DRAFT
GEOPHYSICAL MAPPING OF
GROUNDWATER POTABLE WATER SUPPLY
AND METALS CONTAMINANT LOADING
TECHNOLOGY DEMONSTRATION

BASIN CREEK AND TENMILE CREEK WATERSHEDS
Rimini, Montana

Prepared for
U.S. Army Corps of Engineers

January 9, 2004

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Prepared for

U.S. Army Corps of Engineers, Omaha District

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January 9, 2004

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ACRONYMS AND ABBREVIATIONS

RAMS: Remediation of Abandoned Mine Sites
USACE: U.S. Army Corps of Engineers
U.S. EPA: U.S. Environmental Protection Agency

GEOPHYSICAL MAPPING OF GROUNDWATER POTABLE WATER SUPPLY AND METALS CONTAMINANT LOADING TECHNOLOGY DEMONTRATION
Rimini, Montana

EXECUTIVE SUMMARY

MCS Environmental, Inc. (MCS) and its subcontractor Smith River Environmental, Inc. under contract (DACW09-03-P-0074) to the U.S. Army Corps of Engineers (USACE), conducted a geophysical survey of three areas near the town of Rimini, Montana. The purpose of the project was to locate a drinking water supply for the town. The survey was conducted under the USACE Remediation of Abandoned Mine Sites (RAMS) program and was a cooperative effort with the U.S. Environmental Protection Agency (EPA).

Results of the surveys were as follows:

- Data collected at the Lower Minnehaha Creek site was consistent with bedrock groundwater contained in tight fault structures. No promising drill site could be located.
- Data from the first survey near the Tributary North of Spring Creek indicated the potential for several small water channels under the tributary.
- Data from the second survey near the Tributary North of Spring Creek provided a promising drill site to intercept a water channel feeding a spring. The location was marked.
- A promising drill site along the Middle Spring Creek was located and marked.

1.0 INTRODUCTION

The following report summarizes the work performed under contract DACW09-03-P-0074 for the USACE, Omaha District. The purpose of the Geophysical Mapping of Groundwater Potable Water Supply and Metals Contaminant Loading Technology Demonstration project was to locate a drinking water supply for the town of Rimini, Montana. The work performed follows the Work Plan, prepared by MCS, dated August 8, 2003 and was governed by the Site Safety and Health Plan, prepared by MCS, dated August 5, 2003. These plans were prepared according to the Final Scope of Work for Geophysical Mapping of Groundwater Potable Water Supply for the contract, dated July 16, 2003.

The current drinking water supply for Rimini, Montana is impacted by water draining through abandoned mine sites. The EPA has attempted to drill several wells into water that may not be impacted by the surface water of Tenmile Creek; however, no well drilled to date has intersected sufficient water. A non-impacted water supply for the town of Rimini is a top priority for the EPA.

The EPA reports that several monitoring wells have intersected groundwater. This is an indication that the groundwater is confined to geological structures such as faults. Until the groundwater is suitably mapped, the drilling sites will not be reliable and may never intersect potential drinking water sources.

A relatively new geophysical technology, known as EM Map and covered by U.S. Patent #5,825,188, is now available and has the potential to develop a map of the groundwater in the area of Rimini, Montana. This map would provide the best surface location for drilling drinking water wells and maximizing the probability of intersecting the groundwater system. The EM Map technology will be utilized in conjunction with a water well drilling company to assist the EPA to locate and develop an alternate drinking water source for the town of Rimini, Montana.

2.0 DESCRIPTION OF SITE

Tenmile Creek flows to the north in the northern Boulder Mountains. Extensive hard rock mining took place in the drainage during the past century and the evidence of mining is visible in many areas. Tenmile Creek is accessed via Lewis and Clark County Road 695, often called Rimini Road, that runs up to the town of Rimini, Montana (Section 33T9N,R5W). The access road becomes Helena National Forest Road 1876 at the south end of Rimini and continues to the headwaters of Tenmile Creek.

The first two sites surveyed were at the mouth of Minnehaha Creek and a small tributary to Tenmile Creek that was located south of Minnehaha Creek and west of the Red Mountain Ranch. Both areas are accessible for drilling and have been drilled by EPA contractors looking for drinking water. In both cases, the survey area was a relatively flat area adjacent to the creek or tributary close to the alluvial fill through which Tenmile Creek flows. The final site surveyed was along Spring Creek, which flows from the west and intersects Tenmile Creek in the town of Rimini. This site is immediately west of Rimini. It can be accessed by small 4X4 type vehicles, but the access road would need improvement to allow access by a drilling rig. Figure 1 shows the general area with the survey sites marked (see **FIGURE** section)

3.0 DESCRIPTION OF TECHNOLOGY

EM Map is a geophysical technology designed to map, monitor, and characterize groundwater and subsurface water bearing zones. The technology is based on U.S. Patent #5,825,188, "Method of Mapping and Monitoring Groundwater and Subsurface Aqueous Systems", October 20, 1998. The EM Map technology was used for this study to locate potential drinking water sources near the town of Rimini, Montana.

EM Map relies on the principle that water in the ground is a better conductor than the other components, such as rock or soil. Mineral rich water, salt water, and/or highly acidic water are much better conductors. Saturated clay lenses are better conductors than bed rock or unsaturated alluvium soils, but are not as conductive as groundwater saturated sand or gravel filled channels. Although pure water is a poor conductor, groundwater in equilibrium with the surrounding minerals almost always contains a sufficient quantity of dissolved minerals to be a reasonable conductor of electricity.

Conventional geophysical techniques also utilize this principle, but generate a current in the target conductor indirectly. Figure 2 is provided to illustrate how conventional geophysics might work. An antenna or electrodes are placed on the surface and a primary electric or magnetic field is produced on the surface. This field will cause conductors in the ground to collect a part of the transmitted energy. These conductors produce secondary fields that can be measured to locate the conductor.

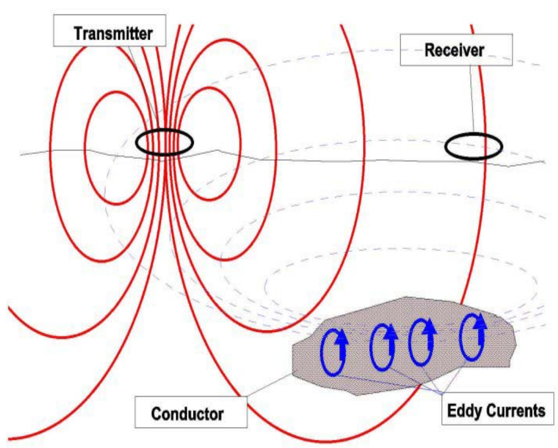


Figure 2- Conventional electromagnetic survey where a field transmitted on the surface energizes a conductor which transmits a secondary field to the surface receiver.

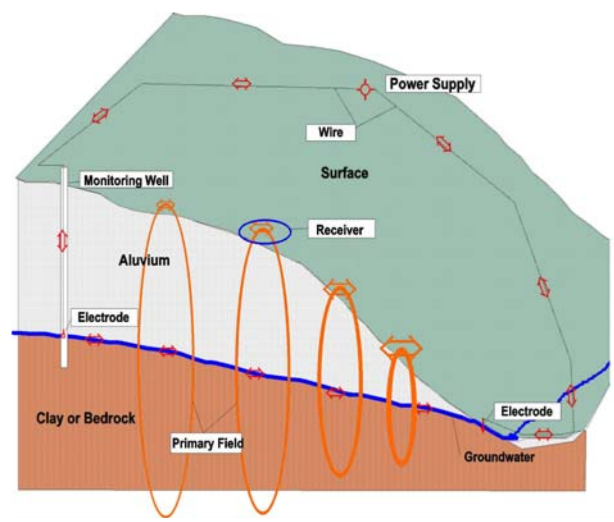


Figure 3- EM Map survey setup where the water under investigation carries the electric current and produces a primary magnetic field.

Conventional geophysical approaches have several inherent problems. A secondary field is much weaker than the primary field that produced it. Measurement of a secondary field is therefore harder and it must be separated or differentiated from the stronger primary field. In addition, soils, rock, or clay layers separating the conductor from the surface can deflect or adsorb one or both fields and the study will produce few results. These problems and others frequently reduce the effectiveness of conventional geophysics for applications involving relatively weak conductors, such as groundwater.

When using EM Map, the water being studied is incorporated directly into the primary circuit. Examples are illustrated in Figure 3. A simple electric circuit is produced that produces a magnetic field perpendicular to the electric current in the water. Thus, the magnetic field produced by the water is a primary field and not a secondary field. Measurement of this primary field is much easier than measuring a secondary field, as in conventional geophysics, and the field measured does not have to be separated from another, stronger field. In theory, EM Map can be used to almost any depth. Mr. Tom Phillips of Smith River Environmental has used EM Map at depths in excess of 1500 feet. Since the field being measured is a magnetic field, few natural materials will interfere with the field produced. This means that surface measurements are reliable and independent of the physical properties of the intervening materials.

3.1 EQUIPMENT PREPARATION

Equipment to provide an AC current at the desired frequency and amperage is required. The EM Map survey for this project used a variable frequency AC power supply provided by the Elgar Electronics Corporation. The AC current provided by the power supply is fed to a controller box, which is designed by Mr. Phillips, to provide additional control over the amperage and voltage of the current produced. The wires from both electrodes are connected into the controller box, setting up a simple electric circuit consisting of the power supply, wires to two electrodes, and the groundwater/earth.

For this study, EM Map surveys were conducted in three separate areas. The first was in an area near the junction of the Minnehaha Creek and Tenmile Creek. A bedrock well was drilled in this area, but had not intercepted a substantial quantity of water. The second site was south of Minnehaha Creek and across Tenmile Creek from the Red Mountain Ranch. This area was designated as “Tributary North of Spring Creek” in the *Summary and Recommendations 2002 Rimini Water Supply Investigation Upper Tenmile Creek Mining Area Site*, prepared by CDM Federal Programs Corporation, dated May 2003. The third site was west of Rimini and adjacent to Spring Creek and was labeled “Middle Spring Creek” by CDM.

An EM Map survey requires building a simple electric circuit on the site, which incorporates the water being mapped into the circuit. For the Minnehaha Creek survey, an electrode was placed in the Minnehaha Creek, to the west of the survey area. Initially, the casing for the Well RWS03 was used as the electrode. CDM personnel provided data indicating that the well was only cased in steel to the about 40 feet in depth. The remainder of the well was the PVC liner of the well. This effectively insulated the well casing from the groundwater in the PVC liner. To make contact with the groundwater, an electrode was suspended just above the bottom of the well, within the well liner. The power supply was located to the east of Well RWS03. A wire was run directly from the well to the power supply to connect this electrode. The electrode in the Minnehaha Creek was connected to the power supply by a wire run well to the north of the survey area. The survey area was restricted to the relatively flat area adjacent to Minnehaha Creek that appeared to be accessible to drilling rigs. A sketch of the setup is provided in Figure 4. An attempt was made to locate survey points using a GPS, however too few satellites could be located by the GPS receiver, presumably due to the heavily wooded terrain.

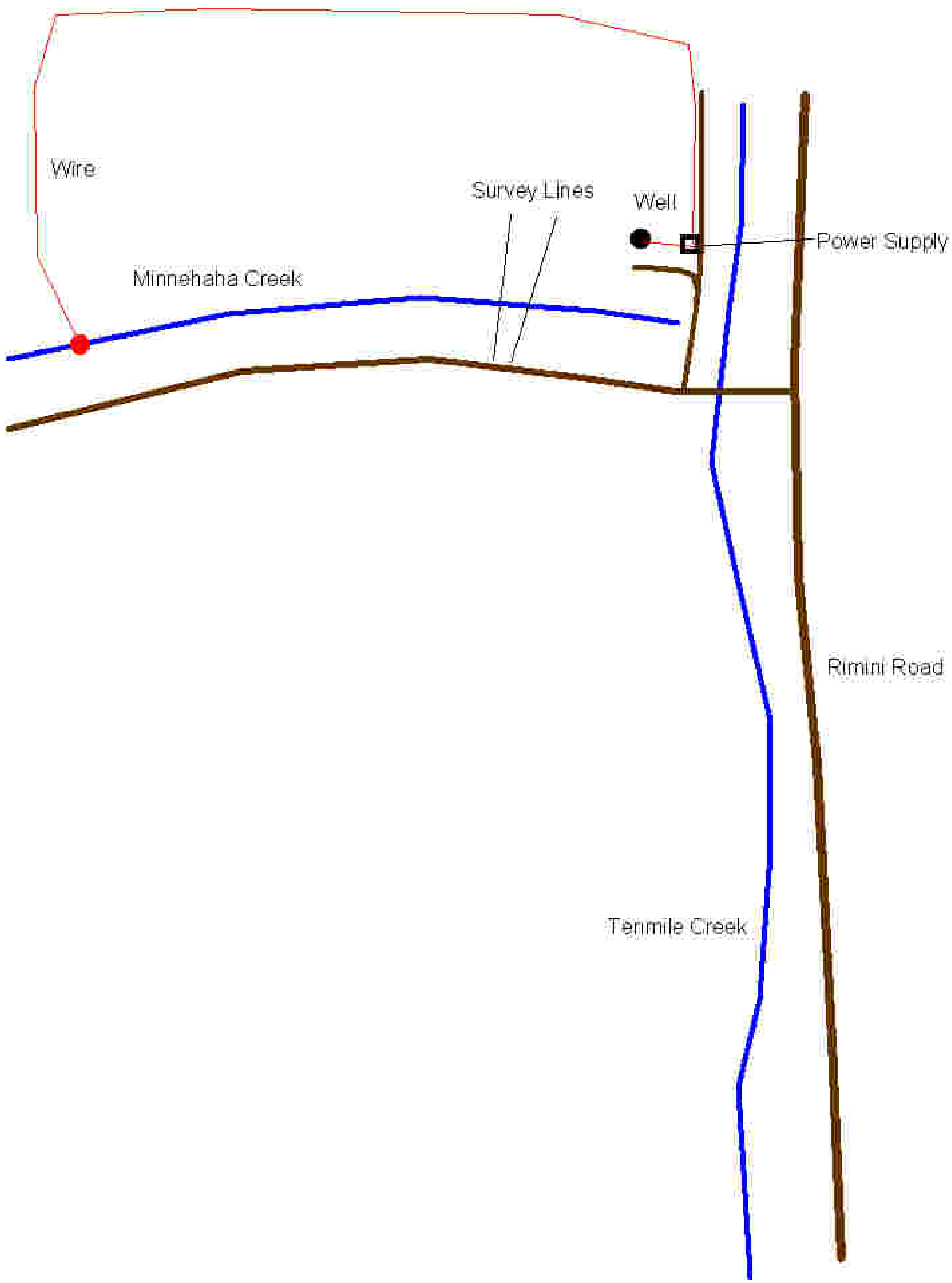


Figure 4- Minnehaha Survey Setup

For the survey conducted in the area known as "Tributary North of Spring Creek", an electrode was placed in the tributary. The second electrode was placed in Well RWS02. This well was drilled into bedrock, north of the Red Mountain Ranch and east of Tenmile Creek. The power supply was located to the north of the well, along the road to Rimini. The wire from the electrode, placed in the tributary, was run to the north of the survey area to the power supply. Well RWS06 was used as the 0 point for the survey. A rectangular grid extending about 300 feet to the south of the Well RWS06 was used as the survey area. The tributary cut through the survey area about 120 feet to the south of the well.

While conducting the second survey, a small seep was located adjacent to and discharging directly into Tenmile Creek. This seep appeared to be fed from the survey area. To obtain data on this water flow, a second survey was conducted in the same general area as the initial survey along the tributary. For this second survey, the electrode in Well RWS02 was moved to the seep. After collecting additional data, the survey area was extended about 200 feet to the north of Well RWS06. Figure 5 shows a sketch of both setups.

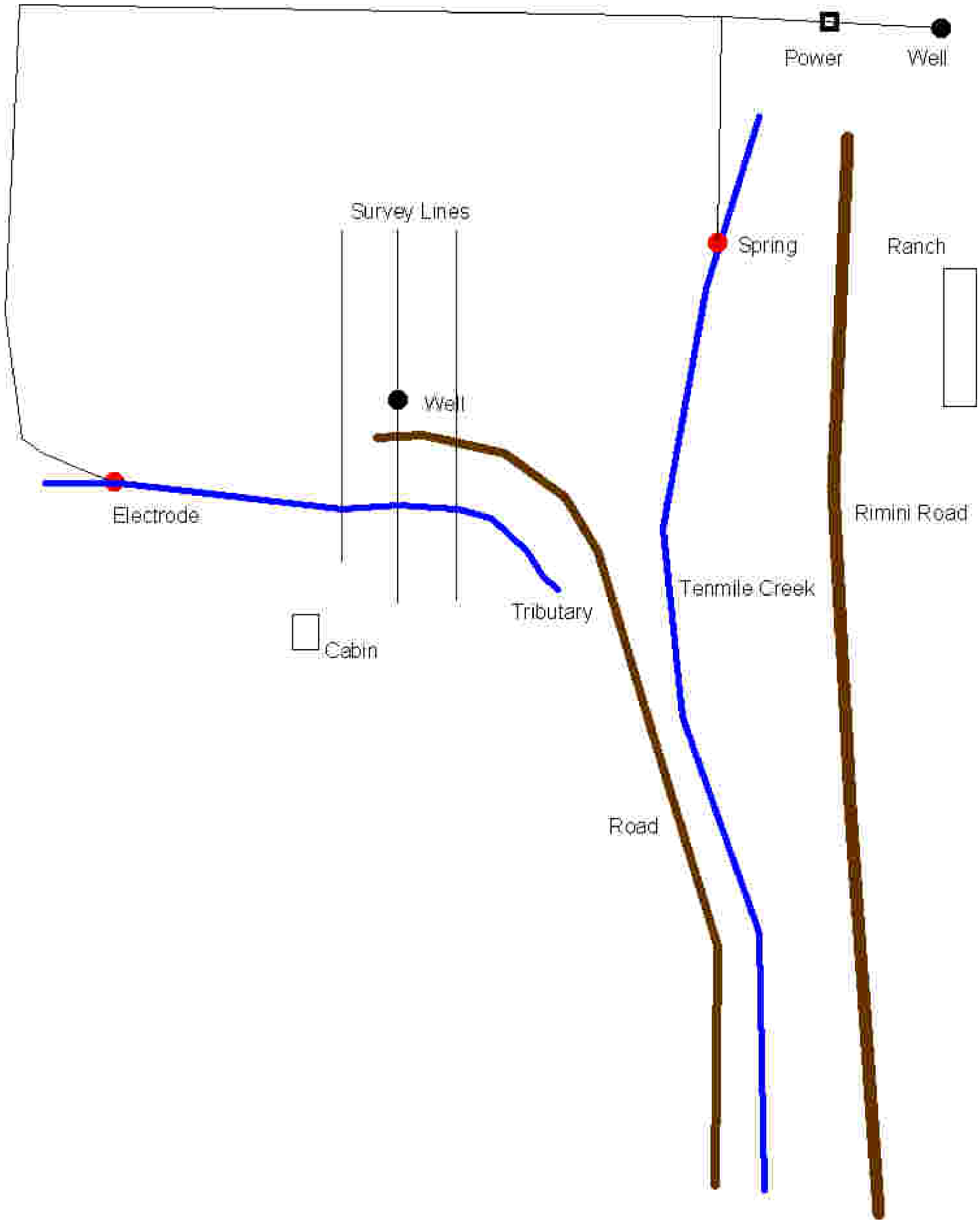


Figure 5- Tributary North of Spring Creek Setup

The third and last survey was conducted at the Middle Spring Creek site. For this survey, CDM arraigned for EnviroCon to transport the survey equipment up to the site via a switchback road that accessed the area above the Lee Mountain reclamation work. A small spring had been located, discharging into Spring Creek, but apparently fed from an area to the south and west of Spring Creek. An electrode was placed directly into the spring and a second electrode was placed in a low area to the south of the spring. The power supply was placed just off the road near the second electrode.

Survey lines were placed across the area that seemed to be up-gradient from the spring. It was hoped that these lines were perpendicular to the path of the groundwater feeding the spring. Figure 6 shows an approximation of the setup used.

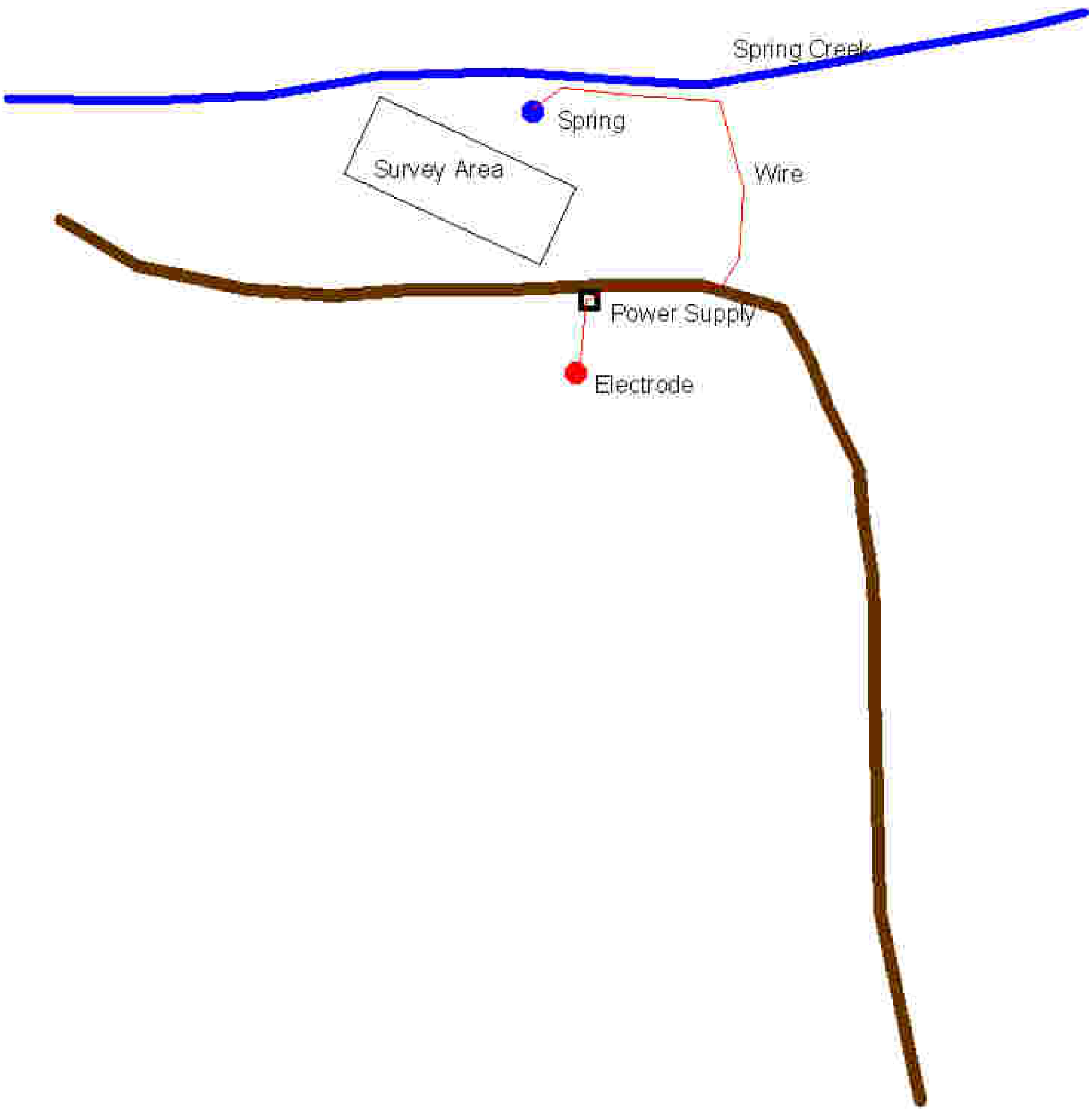


Figure 6- Middle Spring Creek Setup

3.2 SURVEY METHODOLODY

The EM Map technology uses a proprietary magnetic field receiver to measure the magnetic field produced by electric current flowing through a conductor, such as groundwater. The equipment is designed to be directional, i.e., it will only measure the magnetic field along one axis. By orienting the receiver in the horizontal plane, it is possible to locate the minimum and maximum magnetic field, in that plane. The receiver is then rotated 90 degrees into a vertical position to obtain the vertical component of the magnetic field. The receiver produces a small electric current that is proportional to the strength of the magnetic field being measured. The field strength is therefore reported in millivolts.

The equipment used to measure the field strength includes electronic filters to remove magnetic fields produced by 60 cycle power sources. Unfortunately, 60 cycle power sources also produce magnetic fields at the harmonic frequencies, or multiples of 60 cycles. Harmonic fields at 360 cycles and 420 cycles do cause some interference in the collection of data. By using an averaging circuit, this interference is usually eliminated except when very close to high power sources.

For these surveys, EPA provided a GPS to help locate survey grids and key features at the site. Unfortunately, attempts to use the GPS were frustrated by the terrain and a strong enough signal could not be obtained. As a result, the GPS was not utilized.

3.3 DATA INTERPRETATION

The technology can provide information on the location of the center of the water channel, depth to the water, and the location of the edge of the channel. Areas where the water changes elevation or where the conductivity of the water rapidly changes can also be determined. When combined with more conventional data, this information provides a significantly improved understanding of phenomena associated with the groundwater in the area under investigation. For example, if two wells are placed in the same water channel and the EM Map survey shows that no additional channels join this channel, diluting or introducing additional constituents, then changes in water chemistry can only be attributed to changes occurring between the wells, such as natural attenuation or a reaction between dissolved components and the surrounding rock or alluvium.

Figure 7 shows how a magnetic field forms around a linear conductor, perpendicular to the direction of the current flow. The strength of the field is related to the distance from the conductor that produced it. The EM Receiver measures both the horizontal and vertical components of the field produced. When directly over the conductor, the horizontal component of the field is greater than when the measurements are taken on either side. When the electric current in two conductors is equal, the strength of the field measured provides an indication of the depth of the conductor.

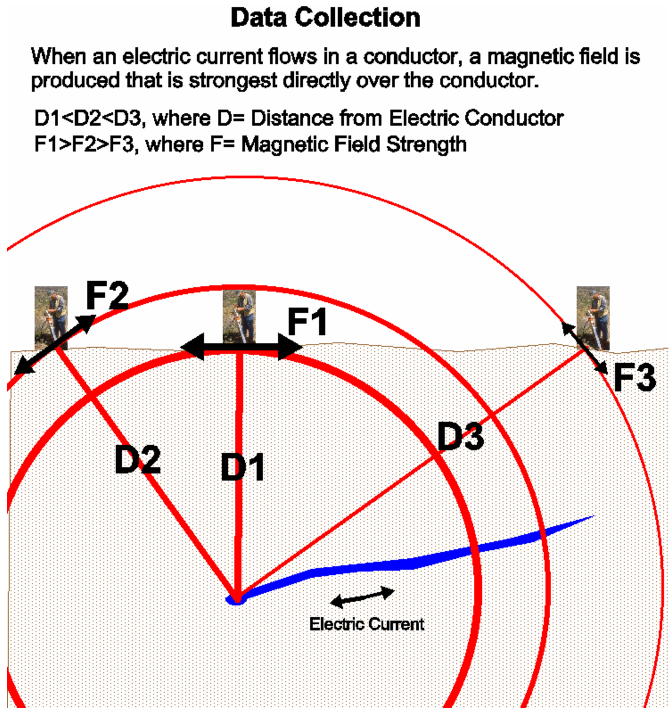


Figure 7- Magnetic field strength varies with distance.

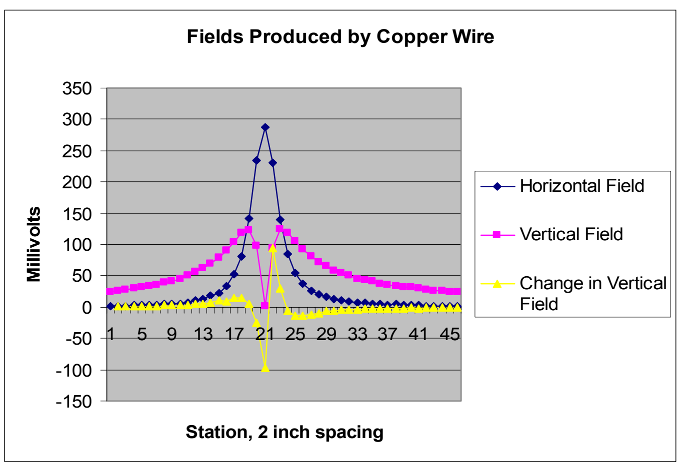


Figure 8- Magnetic field strength measured above a copper wire.

Figure 8 is a graph showing data collected above a copper wire. The horizontal field strength measurements, shown in dark blue, fall off quickly on either side of the conductor positioned directly below station 21. Vertical field measurements are essentially zero directly over the conductor, and increase rapidly on either side. The maximum vertical field strength is at point where the vertical field strength is equal to the horizontal field strength and at a position 45 degrees from vertical relative to the position of the conductor.

Unfortunately, measurements taken from the real world rarely are this simplistic. The data presented at the right, Figure 9, is from field survey measurements taken to locate a leak in a plastic lined pond. This is almost-ideal, real-world data where a small channel of highly-conductive water was easily mapped. This data shows similar features to the "perfect" data presented in Figure 8. Factors that often complicate the survey include: multiple conductors, the field produced from the wire connecting electrodes, the field produced by the electrodes, and cultural features such as water lines, buried cables, sewers, etc. that can collect current and produce a small field.

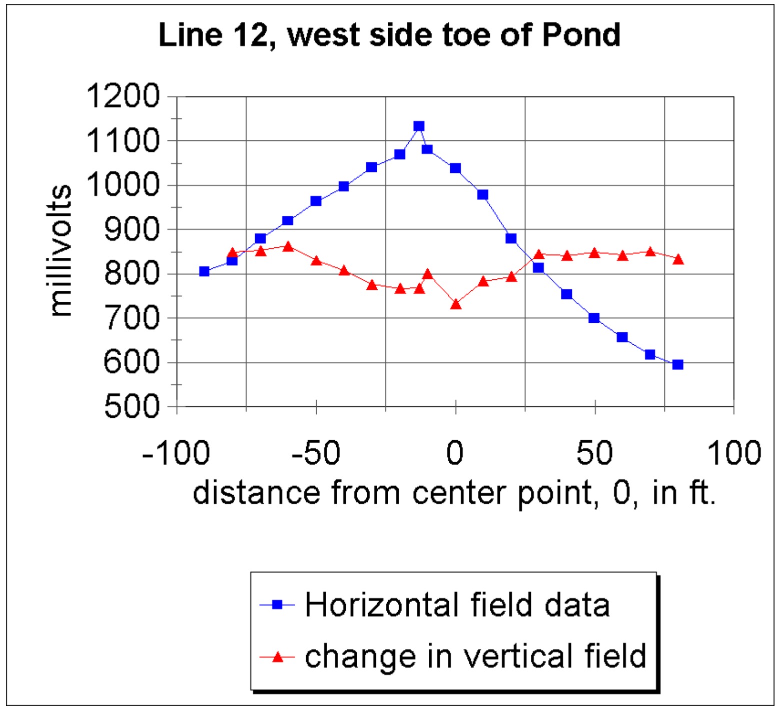


Figure 9- Typical field data.

3.4 QUALITY ASSURANCE AND ERROR ANALYSIS

The EM Technology was conceived and developed by Mr. Phillips. Mr. Phillips performed the EM study for this project. Mr. Phillips has conducted investigations into the reliability of the technology and developed proprietary techniques designed to minimize error and enable the collection of reliable data.

3.4.1 Data Collection

Data consists of a measurement of the magnetic field in the horizontal and vertical plane. A magnetic field receiver, mounted on a tripod, has been built to collect the required data. A compass, fixed to the receiver, is used to measure the orientation of the receiver within the horizontal plane. The mount enables the receiver to be oriented in a horizontal position and rotated in that plane, 360 degrees. The mount can be unlocked to allow the receiver to be rotated 90 degrees to a vertical position and locked in that orientation.

The potential for error occurs from a number of sources, mostly related to the precision of the operator. For this survey, Mr. Phillips, was present for the collection of all data. By using the same procedures (such as rotating the receiver in the same direction each time) for each data point, error can be minimized. By maintaining discipline and performing each data collection task in the same manner, every time, produces highly repeatable results, with an observed error that has not been statistically verified but appears to be less than 0.5 percent. Measurement errors would tend to propagate through all measurements so the relative difference in the magnetic fields would be the same.

3.4.2 Variations in Magnetic Field Strength

During the course of a day the magnetic field produced for the survey will vary in strength. This is primarily caused by natural temperature variations. As surface temperatures rise, the resistance in the electric circuit used to generate the magnetic field, also rise, and less electric current flows in the circuit. Field measurements indicate that the magnetic field varies about 1 percent over the course of a day. A correction can be made for this change by periodically recording the amperage of the electric circuit at the power supply. A correction factor, if needed, can then be calculated assuming a direct correlation between the amperage applied to the circuit and the magnetic field produced.

3.4.3 Base Station Measurements

Methodology developed for an EM Map survey includes taking repeated measurements at a base station. The base station can either be a fixed point near the survey area or a data collection point within the survey. Data are collected at this point as often as possible, and at a minimum, at the start and stop of each survey period. An example would be starting at this point and repeating the same point prior to stopping for a break. This allows a correction factor based on time to be calculated.

3.4.4 Correcting For Breaks in the Survey

For most surveys, data are collected in a grid or along straight lines. When breaks in the survey occur, either for regular activities such as lunch, or for problems such as loss of power, it is important to repeat near by data points to allow corrections to be made for any change in field strength during the break.

3.4.5 Technology Limitations

Whenever electric current flows between two points, a magnetic field will be generated that is shaped by strength and direction. When the electric current is contained in a good conductor, such as a wire, and the conductor is insulated from its surrounding environment, the magnetic field produced is highly predictable and measurement of the field strength can yield precise information on the location, including depth of the conductor within the survey area.

Groundwater, however, rarely meets this definition. Only when the water is contained in a plastic pipe or in a fault within nonconductive rock will the conductive path be truly insulated. In addition, it is likely that a number of conductive paths will exist within the survey area and current will flow along each. While a groundwater channel is normally much more conductive than any other potential conductor in the ground, saturated clay layers, alluvium, and bedrock will also conduct some current, even if in smaller amounts.

As it is likely that for most surveys, multiple current pathways will exist, the technology is significantly limited to the ability of the survey personnel to interpret the data obtained. Unlike more mature geophysical technologies, such as seismic surveys, limited data have been obtained upon which to guide interpretation and to develop algorithms for interpretation.

For relatively simple conditions, such as mapping water in a conduit, fault, or with highly conductive water channels interpretation of the data is usually straight forward and reliable, however for more complex situations, such as with water of low conductivity (drinking water), aquifer mapping, or mapping multiple water channels perched on clay beds, data interpretation is much more complex and not as reliable.

Another limitation of the technology is the data collection methodology. The more data collected, the better the interpretation of the data. Unfortunately, the data collection process is labor intensive and costs limit how much data can be collected for a given survey. Ideally, a data would be collected on a continual and automated basis; this would significantly improve the quality and versatility of the survey.

4.0 SITE INVESTIGATIONS AND DATA INTERPRETATION

4.1 MOUTH OF MINNEHAHA CREEK

4.1.1 Site Investigation

The EM Map survey was performed at the mouth of Minnehaha Creek from August 12 to August 15, 2003. The original equipment setup utilized the steel well casing for Well RW S03 as an electrode. The EM Map equipment could only push about 0.5 amps into the groundwater. When the electrode was moved from the well casing directly into contact the water inside the PVC screened casing, only 0.25 amps of current was the maximum current obtainable.

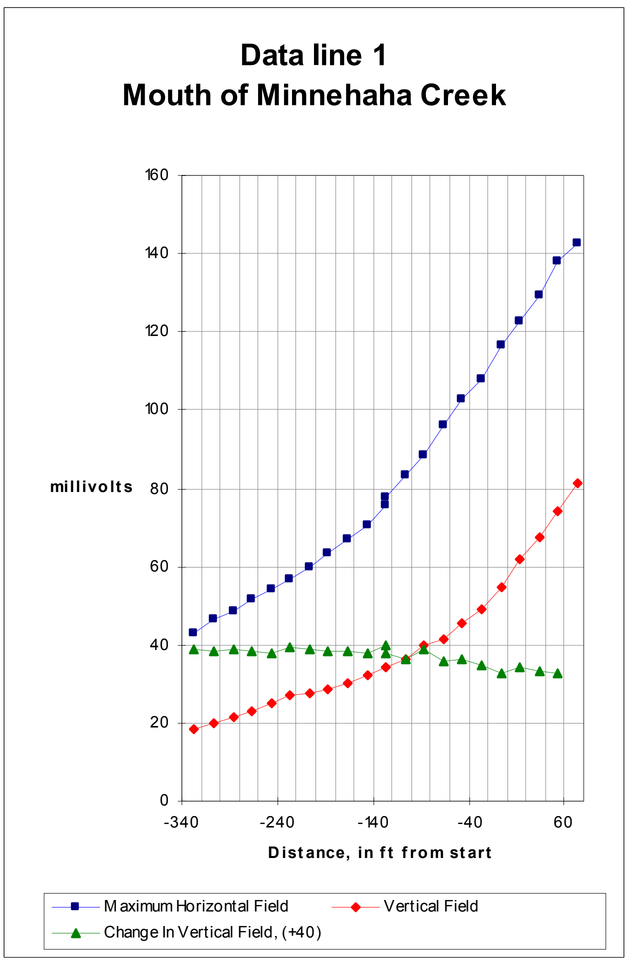


Figure 10- Data Line 1, Mouth of Minnehaha Survey

Data was collected along two lines for this survey. Data collected along line 1 is shown in Figure 10. The horizontal and vertical components of the magnet field are shown blue and red, respectively. The data shown in green is the change in the vertical field strength as determined by subtracting the one data station vertical field from that of the next. To view the change in vertical field at the same time as the other two fields, a constant value, in this graph +40, is added to each calculated value. Two data points are shown at the data point at -126 on the x axis. This data point was repeated as a significant break in the collection of data occurred.

This line ran at an angle of 133 degrees or 47 degrees from north/south. The 0 point on the line was approximately 176 feet due west of Well RWS03.

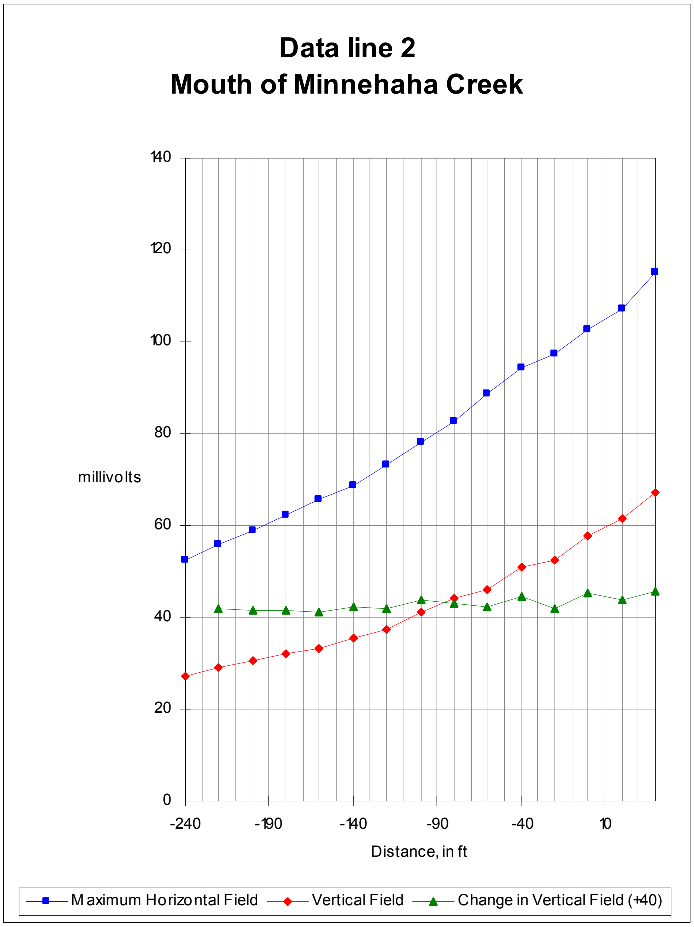


Figure 11- Data Line 2, Mouth of Minnehaha Survey

Data from Line 2 is presented in Figure 11. This data line was at an angle of about 130 degrees, or 50 degrees from north/south. The 0 point on this line was about 240 feet due west of Well RWS03.

4.1.2 Data Interpretation

Using the well casing as the electrode enabled about twice the current to be forced through the groundwater as when the electrode was suspended in the bottom of the well. A possible reason for this is that the well casing provided much more surface area in contact with the water than the suspended electrode.

When a second electrode was suspended, roughly doubling the surface area of the suspended electrode, very little additional current could be forced through the circuit.

This indicates that surface area of the electrode, is not the limiting factor in current flow. Another possibility is that the groundwater at this site is not very conductive, i.e., it contains few dissolved solids. The well casing was in direct contact with the alluvial water, which was previously determined to be impacted by past mining activities, and should contain more dissolved solids and be more conductive.

Data lines 1 and 2 are not consistent with a single channel of water flowing along a major fault structure of another structure within the survey area. The data can be interpreted as showing possible groundwater paths at several locations. These paths are not major features, however, and would likely be small faults. It is likely that the majority of the current follows a broad path through the bedrock water. Since most of this water is in fairly competent bedrock, such as small fractures that do not transmit a significant flow of water, multiple current paths are followed.

The horizontal field strength shown is highest on the northeast end of the survey lines. This end is closer to the well and both the electrode and the wire used to lower the electrode down the well. The electrode and wire will produce magnetic fields in the horizontal plane. Since this end of both survey lines was the closest to the well, this is the most likely explanation for the data observed.

4.2 TRIBUTARY NORTH OF SPRING CREEK

Two surveys were performed on the site referred to by the EPA as the Tributary North of Spring Creek. The first survey was performed on August 19, 2003. A second survey was performed at the site from September 11 to September 14, 2003. This second field visit expanded the survey area to the north and used a different electrode array.

4.2.1 First Survey Site Investigation

The initial survey for this area used an electrode lowered to the bottom of Well RWS02, north of the Red Mountain Ranch. The second electrode was placed directly in the tributary. A circuit using 0.75 amps was established. This was more current than could be established in any of the other surveys, and was three times the current measured during the survey at the Mouth of Minnehaha Creek. This survey and the Minnehaha survey used the same basic setup, with an electrode in a bedrock well and another electrode in a surface stream. This was surprising as the electrodes for the survey at the Mouth of Minnehaha Creek were a shorter distance apart than for this survey. One possible explanation for this observation is that the water in the RWS02 well was much more conductive than for the Well RWS03 used in the Mouth of Minnehaha Creek survey. Another is that the conductivity of the groundwater between electrodes was much higher for this survey. Both explanations could be true.

4.2.2 First Survey Data Interpretation

Horizontal field data from the first survey are shown in Figure 12. The data is consistent with a number of potential water channels flowing at some depth, possibly along the top of competent bedrock. The highest horizontal field on each data line is where a station landed next to the surface tributary. On Data Lines 50 East and 0 East, the data station was next to the flowing water. On Data Line 50 West, the tributary was about 6 feet south of the data station.

Although the surface water is associated with the highest field strength measured, it is significant that the field measured is close to the other data. This is an indication that very little electric current uses the surface water as a path between electrodes. As the measurements are taken about 3.5 feet above the surface, if any current flowed through the surface water its close proximity to the field receiver would create a significant spike in data which would be obvious.

A contour map of the horizontal field strength is shown in Figure 13. High points in the data are shown as blue dots. The blue lines indicate a potential water channel; however, the confidence in these lines is low as the dots could be connected in any number of combinations with equal validity. Well RWS06 is shown as a black dot on the right of the figure. A potential broad band of water is shown as a shaded region overlying the path of the surface water. This is not likely a major source of water. A significant flow would channel the current and produce a more pronounced curve. The GPS did not provide map coordinates in this area even though most of the survey area was in an open area along the tributary. As before, too few satellites could be located by the receiver.

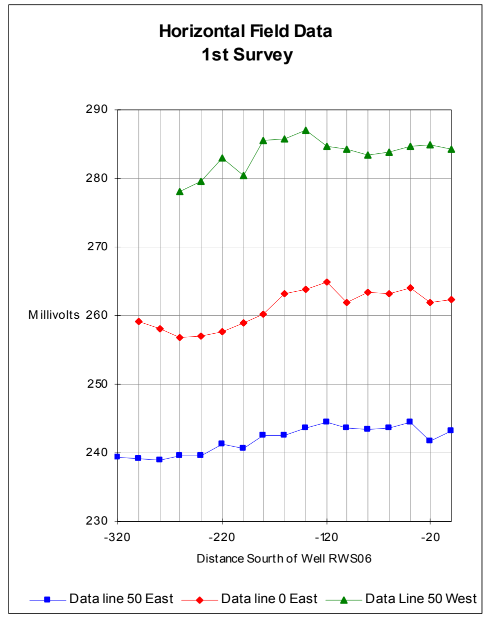


Figure 12- Horizontal Field Data, First Survey

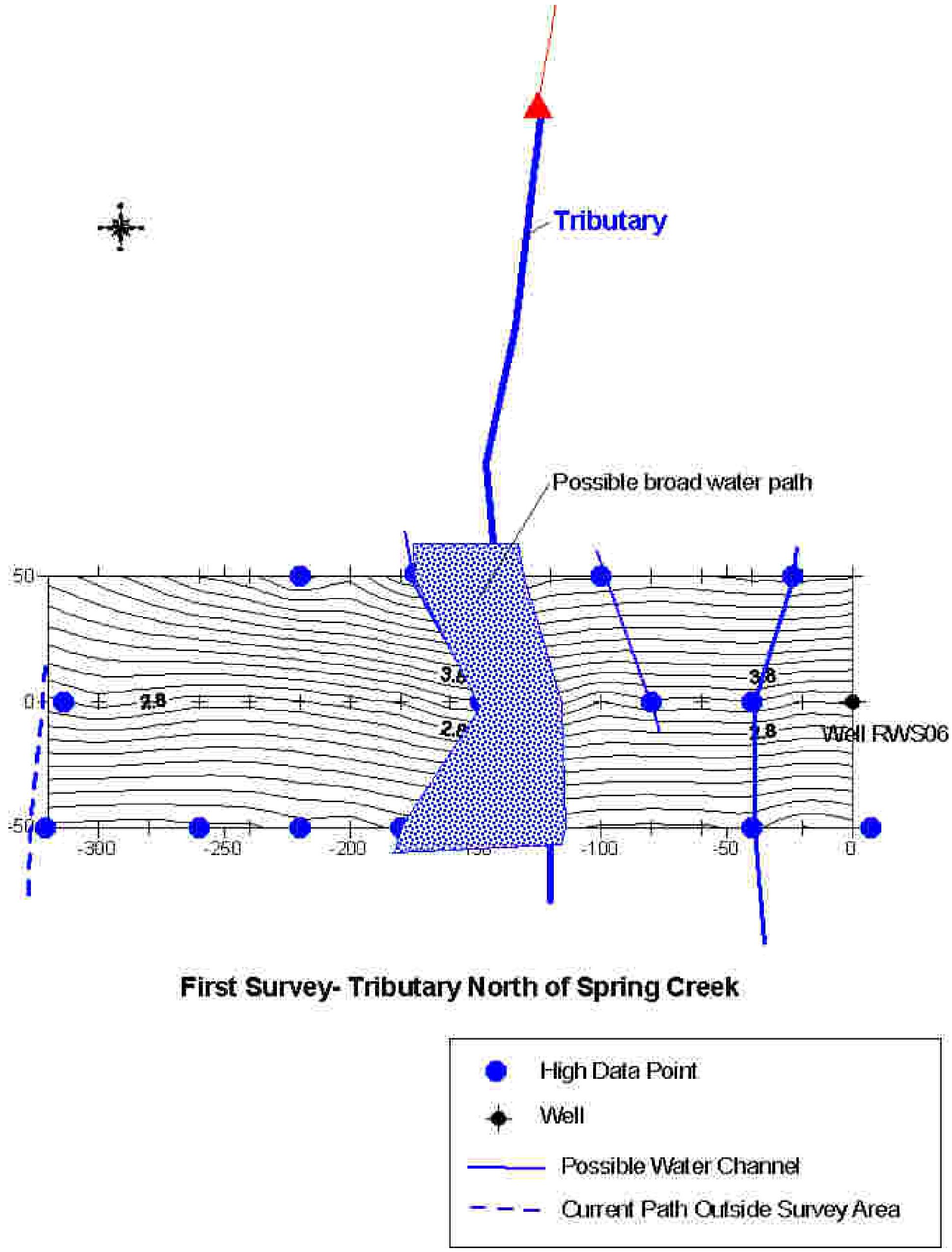


Figure 13- Contour map of horizontal field data from the first survey near the Tributary North of Spring Creek

4.2.3 Second Survey Site Investigation

A second survey was conducted at this site by moving the well electrode to a spring near Tenmile Creek. The second electrode remained in the tributary. Normally, two surface electrodes provide less contact resistance, or rather less resistance between the electrodes and the water they contact than two electrodes in groundwater. In this case, however, only 0.5 amps could be forced into the water. This could mean that the water in the stream has less dissolved solids and is less conductive than the well water. Another possible explanation is that the tributary and the spring do not have a direct contact and the current must flow, in part, through less conductive rock. The latter is unlikely as the both the tributary and the spring should be in direct electrical contact with Tenmile Creek.

The survey area used in the first survey was extended to the north for the second survey. Figure 14 presents the data obtained. This data shows a significant current path crossing line 0 East about 120 feet north of Well RWS06. The data also indicates that very little current is flowing to the north of the major current path. Smaller current paths are observed in the data to the south of the major current path, at approximately the same locations as in the first survey.

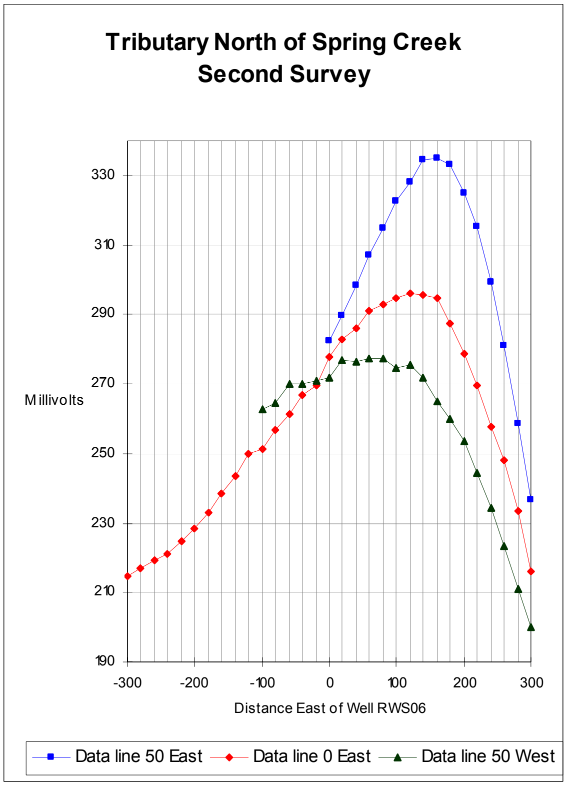


Figure 14- Data from second survey on Tributary North of Spring Creek

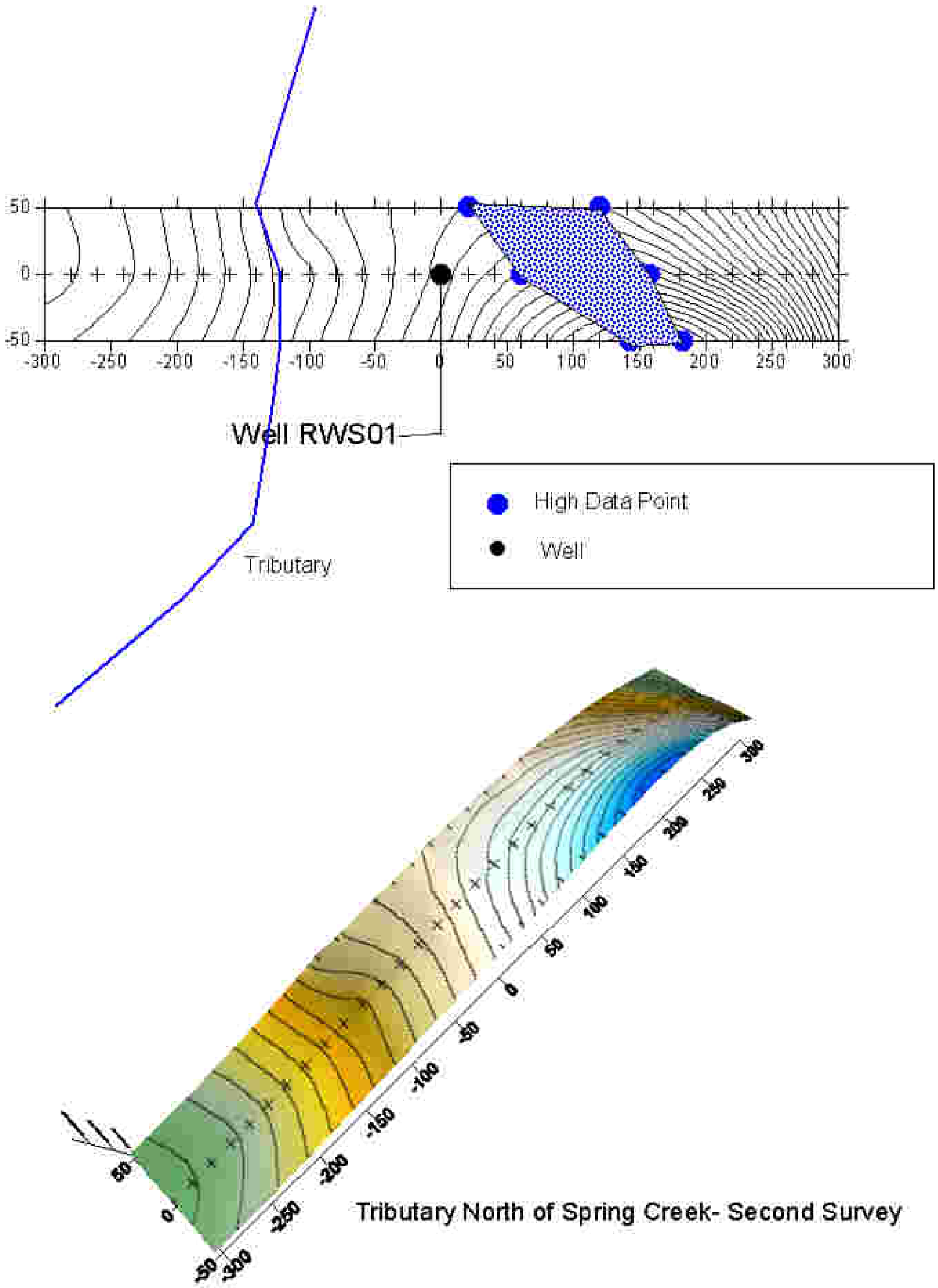


Figure 15- Second Survey, Tributary North of Spring Creek

4.2.4 Second Survey Data Interpretation

Analysis of data line 50 East provides an indication that the depth of the water is about 80 to 100 feet in depth at this point. In addition, the current path is not as broad as on data lines 0 East and 50 West. Broader paths do not provide reliable data on water depth.

Data line 50 West provides an indication that more current is flowing to the south. This is to be expected as the current must find a path to the electrode in the tributary. This is also an indication that the water feeding the spring is not directly connected to the water in the tributary.

An attempt was made to determine the center of the channel feeding the spring. This point should have the highest horizontal field measurement. The highest point measured was marked with flagging and was about 110 feet north of Well RWS06. A contour map of the data is shown in Figure 15. The contours represent lines of equal milli-volt readings. The high reading represented in blue sits about the strongest conductor of current. In this case, the strongest reading came from the groundwater near the 200 foot east-west grid column.

4.3 MIDDLE SPRING CREEK

The Middle Spring Creek site was surveyed on September 15, 2003.

4.3.1 Middle Spring Creek Site Investigation

At the Middle Spring Creek site, a small spring was located south of Spring Creek and accessible from the Lee Mountain road. An electrode was placed directly into the spring and a second electrode was placed in a low area southwest of the spring. Three data lines were collected to determine the path of the water feeding this spring.

Data collected are shown in Figures 16-18.

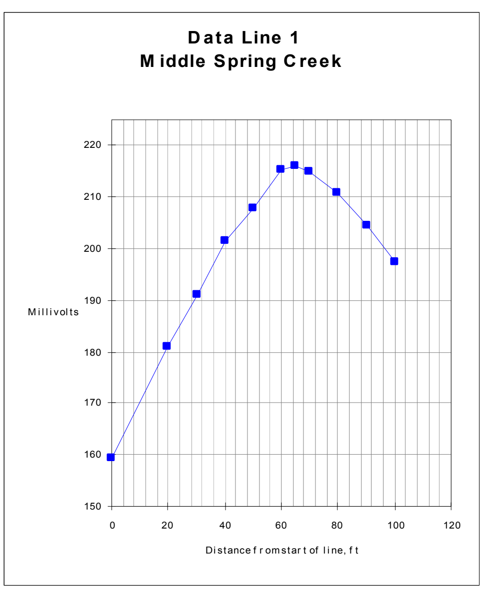


Figure 16- Horizontal field data for Line1, Middle Spring Creek

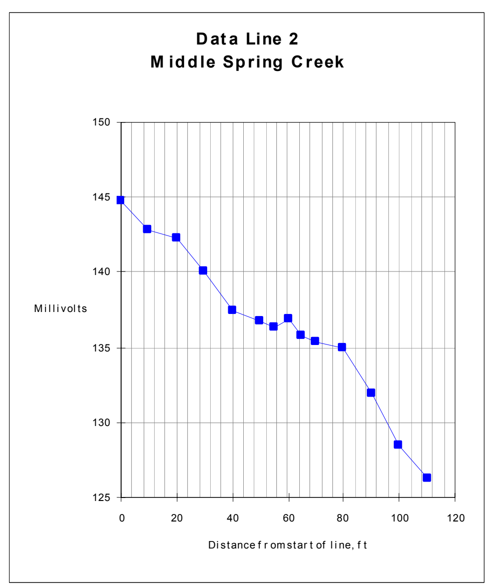


Figure 17- Horizontal field data for Line2, Middle Spring Creek

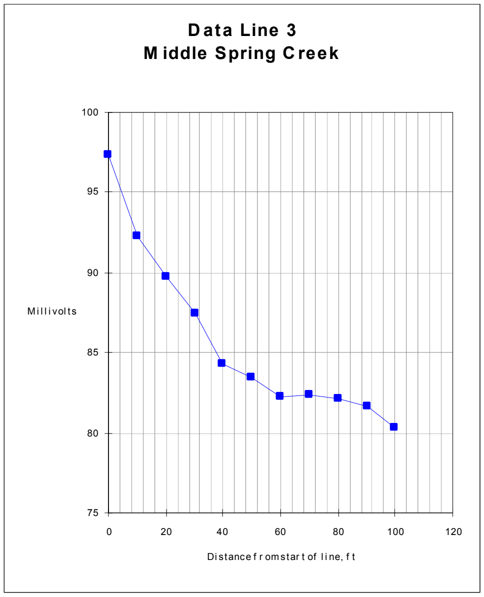


Figure 18- Horizontal field data for Line3, Middle Spring Creek

4.3.2 Data Interpretation

The data indicates that the spring is fed from the southwest. Data line 1 has one major flow path. Data lines 2 and 3 seem to have several. The best drill location could be along data line 1. This spot was marked after completing the survey. The depth to the water is not known.

5.0 SUMMARY AND CONCLUSIONS

- Data collected at the Lower Minnehaha Creek site was consistent with bedrock groundwater contained in tight fault structures. No promising drill site could be located.
- Data from the first survey near the Tributary North of Spring Creek indicated the potential for several small water channels under the tributary.
- Data from the second survey near the Tributary North of Spring Creek provided a promising drill site to intercept a water channel feeding a spring. The location was marked.
- A promising drill site along the Middle Spring Creek was located and marked.

6.0 RECOMMENDATIONS

Recommendations for additional EM Map work in the Tenmile Creek watershed to expand the survey and refine the data include:

1. Survey data from the survey near Minnehaha Creek were consistent with tightly faulted bedrock with few or no potential locations for drilling. The data also indicated the potential for a conducting path, north of the survey area. This area was near the location of the electrode wire and could not be investigated further during this survey. A second survey could be conducted to determine if a potential drill location can be determined, west of Tenmile Creek and north of Minnehaha Creek.

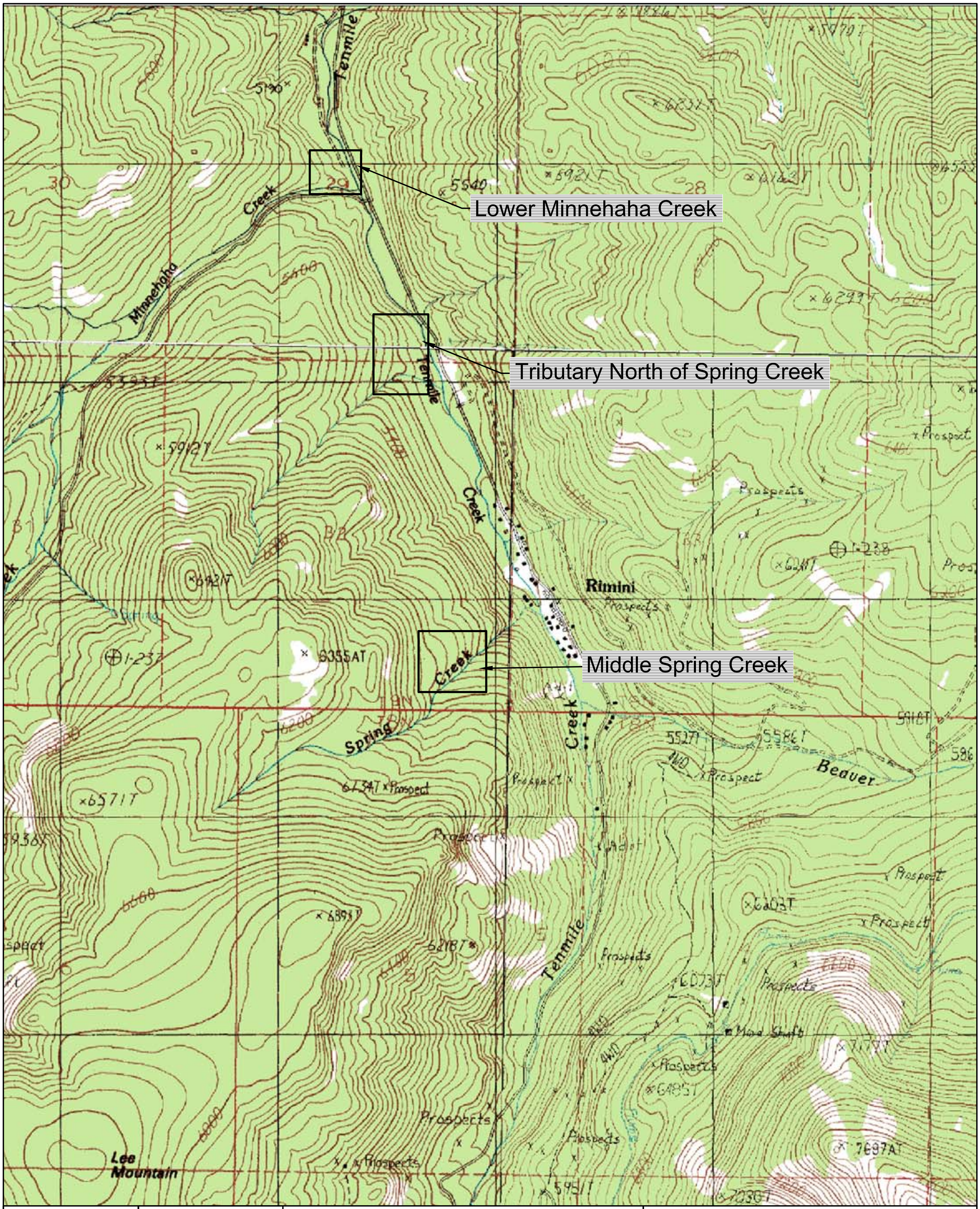
2. A potential site for drilling was determined in the Middle Spring Creek area. Additional EM Mapping work could be beneficial to map this conductor closer to the access road. No attempt was made to map the source of Spring Creek. Such a study could provide a site to intercept Spring Creek as groundwater.

3. While the data obtained for the surveys near the First Tributary North of Spring Creek, additional surveys would be helpful in refining the drill site location and possibly developing a prediction of depth to the conductor.

4. EPA has expressed an interest in locating the path and potential sources for springs and adit discharges around Lee Mountain, near the Paupers Dream Mine, and the Lutrell Repository. These surveys would be helpful in developing remediation/closure options.

M:\Environmental\Current Projects\11033_USACE_LA\11033.002 Rimini EM Survey\Reports

FIGURE



MGS Environmental

5562 ALLOY SOUTH
MISSOULA, MT 59808
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FAX (406) 728-7367

LEGEND

North

Scale (miles)

0.5 0.25 0 0.5

Figure 1: Site Location Map

PROJECT NO.	DATE	REVISION NO.
110033.002.0	Dec. 2003	NA
SCALE 1" = 2000'		DRAWN BY TWC

\Environs\Current Projects\11033_USACE_LA\11033.002 Rimini EM Survey\Drawings\RiminiVic.dwg

REF: USGS 7.5' Topo Quads

APPENDIX A
DAILY CONTRACTOR QUALITY CONTROL REPORTS

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: DACW09-02-P-0067 Date: 8/12/03
Task Order: 5 Report No: 1

Contract Title: Geophysical Mapping of Groundwater Potable Water Supply and Metals Contaminant Loading Basin Creek and Tenmile Creek Watersheds

Location: Rimini, Montana

Weather: Clear P.Cloudy Cloudy Rainfall (100 % of workday)

Temperature during workday: High 86 degrees F. Low 73 degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work Performed
Smith River	2	5	EM survey

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby
EM survey equip.	Rented	5	3

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):
NA

DAILY CONTRACTOR QUALITY CONTROL REPORT (Pg. 2)

4. QUALITY CONTROL TESTING AND RESULTS: (comment on tests and attach test reports):
NA

5. DAILY SAFETY INSPECTIONS: (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):
Checked in with Envirocon prior to conducting survey. Safety Meeting- Directed by Eric Smart. Dry conditions require concern for caution on where hot equipment, including catalytic converters on auto's are used. Tailings are a major concern at site, if visible dust or emissions from tailings are present, no one is allowed on that site without a fitted respirator. This is not a concern for most of EM survey work.

6. REMARKS: (Include conversations with or instructions from the government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):
Modified planned work to include both potential Minnehaha Creek sites. This was based on a conversation with Eric Smart, MCS, and Mike Bishop, EPA. Began setup on Minnehaha Creek, near well RWS03.

CONTRACTOR'S VERIFICATION: The above report is completed and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

T. A. Phillips
CONTRACTOR QC REPRESENTATIVE

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: DACW09-02-P-0067 Date: 8/13/2003
Task Order: 5 Report No: 2

Contract Title: Geophysical Mapping of Groundwater Potable Water Supply and Metals Contaminant Loading Basin Creek and Tenmile Creek Watersheds

Location: Rimini, Montana

Weather: Clear P.Cloudy Cloudy Rainfall (80 % of workday) Thunder late in day, ~3:30 pm required collection of electronic equipment.

Temperature during workday: High 91 degrees F. Low 66 degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work Performed
Smith River	1	6	EM Survey
Smith River	1	8	EM Survey

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby
EM Survey	Rented	4.5	3.5
Generator	Rented	4.5	3.5

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):
NA

DAILY CONTRACTOR QUALITY CONTROL REPORT (Pg. 2)

4. QUALITY CONTROL TESTING AND RESULTS: (comment on tests and attach test reports):
_NA____

5. DAILY SAFETY INSPECTIONS: (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):
Checked in with Envirocon on daily activities and to learn their concerns. Smith River meeting to inform Mike Berringer, SRE, about safety concerns and procedures related to EM Surveys.

6. REMARKS: (Include conversations with or instructions from the government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):
Met with Curt Coover, CDM at job site, showed him how system worked, demonstrated that operation were consistent and had potential to meet needs, learned about construction of wells and determined that the metal casing should not be used as electrode. Gained access to PVC well inside and lowered new electrode to bottom of well. This will insure that some current is injected into bedrock. Toured Minnehaha site and Tributary North of Spring Creek, Looked over Lee Mountain and Middle Spring Creek site to from remote site due to activities at location._

CONTRACTOR'S VERIFICATION: The above report is completed and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

_Thomas Phillips____________
CONTRACTOR QC
REPRESENTATIVE

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: DACW09-02-P-0067 Date:_8/14/03_______
Task Order:_5_________________________ Report No:_3________

Contract Title: Geophysical Mapping of Groundwater Potable Water Supply and Metals Contaminant Loading Basin Creek and Tenmile Creek Watersheds

Location: Rimini, Montana

Weather: Clear P.Cloudy Cloudy Rainfall (_100__% of workday)

Temperature during workday: High__88____ degrees F. Low_68__ degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work Performed
Smith River	2	8	EM survey

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby
EM Survey	Rented	4.5	3.5
Generator	Rented	4.5	3.5

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):
_NA

DAILY CONTRACTOR QUALITY CONTROL REPORT (Pg. 2)

4. QUALITY CONTROL TESTING AND RESULTS: (comment on tests and attach test reports):
_NA____

5. DAILY SAFETY INSPECTIONS: (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):
Checked in with Envirocon to inform them of our work activities prior to conducting survey. Brief review of need to protect against fires, don't park on dry grass, etc.

6. REMARKS: (Include conversations with or instructions from the government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):
Found that new electrode configuration, ie electrode lowered into pvc casing to contact only bedrock water, had significantly higher resistance. Did not know what caused this which required that an inspection of wire and electrodes to insure that animals or other activities had not broken the wire or disturbed the electrodes. The inspection did indicate that an animal had disturbed the wire at one location but did not break the wire. A second electrode was placed into the well to double the surface area of this electrode to see if this improved the circuit. Only a slight improvement was observed. The survey was initiated with half the current output as was possible when using the steel well casing as the electrode.

CONTRACTOR'S VERIFICATION: The above report is completed and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

_Thomas Phillips_____________
CONTRACTOR QC REPRESENTATIVE

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: DACW09-02-P-0067 Date:__8-19-2003___
Task Order:_5_________________________ Report No:__4________

Contract Title: Geophysical Mapping of Groundwater Potable Water Supply and Metals Contaminant Loading Basin Creek and Tenmile Creek Watersheds

Location: Rimini, Montana

Weather: Clear P.Cloudy Cloudy Rainfall (_100__% of workday)

Temperature during workday: High_88___ degrees F. Low_58__ degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work Performed
Smith River	**2**	**16**	**EM Survey**

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby
EM Survey	**Rented**	**8**	
Generator	**Rented**	**8**	

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):
NA

<u>DAILY CONTRACTOR QUALITY CONTROL REPORT</u> (Pg. 2)

4. QUALITY CONTROL TESTING AND RESULTS: (comment on tests and attach test reports):
<u>**NA**</u>

5. DAILY SAFETY INSPECTIONS: (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):
<u>**Stopped at Envirocon trailer to confirm onsite activities and learn their activities.**</u>

6. REMARKS: (Include conversations with or instructions from the government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):
<u>Collected data to enable additional review of data obtained from first Minnehaha survey. Collected survey wire and equipment and moved to 2^{nd} site, First Tributary North of Spring Creek. Located spring close to site and running into Tenmile Creek. Possible electrode site. Placed electrodes in spring to west of drill site and in bedrock well east of road.</u>

CONTRACTOR'S VERIFICATION: The above report is completed and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

__Thomas A. Phillips_____________
CONTRACTOR QC REPRESENTATIVE

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: DACW09-02-P-0067 Date: 8/20/03
Task Order: 5 Report No: 5

Contract Title: Geophysical Mapping of Groundwater Potable Water Supply and Metals Contaminant Loading Basin Creek and Tenmile Creek Watersheds

Location: Rimini, Montana

Weather: Clear P.Cloudy Cloudy Rainfall (100 % of workday)

Temperature during workday: High 88 degrees F. Low 58 degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work Performed
Smith River	2	8 ea.	EM Survey

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby
EM Survey equip	R	8	0
Generator	R	8	0

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):
NA

DAILY CONTRACTOR QUALITY CONTROL REPORT (Pg. 2)

4. QUALITY CONTROL TESTING AND RESULTS: (comment on tests and attach test reports):
_NA_

5. DAILY SAFETY INSPECTIONS: (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):
Stopped in a trailor to check in with Envirocon to inform them of our plans. Placed a wire across road to Rimini by digging small trench in road and burying wire. This insured that no vehicle would get tangled in wire and protected wire.

6. REMARKS: (Include conversations with or instructions from the government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):
Completed survey of 2nd site, Tributary North of Spring Creek. Found small spring near site, north of the tributary and discharging directly into Tenmile Creek which could be associated with the linements associated with the site. Moved well electrode to the spring and took additional data to see changes. Initial setup proved to be more conductive than spring setup 0.75 amps verses 0.5 amps. This is unusual as surface water is usually more conductive than bedrock well water. Initial review of data is promising.

CONTRACTOR'S VERIFICATION: The above report is completed and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

__Thomas A. Phillips___________
CONTRACTOR QC REPRESENTATIVE

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: DACW09-02-P-0067 Date: 8/21/03
Task Order: 5 Report No: 6

Contract Title: Geophysical Mapping of Groundwater Potable Water Supply and Metals Contaminant Loading Basin Creek and Tenmile Creek Watersheds

Location: Rimini, Montana

Weather: Clear P.Cloudy Cloudy Rainfall (100 % of workday)

Temperature during workday: High 87 degrees F. Low 56 degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work Performed
Smith River	2	3.5	EM Survey

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby
EM Survey Equip	R	3.5	4.5
Generator	R	3.5	4.5

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):
NA

DAILY CONTRACTOR QUALITY CONTROL REPORT (Pg. 2)

4. QUALITY CONTROL TESTING AND RESULTS: (comment on tests and attach test reports):
_NA____

5. DAILY SAFETY INSPECTIONS: (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):
Checked in at Envirocon trailer to make sure there were not conflicts or concerns.

6. REMARKS: (Include conversations with or instructions from the government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):
Returned to 2nd survey site to take additional data using second electrode configuration as data indicated that additional data were required to the north of the survey area. Picked up electrodes and wire to move to new site.

CONTRACTOR'S VERIFICATION: The above report is completed and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

__Thomas A. Phillips______________
CONTRACTOR QC
REPRESENTATIVE

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: DACW09-02-P-0067 Date: 8/22/03
Task Order: 5 Report No: 7

Contract Title: Geophysical Mapping of Groundwater Potable Water Supply and Metals Contaminant Loading Basin Creek and Tenmile Creek Watersheds

Location: Rimini, Montana

Weather: Clear P.Cloudy Cloudy Rainfall (100 % of workday)

Temperature during workday: High 84 degrees F. Low 66 degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work Performed
Smith River	2	3.5	EM Survey

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby
EM Survey Equip	R		8
Generator	R		8

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):
NA

DAILY CONTRACTOR QUALITY CONTROL REPORT (Pg. 2)

4. QUALITY CONTROL TESTING AND RESULTS: (comment on tests and attach test reports):

NA

5. DAILY SAFETY INSPECTIONS: (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):

Checked in with at Envirocon Trailer to inform them of our activities. As we were moving to Middle Spring Creek site needed to know where to park vehicles and where we could move safely near Lee Mountain.

6. REMARKS: (Include conversations with or instructions from the government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):

Decided to walk site to determine where to place electrodes for survey. Monitoring wells in the bedrock had been pulled due to remediation activities by Envirocon. Found a small spring that could provide spot to place electrodes. Also found where Spring Creek surfaces. Several potential drill sites, i.e. accessible from the road were found. Road to site has been blocked by Envirocon's remediation activities. Due to deteriorating weather and other problems, it was decided to return to Helena to discuss options with Curt Coover, CDM. Neither Curt or Mike Bishop were available so it was decided to wait to do this survey after we were able to discuss the options with them. Also, it would be helpful to have Envirocon provide some means of accessing the road to the site so that 4 wheelers can be used to transport people and equipment to site. The road to the site seems safe for small vehicles, but will need some work for trucks or larger vehicles, even after Envirocon has repaired the disturbed portion at the Lee Mountian adit.

CONTRACTOR'S VERIFICATION: The above report is completed and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

Thomas A. Phillips__________________
CONTRACTOR QC REPRESENTATIVE

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: DACW09-02-P-0067 Date:_9/11/03______
Task Order:_5___________________________ Report No:_8_________

Contract Title: Geophysical Mapping of Groundwater Potable Water Supply and Metals Contaminant Loading Basin Creek and Tenmile Creek Watersheds

Location: Rimini, Montana

Weather: Clear P.Cloudy Cloudy Rainfall (_50___% of workday)

Temperature during workday: High_61__ degrees F. Low_55__ degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work Performed
Smith River Env	2	6.5	EM Survey

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby
EM Survey equip	R	8	
Generator	R	-	8

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):
Stopped at Envirocon trailer to inform them of where we would be working and to meet with Mike Bishop, EPA and CDM personnel.

NA

DAILY CONTRACTOR QUALITY CONTROL REPORT (Pg. 2)

4. QUALITY CONTROL TESTING AND RESULTS: (comment on tests and attach test reports):

na

5. DAILY SAFETY INSPECTIONS: (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):

Stopped at Envirocon trailer to inform them of where we would be working and to meet with Mike Bishop, EPA and CDM Personnel.

6. REMARKS: (Include conversations with or instructions from the government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):

Set up for additional work at the site, Tributary North of Spring Creek, made arrangements to get access to sites on Middle Spring Creek with Paul (CDM). Met with Mike Bishop, EPA, to brief him on the progress and what we hoped to do to provide him with a potential drill site. Rain prevented collection of data.

CONTRACTOR'S VERIFICATION: The above report is completed and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

Thomas A. Phillips

CONTRACTOR QC REPRESENTATIVE

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: DACW09-02-P-0067 Date:_9/12/03______
Task Order:5___________________________ Report No:_9________

Contract Title: Geophysical Mapping of Groundwater Potable Water Supply and Metals Contaminant Loading Basin Creek and Tenmile Creek Watersheds

Location: Rimini, Montana

Weather: Clear P.Cloudy Cloudy Rainfall (_40___% of workday)

Temperature during workday: High_45___ degrees F. Low_45___ degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work Performed
Smith River	2	1	EM Survey

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby
EM survey equip	R	-	8
Generator	R	-	8

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):
_NA

<u>DAILY CONTRACTOR QUALITY CONTROL REPORT</u> (Pg. 2)

4. QUALITY CONTROL TESTING AND RESULTS: (comment on tests and attach test reports):
_____NA____

5. DAILY SAFETY INSPECTIONS: (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):
_Stopped in at Envirocon trailer to inform that of where we would be working.

6. REMARKS: (Include conversations with or instructions from the government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):
_Weather prohibited set up of electrical equipment no data were collected.

CONTRACTOR'S VERIFICATION: The above report is completed and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

_Thomas A. Phillips________________
CONTRACTOR QC REPRESENTATIVE

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: DACW09-02-P-0067 Date:_9/13/03_________
Task Order:_5________________________ Report No:_10_______

Contract Title: Geophysical Mapping of Groundwater Potable Water Supply and Metals Contaminant Loading Basin Creek and Tenmile Creek Watersheds

Location: Rimini, Montana

Weather: Clear P.Cloudy Cloudy Rainfall (_100_% of workday)

Temperature during workday: High_57_ degrees F. Low_45__ degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work Performed
Smith River	1	4	EM Survey

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby
EM Survey Equip	R	4	4
Generator	R	4	4

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):
_NA____

DAILY CONTRACTOR QUALITY CONTROL REPORT (Pg. 2)

4. QUALITY CONTROL TESTING AND RESULTS: (comment on tests and attach test reports):
_NA____

5. DAILY SAFETY INSPECTIONS: (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):
No one in trailers, and no Envirocon activities at site.

6. REMARKS: (Include conversations with or instructions from the government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):
_Complete initial survey of area north of Well S01 with the and electrode in the seem surfacing at Tenmile Creek.

CONTRACTOR'S VERIFICATION: The above report is completed and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

_Thomas A. Phillips________________
CONTRACTOR QC
REPRESENTATIVE

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: DACW09-02-P-0067 Date:_9/14/03_________
Task Order:_5_______________________ Report No:_11_______

Contract Title: Geophysical Mapping of Groundwater Potable Water Supply and Metals Contaminant Loading Basin Creek and Tenmile Creek Watersheds

Location: Rimini, Montana

Weather: Clear P.Cloudy Cloudy Rainfall (_100_% of workday)

Temperature during workday: High_71_ degrees F. Low_55___ degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work Performed
Smith River	2	6	EM Survey

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby
EM Survey Equip	R	6	2
Generator	R	6	2

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):
_NA____

<u>DAILY CONTRACTOR QUALITY CONTROL REPORT</u> (Pg. 2)

4. QUALITY CONTROL TESTING AND RESULTS: (comment on tests and attach test reports):
_NA____

5. DAILY SAFETY INSPECTIONS: (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):
<u>No one in trailers, and no Envirocon activities at site.</u>

6. REMARKS: (Include conversations with or instructions from the government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):
<u>Obtained extra data on site, flagged center of high data (likely center of water channel), retrieved electrodes and wire to use on next survey.</u>

CONTRACTOR'S VERIFICATION: The above report is completed and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

_Thomas A. Phillips________________
CONTRACTOR QC
REPRESENTATIVE

DAILY CONTRACTOR QUALITY CONTROL REPORT

Contract Number: DACW09-02-P-0067 Date:_9/15/03_________

Task Order:_5_______________________ Report No:_12_______

Contract Title: Geophysical Mapping of Groundwater Potable Water Supply and Metals Contaminant Loading Basin Creek and Tenmile Creek Watersheds

Location: Rimini, Montana

Weather: Clear P.Cloudy Cloudy Rainfall (_100_% of workday)

Temperature during workday: High_65_ degrees F. Low_55__ degrees F.

1. WORK PERFORMED BY CONTRACTOR/SUBCONTRACTOR(S):

Contractor Name	No. of Workers	Crafts/Hours	Work Performed
Smith River	2	8	EM Survey

2. EQUIPMENT DATA:

Type, Size, Etc.	Owned/Rented	Hours Used	Hours Standby
EM Survey Equip	R	8	
Generator	R	8	

3. QUALITY CONTROL INSPECTIONS AND RESULTS: (Include a description of preparatory, initial, and/or follow up inspections or meetings; check of subcontractors work and materials delivered to the site compared to submittals and/or specifications; comments on the proper storage of materials; include comments on corrective actions to be taken):

_NA

DAILY CONTRACTOR QUALITY CONTROL REPORT (Pg. 2)

4. QUALITY CONTROL TESTING AND RESULTS: (comment on tests and attach test reports):
_NA____

5. DAILY SAFETY INSPECTIONS: (Include comments on new hazards to be added to the Hazard Analysis and corrective action of any safety issues):
Stopped at Envirocon trailer to inform them of where we would be working and to arrange for transport to the site.

6. REMARKS: (Include conversations with or instructions from the government representatives; delays of any kind that are impacting the job; conflicts in the contract documents; comments on change orders; environmental considerations; etc.):
Setup and completed a survey in the Middle Spring Creek area. Flagged potential drill sites. Scouted further uphill along Spring Creek and did not find another suitable spot for a survey that could be completed before the weather turned prohibitive.

CONTRACTOR'S VERIFICATION: The above report is completed and correct. All material, equipment used, and work performed during this reporting period are in compliance with the contract documents except as noted above.

_Thomas A. Phillips________________
CONTRACTOR QC REPRESENTATIVE