



**U.S. Geological Survey Professional Paper 1652**

**Integrated Investigations of Environmental Effects of Historical Mining in the Basin and Boulder Mining Districts, Boulder River Watershed, Jefferson County, Montana**

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**Introduction**

The Boulder River watershed is one of many watersheds in the western United States where historical mining has left a legacy of acid mine drainage and elevated concentrations of potentially toxic trace elements. Abandoned mine lands commonly are located on or affect Federal land. Cleaning up these Federal lands will require substantial investment of resources. As part of a cooperative effort with Federal land-management agencies, the U.S. Geological Survey implemented an Abandoned Mine Lands Initiative in 1997. The goal of the initiative was to use the watershed approach to develop a strategy for gathering and communicating the scientific information needed to formulate effective and cost-efficient remediation of affected lands in a watershed. The watershed approach is based on the premise that contaminated sites that have the most profound effect on

water and ecosystem quality within an entire watershed should be identified, characterized, and ranked for remediation.

The watershed approach provides an effective means to evaluate the overall status of affected resources and helps to focus remediation at sites where the most benefit will be gained in the watershed. Such a large-scale approach can result in the collection of extensive information on the geology and geochemistry of rocks and sediment, the hydrology and water chemistry of streams and ground water, and the diversity and health of aquatic and terrestrial organisms. During the assessment of the Boulder River watershed, we inventoried historical mines, defined geological conditions, assessed fish habitat, collected and chemically analyzed hundreds of water and sediment samples, conducted toxicity tests, analyzed fish tissue and indicators of physiological malfunction, examined invertebrates and biofilm, and defined hydrological regimes. Land- and resource-management agencies are faced with evaluating risks associated with thousands of potentially harmful mine sites, and this level of effort is not always feasible for every affected watershed. The detailed work described in this report can help Federal land-management agencies decide which characterization efforts would be most useful in characterization of other affected watersheds.

A large amount of digital data was produced as part of the Boulder River watershed study. Included are biologic, hydrologic, geochemical, geologic, and base cartographic data. Most were collected in the Basin Creek, Cataract Creek, and High Ore Creek subbasins of the Boulder River watershed, and in the portion of the Boulder River into which these creeks flow. A lesser amount was collected throughout the remainder of the Boulder River watershed. The data were converted to a common projection. Hydrography and road features, sample-site locations, and inactive mine and mine-related site locations were revised using digital orthophoto quadrangle (DOQ) imagery. The data are available, in formats compatible with widely used commercial software, on this CD-ROM.

The data on this CD-ROM are available in formats from the software used to create them, and in several other formats including ASCII textfiles, ESRI shapefiles, .dbf files, and TIFF image files. The x,y coordinates of the ArcInfo coverages, ESRI shapefiles, and TIFF image files are in UTM (Universal Transverse Mercator) meters, zone 12, and are cast on the North American Datum of 1927 (NAD27). The FieldSites table in the relational (Access) database also contains the longitude and latitude values of the field site locations in decimal degrees, also in NAD27.

See README2.txt for a list of the directories and subdirectories of this CD-ROM, and their contents. ReadMe files within the individual directories and subdirectories further describe their contents and how to use them. Chapter G of the volume's text describes all the CD-ROM data in great detail.

See note in System Requirements about ESRI ArcExplorer and ERDAS MapSheets Express.

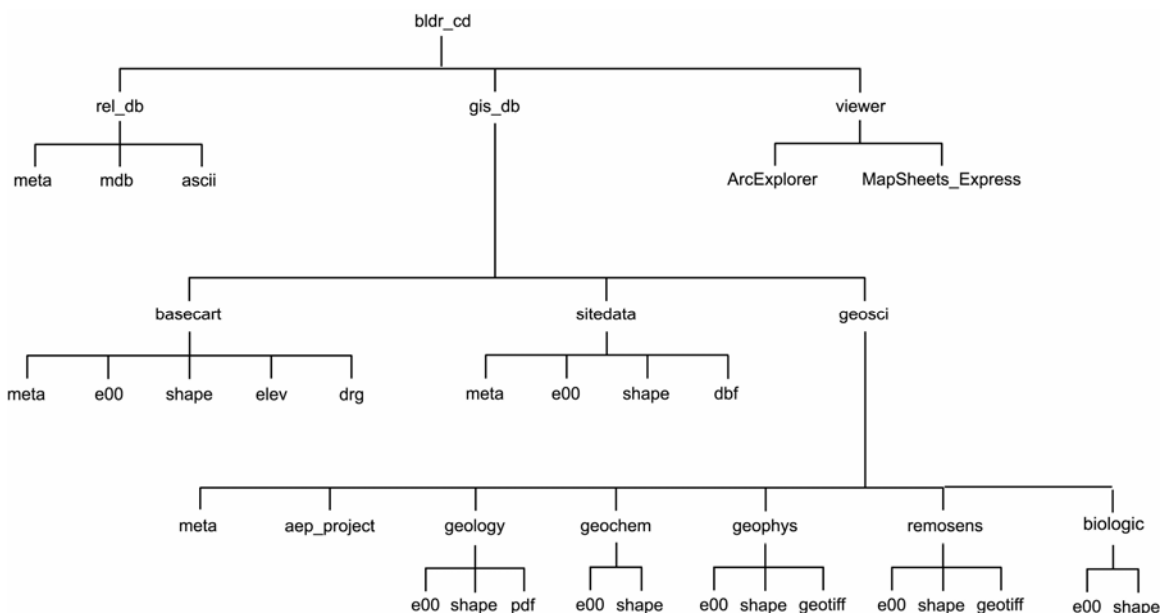
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## Using the Data

The CD-ROM is formatted to allow use by Windows-based and Macintosh computers. However, only certain files contained herein are readable by Macintosh computers, specifically including PDFs and TIFFs.

The following diagram shows the directory tree structure for the Boulder River watershed CD-ROM.



## System Requirements

### MACINTOSH

#### *Acrobat Reader 6:*

MAC OS X v.10.2.2–10.3  
PowerPC G3 processor  
32 MB of RAM with virtual memory on (64 MB recommended)  
70 MB of available hard disk space  
CD-ROM drive

#### *Acrobat Reader 5:*

MAC OS 8.6\*, 9.0.4, 9.1, 9.2, or MAC OS X\*  
PowerPC processor  
64 MB of RAM  
24 MB of available hard disk space  
CD-ROM drive

\*Some features may not be available.

### WINDOWS

Intel Pentium processor  
Microsoft Windows 98 Second Edition, Windows Millennium Edition, Windows NT 4.0 with Service Pack 6, Windows 2000 with Service Pack 2, Windows XP Professional or Home Edition, Windows XP Tablet PC Edition  
32 MB of RAM (64 MB recommended)  
60 MB of available hard disk space  
CD-ROM drive

Note: Installers for Acrobat Reader for Windows and Macintosh platforms are included on this CD-ROM.

#### Note on ESRI ArcExplorer and ERDAS MapSheets Express:

If you are using Microsoft Windows NT or later, you must be logged into an administrator account to install ESRI ArcExplorer or ERDAS MapSheets Express.

For more information, go to [www.esri.com](http://www.esri.com) or [www.erdas.com](http://www.erdas.com) (*aka* [gis.leica-geosystems.com](http://gis.leica-geosystems.com)) respectively.