DRAFT Environmental Assessment: Sand Coulee Acid Mine Drainage Source Control

Abandoned Mine Reclamation Project

PREPARED FOR:

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In cooperation with:
United States Department of the Interior
Office of Surface Mining Reclamation and Enforcement
Casper, Wyoming

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1.0 Introduction

1.1 Purpose and Need

The objective of the Acid Mine Drainage (AMD) Source Control project is to mitigate ongoing discharges of AMD from abandoned coal mines surrounding the community of Sand Coulee. The abandoned mine workings in and around Sand Coulee act as groundwater drains which dewater the overlying Kootenai sandstone and discharge contaminated water to tributaries of Sand Coulee Creek. The AMD is extremely acidic and contains numerous metals, including arsenic, cadmium, chromium, iron, manganese, nickel, thallium, and zinc at concentrations exceeding Montana Department of Environmental Quality (DEQ) standards. DEQ has identified this project for action because AMD has contaminated groundwater in the shallow aquifers around Sand Coulee. Natural downward leakage, fractures, and abandoned well bores have distributed the AMD to the underlying Madison Limestone aquifer as indicated by recent groundwater investigations. The specific goals of the project are to reduce the loading of metals, improve the surface water and groundwater quality in Sand Coulee, and mitigate the ongoing loading of AMD to the Madison Limestone aquifer.

AMD source control would be the proposed action and includes intercepting groundwater in the Kootenai sandstone before it enters the mine workings. Unimpacted groundwater would be discharged to adjacent surface water drainages. The stratigraphy and hydrogeology of the area are both favorable for this groundwater interception strategy. The site also presents an opportunity to compare two prospective approaches. Two well designs would be constructed and evaluated for effectiveness during this project. They consist of 1) a subhorizontal well producing from the unimpacted basal Kootenai sandstone groundwater and discharging to ground surface in an existing ditch, and 2) a vertical well discharging unimpacted groundwater from the Kootenai sandstone into the Madison Limestone aquifer. While each design is potentially effective, implementation in the field is necessary to test actual effectiveness which would be quantified by reductions in the AMD discharges already evident on the surface. This source control approach is the preferred alternative since it reduces the volume of groundwater at the source instead of the symptoms of mine discharges. It provides a technically and financially viable solution by reducing or eliminating expenditures required for continual treatment of AMD. Increasing our understanding of the relative effectiveness of these options would be helpful in determining best practices at other AMD sites throughout Montana and the Rocky Mountain region.

Information for this EA was obtained from several site-specific reports which DEQ and/or HydroSolutions have written and prepared in the past. These reports are not continually cited where text may be used verbatim in this EA. Information from sources other than the following documents are cited as standard citations:

- Montana DEQ. 2011. Environmental Assessment, Sand Coulee Water System, Water Supply Replacement; Abandoned Mine Reclamation Project; Cascade County, Montana. Prepared by Abandoned Mines Section; Remediation Division, in Cooperation with United States Department of the Interior; Office of Surface Mining Reclamation and Enforcement; Casper, Wyoming Field Office. August.
- Montana DEQ. 2014. Sand Coulee Acid Mine Drainage Source Control. Grant application submitted to Montana Department of Natural Resource and Conservation Reclamation Development Grant Program. May.
- HydroSolutions Inc. 2014. Sand Coulee Acid Mine Drainage, Groundwater Interception Investigation, Final Report. Prepared for Montana DEQ, Abandoned Mines Section, Remediation Division. April 30.

1.2 Project Location

Sand Coulee is located approximately 10 miles southeast of Great Falls in Cascade County, Montana. The location is shown on Figure 1. The community is located on East Hunter Road between State Secondary Routes 227 and 226 located to east and west of Sand Coulee. Sand Coulee lies in Township 19N, Range 4E, in parts of sections 13 and 14 at a latitude and longitude of 47.39952 and -111.16797 degrees. Sand Coulee is approximately 3,465 feet above sea level. Adjacent small communities include the former coal mining communities of Belt, Centerville, Stockett, and Tracy (DEQ 2014).

Sand Coulee was initially established as a coal mining town and is unincorporated. As an unincorporated town, Sand Coulee is not served by a municipal government. The community has a volunteer fire department and water is supplied to Sand Coulee by the legally incorporated Sand Coulee Water District. The location of abandoned coal mines and degree of underground workings in the vicinity of Sand Coulee are shown on Figure 2.

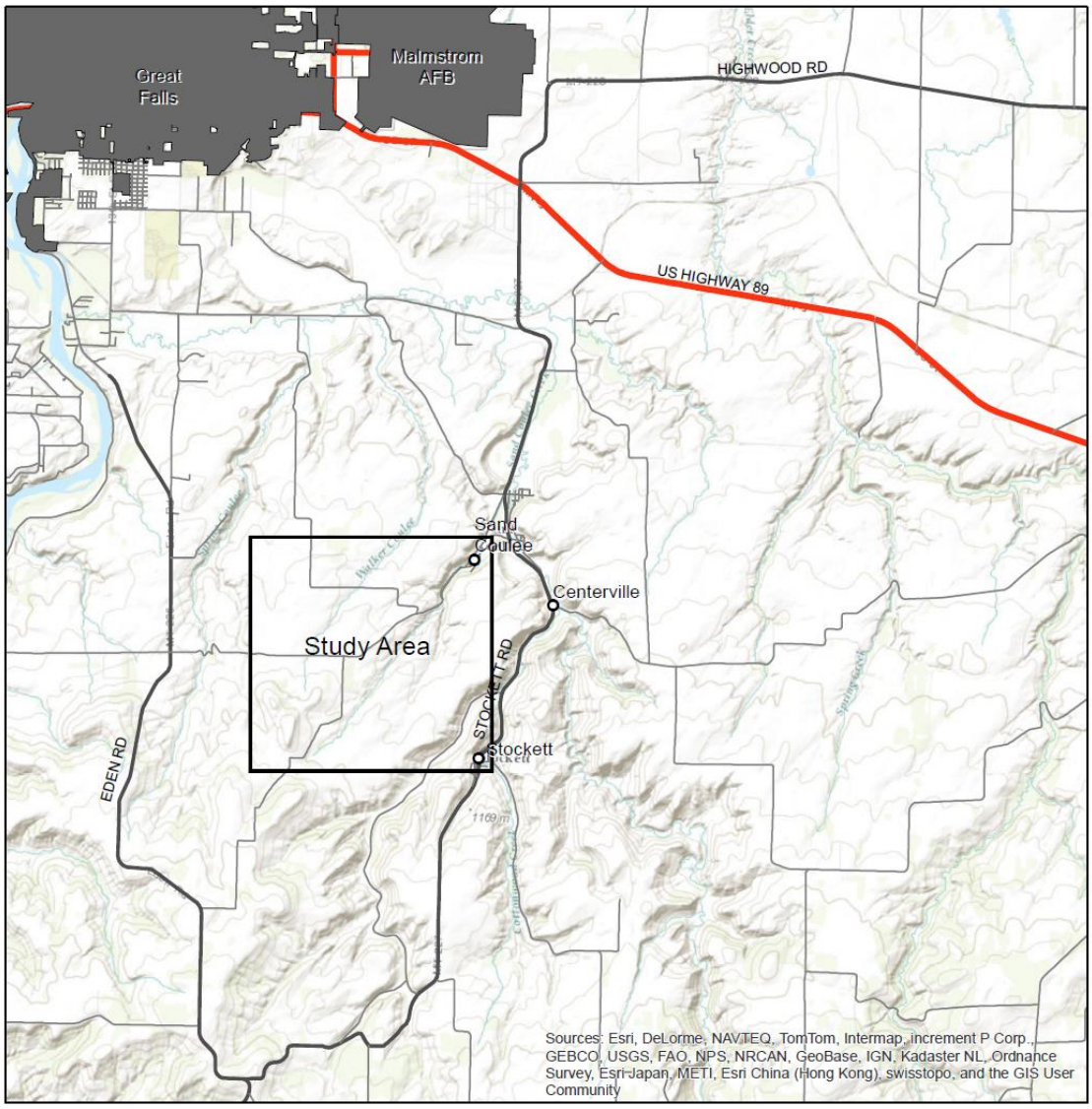

Figure 1. Project location, Cascade County, Montana.

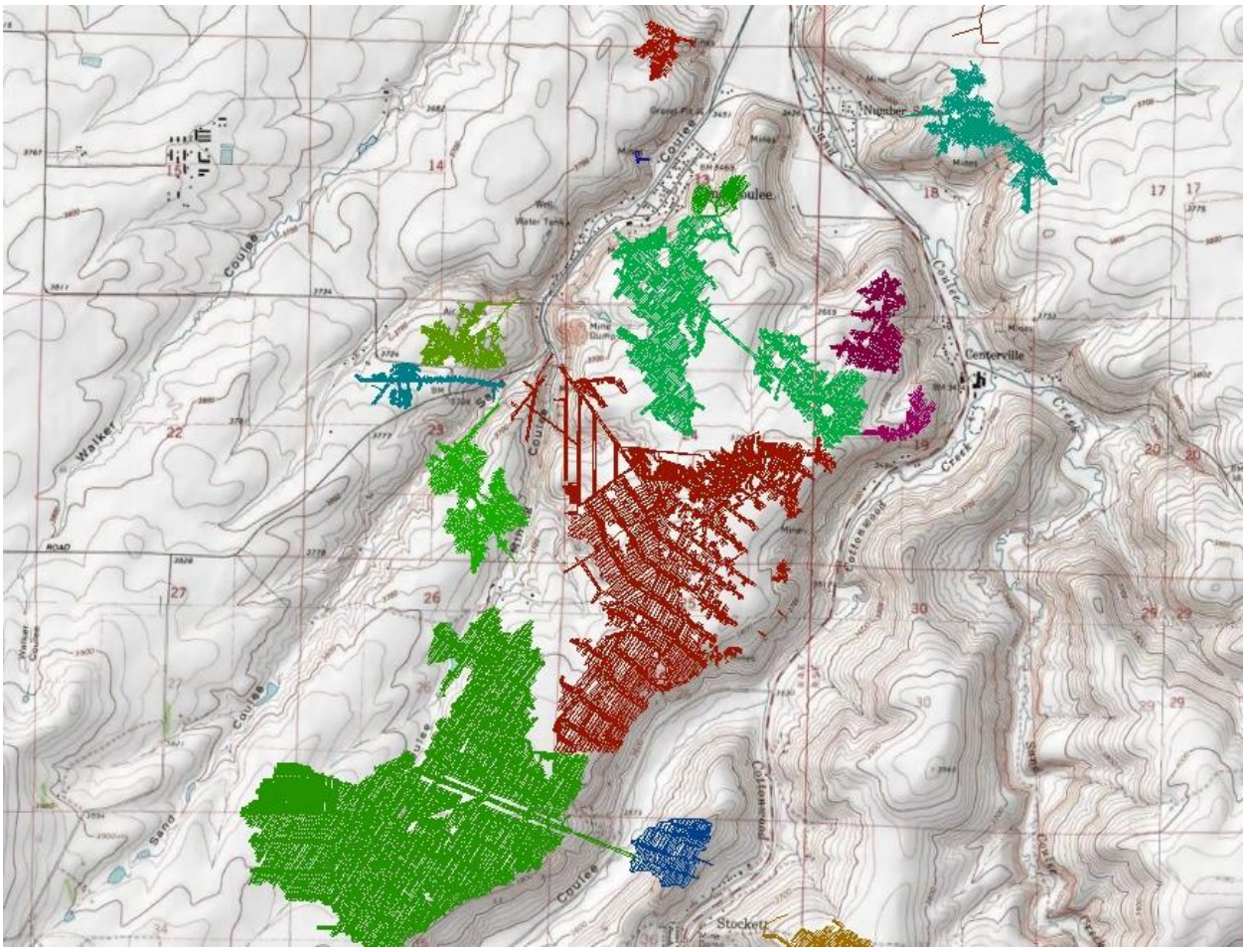

Figure 2. Locations of abandoned coal mines in the vicinity of Sand Coulee

2.0 Description of the Proposed Project and Alternatives

Two alternatives are evaluated as part of this EA and include a no action alternative and the proposed action alternative.

2.1 No Action

Under the No Action Alternative, the Abandoned Mine Reclamation source control project would not be approved for funding by the Office of Surface Mining and Enforcement (OSMRE) and subsequently no source control and groundwater interception project would be completed. Under this alternative, the OSMRE would deny a Federal grant in the amount of $100,000 to implement the abandoned mine land reclamation proposal described above under the proposed action. As a result, current conditions would continue. Citizens of Sand Coulee would continue

to be exposed to and threatened by contaminated mine drainage and the potential effectiveness of the two proposed groundwater interception methods would go unproven. Grant funds from the DNRC would be forfeited by DEQ.

Continual AMD from coal mine workings would have a negative impact on surface waters and aquatic organisms within range of high concentrations of metals and low pH. Any potential improvements expected to receive surface waters from a reduction of AMD waters and recharge of clean water would not be realized. The overall contaminated waters would remain and may increase AMD during periods of anomalous precipitation seasons and recharge to groundwater. In addition, a continual adjustment in underground workings and subsurface collapsing may expose more iron sulfide rich materials to leaching and perpetuate AMD contamination.

2.2 Proposed Action

Under this alternative, the OSMRE RD/FOD would authorize construction activities in the amount of $100,000 for use by DEQ in implementing the abandoned mine land reclamation proposal described herein. DEQ-Abandoned Mine Lands (AML) Program has identified groundwater interception as the preferred source control alternative to implement and test at the Sand Coulee site. This source control would be implemented by intercepting the groundwater in the Kootenai sandstone before it enters the mine workings. A recently completed groundwater flow modeling study assessed how interception wells would reduce the volume of AMD discharging from nearby mines (HydroSolutions 2014). The investigation included multiple modeling methods to assess expected withdrawal rates from the Kootenai sandstone aquifer, and included frictional losses that may reduce production from a subhorizontal well. Investigation results indicated that both subhorizontal and vertical drainage wells are technically feasible and have the potential to reduce the amount of AMD produced by the abandoned mines. Previous studies have shown the effectiveness of directionally drilled horizontal wells to extract water for environmental remediation purposes including groundwater extraction for pump-and-treat systems, total fluids extraction, air sparge, and groundwater containment/migration control, as well as for water supply applications (Fournier 2005).

The results of the model indicate that a single 1,500 foot long subhorizontal well with a screened interval of 500 feet of 4-inch to 6-inch diameter could produce a clean water discharge ranging from 108 to 269 gallons per minute (gpm) (HydroSolutions 2014). A vertical drainage well

connecting the Kootenai Sandstone aquifer in the Kootenai Formation directly to the Madison Limestone aquifer could produce a discharge of 52 gpm for a single drainage well, and a combined discharge of 88 gpm for two drainage wells. Vertical drainage wells would be of considerable less expense than a subhorizontal well; however, production of any clean water to the surface would be eliminated.

Both subhorizontal and vertical wells reduce the source (infiltration of groundwater) instead of treating the symptoms (AMD) of the mine discharges. The results suggest that multiple up-gradient drainage wells could be employed to decrease AMD outflow from the abandoned mines. These wells provide a technically and financially viable solution by reducing the need for continual treatment of the mine discharges. Both subhorizontal and vertical wells would be installed and tested to determine the effectiveness of these alternatives to maximize AMD reduction. A conceptual cross section of the subhorizontal well to be constructed is shown on Figure 3. The proposed well location and lateral extent in plan view is shown on Figure 4. A conceptual cross-section of the vertical drainage well design is shown on Figure 5.

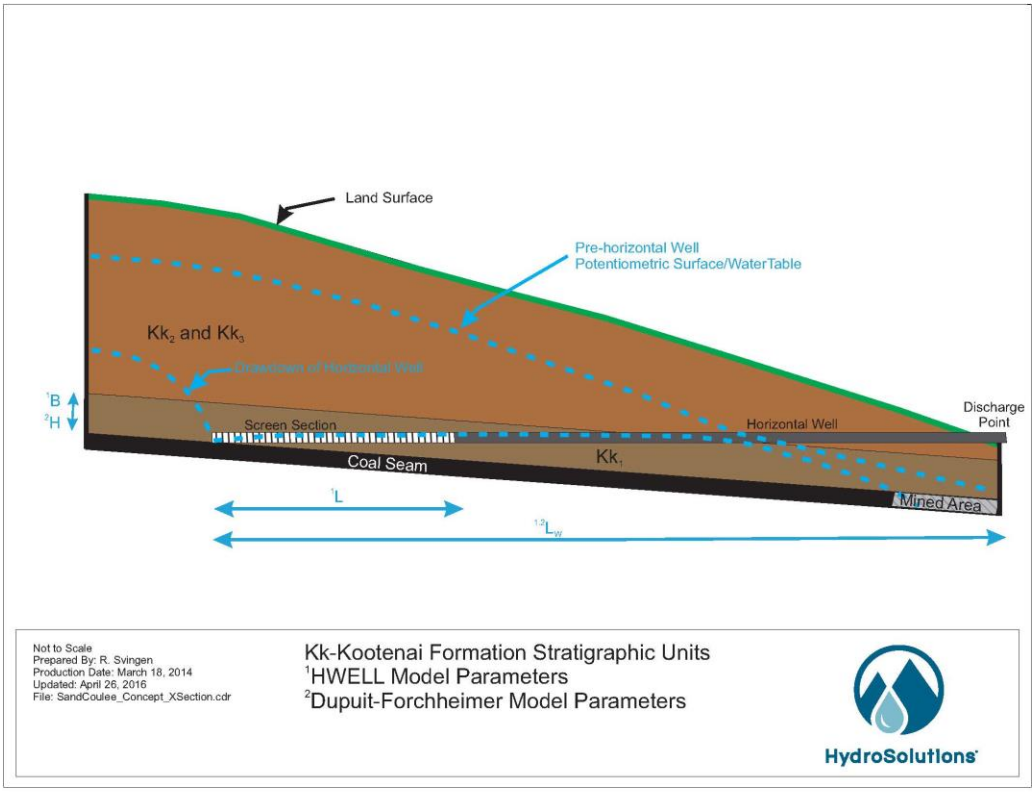

Figure 3. Conceptual cross-section of subhorizontal well design

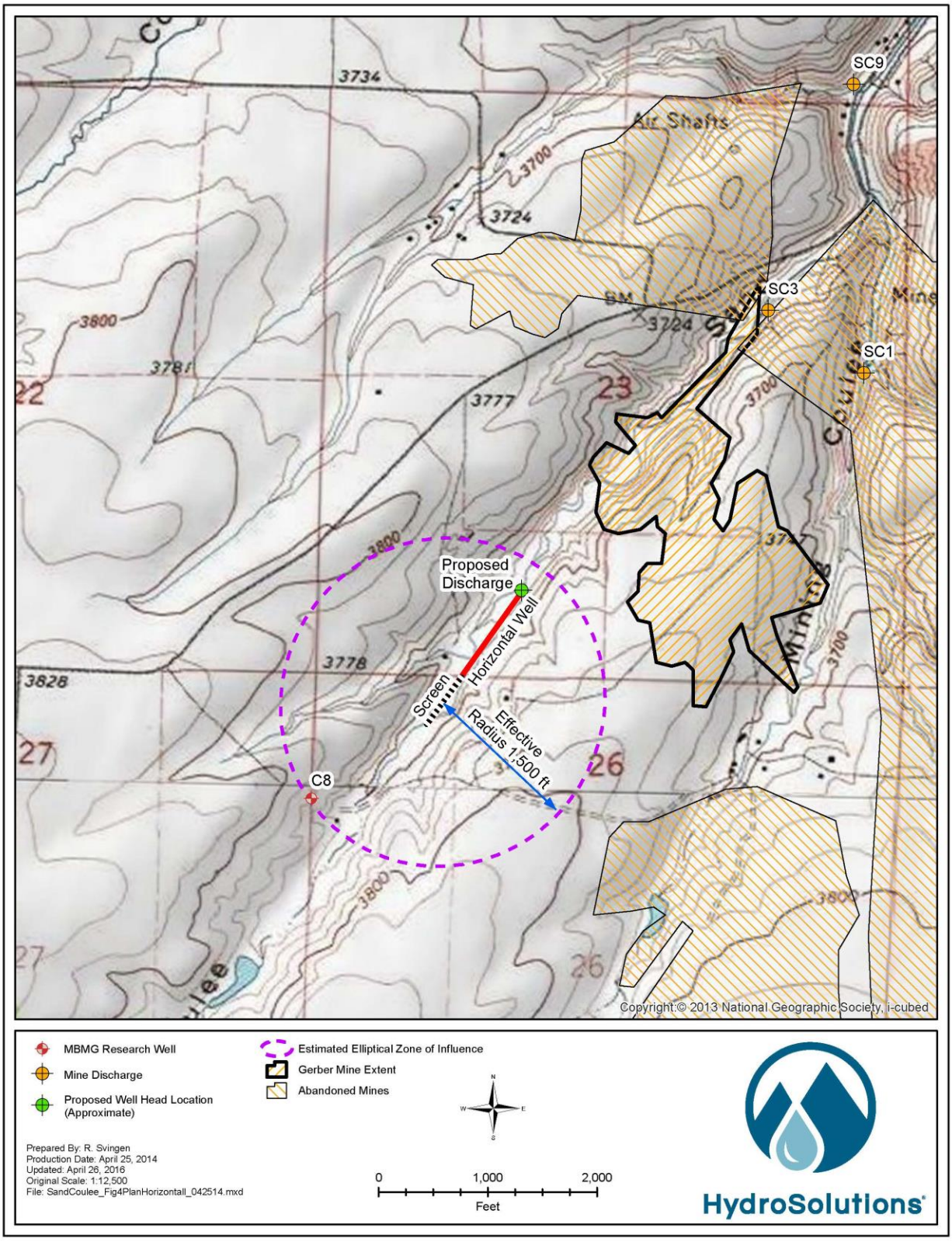

Figure 4. Plan view of proposed subhorizontal well design

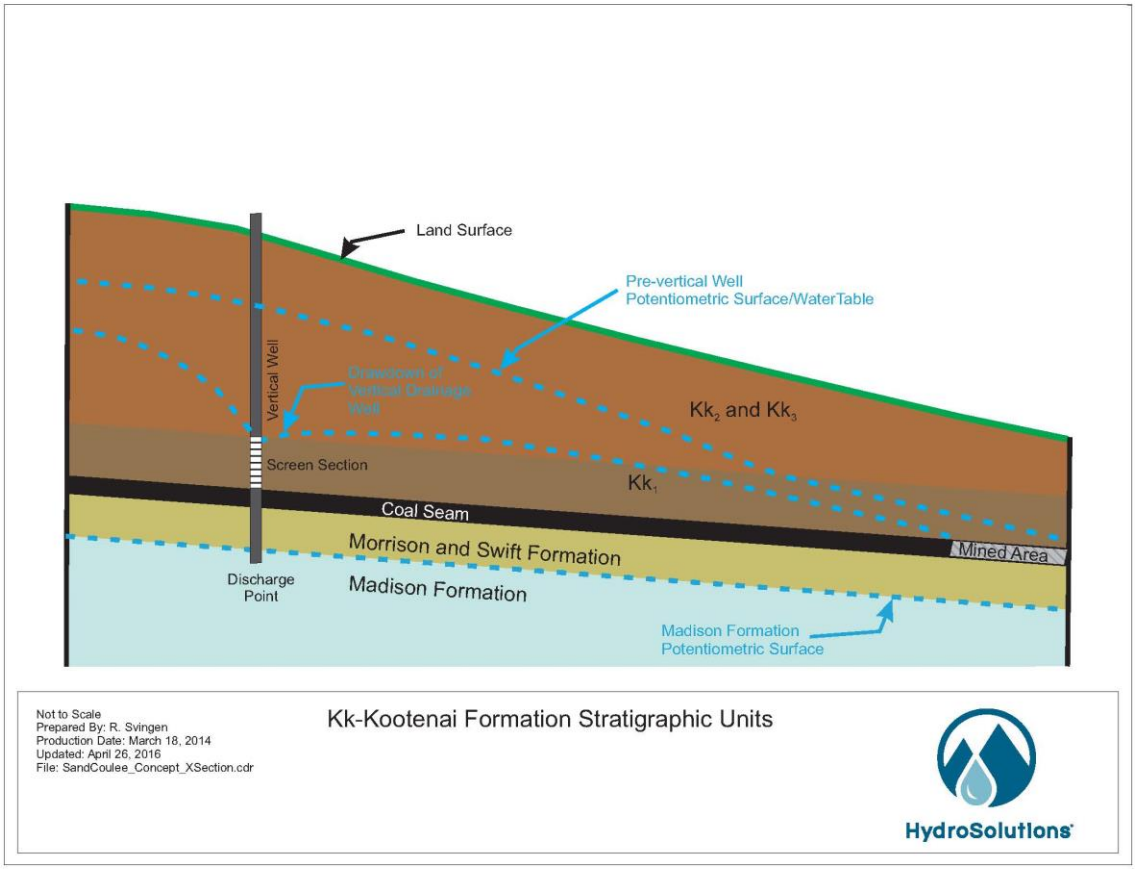

Figure 5. Conceptual cross-section for vertical well design

2.3 Alternatives Not Considered for Further Analysis

Additional Source Control Measures

Other source control measures include mechanisms to reduce or eliminate the AMD discharges such as hydraulic plugging of mine workings. DEQ evaluated the hydraulic plugging approach in 2010 at the Anaconda coal mine in Belt. This approach was found not to be feasible due to safety concerns associated with the stability of the mine roof. Given this experience, and the similarities with shallow mining and concerns for roof instability, DEQ determined that this approach could not be implemented safely in Sand Coulee. Furthermore, this approach would be expected to potentially result in diffuse seepage of AMD through the coal, resulting in vegetative voids along coal outcrop areas. This condition is apparent near Stockett, where extensive areas of bare ground are visible at the coal seam elevation.

Biological Uptake

Montana DEQ is currently working with the Montana Salinity Control Association (MSCA) and MBMG to investigate the use of deep-rooted grasses to reduce recharge of water into the Belt Anaconda mine (Duame et al., 2011). Investigations are currently being conducted by MSCA at this location (MBMG, 2012). In Sand Coulee, planting an alfalfa-grass mixture at the 532-acre Chartier Ranch site was investigated. The Chartier Ranch site is located directly above the Old Sand Coulee Mine workings, approximately one mile south of the community. The investigation included soil moisture measurements and monitoring of discharges from the abandoned mines from 1984 through 1986. The investigation indicated that the alfalfa plot at the Chartier Ranch used almost all available moisture and developed extensive root systems. However, analysis of nearby adit discharges did not identify a statistically significant reduction in flows (Osborne et al., 1987).

Passive Treatment

Passive treatment of AMD employs a treatment technology to improve water quality without requiring continuous inputs of chemical reagents or routine operations and maintenance. DEQ's operating experience with the constructed wetlands indicated that they did not function as low maintenance systems, or provide sufficient treatment of metals to comply with water quality standards. Operational problems included fouling of buried pipe systems, winter freezing resulting in short-circuiting, and plugging of limestone drains due to metal precipitation (McCurley and Koerth, 1994). Guidance provided by OSMRE to DEQ indicated that success of passive treatment methods was enhanced for water which was net alkaline. Using the Risk Analysis Matrix (Pennsylvania Bureau of Abandoned Mine Reclamation, 2009 - Table 1), passive treatment of Sand Coulee AMD is characterized by a high risk for premature failure based on the iron and aluminum concentrations and the flow rate. At Sand Coulee, the use of passive treatment methodologies was found to not be a feasible approach due to the lack of alkalinity, the extreme acidity, the extremely high daily metal loads described above, the extended winter season in the area, and lack of available space to implement this technology.

Active Treatment

The results of the water treatment assessment indicated that lime-based treatment was able to meet DEQ-7 water quality targets for all constituents in the Sand Coulee mine discharges with the exception of thallium and fluoride (Hydrometrics, 2012). Additional treatment for fluoride and thallium would be necessary to meet DEQ-7 standards and was included in the assessment.

Identified treatment plant locations included Belt, Stockett, the Number 5 Coulee (southwest of Stockett), and Sand Coulee. A Net Present Value (NPV) was calculated for each treatment site using a discount interest rate of 3 percent and a return period of 100 years. A ranking system for prioritization of the potential treatment sites was developed incorporating pollutant load, receiving water impacts, human exposure potential, resource potential, treatment feasibility, and treatment cost. Although Sand Coulee had the greatest pollutant load and most significant impacts to receiving waters, Belt was identified as highest final priority site for potential water treatment. Belt rated highest for exposure due to greater population density and proximity to high-risk areas, and Belt Creek had the highest ranking for resource potential to support fishing, boating, and swimming. DEQ recently completed an Engineering Evaluation/Cost Analysis (EE/CA) for treatment of the AMD in Belt. Funding for treatment plants beyond the one in Belt is currently financially infeasible based on the DEQ-AML's predicted funding sources.

3.0 Description of the Existing Environment

3.1 Project Background

The Great Falls Coal Field (Sand Coulee Basin) is dominantly medium-grade bituminous coal occurring at the top of the Morrison Formation of the Jurassic Period. In the Sand Coulee area, the coal deposit averages 8½ feet thick, and decreases to 4½ feet thick in the Belt area, an adjacent historical mining community located approximately 10 miles to the east. At Sand Coulee, the coal is interbedded with layers of carbonaceous shale, shale, and clay. The coal contained a high percentage of sulfur which occurred in the form of iron-pyrite nodules up to 4 inches in diameter. The sulfur accounted for approximately 3 percent of the coal mined, and is the source of the AMD at Sand Coulee which has contaminated surface and groundwater.

Coal production from the Great Falls Coal Field exceeded the combined output from all other Montana coal fields from the 1880s through the turn of the twentieth century. Coal production was dominated by the Great Northern Railway Company (Great Northern) and the Anaconda Copper Mining Company (ACM). In 1888, a branch line of the Montana Central Railway, a predecessor-subsidiary of Great Northern, reached the coal beds of the Sand Coulee area. The first large-scale commercial development of coal property in the field was performed by the Sand Coulee Coal Company, an affiliate of Great Northern. The opening of the Sand Coulee Coal Mine in 1888 marked the beginning of 60 years of coal mining by Great Northern

subsidiaries that extended from Sand Coulee south to the town of Giffen. The coal was used primarily by Great Northern for its railroad operations in Montana and along its mainline extending from Minnesota west to Washington. Smaller businesses mined and shipped coal as well, and numerous truck mines served the local trade.

Sand Coulee coal contained 10,000-11,000 BTUs, a caloric value suitable for locomotive fuel, but not as useful for smelting applications, especially as smelting technology advanced. The high ash content, 18-21%, proved to be a hindrance that limited the industrial and commercial market for the coal. As reserves diminished and as industrial and residential dependence on coal waned, the mines closed. Commercial coal mining ended in Sand Coulee in the 1940s. The coal mining communities of Belt, Centerville, Sand Coulee, Stockett, and Tracy transitioned to small agricultural centers.

In 1965 the State of Montana formed a Water Pollution Control Council. On May 26, 1966 biologist Ralph Boland investigated Sand Coulee Creek. Stream samples collected by Boland showed Sand Coulee Creek flowing at pH 3.3 with an iron content of 740 ppm. Boland's report states: "Every bit of the water in coal mining area is badly polluted. Most is from old mines." The interactions between the AMD discharges, surface water, and groundwater in the area were investigated by the Montana Bureau of Mines and Geology (MBMG) in 1983. The sandstone unit at the base of the Kootenai sandstone which forms the roof of the coal mines was identified as the primary source of groundwater leakage into the abandoned mines (Osborne et al., 1983). An inventory of domestic wells indicated that approximately one-half of the residents obtained their water supplies from the Madison Limestone aquifer. The alluvial groundwater in the area was found to be contaminated by AMD. Seven Madison Limestone wells were identified as potentially impacted by downward leakage of AMD based on elevated total dissolved solids and sulfate concentrations (Osborne et al., 1983).

In 1987 MBMG conducted an investigation of water quality in the alluvial aquifer which indicated that the aquifer was contaminated a distance of over 1,200 feet from Sand Coulee Creek (Osborne et al. 1987). MBMG identified two source control measures to reduce the AMD discharges including 1) reduction of local recharge to the mines using cropping practices to reduce recharge, and 2) interception of groundwater flowing into the mines using subhorizontal wells. The first approach investigated in Sand Coulee using alfalfa to reduce recharge in areas

overlying the abandoned mines. The use of subhorizontal wells was not field tested due to lack of available directional drilling contractors at the time (Osborne et al., 1987).

The United States Geological Survey (USGS) collected monthly water quality and streamflow data at 27 sites in the Sand Coulee and Belt Creek basins from July 1994 through September 1996 (Karper, 1998). This study confirmed the persistence of the water quality problems in mine discharges and in streams in these basins and characterized the seasonal variability in the discharge rates. (Gammons et al. 2010) investigated the isotopic composition of sulfate in the acid mine waters and sulfate in the adjacent sedimentary aquifers as a tool to determine the extent of AMD leakage into the underlying Madison Limestone aquifer. (Gammons et al. 2013) sampled twenty-six domestic water wells completed in the Madison Limestone near the former coal mines. No mining-associated water quality problems were identified, such as low pH or elevated concentrations of trace metals; however, sulfate isotope data indicated AMD incursion in some of the wells.

In 2011 and 2012, DEQ conducted a Water Treatment Assessment of the Great Falls Coal Field. The objective of this investigation was to quantify current flow rates and water quality of adit discharges and streams, identify and prioritize potential groupings of AMD discharges for treatment, evaluate treatability to DEQ-7 water quality standards using lime-based technologies, and estimate costs for active water treatment (Hydrometrics, 2012).

In 2013 and 2014, DEQ evaluated the feasibility of groundwater interception using subhorizontal and vertical wells (HydroSolutions, 2014). This evaluation was conducted to identify a location to pilot test a subhorizontal drainage well and assess the productivity of interception wells and potential reduction in the volume of AMD discharging from nearby mines resulting from the drainage wells. Results indicated that both subhorizontal and vertical drainage wells are technically feasible and have the potential to reduce the volume of AMD produced by the Sand Coulee abandoned mines. The results suggest that multiple, up-gradient drainage wells could be employed to significantly decrease AMD outflow from the abandoned mines (HydroSolutions, 2014).

3.2 Environmental Setting

The community of Sand Coulee is located in a valley floor with an average elevation of approximately 3,465 feet above mean sea level with adjacent flat top terraces at elevations of

approximately 3,700 feet. The surrounding area is generally agricultural and rangeland. Adjacent communities include Tracy, Centerville, and Stockett, which were also developed as coal mining towns at the turn of the century.

Surface Water

Surface waters in the area include the tributary of Sand Coulee Creek (locally referred to as Rusty Ditch) which flows through the town and is heavily contaminated with AMD. Surface drainages in the San Coulee area are shown on Frigure 6. Rusty Ditch is heavily contaminated with mine waste and AMD and flows orange in color. Streamflow is ephemeral and typically ranges from 0 to 3 cubic feet per second (cfs) in the vicinity of the town. During much of the year, this creek does not discharge to Sand Coulee Creek which lies to the northeast, but infiltrates and recharges the underlying alluvial aquifer. Sand Coulee Creek is located northeast of the community and flows north to the Missouri River. There are no lakes within the immediate area. No wetlands exist within the Sand Coulee Water District as reported from the Department of Natural Resources and Conservation (DNRC) interactive mapping program. The community is located in an area determined to be outside the 500 year flood plain of Sand Coulee; however, flooding attributable to clogged culverts in Rusty Ditch has been reported (Hydrometrics, 1983).

AMD is a characteristic of the coal mines in the Great Falls Coal Field reflecting the presence of pyrite, oxygen, and water in the abandoned coal mines. At Sand Coulee the mines were driven up-dip to facilitate drainage and haulage when the mines were operating. This characteristic now acts to facilitate discharges from the drainage tunnels developed during mining. The water exiting the abandoned mines surrounding the Sand Coulee community contains approximately 500 milligrams per liter (mg/L) dissolved iron and has a pH of approximately 3. None of the mine discharges in the Sand Coulee area meet federal or Montana primary and secondary drinking water standards. Due to high acidity and high concentrations of total dissolved solids and metals, the mine effluents are also unsuitable for irrigation and livestock use (Hydrometrics, 1982).

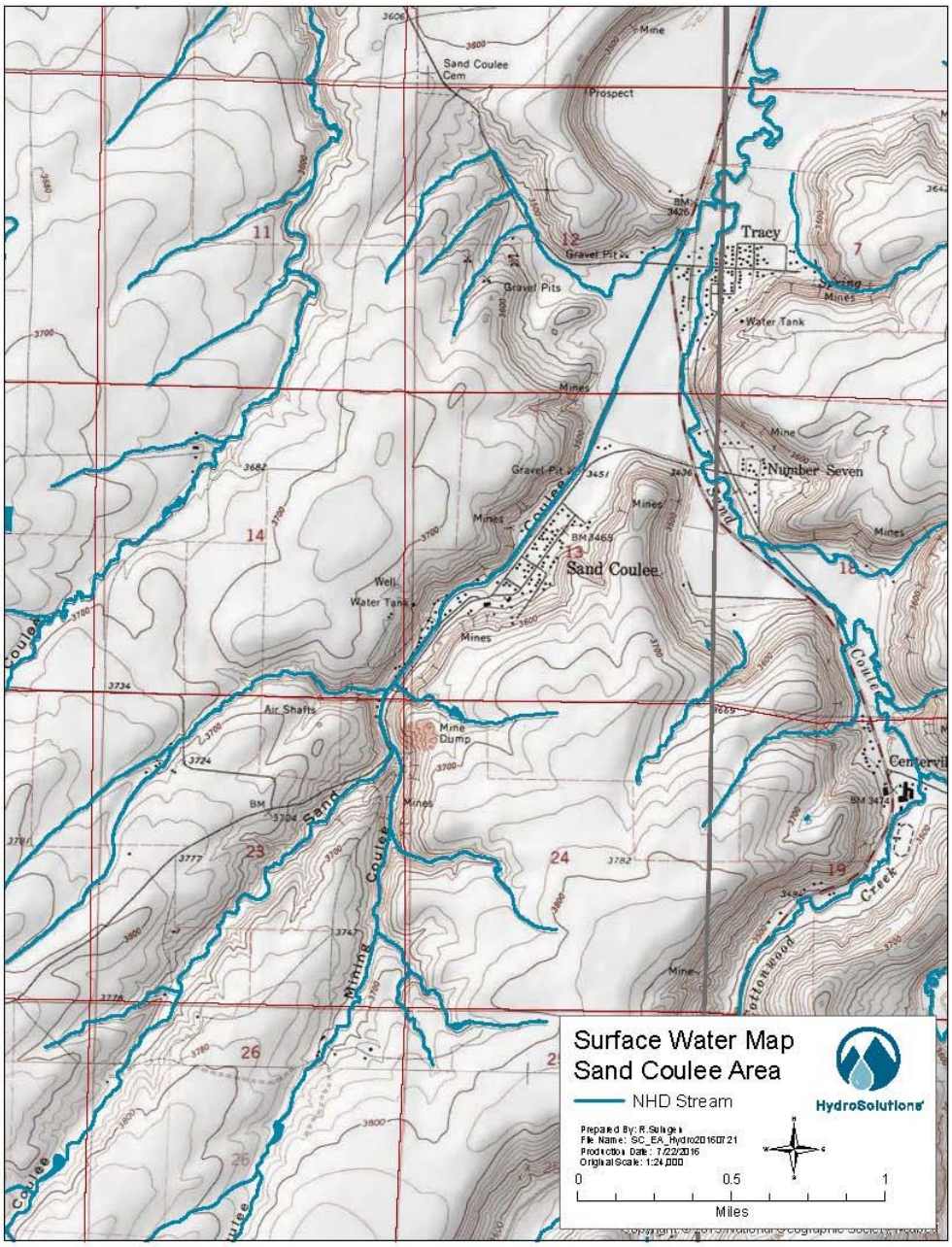

Figure 6. Surface hydrology of the Sand Coulee project area, Cascade County, Montana.

The US Geological Survey (USGS) collected monthly water quality and streamflow data at 27 sites in the Sand Coulee and Belt Creek basins from July 1994 through September 1996 (Karper, 1998). This study included establishing four monitoring stations for mining discharges near the town of Sand Coulee (UGGS stations 14, 16, 19, and 20) and Rusty Ditch in the

community (USGS station 4; Karper, 1998). The median pH of Rusty Ditch was 2.7, and median concentrations of dissolved cadmium, chromium, iron, manganese, nickel, sulfate, zinc, and total dissolved solids were 0.021, 0.11, 360, 4.0, 2.8, 4,500, 11.0, and 5,810 mg/L, respectively (Karper, 1998). These levels exceed federal and state of Montana primary and secondary drinking water standards.

Stream channels cut into the alluvium carry most of the AMD discharge. In the vicinity of Sand Coulee, the alluvial deposits deepen, and stream flow is partially or entirely lost to the alluvium. AMD is therefore a continuous source of contamination to the unconsolidated alluvial aquifer (Osborne et al., 1983). Residents abandoned alluvial wells and consequently there are very few existing domestic wells completed in this aquifer (Osborne et al., 1987). A groundwater investigation conducted from 1985 through 1987 determined that the alluvial aquifer is contaminated by Sand Coulee Creek over a distance greater than 1,200 feet from the creek (Osborne et al., 1987).

Groundwater

The basal Kootenai sandstone is an important aquifer in the area yielding water to domestic wells and springs (Fisher 1909). A geologic map and simplified stratigraphic column of local site conditions is shown in Figure 7. The Kootenai Formation is recharged by infiltration of precipitation, with groundwater flowing generally to the northwest from regional recharge areas located to the southeast in the Little Belt Mountains. Although historic coal mining does not appear to have impacted the groundwater quality within this aquifer, the mine workings have provided a drainage network which dewaters the Kootenai Formation. This dewatering is facilitated by vertical fracturing of the Kootenai Formation, associated with the presence of a major anticlinal structure, the South Arch, in the area. Recent fracturing of the Kootenai Formation may have also developed during the coal removal activities and from ground subsidence following the mining. The Gerber mine discharges AMD to Kate's Coulee, which discharges into Rusty Ditch and flows through the community. The Gerber mine is located south of the Sand Coulee well field and is likely contributing to the dewatering of the Kootenai aquifer.

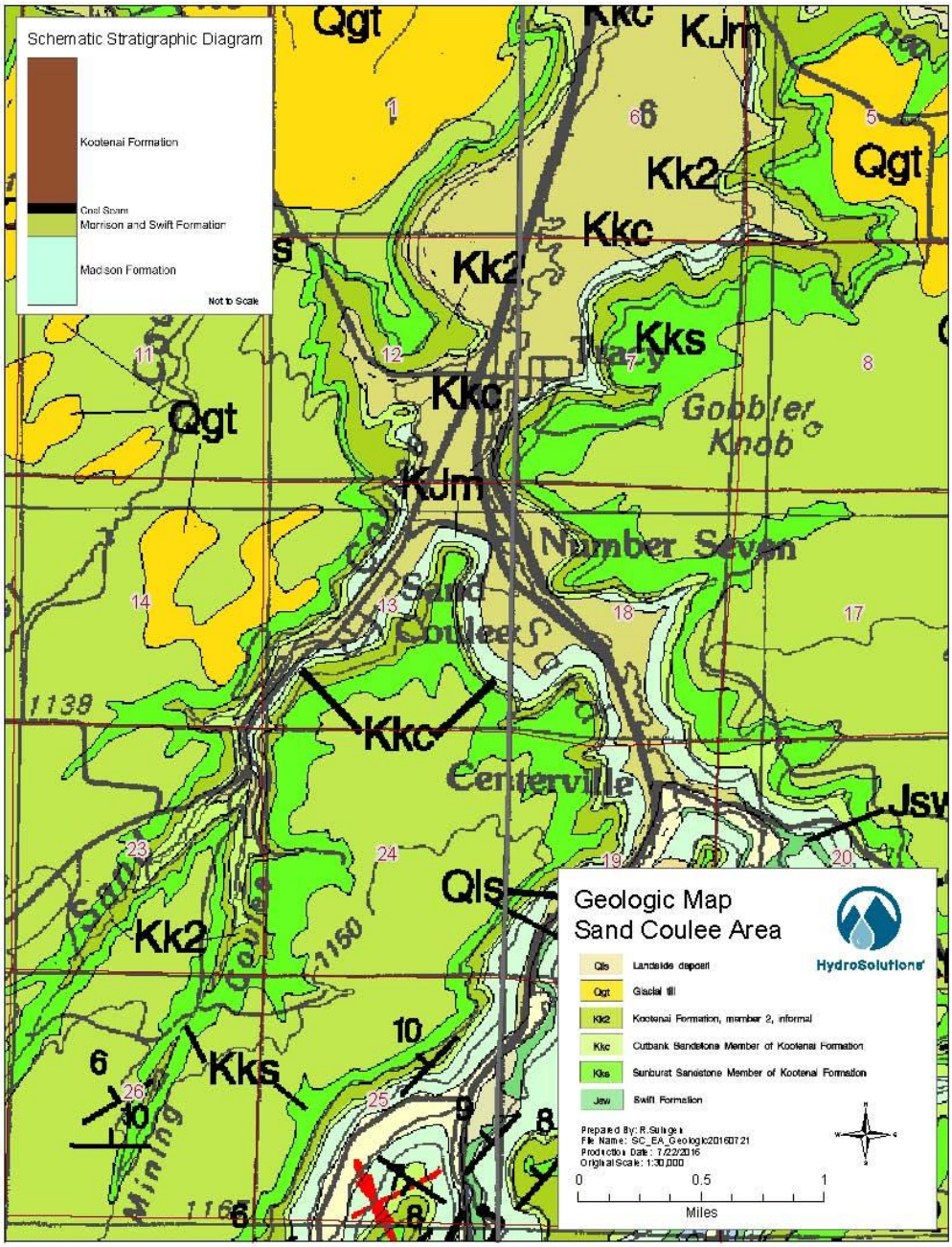

Figure 7. Geologic map of the Sand Coulee project area, Cascade County, Montana.

Few wells are completed in the Swift Formation in the project area. Recharge to the Swift Formation is limited by the low permeability shale beds in the overlying Morrison Formation and by up-dip truncation of the Swift Formation along the little Belt Mountains (Goers 1968). Shallow alluvial wells have been replaced by deeper bedrock wells constructed in the underlying Swift sandstone and Madison Limestone to avoid AMD contamination. However, both aquifers show

evidence of AMD contamination. (Osborne et al. 1983) reported that the fractured nature of the underlying bedrock, the presence of solution cavities in the Madison Limestone, and the steep vertical hydraulic gradients has distributed contaminated groundwater to the deeper bedrock aquifers in the area. Elevated concentrations of TDS and sulfate indicate that seven of sixteen wells completed in the Swift sandstone and Madison Limestone in the Sand Coulee area were contaminated to some extent by downward leaking AMD.

Mine drainage has also dewatered much of the overlying Kootenai Formation, which under normal conditions is a common source aquifer for groundwater development in the area. Drilling records and the results of recent investigations indicate that the bottom 25 feet of the Kootenai Formation are water saturated in the well field area. The Water District historically relied on groundwater wells completed in lower Kootenai Formation sandstone and upper Morrison Formation coal as the sole water source for the community water supply system. The Sand Coulee Water District wells are completed in this coal unit of the upper Morrison and the coal appears to be one of the sources of groundwater inflow to the wells. Recently, a new public water supply well was drilled into the Madison Limestone to replace the Kootenai Formation wells.

Geology

The room and pillar coal mining which occurred from 1880s to the 1940s extracted coal from the upper Jurassic Morrison Formation. The coal seam is approximately 6 to 8 feet thick in the area and likely contains accumulations of iron-pyrite nodules left over from sorting work performed by the coal miners. The high pyrite content of the coal results in elevated acid producing capacity from the oxidation of the pyrite in the partially flooded mine workings. There are presently 29 abandoned mine sites within 1 mile of Sand Coulee, with 4 abandoned coal mines bordering the community (see Figure 2) . These mines include the Sand Coulee Mine located to the south, the Nelson No. 1 mine bordering the community to the south and east, the Gerber mine located to the southwest, and the Nelson No. 2 mine located to the north. Open mine adits are present west of the community; however, historical records indicate that the terrace directly west of Sand Coulee was not mined extensively. Current and previous public water supply wells have been drilled in this area.

The geology of the area consists of a gently dipping sequence of sedimentary rocks which slope to the north and west exposing progressively older formations in the upstream drainages to the

south. The Kootenai Formation underlies the upland terraces and forms the coulee walls surrounding Sand Coulee and is comprised of interbedded shale and siltstone lenses with discontinuous sandstone beds (Wilkie, 1983). Typical thickness of the Kootenai Formation in the Sand Coulee area is approximately 180 feet (Hydrometrics, 2010). The basal member of the Kootenai Formation is a coarse-grained, cross-bedded sandstone with beds of conglomeratic pebble sandstone deposited in the channels of a major river system (Osborne et al 1983). The basal Kootenai is typically 30 to 45 feet thick and is laterally continuous (Silverman and Harris, 1967). The basal Kootenai overlies the coal deposit of the Upper Morrison Formation on an erosional unconformity, and forms the roof of most of the coal mines in the area (Osborne et al., 1983).

The Morrison Formation consists of 120 to 180 feet of mudstone containing lenses of limestone, sandstone, coal, and shale which were deposited in lacustrine and flood plain environments (Silverman and Harris, 1967). Mining occurred in the Stockett Bed in the upper part of the Morrison Formation, which includes medium-grade bituminous coal deposits and dark gray carbonaceous shale at the upper contact with the Kootenai Formation. The coal seam contains a high percentage of sulfur which occurred in the form of iron-pyrite nodules disseminated throughout the coal.

The Morrison Formation is underlain by the Swift Formation, a calcareous, coarse- to fine-grained sandstone with interbedded shale ranging from 0 to 40 feet thick in the Sand Coulee area (Hydrometrics, 1982). The Swift Formation is underlain by the Madison Group Mission Canyon and Lodgepole Formations, which are generally referred to together as the Madison Limestone. The thickness of the Madison Limestone in the Great Falls area ranges from 1,200 to 1,700 feet (Smith, 2008) and consists of massive to thick-bedded limestone with thin chert interbeds transitioning downward into thinner-bedded limestone and mudstone. Its top is exposed locally along the bottom of Cottonwood Coulee, approximately one mile east of Sand Coulee.

Unconsolidated Quaternary deposits overlie bedrock in valley bottoms. The unconsolidated deposits are comprised of fluvial sand, silt and clay, windblown sand, older alluvial terrace deposits, colluvium, landslide deposits, and lacustrine silt and clay. Generally, the thickness of the Quaternary deposits is 30 feet or less in the small coulees. North of Tracy, alluvial deposits interfinger with the outwash and lacustrine deposits of the ancient Missouri River channel. The

glacio-lacustrine sediments in the ancestral Missouri channel currently occupied by lower Sand Coulee Creek exceed 300 feet in thickness (Osborne et al., 1987).

Land Use

The Sand Coulee area is primarily surrounded by agriculture and rangeland with urban designation for the communities of Sand Coulee, Tracy, and Centerville. No significant changes in land uses are anticipated in the proposed action area.

Cultural Resources

In 2010, DEQ conducted a cultural resources inventory of Sand Coulee which included an investigation of property ownership (RTI 2010). Property records indicated that the properties in Sand Coulee are owned by private citizens; no corporate property ownership was identified (RTI 2010). One property was identified within the town of Sand Coulee, and several historic mine sites were documented via a records search.

The Montana State Historical Preservation Office (SHPO) was contacted regarding known or potential historical, archaeological, or cultural resources that may be impacted. The records search covered Township 19N, Range 4E, Sections 13, 14, and 23 (SHPO, 2016). In addition to the sites discussed in the 2010 inventory, two sites were identified in the NE quarter of Section 23 (24CA1611 and 24CA1607), and the Mount Oregon Mine (24CA0187) was located on the southern border of Section 14 to the northwest of the project site. Site 24CA1611 is a lithic material concentration (geologic site) located on private lands, but no data exist on its time period. Site 24CA1607 is a historic structure.

SHPO indicated that any structure over fifty years of age is considered historic and is potentially eligible for listing on the National Register of Historic Places. SHPO concluded that if there is no disturbance to structures over 50 years of age, there is a low likelihood that cultural properties would be impacted by the project. DEQ determined that no historic properties exist in the area where subhorizontal and vertical drilling would occur and that the project would have no effect on properties eligible for listing on the National Register. SHPO concurred with this determination on April 18, 2016 (Murdo, 2016). Consultation related to SHPO is contained in Appendix A.

Fish and Wildlife

The area around Sand Coulee is characterized by grassland ecology with areas of mixed grass prairie interspersed among agricultural fields. Although the historic mining sites retain high levels of disturbance, there are undisturbed areas of prairie capable of supporting wildlife. The degraded water quality likely precludes any useable aquatic habitat in the drainage system for tributaries to Sand Coulee and Sand Coulee although both are intact. Appendix B includes the results from the Montana Natural Heritage Program (MT NHP) data request for special status species occurrences within a five-mile radius of the project area. The MT NHP identified records for five vertebrate species (3 birds, 1 reptile, and 1 mammal) and five plant species (Table 1). No federally-listed species were identified. Most of the occurrences were centered on or near the Missouri River corridor, including a single bald eagle nest near the Big Bend Fishing Access Site (MT NHP 2016a). The only species of concern documented within a mile of the site is the long-billed curlew. These birds may nest in the undeveloped prairie lands near the site.

Table 1. Species identified by MT NHP as occurring within a five-mile radius of the proposed Sand Coulee project area.

Scientific Name	Common Name	Status	Typical Habitat	Habitat present in or near the project area?
Animals				
Ardea herodius	Great blue heron	SOC[1]	Rivers and marshy areas	No
Haliaetus leucocephalis	Bald eagle	Sensitive[2]	Forested areas along rivers and lakes	No
Numenius americanus	Long billed curlew	SOC	Mixed-grass prairie	Yes
Lasiurus cinereus	Hoary bat	SOC	Forested areas, feeds over water	No
Apalone spinifera	Spiny softshell	SOC	Large river oxbows	No
Plants				
Psilocarphus brevissimus	Dwarf woolly-heads	SOC	Vernal pools during dry season	Possible
Pediomelum hypogaeum	Little Indian Breadroot	Potential SOC	Loose sandy soils, plains	Possible
Bacopa rotundifolia	Roundleaf Water-hyssop	SOC	Muddy pond shores	No
Carex sychnocephala	Many-headed sedge	SOC	Moist valley meadows	No
Najas guadalupensis	Guadalupe Water-nymph	SOC	Oxbows, sloughs	No

[1] Species of Concern in Montana

[2]Bald eagles are no longer considered a species of special concern. However, they retain protection under the Bald and Golden Eagle Protection Act, 16 U.S.C. 668-668c.

Greater sage-grouse (*Centrocercus urophasianus*) are a prairie species that is currently under consideration for listing under the Endangered Species Act. Although they do occur in Choteau County, the project area is outside of their documented range, and no generalized observations for this species have been recorded in the area (MT NHP 2016b).

Soils

Soils in the area where the proposed subhorizontal and vertical wells would be located are primarily 1) Big Timber-Castner Complex with 8 to 30 percent slopes and 2) Bitton and Roy Soils with 10 to 65 percent slopes. Neither soil type is considered prime farmland. Soils are considered well drained with no frequency of flooding. The Big Timber-Castner Complex have a soil profiles from 1 to 60 inches in depth of clay loam and gravelly clay loam overlying unweathered bedrock. The Bitton and Roy soils have a profile from 1 to 60 inches in depth of stony loam to very stony loam (NRCS 2016).

Seven other soils are classified in the immediate vicinity of the proposed wells including:

Absarokee clay loam	8 to 15 percent slopes
Absarokee-Sinnigam complex	2 to 8 percent slopes
Castner-Sinnigam complex	2 to 15 percent slopes
Darret-Castner complex	2 to 8 percent slopes
Ipano-Ticell loams	0 to 4 percent slopes
Ipano-Ticell loams	4 to 10 percent slopes
Twin Creek loam	2 to 8 percent slopes

The Twin Creek Loam is classified as farmland of statewide importance; however, no activity is expected to occur on land with this soil type. The subhorizontal well and vertical drainage wells installed as part of this investigation would be installed in soils classified as 1) Big Timber-Castner Complex and 2) Bitton and Roy Soils

There are no lakes within the immediate area. No wetlands exist within the Sand Coulee Water District as reported from the Department of Natural Resources and Conservation (DNRC) interactive mapping program. The proposed reclamation project would have no impact on wetlands or rare or endangered plants species.

These soil types do not exhibit properties that may be problematic with installation of subhorizontal and vertical source control wells, in particular reclamation of any disturbance from drilling activity. The proposed location for these wells are on sloping and benched agricultural land that is currently used for grazing and grass hay crops.

Recreational Resource Values

The proposed source control wells are located entirely on private land where there is a public easement. No wilderness areas, National Parks, Wild and Scenic Rivers or other recreational resource areas are contained within the project area (Montana DEQ 2011). Open lands on the edge of Sand Coulee are private property used for ranching and farming.

Air Quality

Air quality in Cascade County is classified as "Unclassifiable/Attainment or Better than National Standards" (40 CFR 81.327) for the National Ambient Air Quality Standards for all criteria pollutants (Montana DEQ 2011).

Noise

The proposed drill site is situated south of a small residential community and close to private residences. Noise in the community is limited to noises associated with that residential use, traffic noise associated with the county road that passes through the community, and any noise that might intrude from nearby farming or ranching operations. Nearby farm dwellings are closest to the proposed well locations.

Social and Economic Values

Sand Coulee is a census-designated place and unincorporated community in Cascade County, Montana, United States. Its population was 212 as of the 2010 census. As of July 1, 2015, the population of Sand Coulee was 227. The formal boundaries for the Sand Coulee Census Designated Place encompass a land area of 2.62 sq. miles and a water area of 0 sq. miles (Sand Coulee Mt Profile 2016). There are 73 water service connections (Montana DEQ 2011). Information on the population of Sand Coulee, income, and housing data as of July 1, 2015 are provided on Table 2.

Conformance with Federal, State, Regional, and/or Local Land Use Plans, Programs and Policies

Reclamation construction activities associated with the proposed action would comply with Montana's Abandoned Mine Reclamation State Plan and applicable State and Federal laws and rules. Drilling and installation of source control wells with the purpose of reducing AMD discharge would minimize threats to public health, general welfare, and the environment.

Environmental Justice

Based on United States Government Census figures, the median household income in Cascade County is $40,434, and in Sand Coulee is $47,990. The dominant race in Cascade County is "white" with 89% of the population. The next largest percentage of the population by race is "American Indian" with 4.3 percent (Montana DEQ 2011).

The AMRB has prioritized the Sand Coulee Source Control Project in accordance with the programmatic mandate that requires reclamation of eligible coal sites as the highest reclamation priority. No consideration regarding the selection of this project was made in relation to income or race.

Table 2. Sand Coulee, Montana Data and Demographics as of July 1, 2015.

POPULATION	
Total Population	227
Population in Households	227
Population in Families	188
Population in Group Qrtrs	0
Population Density[1]	87
Diversity Index[2]	13
HOUSEHOLDS	
Total Households	95
Average Household Size	2.39
Family Households	67
Average Family Size	3
HOUSING	
Total Housing Units	100 (100%)
Owner Occupied HU	77 (77.0%)
Renter Occupied HU	18 (18.0%)
Vacant Housing Units	5 (5.0%)
Median Home Value	$177,941
Average Home Value	$198,052
INCOME	
Median Household Income	$47,990
Average Household Income	$59,831
Per Capita Income	$25,392

Notes:
[1]Population Density = Total Population per square mile.
[2]The Diversity Index is a scale of 0 to 100 that represents the likelihood that two persons, chosen at random from the same area, belong to different race or ethnic groups. If an area's entire population belongs to one race AND one ethnic group, then the area has zero diversity. An area's diversity index increases to 100 when the population is evenly divided into two or more race/ethnic groups. Based on Census 2010 counts, the Diversity Index for the United States was 60.6 and it is expected to increase to 64.8 by July 1, 2018.
Source: http://montana.hometownlocator.com/mt/cascade/sand-coulee.cfm

4.0 Environmental Consequences

This chapter evaluates the potential impacts to the physical environment including impacts to geology, soils, water quality and quantity, air quality, terrestrial and aquatic wildlife, vegetation, special status species, demands on environmental resources, historical and archaeological sites, and aesthetics. It also reviews potential impacts to the human environment including impacts to population, human health and safety, socioeconomic factors, demands for energy, and transportation networks. No impacts were identified for social structures, housing, cultural uniqueness, or recreation and wilderness.

4.1 No Action

Under the No Action Alternative current conditions would continue. The extent and degree of change to each affected resource is described below. There would be no appreciable changes to the following resource areas, geology, land use, soils, cultural resources, recreational resource value, air quality, noise, or social and economic values under the No Action Alternative.

Hydrology and Water Resources

Under the No Action alternative, the discharges of AMD would continue unabated. The adverse effects of AMD have impacted Sand Coulee for over a century. The water quality studies conducted over the past 40 years indicate the continuing severe water quality impacts caused by the AMD, so there is no evidence of any attenuation of the severity of the problem. Sand Coulee is unique in the Great Falls Coal Field in that minimal surface water flows exist which do not originate from abandoned mine adits. Sand Coulee (Rusty Ditch) has the water quality of raw AMD as it passes through the community. Results from the Water Treatment Assessment (Hydrometrics, 2012) indicate that DEQ-7 human health and/or aquatic life standards were exceeded for arsenic, beryllium, cadmium, chromium, copper, fluoride, iron, manganese, nickel, selenium, thallium and zinc in Sand Coulee. The loading analysis indicated that approximately 2,500 pounds of iron, 1,700 pounds of aluminum, and 20,600 pounds of sulfate are discharged daily to Sand Coulee (Hydrometrics, 2012). The investigations indicate that the underlying Madison Limestone aquifer is the ultimate receptor of the AMD discharges (Osborne et al., 1983; Osborne et al., 1987; Gammons et al., 2013). Given the continuous nature of the discharges and the existence of preferential flow paths in karst aquifers, the AMD poses a risk of contamination to the Madison Limestone aquifer beyond the immediate Sand Coulee area.

Fish and Wildlife

Under the No Action Alternative, the AMD would continue to be a potential source of toxins to fish, wildlife, and invertebrates in the area. The degraded condition of the surface water has precluded establishment of any aquatic life, and these conditions would be expected to continue in the absence of any remediation.

Conformance with Federal, State, Regional, and/or Local Land Use Plans, Programs and Policies

The No Action Alternative would not be in accordance with the Montana Abandoned Mine Reclamation Plan. Montana DEQ is responsible for regulating mining and the restoration of lands disturbed by mining and responsible for administering abandoned mine reclamation grants obtained from the federal government. The agency provides administrative personnel and procures services related to abandoned mine reclamation. These grants are provided out of funds collected from the coal mining industry under the Surface Mining Control and Reclamation Act of 1977 (SMCRA). DEQ project managers are responsible for large individual operating budgets for Montana's many reclamation construction projects.

4.2 Proposed Action

Under this alternative, the OSMRE would authorize construction activities for the purposes of implementing the abandoned mine land reclamation proposal described in Section 2.2 of this document. The extent and degree of change to each affected resource due to the implementation of the Proposed Action is described below.

Hydrology and Water Resources

DEQ has determined that groundwater interception provides the logical source control methodology to implement and test at this time. Source control is the preferred alternative as it treats the source instead of the symptoms of the mine discharges. It provides a technically and financially viable solution by reducing or eliminating expenditures required for continual treatment of the mine discharges.

This source control would be implemented by intercepting the groundwater in the Kootenai sandstone before it enters the mine workings. A recently completed investigation assessed the potential reduction in the volume of AMD discharging from nearby mines resulting from

interception wells (HydroSolutions, 2014). The investigation included multiple modeling methods to assess expected withdrawal rates from the Kootenai sandstone aquifer, and included frictional losses that may reduce production from a subhorizontal well. Investigation results indicated that both subhorizontal and vertical drainage wells are technically feasible and have the potential to reduce the amount of AMD produced by the abandoned mines.

The results of the modeling indicate that a single 1,500 foot long subhorizontal well with a screened interval of 500 feet of 4-inch to 6-inch diameter could produce a discharge ranging from 108 to 269 gpm (see Figure 4). In addition, a single vertical drainage well could capture up to 52 gpm (see Figure 5). The results suggest that multiple up-gradient drainage wells could be employed to significantly decrease AMD outflow from the abandoned mines (HydroSolutions, 2014).

Groundwater

Groundwater impacts would be regionally beneficial for the long-term. The quality of groundwater would improve as a result of interception prior to infiltration into mine workings. A controlled reduction of volume of groundwater able to interact with acid-generating mine waste in the underground workings would occur. In this case, any groundwater that continues to migrate vertically downward into the Madison Limestone aquifer from the mine workings would be minimal if interception occurs. The detrimental impacts on water quality in the Madison Limestone aquifer would be reduced.

The quantity of water impacted during this project would be dependent upon the type of interception wells and the proposed discharge of collected groundwater. The mines were driven up-dip to facilitate drainage and haulage when the mines were operating. The mine workings now act to facilitate uncontrolled discharges from the drainage tunnels developed during mining. Installation of subhorizontal interception wells would collect clean groundwater prior to infiltration into mine workings and discharge the clean water directly into tributaries to Sand Coulee. These subhorizontal wells would reduce uncontrolled AMD discharge and increase the quantity of unimpacted groundwater discharged to surface water bodies.

Installation of vertical interception wells would collect groundwater in the Kootenai Formation and allow natural injection of the captured groundwater into the underlying Madison Limestone aquifer. The volume of groundwater discharging to mine workings and thus into surface waters

would be reduced. However, prior to mining, groundwater did not flow directly into surface water bodies. The discharge of AMD-laden groundwater into surface water is an anthropogenic consequence that would be remediated as part of these source control wells. Therefore, the benefit of any impact to groundwater quantity from collection and injection wells likely outweighs the existing negative impact to surface water quality. There would be no specialized mitigation measures required to reduce impacts to groundwater.

Surface water

Impacts would be beneficial in the long term to the regional surface water resource. A reduction in AMD discharge and associated metals in the tributaries would benefit wildlife and aquatic organisms, and potentially allow for beneficial use of surface waters further upstream than has occurred since mine impacts. The water exiting the abandoned mines surrounding the Sand Coulee community contains approximately 500 mg/L dissolved iron and has a pH of approximately 3.0. None of the mine discharges in the Sand Coulee area meet federal or Montana primary and secondary drinking water standards. Due to high acidity and high concentrations of total dissolved solids and metals, the mine effluents are also unsuitable for irrigation and livestock use (Hydrometrics, 1982). AMD is a continuous source of contamination to the surface water and any reduction in discharge would be beneficial.

Land Use

Although there are not likely to be any primary impacts to land use in the Sand Coulee area due to the Proposed Action, over the long term, reducing or removing the source of AMD in the area could lead to an improvement in land condition. Any impacts to land use would likely be beneficial, long-term, and locally realized.

Cultural Resources

The Montana State Historical Preservation Office (SHPO) was contacted regarding known or potential historical, archaeological, or cultural resources that may be impacted. SHPO indicated that any structure over fifty years of age would be considered historic and is potentially eligible for listing on the National Register of Historic Places. SHPO concluded that if there is no disturbance to structures over 50 years of age, there is a low likelihood that cultural properties would be impacted by the project. The two identified sites in Section 23 are removed from the project area and would not be disturbed by any on-the-ground activities initiated under the Proposed Action, nor would the proposed horizontal well extend beneath the sites. SHPO requested that if

structures need to be altered, or if cultural materials are inadvertently discovered during this project that the State office be contacted and the site investigated Consultation related to SHPO is contained in Appendix A.

Fish and Wildlife

The potential impacts to plant and animal species of concern were assessed based on a query of the Montana National Heritage Program (MT NHP). The query covered lands within a five-mile radius of Township 19 North, Range 4 East, Section 23. Search results indicated that no US Fish and Wildlife Service threatened or endangered plant or animal species have been identified in the project area (USFWS 2016).

The MT NHP search identified 10 special status species, but only 1 species has been documented within a mile of the project area (MT NHP, 2016a). Three potential sites for long-billed curlew (*Numenius americanus*) were recorded in adjacent sections, but there are no documented sightings within Section 23. Long-billed curlew are a Montana Species of Special Concern (Table 1). They are a prairie grassland species, and prefer to nest in open, short-statured grasslands and generally avoid areas with trees, dense shrubs, or tall, dense grasses (Dugger and Dugger 2002). It is unlikely that the construction activities associated with the project would have any detrimental effect on this species as their identified breeding sites are removed from the project area. Search results are presented in Appendix B.

Improving the quality of surface water in the area would benefit any wildlife living in or traveling through the area. If surface water quality could be improved to the point where aquatic life support is possible, this would represent a significant benefit to the surrounding ecology.

Soils

The abandoned mine reclamation project would have no effect on prime and unique farmland. The proposed reclamation project would have no impact on wetlands or rare or endangered plants species.

Recreational Resource Values

This project would have no impact on recreational resources. The proposed reclamation project occurs on private property.

Air Quality
The project is not anticipated to impact air quality.

Noise
The Proposed Action would result in a slight increase in noise during the drilling and aquifer testing phase for this project. Noise increase would be a result of drill rigs and site preparation activities, the effect would be short-term, local, and minor. Drilling would be confined to daylight activities. Pumping tests may be performed over a period of 3 to 5 days and may generate noise from the power source and well pump.

Social and Economic Values
The Proposed Action would mitigate public health and safety hazards by improving the surface water for Sand Coulee residents. Sense of community would increase as Sand Coulee is perceived as a suitable location with a more aesthetically pleasing environment. The reclamation project would allow farming and ranching uses to continue, preserving existing social and economic values.

Aesthetic property values in Sand Coulee may increase as a result of this proposed source control activity. A reduction of AMD discharge to tributaries to Sand Coulee would provide a more attractive environment for the community.

Conformance with Federal, State, Regional, and/or Local Land Use Programs
The source control project and associated construction would be in accord with the Montana Abandoned Mine Reclamation Plan, and State and Federal Regulations

Environmental Justice
The Sand Coulee Source Control Project would have no disproportionate effect on any demographic population with regard to either income level or minority status.

5.0 Consultation and Coordination

In preparing this EA, the Montana Department of Environmental Quality Remediation Division consulted with the following agencies:

- State Historic Preservation on issues related to cultural resources and the eligibility of properties for listing on the National Register of Historic Places.

- Montana National Heritage Program on issues related to federally listed threatened and endangered species.

MDEQ was assisted in preparation of this EA by David Donohue and Leanne Roulson, HydroSolutions Inc, Helena, Montana

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Appendix A

State Historic Preservation Office Concurrence

Leanne Roulson

From: Murdo, Damon <dmurdo@mt.gov>
Sent: Monday, April 18, 2016 2:53 PM
To: Leanne Roulson
Subject: RE: SHPO file search request- Sand Coulee area
Attachments: 2016041804.pdf; CRABS.pdf; CRIS.pdf

Big Sky. Big Land. Big History.
Montana
Historical Society

April 18, 2016

Leanne Roulson
HydroSolutions
303 Clarke Street
Helena MT 59601

RE: SAND COULEE ACID MINE DRAINAGE SOURCE CONTROL. SHPO Project #: 2016041804

Dear Leanne:

I have conducted a cultural resource file search for the above-cited project located in Sections 13, 14, 23, T19N R4E. According to our records there have been a few previously recorded sites within the designated search locales. In addition to the sites there have been a few previously conducted cultural resource inventories done in the areas. I've attached a list of these sites and reports. If you would like any further information regarding these sites or reports you may contact me at the number listed below.

It is SHPO's position that any structure over fifty years of age is considered historic and is potentially eligible for listing on the National Register of Historic Places. If any structures are to be altered and are over fifty years old we would recommend that they be recorded and a determination of their eligibility be made.

As long as there will be no disturbance or alteration to structures over fifty years of age we feel that there is a low likelihood cultural properties will be impacted. We, therefore, feel that a recommendation for a cultural resource inventory is unwarranted at this time. However, should structures need to be altered or if cultural materials be inadvertently discovered during this project we would ask that our office be contacted and the site investigated.

If you have any further questions or comments you may contact me at (406) 444-7767 or by e-mail at dmurdo@mt.gov. I have attached an invoice for the file search. Thank you for consulting with us.

Sincerely,

Damon Murdo
Cultural Records Manager
State Historic Preservation Office

File: DEQ/AIR WATER WASTE MNG/2016

Appendix B

Montana Natural Heritage Program Data Query

MONTANA
Natural Heritage
Program

P.O. Box 201800 • 1515 East Sixth Avenue • Helena, MT 59620-1800 • fax 406.444.0266 • tel 406.444.5354 • http://mtnhp.org

March 15, 2016

Leanne Roulson
HydroSolutions
PO Box 1779
Helena, MT 59624

Dear Leanne,

I am writing in response to your recent request regarding Montana Species of Concern in the vicinity of the Sand Coulee EA project, in Section 23, T19N, R04E, in Cascade County. I checked our databases for information in this general area and have enclosed 8 species occurrence reports for 5 animal species of concern, 5 species occurrence reports for 5 plant species of concern, a map depicting species of concern locations, and explanatory material, including agency contacts that may have additional information about the area. Note that the maps are in Adobe GeoPDF format. With the appropriate Adobe Reader, it provides a convenient way to query and understand the information presented on the map. Documentation is included.

Please keep in mind the following when using and interpreting the enclosed information and maps:

(1) These materials are the result of a search of our database for species of concern that occur in an area defined by the requested township, range and section(s) with an additional five-mile buffer surrounding the requested area. This is done to provide a more inclusive set of records and to capture records that may be immediately adjacent to the requested area. Please let us know if a buffer greater than 5 miles would be of use to your efforts. Reports are provided for the species of concern that are located in your requested area with a five-mile buffer. Species of concern outside of this buffered area may be depicted on the map due to the map extent, but are not selected for the SOC report.

(2) On the map, polygons represent one or more source features and possibly additional extents associated with the source features. A source feature is a point, line, or polygon that is the basic mapping unit of a Species Occurrence (SO) representation. In addition to the base unit, the polygon may include additional extents tied to locational uncertainty (points always have locational uncertainty) and/or breeding territory. The recorded location of the occurrence may vary from its true location due to many factors, including the level of expertise of the data collector, differences in survey techniques and equipment used, and the amount and type of information obtained. Therefore, this inaccuracy is characterized as locational uncertainty, and is now incorporated in the representation of an SO. If the extent of the source feature and uncertainty are smaller than published accounts of breeding territory extent of a species, the polygons of some SOs will be buffered to encompass that extent. If you have a question concerning a specific SO, please do not hesitate to contact us.

(3) This report may include sensitive data, and is not intended for general distribution, publication, or for use outside of your organization. In particular, public release of specific location information may jeopardize the welfare of threatened, endangered, or sensitive species or biological communities.

(4) The accompanying map(s) display land management status, which may differ from ownership. Features shown on this map do not imply public access to any lands.

(5) Additional biological data for the search area(s) may be available from other sources. We suggest you contact the U.S. Fish and Wildlife Service for any additional information on threatened and endangered species (406-449-5225). For additional fisheries information in your area of interest, you may wish to contact Montana Fish, Wildlife, and Park's Montana Fisheries Information System (phone: 406-444-3373, or web site: **http://fwp.mt.gov/fishing/mFish/**).

(6) Additional information on species habitat, ecology and management is available on our web site in the Plant, Animal, and ecological Systems Field Guides, which we encourage you to consult for valuable information. You can access these guides at http://mtnhp.org. General information on any species can be found by accessing the link to NatureServe Explorer.

The results of a data search by the Montana Natural Heritage Program reflect the current status of our data collection efforts. These results are not intended as a final statement on sensitive species within a given area, or as a substitute for on-site surveys, which may be required for environmental assessments. The information is intended for project screening only with respect to species of concern, and not as a determination of environmental impacts, which should be gained in consultation with appropriate agencies and authorities.

In order to help us improve our services to you, we invite you to take a simple survey. The survey is intended to gather some basic information on the value and quality of the information and services you recently received from the Montana Natural Heritage Program. The survey is short and should not take more than a few minutes to complete. All information will be kept confidential and will be used internally to improve the delivery of services and to help document the value of our services. Use this link to go to the survey: **http://www.surveymonkey.com/s/RYN8Y8L**.

I hope the enclosed information is helpful to you. Please feel free to contact me at (406) 444-3290 or via my e-mail address, below, should you have any questions or require additional information.

Sincerely,

Martin P. Miller
Montana Natural Heritage Program
martinm@mt.gov

Natural Resource Information System
Montana State Library
PO Box 201800
Helena, MT 59620-1800
(406)444-5354 mtnhp@mt.gov

Species of Concern Data Report

Visit http://mtnhp.org for additional information.

Report Date:
Tuesday, March 15, 2016

Ardea herodias

View Species in MT Field Guide

Common Name: Great Blue Heron
General Habitat: Riparian forest
Description: Birds
Mapping Delineation:
Confirmed nesting area buffered by a minimum distance of 6,500 meters in order to be conservative about encompassing the areas commonly used for foraging near the breeding colony and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters.

Species Status

Click Status for Explanations

Natural Heritage Ranks:
State: S3
Global: G5

Federal Agency Status:
U.S. Fish & Wildlife Service:
U.S. Forest Service:
U.S. Bureau of Land Management:

FWP SWAP Status: SGCN3

MT PIF Code:

Species Occurrences

Species Occurence Map Label: 10119195

First Observation Date: 04/21/2011
Last Observation Date: 04/21/2011
SO Number:
Acreage: 32,799

Haliaeetus leucocephalus

View Species in MT Field Guide

Common Name: Bald Eagle
General Habitat: Riparian forest
Description: Birds
Mapping Delineation:
Confirmed nesting area buffered by a minimum distance of 2,000 meters in order to be conservative about encompassing the breeding territory and area commonly used for renesting and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters.

Species Status

Click Status for Explanations

Natural Heritage Ranks:
State: S4
Global: G5

Federal Agency Status:
U.S. Fish & Wildlife Service: DM; BGEPA; MBTA; BCC
U.S. Forest Service: SENSITIVE
U.S. Bureau of Land Management: SENSITIVE

FWP SWAP Status:

MT PIF Code: 2

Species Occurrences

Species Occurence Map Label: 10136626

First Observation Date: 03/01/2001
Last Observation Date: 09/01/2006
SO Number:
Acreage: 3,105

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Species of Concern Data Report

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Report Date:
Tuesday, March 15, 2016

Numenius americanus

View Species in MT Field Guide

Common Name: Long-billed Curlew
General Habitat: Grasslands
Description: Birds
Mapping Delineation:

Confirmed breeding area based on the presence of a nest, chicks, or territorial adults during the breeding season. Point observation location is buffered by a minimum distance of 200 meters in order to approximate the breeding territory size reported for the species in Idaho and otherwise is buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters.

Species Status

Click Status for Explanations

Natural Heritage Ranks:

State: S3B
Global: G5

Federal Agency Status:

U.S. Fish & Wildlife Service:
U.S. Forest Service:
U.S. Bureau of Land Management: SENSITIVE

FWP SWAP Status: SGCN3

MT PIF Code: 2

Species Occurrences

Species Occurence Map Label: 10123802
First Observation Date: 04/19/2012
Last Observation Date: 04/19/2012
SO Number:
Acreage: 31

Species Occurence Map Label: 10123803
First Observation Date: 04/19/2012
Last Observation Date: 04/19/2012
SO Number:
Acreage: 31

Species Occurence Map Label: 10123807
First Observation Date: 04/19/2012
Last Observation Date: 04/19/2012
SO Number:
Acreage: 31

Species Occurence Map Label: 10123806
First Observation Date: 04/19/2012
Last Observation Date: 04/19/2012
SO Number:
Acreage: 58

Lasiurus cinereus

View Species in MT Field Guide

Common Name: Hoary Bat
General Habitat: Riparian and forest
Description: Mammals
Mapping Delineation:

Confirmed area of occupancy based on the documented presence (mistnet captures, definitively identified acoustic recordings, and definitively identified roosting individuals) of adults or juveniles during the active season. Point observation location is buffered by a minimum distance of 3,500 meters in order to be conservative about encompassing the maximum reported foraging distance for the congeneric Lasiurus borealis and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters.

Species Status

Click Status for Explanations

Natural Heritage Ranks:

State: S3
Global: G5

FWP SWAP Status: SGCN3

MT PIF Code:

Federal Agency Status:

U.S. Fish & Wildlife Service:
U.S. Forest Service:
U.S. Bureau of Land Management:

Species Occurrences

Species Occurence Map Label: 10138561

First Observation Date: 06/16/1999
Last Observation Date: 06/16/1999
SO Number:
Acreage: 9,510

Apalone spinifera

View Species in MT Field Guide

Common Name: Spiny Softshell
Description: Reptiles
General Habitat: Prairie rivers and larger streams

Mapping Delineation:

Stream reaches where the species presence has been confirmed through direct capture or where they are believed to be present based on the professional judgement of a biologist due to confirmed presence in adjacent areas. In order to reflect the importance of adjacent terrestrial habitats to survival, stream reaches are buffered 100 meters into the terrestrial habitat based on PACFISH/INFISH Riparian Conservation Area standards.

Species Status

Click Status for Explanations

Natural Heritage Ranks:

State: S3
Global: G5

FWP SWAP Status: SGCN3

MT PIF Code:

Federal Agency Status:

U.S. Fish & Wildlife Service:
U.S. Forest Service:
U.S. Bureau of Land Management: SENSITIVE

Species Occurrences

Species Occurence Map Label: 10033190

First Observation Date: 07/22/2009
Last Observation Date: 08/12/2010
SO Number:
Acreage: 8,493

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Species of Concern Data Report

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Report Date:
Tuesday, March 15, 2016

Psilocarphus brevissimus

View Species in MT Field Guide

Common Name: Dwarf woolly-heads
General Habitat: Wetland/Riparian
Description: Vascular Plants
Mapping Delineation:

Individual occurrences are generally based upon a discretely mapped area provided by an observer and are not separated by any pre-defined distance. Individual clusters of plants mapped at fine spatial scales (separated by less than approximately 25-50 meters) may be grouped together into one occurrence if they are not separated by distinct areas of habitat or terrain features. Point observations are buffered to encompass any locational uncertainty associated with the observation.

Species Status

Click Status for Explanations

Natural Heritage Ranks:
State: S2S3
Global: G4

Federal Agency Status:
U.S. Fish & Wildlife Service:
U.S. Forest Service: SENSITIVE
U.S. Bureau of Land Management:

Species Occurrences

Species Occurence Map Label: 44596

First Observation Date:	08/13/1891	**SO Number:**	1	**Acreage:**	9,616
Last Observation Date:	08/13/1891	**SO Rank:**	H		

Pediomelum hypogaeum

View Species in MT Field Guide

Common Name: Little Indian Breadroot
General Habitat: Grasslands/Woodlands (Open, sandy sc
Description: Vascular Plants
Mapping Delineation:

Individual occurrences are generally based upon a discretely mapped area provided by an observer and are not separated by any pre-defined distance. Individual clusters of plants mapped at fine spatial scales (separated by less than approximately 25-50 meters) may be grouped together into one occurrence if they are not separated by distinct areas of habitat or terrain features. Point observations are buffered to encompass any locational uncertainty associated with the observation.

Species Status

Click Status for Explanations

Natural Heritage Ranks:
State: S3S4
Global: G5

Federal Agency Status:
U.S. Fish & Wildlife Service:
U.S. Forest Service:
U.S. Bureau of Land Management:

Species Occurrences

Species Occurence Map Label: 56430

First Observation Date:	06/20/1886	**SO Number:**	19	**Acreage:**	49,683
Last Observation Date:	06/20/1886	**SO Rank:**	H		

Bacopa rotundifolia

View Species in MT Field Guide

Common Name: Roundleaf Water-hyssop
General Habitat: Wetland/Riparian
Description: Vascular Plants
Mapping Delineation:

Individual occurrences are generally based upon a discretely mapped area provided by an observer and are not separated by any pre-defined distance. Individual clusters of plants mapped at fine spatial scales (separated by less than approximately 25-50 meters) may be grouped together into one occurrence if they are not separated by distinct areas of habitat or terrain features. Point observations are buffered to encompass any locational uncertainty associated with the observation.

Species Status

Click Status for Explanations

Natural Heritage Ranks:

State: S3?
Global: G5

Federal Agency Status:

U.S. Fish & Wildlife Service:
U.S. Forest Service:
U.S. Bureau of Land Management:

Species Occurrences

Species Occurence Map Label: 44730

First Observation Date:	08/13/1891	**SO Number:**	3	**Acreage:**	9,587
Last Observation Date:	08/13/1891	**SO Rank:**	H		

Carex sychnocephala

View Species in MT Field Guide

Common Name: Many-headed Sedge
General Habitat: Wetland/Riparian
Description: Vascular Plants
Mapping Delineation:

Individual occurrences are generally based upon a discretely mapped area provided by an observer and are not separated by any pre-defined distance. Individual clusters of plants mapped at fine spatial scales (separated by less than approximately 25-50 meters) may be grouped together into one occurrence if they are not separated by distinct areas of habitat or terrain features. Point observations are buffered to encompass any locational uncertainty associated with the observation.

Species Status

Click Status for Explanations

Natural Heritage Ranks:

State: S1S2
Global: G4

Federal Agency Status:

U.S. Fish & Wildlife Service:
U.S. Forest Service:
U.S. Bureau of Land Management:

Species Occurrences

Species Occurence Map Label: 31877

First Observation Date:	09/08/1891	**SO Number:**	1	**Acreage:**	49,683
Last Observation Date:	09/08/1891	**SO Rank:**	H		

Najas guadalupensis

View Species in MT Field Guide

Common Name: Guadalupe Water-nymph
General Habitat: Aquatic
Description: Vascular Plants
Mapping Delineation:

Individual occurrences are generally based upon a discretely mapped area provided by an observer and are not separated by any pre-defined distance. Individual clusters of plants mapped at fine spatial scales (separated by less than approximately 25-50 meters) may be grouped together into one occurrence if they are not separated by distinct areas of habitat or terrain features. Point observations are buffered to encompass any locational uncertainty associated with the observation.

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Species of Concern Data Report

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Report Date:
Tuesday, March 15, 2016

Species Status

Click Status for Explanations

Natural Heritage Ranks:

State: S2S3
Global: G5

Federal Agency Status:

U.S. Fish & Wildlife Service:
U.S. Forest Service:
U.S. Bureau of Land Management:

Species Occurrences

Species Occurence Map Label: 44597

First Observation Date: 08/25/1891
Last Observation Date: 08/25/1891
SO Number: 2
SO Rank: H
Acreage: 9,604

Montana Species of Concern
Sand Coulee EA

SPECIES OCCURRENCE: A polygon feature representing only what is known from direct observation with a defined level of certainty regarding the spatial location of the feature.

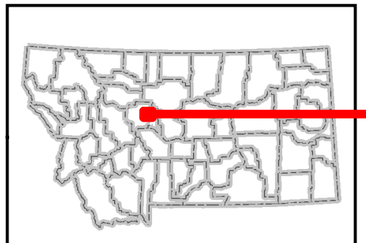
- Lichens
- Bryophytes
- Vascular Plants
- Invertebrates
- Amphibians
- Fish
- Reptiles
- Birds
- Mammals

Sites

- Sites

Wetland Types

- Lake
- River
- Freshwater Pond
- Freshwater Emergent Wetland
- Freshwater Scrub-Shrub Wetland
- Freshwater Forested Wetland
- Riparian Emergent
- Riparian Scrub-Shrub
- Riparian Forested



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Not all legend items may occur on the map.

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