November 3, 2011

Ms. Pebbles Clark  
Reclamation Specialist  
Montana Department of Environmental Quality  
Abandoned Mine Lands Program  
P.O. Box 200901  
Helena, MT 59620-0901

Report of Subsidence Investigation – Phase 1  
501 Broadway Avenue South  
Red Lodge, Carbon County, MT

Dear Ms. Clark:

The following memorandum summarizes the investigation activities performed by DOWL HKM during August and September 2011 in regards to a complaint of subsidence at the above referenced property located in Red Lodge, Montana. This work was completed as outlined in Task Order No. 19, which was issued pursuant to DEQ Contract No. 407033 between DOWL HKM (Contractor) and the Montana Department of Environmental Quality (DEQ). The purpose of Task Order No. 19 is for review of existing background data in the area of the subject property related to the settlement complaint by Mr. Marvin Dukart performing a limited site survey and inspection.

If you have any questions regarding this project, please contact me at (406) 869-6372 or email to cpeterson@dowlhkm.com.

Sincerely,

DOWL HKM

Charles L. Peterson, PG  
Project Manager

Carla Van Siclen, PG  
Geologist/GIS Specialist

Encl. Memorandum Report and CD
MEMORANDUM

TO: Ms. Pebbles Clark, Reclamation Specialist
    Montana Department of Environmental Quality
    Abandoned Mine Lands Program

FROM: Charles L. Peterson, PG, Project Manager
       Carla Van Siclen, PG, Geologist/GIS Specialist

SUBJECT: Report of Subsidence Investigation – Phase 1
         501 Broadway Avenue South
         Red Lodge, Carbon County, MT

DATE: November 3, 2011

PROJECT DESCRIPTION

On August 24, 2011, on behalf of Mr. Marvin Dukart, owner of the subject property, the mayor of Red Lodge, Brian Roat, contacted the Montana Department of Environmental Quality Abandoned Mine Lands Program (DEQ-AML) regarding potential settlement at 501 Broadway Avenue South. The location of the subject property is shown on Figure 1 in Appendix A. According to the Mayor there “is a rapid subsidence going on at this address—in front with the sidewalk and at the front of the house—front porch is pulling away from the house.” A request was made by the DEQ-AML to conduct an initial site visit to assess the reported settlement. Current and future assessment activities by the DEQ-AML and DOWL HKM are directed at determining if settlement at the subject property is directly related to mine subsidence or other mining related activities.

On August 25th, 2011 DOWL HKM Professional Geologist, Carla Van Siclen, and Licensed Surveyor, Bob Rux, conducted a site inspection of the house and property and performed a limited spot elevation survey of the area of settlement at the front of the house. Photos were taken during the August 25th site visit (See Appendix B). On August 30th Charlie Peterson and Carla Van Siclen performed a second site inspection of the subject property to review the surveyed locations and observations made during the previous visit. The following sections provide the results of the survey and site inspection.

BACKGROUND

Local Geologic Setting

Red Lodge, Montana is located on the northern edge of the Beartooth Mountain Range along the Rock Creek valley. Quaternary alluvial terraces and recent alluvium overlie the Tertiary Fort Union Formation in the area. Figure 2 in Appendix A is a geologic map of the Red Lodge area (Lopez, 2005). A thick Quaternary alluvial terrace deposit (Qat2) forms the west edge of the valley and is referred to as the West Bench. Thinner deposits of Quaternary alluvium (Qat3 and Qat4) overlie the
Fort Union which has been eroded to form the east edge (East Bench) of the valley. The town of Red Lodge is underlain by Quaternary terrace deposits and recent alluvium (Qat1 and Qal).

Based on a review of published material and well logs, the thickness of the alluvium appears to vary from a few feet to over 100 feet in the valley bottom. As part of a preliminary study of the potential for subsidence in the Red Lodge and Bearcreek Areas, Chen-Northern (1987) advanced a drill hole (DH-3) to 450.5 feet approximately two to three blocks north of the subject property (Figure 3 in Appendix A). The base of the alluvium was encountered at a depth of 108 feet. At least 85 feet of alluvium was encountered in drill hole DH-4 advanced as part of the Spectrum (1998) investigation and grouting project. However, during well log research of the Montana Bureau of Mines and Geology (MBMG) Groundwater Information Center (GWIC) website several well logs along the central and east sides of town noted encountering relatively shallow (less than 25 feet) bedrock (Figure 3 in Appendix A).

Some of the wells penetrated bedrock fifty feet or more and were installed by different drilling companies. Note that the Object ID listed near each well can be used as a cross reference with Table 1 in Appendix C. Table 1 presents additional well information obtained directly from the GWIC website, with the exception of the “Depth to Bedrock” information which was added by DOWL HKM after review of the well logs. There is some indication that the exploration holes referenced in Campbell (1906) also encountered bedrock at a shallow depth. Based on this information, relatively shallow bedrock may exist below the subject property.

The Fort Union Formation is readily exposed along the east bench and consists of mainly shale, siltstone, sandstone, and coal deposits. The bedrock in the Red Lodge area dips approximately 25 degrees to the south-southwest toward the Beartooth Mountains (Lopez, 2005). The coal deposits are part of the Red Lodge-Bearcreek Coal Field, formerly the Red Lodge Coal Field (Roberts, 1999 and Woodruff, 1909). The coal deposits are present on the east and west benches as well as below the town of Red Lodge.

**Groundwater**

As previously mentioned; groundwater well information was retrieved from the MBMG GWIC database and reviewed. Well locations were plotted in ArcGIS using the latitude and longitude coordinates provided in the GWIC database and are shown on Figure 3 in Appendix A. Note that the accuracy of the coordinate locations provided by GWIC can vary substantially depending on the method used to locate the wells. According to the GWIC metadata, some wells were located using a more accurate Global Positioning System (GPS) and a site visit has been conducted. However, most of the wells were located by contract drillers and landowners using a township, range, section, and tract description and substantial errors in location are possible. Additional well information is provided in Table 1 in Appendix C.

The depth of groundwater below the surface near the subject property appears to be in the range of 5 to 18 feet. According to the MBMG GWIC website 15 long term monitoring stations exist in Carbon County. However, only one well (Object ID 32) is located in the valley bottom. This well is located approximately eight blocks north of the subject property and is completed at a depth of 38 feet in alluvium. Static water level readings have been collected at this site since 2002. Water level readings were relatively consistent from 2002 through 2010 and ranged from about 12 to 14 feet below ground surface. However, in 2011 the range in water level readings varied from about 9 feet
to 15.6 feet below the ground surface. Review of the United States Geological Survey (USGS) National Water Information System Mapper website, no long term groundwater monitoring sites maintained by the USGS are located in the town of Red Lodge. No additional water level information was reviewed for this study.

Mining History

Coal was first discovered along the east side of the Rock Creek drainage in the mid-1860’s (Spectrum, 1989 and Anderson, 1983). There was no accessible market at the time, but with the completion of the Laurel to Red Lodge railroad in 1889, commercial mining commenced (Spectrum, 1989 and Anderson, 1983). The Red Lodge mining district consisted of two mines, the Sunset and Red Lodge Mines, referred to on the Carbon County Historical Society website as the West Side or Sunset Mine and the East Side or Sunrise Mine, respectively.

Campbell (1906) identifies eleven coal beds in the Red Lodge area and notes that additional thin beds of coal occur lower down in the rock section. Roberts (1999) states that “in the Red Lodge district, at least seven coal beds, originally designated as coal beds 1 through 7, were identified in the coal-bearing interval of the Fort Union.” Two additional beds were later discovered which are referred to as beds Number (No.) 1½ and 4½ (Roberts, 1999 and Woodruff, 1909). According to Combo (1949), eight beds of coal (No. 1, 1½, 2, 3, 4, 4½, 5, and 6) are known to have been worked in the vicinity of Red Lodge.

Hard copies of the historic mine maps and information related to a project conducted by MSU-B College of Technology which took the historical mine maps and converted them to a three dimensional electronic format was provided to DOWL HKM by DEQ-AML. The MSU-B information indicates that maps for coal beds No. 1½, 2, 3, 4, 5, and 6 were located and converted to a digital format. A preliminary summary memo for the MSU-B project indicates that they were not able to locate any records for beds No. 4½, 7, or 8. There is also no information on coal bed No. 1 in the data from the MSU-B project. Although they may exist, it appears that historic mine maps for these four beds have not been located. Also, based on review of the Chen-Northern (1987) report, another map showing mining of the No. 2 bed below the town of Red Lodge exists. Historical mine maps exist for six of the eight beds known to be worked in the vicinity of Red Lodge (No. 1½, 2, 3, 4, 5, and 6). It is the understanding of DOWL HKM that no maps have been located for beds No. 1 or 4½ or beds No. 7 or 8, which may indicate these beds were not mined extensively in the Red Lodge area.

Mine workings underlie the East and West Benches as well as portions of the town of Red Lodge. Preliminary review of the Chen-Northern (1987) report, historical maps, and the data developed by MSU-B show that the No. 4 and No. 5 beds were mined in the area below the subject property. The No. 2 bed was mined to within approximately ½ block south of the subject property. The No. 2 bed would have had workings closest to the surface in the area of the subject property. However, no underground mine map of the No. 2 bed in this area has been located by the DEQ-AML. As part of a preliminary study of the potential for subsidence in the Red Lodge and Bearcreek Areas, Chen-Northern (1987) borrowed mine maps from Meridian Minerals and developed three maps of the Red Lodge area showing depth of cover, cumulative mined thickness, and subsidence potential. Electronic versions of these maps, which were imported into ArcGIS and geo-referenced by DOWL HKM are presented in their modified form as Exhibits 1, 2, and 3 in Appendix A. The cumulative mined thickness map (Exhibit 2 in Appendix A) shows that anywhere from zero to 18 feet of
material has been mined from below the area of the subject property with what appears to be the
area of greatest thickness (18 feet) located near the northeast corner of the lot. Chen-Northern
(1987) also developed cross sections of mine limits (Exhibit 4 in Appendix A), the locations of
which are shown on Exhibit 1. However, note that cross section A-A’ and C-C’ are mislabeled and
should be reversed when comparing the cross sections to the maps.

Relatively shallow bedrock may exist below the subject property, however, based on Chen-
Northern’s interpretation (Exhibit 1 and Cross section B-B’), it appears that mining in the area of
the subject property occurred about 500 feet below the ground surface and deeper. South of the
subject property (about ½ block) it appears that the No. 2 bed was mined at a depth of between 300
and 350 feet. Note that the original mine maps and any maps interpreted from the original mine
maps may have some level of inaccuracy associated with them. Reasons for these inaccuracies
could range from original survey errors to assumptions made during conversion to an electronic
format. The location of the pillars, voids, tunnels, and any below grade features should be
considered approximate.

The coal production in 1889 was 6,000 tons and in 1920 production was over a million tons
(Spectrum, 1989 and Anderson, 1983). In 1924, coal production began in Colstrip, Montana,
forcing a cut back in production at Red Lodge (Spectrum, 1989 and Anderson, 1983). The West
Side Mine closed July 31, 1924 and the East Side Mine closed June 30, 1932 (Zupan and Owen,
2000). According to the Mining Artifacts & History website, “The Great Depression forced more
mines to close, and in 1943 an underground explosion killed 74 men at the Smith Mine in Bearcreek
four miles east of Red Lodge, devastating the community and effectively ending coal mining in
Carbon County.”

Subsidence related to the mining activities has been documented east of Red Lodge and in the Bear
Creek Area (Spectrum, 1989). Chen-Northern (1987) only identified two small areas of moderate
subsidence potential on the east side of town, just south of the subject property (Exhibit 3, Appendix
A). It has been approximately 70 to 80 years since mining ceased in the Red Lodge area. Although
subsidence related to mining could have occurred in that time, based on the information reviewed
by DOWL HKM, it appears that the Hymer Mine Shaft subsidence on Adams Avenue South is the
only documented active subsidence within the town of Red Lodge.

History of the Subject Property

DOWL HKM reviewed the Sanborn Fire Insurance maps of the property from 1891, 1896, 1901,
1907, 1912 and 1927 at the Carbon County Historical Society in Red Lodge, Montana. There is no
Sanborn map coverage of the property in 1891, 1896, or 1901. The 1907 Sanborn map shows a
small cabin located in the south-central portion of the lot. However, on the 1912 and 1927 Sanborn
maps the cabin is gone and a structure/home is shown in the same general location as the current
home. There is also a small structure in the northwest corner of the property. It appears that the
main part of the house was constructed between 1907 and 1912. No detailed information regarding
the settlement or the progression of settlement was obtained prior to the site inspection.
FIELD INVESTIGATION

Site Inspection

The site inspection included visual inspection of the property and the exterior of the house at 501 Broadway Ave. S. and taking photographs of pertinent features (See Figure 4 in Appendix A, and Appendix B). The general condition of the sidewalk and street (Broadway Ave. S.) were also noted. The residence at 501 Broadway Ave. S. is a two story wooden framed house built upon a mixed concrete/concrete block foundation. There is a set of concrete stairs leading up to the front entrance. There is a deck and entrance at the back of the house. The deck obscures the south half of the west foundation wall. There appears to be additions to the original structure at the front and back of the house. Most of the concrete portion of the foundation appears to be covered with a stucco façade. The entire foundation appeared to have been recently painted. The house is provided with city water and sanitary sewer service, underground natural gas and overhead electric service.

There is a concrete (city) sidewalk along the east side of the property. A concrete walkway was observed leading from the city sidewalk to the front steps. A low spot and significant crack in the city sidewalk was very apparent. DOWL HKM probed the crack in the city sidewalk and it appeared to be open to a depth of about 4 inches. An offset crack in the walkway just below the front steps was also observed. The settlement in the city sidewalk appears to have existed for a period of time as grass had grown into the low spot along the crack. However, fresh pieces of broken concrete in the city sidewalk and a fresh looking surface to the cracked concrete in the walkway possibly indicate recent movement.

The yard surrounding the house consists of a lawn and a few trees and ornamental bushes and no underground sprinkler system was observed. There is a detached garage/structure located along the west side of the lot. There was no obvious depressions in the yard with the exception of the area near the cracked concrete sidewalk east of the house. A crack was also noted in the asphalt pavement of Broadway Ave. S. that generally lines up with the cracks in the sidewalk and walkway but no obvious low spot was observed in the street.

Most of the house foundation is visible but somewhat obscured by paint and stucco. However, overall the foundation appeared to be in relatively good condition with the exception of the area near the northeast corner of the house. Two cracks were observed on either side of the concrete steps at the contact with the foundation (front addition) of the house. These cracks were open and the crack on the north side appeared to be offset slightly down to the east (indicating some recent settlement of the concrete stairs). Another open crack was observed near the northeast corner of the house where the front addition and the main foundation of the house meet. The crack was observed in the stucco façade and may not penetrate the entire foundation wall. This open crack may indicate possible settlement of a portion of the foundation, although it may just be the stucco façade cracking in response to the settlement of the front stairs. Other hairline cracks were observed in the foundation (Figure 4 in Appendix A).

Spot Elevation Survey

Spot elevation measurements of the ground surface were collected of the city sidewalk and concrete walkway on August 25th, 2011. Survey locations are shown on Figure 4 in Appendix A. The vertical elevations and horizontal positions for these points were measured using a Trimble R-6 dual
frequency survey grade GPS receiver in RTK mode. The high level of horizontal accuracy that the survey grade GPS receiver provided will enable the same spot elevation locations to be re-established in the future. The vertical datum for this survey is North American Vertical Datum (NAVD) 88. The horizontal datum is North American Datum (NAD) 83. Horizontal coordinates are Montana Zone 2500 State Plane. Horizontal units are International Feet and vertical units are U.S. Survey Feet.

As was observed during the site visit, the survey shows that the low spots occur along the crack in the city sidewalk and concrete walkway (Figure 4a in Appendix A).

CONCLUSIONS

- It appears that recent settlement of the city sidewalk, concrete walkway and front stairs at the subject property has occurred relatively recently. There is also an open crack near the northeast corner of the foundation that may indicate possible settlement of a portion of the foundation, although it may just be the stucco façade cracking in response to the settlement of the front stairs.

- The settlement appears to be limited to the northeast corner of the lot and city sidewalk.

- Based on well log review, relatively shallow (less than 25 feet) bedrock may exist below the subject property. However, mining activities appear to have occurred at depths of between 300 and 350 feet and deeper about ½ block south of the subject property and 500 feet and deeper in the area of the subject property.

- There are many reasons for the settlement of flatwork (sidewalk and walkways) and foundations that are unrelated to mine subsidence. The age of the flatwork and foundation, type of construction, foundation depth, soil and rock type present below the foundation, depth to groundwater or groundwater fluctuations, utility related issues, extreme weather conditions, and tree roots can contribute factors to the current condition of the flatwork and foundations. The location and orientation of the settlement observed in the flatwork and foundation indicate that there may be a utility related issue occurring such as a leak in a water supply line that services the house.

- Preliminary review of the Chen-Northern (1987) report, historical maps, and the data developed by MSU-B show that the No. 4 and No. 5 beds were mined in the area below the subject property. A cumulative mined thickness map developed by Chen-Northern (1987) shows that anywhere from zero to 18 feet of material has been mined from below the area of the subject property. Chen-Northern (1987) also shows the No. 2 bed was mined to within approximately ½ block south of the subject property. The No. 2 bed would have had workings closest to the surface in the area of the subject property. However, no underground mine map of the No. 2 bed in this area has been located by the DEQ-AML. Note that the original mine maps and any maps interpreted from the original mine maps may have some level of inaccuracy associated with them and the location of the pillars, voids, tunnels, and any below grade features should be considered approximate.
RECOMMENDATIONS

Based upon review of the information supplied by DEQ-AML, published information, the site inspection, and survey results, to determine if the observed settlement is directly related to mine subsidence or other mining related activities, the following recommendations are made:

- Leaking water lines can cause soil settlement or migration of fine-grained soil along the utility trench and subsequent settlement. DOWL HKM recommends the water supply line servicing the house be located and tested for leaks and all utility line locations be documented. DOWL HKM has requested a utility locate in order to confirm the utility locations including the water line that services the house. On September 14, 2011, DOWL HKM submitted a utility locate request to the one-call utility locate service to have the utilities marked for this property. However, no utilities had been marked as of September 17, 2011. A follow-up field check should be conducted to make sure utilities have been marked.

- It is recommended that periodic site inspections and surveys be completed to monitor and document any potential settlement. The survey should include repeating the initial survey to document the location, rates, and magnitude of any subsidence. It is recommended that a survey be conducted before winter (November) and again in the spring after the snow melts.

- DEQ-AML should keep in touch with the land owner on regular basis to monitor the situation.

- DOWL HKM recommends that an interview be conducted with the landowner using a standardized questionnaire format to develop a historical perspective of the settlement observed.

- Instrumentation could potentially be installed, such as crack monitors, to gauge whether there is any additional movement in the house foundation.

- The house is built upon a mixed concrete/concrete block foundation. Most of the house foundation is visible but somewhat obscured by paint and stucco. However, overall the foundation appeared to be in relatively good condition with the exception of the area near the northeast corner of the house. As previously mentioned, there are many reasons for the settlement of flatwork (sidewalk and walkways) and foundations. Differences in foundation construction techniques within one house foundation can sometimes magnify even minor settlement of the surface soil. If the water/utility lines are found to be in sound condition, DOWL HKM recommends a shallow foundation investigation near the northeast corner of the house to document the soil types present below the footings as well as footing types and depths.

- An attempt should be made to locate any additional mine maps or mine related information, particularly the map of the No. 2 bed or any information referenced in the Chen-Northern (1987) report specific to the Red Lodge area mining.
A sub-surface exploration program may be considered after the above mentioned recommended tasks are completed.

The objectives of any sub-surface exploration program are recommended to determine basic geologic conditions including documenting depth to groundwater, soil types and thicknesses, and depth to bedrock. The exploration program may be designed to establish the depth, thickness, and current condition of the existing coal beds. A thorough and well designed exploration program can most likely determine whether collapse of the mined coal seams has occurred locally. However, documenting active subsidence is a separate issue and a much more difficult task. There are numerous types of drill rigs and drilling contractors that can penetrate the coarse alluvium and bedrock to the depths required by any drilling program.

LIMITATIONS AND CONCERNS

Very little sub-surface information exists near the subject property and no subsurface evaluation was conducted of the subject property for this study.

REFERENCES


Carbon County Historical Society Website, Website last accessed on September 15, 2011 http://www.carboncountyhistory.com/content.asp?navID=exhibits&mainNav=Exhibits&subNav=Mining&content=mining

Carbon County Historical Society Mine Maps, various dates, provided to DOWL HKM in hard copy by Montana Department of Environmental Quality, Abandoned Mine Lands Program.

Carbon County Historical Society Mine Maps, 1904, in-house paper copies of archived information regarding Hymer Mine Shaft, located at Carbon County Historical Society building, 224 North Broadway, Red Lodge, Montana, 59068


Colorado-West Website: reprint of article on Hebgen Lake Quake, 1959, Billings Gazette, Website last accessed on September 12, 2011; www.colorado-west.com/cooke/hebgen.html


Montana State University Billings, 2011, Coal Project, Red Lodge, Montana, Project files provided to DOWL HKM in electronic format by Montana Department of Environmental Quality, Abandoned Mine Lands Program.


APPENDIX A

FIGURES AND EXHIBITS
Figure 1 - Vicinity Map
501 Broadway Avenue South
Block 36, Lot 1, Red Lodge First Addition
Red Lodge, Montana

Map Source: USGS 7.5 Minute Topographic Map Series
Red Lodge East and Red Lodge West Quadrangles

Q:\31\20281\ArcGIS\Exhibits\Red Lodge Vicinity Map 501 Broadway.mxd  9/13/2011
Figure 2 - Geologic Map
Red Lodge, Carbon County Montana

Map Source: Lopez, 2005, Geology of the Red Lodge Area Carbon County, Montana (Modified by DOWL HKM)
Figure 4 - August 2011 Site Survey
Survey by DOWL HKM; Horizontal Datum: Montana State Plane NAD83 International Feet; Vertical Datum: NAVD 88 US Feet
Property Boundary: State Cadastral Data (2011)
(Note: Structures, Property Boundaries, and Crack Locations Approximate)

Possible Small Cracks between CMU Block on West and North Foundation Wall near Northwest Corner

Hairline Crack 1
Hairline Crack 2
Hairline Crack 3
Hairline Crack 4
Hairline Crack 5
Hairline Crack 6

Crack 7 Open and Offset
Cracks at Contact of Stairs and Foundation

501 Broadway Avenue South

Survey by DOWL HKM; Horizontal Datum: Montana State Plane NAD83 International Feet; Vertical Datum: NAVD 88 US Feet
Property Boundary: State Cadastral Data (2011)
(Note: Structures, Property Boundaries, and Crack Locations Approximate)
Exhibit 1-Depth of Cover

Legend
- House of interest
- Drill Holes
  - Chen-Northern, 1987
  - Spectrum, 1998

Background: 2009 NAIP - Depth of Cover Map Overlay; Chen-Northern Inc., 1987 modified by DOWL-HKM 2011 (Note: Map Contacts are Approximate)
APPENDIX B

PHOTOGRAPHS
View Southeast of North Foundation and Open Crack 7 in Stucco Where the Front Addition and Main House Foundation Meet
501 Broadway Avenue South, Red Lodge, MT

View South of Front Stairs - Note Open Crack Between the Stairs and Foundation
501 Broadway Avenue South, Red Lodge, MT

View South of Front Stairs and Crack in Walkway
501 Broadway Avenue South, Red Lodge, MT

View West of East Foundation and Hairline Crack 1 near Southeast Corner of House
501 Broadway Avenue South, Red Lodge, MT
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View East of West Foundation and Crack 5 in CMU Block  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 13-01-16 - 0105.JPG

8/25/2011 1:01:41 PM  
View East of West Foundation and Paint Peeling or Possible Cracking in CMU Block  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 13-01-41 - 0106.JPG

8/25/2011 1:02:54 PM  
View South of North Foundation and Paint Peeling or Possible Cracking in CMU Block  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 13-02-54 - 0107.JPG

8/25/2011 1:03:05 PM  
View South of North Foundation and Hairline Crack 6 at Back Addition  
501 Broadway Avenue South, Red Lodge, MT  
2011-08-25 13-03-05 - 0108.JPG
APPENDIX C

TABLE 1 – WELL INFORMATION
<p>| OBJECT ID | GWIC ID | Latitude | Longitude | Geomethod Lat Lon | Datum Lat Lon | Township | Range | Quarter Sections | Site Type | DNRC Water Rights | Site Name | Altitude | Primary Aquifer | Total Depth | Static Water Level | Diving Water Level | Pumping Water Level | Yield | Test Type | Test Hours | Drilling Item Setting | Recovery Water Level | Recovery Time | Drilling Company | Date Completed | Well Use | Depth to Bedrock (feet) |
|-----------|---------|----------|-----------|-------------------|---------------|----------|-------|------------------|-----------|------------------|-----------|----------|---------------|------------|-----------------|-----------------|-----------------|----------------|------------|-------------|-------------|-----------------|---------------------|---------------|------------------|--------------|---------|------------------|</p>
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### Notes
- **Type**: TRS-SEC, NAV-GPS, SUR-GPS
- **Well Name**: City of Red Lodge - Well 0
- **Date**: Various dates ranging from 5/27/1977 to 9/23/2004
- **Company**: Douglas Drilling, Rock Creek Drilling, Aqua Drilling, etc.
- **Purpose**: Irrigation, Domestic, School, Public Water Supply, etc.
APPENDIX D

ELECTRONIC FILES
(REPORT, FIGURES AND EXHIBITS, GIS FILES FOR SURVEY DATA)