INVENTORY OF GEOLOGICAL AND GEOPHYSICAL DATA AND SAMPLES
AT THE MONTANA BUREAU OF MINES AND GEOLOGY

U.S. Geological Survey (USGS) Award No. 08HQGR0125

FINAL TECHNICAL REPORT
Phase II

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Final Technical Report

The Montana Bureau of Mines and Geology (MBMG), located in Butte, Montana, has an extensive collection of mineral specimens, geological and geophysical maps, and reports for most of the underground mines in Butte and the surrounding area, including the famous Berkeley Pit, one of the largest open pit copper mines in the world. The reports are irreplaceable sources of information about the area because all of the underground mines and the Berkeley Pit are now flooded and inaccessible. Additionally, MBMG has collected information from other mines located throughout Montana and mineral specimens from throughout the world from private donors and companies that are no longer in business.

In 2006, the MBMG successfully applied to participate in Phase I of the National Geological and Geophysical Data Preservation Program (NGGDDP). Awarded $5000, the Bureau conducted an assessment of the estimated volume, quality, and accessibility of its current collections. Phase II funds were awarded to the MBMG to develop a Data Preservation Plan, inventory portions of selected MBMG data collections, create USGS-appropriate metadata for the inventories and upload collection metadata to the USGS National Digital Catalog. This technical report is submitted in fulfillment of the Phase II grant award requirements. Quarterly SF 272 financial reports have been submitted as required and the final financial report and the SF 269, Final Financial Status report, will be submitted within the next 60 days.

MBMG Collections

The MBMG’s collections include historical mines and minerals data; water-well logs; oil and gas well logs; coal records; seismic data; a one-of-a-kind collection of thin sections, polished sections, and samples from the Butte underground mines (the Anaconda Collection); aerial photographs spanning multiple decades that provide information on land change; and about 15,000 fine mineral specimens that are the foundation of Montana’s only true mineral museum. The collections are routinely used by local, state, and federal agencies, lawyers, small miners, mining companies, researchers, mining/engineering students, realtors, and teachers as well as the general public.
**Inventorying Process**

The following collections were proposed as part of NGGDDP Phase II inventorying, metadata creation and uploading of this data to the National Digital Catalog:

<table>
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<tr>
<th>Collection</th>
<th>% Collection Metadata proposed</th>
<th>% Collection Metadata created</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water well log inventory</td>
<td>15%</td>
<td>30% (records)</td>
</tr>
<tr>
<td>Anaconda collection</td>
<td>20%</td>
<td>100% (6,183 records)</td>
</tr>
<tr>
<td>Mineral Museum specimen collection</td>
<td>20%</td>
<td>Withdrawn</td>
</tr>
<tr>
<td>Historic mining reports collection</td>
<td>15%</td>
<td>50% (2,389 records)</td>
</tr>
<tr>
<td>Aerial photo collection</td>
<td>As time permits</td>
<td>Inventory completed (233,370 records); metadata, other than spatial locations, created.</td>
</tr>
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</table>

Inventories of the selected collections were conducted by the principal investigator, Peggy Delaney, one temporary, part time employee and a 1.0 fte student worker. An inventory of the Mineral Museum was completed however; an administrative decision was made to withdraw this inventory from the NGGDDP program. The MBMG Director and the Museum Curator realized that publication of the Museum’s collections in the USGS National Digital Catalog will create considerable security concerns. We also consulted with similar mineral museums and found that they do not publish an inventory of their collections for the same reason. As a result of this decision, the amount of metadata created for the other MBMG data collections committed to in Phase II was increased.

**Anaconda Collection**

The collection was started as early as 1940 by Anaconda Copper Mining (ACM) company geologists and expanded through 1981 at which time mining operations of the ACM/ARCO ceased and the underground workings and open pit were flooded. Sample locations from the Butte mines are plotted on mine-level maps, mapped at 100-foot intervals from surface to the 4,600-ft level. The collection is organized in 2,679 drawers and is estimated to contain more
than 80,000 specimens, including many polished slabs and over 10,000 thin sections from Butte, the state of Montana and international locations at which the ACM held mining operations. Accession numbers were assigned to groups of individual samples from the same location.

Therefore, the number of total groups of accessioned samples is 13,082. Of these, spatial locations were available for only those from the Butte mines. A total of 6,183 records for metadata in this collection were created and uploaded to the National Digital Catalog.

**Ground Water Data Collection**

Water-well data are maintained in the MBMG’s Ground-Water Information Center (GWIC). The collection currently includes approximately 250,000 hard-copy and digital records describing wells, boreholes, springs, etc. in Montana. The paper collection is stored in the GWIC offices at the Bureau. Electronic copies of the data are stored on an SQL server and are available over the internet at [http://mbmggwic.mtech.edu](http://mbmggwic.mtech.edu). In addition to the well-log, borehole, and springs data records, GWIC includes: 33,300 water-quality analyses from 14,700 sites, 2.3 million historic water-level records from 12,300 sites, thousands of field-inventory data sets, and data from aquifer tests.

A total of 20,000 records from this collection have been uploaded to the National Digital Catalog.

**Aerial Photo Collection**

The Bureau’s aerial photo repository has been accumulated over decades, mostly through donations and some purchases for mapping projects. The photos are used frequently by Bureau staff to assist with geologic field mapping and other investigations, and less frequently by the public.

An inventory of the collection was completed in September, 2009. As of that date, 233,370 photos were recorded. Spatial locations were not available and will need to be created in order to meet the USGS metadata requirements for catalog insertion. The MBMG has received 30 boxes of additional photos since the inventory was compiled. These photos will be inventoried at a future date. The EROS data center has been contacted to assist us in electronically retrieving spatial locations for the photos that we currently have in our inventory. If all of the photos that the MBMG has in its inventory are redundant with those electronically available from EROS, we will consult with the NGGDDP for direction on whether or not to upload our information into the National Digital Catalog.

**Historical Mining Property Files**

The historical mining collection has been compiled over the years through commercial
and private donations. The MBMG presently has over 3,800 filed mineral property files containing historical, engineering and geologic reports, pictures, correspondence, and production records. Metadata for 2,389 mining property files were uploaded to the National Digital catalog.

Phone and email requests regarding these files are directed to the MBMG Research Assistant. Other users come to the MBMG to review the materials onsite. Upon request, materials are copied and sometimes scanned for users. At the present time, digital images of maps and property files do not exist.

If resources were to become available (funding and staffing), it would be desirable to:
1. Obtain additional map storage cabinets to accommodate collection growth;
2. Implement a bar coding system for individual maps and property files;
3. Obtain a high speed, high resolution large-format map scanner to facilitate the digitization of the map collection;
4. Secure additional staffing to assist with collection preparation and digitization;
5. As the collections are catalogued, develop and maintain a collection address on the MBMG website so users could access, at a minimum, the inventory list of the collection. As digital images of the collection are made, it would be user-beneficial to provide access to these images for online use.

**MBMG Data Preservation Plan**

The MBMG has written a Data Preservation plan, which is included for review. The plan has gone through two reviews and final review and administrative approval is pending. Implementation of the plan will occur after June 1, 2010.

**MBMG Facility Relocation**

In December 2009 – January 2009, the MBMG relocated a newly constructed facility on the west end of the Montana Tech Campus. The new facility has addressed most of the constraints for data storage and public access that the former building posed. The new building is climate controlled, has handicapped access, and will provide some provision for expansion of the MBMG’s data collections onsite.
Summary

The Montana Bureau of Mines and Geology continues to recognize the immense value of historical mining, geology, hydrology, mineralogy, and seismic information and, particularly, the irreplaceable information and physical specimens from mines and areas that are no longer accessible. It will continue to expand its collections and contribute metadata about those collections to the National Digital Catalog and the efforts of the USGS in centralizing collection information for access by the public.
Attachment A: MBMG Data Preservation Plan
PURPOSE AND JUSTIFICATION

In 1919 the Montana Bureau of Mines and Geology (MBMG or Bureau) was legislatively established by the State of Montana to collect and publish geologic and mining information about the state. More specifically, the MBMG is responsible for collecting geologic and mineral specimens; geologic, hydrologic, seismic and mining-related historical photographs, reports, and analyses pertaining to the state of Montana.

To fulfill its mission, the MBMG maintains significant data collections: historical mines and minerals data; water-, oil-, and gas-well logs; coal borehole records; seismic (electronic and paper) data; thin and polished mineral specimen and rock sections, representative samples from the Butte underground mines (also known as the Anaconda Collection), aerial photographs spanning several decades, and a substantial number of fine mineral specimens that provide the foundation for Montana’s premier mineral museum. The Bureau also holds significant historical records that do not belong to any specific collection, but which have been secured to prevent their destruction and loss.

Many MBMG collections contain unique and irreplaceable information used by broad constituencies including local, state, and federal agencies, lawyers, consultants, professional associations, special interest groups, individual private miners, mining companies, mining/engineering students, realtors, teachers, and the general public.

In order to continually improve its collections and meet or exceed its clientele’s information-access expectations, MBMG has developed a long-range plan for expansion, acquisition, preservation, digitization, and promotion of its collections. Additionally, MBMG has developed internal processes to inventory its physical and digital collections so that the agency and its customers can easily know what each collection contains and to better plan preservation efforts.
INVENTORYING

MGMB collections include physical collections (of minerals, specimens, maps, old publications, well logs, geophysical logs, earthquake records and aerial photos), and digital collections (of scanned publications, maps, well logs, and seismographs).

MBMG has created inventories of each collection’s contents however individual inventories vary in terms of detail, completeness and format. An inventory includes specific information about the records or specimens in the collection. Inventory types vary by collection from paper-based descriptions of static collections to electronic databases describing active, expanding, collections.

PHYSICAL DATA

Inventorying goals include:

Within 5 years of acceptance of this plan, MBMG will update inventories for all collections it maintains:

1. MBMG will coordinate the collection inventorying process with staff members who manage each collection.
2. Collections to be included in the inventorying process (in order of priority) include, but are not limited to:
   1. water-well logs;
   2. historical mines and minerals data;
   3. samples, thin sections, and polished sections from the Butte underground mines (the Anaconda Collection);
   4. seismic data;
   5. Mineral Museum fine specimens;
   6. oil and gas well logs;
   7. coal records;
   8. aerial photographs

The MBMG will participate in the National Geographic and Geophysical Data Preservation Program (NGGDPP) by:

1. Applying for appropriate grant funding to assist the MBMG with program participation;
2. Contributing its electronic inventories to the National Digital Catalog in compliance with the metadata requirements prescribed by the NGGDPP;
3. Annually, update the MBMG’s inventories in the NGGDPP National Digital Catalog.
DIGITAL DATA

The MBMG presently has limited number of collections available to its users electronically. The collections include a portion of the publications inventory, some STATEMAP publications and the entire groundwater well log collection. An index of all MBMG publications available is accessible through the Publications Office’s online catalog. A limited number of MBMG-produced publications are available electronically to the public for downloading and printing at no charge. All publications may be ordered and purchased online through the catalog website. The MBMG also offers electronic search-and-retrieve access to its expansive groundwater well log inventory through the Groundwater Information Center (GWIC) database. Well logs are submitted continually by water-well drillers throughout the state of Montana, processed by GWIC staff, and entered into the database. The original documents for the well logs are archived. GWIC began to create electronic records through rudimentary coding in the 1970s and progressed through tape uploading and modem-accessible data through the 1980s. By 1998, GWIC had progressed to its present SQL Server based database management system which is accessible through a public website. GWIC’ data evolution has set the standard for digitizing and accessing all remaining MBMG collection inventories. It is the standard that was used as the model for the online publications catalog and will be used as other inventories and selected collections are digitized and made accessible to the general public.

Digital data inventorying goals include:

1. Convert all MBMG paper inventories to electronic inventories;
2. identify MBMG collections that will be digitized for electronic access by collection users (e.g. historical mining property files and maps);
3. create a consistent metadata protocol to be used when creating both digital MBMG collections and their accompanying inventories, identify relevant data standards, metadata content and format;
4. maintain current inventories of all collections;
5. transfer MBMG collection inventories to the National Digital Catalog on a semi-annual basis.
PRESERVATION PRIORITIES

PHYSICAL AND DIGITAL DATA

Collections will be preserved according to the following priorities:

A. Existing collections that are most frequently used by the MBMG’s constituents or those for which electronic databases have already been created;
B. Newly established collections that are anticipated to be frequently used. An inventory database will be completed upon each new collection acquisition;
C. Static collections and those that are infrequently used will be inventoried last.

ACQUISITION

The MBMG has long recognized that its collections are unique and irreplaceable and has devoted resources to act as a welcoming repository for donations of this information as well as to its preservation, promotion and use. The MBMG will make every reasonable effort to identify collections that may be endangered and would be appropriate additions to its existing collections. Such efforts will include collaboration with mining companies, regulatory agencies, museums, historical societies and professional associations, the general public through print and electronic media and promotional events.

PHYSICAL DATA

Materials and/or specimens may be acquired by the MBMG through donations from the public or private sectors, purchase or development by the MBMG itself. All acquisitions made by donation or purchase will comply with the policies and procedures of the Montana Tech Foundation.

A. The MBMG will consider the following guidelines when acquiring, retaining or disposing new materials or specimens for its collections. The materials or specimens:
1. pertain to the state of Montana;
2. are not already available in the collections;
3. are not available from other libraries or archives;
4. add to the body of knowledge encompassed by the collection;
5. revise or correct early versions of the materials in the collections;
6. are in better physical condition than existing identical materials;
7. are rare, historically significant, unique, or Montana-specific specimens or materials pertaining to those areas of geology about which the MBMG is mandated to provide information.
B. **Donated Materials**
   1. Prior to accepting private or public donations of materials for the MBMG’s collections, the prospective donor will be asked to supply a detailed and complete inventory of the items to be donated. The MBMG reserves the right to review the inventory and select those items it deems appropriate for acceptance (see guidelines above). If the prospective donor plans to use the donation as a tax deduction, the donor will be responsible for securing an appraisal of the items to be donated. The MBMG may provide the prospective donor a list of third-party appraisers or experts in the field to assist them, but the MBMG will not conduct appraisals of materials to be donated.
   2. The MBMG will reconcile the submitted inventory with the actual items transferred to its possession and provide the donor a letter of receipt of said donation.
   3. Upon acceptance of the donation, the donated materials become property of the MBMG. The MBMG will reserve the right to manage the items donated as it determines appropriate.
   4. Materials accepted by the MBMG will be inventoried and added to the appropriate collections.

C. **Purchased Materials**
   1. Specimens or other materials that the MBMG determines to be desirable and appropriate additions to its collections will be purchased in accordance to the policies and procedures of the Montana Tech Foundation.
   2. The prospective seller will be responsible for conducting a third-party appraisal of the materials to be used during negotiation of the purchase price. The MBMG or the Montana Tech Foundation will not conduct appraisals for this purpose but may identify for the seller a list of third-party appraisers or experts in the field to assist them in the appraisal process.
   3. Terms of purchase will be mutually developed by the seller, the MBMG and the Montana Tech Foundation.
   4. Upon completion of the terms of purchase, an Asset Transfer Agreement will be signed by the seller and the appropriate representative of Montana Tech of The University of Montana.
   5. Materials purchased by the MBMG will be inventoried and added to the appropriate collections. Inventories will be assessed for excessive copies and unusable information and such information will be disposed of as directed by this plan.
   6. Hard copy, original records will be cleaned, repaired and preserved according to generally accepted restoration and preservation guidelines by MBMG staff in charge of each collection.
7. Hard copy, original records that may be accessed by the MBMG or its clientele will be stored in designated areas within the MBMG’s facility. Those hard-copy records that have been digitized will be stored in the MBMG’s archival areas or offsite in climate-controlled, secured storage facilities, as funding permits.

D. Materials developed or created by the Montana Bureau of Mines and Geology
   As legislatively mandated, the MBMG is responsible for collecting and publishing geologic and mining information about the state. The MBMG publications are managed by its Publications Office. The Publications Office is responsible for maintaining a supply of hard copies of its reports and provides digital copies of many of its materials as well. Retention of these reports complies with the state of Montana’s record and retention policies and procedures.

DIGITAL DATA

The MBMG receives historical collections in a variety of media (e.g., floppy storage disks, Bernoulli disks, audio, video and data tapes, etc.) as well as hard copy materials. Acceptance of such collections is subject to the acquisition guidelines as physical collections received by the MBMG. Additionally, acceptance of digital collections will be subject to:
   A. The condition of the media – media that has been damaged and is illegible will not be accepted;
   B. Availability of technology to access the digital data – the MBMG will make a good faith effort to locate the technologic means to access data on media that is considered out of date or obsolete. If the technology cannot be found or no longer exists, the MBMG reserves the right to refuse acceptance of outdated media.
   C. Availability of technology to transfer the data to current storage media;
   D. Cost feasibility of accessing and transferring data to current storage media – the nature and content of the data must be irreplaceable, unique and contribute significantly to the collection to justify the cost for access and transference to current storage media.

Retention of the MBMG’s historical collections will comply with the state of Montana’s record and retention policies and procedures.

DISPOSAL

The MBMG recognizes that the continued expansion of its collections will be impacted by:
   • limited onsite archival space;
   • available and cost feasible offsite archival space; and
   • cost to expand and upgrade digital storage and software.
In an effort to maximize the efficient utilization of available physical and digital storage capacity, as well as manpower and budget to manage its collections, the MBMG will evaluate the content of selected collections; identify materials that are no longer appropriate for retention and dispose of such materials in accordance with the Administrative Rules of Montana that govern the MBMG. Record retention and disposal rules for the state of Montana may be found at http://sos.mt.gov/Records/State_Forms.asp. Guidelines for identifying materials to be disposed will be recommended by those MBMG personnel responsible for managing their respective collections and approved by the State Geologist. General guidelines that support disposal of collection materials include:

A. Numerous copies of the same materials exist. A determination should be made about the number of duplicated materials to retain, if any.
B. The condition of the material has degraded to the point of not being usable. Every effort should be made to stabilize and digitize hard copy information, if possible, if the MBMG feels that the data is unique, valuable and contributes significantly to the body of information represented in the collection.
C. The information is available and accessible at other repositories;
D. The information is inaccurate, outdated and has been replaced by newer versions.
E. The information is incomplete and does not contribute to the overall body of knowledge contained in the collection.

**DOCUMENTATION/METADATA**

The MBMG will develop documentation and create metadata for the contents of each collection (both hard copy and digital) it maintains. Metadata will be standardized by the type of collection for which it is developed and by the reporting requirements of non-MBMG organizations and repositories with which the collection information is shared (e.g., NGGDPP National Digital Catalog, etc.). The following metadata will be compiled, if possible, for those collections shared with other agencies:

- unique record identification number;
- record title (e.g., mine name, seismic record name, well-log name, etc.)
- data type (e.g., claim map, well log, seismic record, property file, specimen, etc.)
- description of information contained in the record
- location (township, range, section, county, district, state, etc.)
- coordinates (latitude and longitude, decimal format to 5 decimal places)
- collection date of record, if applicable
- reference date

Additional collection-specific metadata may be created in order to assist users of the data in refining searches or to provide users with additional information about each record.
PRESERVATION

The MBMG collections include a variety of media including mineral specimens, plastic/acrylic folios, paper documents, vellum, mylar, and linen maps, books, digital media (e.g. computer floppy disks, Bernoulli disks, electronic tape, cassette tapes, etc.). Additionally, the MBMG has created and maintains four digital collections at this time that are web-accessible by users.

Some physical collections contain rare and unique materials dating from the turn of the 19th century or specimens obtained from locations that are no longer physically accessible. The MBMG has maintained a strong commitment to acquire such information, restore it to its best possible condition and preserve it for future generations.

Likewise, it is the goal of the MBMG to manage its digital records in a manner that ensures the digital record is present, can be readily accessed, is appropriately documented, accurate and can be maintained throughout time.

PHYSICAL DATA

A. Infrastructure and Collections Needs

Designated MBMG employees are responsible for managing specific collections for the Bureau. They are responsible for 1) evaluating newly acquired additions for acceptance to the appropriate collection, 2) cataloging and/or accessioning physical specimens or paper records into the collection (including adding the record to the digital collection if available), 3) preparing the record or specimen for long term display or storage (e.g., cleaning and stabilizing the specimen or record), and 4) storing the record or physical specimen (e.g., storing in permanent archive, displaying in designated areas).

Each physical collection has been managed by different MBMG staff members over the years lending some inconsistency to the collections’ management and preservation. Collections are housed in a variety of storage spaces throughout the building in which the MBMG is located. This particular building is over 100 years old and has inadequate climate controls, no fire suppression system, virtually no archival referencing system and poor access for the public. Additionally, some collections have been stored in commercial shipping/storage containers that have no climate controls and are vulnerable to insect penetration.

The MBMG will be relocating to a new building in 2009-10. Although the new building will have much improved climate controls and a fire suppression system, the amount of designated storage space for collection archives is barely adequate for current collections and will not accommodate ongoing collection expansion.
These issues elicit the following infrastructure needs:

1. standardized collection practices for acquired specimens and records that conform to state and university donation acceptance requirements;
2. standardized cleaning, repairing and storage practices for acquired specimens and records;
3. standardized record/specimen metadata creation protocols;
4. standardized record/specimen retention and disposal protocols (in compliance with Montana Administrative Rules);
5. adequate and functional storage units for each collection that will maximize record/specimen preservation and security;
6. adequate centralized and accessible archival storage space for frequently used collections;
7. offsite, climate-controlled and secure archival storage space for infrequently accessed collections.

DIGITAL DATA

A. Infrastructure and Collection Needs

The MBMG maintains the following online data repositories:

• a Publications Office Catalog that includes MBMG-produced publications, selected USGS and US Forest Service publications, and a variety of professional association publications. Most publications are retained in hard copy format but MBMG-produced publications that were the product of publicly-funded programs are available in their entirety as digital publications.

• the Groundwater Information Center database that includes well-completion reports from drillers, measurements of well performance and water quality based on site visits, water-level measurements at various wells for periods of up to 60 years, and water-quality reports for thousands of samples.

• the Earthquake Studies Office’s location maps and seismogram database which provides the user with daily seismic reports from seismograph stations located throughout the state of Montana;

• the Geographic Information Systems lab that provides digital data zip files for 100k and 250k geologic maps, EDMAP publications and special area maps; and

• a limited number of downloadable publications and maps produced by the MBMG’s Research division and available through links on the Publications Office Catalog.
The digital inventories are managed by designated MBMG staff in collaboration with the MBMG Database Administrator and the Information Systems Technician (for webpage support). Additional digital databases have been created by other MBMG staff for other physical inventories that they manage. The digital inventories vary in the software programs used to create them and the metadata structure that documents them. Generally, these other collections are for internal use and not available public.

The MBMG Database Administrator has constructed and implemented the digital inventory system (the GWIC system) that will be the standard for development and refinement of all other MBMG digital collections, both existing and new. The GWIC system has been developed and refined over many years and has proved to be programmatically reliable and user friendly.

New digital inventories under construction include:
- Mineral Museum specimens
- historical mining property files and map files
- the Anaconda collection
- aerial photo collection
- seismogram collection
- coal records
- oil and gas logs

The digital collections reside on network database servers running Microsoft SQL Server 2005 under Windows Server 2003/2008. System backup is done on a daily, weekly and monthly basis. Data backups reside on additional servers located onsite at MBMG. Remote-location backups are not in use at this time. The MBMG does not have a formal disaster recovery process or policy in place at this time that specifically addresses hardware, software and data recovery.

Access security is controlled by the MBMG’s Computer Service Specialist and the Database Administrator. There have been no security breaches of any of the digital collections but maintenance, review and enhancement of the networked server system should be made on a predetermined basis.

The MBMG also occasionally receives donated information recorded on outdated or obsolete digital media (i.e., Bernoulli tapes, floppy disks, magnetic tape, cassette tapes, etc.). Retrieval of information from these media poses a significant challenge to the MBMG as the hardware to access the information is not readily available.

Another challenge is the fact that collection files and their metadata may be transferred from one storage medium or location to another, as their activity decreases and/or their use changes. A
tracking feature is needed to record the change of location to facilitate efficient access to these collections.

Digital inventory infrastructure needs for the MBMG include:

1. **Adoption of a digital inventory and data repository standard** for all digital information collections held and managed by the MBMG. The standard will include a formal metadata development guide that incorporates a standardized record classification/filing and naming systems, access modes and protective markings (for security purposes); system platform and configuration protocols; and formal management, access and use, and security protocols of the digital collections. Likewise, the standard will be updated to meet the regulatory and/or uploading requirements of and system interoperability with other government agencies or data repositories with which MBMG collections are shared.

2. **Development of a media sustainability and migration plan** to minimize the potential for media obsolescence or degradation. Related to this issue is the potential for software file format obsolescence, both for digital record creation and storage and user access to the information. The media migration plan should incorporate a strategy to address this issue as well and to ensure that active preservation of digital objects and metadata over long periods of time is ensured.

3. **Development of a standardized collection storage/metadata tracking system** to record the change of record location and/or metadata.

4. **Periodic evaluation and updating of the digital collection backup system**, including evaluating the need and feasibility for remote, offsite backup locations.

5. **Development and approval of a disaster recovery plan** for all MBMG digital collections. The plan should evaluate the feasibility of system redundancy including offsite, remote digital storage of its backup medium.

6. **Development and approval of a network access and security plan** for all MBMG digital collections.

**Database/digital collections needs**

The MBMG has long demonstrated its commitment to create and preserve digital versions of the information collections it maintains, including the ongoing evaluation and updating of its digital information storage capacity. The digital collections reside on a system of network servers maintained by the MBMG Computer Service Specialist. Digital storage capacity has been increased in response to growing digital collections and expected continued growth in
both existing and new digital collections.

Digital records are created:

- at the time the record is created – as MBMG reports are generated, they are digitized for online access by user groups. The MBMG’s Information Services Division is responsible for digitizing this group of information and has established a set of scanning standards for the process.

- via record data entry into the collection inventory. Specifically, water-well log reports are entered into the GWIC system from paper copies as they are received by the MBMG;

- by automatic digitization – many of the seismic recording stations have been converted to digital capture of the information which is then stored on independent servers in the Earthquake Studies Office. The information is analyzed by staff and then made available online to the public.

- as a special request or project - selected historical mining property files and maps have been digitized upon request and saved to a designated directory on the MBMG server network. Additionally, a static database has been created for geologic formation elevations obtained from oil and gas well logs.

Data formats for MBMG digital records vary by collection due to the purpose for which they were created, the users’ needs, and the evolution of available technology. Database/digital collection needs include:

1. Periodic review of existing digital storage capacity and system requirements to accommodate creation of new collections and long term retention of existing digital collections. Review will include recommendations for both short- and long-term hardware and data storage acquisitions.

2. Review of data formats used for existing data collections and development of a standardized data format structure by collection type.

3. Review and prioritization of digital collection data conversion to MBMG standardized data formats (see #2 above).

4. Review and reprioritization of existing and potential new physical data collections to be digitized in 1-3 years.
5. Review and identification of digital collections that are outdated, obsolete or no longer needed and can be archived and/or deleted from active digital storage.

**ACCESS AND USE**

**User Community**

The MBMG has responded to inquiries related to Montana geology and mining to the general public, mining companies, geologists, engineers, consultants, researchers, lawyers, private miners, hydrologists, well drillers, students, state agencies, libraries and museums. Responses include written reports or letters, onsite property evaluation and research of the MBMG’s collections by its staff or users as described above.

Public access to the MBMG collections is made either physically or online via the Bureau’s website.

**PHYSICAL AND DIGITAL DATA**

At the present time, MBMG and its collections are in the process of relocating to a new facility. The new building will be fully accessible to the public and provide much improved heating and ventilation for collections than the space in which the collections were formerly housed. Although space designated in the new building for the MBMG’s collections is adequate for the existing inventories, there is no room for inventory expansion.
Access by users varies according to the collection:

<table>
<thead>
<tr>
<th>Collection</th>
<th>Description</th>
<th>Access Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBMG Publications</td>
<td>Direct access to hard copy publications is made at the Publications Office 8:00 a.m. – 4:00 p.m. The Publications Office also provides an online catalog through the MBMG website that users can search for and purchase publications or download and print selected publications.</td>
<td>Publications may be purchased at listed prices.</td>
</tr>
<tr>
<td>Historical mine property files and maps</td>
<td>Access is supervised by a designated staff member; information is pulled upon request and shared with the customer. Online access to the collection or inventory list is not available at this time.</td>
<td>Hard copies of information may be purchased.</td>
</tr>
<tr>
<td>Water-well logs</td>
<td>Supervised access to hard copy log data is available by visiting the GWIC office. Web access is made via the Groundwater Information Center’s website at <a href="http://mbmggwic.mtech.edu/">http://mbmggwic.mtech.edu/</a></td>
<td>Information may be downloaded and printed at no charge by the user.</td>
</tr>
<tr>
<td>Anaconda specimen collection</td>
<td>Access is made by request to the collection curator (a MBMG staff member); physical access is arranged by the curator and supervised by the curator. At the curator’s discretion, a thin section of mineral samples may be sent to requesting institutions of higher education for research purposes. Online access to the collection or inventory list is not available at this time.</td>
<td>The specimens are available for research purposes only and are not available for sale.</td>
</tr>
<tr>
<td>Seismic records</td>
<td>Access to hard copy records is infrequent and made by request to the MBMG Seismologist who then provides a copy of the paper seismograms to the requestor. Access to computerized seismograms is available via the Bureau’s website at <a href="http://www.mbm.mtech.edu/quake/quake.asp">http://www.mbm.mtech.edu/quake/quake.asp</a></td>
<td>Hard copies are made upon request by researchers and provided at no charge.</td>
</tr>
<tr>
<td>Mineral</td>
<td>Access to displayed specimens is available</td>
<td>Museum does</td>
</tr>
<tr>
<td>Museum specimens</td>
<td>during posted Museum hours (varies by season). Specimens are not available for sale. Access to non-displayed, accessioned specimens is not available.</td>
<td>operate a gift shop where mineral-related goods, books and references are available for sale.</td>
</tr>
<tr>
<td>Aerial Photos</td>
<td>Access to the photos is made by customer request. Photos of specific geographic areas are pulled from the collection by MBMG staff to show to the user. Online access to the collection or inventory list is not available at this time.</td>
<td>Hard copies of photos are made upon request and purchased at established prices.</td>
</tr>
<tr>
<td>Oil, gas and coal records</td>
<td>Access is not available to the collection at this time. Upon request, MBMG staff may pull requested information, copy it and send it to the requestor.</td>
<td>Requests for information have been infrequent.</td>
</tr>
<tr>
<td>Geological mapping records</td>
<td>User access is available by ordering hard copy maps through the MBMG Publications Office. Users may also access select online and PDF downloadable versions of selected maps via the MBMG’s Geographic Information System (GIS) (<a href="http://www.mbmgonline.mtech.edu/gis/gis-products.asp">http://www.mbmgonline.mtech.edu/gis/gis-products.asp</a>) and its STATEMAP webpage at <a href="http://www.mbmgonline.mtech.edu/gmr/gmr-statemap.asp">http://www.mbmgonline.mtech.edu/gmr/gmr-statemap.asp</a>.</td>
<td>Publications may be purchased at listed prices. Online downloadable versions are available at the websites listed.</td>
</tr>
</tbody>
</table>

**ADVISORY COMMITTEE**

The MBMG is committed to achieve the following data preservation goals:

- continue to refine, update, and expand its collections, both physical and digital,
- establish best data preservation practices for physical collections,
- establish standards for metadata creation and digitization of paper data,
- regular evaluation of data storage capacity for both physical and digital collections,
- define access, security, disaster recovery protocols for its collections, both physical and digital,
• further develop its website to broaden electronic access to more MBMG collections,
• develop protocols for data retention and disposal in accordance with Montana regulatory guidelines,
• partner with other mining and geologic-related information repositories in the state of Montana to establish reciprocating links to their websites, if available
• expand MBMG outreach activities related to its collections.

To achieve the above objectives, the MBMG will create an advisory committee. Initially, the advisory committee members will be MBMG staff. At a future date the committee may also include collection users and representatives from education, mining and geology professions, state agencies and other Montana museums and libraries with whom the MBMG interacts. The initial committee will address internal data acquisition and preservation objectives. The committee may be expanded in the future to address outreach and partnership data preservation objectives.

OUTREACH

The MBMG has been committed to foster a broader public understanding and appreciation of the fields of geology-related sciences with a variety of outreach efforts. The MBMG has also been committed to informing users and the general public of its research efforts, publications, and collections. Historically, these efforts have included:

• presentations by staff at schools throughout the state of Montana;
• poster presentations at state, regional and national conferences;
• MBMG staff-authored publications in professional journals;
• staff presentations at local and state professional meetings;
• development of an MBMG website detailing the Bureau’s activities and providing online access to the information resources it has for public use;
• staff participation on selected professional boards and legislative committees;
• onsite mining property evaluations by the Staff Mining Engineer;
• assistance to private, small operation hard rock miners in the development of state-required plans of operations;
• annual seminar series for geologic professionals, the general public, and students on a wide range of geology-related topics;
• annual lecture/seminar/field trip series offered by the Mineral Museum to provide participants of all age groups the opportunity for hands on learning about minerals, fossils, general geology, seismology and hydrology;
• annual field trips for rural schools about MBMG hydrology research being conducted in their areas,
• annual hands on summer workshop at the local library for grade school children;
• Mineral Museum tours throughout the year offered to elementary, middle and high school students upon request.

All of the above activities (with the exception of statewide school presentations) are still conducted by the MBMG. Current outreach efforts are developed and implemented by individual MBMG staff under the supervision of the State Geologist.

**FUNDING**

Historically, the MBMG’s collection and data preservation management activities have been funded through legislatively approved state funding. State funding of the MBMG has allowed it to provide fulltime staffing for its Publications Office and the historic mine property files, GWIC, and map collections; and part time staffing for management of the Anaconda collection and the Mineral Museum collection. The cost of managing the collections is marginally recouped by charging user fees. Other collections have been added to and maintained by MBMG staff as time permits within the constraints of their regular workloads.

The Earthquake Studies Office receives limited funding from the USGS (to download seismic data to its repository), the Salish and Kootenai tribes in Montana (to conduct seismic monitoring on their lands), the USFS (to operate a seismic station at the Quake Lake Visitors’ Center near Yellowstone Park) and FEMA grant funds (to evaluate seismic hazards in Silver Bow County).

The Mineral Museum is working with the Montana Tech of The University of Montana Foundation to implement a “Friends of the Museum” program to assist it in securing donations toward the acquisition of funds for specimen purchases and facility and program development.

Recently acquired funding through the USGS NGGDPP grant has allowed the MBMG to begin development of a formal collection management and data preservation program. Continued implementation of the collection management and data preservation program will be dependent upon additional grant support, development of new user fees, cultivation of industry financial support and private donor support.

**PARTNERSHIPS**

The MBMG partners with many federal, state and local agencies as well as private mining companies, individual mining property owners, and consultants, and mineral collectors that influence the creation and capture of data for the MBMG collections.
The MBMG’s Earthquake Studies’ Office (ESO) partners with USGS Advanced National Seismic System and downloads real time data from a given set of defined seismic stations for use in the USGS monitoring system. Additionally, the ESO has established several seismic monitoring stations on the property of the Confederated Salish and Kootenai tribes to monitor seismic activity on their lands.

The ESO operates a seismic station at the Quake Lake Visitors’ Center in cooperation with the West Yellowstone Ranger district. Data from that station is recorded and analyzed by the MBMG as part of its supporting role with the USFS.

Real time copies of the ESO’s digital seismic data is copied and sent to the Incorporated Research Institutions for Seismology’s (IRIS) data management center for archiving. The ESO will also be acquiring 10 EarthScope sites that will be incorporated into the MBMG seismic network. EarthScope is an NSF-funded program to study the mantle and core of the earth by monitoring seismic activity through 400+ EarthScope seismic stations.

The MBMG ESO co-wrote a successful grant proposal with Silver Bow County (Montana) to evaluate geologic hazards in Silver Bow County. The grant was funded by FEMA through its Pre-Disaster Mitigation Grant, a 3-year program that will be completed by July 2010. A public information display will be created as part of this project. The MBMG ESO has applied for a grant through Advanced National Seismic System (USGS) for upgrading 3 existing seismic stations in MT.

Additionally, the MBMG is participating in the USGS National Geologic and Geophysical Data Preservation Program (NGGDP) and will be uploading digital inventories of selected collections for inclusion in a National Digital Catalog. The purpose of the catalog is to provide a single “clearinghouse” of resources available at participating state geologic surveys for the general public.

The MBMG’s STATEMAP and EDMAP programs are both funded through a competitive grant process with the U.S. Geological Survey as a part of the National Geological Mapping Act of 1992. The STATEMAP program focuses on the preparation of geologic mapping projects for the state of Montana while the EDMAP program provides support for senior and graduate-level field mapping theses and dissertations.
Inventory Creation

**Goal 1:** The MBMG will inventory its existing physical and digital collections, and submit the inventories for inclusion into the National Digital Catalog (NDC).

<table>
<thead>
<tr>
<th>Strategy</th>
<th>When</th>
<th>Responsible Person</th>
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</thead>
<tbody>
<tr>
<td>The MBMG will inventory data collections to be included in the National Digital Catalog for the 2008-09 NGGDDP funding cycle:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. the water well log collection (GWIC information)</td>
<td>15%</td>
<td>2009-10 Research Assistant/with oversight from MBMG staff in charge of each collection</td>
</tr>
<tr>
<td>2. the thin sections and polished sections of the Anaconda collection</td>
<td>20%</td>
<td>2009-10 Research Assistant/with oversight from MBMG staff in charge of each collection</td>
</tr>
<tr>
<td>3. the Mineral Museum mineral specimen collection</td>
<td>20%</td>
<td>2009-10 Research Assistant/with oversight from MBMG staff in charge of each collection</td>
</tr>
<tr>
<td>4. the historic mining engineering-related maps and reports collection; and</td>
<td>15%</td>
<td>2009-10 Research Assistant/with oversight from MBMG staff in charge of each collection</td>
</tr>
<tr>
<td>5. the aerial photo collection</td>
<td>As time permits</td>
<td></td>
</tr>
<tr>
<td>• Hard copy inventories of identified collections will be converted to digital inventories using metadata fields that are consistent with NDC’s data transfer protocols.</td>
<td>2009-10</td>
<td>Research Assistant/Database Administrator</td>
</tr>
<tr>
<td>• Digital inventories will be reviewed and/or modified to ensure that data fields are consistent with required NDC metadata requirements.</td>
<td>2009-10</td>
<td>Research Assistant/with oversight from MBMG staff in charge of each collection</td>
</tr>
<tr>
<td>• Other MBMG data collections will be scheduled for inventorying and inclusion in the NDC.</td>
<td>2010-12</td>
<td>Research Assistant/with oversight from MBMG staff in charge of each collection</td>
</tr>
</tbody>
</table>
Inventory Creation (cont.)

- Audit each physical collection to ensure that the physical contents agree with the written or digital inventory lists created for the respective collection

| 2010-12 | Research Assistant/with oversight from MBMG staff in charge of each collection |

Acquisition and Disposal

**Goal 1:** The MBMG will identify mining and geology-related physical collections that are historically significant and in danger of being lost for possible acquisition and addition to its existing collections.

The MBMG will

- Develop and approve guidelines for the acquisition, preservation and disposal of collection materials and specimens; all guidelines will conform to the Administrative Rules of Montana and Montana University System policies.

| 2009-11 | Research Assistant/State Geologist (oversight) |

1. Guidelines to be developed may include
   - Donation acceptance policy
   - Data retention and disposal policy

| 2010-11 | Internal advisory committee with support from Research Assistant/Staff Mining Engineer |
### Acquisition and Disposal (cont.)

- **Goal 2:** The MBMG will evaluate its existing holdings annually and identify those materials which do not meet data retention and/or preservation criteria. Such materials will be disposed of according to the MBMG disposal guidelines. Priority for evaluating existing collections will be based on the frequency of collection use; historical significance of the materials; existing availability of the materials elsewhere, storage space constraints of the each collection; accuracy of the materials; the amount of duplicate materials in each collection; and the condition of collection materials.

<table>
<thead>
<tr>
<th>Action</th>
<th>Year</th>
<th>Responsible Party</th>
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</thead>
<tbody>
<tr>
<td>1. create and distribute a flyer (both hard copy and electronic)</td>
<td>2010</td>
<td>Research Assistant/Staff Mining Engineer with oversight by the State Geologist</td>
</tr>
<tr>
<td>describing the MBMG data acquisition and preservation program; The flyer will contain information about MBMG guidelines for identifying, purchasing and accepting donated materials. The flyer will be distributed to other museums, general public, schools, colleges, and professional associations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. post information about the program on its website and provide a contact link to the MBMG for potential donors or users of the information;</td>
<td>2010</td>
<td>Research Assistant/MBMG Webmaster</td>
</tr>
<tr>
<td>3. write an article about the data acquisition and preservation program and submit to applicable professional journals for publication</td>
<td>2010</td>
<td>Research Assistant/Staff Mining Engineer</td>
</tr>
</tbody>
</table>
**Acquisition and Disposal (cont.)**

The MBMG will:

- develop a prioritized list of the collections to be evaluated;  
  2011  Research Assistant/with MBMG Director oversight

- complete the evaluation of all collections within 5 years from the acceptance of this plan in accordance to a schedule developed and approved by the state geologist;  
  2011-16  Research Assistant/with oversight from MBMG staff in charge of each collection

- purge those materials so identified by the evaluation;  
  2011-16  Research Assistant/with oversight from appropriate MBMG staff

- dispose of materials in accordance with the MBMG’s approved guidelines; document disposition of all materials;  
  2011-16  Research Assistant/with oversight from appropriate MBMG staff

- conduct ongoing evaluations of collections and purge as indicated  
  Annually  Research Assistant/with oversight from appropriate MBMG staff

**Preservation**

<table>
<thead>
<tr>
<th>Goal 1.</th>
<th>The MBMG will develop “best practice” data preservation management protocols for all physical and digital collections.</th>
</tr>
</thead>
</table>

**Physical Collections:**

| 1. | Develop standardized cleaning, repairing and storage protocols for physical records and specimens;  
| 2010-11 | Research Assistant/with oversight from appropriate MBMG staff |
### Preservation (cont.)

<p>| | | |</p>
<table>
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<tbody>
<tr>
<td>2. Acquire appropriately sized and functional storage containers that maximize available storage space; for each collection type</td>
<td>2010 and ongoing</td>
<td>appropriate MBMG staff</td>
</tr>
<tr>
<td>3. Relocate hardcopy original data to designated storage areas in newly constructed Natural Resources building or to offsite storage areas. Collections to be relocated include: Water well logs, historic mining and engineering-related maps, reports; aerial photos</td>
<td>2009-10</td>
<td>appropriate MBMG staff</td>
</tr>
<tr>
<td>4. Develop a schedule for selecting and digitizing hard copy, paper collections within the Bureau; (all newly created MBMG publications will be electronically stored as they are produced for user access, retrieval and purchase).</td>
<td>2010-11</td>
<td>Research Assistant/with MBMG Director oversight</td>
</tr>
<tr>
<td>5. Establish an MBMG policy addressing digitization protocols for newly created or acquired hard copy documents (i.e., electronic production will include metadata creation that conforms to internal MBMG data management policies and is compatible or convertible to formats used by collaborating resource databases).</td>
<td>2010-11</td>
<td>Research Assistant/with MBMG Director oversight</td>
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</table>

### Digital Collections:

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<tbody>
<tr>
<td>1. Develop a digital inventory and data repository protocol to manage metadata development, classification/filing and naming systems, platform and configuration protocols, and access/use/security protocols.</td>
<td>2010-11</td>
<td>Internal advisory committee with support from Database administrator and Computer service specialist</td>
</tr>
<tr>
<td>Preservation (cont.)</td>
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<td>-----------------------------------------------------------------------------------</td>
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<tr>
<td>Digital Collections:</td>
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<tr>
<td>2. Develop a media sustainability and migration plan to address media obsolescence</td>
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<tr>
<td>and degradation issues and to establish digital platform standards for all MBMG</td>
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<td>digital collections and inventories.</td>
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<tr>
<td>2011-12</td>
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<tr>
<td>Internal advisory committee with support from Database administrator and Computer</td>
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<tr>
<td>service specialist</td>
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<tr>
<td>3. Develop a digital collection storage and metadata tracking system to record</td>
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<tr>
<td>changes in collection/records locations and metadata associated with collections.</td>
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<tr>
<td>2011-12</td>
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<tr>
<td>Internal advisory committee with support from Database administrator and Computer</td>
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<td>service specialist</td>
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<tr>
<td>4. Evaluate existing digital storage capacity and system requirements and make</td>
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<tr>
<td>recommendations for expansion when indicated to accommodate new digital</td>
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<tr>
<td>collections and effective management of existing collections.</td>
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<tr>
<td>Annually</td>
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<tr>
<td>Internal advisory committee with support from Database administrator and Computer</td>
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<tr>
<td>service specialist</td>
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<tr>
<td>5. Evaluate digital collection backup system and review need and feasibility of</td>
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<tr>
<td>remote or offsite backup locations.</td>
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<tr>
<td>2010-11</td>
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<tr>
<td>Internal advisory committee with support from Database administrator and Computer</td>
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<tr>
<td>service specialist</td>
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<tr>
<td>6. Develop and approve a formal disaster recovery plan for all MBMG</td>
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<tr>
<td>collections addressing issues such as system redundancy.</td>
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<tr>
<td>2010-11</td>
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<tr>
<td>Internal advisory committee with support from Database administrator and Computer</td>
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<tr>
<td>service specialist</td>
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<tr>
<td>7. Develop and approve a formal system network access and security plan for all</td>
<td></td>
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<tr>
<td>MBMG collections.</td>
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<tr>
<td>2010-11</td>
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<tr>
<td>Internal advisory committee with support from Database administrator and Computer</td>
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<tr>
<td>service specialist</td>
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</tbody>
</table>
### Access and Use

<table>
<thead>
<tr>
<th>Access and Use</th>
<th>Responsible Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Develop formal policy on access, use and security of each physical collection.</td>
<td>2010-11 Internal advisory committee with support from designated MBMG staff</td>
</tr>
<tr>
<td>2. Continue to participate in USGS NGGDDP program (when funded) and add new collection inventories as time and resources indicated by grant requirements.</td>
<td>2010-11 Internal advisory committee with support from designated MBMG staff</td>
</tr>
<tr>
<td>3. Review previously uploaded USGS National Digital Catalog data for updating and corrections.</td>
<td>Annually Research Assistant with oversight from appropriate Bureau geologist</td>
</tr>
</tbody>
</table>

### Advisory Committee

<table>
<thead>
<tr>
<th>Advisory Committee</th>
<th>Responsible Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Create a Data Preservation Advisory committee comprised initially of internal MBMG staff.</td>
<td>2010-11 State geologist</td>
</tr>
<tr>
<td>2. The Data Preservation committee will develop those standards, policies and protocols as noted in this plan for implementation by the MBMG</td>
<td>2010- Ongoing Internal advisory committee with support from designated MBMG staff</td>
</tr>
<tr>
<td>3. Expand the committee to include representatives from external collection users to assist in developing and outreach and marketing plan for the MBMG collections.</td>
<td>2011-12 Internal advisory committee with state geologist oversight</td>
</tr>
<tr>
<td>a. The plan will include strategies to expand existing and develop new outreach and marketing of the MBMG’s collection products,</td>
<td></td>
</tr>
<tr>
<td>b. identify new partnership opportunities to increase public awareness and use of the MBMG collections and other sources of geologic information; and</td>
<td></td>
</tr>
</tbody>
</table>
c. identify new funding opportunities (including grant and philanthropic sources) to support ongoing collection development, digitization and use of the collections.