Appendix 7-3

Probable Hydrologic Consequences Determination

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General

The best available adjacent area data to assist in making a determination of probable hydrologic consequences of the proposed operation comes from the adjacent Horse Canyon Mine, and Columbia Mines. The Columbia Mine has been closed since the late 1960's, and the Horse Canyon Mine has been closed since the mid-1980's. The Horse Canyon Mine has also been reclaimed under SMCRA.

Data gathered from these mines and the surrounding hydrologic regime has been used in this determination, as well as baseline data gathered in the area of the proposed Lila Canyon Mine Extension.

Pertinent water monitoring data for the Horse Canyon Mine and Lila Canyon Extension are included in Appendices 7-1, 7-2, and 7-6 of this application and Appendix VII-1 of the Horse Canyon MRP. Additional recent monitoring data are available from the DOGM electronic database. Baseline geologic information is presented in Chapter 6 of this P.A.P. Baseline hydrologic information, descriptions of the function of the streams and groundwater systems, and discussions of various issues regarding the data are presented in Sections 724.100 and 724.200 of this P.A.P. To ensure that this document addresses these issues, these data, descriptions, and discussions are referenced and should be considered a part of this document.

Mining in the Horse Canyon area began in the late 1930's. Detailed hydrologic information was first gathered in the late 1970's. It is impossible to precisely describe the area's pre-mining hydrology due to the adjacent historical mining. The conditions represented by these data help to define the hydrology about the time SMCRA was passed.

Analysis of Data

Potential impacts of coal mining on the quality and quantity of surface and groundwater flow may include:

- Contamination from acid- or toxic-forming materials;
- Increased sediment yield from disturbed areas;

- Increased total dissolved solids concentrations;
- Flooding or stream flow alteration;
- Impacts to groundwater or surface water availability;
- Hydrocarbon contamination from above ground storage tanks or from the use of hydrocarbons in the permit area;
- Contamination of surface and groundwater from road salting; and
- Contamination of surface water from coal spillage due to hauling operations.

Potential Impacts to the Hydrologic Balance. Potential impacts of the Lila Canyon Mine on the hydrologic balance of the permit and adjacent areas are addressed in the following sections:

Acid- or Toxic- Forming Materials. Information on acid-and toxic-forming materials is presented in Chapter 6. These data show that no acid- or toxic-forming materials are present to the north or south of the Lila Canyon Mine. Given the Lila Canyon Mine will be opened in the same strata as has been disturbed to the north at the Horse Canyon Mine and the Boreholes S-24 and S-25 to the south, no impacts from Acid or Toxic forming materials are anticipated.

Additionally, rocks of the Mesa Verde Group are carbonaceous, resulting in persistence of acids and related toxins in water in the mine and adjacent strata unlikely. Also, the design of the refuse pile will prevent any acid or toxic potential from material removed from the mine. Based upon the hydrology, geology, and climate of the area probability of acid or toxic impacts from materials removed from the mine or from mine water discharge is unlikely. Thus, no significant potential exists for the contamination of surface and groundwater in the permit and adjacent areas by acid- or toxic-forming materials.

Sediment Yield. The potential impact of mining and reclamation on sediment yield is an increase in sediment in the surface waters downstream from disturbed areas. Sediment-control measures (such as sedimentation ponds, diversions, etc.) will be installed to minimize this impact. These facilities will be regularly inspected (see Section 514) and maintained to ensure that they remain in proper operating condition.

The implementation of sediment control measures are mandated to minimize the erosion hazard associated with mining operations. Argument has been presented that reducing the sediment load, while the sediment carrying capacity of the stream remains the same, can result in increased stream bed and stream bank erosion. This would be true, if the flow rate released to the stream remained the same. However, the use of sediment control structures results in the peak flow released from the site being reduced to a controlled rate which is less than the natural peak flow. Therefore, the sediment carrying capacity of the stream is correspondingly reduced. Additionally, the duration of the lower rate controlled release from the sediment control structures aids in enhancing the development of vegetation along the stream banks which provides additional stabilization of the channel banks and bed. While the bed and bank impacts are not anticipated, the applicant has agreed to monitor the conditions of the channel downstream of the site for geomorphic and erosional change as a result of mine discharges.

All construction and upgrading activities will be undertaken during periods of dry weather, commencing in late spring and lasting through fall. For both the mining and reclamation periods, it is expected that construction, upgrading, or regrading activities would cause an increase in sediment load to the stream. Temporary sediment controls will be used whenever possible to lessen the impact of construction activities.

Stream buffer zones have been delineated upstream and downstream of the disturbed area of the mine facilities. These buffer zones will aid in ensuring that no disturbance occurs within the area of the unprotected channel. While these buffer zones are planned and will be installed and maintained for the intermittent by definition stream, it should be recognized that the reach of the channel that is being protected is ephemeral in nature and not an intermittent or perennial nature reach (see Appendix 7-7 for characterization of streams).

Subsidence tends to cause a warping or sagging of the surface in the area of the mined out area. Within the stream channel that crosses a subsided area, at the upstream boundary of the subsidence, the stream channel is steepened, resulting in the potential for additional erosion in the steepened reach. As the stream crosses the sagged subsided area, the channel gradient decreases below the pre-subsided slope. This results in increased glides and extended pools in intermittent and perennial streams or areas of increase deposition in ephemeral streams. Subsidence cracks which intersect stream channels with steep gradients could, for a short period of time, result in a local increase in the sediment yield of the stream. However, this sediment increase would also cause the crack to quickly fill, recreating pre-subsidence stream channel conditions. Thus, the potential impact to sediment yield from subsidence in the permit area would be minor and of short duration.

Various sediment-control measures will be implemented during reclamation as the vegetation becomes established. As discussed in Section 542.200 of this P.A.P., these measures will include installation of silt fences and straw-bale dikes in appropriate locations to minimize potential contributions of sediment to the Right Fork of Lila Canyon. These measures will reduce the amount of erosion from the reclaimed areas, thereby precluding adverse impacts to the environment.

Acidity, Total Suspended Solids, and Total Dissolved Solids. Probable impacts of mining and reclamation operations on the acidity and total suspended solids concentrations of surface and groundwater in the permit and adjacent areas were addressed previously in this section. Since the proposed Lila Canyon Mine has not started, there is no specific data available on Lila mine water. Therefore, quality information obtained from the adjacent Horse Canyon Mine workings was used to be representative of the water quality expected in the Lila Canyon Mine. This is due to the mines being adjacent to each other and the same geologic strata being mined.

Data presented in Appendices 7-1 and 7-6 and summarized in Section 724.100 of this P.A.P. indicate that the TDS concentration of water in the Blackhawk Formation (as measured in inflow to the nearby Horse Canyon Mine) ranged from approximately 1400 to 2400 mg/l and is of the sodium-bicarbonate type. As noted in Section 724.200, the TDS concentration of water in the Right Fork of Lila Canyon is unknown, but likely to be similar to the flows in Horse Canyon Creek which are in the range from 1200 to 1500 mg/l. This comparison is justified due to the similar exposures of strata that both streams flow across and the similarity in the watershed conditions. The dominant ions in this water are calcium and bicarbonate during high-flow periods, whereas the dominant ions during low-flow periods are sodium, magnesium, sulfate, and bicarbonate.

These data suggest that the TDS concentration of water in the Right Fork of Lila Canyon can be expected to increase by a factor of 1.5 for the water discharged from the mine to the drainage. This concentration is similar to concentrations found in other streams along the Book Cliffs are described by Waddell, et. Al. (1986). It should be noted that it is anticipated that the Lila Canyon Mine will use powdered limestone or dolomite (i.e., calcium-magnesium-carbonate) for rock dust. It is not anticipated that gypsum rock dust (calcium-sulfate) will be used in the mine. Hence, dissolution of rock dust by water in the mine should not influence the chemical type of water in the drainage if mine water is discharged to the Right Fork of Lila Canyon.

As indicated in the P.A.P., the total iron and manganese concentrations in potential discharges from the mine are not significantly elevated to an effect downstream uses. Also, as discussed in Appendix 7-9, the worst case mine water discharge rate specified by the Division is expected to affect only a distance of 3.4 miles downstream from the mine.

Lila Canyon drainage, as part of the lower Price River basin, is classified according to Section R317-2-13 of the Utah Administrative Code (Standards of Quality for Waters of the State) as a class 2B (secondary contact recreation use), 3C (nongame fish and other aquatic life use), and 4 (agricultural use) water. No TDS standards exist for class 2B and 3C water. The TDS standard for class 4 water is 1,200 mg/l. Hence, if discharges occur from the Lila Canyon Mine to the Right Fork of Lila Canyon, the data indicate that the TDS concentration of these discharges will slightly exceed the agricultural use water-quality standard.

As there is limited agricultural use in the area, this TDS exceedance is not considered significant. The major usable water resources in the area that could potentially be affected are springs and ephemeral channels. These water sources are used by wildlife and livestock. Most of these sources are locate upstream of the proposed discharge point. Therefore, there would be no impact to these existing sources. Additionally, the quality of water discharge from the mine is expected to be significantly better than the other waters which occurs from the Mancos Shale which downstream agriculture currently uses (TDS ranging from 2200 to 4800 mg/l).

Concerns have been raised that there might be impacts of increased salinity from the solution of salts from the Mancos Shale. While it is likely that a small increase in TDS from salts picked up from the Mancos Shale, this is not expected to be a significant problem. Appendix 7-9 includes a calculation of how far a worst case mine discharge of 500 gpm would be expected to flow. This flow rate is thought to be higher than the expected discharge amount, but it does provide a worse case estimate. Because of infiltration and evapotranspiration, the mine discharge affect is limited to a distance of 3.4 miles and is not expected to reach the Price River. Therefore, it is not expected that any salinity increase would affect downstream waters.

It should also be noted that the dissolved iron standard for class 3C water is 1.0 mg/l. No dissolved iron standard exists for class 2B or 4 waters. The data presented above indicate that potential discharge water from the mine will not exceed the dissolved iron standard of Lila Canyon. No standards exist in the R317 regulations for total iron, dissolved manganese, or total manganese. However, the data presented above indicate that potential discharges from the mine to the Right Fork of Lila Canyon will meet the effluent limitations of 40 CFR 434.

No hydrologic impacts have been noted at the adjacent Horse Canyon Mine due to subsidence. Although tension cracks may locally divert water into deeper formations, resulting in increased leaching of the formation and increased TDS concentrations, the potential of this occurring is considered minimal. This conclusion is based on experience at the Horse Canyon Mine and on the fact that the shale content of the North Horn Formation, the Price River Formation, and the Blackhawk Formation should cause these subsidence cracks to heal quickly where they are saturated by groundwater flow. Thus, potential impacts on TDS concentrations would be minor and not of significant concern.

Flooding or Streamflow Alteration. Runoff from all disturbed areas will flow through a sedimentation pond or other sediment-control device prior to discharge to the Right Fork of Lila Canyon. Three factors indicate that these sediment-control devices will minimize or preclude flooding impacts to downstream areas as a result of mining operations:

1. The sedimentation pond has been designed and will be constructed to be geotechnically stable. Thus, the potential is minimized for breaches of the sedimentation pond to occur that could cause downstream flooding.

2. The flow routing that occurs through the sedimentation pond and other sediment-control devices reduces peak flows from the disturbed areas. This precludes flooding impacts to downstream areas.

3. By retaining sediment on site in the sediment-control devices, the bottom elevations of the Right Fork of Lila Canyon downstream from the disturbed area will not be artificially raised. Thus, the hydraulic capacity of the stream channel will not be altered.

The volume of streamflow will increase in the Right Fork of Lila Canyon if water is discharged from the mine to the drainage. Potential impacts to the drainage channel could include the displacement of fines on the channel bottom, and minor widening of the channel. However, the degree of widening will likely be minimized by the increased vigor and quantity of vegetation which will be sustained along the stream channel by the increased availability of water. In particular, it is anticipated that a phreatophyte streambank vegetative community will develop as a result of mine-water discharges. This effect will occur for the distance downstream that surface flows can be sustained above channel transmission losses. Based on the maximum anticipated estimate of mine water discharge, it is unlikely that any flooding will occur to the downstream channel as the flow (1.1cfs) is significantly below the bankfull conditions of the channel. Care will be taken during discharge of this water to avoid erosion at the discharge point or flooding of downstream areas. Once mining ceases, the mine will be sealed and no discharges will occur. The streamflow in the Right Fork of Lila Canyon will then return to pre-mining discharge levels. Downstream impacts from such discharge will be limited to the establishment of riparian area along the stream channel. The flow are expected to be below the flow threshold to result in changes to the stream channel.

Following reclamation, stream channels which have been altered by mining operations will be returned to a stable state (see Section 762.100). The reclamation channels have been designed to safely pass the peak flow resulting from the 10-year, 6-hour or the 100-year, 6-hour precipitation event as appropriate for the channel and in accordance with the R645 regulations. Thus, flooding in the reclaimed areas will be minimized. Interim sediment-control measures and maintenance of the reclaimed areas during the post-mining period will preclude deposition of significant amounts of sediment in downstream channels following reclamation, thus maintaining the hydraulic capacity of the channels and precluding adverse, off-site flooding impacts.

Subsidence tension cracks that appear on the surface will increase the secondary porosity of the formations overlying the Lila Canyon Mine. During the period prior to healing of these cracks, this increased percolation will decrease runoff during the high-flow season (when the water would have rapidly entered the stream channel rather than flowing into the groundwater system). During low-flow periods, the result of this increased percolation will be an increase in the base flow of the stream. Hence, the net result will be a decrease in the flooding potential of the affected stream.

An additional flooding issue is the potential for flooding of the mine following mining and the discharge of water from the portals. Since the regional geology and hydrologic regimes of the Horse Canyon and Lila Canyon Mines are so similar, data has been extrapolated from the Horse Canyon Mine to the proposed Lila Canyon Mine. The proposed Lila Canyon Mine portals are located up-dip from areas in the mine where water may be expected; therefore, the only mine water expected to reach the surface is that which is pumped. Mine water is not expected to reach the portal level or flow from the reclaimed portal level or flow from the reclaimed portals of either the reclaimed Horse Canyon Mine or the Lila Canyon Mine based on the following information:

1) Mine water level information gathered in 1986 and 1993 indicates that there has been little rise in the water level since mining activities ceased.

2) The Sunnyside Fault is not a large producer of water. As an example, the Columbia Mine located north of the Horse Canyon Mine also encountered the Sunnyside Fault zone and has been closed since the late 1960's. If water inflow rates were high, the mine workings would have flooded, developing a head differential between the Columbia Mine and the Horse Canyon Mine (pumped). If the fault zone were a good conductor of water, the inflow to the Horse Canyon Mine would have been high, driven by the head from the flooded Columbia Mine Workings. However this was not the case and the water levels have not flooded much beyond the water levels in the Horse Canyon Mine while it was pumped. Suggesting that there is no head to cause a flooding rise and that the Sunnyside Fault is not a significant conduit for water flow.

3) Sieler and Baskins (1986) showed that the water quality for natural waters generally drops significantly when exposed to mine workings (gob, etc). The water quality of the mine water samples from the Horse Canyon Mine sump locations (2 Dip, Main Slope, 2E-B) as compared to the water quality of springs in the lower stratigraphic section of the Horse Canyon permit area show little difference in TDS. This indicates that majority of the water in the mine is not the result of inflow along the fault zone from the Columbia Mine. Suggesting that the fault zone is a poor conductor of water for the poorer quality water expected from the flooded Columbia Mine workings or that the Columbia Mine workings have not flooded much beyond the water levels in the Horse Canyon Mine while it was pumped.

4) The three Piezometers, IPA-1, 2 and 3 shown on Plate 7-1, suggest that the gradient is down dip away from the portal

area. The Piezometer readings can be found in Appendix 7-1.

5) The coal mined at Horse Canyon (as well as that at Lila Canyon) is underlain by a marine sheet sandstone (Sunnyside, see Geology, Chapter VI). Lines (1985) did extensive petrographic work on porosity and permeability in the formation (see Table 1). If the water level in the mine were to ever approach the level of the portal, the Sunnyside marine sandstone would likely discharge water, preventing any head development behind the portal closures.

6) Much of the Horse Canyon Mine floor has been fractured by the effects of pillar removal, especially near the outcrop. Fracturing develops secondary porosity and enhances the permeability of the underlying Sunnyside marine sandstone. This would function as a means to dissipate any head which might otherwise develop on the portals. The proposed longwall mining in the Lila Canyon Mine is also expected to produce floor fracturing.

7) There is a difference in elevation of about 400 to 500 feet between the lowest portal and the approximate water level in the Horse Canyon mine (1986 and 1993). If the water level in the mine continues to rise, the head differential between the discharging aquifer and the mine will decrease. The decrease in head will have the direct effect of decreasing the inflow rate into the mine. Additionally, the volume of water required to "fill the mine" would also have to fill the strata above the mine, which has been dewatered throughout the history of the mine.

Based on these factors it is unlikely that the groundwater level in the lower groundwater zone will ever rise to the level of the portal, at any portal location for either the Horse Canyon or Lila Canyon Mines. Hence, there should be no natural discharge of groundwater through any of the sealed portals. To verify this, stand pipes will be incorporated into the grading plans for the portals so that water levels can be checked annually.

Groundwater and Surface Water Availability. Potential impacts to the availability of surface and groundwater from the Lila Canyon Mine operations include both decreased and increased stream flows and spring discharges caused by mine-related subsidence, bedrock fracturing, and aquifer dewatering. These potential impacts are discussed below.

Potential for Decreased Spring and Stream Flows

To date, while surface subsidence has been identified as a result of coal mining in the nearby Horse Canyon Mine, no impact or disruption of spring and seep or stream flows have been identified. Bedrock fracturing routinely occurs, depending on the overburden thickness, in the rock units overlying mined coal seams. As discussed in the MRP, section 724.100, the groundwater zones in the proposed mine area is divided into two zones. The upper zone consists of discontinuous, localized perched zones which are separated vertically from the coal or any deeper groundwater bearing zone. This zone is monitored by the spring sampling. The deeper zone of groundwater consists of the Sunnyside sandstone underlying the coal seam. This zone contains groundwater that is under pressure and is the zone monitored by the monitoring wells. Given the limited number of springs and limited groundwater resources of the Castlegate Sandstone and Blackhawk Formations in the permit and adjacent areas, there is essentially no connection between the upper and lower zones. Therefore, subsidence or fracturing would affect the hydrologic balance in the area only if zones of increased vertical hydraulic conductivity were created which extended through the Price River Formation into the North Horn-Flagstaff and Colton Formations.

When subsidence occurs as a result of mining, there are four zones that occur above the mined out area. As shown in Figure 1, the zones are: a caved zone that occurs in the 6 to 10 times the thickness of the coal seam, a fractured zone which occurs 10 to 30 times the thickness of the coal seam, and deformation zone which occurs 30 to 60 times the thickness of the coal seam, and finally, a soil zone which occurs on the ground surface. Damage to surface and groundwater resources generally occur in the caved and fractured zones. Little or no damage occurs in the deformed zone. With only localized effects felt in the soil zone. As discussed in Section 525.120, the strains for the rock in the proposed mine area, as a result of mining, should limit subsidence deformation to those areas where the overburden is less than 630 feet.

Where surface disruption or cracks appear, the general mechanism is extension of the soil mantle. Natural processes will heal these crack over time. Runoff and snowmelt will wash sediments into the crack and fill any voids created. As this process progresses, the crack disappear and the surface runoff and snowmelt return to normal courses. In the Wasatch Plateau and Book Cliffs area, the clays in the area are expansive and tend to seal these cracks very rapidly. Sidel, et.al. (1996) found that minor surface changes in the area of Burnout Creek recovered within two years.

As indicated in Figure 7-4 of the PAP, the majority of the identified springs and seeps are located outside of the maximum limits of subsidence. Therefore, the potential impact is significantly reduced. Where springs are located within the maximum limits of subsidence (L-9-G), the overburden thickness is estimated to be greater than 1500 feet. Therefore, in these areas, subsidence strains, as described in Section 525.120, will not be enough to result in surface rupture or deformation. Thus, potential impact to the springs within the area of subsidence is not expected.

Concerns have been raised regarding the potential impact from subsidence on state appropriated water in the Right fork of Lila Wash, Stinky Wash, and Water rights 91-2617 through 91-2621. As discussed in the MRP, Section 724.200, these water rights are associated with stock ponds. These stock ponds are located off the main channel, in small side tributaries. A recent site visit with DOGM personnel confirmed the locations of the stock ponds and associated water rights. As these ponds are located off the main channel and do not have diversions from the main channel, none of these pond will store water from the proposed permit area. Therefore, there can be no subsidence impact to the water rights downstream of the proposed permit area. As part of the subsidence monitoring plan, the area of the streams will be visually inspected during periods of 2nd mining and 3 month after to determine if any impacts occur. If impacts are identified, the mitigation plans described in Chapter 5 will be implemented.

Several lines of evidence suggest that mining-related subsidence and bedrock fracturing have not resulted in decreased stream flows or groundwater discharge in the vicinity of the nearby Horse Canyon Mine. Although considerable seasonal and climatic variability are noted in the hydrographs of springs in the permit and adjacent areas, data for both Horse Canyon Creek and springs which overlie the Horse Canyon Mine workings do not show discharge declines which may be attributed to either subsidence or bedrock fracturing (see Appendices 7-1 and 7-6).

Active groundwater systems in the Colton, Flagstaff-North Horn, and Price River Formations are separated from the Blackhawk Formation by the Castlegate Sandstone. As discussed in Section 724.100, this formation contains no springs and is not considered to be a major groundwater resource. Past mining in the Horse Canyon Mine has not increased the rate of spring discharge from the Price River Formation, indicating that groundwater from the overlying formations is not being diverted into this formation. The absence of increased saturation in the Price River Formation indicates that vertical zones of artificially-increased hydraulic conductivity or secondary porosity does not extend into the Price River Formation and from thence into the overlying active groundwater systems of the North Horn-Flagstaff Formations.

Data presented in Appendices 7-1 and 7-6 and summarized in Section 724.100 indicate that the low-permeability lower groundwater system, in the vicinity of mined coal seams, contains groundwater which is compartmentalized both vertically and horizontally. Coal mining locally dewaters isolated, overlying saturated rock layers in the Blackhawk Formation but does not appear to draw significant additional recharge from overlying or underlying zones.

Additionally, the springs which supply most of the local flow discharge from the upper discontinuous perched aquifers in the Flagstaff-North Horn or Colton Formations. These springs or groundwater zones receive snowmelt and precipitation recharge from the local area above each spring. The recharge area for each spring is limited, as evidenced by the limited flow rates, decreasing flow through the year, and the steep topography above them. Also they are perched above the underlying lower groundwater zone and the intervening formations contains swelling clays which tend to heal small fractures. Since the perched zones materials are isolated both vertically and horizontally and are lenticular in nature, there is a great probability that fractures in one area will not drain all the different perched aquifers because they are not interconnected. As the strains from subsidence are not expected to reach the level of the upper groundwater zone, there is little chance that the recharge to these springs might be affected.

The very low permeability and vertical gradients in Blackhawk Formation rock layers underlying actively mined coal seams in the Horse Canyon Mine and the absence of significant discharge into the mine from these layers indicates that mining does not draw groundwater from the underling portions of the Blackhawk and Mancos Shale. Additionally, the distinctive solute composition of Mancos Shale groundwater has not been observed inside the Horse Canyon Mine indicating that the saturated zones in the Blackhawk and Mancos are separate.

From the above discussion, it appears that the Horse Canyon Mine has not decreased groundwater discharge in overlying or underlying groundwater systems. Since the conditions of the springs in the area of the Lila Canyon Mine are the same, with the same strata, it is unlikely that coal mining will effect the discharges of any spring as a result of mining in the Lila Canyon permit and adjacent areas.

Concern has been raised that the mining might impact flows in the Range Creek basin. This issue has been addressed in the MRP, Section 724.200, Pages 29-33. As discussed in the MRP, the distance of the five to six miles horizontal distance from proposed permit area to Range Creek (see Plate 7-1a) and the isolating effects of the over 1,000 feet of low-permeability, isolating strata between the coal seam and the creek elevation (see Plate 7-1B and Table above) and the limited potential impact of subsidence damage to the recharge area, it is not likely that the Lila Canyon Mine will adversely effect Range Creek. Due to these conditions, no baseline or other sampling has been gathered nor is anticipated on Range Creek. For the above reasons Lila Canyon extension does not present any Probable Hydrologic Consequences to Range Creek.

The contamination, diminution, or interruption of any water resources would not likely occur within the mine permit or adjacent areas. Since surface water flows only a limited part of year and will be provided protection by use of sediment controls, the major usable water resources that could potentially be effected in the area would be springs that are currently in use by wildlife and livestock. Most of these springs are located upstream of the permit area or are in areas where subsidence resulting from post-1977 mining is not documented or expected. To date no known depletion of flow and quality of surveyed springs in the Horse Canyon permit area exists, and none are expected in the Lila Canyon area, based on available data from the Horse Canyon Mine. Although pre-mining data is not available for Horse Canyon, depletion problems from subsidence are not known to have been filed and are not indicated by sampling results in Appendices 7-1 and 7-2. Therefore, it is unlikely an alternative water supply will be needed, although they have been identified in Section R645-301-727.

L-16-G and L-17-G are seeps being monitored in Stinky Spring Canyon. Bighorn sheep have been observed within the canyon but have never been observed drinking the water.

Flows from these springs are historically less than 0.5 gpm and show a general seasonal decrease throughout the season. These sites were not identified during baseline surveys and are believed to exist intermittently and are not always evident. The low flow rates and intermittent nature of these springs suggest that they are local in nature.

These springs are located within the Central Graben, which is a block that has been downdropped between 145 and 250 feet relative to the adjacent bedrock. They occur near the contact between the Mancos Shale and the overlying Blackhawk Formation. The fractured nature of the bedrock along the edges of the Central Graben, as a result of the faulting, likely are the limits of the areal extent of the recharge or source area to the springs. The low-permeability of the surrounding Mancos Shale likely isolate the graben block from groundwater in the surrounding bedrock. Thus, the recharge to the springs is likely limited to the area of the consolidated graben block.

As indicated previously, there is no evidence that mining in the Horse Canyon Mine had any influence on the underlying formations. Therefore it is likely that the Lila Canyon Mine would have similar affects. Due to the springs location and lateral separation from the mine, outside the permit area, outside the limit of subsidence, being separated from the mine block by faulting within the Central Graben, and being 500 to 600 feet below the coal seam, there is no potential for Lila Canyon Mine to negatively impact these springs or there recharge sources.

Based on the review of the information presented in section 724.100 of the MRP, there does not appear to be any regional groundwater zone. The upper groundwater zone is a series of discontinuous, lenticular, isolated perched zones with limited recharge. Generally each zone is isolated, both horizontally and vertically, from those surrounding it. This upper zone is separated vertically from the lower zone in the Sunnyside Sandstone by the Castlegate Sandstone. No impacts to the function and quality of the springs in the upper zone are anticipated from mining subsidence.

The underlying groundwater zone is not used for any purpose and has limited ability to produce water due to the low hydraulic conductivity and the depth to water from the top of the Book Cliffs. While this lower zone contains water, it does not meet the definition of an aquifer as indicated above (see discussion in Section 724.100 of MRP).

<u>Potential for Increased Stream Flows</u>

If sufficient water is encountered in the Lila Canyon Mine workings to require discharge of that water to the surface, the flow of the Right fork of Lila Canyon will be increased. This flow could be ultimately to the Price and Green Rivers. The impact of such discharge by the development of the Lila Canyon extension would be quite limited.

The majority of water discharged from the mine would be water held in storage in the saturated zones above the coal seam. It is unlikely that any water below the coal seam would be affected or drained by the mine workings.

It is difficult to estimate the maximum potential discharge from the mine, however, DOGM has determined that a maximum discharge rate of 500 gpm should be used for design purposes. Appendix 7-9 estimates that a constant 500 gpm discharge would extend a maximum of 3.4 miles downstream of the mine. Under the absolute worst case conditions, if this discharge were to extend to reach the Price River, based on this discharge rate, during the life of the operation, the water extracted would be 22,600 ac-ft of water or approximately 800 ac-ft per year. Discharge for the Price River at Woodside has a mean annual flow of 88,000 ac-ft/yr. Discharge for the Green River at Green River has a mean annual flow of 4,484,000 ac-ft/yr. Therefore the average discharge at 500 gpm from the mine would be 0.9% of the Price River flow volume and 0.02% of the Green River flow volume. Given the standard fluctuations in the stream flows, this small flow addition would have little effect on the streams.

It should be emphasized that the 500 gpm estimate is considered by UEI to be conservatively high. The adjacent Horse Canyon Mine had a maximum discharge of 90 gpm. While the Soldier Canyon Mine farther to the north in the Book Cliffs, the rate of water discharged was estimated to be 15,000,000 gallons per year (approximately 30 gpm).

If water does need to be discharged, it will be sampled and discharged in accordance with the approved UPDES Discharge Permit. If the quality parameters of the mine water do not meet UPDES standards, the water will be treated prior to discharge. Treatment may include holding/settling in the mine, pumping to retaining or sediment ponds, chemical treatment or other approved means to prevent non-compliant discharge.

Based on the results of the evaluation presented in Appendix 7-9, the discharge of this amount of water from the mine is not expected to have a significant impact on the downstream resources. Based on the results from Appendix 7-9, the mine discharge flow will be lost due to evapotranspiration, transmission losses and percolation within 3.4 miles from the discharge point. Therefore, the discharge will not reach the Price, Green, or Colorado Rivers. The discharge of the water will have a positive impact on the vegetation and wildlife of the area by providing a fairly constant supply of water along this limited reach of the channel.

Based on comparison of upstream and downstream data gathered on Horse Canyon Creek which incorporates the analysis from past mine discharges to the channel, water quality will not be drastically affected in the intermittent drainage in the event of discharge of mine water into the channel. The expected impacts to the channels of the Lila Canyon area are very likely to be similar to those at Horse Canyon due to the close proximity, and similarities of mining and drainage conditions.

Concerns have been raised regarding the character of the streams in the area. Utah still uses the Office of Surface Mining two part definition of intermittent streams -

> "means (a) a stream, or reach of a stream, that drains a watershed of at least one square mile, or (b) a stream, or reach of a stream, that is below the local water table for at least some part of the year and obtains its flow from both surface runoff and groundwater discharge." Utah Admin Code R645-100 (2006)

The first part is an arbitrary size determination, while the second part is a scientific definition. While the drainage areas of several of the streams within the proposed permit area are greater than one square mile, the character of the flows in all the channels are ephemeral in nature. Colorado, Montana, New Mexico, and Wyoming regulatory programs have changed their rules to use the scientific definition for an intermittent stream and do not use an arbitrary size to determine the flow condition of a stream.

The stream channels on and adjacent to the Lila Canyon Mine permit area have been characterized in Appendix 7-1, Appendix 7-7, Appendix 7-10, Table 7-1A Table 7-2 and Table 7-1C to be naturally ephemeral. Perennial and intermittent streams yield a flow that is mostly continuous and dependable, known as baseflow. Baseflow is a water supply from groundwater that keeps flow in the stream channels after snowmelt and rainfall runoff has ended. Perennial stream channels have a baseflow year around, while intermittent streams maintain a baseflow during part of the year, usually during spring and early summer. A stream with baseflow has a more dependable water source that can support more vegetation, wildlife, agriculture and industry. Ephemeral stream channels do not have a baseflow. They do not support lush vegetation, wildlife, agriculture or industry. All the stream channels draining from the Lila Canyon permit area do not have a baseflow, except immediately next to springs, as discussed earlier. There are no water rights filed down stream of the mine site that can be impacted from mining operations.

Appendix 7-7 presents the characteristics of the channels within the proposed permit area. The characterization is based on the definition of ephemeral streams in the DOGM rules. Reaches of these streams flow only in response to direct precipitation and based on monthly monitoring at no point in the year does the groundwater table extend above the bottom of the channel to provide baseflow to the channel. Therefore, the channels fit the criteria for ephemeral drainages. While DOGM rules for drainages greater than one square mile stipulate that these drainages are to be considered intermittent in nature, that does not change the flow characteristics of the drainages.

The intermittent stream definition creates a problem of expectation. An intermittent stream is expected to have flow for a period of the year when the water table is above the ground surface. As such a standard monthly surface water monitoring program should and would be able to sample the flows. An ephemeral stream which does not flow as a general rule, but only in direct response to precipitation events or significant snowmelt, would be expected to be dry. Therefore, a standard monthly monitoring program would not result in flow data except on a very infrequent basis.

As a result, concerns regarding the lack of flow data have been raised for the intermittent streams within the permit area. For these are intermittent streams, it has become an issue as to why no flow and water quality data has been collected. As indicated above, these streams may be defined as intermittent, but they function as ephemeral drainages. For ephemeral streams, the standard condition for the channel is dry. The monthly monitoring has provided data which document the lack of flow. The flow modeling, described in the MRP section 724.200 for the watersheds within the permit area, suggests that for short duration, frequent storms (2 to 10 yr), while the watershed would be wetted, no generally concentrated flow would be evident. Higher frequency, longer duration events (10yr +) would result in increasing amounts of runoff. Therefore, for a short period (less than 10 years), the expected flow condition for an ephemeral character stream would be no flow.

Based on the data from the Western Regional Climate Center, presented in MRP section 724.400, the probability of precipitation events capable of generating runoff is very low. Table 7-1C shows that the probability of a 1-day event with more than 0.5" of runoff is less than 5 percent. According to the flow simulations in section 724.200, runoff is not common in storms with less than 1.2 inches of rainfall (10 year event).

Also, the lack of monthly water monitoring data for the period of December and January for most years was raised as a concern. Generally, the access to the sites is prevented by snow. This is not considered a significant problem due to the general lack of precipitation and flow during this period. Average precipitation at Sunnyside during December and January is generally under 2 inches of precipitation of the annual average of over 14 inches (see Table 7-1B). Average maximum temperatures during December and January at Sunnyside are reported to be around freezing (see Table 7-1B). At the mine site, the elevation is higher, therefore, the temperatures would be lower. Thus, any precipitation would generally be in the form of snow which would not result in a runoff event. Any snow melt which might occur would be at a very slow rate which would also not result in runoff, but would likely ripen the snowpack and locally infiltrate into the soil.

Further, a concern regarding the identification of seasonal variation in flows and water quality has been raised. Based on the monthly monitoring, there has been no consistent or seasonal flows identified in any of the drainages in the proposed permit area. Thus, the modeling presented in the MRP section 724.200 is representative of the flows in the drainages. These are characterized by infrequent runoff events from isolated, heavy precipitation occurrences with very limited durations. Based on these types of runoff events, the drainages are ephemeral in nature and the use of the downstream waters is very limited. This is evidenced by the limited number of State appropriated waters in the downstream drainages (see Plate 7-3). There are no water rights with flow diversions found on the downstream drainages which collect water from the proposed permit area. A series of stock ponds are found within the Grassy Wash drainage. Information from the BLM presented on Plate 7-3 show the stock ponds and the associate water rights. A series of four ponds have been constructed for which there are no water rights. As discussed in Section 724.200,of these ponds, only one had a diversion structure on the main stream channels that flow from the permit area. Based on a site visit in January 2004, a pond, labeled Blaine's Folley reservoir, was found silted in, though a new diversion works had been constructed at the confluence of the Right Fork of Lila Canyon and Grassy Wash. In checking with the BLM personnel, the pond improvements were not part of agency range improvements. Recent site visits have shown that the diversion structure in the Right Fork of Lila Canyon have been breached. This will result in very limited flow reaching this pond. Given the lack of flow from the permit area to these ponds, there is little impact that could be caused by the mining activities.

Potential Hydrocarbon Contamination. Diesel fuel, oils, greases, and other hydrocarbon products will be stored and used at the site for a variety of purposes. Diesel and oil stored in above-ground tanks at the mine surface facilities may spill onto the ground during filling of the storage tank, leakage of the storage tank, or filling of vehicle tanks. Similarly, greases and other oils may be spilled during use in surface and underground operations.

The probable future extent of the contamination caused by diesel and oil spillage is expected to be small for three reasons. First, because the tanks will be located above ground, leakage from the tanks will be readily detected and repaired. Second, spillage during filling of the storage or vehicle tanks will be minimized to avoid loss of an economically valuable product. Finally, the Spill Prevention

Control and Countermeasure Plan which will be developed for the site will provide inspection, training, and operation measures to minimize the extent of contamination resulting from the use of hydrocarbons at the site. This plan is not required to be submitted. However, a copy will be maintained at the mine site as required by the Utah Division of Water Quality.

Road Salting. No salting of roads will occur within the permit area. Hence, this impact is not a significant concern.

Coal Haulage. Coal will be hauled over the county road from the mine portal area to Utah Highway 6 and thence to its ultimate destination. In the event of an accident which causes coal to spill from the trucks, residual coal following cleanup of the spill may wash into local streams during a runoff event. Possible impacts to the surface water are increased total suspended solids concentrations and turbidity from the fine coal particulates. The probability of a spill occurring in an area sufficiently close to a stream channel to introduce coal to the stream bed is considered small.

In addition to spills, wind may carry coal dust or small pieces of coal from the open top of the coal trucks into drainages near the roads. The impact from fugitive coal dust is considered to be insignificant due to the small amounts lost during haulage in the permit and adjacent areas.

Water Consumption. The USFWS have identified that water consumption by underground coal mining operations could jeopardize the continued existence of and/or adversely modify the critical habitat of the Colorado River endangered fish species: Colorado pikeminnow, humpback chub, bonytailed chub, and razor back sucker. The USFWS has determined that water consumption by underground operations could potentially have adverse effects on the Colorado River basin. The USFWS considers consumption to include: evaporation from ventilation, coal preparation, sediment pond evaporation, subsidence on springs, alluvial aquifer abstractions into mines, postmining inflow to workings, coal moisture loss, and direct diversions. These consumption process are discussed below.

<u>Bath House/Office</u>
It has been estimated that the Bath House/Office will consume approximately 35 gallon per day per person for shower and human consumption. This estimate results in a usage of 1,260,000 gal/yr or 3.86 ac-ft/yr.

<u>Evaporation from Ventilation</u> - evaporation rates have been estimated at 2.5 gallons per million cubic feet of ventilated air. This number is dependent on

temperature and relative humidity. It is estimated that with the projected usage of 473,040 million cf/yr of air and a loss of 2.5 gallons per million c.f. Therefore, the water consumption for evaporation would be approximately 1,183,600 gallons per year or 3.63 acre feet of water.

Coal Preparation - The operator does not anticipate any coal preparation that would result in water usage.

Sediment Pond Evaporation - The sediment pond is used to hold rain and snow runoff that flows over disturbed areas of the coal mining and reclamation operations until accumulated sediment has dropped out. At that point the water is discharged into a receiving stream. The holding time for this water is planned to be short, therefore, no significant evaporation loss is expected. This would not be considered a consumption mechanism.

Subsidence on Springs - As shown in Appendix 7-8 and discussed in Section 525.120 of the application, the majority of springs cannot be adversely effected by subsidence because of their physical location (off the permit area and outside the area of potential subsidence) or for those within the permit area because of the amount of cover, 1000 feet or more, which as discussed in Section 525.120 are not expected to experience any significant deformation for covers over 630 feet. In the adjacent Horse Canyon mine, which was mined for over 45 years, there have been no reported effects on springs due to subsidence.

Alluvial Aquifer Abstractions into Mines - There will be no water infiltrations from alluvial systems into the mine.

Postmining Inflow to Workings - Postmining all openings will be sealed and backfilled. The proposed mine openings for Lila Canyon are at an elevation where no surface inflow is possible. This coupled with the sealing plan for the portals makes postmining inflows virtually impossible.

Coal Moisture Loss - It has been estimated that coal moisture loss or usage to be estimated at 4.5 gallons per ton of coal mined (see Table 2). Using the estimated usage for mining with an estimated production of 4.5 Million tons per year a usage of 20,250,000 gal per year or 62.12 acre feet can be estimated. It should be noted that due to the extremely low hydraulic conductivity rates measured in the general area, that groundwater movement is very slow. Using the average hydraulic conductivity measured for Blackhawk Sandstone (3.0 x 10^{-6} cm/sec) (see Table 1) which is equal to .1 inch per day. Therefore, water encountered underground would take approximately 1,736 years to travel one mile. This water is considered relatively immobile. The water encountered and used underground would not reach the Colorado Drainage in any reasonable time, if ever, and thus water consumed underground cannot negatively effect the Colorado River Basin.

Surface Dust Suppression It has been estimated that usage on the surface for dust suppression will be approximately 10,000 gallon per day or 3,650,000 gallons per year. This results in a usage of 11.20 acre feet per year.

Direct Diversions - no consumption.

Adding the four losses due to mining equals to 80.81 acre feet which is below the mitigation level of 100 acre feet. UEI does hold 362.76 acre feet of underground water rights to offset any consumption. Therefore, it is the opinion of UtahAmerican Energy, Inc. that water consumption by underground coal mining operation will NOT jeopardize the existence of or adversely modify the critical habitat of the Colorado River endangered fish species.

Conclusion

Based on available data and expected mining conditions, the proposed mining and reclamation activity is not expected to proximately result in contamination, diminution or interruption of an underground or surface source of water within the proposed permit or adjacent areas which is used for domestic, agricultural, industrial, wildlife or other legitimate purpose.

It should be noted that the determination of no known depletion of flow or quality is based on available data, which is primarily post-mining. UtahAmerican Energy Inc. will report actual water depletion values annually in the Annual Report.

Table 2 Projected Water Usage (Quantitative Water Consumption Impact Assessment)	
1- Bath House/Office a. 150 @ 35 gpd/ea. = 5250 x 240	1,260,000 gal./yr.
2- Mining(Coal moisture loss) a. 2 Sections (1) 4.5 M Ton @ 4.5 gal./ton	20,250,000 gal./yr.
3- Fan (Evaporation from ventilation) a. Evaporation (1) 900,000 cfm @ 473,040 M cf/yr. (2) 2.5 gal./M c.f.	1,183,600gal./yr.
4. Surface Dust Suppression 10,000 gallon per day	3,650,000 gal/yr.
Total Usage	26,343,600 gal./yr. (80.81 ac.ft./yr.)

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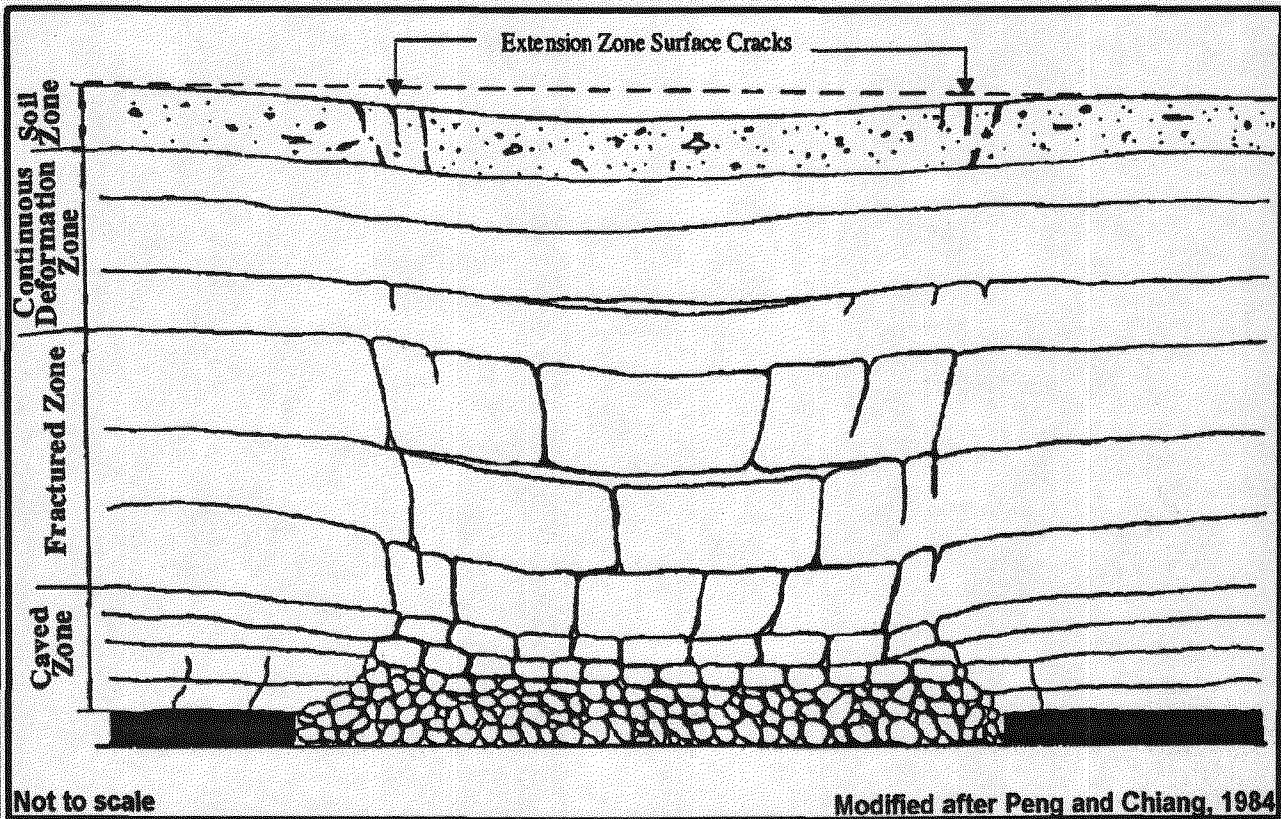
Table 1					
HYDRAULIC PROPERTIES of STRATA in the WASATCH and BOOK CLIFFS COAL FIELDS, UTAH					
SOURCE		**FORMATION**			
		Price River	Castlegate	Blackhawk	Star Point
Soldier Cyn Mine	SC-11G			$2x10^{-7}$ cm/sec*	
	SC-12G			$1.5x10^{-5}$ cm/sec	
	SC-13G			10^{-6} cm/sec	
USGS (Waddell, 1986)	G95.5	$7.5x10^{-4}$ cm^2/sec**			
	G93.5		$2.1x10^{-4}$ cm^2/sec		
	G100.4		$3.2x10^{-5}$ cm^2/sec		
USGS (Lines, 1985)	(D-17-6) 27bda-1 Horizontal			$5.3x10^{-6}$ cm/sec (ss)	
				$3.3x10^{-11}$ cm/sec(silt)	
				$3.9x10^{-6}$ cm/sec (ss)	
				$3.9x10^{-12}$ cm/sec(shale)	
				$7.0x10^{-11}$ cm/sec(silt)	
					$1.1x10^{-5}$ cm/sec(ss)
					$5.3x10^{-6}$ cm/sec(ss)
	(D-17-6) 27bda-1 Vertical			$1.3x10^{-6}$ cm/sec (ss)	
				$4.2x10^{-11}$ cm/sec(silt)	
				$1.4x10^{-6}$ cm/sec (ss)	
				not measured	
				$7.8x10^{-10}$ cm/sec(silt)	
					$3.9x10^{-6}$ cm/sec(ss)
					$2.3x10^{-6}$ cm/sec(ss)

* cm/sec = hydraulic conductivity

** cm^2/sec = transmissivity



0' NTS

FIGURE 1. SUBSIDENCE PROFILE