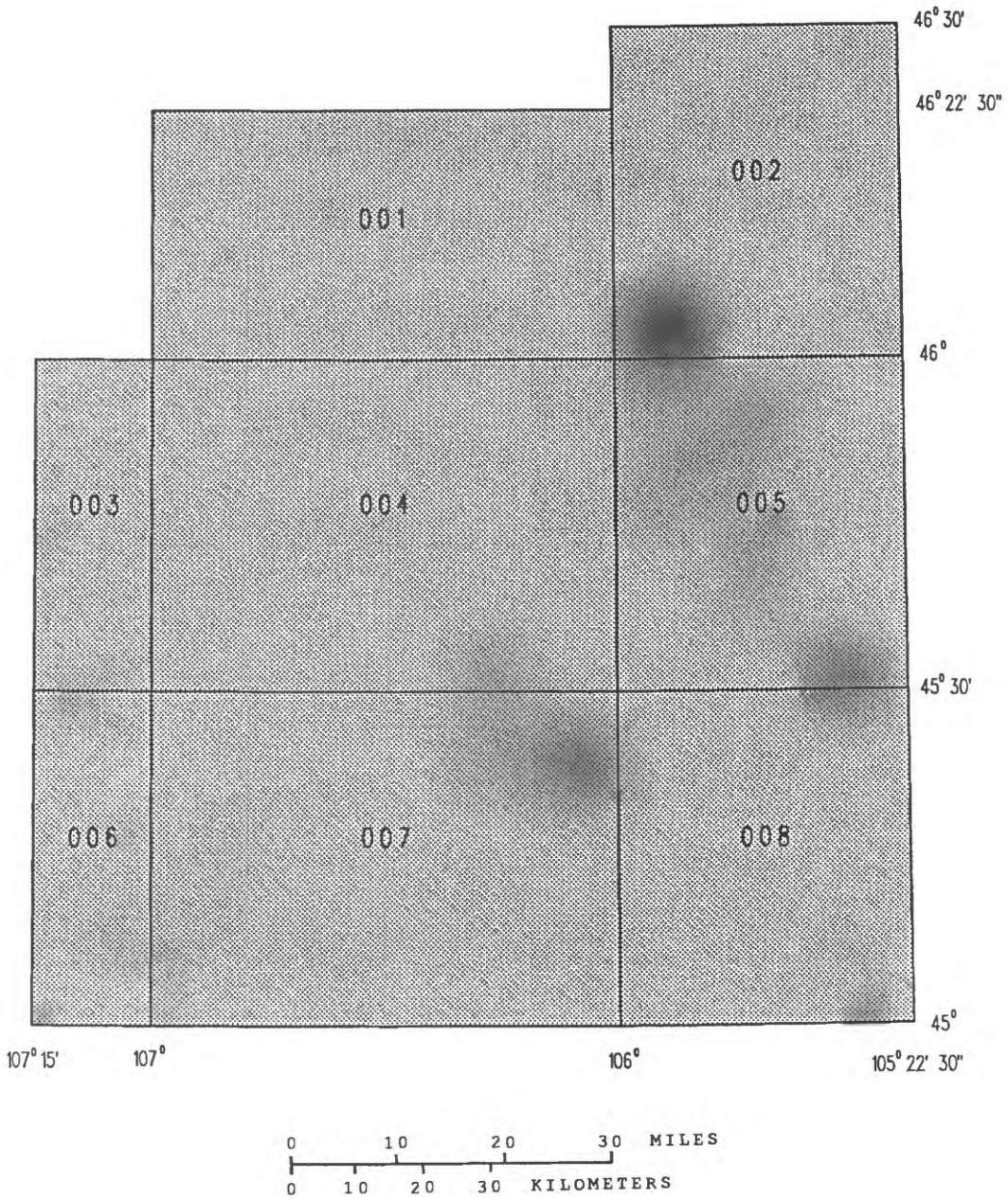

Figure 8.--Geographic extent of information for data layer: boundaries (directory name BOUNDARIES). Numbers identify 30 X 60 minute quadrangles.

Table 13.--*Documentation for the data layer: boundaries (directory name BOUNDARIES)*

COVERAGE DOCUMENTATION

DATA LAYER:	BOUNDARIES
COVERAGE NAME(S):	BND3999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	U.S. Geological Survey, National Mapping Division. Data from 1:24,000 scale Digital Line Graphs.
DATA VINTAGE:	Various map dates from 1966 through 1978.

ATTRIBUTE INFORMATION

DATAFILE NAME: BND3999.PAT
8 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	BND3999#	4	5	B	-	
13	BND3999-ID	4	5	B	-	
17	STATE	3	3	I	-	State FIPS (Federal Information Processing Standards) code (30= Montana; 56=Wyoming)
20	COUNTY	3	3	I	-	County FIPS code; described in INFO file COUNTY.EXPAND
23	CODE1	3	3	I	-	Minor code; described in INFO file CODE.EXPAND
26	CODE2	3	3	I	-	Minor code; described in INFO file CODE.EXPAND

A complete description of U.S. Geological Survey Digital Line Graphs and an explanation of all major and minor codes are available in the report--U.S. Geological Survey, 1986, Digital Line Graphs from 1:24,000 scale maps: National Mapping Division Data Users Guide 1, 109 p.

INFO expand files for
coverage BND3999

FILENAME: COUNTY.EXPAND

$RECNO	COUNTY	NAME
1	3	BIG HORN
2	17	CUSTER
3	75	POWDER RIVER
4	87	ROSEBUD
5	103	TREASURE
6	5	CAMPBELL WY
7	33	SHERIDAN WY

FILENAME: CODE.EXPAND

$RECNO	CODE1	CODE2	DESCRIPTION
1	101	101	Incorporated city, village, town, borough, or hamlet
2	104	104	National forest or grassland
3	107	107	Indian reservation
4	151	151	Small park (city, county, or private)

Climate

The climate (directory name CLIMATE) layer contains coverages of precipitation station data, and lines of equal precipitation. The geographic extent of this information is shown in figure 9, and the documentation is given in tables 14 and 15.

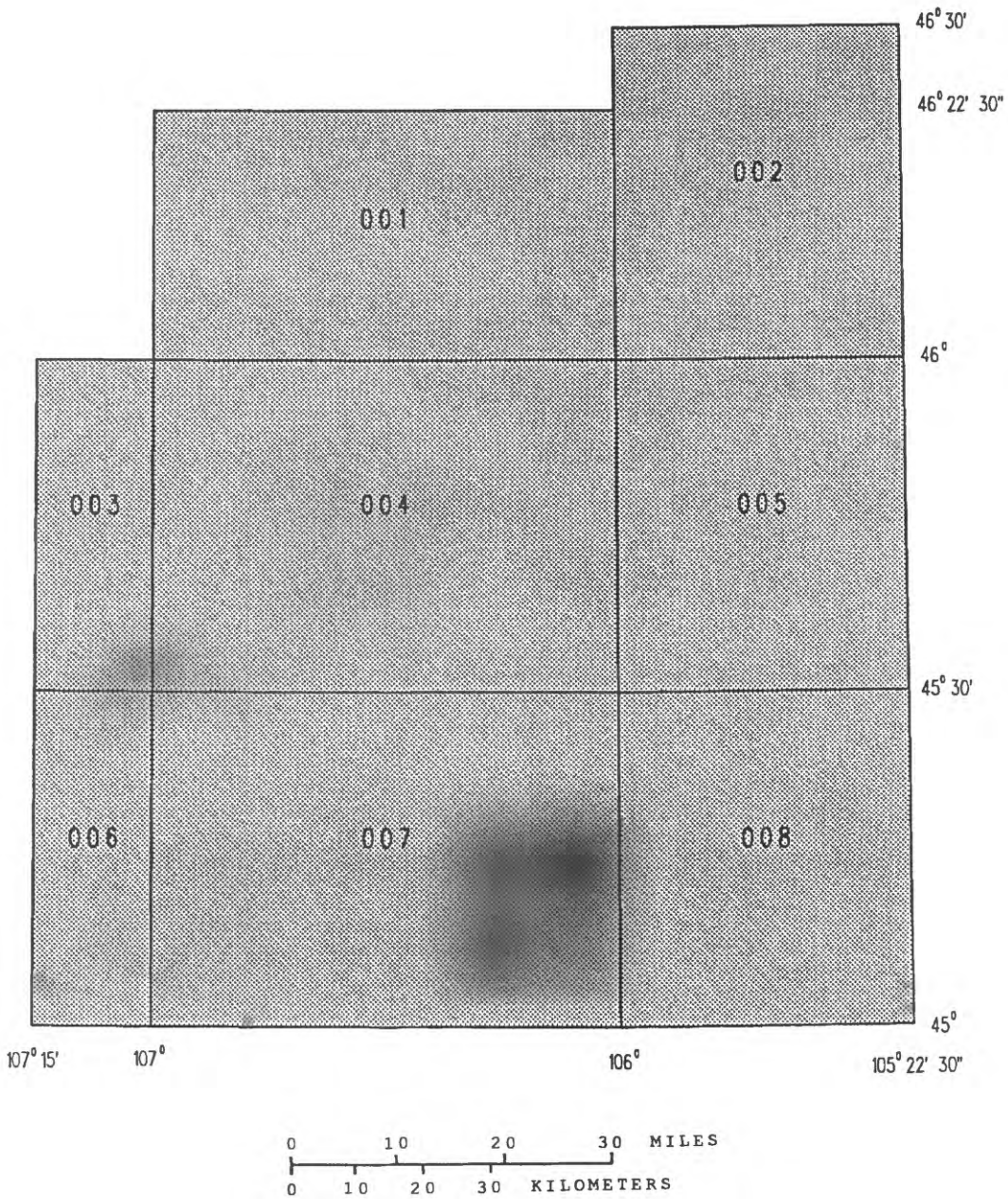

Figure 9.--Geographic extent of information for data layer: climate (directory name CLIMATE). Numbers identify 30 X 60 minute quadrangles.

Table 14.--*Documentation for the data layer: climate (directory name CLIMATE), coverage CLP1999*

COVERAGE DOCUMENTATION

DATA LAYER:	CLIMATE (precipitation station data)
COVERAGE NAME(S):	CLP1999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Point
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	National Oceanic and Atmospheric Administration (NOAA), 1982, Monthly normals of temperature, precipitation, and heating and cooling degree days, 1951-80, Montana: Asheville, N.C., 23 p.
DATA VINTAGE:	Compiled for data through 1980. Monthly mean precipitation values are for 1951-80 base period. Mean annual precipitation values are given for 1941-70 and 1951-80 base periods.

ATTRIBUTE INFORMATION

DATAFILE NAME: CLP1999.PAT
21 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	CLP1999#	4	5	B	-	
13	CLP1999-ID	4	5	B	-	
17	STATION-NUMBER	4	4	I	-	NOAA station number
21	ALTITUDE	5	5	N	0	Altitude of station (feet above sea level)
26	ANNUAL-MEAN	5	6	N	2	Mean precipitation (inches [in.]) 1951-80
31	JAN-MEAN	5	5	N	2	January mean precipitation (in.)
36	FEB-MEAN	5	5	N	2	February mean precipitation (in.)
41	MAR-MEAN	5	5	N	2	March mean precipitation (in.)
46	APR-MEAN	5	5	N	2	April mean precipitation (in.)
51	MAY-MEAN	5	5	N	2	May mean precipitation (in.)
56	JUN-MEAN	5	5	N	2	June mean precipitation (in.)
61	JUL-MEAN	5	5	N	2	July mean precipitation (in.)
66	AUG-MEAN	5	5	N	2	August mean precipitation (in.)
71	SEP-MEAN	5	5	N	2	September mean precipitation (in.)
76	OCT-MEAN	5	5	N	2	October mean precipitation (in.)
81	NOV-MEAN	5	5	N	2	November mean precipitation (in.)
86	DEC-MEAN	5	5	N	2	December mean precipitation (in.)
91	PRECIP-70	5	6	N	2	Mean annual precipitation for 1941-70 base period (in.)
96	STATION-NAME	25	25	C	-	NOAA station name

Table 15.--*Documentation for the data layer: climate (directory name CLIMATE), coverage CLP2999*

COVERAGE DOCUMENTATION

DATA LAYER:	CLIMATE (lines of equal precipitation)
COVERAGE NAME(S):	CLP2999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Line
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	U.S. Soil Conservation Service, 1977, Average annual precipitation, Montana, based on 1941-70 base period: Bozeman, Montana, 16 p.
DATA VINTAGE:	1941-70, published 1977.

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic, AMS Series
MAP SCALE-original:	1:250,000
MAP SCALE-digitized:	1:250,000
MAP MEDIUM:	Paper
MAP PROJECTION:	Transverse Mercator

ATTRIBUTE INFORMATION

DATAFILE NAME: CLP2999.AAT
8 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	FNODE#	4	5	B	-	
5	TNODE#	4	5	B	-	
9	LPOLY#	4	5	B	-	
13	RPOLY#	4	5	B	-	
17	LENGTH	4	12	F	3	
21	CLP2999#	4	5	B	-	
25	CLP2999-ID	4	5	B	-	
29	PRECIP	2	5	I	-	Precipitation (inches), 1941-70

Coal Reserves and Chemistry

The coal reserves and chemistry (directory name COAL) layer contains information on coal reserves of 39 strippable coal fields and coal chemical data. Coverage CCE1999, of coal chemical data, contains information on the ash, sulfur, and BTU content of coal samples. The geographic extent of this information is shown in figure 10, and the documentation is given in tables 16 and 17.

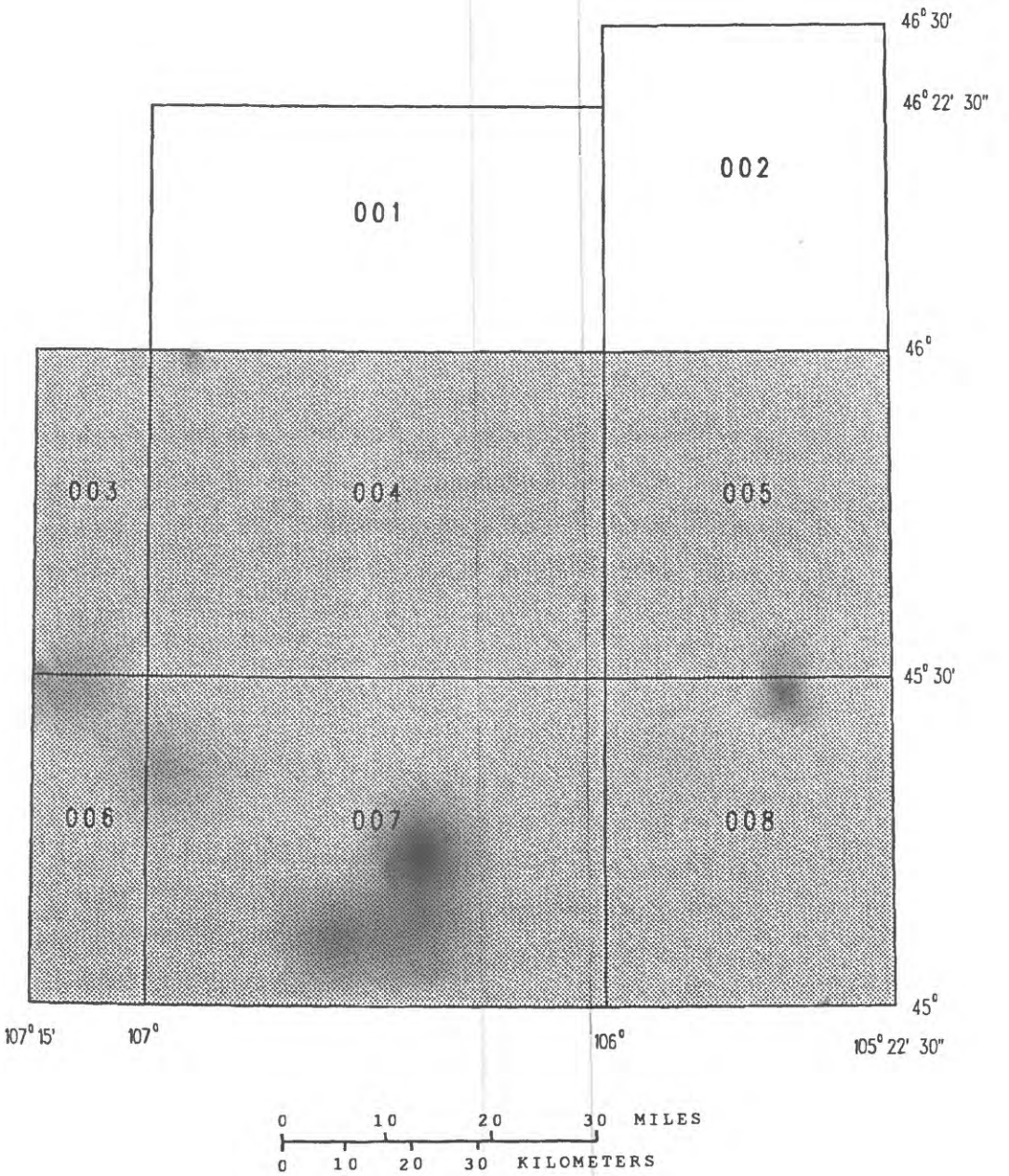

Figure 10.--Geographic extent of information for data layer: coal reserves and chemistry (directory name COAL). Numbers identify 30 X 60 minute quadrangles.

Table 16.--*Documentation for the data layer: coal reserves and chemistry (directory name COAL), coverages CST3999, CST3003, CST3004, CST3005, CST3006, CST3007, and CST3008*

COVERAGE DOCUMENTATION

DATA LAYER:	COAL (area of strippable coal)
COVERAGE NAME(S):	CST3999, CST3003, CST3004, CST3005, CST3006, CST3007, and CST3008
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	Quadrangles 003 through 008
SOURCE OF DATA:	Bergantino, R.N., Pederson, R.J., and Berg, R.B., 1980 Mineral resources map of the Hardin 1 X 2 degree quadrangle, southeastern Montana: Montana Bureau of Mines and Geology Montana Atlas MA 2-C, scale 1:250,000. Bergantino, R.N., and Cole, G.A., 1981, Mineral resources map of the Ekalaka 1 X 2 degree quadrangle, southeastern Montana: Montana Bureau of Mines and Geology Montana Atlas MA 1-C, scale 1:250,000.
DATA VINTAGE:	1980 and 1981.

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:250,000
MAP SCALE-digitized:	1:250,000
MAP MEDIUM:	Paper
MAP PROJECTION:	Transverse Mercator

ATTRIBUTE INFORMATION

DATAFILE NAME: CST3999.PAT
6 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	CST3999#	4	5	B	-	
13	CST3999-ID	4	5	B	-	
17	STRIP-CODE	1	1	I	-	Code indicating area of strippable coal (code = 1)
18	COAL-FIELD	2	2	I	-	Coal-field number; described in INFO file COAL-FIELD.EXPAND

Table 16.--*Documentation for the data layer: coal reserves and chemistry (directory name COAL), coverages CST3999, CST3003, CST3004, CST3005, CST3006, CST3007, and CST3008*--Continued

INFO expand file for coverage CST3999

FILENAME: COAL-FIELD.EXPAND

$RECNO	COAL-FIELD	NAME	COAL BEDS	RESERVES*
1	1	Ashland	Knobloch, Sawyer	3,053.69
2	2	Beaver Creek-Liscom Creek	Flowers-Goodale, Knobloch, Terret	627.49
3	3	Birney	Brewster-Arnold	180.55
4	4	Canyon	Brewster-Arnold, Wall	1,950.11
5	5	Cheyenne Meadows	Knobloch	1,200.00
6	6	Colstrip	Rosebud	1,389.07
7	7	Corral-Thompson Creek	Cook, Canyon, Hope, Swift, Wall	1,822.34
8	8	Davis Creek	Robinson	35.00
9	9	Decker	Anderson-Dietz	2,201.28
10	10	Deer Creek	Anderson-Dietz	493.34
11	11	Goodspeed Butte, Diamond Butte, Fire Gulch	Cook, Canyon, Pawnee	1,383.66
12	12	Greenleaf Creek-Miller Creek	Knobloch, Rosebud, Sawyer	453.71
13	13	Hanging Woman Creek	Anderson, Dietz	2,704.25
14	14	Jeans Fork	Robinson	110.00
15	15	Kirby	Anderson, Canyon, Dietz, Wall	1,683.09
16	16	Lame Deer	Knobloch	150.00
17	17	Little Wolf	McKay, Roland	314.00
18	18	Otter Creek	Knobloch	2,075.55
19	19	Poker Jim Lookout	Anderson, Dietz	872.62
20	20	Poker Jim Creek-O'Dell Creek	Knobloch	938.07
21	21	Roland	Roland	218.04
22	22	Sarpy Creek	McKay, Rosebud	1,481.39
23	23	Squirrel Creek	Roland	133.41
24	24	Sweeny Creek-Snider Creek	Terret	326.33
25	25	Tie Creek	Knobloch	200.00
26	26	West Moorhead	Anderson, Dietz, Canyon	1,971.42
27	27	Wolf Mountains	Anderson, Dietz, Canyon, Roland	2,070.00
28	28	Yager Butte	Cook, Elk, Dunning	2,975.76
29	29	Pumpkin Creek	Sawyer	2,426.50
30	30	Foster Creek	Flowers-Goodale, Knobloch, Terret	1,427.90
31	31	Broadus	Broadus	739.82
32	32	East Moorhead	T	525.21
33	33	Threemile Buttes	Canyon, Ferry, Cook	225.40
34	34	Sonnette	Cook, Pawnee	683.23
35	35	Home Creek Butte	Canyon, Ferry	217.21
36	36	Little Pumpkin Creek	Sawyer A and C, D, X, E	215.83
37	37	Sand Creek	Knobloch	267.34

* in millions of tons

Table 17.--*Documentation for the data layer: coal reserves and chemistry (directory name COAL), coverage CCE1999*

COVERAGE DOCUMENTATION

DATA LAYER:	COAL (ash, sulfur, and BTU [British Thermal Unit] data)
COVERAGE NAME(S):	CCE1999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Point
GEOGRAPHIC EXTENT:	Quadrangles 003 through 008
SOURCE OF DATA:	U.S. Geological Survey, Geologic Division, National Coal Resources Data Base. Coverage generated from digital tabular data.

NATIONAL COAL RESOURCES DATA SYSTEM - U.S. Geological Survey
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DATA VINTAGE: Retrieval May 15, 1989.

ATTRIBUTE INFORMATION

DATAFILE NAME: CCE1999.PAT
11 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	CCE1999#	4	5	B	-	
13	CCE1999-ID	4	5	B	-	
17	ID	14	14	C	-	Identifier for sample site
31	DATE	8	8	D	-	Date data collected
39	DATA-SOURCE	20	20	C	-	Agency collecting data
59	COAL-BED	20	20	C	-	Name of coal bed sampled
79	ASH	6	6	N	2	Ash content (weight percent)
85	SULFUR	6	6	N	2	Sulfur content (weight percent)
91	BTU	6	6	N	0	Heating value (BTU)

Coal Stratigraphy

The coal stratigraphy (directory name COAL_STRAT) layer contains stratigraphic data from drill holes and outcrops for nine coal beds. The data are sorted by name of coal bed. Coverage names are ANDERSON, CANYON, COOK, DIETZ, KNOBLOCH, ROLAND, ROSEBUD, SAWYER, and WALL. The geographic extent of this information is shown in figure 11, and the documentation is given in table 18.

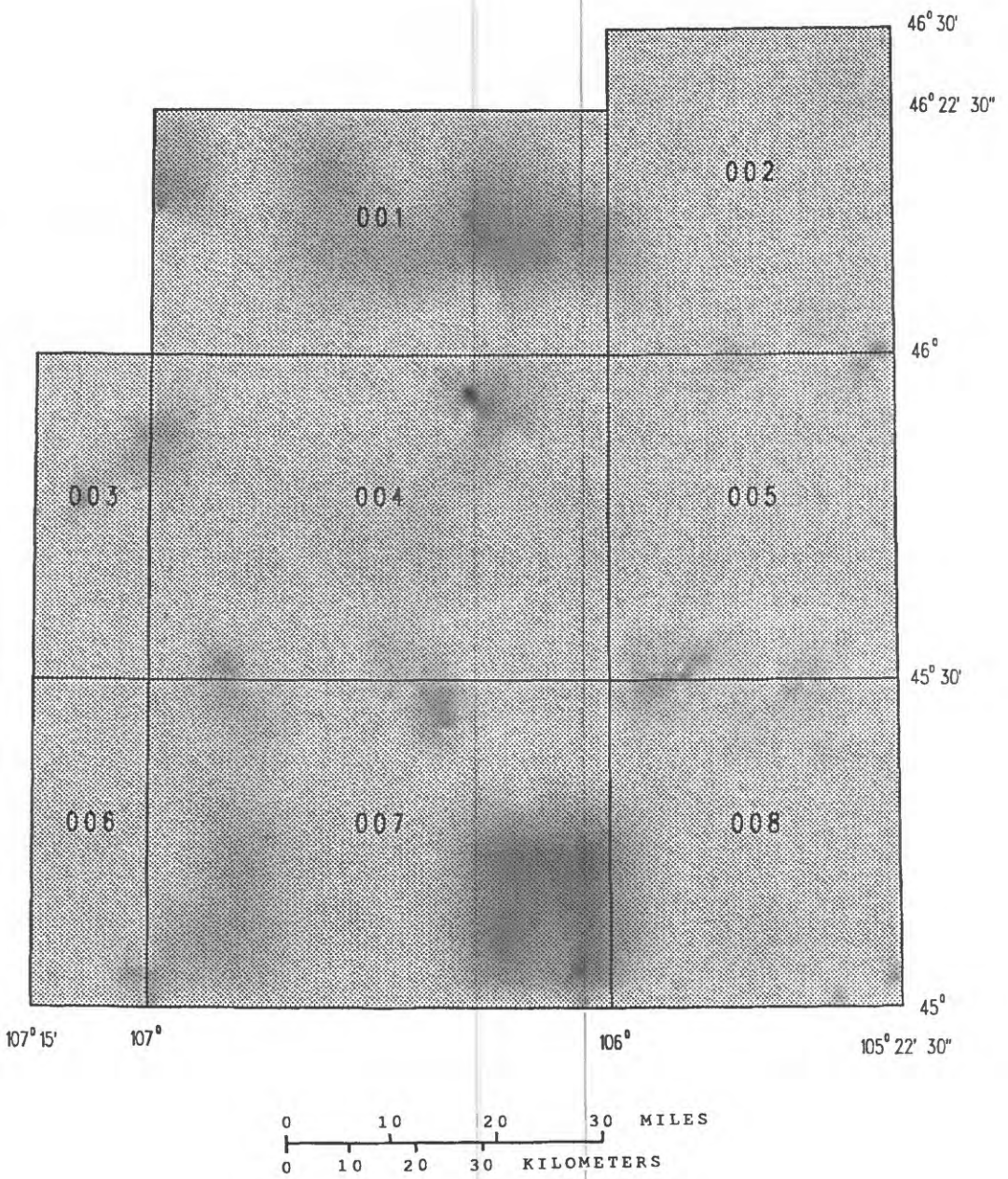

Figure 11.--Geographic extent of information for data layer: coal stratigraphy (directory name COAL_STRAT). Numbers identify 30 X 60 minute quadrangles.

Table 18.--*Documentation for the data layer: coal stratigraphy (directory name COAL_STRAT)*

COVERAGE DOCUMENTATION

DATA LAYER:	COAL_STRAT (stratigraphic data from drill holes and outcrops)
COVERAGE NAME(S):	ANDERSON, CANYON, COOK, DIETZ, KNOBLOCH, ROLAND, ROSEBUD, SAWYER, and WALL
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Point
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	U.S. Geological Survey, Geologic Division, National Coal Resources Data Base. Coverages generated from digital tabular data.

NATIONAL COAL RESOURCES DATA SYSTEM - U.S. Geological Survey
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DATA VINTAGE: Retrieval May 15, 1989.

ATTRIBUTE INFORMATION

DATAFILE NAME: ANDERSON.PAT
18 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	ANDERSON#	4	5	B	-	
13	ANDERSON-ID	4	5	B	-	
17	ID	14	14	C	-	Identifier for site
31	DATE	8	8	D	-	Date data collected
39	DATA-SOURCE	25	25	C	-	Agency collecting data
64	ALTITUDE	5	5	N	0	Altitude of site (feet [ft] above sea level)
69	DEPTH	5	5	N	0	Depth of drill hole (ft below land surface) (outcrop sites and some drill sites have no depth data)
74	TOP	6	6	N	1	Top of coal bed (ft below land surface)
80	THICKNESS	5	5	N	1	Thickness of coal bed (ft)
85	COAL-BED	20	20	C	-	Name of coal bed
105	TOP2	6	6	N	1	Top of second coal bed or split (ft below land surface)
111	THICKNESS2	5	5	N	1	Thickness of second coal bed or split
116	COAL-BED2	20	20	C	-	Name of second coal bed or split
136	TOP3	6	6	N	1	Top of third coal bed or split (ft below land surface)
142	THICKNESS3	5	5	N	1	Thickness of third coal bed or split
147	COAL-BED3	20	20	C	-	Name of third coal bed or split

Drainage Basins

The drainage basins (directory name DRAINAGE_BASINS) layer delineates the major drainage basins of the area. The geographic extent of this information is shown in figure 12, and the documentation is given in table 19.

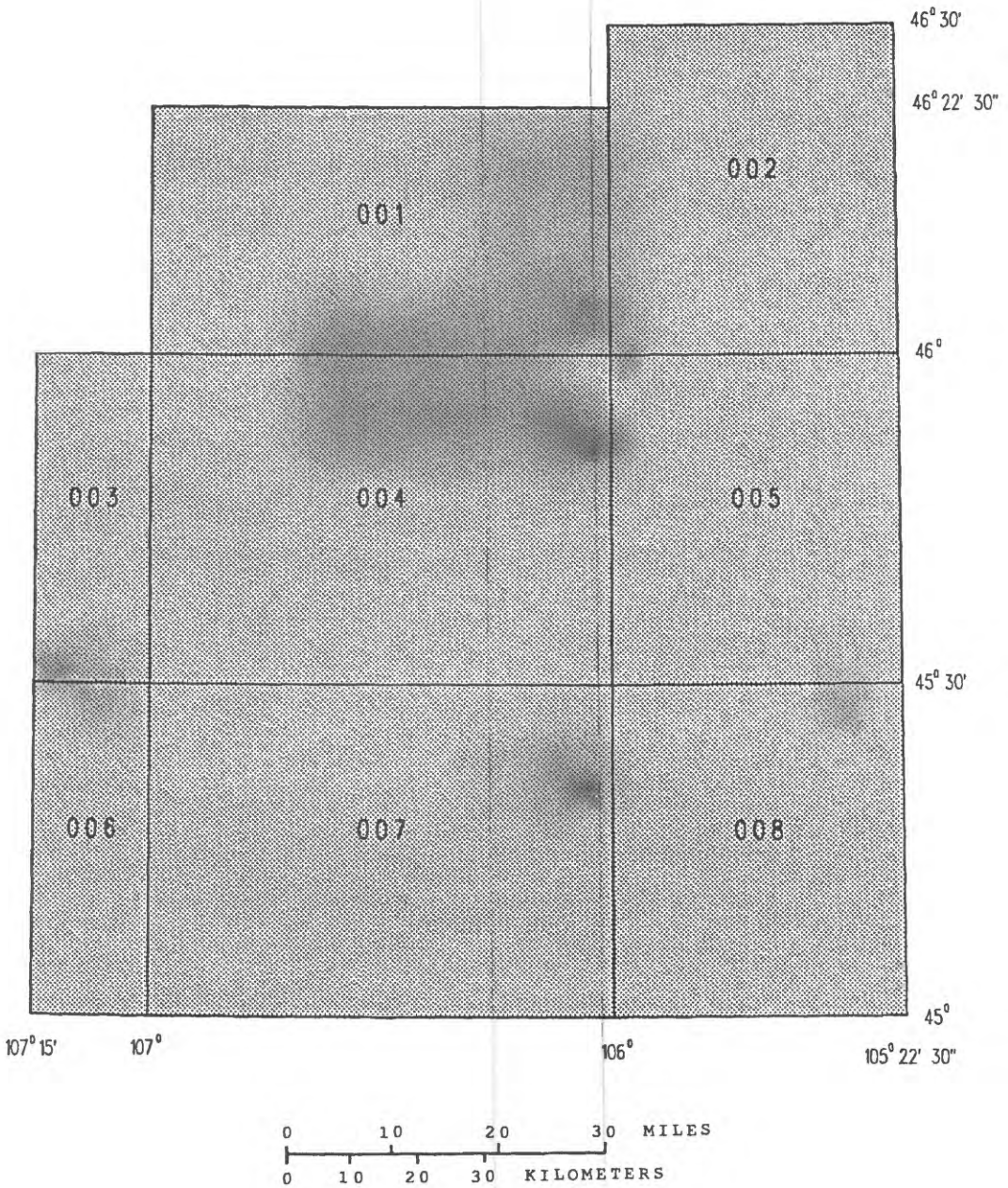

Figure 12.--Geographic extent of information for data layer: drainage basins (directory name DRAINAGE_BASINS). Numbers identify 30 X 60 minute quadrangles.

Table 19.--*Documentation for the data layer: drainage basins (directory name DRAINAGE_BASINS)*

COVERAGE DOCUMENTATION

DATA LAYER:	DRAINAGE_BASINS (outline of major basins)
COVERAGE NAME(S):	DRB3999 and DRB2999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon and line
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	Digitized from U.S. Geological Survey 7.5 X 7.5 minute topographic maps. Hyrologic unit codes are from: U.S. Geological Survey, 1974, Hydrologic unit map, State of Montana: U.S. Geological Survey Hydrologic Unit Map, scale 1:500,000, 2 sheets.
DATA VINTAGE:	Various map dates; digitized in 1989.

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:24,000
MAP SCALE-digitized:	1:24,000
MAP MEDIUM:	Paper
MAP PROJECTION:	Polyconic

ATTRIBUTE INFORMATION

DATAFILE NAME: DRB3999.PAT
5 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	DRB3999#	4	5	B	-	
13	DRB3999-ID	4	5	B	-	
17	HUC	8	8	I	-	Hydrologic unit code

Note: Coverage DRB3999 is a polygon map with closure lines around the perimeter of the study area. Coverage DRB2999 is a line coverage showing only drainage-basin boundaries; it has no user-defined attributes.

Flood Plains

The flood plains (directory name FLOOD_PLAINS) layer delineates areas that would be inundated by a flood with a recurrence interval of 100 years. The geographic extent of this information is shown in figure 13, and the documentation is given in table 20.

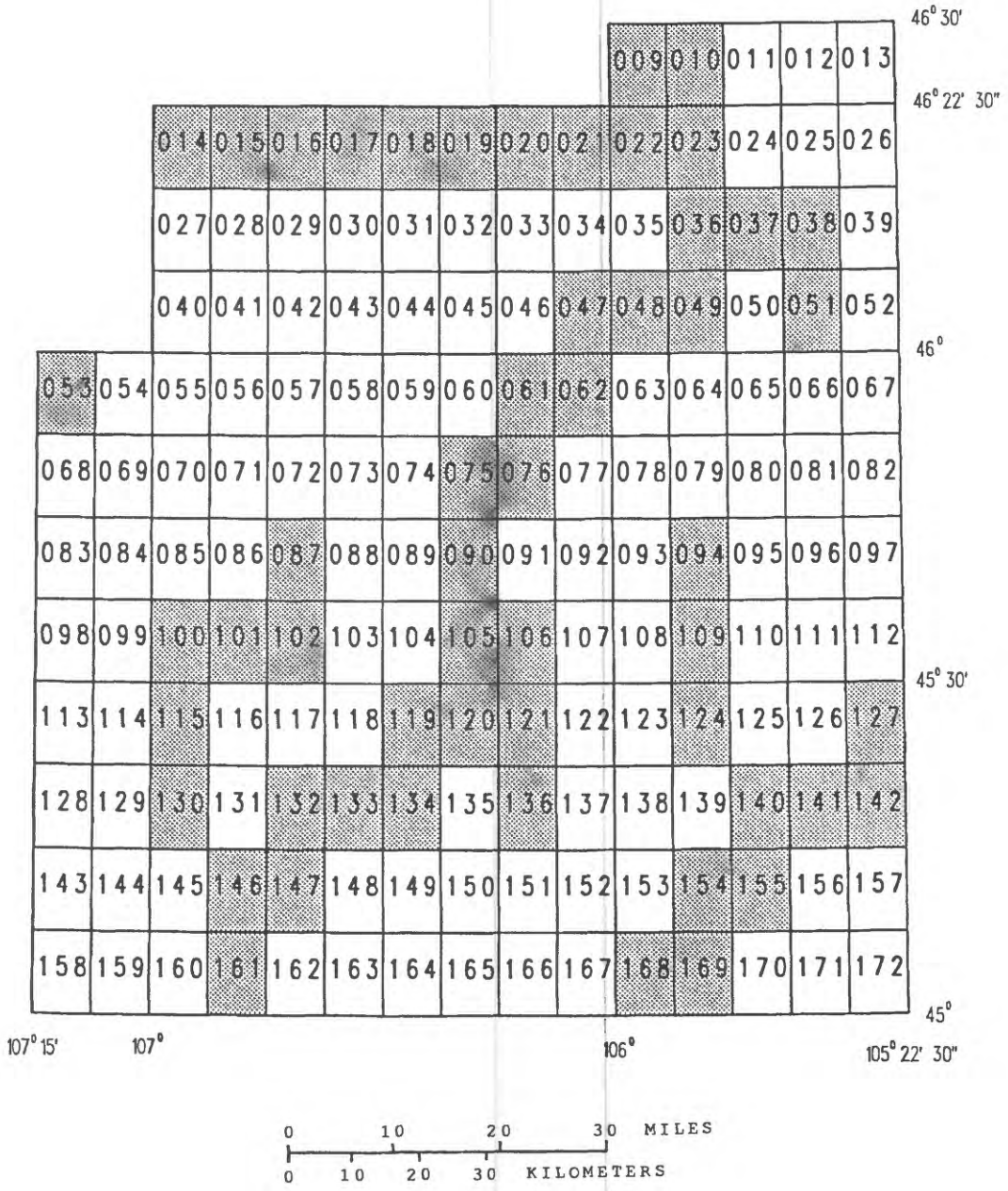

Figure 13.--Geographic extent of information for data layer: flood plains (directory name FLOOD_PLAINS). Numbers identify 7.5 X 7.5 minute quadrangles.

Table 20.--*Documentation for the data layer: flood plains (directory name FLOOD_PLAINS)*

COVERAGE DOCUMENTATION

DATA LAYER:	FLOOD_PLAINS (area of 100-year flood)
COVERAGE NAME(S):	FLD3001, FLD3002, FLD3003, FLD3004, FLD3005, FLD3007, FLD3008, and FLD3999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	Quadrangles 009, 010, 014-023, 036-038, 047-049, 051, 053, 061, 062, 075, 076, 087, 090, 094, 100-102, 105, 106, 109, 115, 119-121, 124, 127, 130, 132-134, 136, 140-142, 146, 147, 154, 155, 161, 168, and 169.
SOURCE OF DATA:	U.S. Geological Survey, Water Resources Division, Helena, Montana.
DATA VINTAGE:	Maps prepared 1970-79.

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:24,000
MAP SCALE-digitized:	1:24,000
MAP MEDIUM:	Mylar or paper copies
MAP PROJECTION:	Polyconic

ATTRIBUTE INFORMATION

DATAFILE NAME: FLD3999.PAT
5 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	FLD3999#	4	5	B	-	
13	FLD3999-ID	4	5	B	-	
17	CODE	3	5	I	-	Code indicating areas within 100-year flood plain (100 = area within flood plain; 0 = not flooded or not mapped)

Geographic Names

The geographic names (directory name GEOGRAPHIC_NAMES) layer contains information on feature names, as shown on U.S. Geological Survey topographic maps. The geographic extent of this information is shown in figure 14, and the documentation is given in table 21.

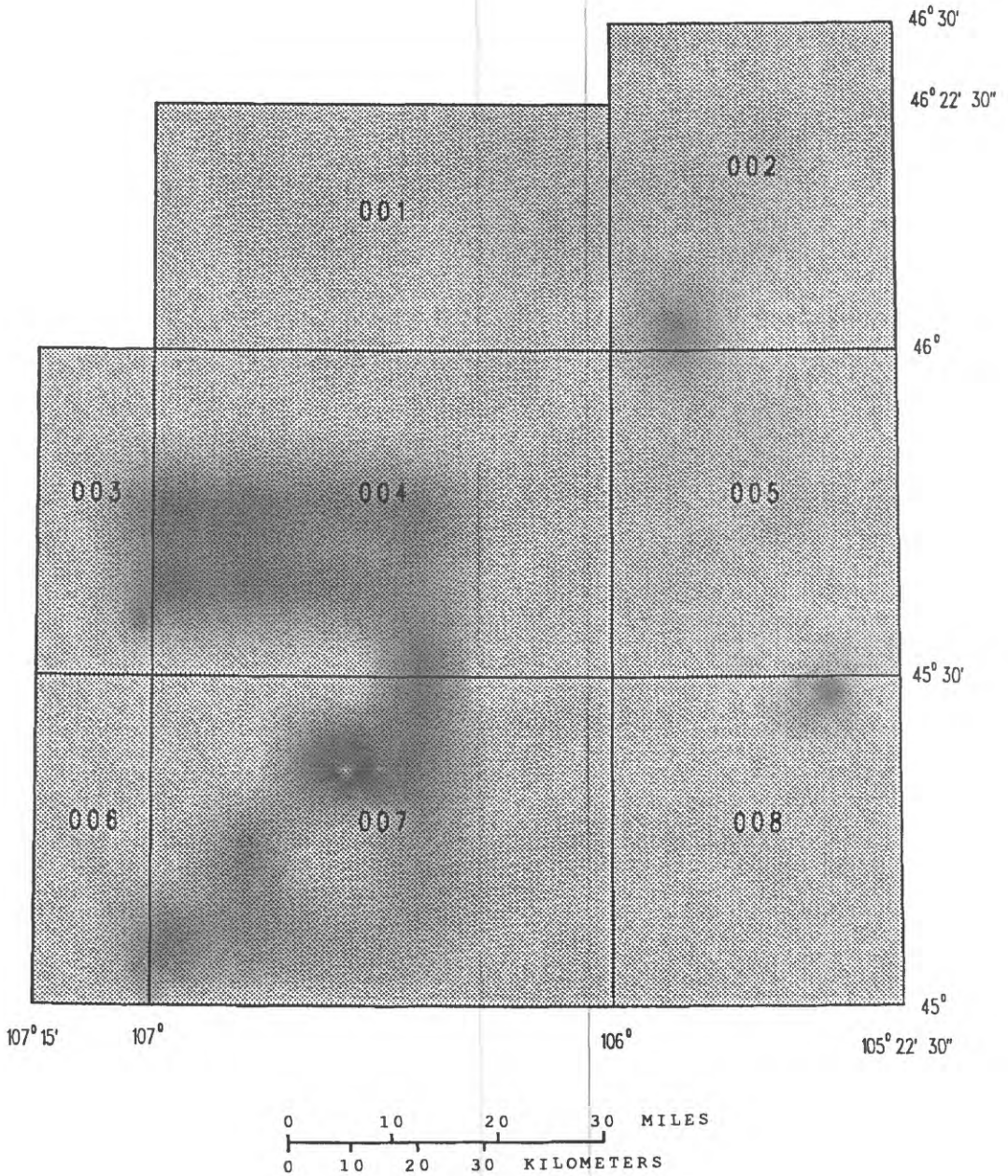

Figure 14.--Geographic extent of information for data layer: geographic names (directory name GEOGRAPHIC_NAMES). Numbers identify 30 X 60 minute quadrangles.

Table 21.--*Documentation for the data layer: geographic names (directory name GEOGRAPHIC_NAMES)*

COVERAGE DOCUMENTATION

DATA LAYER:	GEOGRAPHIC_NAMES
COVERAGE NAME(S):	GNS1999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Point
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	U.S. Geological Survey, National Mapping Division: geographic names from 7.5 X 7.5 minute topographic maps. Coverage generated from digital tabular data.
DATA VINTAGE:	Data compiled 1988.

ATTRIBUTE INFORMATION

DATAFILE NAME: GNS1999.PAT
8 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	GNS1999#	4	5	B	-	
13	GNS1999-ID	4	5	B	-	
17	FEATURE	9	9	C	-	Type of geographic feature
26	ALTITUDE	4	4	I	-	Altitude of feature (feet above sea level)
30	COUNTY	3	3	I	-	County of feature (FIPS [Federal Information Processing Standards] code)
33	NAME	50	50	C	-	Name of geographic feature

Geology

The geology (directory name GEOLOGY) layer contains information on bedrock geology and fault lines. Alluvial deposits are not shown on the geology coverage. The geographic extent of this information is shown in figure 15, and the documentation is given in tables 22 and 23.

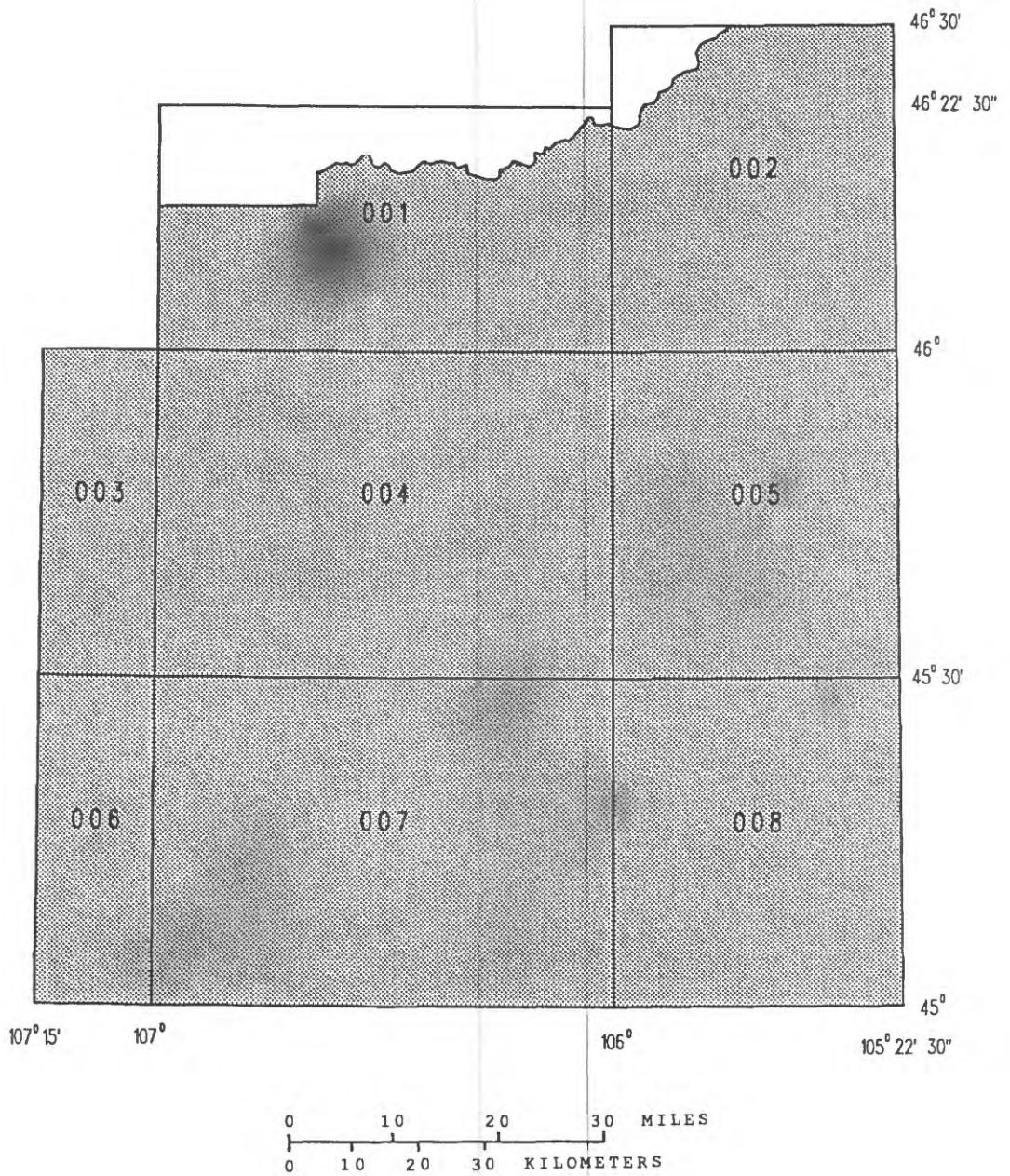

Figure 15.--Geographic extent of information for data layer: geology (directory name GEOLOGY). Numbers identify 30 X 60 minute quadrangles.

Table 22.--*Documentation for the data layer: geology (directory name GEOLOGY), coverage GLG3999*

COVERAGE DOCUMENTATION

DATA LAYER:	GEOLOGY (bedrock geology)
COVERAGE NAME(S):	GLG3999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	South of Yellowstone River
SOURCE OF DATA:	Lewis, B.D., and Roberts, R.S., 1978, Geology and water-yielding characteristics of rocks of the northern Powder River Basin, southeastern Montana: U.S. Geological Survey Miscellaneous Investigations Map I-847-D, scale 1:250,000, 2 sheets.
DATA VINTAGE:	1978

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:250,000
MAP SCALE-digitized:	1:250,000
MAP MEDIUM:	Paper
MAP PROJECTION:	Lambert conformal conic

ATTRIBUTE INFORMATION

DATAFILE NAME: GLG3999.PAT
5 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	GLG3999#	4	5	B	-	
13	GLG3999-ID	4	5	B	-	
17	FORMATION	4	10	C	-	Member or formation code. Codes are listed in INFO file FORMATION.EXPAND

INFO expand file for
coverage GLG3999

FILENAME: FORMATION.EXPAND

$RECNO	FORMATION	NAME
1	Tw	Paleocene-Eocene Wasatch Formation
2	Tft	Tongue River Member of Paleocene Fort Union Formation
3	Tfl	Lebo Shale Member of Fort Union Formation
4	Tftu	Tullock Member of Fort Union Formation
5	Khc	Upper Cretaceous Hell Creek Formation
6	Kb	Upper Cretaceous Bearpaw Shale

Table 23.--*Documentation for the data layer: geology (directory name GEOLOGY), coverage GLG2999*

COVERAGE DOCUMENTATION

DATA LAYER:	GEOLOGY (fault lines)
COVERAGE NAME(S):	GLG2999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Line
GEOGRAPHIC EXTENT:	South of Yellowstone River
SOURCE OF DATA:	Lewis, B.D., and Roberts, R.S., 1978, Geology and water-yielding characteristics of rocks of the northern Powder River Basin, southeastern Montana: U.S. Geological Survey Miscellaneous Investigations Map I-847-D, scale 1:250,000, 2 sheets.
DATA VINTAGE:	1978

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic
MAP SCALE-original:	1:250,000
MAP SCALE-digitized:	1:250,000
MAP MEDIUM:	Paper
MAP PROJECTION:	Lambert conformal conic

ATTRIBUTE INFORMATION

DATAFILE NAME: GLG2999.AAT
8 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	FNODE#	4	5	B	-	
5	TNODE#	4	5	B	-	
9	LPOLY#	4	5	B	-	
13	RPOLY#	4	5	B	-	
17	LENGTH	4	12	F	3	
21	GLG2999#	4	5	B	-	
25	GLG2999-ID	4	5	B	-	
29	TYPE	1	1	I	-	Type of fault (Type = 1 indicates drawn with solid line. Type = 2 indicates inferred or approximately located)

Hydrography

The hydrography (directory name HYDROGRAPHY) layer contains information on water features of the region. The coverages contain both polygon (lakes, ponds, and reservoirs) and line (stream) water features. The geographic extent of this information is shown in figure 16, and the documentation is given in table 24.

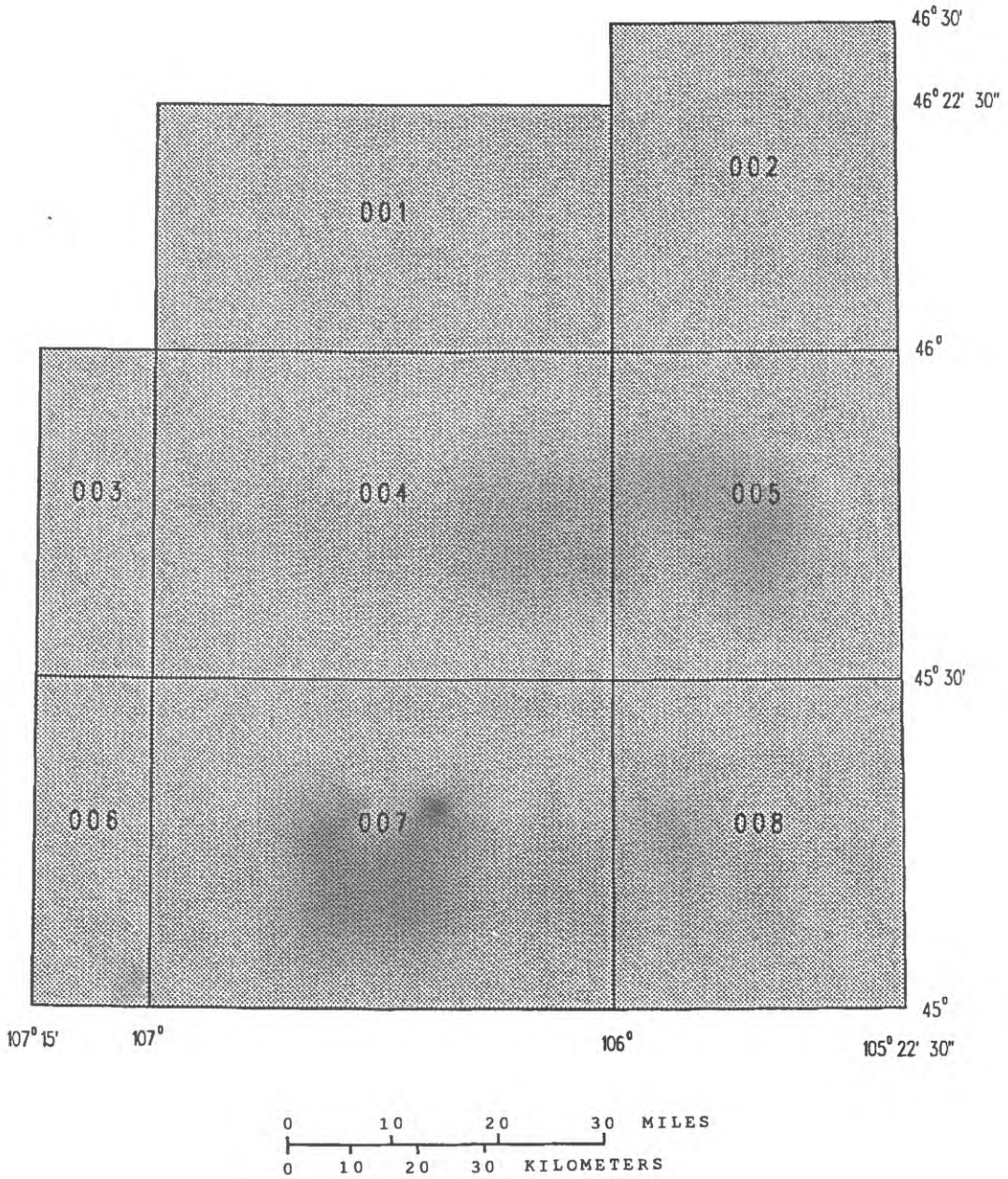

Figure 16.--Geographic extent of information for data layer: hydrography (directory name HYDROGRAPHY). Numbers identify 30 X 60 minute quadrangles.

Table 24.--*Documentation for the data layer: hydrography (directory name HYDROGRAPHY)*

COVERAGE DOCUMENTATION

DATA LAYER:	HYROGRAPHY (water features)
COVERAGE NAME(S):	HYD3001, HYD3002, HYD3003, HYD3004, HYD3005, HYD3006, HYD3007, and HYD3008
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon and line
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	U.S. Geological Survey, National Mapping Division. Data from 1:100,000 scale Digital Line Graphs.
DATA VINTAGE:	Various map dates, compiled 1988.

ATTRIBUTE INFORMATION

DATAFILE NAME: HYD3001.PAT
8 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	HYD3001#	4	5	B	-	
13	HYD3001-ID	4	5	B	-	
17	MAJOR1	6	6	I	-	Major code (50=hydrologic feature)
23	MINOR1	6	6	I	-	Minor code; described in INFO file MINOR.EXPAND
29	MAJOR2	6	6	I	-	Major code (50=hydrologic feature)
35	MINOR2	6	6	I	-	Minor code; described in INFO file MINOR.EXPAND

DATAFILE NAME: HYD3001.AAT
11 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	FNODE#	4	5	B	-	
5	TNODE#	4	5	B	-	
9	LPOLY#	4	5	B	-	
13	RPOLY#	4	5	B	-	
17	LENGTH	4	12	F	3	
21	HYD3001#	4	5	B	-	
25	HYD3001-ID	4	5	B	-	
29	MAJOR1	6	6	I	-	Major code (50=hydrologic feature)
35	MINOR1	6	6	I	-	Minor code; described in INFO file MINOR.EXPAND
41	MAJOR2	6	6	I	-	Major code (50=hydrologic feature)
47	MINOR2	6	6	I	-	Minor code; described in INFO file MINOR.EXPAND

A complete description of U.S. Geological Survey Digital Line Graphs and an explanation of all major and minor codes are available in the report--U.S. Geological Survey, 1989, Digital Line Graphs from 1:100,000 scale maps: National Mapping Division Data Users Guide 2, 88 p.

Table 24.--*Documentation for the data layer: hydrography (directory name HYDROGRAPHY)*--Continued

INFO expand file for
coverage HYD3001

FILENAME: MINOR.EXPAND

$RECNO	MINOR1	MINOR2	DESCRIPTION
1	1	1	Upper origin of stream
2	2	2	Upper origin of stream at water body
3	3	3	Sink, channel no longer evident
4	4	4	Stream entering water body
5	5	5	Stream exiting water body
6	100	100	Alkali flat
7	101	101	Reservoir
8	102	102	Covered reservoir
9	103	103	Glacier or permanent snowfield
10	104	104	Salt evaporator
11	105	105	Inundation area
12	106	106	Fish hatchery or farm
13	107	107	Industrial water impoundment
14	108	108	Area to be submerged
15	109	109	Sewage disposal pond or infiltration bed
16	110	110	Tailings pond
17	111	111	Marsh, wetland, swamp, bog
18	112	112	Mangrove area
19	113	113	Rice field
20	114	114	Cranberry bog
21	115	115	Flats (tidal, mud, sand, gravel)
22	116	116	Bays, estuaries, gulfs, oceans, seas
23	117	117	Shoal
24	118	118	Soda evaporator
25	200	200	Shoreline
26	201	201	Manmade shoreline
27	203	203	Indefinite shoreline
28	204	204	Apparent limit
29	205	205	Outline of a Carolina bay
30	206	206	Danger curve
31	300	300	Spring
32	301	301	Non-flowing well
33	302	302	Flowing well
34	303	303	Riser
35	304	304	Geyser
36	305	305	Windmill
37	400	400	Rapids
38	401	401	Falls
39	402	402	Gravel pit or quarry filled with water
40	403	403	Gaging station
41	404	404	Pumping station
42	405	405	Water intake
43	406	406	Dam or weir
44	407	407	Canal lock or sluice gate
45	408	408	Spillway
46	409	409	Gate (flood, tidal, head, check)
47	410	410	Rock
48	411	411	Crevasse
49	412	412	Stream
50	413	413	Braided stream
51	414	414	Ditch or canal
52	415	415	Aqueduct
53	416	416	Flume
54	417	417	Penstock
55	418	418	Siphon
56	419	419	Channel in water area

Table 24.--*Documentation for the data layer: hydrography (directory name HYDROGRAPHY)*--Continued

INFO expand file for
coverage HYD3001--Continued

FILENAME: MINOR.EXPAND--Continued

$RECNO	MINOR1	MINOR2	DESCRIPTION
57	420	420	Wash or ephemeral stream
58	421	421	Lake or pond
59	422	422	Coral reef
60	423	423	Sand in open water
61	424	424	Spoil area
62	601	601	Underground
63	602	602	Overpassing
64	603	603	Elevated
65	604	604	Tunnel
66	605	605	Right bank
67	606	606	Left bank
68	607	607	Under construction
69	608	608	Salt
70	609	609	Unsurveyed
71	610	610	Intermittent
72	611	611	Abandoned or discontinued
73	612	612	Submerged or sunken
74	614	614	Dry
75	615	615	Mineral or hot (sulfur, alkali)
76	616	616	Navigable, transportation
77	617	617	Underpassing
78	618	618	Earthen construction

Land Survey

The land survey (directory name LAND_SURVEY) layer contains information on public land survey of township, range, and section. The geographic extent of this information is shown in figure 17, and the documentation is given in table 25.

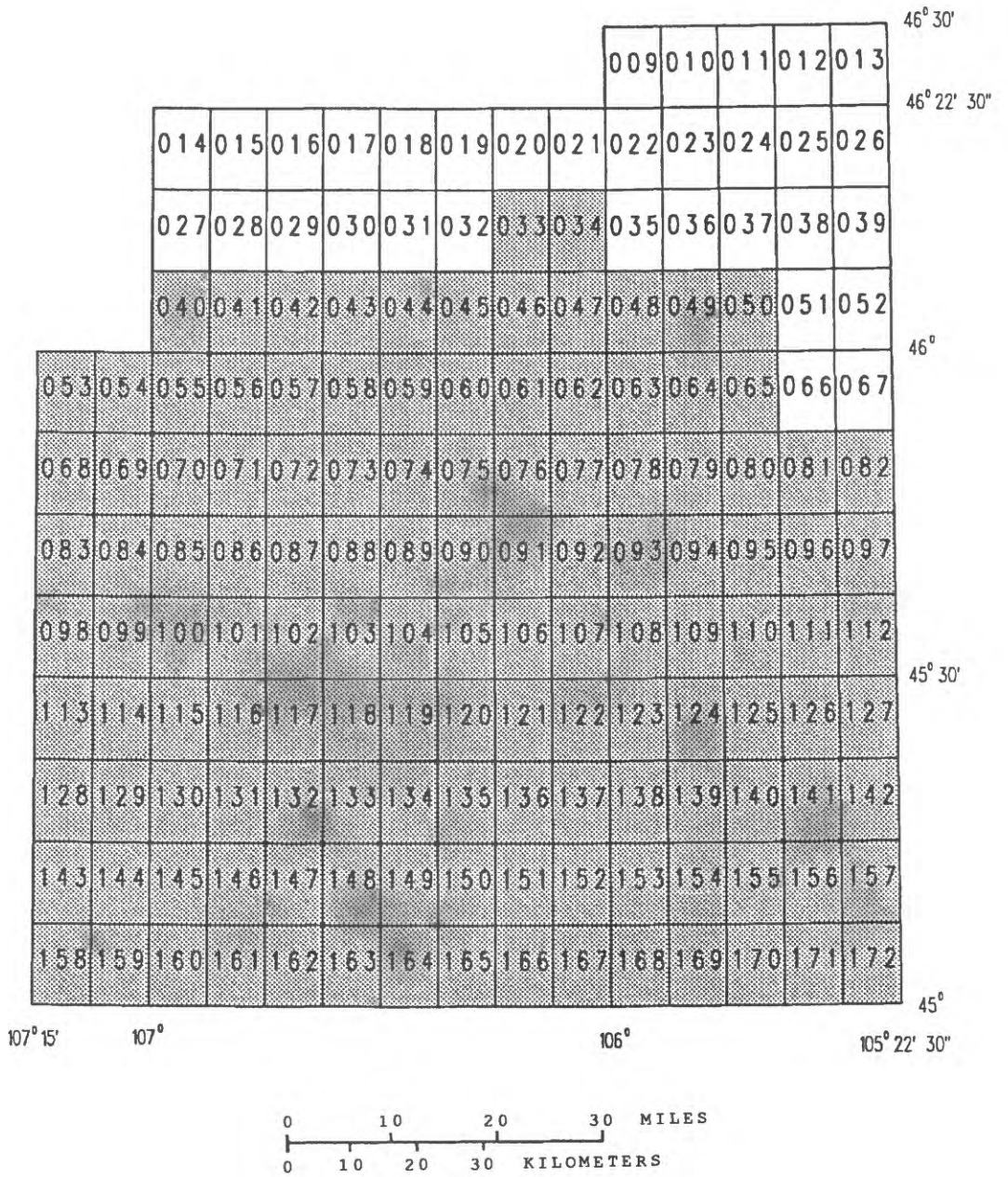

Figure 17.--Geographic extent of information for data layer: land survey (directory name LAND_SURVEY). Numbers identify 7.5 X 7.5 minute quadrangles.

Table 25.--*Documentation for the data layer: land survey (directory name LAND_SURVEY)*

COVERAGE DOCUMENTATION

DATA LAYER:	LAND_SURVEY (public land survey)
COVERAGE NAME(S):	PLS3033 through PLS3172 (some quadrangles not available)
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	All quadrangles except 009-032, 035-039, 051, 052, 066, and 067
SOURCE OF DATA:	U.S. Geological Survey, National Mapping Division. Data from 1:24,000 scale Digital Line Graphs.
DATA VINTAGE:	Various map dates from 1966 through 1978, compiled 1989.

ATTRIBUTE INFORMATION

DATAFILE NAME: PLS3040.PAT
9 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	PLS3040#	4	5	B	-	
13	PLS3040-ID	4	5	B	-	
17	TOWNSHIP	3	5	I	-	Township number (507 indicates township 7 1/2)
20	N/S	1	1	C	-	North or south of base line
21	RANGE	3	5	I	-	Range number
24	E/W	1	1	C	-	East or west of principal meridian
25	SECTION	2	5	I	-	Section number

A complete description of U.S. Geological Survey Digital Line Graphs and an explanation of all major and minor codes are available in the report--U.S. Geological Survey, 1986, Digital Line Graphs from 1:24,000 scale maps: National Mapping Division Data Users Guide 1, 109 p.

Land Use and Land Cover

The land use and land cover (directory name LAND_USE) layer contains information on both land use (such as urban or agricultural) and land cover (such as rangeland, forest land, or wetland). The geographic extent of this information is shown in figure 18, and the documentation is given in table 26.

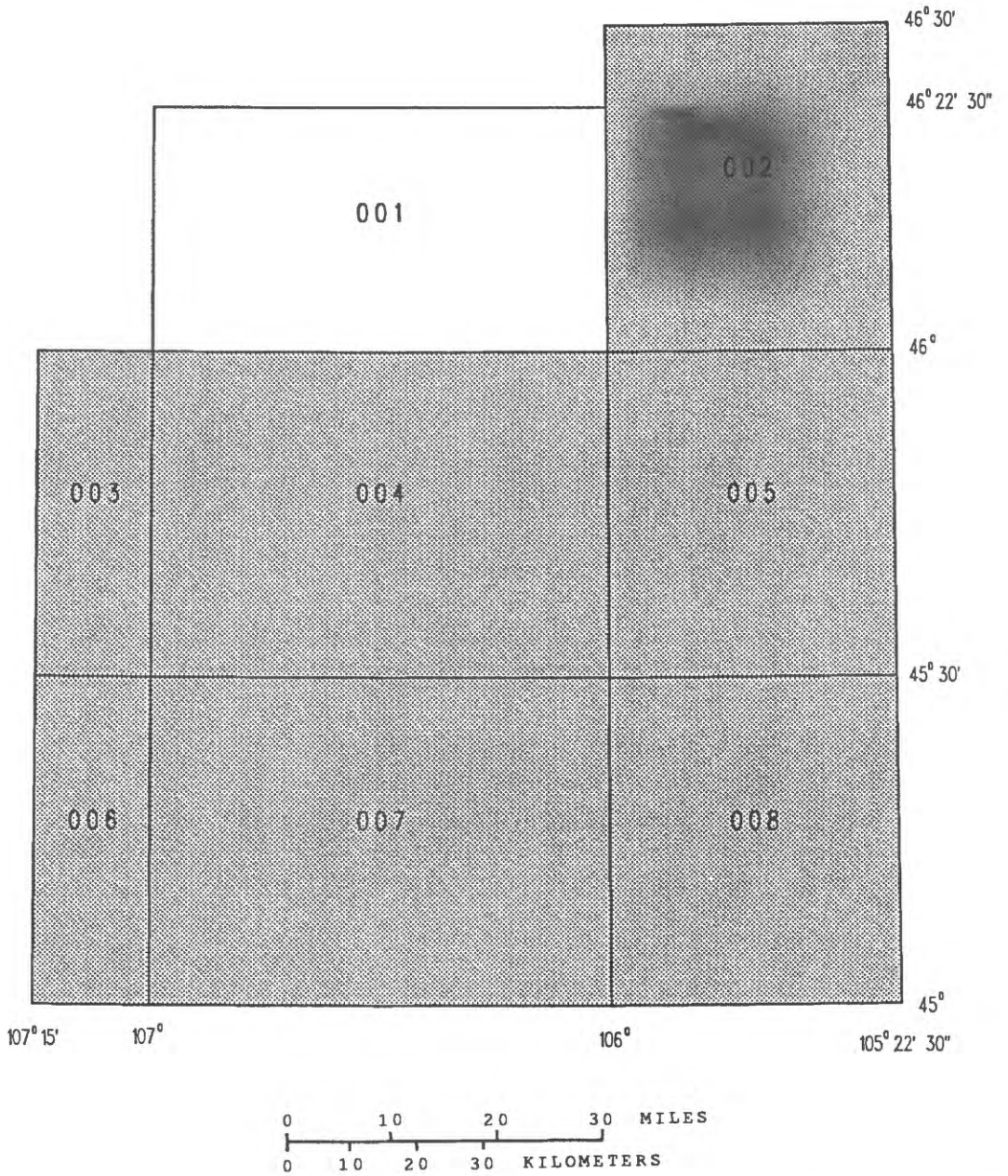

Figure 18.--Geographic extent of information for data layer: land use and land cover (directory name LAND_USE). Numbers identify 30 X 60 minute quadrangles.

Table 26.--*Documentation for the data layer: land use and land cover (directory name LAND_USE)*

COVERAGE DOCUMENTATION

DATA LAYER:	LAND_USE (land use and land cover)
COVERAGE NAME(S):	LUC3002, LUC3003, LUC3004, LUC3005, LUC3006, LUC3007, and LUC3008
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	Quadrangles 002 through 008
SOURCE OF DATA:	U.S. Geological Survey, National Mapping Division. Data from GIRAS (Geographic Information Retrieval and Analysis System) files, 1:250,000 series.
DATA VINTAGE:	1976 (Ekalaka quadrangle), 1970 (Hardin quadrangle), 1975 (Miles City quadrangle).

ATTRIBUTE INFORMATION

DATAFILE NAME: LUC3002.PAT
5 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	LUC3002#	4	5	B	-	
13	LUC3002-ID	4	5	B	-	
17	CODE	2	2	I	-	Land use/cover CODE described in INFO file CODE.EXPAND
	** REDEFINED ITEMS **					
17	C1	1	1	I	-	First digit of CODE used to generalize land use/cover category. 1 = Urban or built-up land 2 = Agricultural land 3 = Rangeland 4 = Forest land 5 = Water 6 = Wetland 7 = Barren land

Table 26.--*Documentation for the data layer: land use and land cover (directory name LAND_USE)*--Continued

INFO expand file for
coverage LUC3002

FILENAME: CODE.EXPAND

$RECNO	CODE	DESCRIPTION
1	11	Residential
2	12	Commercial and services
3	13	Industrial
4	14	Transportation
5	15	Industrial and commercial complexes
6	16	Mixed urban or built-up land
7	17	Other urban or built-up land
8	21	Cropland and pasture
9	22	Orchards
10	23	Confined feeding operations
11	24	Other agricultural land
12	31	Herbaceous rangeland
13	32	Shrub and brush rangeland
14	33	Mixed rangeland
15	41	Deciduous forest land
16	42	Evergreen forest land
17	43	Mixed forest land
18	51	Streams and canals
19	52	Lakes
20	53	Reservoirs
21	54	Bays and estuaries
22	61	Forested wetland
23	62	Nonforested wetland
24	71	Dry salt flats
25	72	Beaches
26	73	Sandy areas other than beaches
27	74	Bare exposed rock
28	75	Strip mines
29	76	Transitional areas
30	77	Mixed barren land

Permit Sites

The permit sites (directory name PERMIT_SITES) layer contains information on MPDES (Montana Pollutant Discharge Elimination System) permits for all active coal mines in the study area. Coverage MPD1999 shows permitted sites of possible discharge to streams, permit number, and name of permittee. The geographic extent of this information is shown in figure 19, and the documentation is given in table 27.

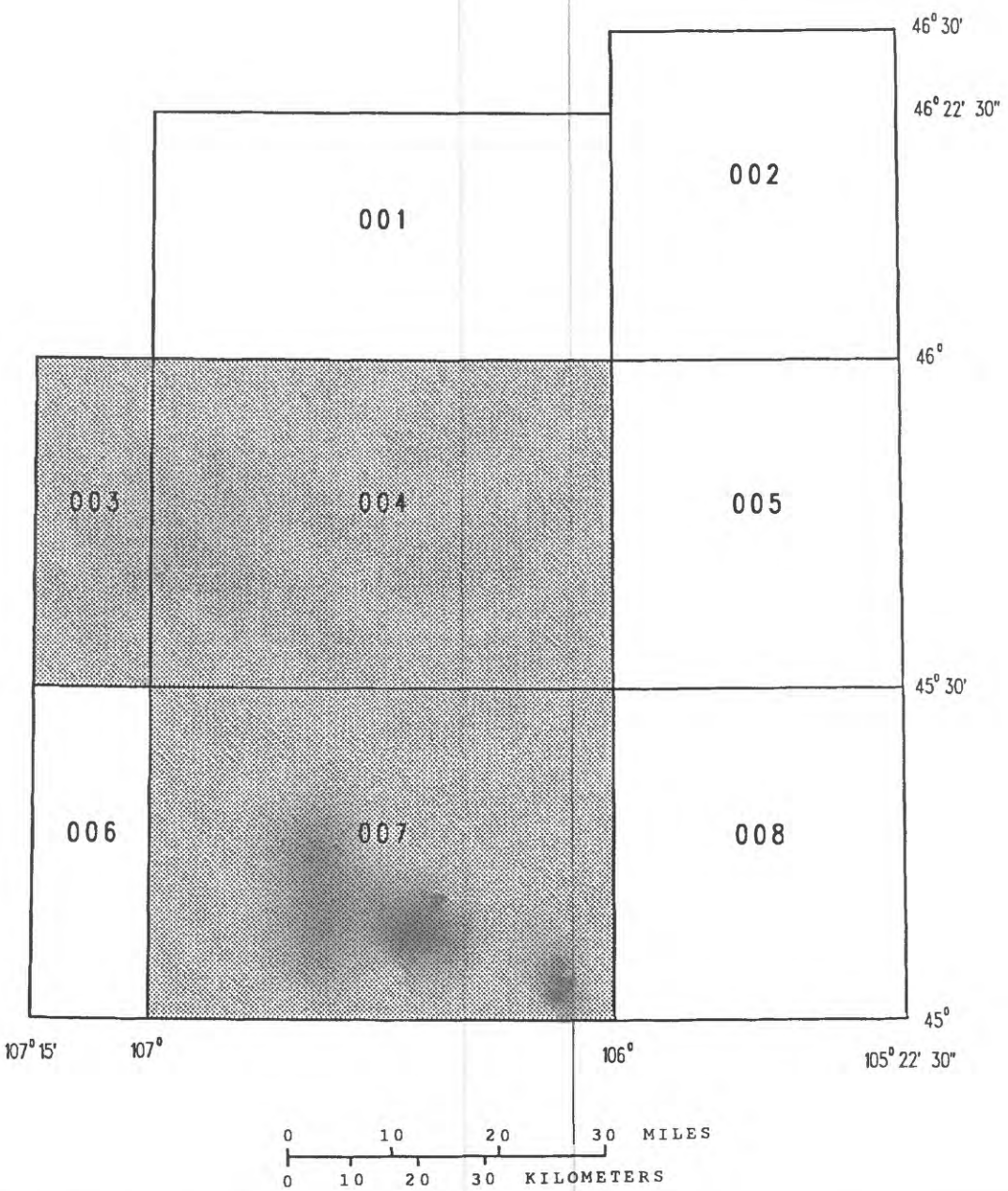

Figure 19.--Geographic extent of information for data layer: permit sites (directory name PERMIT_SITES). Numbers identify 30 X 60 minute quadrangles.

Table 27.--*Documentation for the data layer: permit sites (directory name PERMIT_SITES)*

COVERAGE DOCUMENTATION

DATA LAYER:	PERMIT_SITES (MPDES [Montana Pollutant Discharge Elimination System] permit sites for all active coal mines)
COVERAGE NAME(S):	MPD1999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Point
GEOGRAPHIC EXTENT:	Located in quadrangles 003, 004, and 007
SOURCE OF DATA:	Data obtained from files located at Montana Department of Health and Environmental Sciences, Water Quality Bureau, Helena, Montana.
DATA VINTAGE:	Source maps and files have various dates: Decker Coal Company, November 19, 1985; updated July 5, 1989. Peabody Coal Company, January 6, 1989 and January 15, 1990. Spring Creek Coal Company, July 1987; updated April 1988. Western Energy Company, May 3, 1989. Westmoreland Resources Inc., March 24, 1987.

SOURCE-MAP INFORMATION

MAP TYPE:	Topographic; East Decker sites from latitude-longitude
MAP SCALE-original:	Various scales (1:4,800 to 1:24,000)
MAP SCALE-digitized:	1:24,000 and 1:100,000
MAP MEDIUM:	Paper
MAP PROJECTION:	Unknown (transformed to Universal Transverse Mercator zone 13 with minimal error in positional accuracy)

ATTRIBUTE INFORMATION

DATAFILE NAME: MPD1999.PAT
7 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	MPD1999#	4	5	B	-	
13	MPD1999-ID	4	5	B	-	
17	PERMIT-NUMBER	10	10	C	-	MPDES permit number.
27	DISCHARGE-POINT	4	4	C	-	Discharge point number as shown on permit applications and records.
31	PERMITTEE	25	25	C	-	Name of permittee.

Railroads

The railroads (directory name RAILROADS) layer contains information on all railroads in the study area. The geographic extent of this information is shown in figure 20, and the documentation is given in table 28.

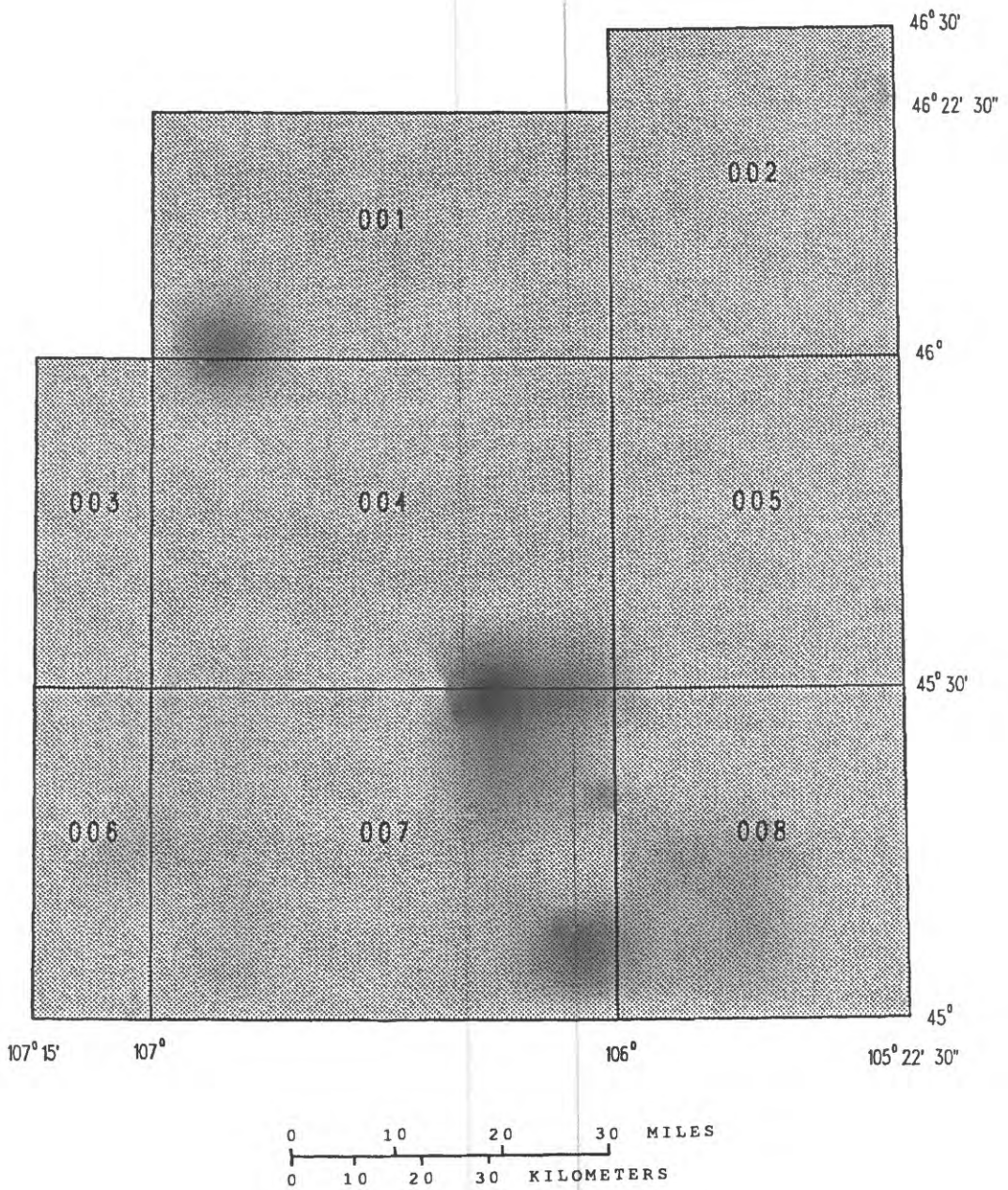

Figure 20.--Geographic extent of information for data layer: railroads (directory name RAILROADS). Numbers identify 30 X 60 minute quadrangles.

Table 28.--*Documentation for the data layer: railroads (directory name RAILROADS)*

COVERAGE DOCUMENTATION

DATA LAYER:	RAILROADS
COVERAGE NAME(S):	RRD2999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Line
GEOGRAPHIC EXTENT:	Quadrangles 001 through 008
SOURCE OF DATA:	U.S. Geological Survey, National Mapping Division. Data from 1:100,000 scale Digital Line Graphs.
DATA VINTAGE:	Various map dates, compiled 1988.

ATTRIBUTE INFORMATION

DATAFILE NAME: RRD2999.AAT
11 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	FNODE#	4	5	B	-	
5	TNODE#	4	5	B	-	
9	LPOLY#	4	5	B	-	
13	RPOLY#	4	5	B	-	
17	LENGTH	4	12	F	3	
21	RRD2999#	4	5	B	-	
25	RRD2999-ID	4	5	B	-	
29	MAJOR1	6	6	I	-	Major code (180=railroad feature)
35	MINOR1	6	6	I	-	Minor code; described in INFO file MINOR.EXPAND
41	MAJOR2	6	6	I	-	Major code (180=railroad feature)
47	MINOR2	6	6	I	-	Minor code; described in INFO file MINOR.EXPAND

A complete description of USGS Digital Line Graphs and an explanation of all major and minor codes are available in the report--U.S. Geological Survey, 1989, Digital Line Graphs from 1:100,000 scale maps: National Mapping Division Data Users Guide 2, 88 p.

Table 28.--*Documentation for the data layer: railroads (directory name RAILROADS)*--Continued

INFO expand file for coverage RRD2999

FILENAME: MINOR.EXPAND

$RECNO	MINOR1	MINOR2	DESCRIPTION
1	201	201	Railroad
2	202	202	Railroad in street or road
3	204	204	Carline
4	205	205	Cog railroad or incline railway
5	207	207	Ferry crossing
6	208	208	Railroad siding
7	209	209	Perimeter or limit of yard
8	210	210	Arbitrary line extension
9	400	400	Railroad station
10	401	401	Turntable
11	402	402	Roundhouse
12	600	600	Historical
13	601	601	In tunnel
14	602	602	Overpassing on bridge
15	603	603	Abandoned
16	604	604	Dismantled
17	605	605	Underpassing
18	606	606	Narrow gauge
19	607	607	In snowshed or under structure
20	608	608	Under construction
21	609	609	Elevated
22	610	610	Rapid transit
23	611	611	On drawbridge
24	612	612	Private
25	613	613	U.S. Government

Roads

The roads (directory name ROADS) layer contains information on roads and trails. The geographic extent of this information is shown in figure 21, and the documentation is given in table 29.

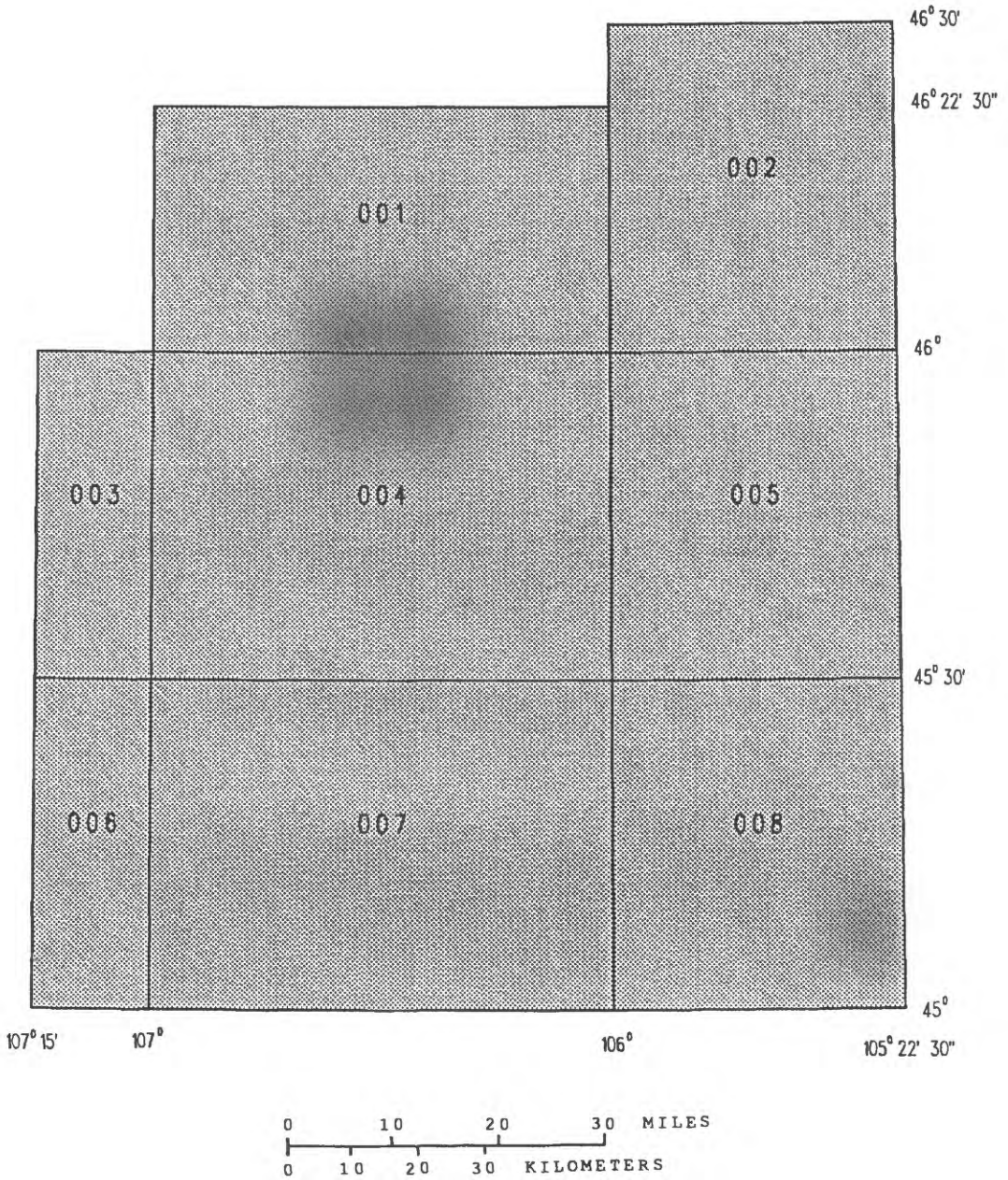

Figure 21.--Geographic extent of information for data layer: roads (directory name ROADS). Numbers identify 30 X 60 minute quadrangles.

Table 29.--*Documentation for the data layer: roads (directory name ROADS)*

COVERAGE DOCUMENTATION

DATA LAYER:	ROADS (roads and trails)
COVERAGE NAME(S):	RDS2001, RDS2002, RDS2003, RDS2004, RDS2005, RDS2006, RDS2007, and RDS2008
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Line
GEOGRAPHIC EXTENT:	Quadrangles 001 through 008
SOURCE OF DATA:	U.S. Geological Survey, National Mapping Division. Data from 1:100,000 scale Digital Line Graphs.
DATA VINTAGE:	Various map dates, compiled 1988.

ATTRIBUTE INFORMATION

DATAFILE NAME: RDS2001.AAT
15 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	FNODE#	4	5	B	-	
5	TNODE#	4	5	B	-	
9	LPOLY#	4	5	B	-	
13	RPOLY#	4	5	B	-	
17	LENGTH	4	12	F	3	
21	RDS2001#	4	5	B	-	
25	RDS2001-ID	4	5	B	-	
29	MAJOR1	6	6	I	-	Major code; described in INFO file MAJOR.EXPAND
35	MINOR1	6	6	I	-	Minor code; described in INFO file MINOR.EXPAND
41	MAJOR2	6	6	I	-	Major code; described in INFO file MAJOR.EXPAND
47	MINOR2	6	6	I	-	Minor code; described in INFO file MINOR.EXPAND
53	MAJOR3	6	6	I	-	Major code; described in INFO file MAJOR.EXPAND
59	MINOR3	6	6	I	-	Minor code; described in INFO file MINOR.EXPAND
65	MAJOR4	6	6	I	-	Major code; described in INFO file MAJOR.EXPAND
71	MINOR4	6	6	I	-	Minor code; described in INFO file MINOR.EXPAND

A complete description of USGS Digital Line Graphs and an explanation of all major and minor codes are available in the report--U.S. Geological Survey, 1989, Digital Line Graphs from 1:100,000 scale maps: National Mapping Division Data Users Guide 2, 88 p.

INFO expand files for
coverage RDS2001

FILENAME: MAJOR.EXPAND

$RECNO	MAJOR1	MAJOR2	MAJOR3	MAJOR4	DESCRIPTION
1	170	170	170	170	Minor code indicates road feature
2	171	171	171	171	Minor code equals number of lanes
3	172	172	172	172	Minor code equals Interstate route number
4	173	173	173	173	Minor code equals U.S. route number
5	174	174	174	174	Minor code equals State route number

Table 29.--*Documentation for the data layer: roads (directory name ROADS)--Continued*

INFO expand files for coverage RDS2001--Continued

FILENAME: MAJOR.EXPAND--Continued

$RECNO	MAJOR1	MAJOR2	MAJOR3	MAJOR4	DESCRIPTION--Continued
6	175	175	175	175	Minor code equals reservation, park, or military route number
7	176	176	176	176	Minor code equals county route number

FILENAME: MINOR.EXPAND

$RECNO	MINOR1	MINOR2	MINOR3	MINOR4	DESCRIPTION
1	201	201	201	201	Primary route, class 1, symbol undivided
2	202	202	202	202	Primary route, class 1, symbol divided by centerline
3	203	203	203	203	Primary route, class 1, divided, lanes separated
4	204	204	204	204	Primary route, class 1, one way, other than divided highway
5	205	205	205	205	Secondary route, class 2, symbol undivided
6	206	206	206	206	Secondary route, class 2, symbol divided by centerline
7	207	207	207	207	Secondary route, class 2, symbol divided, lanes separated
8	208	208	208	208	Secondary route, class 2, one way, other than divided highway
9	209	209	209	209	Road or street, class 3
10	210	210	210	210	Road or street, class 4
11	211	211	211	211	Trail, class 5, other than four-wheel-drive vehicle
12	212	212	212	212	Trail, class 5, four-wheel-drive vehicle
13	213	213	213	213	Footbridge
14	214	214	214	214	Ferry crossing
15	215	215	215	215	Perimeter of parking area
16	216	216	216	216	Arbitrary extension of line
17	217	217	217	217	Road or street, class 3, symbol divided by centerline
18	218	218	218	218	Road or street, class 3, divided, lanes separated
19	221	221	221	221	Road or street, class 3, one way
20	222	222	222	222	Road in transition
21	401	401	401	401	Traffic circle
22	402	402	402	402	Cloverleaf or interchange
23	403	403	403	403	Toll gate, toll plaza, or perimeter of toll plaza
24	404	404	404	404	Weigh station
25	405	405	405	405	Nonstandard section of road
26	601	601	601	601	In tunnel
27	602	602	602	602	Overpassing, on bridge
28	603	603	603	603	Under construction, classification known
29	604	604	604	604	Under construction, classification unknown
30	605	605	605	605	Labeled 'old railroad grade'
31	606	606	606	606	Submerged or in ford
32	607	607	607	607	Underpassing
33	615	615	615	615	Bypass route
34	616	616	616	616	Alternate route
35	617	617	617	617	Business route
36	622	622	622	622	Truck route

Saturated Paste

The saturated paste (directory name SAT_PASTE) layer contains geochemical data from saturated-paste extracts obtained from coal overburden. SPE1999 contains data for overburden above the first (uppermost) coal bed in a drill hole, SPE1999.2 contains data for overburden above the second coal bed in a drill hole, and SPE1999.3 contains data for overburden above the third coal bed in a drill hole. The geographic extent of this information is shown in figure 22, and the documentation is given in table 30.

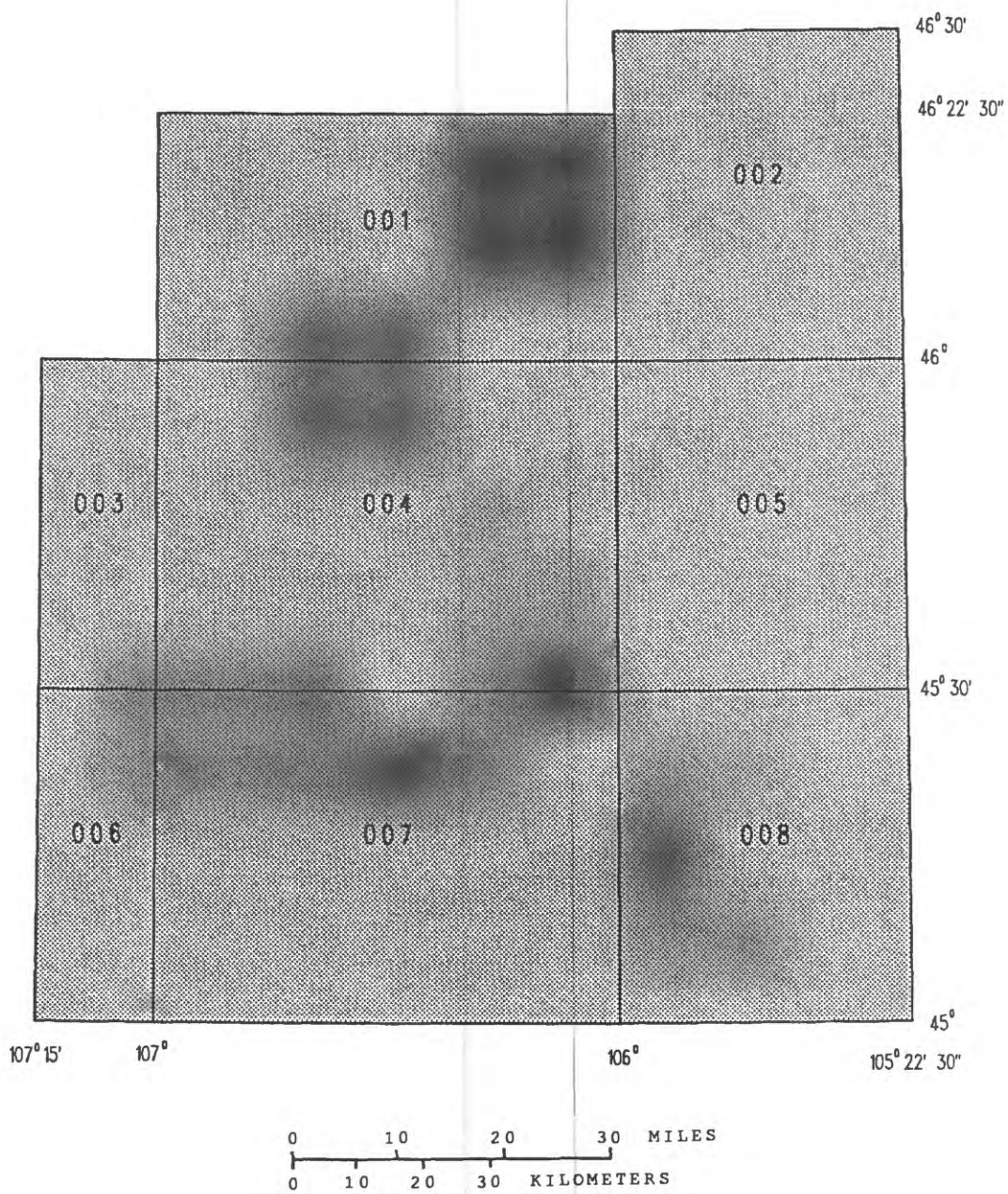

Figure 22.--Geographic extent of information for data layer: saturated paste (directory name SAT_PASTE). Numbers identify 30 X 60 minute quadrangles.

Table 30.--*Documentation for the data layer: saturated paste (directory name SAT_PASTE)*

COVERAGE DOCUMENTATION

DATA LAYER:	SAT_PASTE (saturated paste extracts from coal overburden)
COVERAGE NAME(S):	SPE1999, SPE1999.2, and SPE1999.3
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Point
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	Harrington, A.H., 1984, Compilation of overburden saturated paste analyses from the Fort Union Coal Region [Montana and Wyoming]: Montana Bureau of Mines and Geology Open-File Report MBMG 141, 301 p. Coverages generated from tabular information from digital tape.
DATA VINTAGE:	Compiled in 1984.

ATTRIBUTE INFORMATION

DATAFILE NAMES: SPE1999.PAT, SPE1999.2.PAT, SPE1999.3.PAT
29 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	SPE1999#	4	5	B	-	
13	SPE1999-ID	4	5	B	-	
17	LOCAL-ID	14	14	C	-	Township, range, and section
31	OTHER-ID	10	10	C	-	Original drill hole identifier
41	SOURCE-CODE	2	5	I	-	Code for source of data (all codes are listed in INFO file SOURCE.EXPAND)
43	LAB-CODE	2	5	I	-	Code for laboratory (all codes are listed in INFO file LAB.EXPAND)
45	DATE	8	8	D	-	Date of drilling or analysis
53	NUMBER-SAMPLES	2	5	I	-	Number of paste samples
55	DEPTH-START	6	10	N	1	Beginning sample depth (feet below land surface)
61	DEPTH-END	6	10	N	1	Ending sample depth (feet below land surface)
67	OVERBURDEN-CODE	2	5	I	-	Code for name of coal overburden (codes listed in INFO file OVERBURDEN.EXPAND)
69	SC-MEDIAN	6	10	N	2	Median specific conductance (microsiemens per centimeter at 25 degrees Celsius [µS/cm])
75	PH-MEDIAN	6	10	N	2	Median pH
81	CA-MEDIAN	6	10	N	2	Median calcium (milliequivalents per liter [meq/L])
87	MG-MEDIAN	6	10	N	2	Median magnesium (meq/L)
93	NA-MEDIAN	6	10	N	2	Median sodium (meq/L)
99	SC-MAX	6	10	N	2	Maximum specific conductance (µS/cm)

Table 30.--*Documentation for the data layer: saturated paste (directory name SAT_PASTE)*--Continued

ATTRIBUTE INFORMATION--Continued

DATAFILE NAMES: SPE1999.PAT, SPE1999.2.PAT, SPE1999.3.PAT--Continued
29 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
105	PH-MAX	6	10	N	2	Maximum pH
111	CA-MAX	6	10	N	2	Maximum calcium (meq/L)
117	MG-MAX	6	10	N	2	Maximum magnesium (meq/L)
123	NA-MAX	6	10	N	2	Maximum sodium (meq/L)
129	SC-MIN	6	10	N	2	Minimum specific conductance (µS/cm)
135	PH-MIN	6	10	N	2	Minimum pH
141	CA-MIN	6	10	N	2	Minimum calcium (meq/L)
147	MG-MIN	6	10	N	2	Minimum magnesium (meq/L)
153	NA-MIN	6	10	N	2	Minimum sodium (meq/L)
159	ADDITIONAL-DATA	1	1	I	-	Code indicating additional deeper coal beds with overburden data (1= yes, 0=no). Data for second coal bed is in coverage SPE1999.2 and data for third coal bed is in coverage SPE1999.3

Table 30.--*Documentation for the data layer: saturated paste (directory name SAT_PASTE)*--Continued

INFO expand files for
SPE1999, SPE1999.2, and SPE1999.3

FILENAME: SOURCE.EXPAND

$RECNO	SOURCE-CODE	SOURCE-NAME
1	0	Unknown
2	1	Peabody Coal Company
3	2	Western Energy Company
4	3	Shell Oil Company (Youngs Creek)
5	4	Department of State Lands
6	5	Decker Coal Company
7	6	Big Horn Coal Company
8	7	MONTCO Coal Company
9	8	Consolidation Coal Company
10	9	U.S. Bureau of Reclamation
11	10	Montana Bureau of Mines & Geology
12	11	Northern Cheyenne Research Program
13	12	Peter Kiewit & Sons Company
14	13	NERCO (Spring Creek Mine)
15	14	Shell Oil Company (Pearl area)
16	15	Westmoreland Resources, Inc.
17	16	Montana State University

FILENAME: LAB.EXPAND

$RECNO	LAB-CODE	LAB-NAME
1	0	Unknown
2	1	U.S. Geological Survey Central Laboratory
3	2	Montana Testing Laboratories, Inc.
4	3	Northern Testing Laboratory
5	4	Montana State University
6	5	Front Range Environmental Laboratory
7	6	Colorado School of Mines Research Institute
8	7	PKS Laboratory
9	8	Camp Dresser & McKee Laboratory
10	9	U.S. Bureau of Reclamation, Bismarck, N. Dak.
11	10	Energy Laboratories
12	11	Colorado State University
13	12	Inter-mountain Laboratories

FILENAME: OVERBURDEN.EXPAND

$RECNO	OVERBURDEN-CODE	OVERBURDEN-NAME
1	0	Unknown
2	1	Roland
3	2	Smith
4	3	Anderson
5	4	Anderson-Dietz
6	5	Anderson-Dietz 1
7	6	Anderson-Dietz 1-Dietz 2
8	7	Dietz
9	8	Dietz 1
10	9	Dietz 1-Dietz 2
11	10	Dietz 2
12	11	Canyon
13	12	Ferry
14	13	Cook

Table 30.--*Documentation for the data layer: saturated paste (directory name SAT_PASTE)*--Continued

INFO expand files for
SPE1999, SPE1999.2, and SPE1999.3--Continued

FILENAME: OVERBURDEN.EXPAND--Continued

$RECNO	OVERBURDEN-CODE	OVERBURDEN-NAME
15	14	Cook-upper bench
16	15	Cook-lower bench
17	16	Wall
18	17	Elk
19	18	Pawnee
20	19	Dunning
21	20	E
22	21	X
23	22	C-D
24	23	Brewster-Arnold
25	24	T
26	25	Sawyer
27	26	A
28	27	Knobloch
29	28	Knobloch-upper bench
30	29	Knobloch-middle bench
31	30	Knobloch-lower bench
32	31	Rosebud
33	32	Rosebud-McKay
34	33	McKay
35	34	Robinson
36	35	Broadus
37	36	Flowers-Goodale
38	37	Terret
39	38	Dominy
40	39	Dominy-upper bench
41	40	Dominy-middle bench
42	41	Dominy-lower bench
43	42	Carpenter Creek
44	43	Harmon
45	44	C (lignite)
46	45	G
47	46	Pust
48	47	Lane
49	48	Carrol
50	49	S
51	50	Coal Ridge
52	51	Lanark
53	52	Fort Peck
54	53	Fort Kipp
55	54	Local
56	55	Minor
57	56	Unnamed
58	57	Mammoth
59	58	Big Dirty
60	59	McKelvey
61	60	Nance
62	61	Rehder
63	62	Mammoth-Rehder
64	63	Wyo. Dietz 2
65	64	Wyo. Dietz 3
66	65	Wyo. Monarch
67	66	Wyo. Carney
68	67	Wyo. Carney-Masters
69	68	Squirrel Creek

Streamflow

The streamflow (directory name STREAMFLOW) layer contains flow statistics for all U.S. Geological Survey streamflow-gaging stations in the study area. The geographic extent of this information is shown in figure 23, and the documentation is given in table 31.

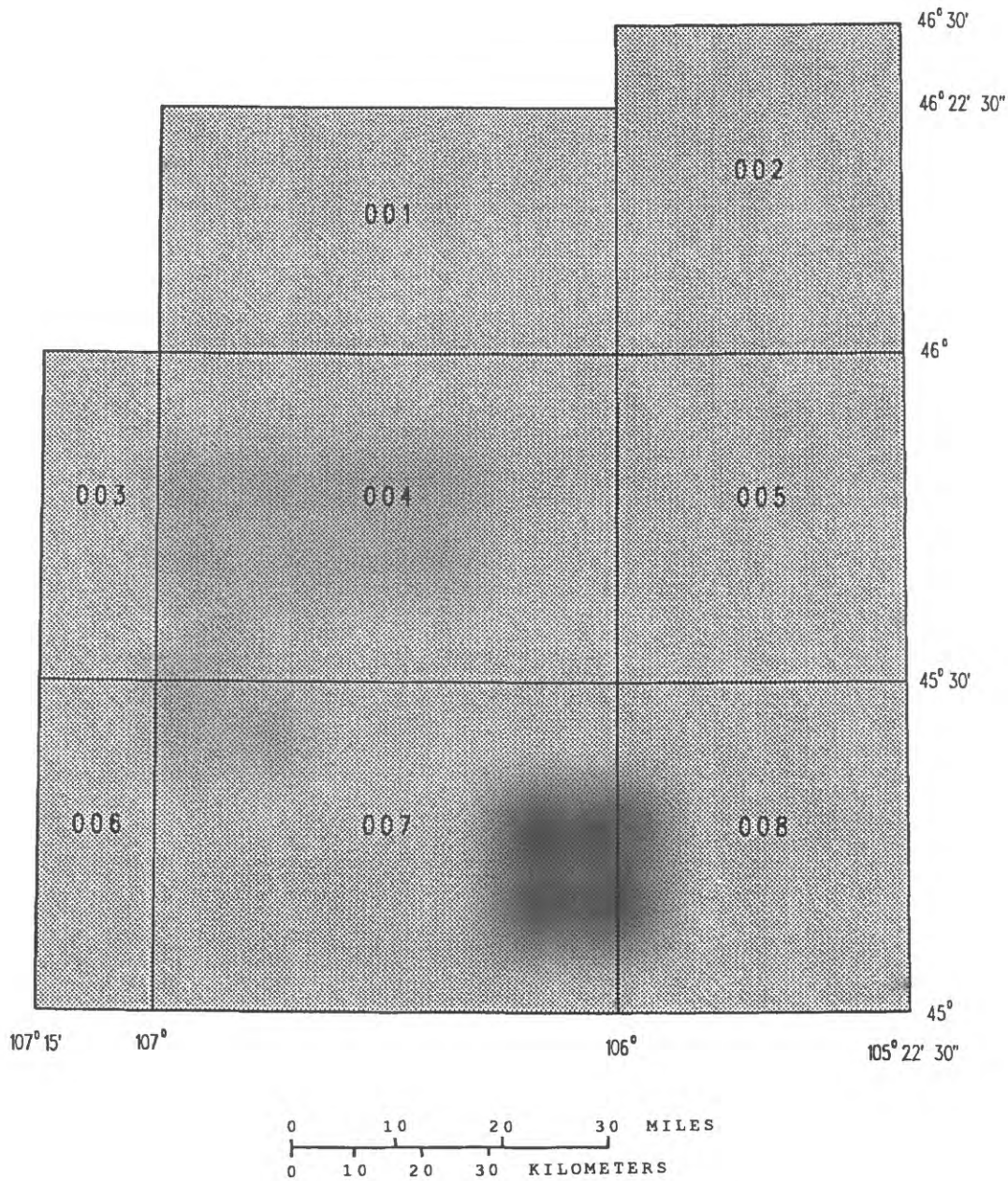

Figure 23.--Geographic extent of information for data layer: streamflow (directory name STREAMFLOW). Numbers identify 30 X 60 minute quadrangles.

Table 31.--*Documentation for the data layer: streamflow (directory name STREAMFLOW)*

COVERAGE DOCUMENTATION

DATA LAYER:	STREAMFLOW (flow statistics and data from streamflow-gaging stations)
COVERAGE NAME(S):	STR1999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Point
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	U.S. Geological Survey, issued annually, Water resources data, Montana: Helena, Mont., U.S. Geological Survey Water-Data Report. Coverage generated from digital tabular data produced by U.S. Geological Survey statistical summary programs.
DATA VINTAGE:	Includes streamflow data through water year 1987; peak flows were calculated from data through water year 1988.

ATTRIBUTE INFORMATION

DATAFILE NAME: STR1999.PAT
23 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	STR1999#	4	5	B	-	
13	STR1999-ID	4	5	B	-	
17	STATION-ID	8	8	C	-	U.S. Geological Survey station number
25	STATION-NAME	50	50	C	-	Station name
75	ALTITUDE	5	5	I	-	Altitude at station (feet above sea level)
80	DRAIN-AREA	8	10	N	2	Drainage area upstream from station (square miles)
88	POR-START	8	8	D	-	Starting date for period of record
96	POR-END	8	8	D	-	Ending date for period of record
104	ANNUAL-MEAN	8	10	N	2	Mean annual flow (cubic feet per second [ft^3/s])
112	JAN-MEAN	8	10	N	2	January mean flow (ft^3/s)
120	FEB-MEAN	8	10	N	2	February mean flow (ft^3/s)
128	MAR-MEAN	8	10	N	2	March mean flow (ft^3/s)
136	APR-MEAN	8	10	N	2	April mean flow (ft^3/s)
144	MAY-MEAN	8	10	N	2	May mean flow (ft^3/s)
152	JUN-MEAN	8	10	N	2	June mean flow (ft^3/s)
160	JUL-MEAN	8	10	N	2	July mean flow (ft^3/s)
168	AUG-MEAN	8	10	N	2	August mean flow (ft^3/s)
176	SEP-MEAN	8	10	N	2	September mean flow (ft^3/s)
184	OCT-MEAN	8	10	N	2	October mean flow (ft^3/s)
192	NOV-MEAN	8	10	N	2	November mean flow (ft^3/s)
200	DEC-MEAN	8	10	N	2	December mean flow (ft^3/s)

Table 31.--*Documentation for the data layer: streamflow (directory name STREAMFLOW)*--Continued

DATAFILE NAME: STR.MAX-MIN
25 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	STATION-ID	8	8	C	-	U.S. Geological Survey station number
9	JAN-MAX	8	10	N	2	January maximum flow (ft^3/s)
17	FEB-MAX	8	10	N	2	February maximum flow (ft^3/s)
25	MAR-MAX	8	10	N	2	March maximum flow (ft^3/s)
33	APR-MAX	8	10	N	2	April maximum flow (ft^3/s)
41	MAY-MAX	8	10	N	2	May maximum flow (ft^3/s)
49	JUN-MAX	8	10	N	2	June maximum flow (ft^3/s)
57	JUL-MAX	8	10	N	2	July maximum flow (ft^3/s)
65	AUG-MAX	8	10	N	2	August maximum flow (ft^3/s)
73	SEP-MAX	8	10	N	2	September maximum flow (ft^3/s)
81	OCT-MAX	8	10	N	2	October maximum flow (ft^3/s)
89	NOV-MAX	8	10	N	2	November maximum flow (ft^3/s)
97	DEC-MAX	8	10	N	2	December maximum flow (ft^3/s)
105	JAN-MIN	8	10	N	2	January minimum flow (ft^3/s)
113	FEB-MIN	8	10	N	2	February minimum flow (ft^3/s)
121	MAR-MIN	8	10	N	2	March minimum flow (ft^3/s)
129	APR-MIN	8	10	N	2	April minimum flow (ft^3/s)
137	MAY-MIN	8	10	N	2	May minimum flow (ft^3/s)
145	JUN-MIN	8	10	N	2	June minimum flow (ft^3/s)
153	JUL-MIN	8	10	N	2	July minimum flow (ft^3/s)
161	AUG-MIN	8	10	N	2	August minimum flow (ft^3/s)
169	SEP-MIN	8	10	N	2	September minimum flow (ft^3/s)
177	OCT-MIN	8	10	N	2	October minimum flow (ft^3/s)
185	NOV-MIN	8	10	N	2	November minimum flow (ft^3/s)
193	DEC-MIN	8	10	N	2	December minimum flow (ft^3/s)

DATAFILE NAME: STR.PEAK
8 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	STATION-ID	8	8	C	-	U.S. Geological Survey station number
9	YEARS-RECORD	2	2	I	-	Number of years of record used for calculating peak flows (peak flows not calculated for stations with less than 10 years of record)
11	PEAK-2	6	10	I	-	2-year peak flow (ft^3/s)
17	PEAK-5	6	10	I	-	5-year peak flow (ft^3/s)
23	PEAK-10	6	10	I	-	10-year peak flow (ft^3/s)
29	PEAK-25	6	10	I	-	25-year peak flow (ft^3/s)
35	PEAK-50	6	10	I	-	50-year peak flow (ft^3/s)
41	PEAK-100	6	10	I	-	100-year peak flow (ft^3/s)

DATAFILE NAME: STR.DURATION
6 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	STATION-ID	8	8	C	-	U.S. Geological Survey station number
9	DURATION-10	8	10	N	2	Flow equaled or exceeded 10 percent of time
17	DURATION-30	8	10	N	2	Flow equaled or exceeded 30 percent of time
25	DURATION-50	8	10	N	2	Flow equaled or exceeded 50 percent of time
33	DURATION-70	8	10	N	2	Flow equaled or exceeded 70 percent of time
41	DURATION-90	8	10	N	2	Flow equaled or exceeded 90 percent of time

Note: These INFO files can be related to one another using item STATION-ID.

Templates

The templates (directory name TEMPLATES) layer contains the outline of the Custer National Forest, and coverages of quadrangle boundaries. Coverage QUADS_24K contains boundaries and names of all 7.5 X 7.5 minute quadrangles and coverage QUADS_100K contains boundaries and names of all 30 X 60 minute quadrangles. The geographic extent of this information is shown in figure 24, and the documentation is given in table 32.

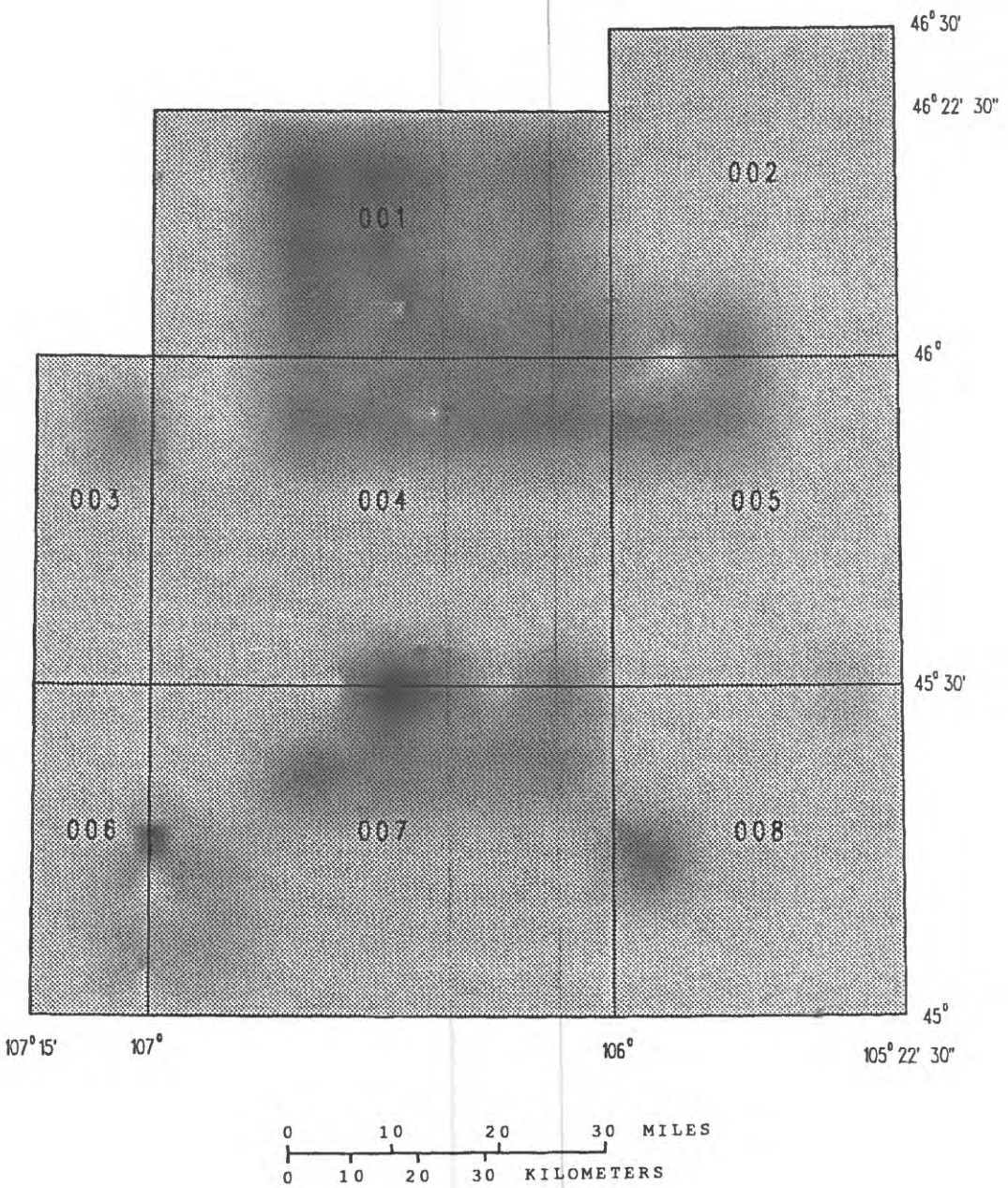

Figure 24.--Geographic extent of information for data layer: templates (directory name TEMPLATES). Numbers identify 30 X 60 minute quadrangles.

Table 32.--*Documentation for the data layer: templates (directory name TEMPLATES)*

COVERAGE DOCUMENTATION

DATA LAYER:	TEMPLATES (outline of Custer National Forest and quadrangle outlines)
COVERAGE NAME(S):	CUSTER_NF, QUADS_24K, and QUADS_100K
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Polygon
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	U.S. Geological Survey, National Mapping Division. Boundaries of the Custer National Forest are from 1:24,000 scale Digital Line Graphs. Quadrangle boundaries were generated from latitude-longitude coordinates of the corners of all 7.5 X 7.5 minute quadrangles in the study area.
DATA VINTAGE:	Compiled in 1988.

ATTRIBUTE INFORMATION

DATAFILE NAME: CUSTER_NF.PAT
5 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	CUSTER_NF#	4	5	B	-	
13	CUSTER_NF-ID	4	5	B	-	
17	CODE1	3	3	I	-	Code indicating areas of national forest (104=forest area)

DATAFILE NAME: QUADS_24K.PAT
5 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	QUADS_24K#	4	5	B	-	
13	QUADS_24K-ID	4	5	B	-	
17	QUADNAME	30	30	C	-	Name of quadrangle

DATAFILE NAME: QUADS_100K.PAT
5 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	QUADS_100K#	4	5	B	-	
13	QUADS_100K-ID	4	5	B	-	
17	QUADNAME	30	30	C	-	Name of quadrangle

Utilities

The utilities (directory name UTILITIES) layer contains information on pipelines, powerlines, landing strips, and miscellaneous transportation features. The geographic extent of this information is shown in figure 25, and the documentation is given in table 33.

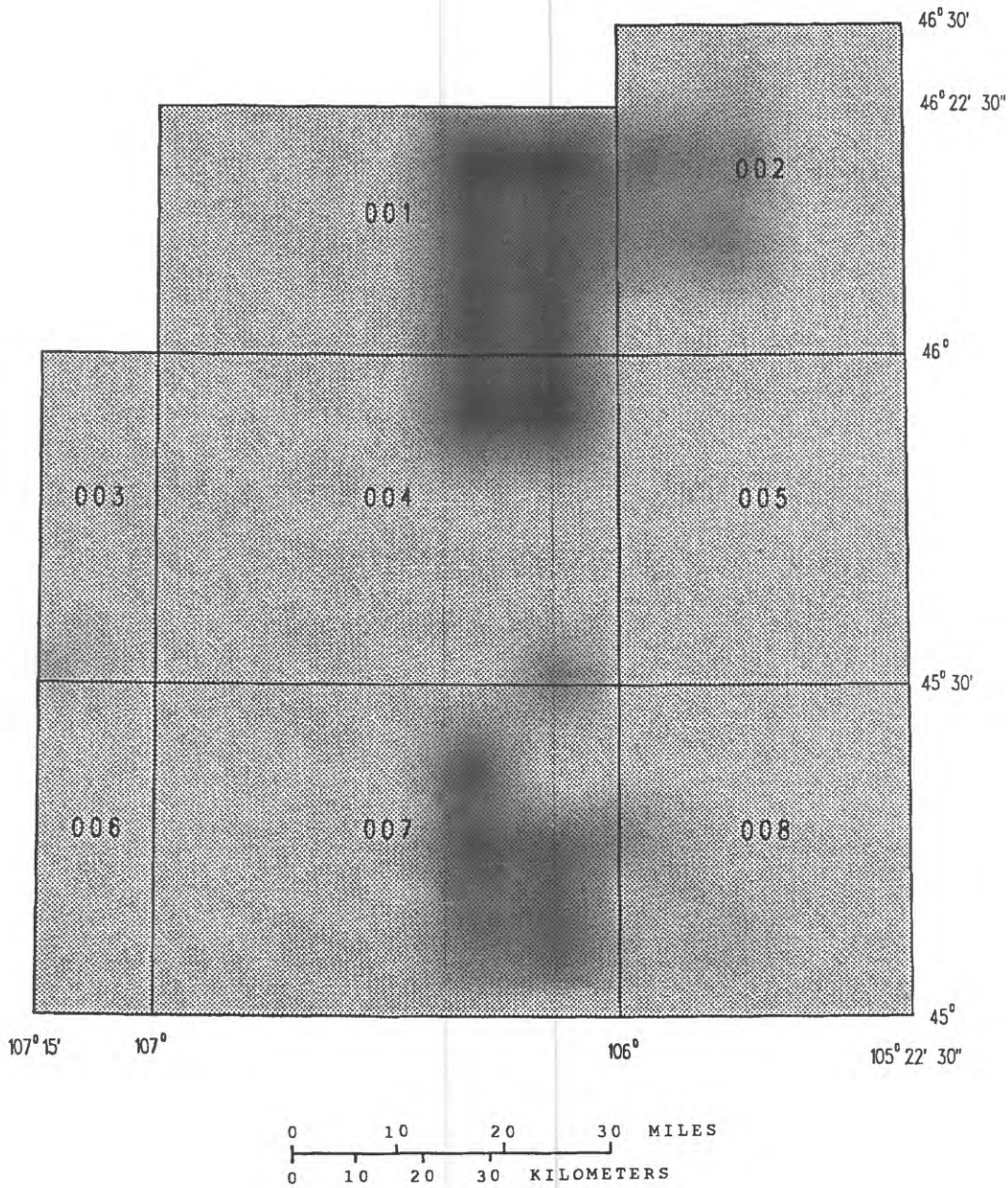

Figure 25.--Geographic extent of information for data layer: utilities (directory name UTILITIES). Numbers identify 30 X 60 minute quadrangles.

Table 33.--*Documentation for the data layer: utilities (directory name UTILITIES)*

COVERAGE DOCUMENTATION

DATA LAYER:	UTILITIES (pipelines, powerlines, and landing strips)
COVERAGE NAME(S):	UTL2999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Line
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	U.S. Geological Survey, National Mapping Division. Data from 1:100,000 scale Digital Line Graphs.
DATA VINTAGE:	Various map dates, compiled 1988.

ATTRIBUTE INFORMATION

DATAFILE NAME: UTL2999.AAT
9 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	FNODE#	4	5	B	-	
5	TNODE#	4	5	B	-	
9	LPOLY#	4	5	B	-	
13	RPOLY#	4	5	B	-	
17	LENGTH	4	12	F	3	
21	UTL2999#	4	5	B	-	
25	UTL2999-ID	4	5	B	-	
29	MAJOR1	6	6	I	-	Major code (190=utilities feature)
35	MINOR1	6	6	I	-	Minor code (201=pipeline, 202= power transmission line, 403= landing strip or airport)

A complete description of USGS Digital Line Graphs and an explanation of all major and minor codes are available in the report--U.S. Geological Survey, 1989, Digital Line Graphs from 1:100,000 scale maps: National Mapping Division Data Users Guide 2, 88 p.

Water Quality

The water quality (directory name WATER_QUALITY) layer contains information on the quality of surface water at U.S. Geological Survey streamflow-gaging stations and the quality of ground water from wells and springs. The geographic extent of this information is shown in figure 26, and the documentation is given in tables 34 and 35.

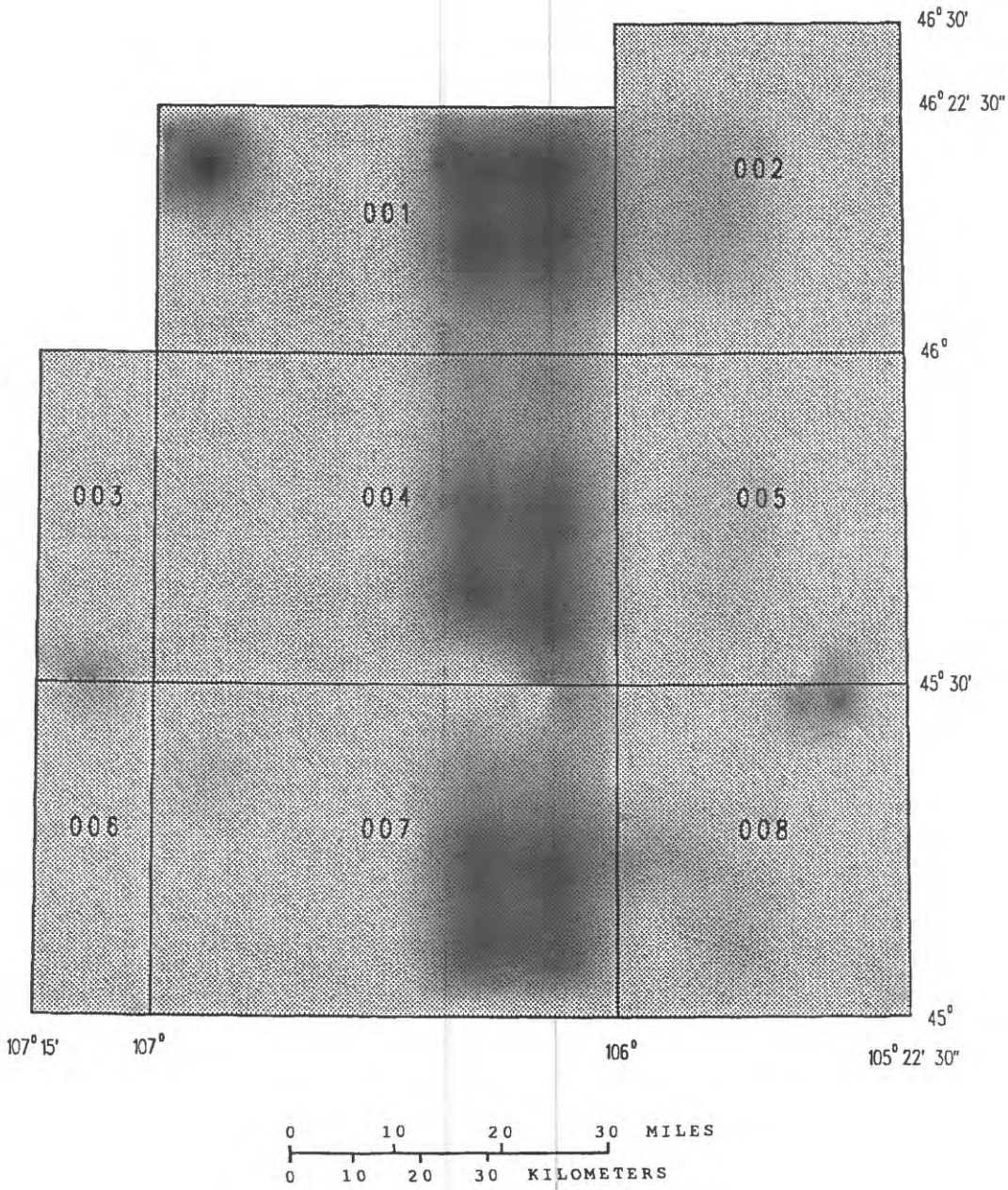

Figure 26.--Geographic extent of information for data layer: water quality (directory name WATER_QUALITY). Numbers identify 30 X 60 minute quadrangles.

Table 34.--*Documentation for the data layer: water quality (directory name WATER_QUALITY), coverage QWS1999*

COVERAGE DOCUMENTATION

DATA LAYER:	WATER_QUALITY (quality of surface water)
COVERAGE NAME(S):	QWS1999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Point
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	U.S. Geological Survey, issued annually, Water resources data, Montana: Helena, Mont., U.S. Geological Survey Water-Data Report. Coverage generated from digital tabular data produced by U.S. Geological Survey statistical summary programs.
DATA VINTAGE:	Includes data through water year 1988.

ATTRIBUTE INFORMATION

DATAFILE NAME: QWS1999.PAT
31 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	QWS1999#	4	5	B	-	
13	QWS1999-ID	4	5	B	-	
17	STATION-ID	8	8	C	-	U.S. Geological Survey station number
25	STATION-NAME	50	50	C	-	Station name
75	DRAIN-AREA	8	10	N	2	Drainage area upstream from station (square miles)
83	POR-START	8	8	D	-	Starting date for period of record
91	POR-END	8	8	D	-	Ending date for period of record
99	SC-MEDIAN	6	10	N	0	Median specific conductance (microsiemens per centimeter at 25 degrees Celsius)
105	SC-SAMPLES	3	5	I	-	Number of specific conductance samples
108	PH-MEDIAN	5	10	N	2	Median pH
113	PH-SAMPLES	3	5	I	-	Number of pH samples
116	ALK-MEDIAN	5	10	N	0	Median alkalinity (milligrams per liter [mg/L] as calcium carbonate)
121	ALK-SAMPLES	3	5	I	-	Number of alkalinity samples
124	CA-MEDIAN	5	10	N	0	Median calcium concentration (mg/L)
129	CA-SAMPLES	3	5	I	-	Number of calcium samples
132	MG-MEDIAN	5	10	N	0	Median magnesium concentration (mg/L)
137	MG-SAMPLES	3	5	I	-	Number of magnesium samples
140	NA-MEDIAN	5	10	N	0	Median sodium concentration (mg/L)
145	NA-SAMPLES	3	5	I	-	Number of sodium samples
148	K-MEDIAN	5	10	N	1	Median potassium concentration (mg/L)
153	K-SAMPLES	3	5	I	-	Number of potassium samples
156	SO4-MEDIAN	5	10	N	0	Median sulfate concentration (mg/L)
161	SO4-SAMPLES	3	5	I	-	Number of sulfate samples
164	CL-MEDIAN	5	10	N	1	Median chloride concentration (mg/L)
169	CL-SAMPLES	3	5	I	-	Number of chloride samples
172	F-MEDIAN	5	10	N	2	Median fluoride concentration (mg/L)
177	F-SAMPLES	3	5	I	-	Number of fluoride samples
180	DS-MEDIAN	6	10	N	0	Median dissolved-solids concentration (mg/L)
186	DS-SAMPLES	3	5	I	-	Number of dissolved-solids samples

Table 35.--*Documentation for the data layer: water quality (directory name WATER_QUALITY), coverage QWW1999*

COVERAGE DOCUMENTATION

DATA LAYER: WATER_QUALITY (quality of ground water)
COVERAGE NAME(S): QWW1999
COVERAGE UNITS: Meters
COVERAGE PROJECTION: Universal Transverse Mercator zone 13
FEATURE TYPE: Point
GEOGRAPHIC EXTENT: Entire area

SOURCE OF DATA: U.S. Geological Survey, issued annually, Water resources data, Montana: Helena, Mont., U.S. Geological Survey Water-Data Report. Coverage generated from digital tabular data.

DATA VINTAGE: Includes data through water year 1988.

ATTRIBUTE INFORMATION

DATAFILE NAME: QWW1999.PAT
23 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	QWW1999#	4	5	B	-	
13	QWW1999-ID	4	5	B	-	
17	LOCAL-ID	14	14	C	-	Township, range, and section
31	USGS-ID	15	15	C	-	Site identifier from WATSTORE (U.S. Geological Survey's Water Data Storage and Retrieval System)
46	OTHER-ID	15	15	C	-	Other identifier
61	SITE-TYPE	2	2	C	-	Type of site: spring(SP), ground water(GW)
63	ALTITUDE	5	5	N	0	Altitude of land surface (feet above sea level; -9999. indicates null value)
68	AQUIFER	7	7	C	-	Aquifer code described in file AQUIFER.EXPAND
75	DEPTH	5	5	N	0	Well depth (feet below land surface; -9999. indicates null value)
80	SAMPLE-DATE	8	10	D	-	Date of sample collection
88	SC	6	10	N	0	Specific conductance (microsiemens per centimeter at 25 degrees Celsius; -99999. indicates null value)
94	PH	4	10	N	1	pH (-9. indicates a null value)
98	ALK	5	10	N	0	Alkalinity (milligrams per liter [mg/L] as calcium carbonate; -9999. indicates null value)
103	CA	6	10	N	1	Calcium concentration (mg/L); (-999. indicates null value)
109	MG	6	10	N	1	Magnesium concentration (mg/L); (-999. indicates null value)
115	NA	6	10	N	1	Sodium concentration (mg/L); (-999. indicates null value)
121	K	6	10	N	1	Potassium concentration (mg/L); (-999. indicates null value)
127	SO4	6	10	N	1	Sulfate concentration (mg/L); (-999. indicates null value)

Table 35.--*Documentation for the data layer: water quality (directory name WATER_QUALITY), coverage QWW1999*--Continued

ATTRIBUTE INFORMATION--Continued

DATAFILE NAME: QWW1999.PAT--Continued
23 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
133	CL	6	10	N	1	Chloride concentration (mg/L); (-999. indicates null value)
139	F	6	10	N	2	Fluoride concentration (mg/L); (-99. indicates null value)
145	DS	6	10	N	0	Dissolved-solids concentration (mg/L); (-99999. indicates null value)

Wells

The wells (directory name WELLS) layer contains information on well construction, water levels, and well discharge. The geographic extent of this information is shown in figure 27, and the documentation is given in table 36.

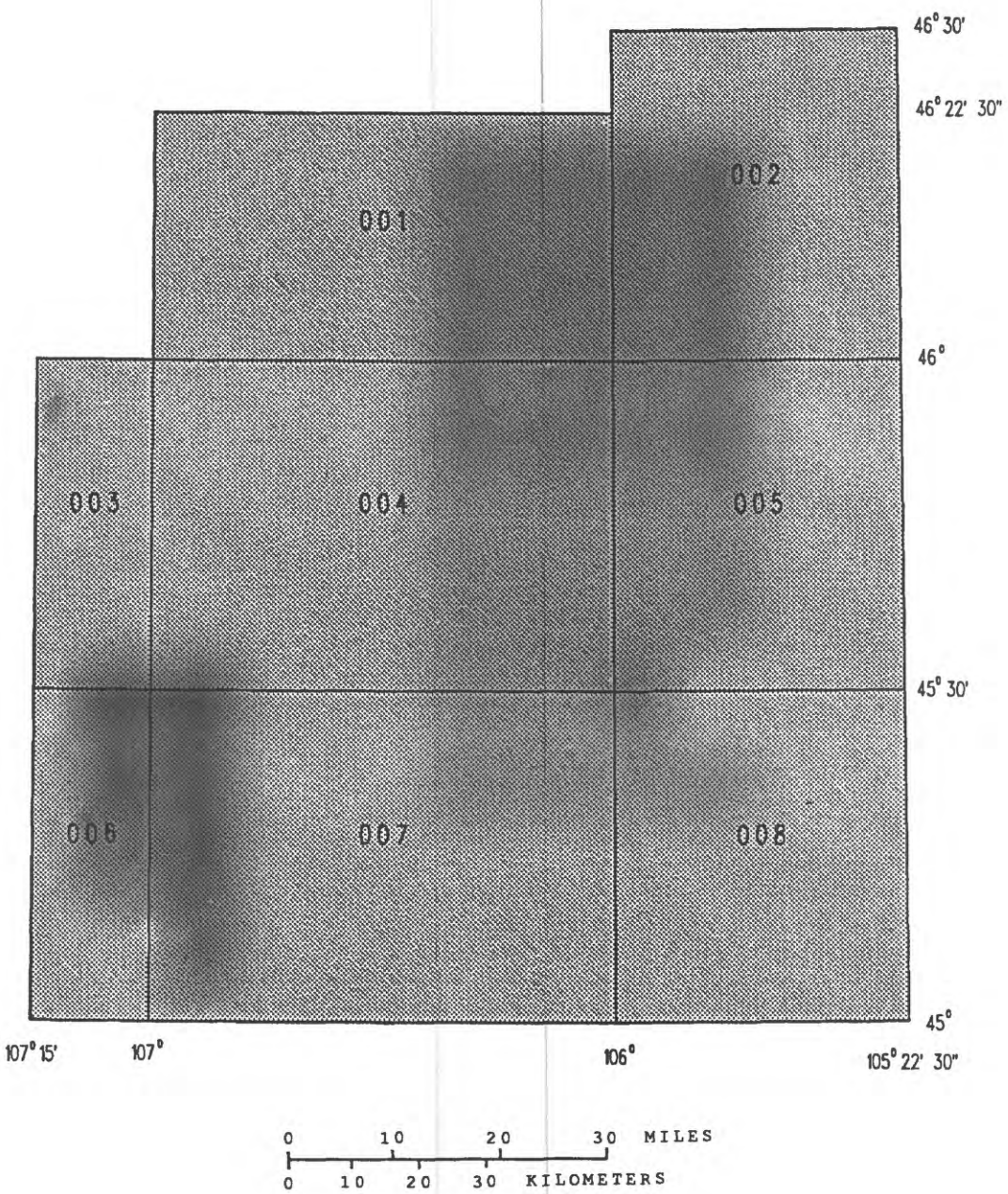

Figure 27.--Geographic extent of information for data layer: wells (directory name WELLS). Numbers identify 30 X 60 minute quadrangles.

Table 36.--*Documentation for the data layer: wells (directory name WELLS)*

COVERAGE DOCUMENTATION

DATA LAYER:	WELLS (well construction, water levels, and well discharge)
COVERAGE NAME(S):	WLS1999
COVERAGE UNITS:	Meters
COVERAGE PROJECTION:	Universal Transverse Mercator zone 13
FEATURE TYPE:	Point
GEOGRAPHIC EXTENT:	Entire area
SOURCE OF DATA:	U.S. Geological Survey, Water Resources Division, Helena, Mont. Data from WATSTORE (U.S. Geological Survey's Water Data Storage and Retrieval System) data base. Coverage generated from digital tabular data.
DATA VINTAGE:	Compiled from data through 1988.

ATTRIBUTE INFORMATION

DATAFILE NAME: WLS1999.PAT
17 ITEMS: STARTING IN POSITION 1

COL	ITEM NAME	WDTH	OPUT	TYP	N.DEC	DESCRIPTION
1	AREA	4	12	F	3	
5	PERIMETER	4	12	F	3	
9	WLS#	4	5	B	-	
13	WLS-ID	4	5	B	-	
17	LOCAL-ID	14	14	C	-	Township, range, and section
31	USGS-ID	15	15	C	-	Site identifier from WATSTORE
46	SITE-TYPE	1	1	C	-	Type of site: W, well; S, spring; X, test hole
47	WATER-USE	1	1	C	-	Code for use of water; codes described in WATER-USE.EXPAND
48	ALTITUDE	5	5	N	0	Altitude of land surface (feet above sea level; -9999. indicates null value)
53	AQUIFER	7	7	C	-	Aquifer code described in file AQUIFER.EXPAND
60	DEPTH	5	5	N	0	Well depth (feet below land surface; -9999. indicates null value)
65	WATER-LEVEL	7	7	N	2	Water level (feet below land surface; - indicates above land surface; -999. indicates null value)
72	WL-DATE	8	8	D	-	Date of water-level measurement
80	WL-METHOD	1	1	C	-	Method of water-level measurement; described in WL-METHOD.EXPAND
81	DISCHARGE	7	7	N	2	Well discharge (gallons per minute; -999. indicates null value)
88	DISCHARGE-METHOD	1	1	C	-	Method of discharge measurement; described in DISCH-METHOD.EXPAND
89	DATA-SOURCE	4	4	C	-	Agency that collected well data; (USGS=U.S. Geological Survey; MBMG= Montana Bureau of Mines and Geology)

Table 36.--*Documentation for the data layer: wells (directory name WELLS)*--Continued

INFO expand files for coverage WLS1999

FILENAME: WATER-USE.EXPAND

$RECNO	WATER-USE	DESCRIPTION
1	C	Commercial
2	H	Domestic
3	I	Irrigation
4	N	Industrial
5	P	Public supply
6	R	Recreation
7	S	Stock
8	U	Unused
9	Z	Other

FILENAME: AQUIFER.EXPAND

$RECNO	AQUIFER	DESCRIPTION
1	110ALVM	Quaternary alluvium
2	110TRRC	Quaternary terrace deposits
3	111ALVM	Holocene alluvium
4	111SPBK	Spoil banks
5	111TRRC	Holocene terrace deposits
6	112ALVM	Pleistocene alluvium
7	112TRRC	Pleistocene terrace deposits
8	124WSTC	Eocene Wasatch Formation
9	125FRUN	Paleocene Fort Union Formation
10	125LEBO	Paleocene Lebo Shale Member of Fort Union Formation
11	125TGRV	Paleocene Tongue River Member of Fort Union Formation
12	125TLCK	Paleocene Tullock Member of Fort Union Formation
13	211FHHC	Fox Hills-Hell Creek aquifer
14	211HLCK	Upper Cretaceous Hell Creek Formation
15	211FXHL	Upper Cretaceous Fox Hills Sandstone

FILENAME: WL-METHOD.EXPAND

$RECNO	WL-METHOD	DESCRIPTION
1	A	Airline
2	E	Estimated
3	G	Pressure gage
4	N	Not measured
5	R	Reported
6	S	Steel tape
7	T	Electric tape
8	Z	Other
9	U	Unknown

FILENAME: DISCH-METHOD.EXPAND

$RECNO	DISCHARGE-METHOD	DESCRIPTION
1	B	Bailer
2	C	Current meter
3	E	Estimated
4	N	Not measured
5	O	Orifice
6	R	Reported
7	U	Unknown
8	V	Volumetric
9	W	Weir
10	Z	Other

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