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PLAN FOR PROTECTION OF THE HYDROLOGIC BALANCE

(1) Plan to Minimize Disturbance to the Hydrologic Balance During and After Mining Activities

SCM will conduct all mine area operations in such a way as to minimize possible impacts to the hydrologic balance. Specific details of the measures to be taken are addressed below and in rule responses for subchapters 5 through 12.

(l)(a) Protection of Surface and Groundwater Quality

The quality of surface water within and adjacent to the SCM mine is protected by a surface water control system that includes ponds, traps, diversions and culverts. Water originating in or flowing through disturbed areas will be collected by a drainage control system and allowed to settle in a sediment control pond before it is discharged to the natural drainage. Changes to natural drainage channels will be kept to a minimum. Water quality samples taken at sampling sites during mining have been in good agreement with pre-mining samples. The mine is not expected to cause any change in total suspended solids (TSS) or total dissolved solids (TDS) concentrations in water reaching the Tongue River.

Groundwater Quality

SCM engaged the Colorado School of Mines Research Institute to analyze and evaluate characteristics of the overburden materials at SCM. Their studies identified potentially high concentrations of salts, sodium, nickel, iron, molybdenum and nitrate in portions of the overburden. Potentially high concentrations of some of these same elements were also identified in samples of overburden from the West and East Decker Mines. Potential effects of these concentrations were analyzed as a part of the environmental impact statement process for the East Decker Mine and North Decker Extension; results of that analysis are included in that final EIS. The final EIS concluded that existing concentrations of these elements would not have significant adverse effect on water quality of the area.

In addition, SCM has conducted a comparison of the overburden materials which will be disturbed within the approved SCM permit area with those present in the proposed Pearson Creek Amendment Area. The overburden quality comparison between the two areas is discussed in Section 17.24.304. Based on this comparison and the estimation of postmine groundwater quality discussed in the Probable Hydrologic Consequences Update (Appendix L), the quantity and quality of

both surface water and groundwater within and adjacent to the proposed mine plan area will be protected from adverse effects of the proposed mining activities.

(1)(b) Protection of Rights of Present Water Users

SCCC will replace the water supply of any nearby landowner, as necessary, if such water supply is contaminated, diminished, or interrupted as a result of mining operations. See Section 17.24.304(6)(b)(ii)(c).

(1)(c) Protection of Water Quantity From Adverse Mining Effects; Providing Alternative Sources of Water

The quantity of groundwater in the Anderson-Dietz (A/D) coal in the Pit 1, 2 and 3 permit area is regulated by infiltration recharge along outcrops and subcrops of permeable units in upland areas primarily west of the mine area. Because the principal recharge areas west (upgradient) of the mine area will not be disturbed at Spring Creek Mine and mine backfill will have hydrologic properties favorable for storage and transmission of groundwater through the mine spoil to the undisturbed aquifers located east, (downgradient) of the mine area, impacts to water quantity will be temporary. The Spring Creek Fault, located north of the Pits 1, 2 and 3 portion of the mine area, serves as a barrier to groundwater flow in the A/D coal bed because the displacement on this fault is sufficient to fully offset the 80 foot thick A/D coal bed. Displacement on the east-northeast trending Spring Creek Fault is apparently sufficient to juxtapose the Canyon coal bed (D-3) beneath the Pits 1, 2 and 3 portion of the mine area with the A/D bed which will be mined on the north side of the fault in Pit 4. As a worst case scenario, drawdown associated with mining in Pit 4 is predicted to propagate southward across the Spring Creek fault into the Canyon coal aquifer located approximately 120 feet below the A/D coal bed in the Pits 1, 2 and 3 portion of the mine area. No water usage from the Canyon coal bed has been developed in the predicted impact area.

Recharge to the A/D aquifer within the Pit 4 area also occurs in the uplands to the west and northwest of the Pit 4 area with some component of flow potentially derived from the Canyon coal aquifer by way of the Carbone Fault. Based on the comparison of water quality of the upgradient coal wells AD-2, AD-3 and AD-4 in the Pit 4 area with the clinker well, CL-1, located north of the Carbone Fault it appears that the A/D coal in Pit 4 also receives a portion of its recharge from a clinker source upgradient of Pit 4. Moderate drawdowns will occur in unmined coal adjacent to the PIT 4 AREA.

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Under the direction of SCCC, WATEC of Denver, Colorado performed a study to evaluate the mine water inflow and the recharge capacity of reclaimed lands at SCCC (see Appendix E, Volume 1). Two separate plans for mining at the Pits 1, 2 and 3 portion of the permit area were examined to estimate quantities of mine water inflow and the long term effects of mining upon groundwater levels in the vicinity. Maximum calculated mine water inflows into Pits 1, 2 and 3 based on the 1979 WATEC studies are about 150 gallons per minute. Many computational methods could have been used in estimating inflows and the resulting effects, but the Darcy-type equations were the most useful. The Darcy-type equations have also been applied to proposed operations within the Pit 4 area. Inflows into Pit 4 based on the 1998 WWC Engineering drawdown calculations for Pit 4 in Attachment D of Appendix L are estimated at 69 gpm. Mining progressions into areas of less saturation, the additive effects of ongoing and preceding workings, and backfilling will combine to limit inflow to a quantity insufficient for anticipated water demands.

The A/D coal seam is the principal aquifer that will be affected by the mining process. (Of all the areas to be disturbed by mining, only within the northern and western portions of the Pit 4 area is the aquifer totally saturated. In all areas the aquifer is slowly transmissive). Based upon extensive drill records, the overburden is expected to contain only scattered, perched pockets of groundwater and, therefore, is not expected to be an important source of mine water inflow. The quantity of groundwater contained in overburden units at Spring Creek Coal is considered insignificant and no adverse effects in these units from mining is anticipated.

The A/D coal seam aquifer has water quality characteristics similar to the Canyon coal and somewhat similar to those of the saturated underburden. These similarities imply related geochemical processes affecting the chemical evolution of water types as flows proceed through similar geological media. The complicated faulting noted in the area may also be responsible for some groundwater mixing.

Three of the four water supply wells within the permit area will be obliterated by mining. There are also two other known stock water supply wells in NW1/4 Section 13 which will be affected by mining. These wells, on Spring Creek Coal surface, are not expected to require replacement.

WATEC of Denver has estimated the ability of backfilled materials to fulfill the hydrologic role (as an aquifer) now fulfilled by the coal seams will take

materials by inflow from undisturbed portions of the coal, deep percolation of precipitation, and deep percolation through reclaimed or natural stream beds. Two monitoring wells, SP-1 and SP-2, have been installed in replaced spoils at Spring Creek Mine. Water level and water quality data for these wells are provided in the Annual Reports of Hydrologic Monitoring. Appendix L contains a detailed discussion of the trends shown by these wells to date, which suggest recovery of water levels in some areas of backfill occurs more rapidly than originally projected (see Appendix L for more detailed discussion). Recovery estimates are complicated by a number of dynamic factors based on the configuration and timing of pit progression related to recharge and discharge boundaries as well as the complex variability of backfill texture and slope aspect which will greatly affect the rate of groundwater recovery in some areas. Studies of reclaimed spoils generally conclude that vertical recharge to resoiled, revegetated spoils approach rates for native range conditions. Additional factors affecting surface infiltration are soil texture, extent of fragmentation, sodium content, bulk density and slope. Only with the presence of considerable hydrous (expandable) clays will spoils apparently swell sufficiently to reduce infiltration. Topsoil or suitable material which should closely match native range infiltration conditions will be placed on reclaimed spoils.

Infiltration of vadose water and movement of groundwater is a function of bulk density. Infiltration decreases with increasing bulk density. Water storage increases with increasing bulk density. Notwithstanding extensive fracturing of the overburden, studies indicate that hydraulic conductivity of the spoils will initially be greater than in overburden. Progressing compaction of reclaimed spoils should cause variation in Pits 1, 2 and 3 area porosity and infiltration rates.

Studies indicate that settlement rate is related to time. Therefore, it is anticipated that reduction of hydraulic conductivity due to compaction will also follow a time relationship. The rate of groundwater saturation will be monitored in reclaimed spoils monitor wells. Aquifer testing will be conducted on selected spoil wells to obtain empirical information on spoil hydraulic properties. These data will give information regarding transmissivity and recharge capacity of reclaimed spoils.

Groundwater monitoring wells will be periodically sampled to determine water quality and water level in the A/D coal aquifer, underburden, and the Canyon coal seam aquifer. These data will be compared to data collected within the baseline period in order to assess impacts due to mining. Spoil monitoring wells will be placed in reclaimed spoils to periodically monitor groundwater level and water

quality. Alluvium and clinker material will be monitored for water level and quality Volume 2, Hydrology of the EBS). The A/D coal seam is the uppermost mineable coal seam within the permit area. The A/D coal seam carries some water due to cleats and other fractures within the coal, but transmissivity values are low, averaging from 980 gpd/ft to 1320 gpd/ft (Volume 2, Hydrology of the EBS) for all drawdown and recovery tests conducted to date in the Pits 1, 2 and 3 portions of the permit area and from 4.8 gpd/ft to 332 gpd/ft in Pit 4 (Appendix I).

Information pertaining to groundwater recharge has been generated as part of the hydrology baseline program and as part of mine hydrology studies. Graphical information for the Pits 1, 2 and 3 portion of the mine area consists of cross sections, and an A/D coal seam saturation diagram. (Figures 14B and 14C, respectively, Volume 1, Amendment 1 of the EBS). Potentiometric surface maps for the mine area are updated annually in the Annual Report of Hydrologic Monitoring to the MDEQ. Appendix L Plate L-2 shows the postmine potentiometric surface for the proposed mine boundary. Appendix I, Premine Hydrology , contains geologic exhibits that depict structural and stratigraphic relationships within the Carbone Amendment area and the Pearson Creek Amendment area on Plates I-8 and I-10; respectively. The Carbone Amendment area occupies a portion of a down-dropped fault block (graben) bounded by two northeast trending normal faults, the Spring Creek fault on the south and the Carbone Fault on the north. A west to east geologic cross section, H-HN, has been prepared to demonstrate groundwater relationships between monitor wells in the Pit 4 area and nearby, downgradient, water-supply wells located between the permit area and the Tongue River Reservoir. This cross-section is intended to assist with the prediction of potential impacts to private wells from mining activities at Spring Creek, so that an appropriate monitoring program can be implemented. Annual Reports of Hydrologic Monitoring include plates exhibiting the most current configuration of the A/D potentiometric surface.

The east northeast trending Spring Creek Fault separates the Pits 1, 2 and 3 portion of the mine area from Pit 4. The stratigraphic displacement on this high angle normal fault ranges from approximately 130 to over 200 feet, effectively truncating the 80 foot thick A/D coal aquifer on opposite sides of the fault. Differences in water level elevations in offset aquifer units (coal) on opposite sides of the Spring Creek Fault support the contention that the fault serves as a hydrologic barrier to groundwater flow in the A/D aquifer.

The A/D coal seam in Pit 4 north of and across the Spring Creek Fault is downthrown by about 150 feet of vertical displacement relative to the Pits 1, 2 and 3 portion of the mine permit area. The groundwater in the coal on the north, downthrown side of the fault presumably accumulates predominantly by lateral migration from recharge areas located in outcrops or burned areas updip of the Pit 4 area in the highlands to the north and west of the Pit 4 area. Water quality comparisons of clinker well, CL-1, and upgradient coal wells AD-2, AD-3 and AD-4 indicate a potential for a component of flow from recharge through extensive clinker along the upper reaches of Spring Creek, upstream of the Pit 4 area boundary. An anomalously high water level in Canyon coal well, CN-1, north of the Carbone Fault bounding the north side of the Pit 4 area, indicates a potential for a small component of flow from the Canyon bed to the A/D bed by way of the Carbone Fault. The A/D coal bed north of and across the Carbone Fault is upthrown and separated by about 40 to 70 feet of vertical displacement. The coal on the north of the fault was shallow and is predominantly burned with only remnants of unburned coal occurring in some areas beneath extensive clinker. Although no drill holes have been completed through the A/D within the tall ridge north of the Carbone Fault on the west boundary of the Pit 4 area, it is presumed the coal is at some point in the side slope unburned and extends westward, updip, under the hill. Efforts to find water in the clinker at two locations on the north side of the Carbone Fault in 1998 were unsuccessful. Static water levels in the A/D and Canyon coals on opposite sides of the Carbone Fault indicate a potential for groundwater to occur in structurally low portions of the A/D clinker.

Water level records of wells located near the Spring Creek Fault suggest moderate response of these wells to water level fluctuations in alluvium along the fault trace upstream of the mine permit area. Lack of clear response in the A/D bed across the fault, however, indicates that the fault serves as an effective groundwater barrier, limiting drawdown impacts in the A/D bed, due to mining, on opposite sides of the fault.

(2)(a) Protection Plan Description: Drainage

Details of a drainage control plan are presented in Sections 17.24.631 through 17.24.652.

(2)(b) Treatment of Drainage, Including the Quality of Discharge

Treatment of process water and disturbed area runoff is addressed in Section 17.24.633.

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(2)(c) Restoration of Approximate Recharge Capacity

Recharge restoration is addressed in Section 17.24.644.

(2)(d) Monitoring and Semi-annual Reporting of Water Quality and Quantity

Hydrologic monitoring plans are presented in Sections 17.24.314A (Addendum to this Section), 17.24.645 and 17.24.646.

(3) Probable Hydrologic Consequences Assessment

All requirements of this section and subsections (a) through (c) are addressed in Appendix L, "Probable Hydrologic Consequences Update". Appendix L has been updated to reflect information gained by years of monitoring and by baseline hydrologic investigations. Appendix I shows the premine hydrology of the Spring Creek Mine. Appendix J has been added to describe the postmine hydrology.

(4) Adverse Hydrologic Impacts Supplement

No substantial adverse hydrologic impacts have been identified or are expected. The MDEQ has not required a supplemental investigation. Refer to Appendix L, "Probable Hydrologic Consequences Update" for further information.