BOOKCLIFFS I
CUMULATIVE HYROLOGIC IMPACT ASSESSMENT (CHIA)

For

CENTENNIAL PROJECT
C/007/0019

In
CARBON COUNTY, UTAH

August 18 2005

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I. INTRODUCTION

This report contains a Cumulative Hydrologic Impact Assessment (CHIA) for Andalex Resources, Inc., Centennial Project located in Carbon County, Utah. The assessment encompasses the probable cumulative impacts of all anticipated coal mining on the hydrologic balance in and adjacent to Centennial's proposed and active underground mine complex, and evaluates whether the operations proposed in the application have been designed to prevent damage to the hydrologic balance outside the proposed mine plan area.

This report complies with federal legislation passed under the Surface Mining Control and Reclamation Act (SMCRA) and subsequent Utah and federal regulatory programs under R614-301-131.400 and 30 CFR 784.14(f), respectively.

This assessment was prompted by a significant revision to the mining and reclamation plan. It incorporates the area identified by the mining company as the Mathis/ Summit Creek Boundary Change. The boundary change includes 360 acres of fee property in Section 36, T12S, R10E.and 630.21 acres of Federal Lease UTU-79975. The mine plan modification will bring the total mine holdings to 6517.53 acres.

Tower Resources Inc., Centennial Project is located within the Book Cliffs Coal Field approximately 10 miles north-northeast of Price, Utah (Plate 1). The Book Cliffs form a rugged, southerly facing escarpment that delineates the Uintah Basin to the North from the San Rafael Swell to the south. Elevations along the Book Cliffs range from approximately 5,000 to 9,000 feet. Precipitation varies from approximately 20-inches at the highest elevations to 8-inches along the Price River downstream of the town of Wellington. The Book Cliffs area may be classified as mid-latitude steppe to semi-arid desert.

Vegetation varies from the sagebrush/grass community type at lower elevations to the Douglas fir/aspen community at higher elevations. Other vegetative communities include mountain brush, pinyon-juniper, pinyon-juniper/sagebrush and riparian. These communities are primarily used for wildlife habitat and livestock grazing.

The Centennial Mine leases are all within the Price River drainage. Surface runoff from the Book Cliffs area flows into the Price River drainage basin of east-central Utah. The Price River originates near Scofield Reservoir and flows southeasterly into the Green River, north of the town of Green River, Utah. Water quality is good in the mountainous headwater tributaries, but deteriorates rapidly as flow traverses the Mancos Shale. The shale lithology typically has low permeability, is easily eroded and contains large quantities of soluble salts that are a major contributor to poor water quality. Depending upon the duration of contact, water quality degrades downstream to where total dissolved solids (TDS) levels of 3,000 milligrams per liter (mg/1) are common. The predominant ion leached from the Mancos Shale is sulfate (SO4) with values over 1,000 mg/l common in the lower reaches of the Price River. The addition of the North Mathis and Summit Creek leases straddle the drainage divides of Mathis Creek, Deep

Canyon, and Summit Creek, which all drain to the north, but eventually contribute to the Price River. Drainages from the Centennial Project CHIA area enter the Mancos Shale a short distance from leaving the mine area.

Outcropping rocks of the Book Cliffs range from Upper Cretaceous to Quaternary in age. The rock record reflects an overall fluctuating regressive sequence from marine (Mancos Shale) through littoral and lagoonal (Blackhawk Formation) to fluvial (Castlegate Sandstone, Price River Formation and North Horn Formation) and lacustrine (Flagstaff Formation) depositional environments. Oscillating depositional environments within the overall regressive trend are represented by members of the Blackhawk Formation. The major coal bearing unit within the Book Cliffs Coal Field is the Blackhawk Formation.

During the mine-life of the Centennial Project the Apex Mine extracted coal from the Lower Sunnyside seam, the Pinnacle Mine extracted from the Centennial and Gilson seams and the Aberdeen mine has extracted coal from the Aberdeen seam.

This Cumulative Hydrologic Impact Assessment (CHIA) is a findings document involving the assessment of the cumulative impact of all anticipated coal mining operations on the hydrologic balance within the Cumulative Impact Area (CIA). The objectives of a CHIA document are to:

- Identify the Cumulative Impact Area (CIA) (Part II)
- Describe the hydrologic system (Part III)
- Identify hydrologic concerns (Part IV)
- Identify relevant standards against which predicted impacts can be compared. (Part V)
- Make a statement of findings (Part VI)

This CHIA has been prepared by the Utah Division of Oil, Gas, and Mining. It complies with federal and Utah Coal regulations as found in 30 CFR 784.14(f) and R645-301-729, respectively.

II. CUMULATIVE IMPACT AREA (CIA)

Plates 1 and 2 delineates the CIA for current Centennial Project operations. The CIA is the area within actual and anticipated coal mining activities that interact to affect the surface and ground water. The CIA is determined based on anticipated mining activities, knowledge of surface and ground water resources, and anticipated impacts of mining on those water resources.

The CIA incorporates any potential surface and subsurface effects to the hydrologic regime. The northern boundary of the CIA has been established at the natural stream channel of Summit Creek that runs westward in Whitmore Park. The flow from Summit Creek drains into Willow Creek and then into the Price River below Castlegate, Utah. Although this area appears extensive, it reflects the maximum area for expected effects that mining could incur on the surface and ground waters. The CIA was not changed as a result of the current mine plan modification, because the Mathis/Summit Creek property resides well within the CIA boundary. There will be no surface disturbance as a result of mining the Mathis/ Summit Creek properties. All operations will take place underground.

The southern and eastern portion of the CIA includes the Deadman Canyon drainage, the Straight Canyon drainage, the Hoffman Creek drainage and several other unnamed ephemeral drainages between Deadman Canyon and Hoffman Creek. Runoff from these drainages eventually unites and flows south into Deadman Creek and Coal Creek and eventually into the Price River. Most of the Centennial Project permit area, including all disturbed areas, drains to the Price River by way of Deadman Creek. The Centennial Project CIA and Soldier Canyon-Dugout Canyon CIA are contiguous in the Coal Creek drainage. Approximately 320-acres of the Soldier Creek permit is located west of Coal Creek, however there is no plans for mining to occur in that area. It is anticipated that neither mine operation will cause measurable or noticeable impacts to the hydrologic balance of this drainage, either individually or cumulatively; there will be no surface facilities for either mine in the Coal Creek drainage, neither operation will cause subsidence beneath or immediately adjacent to Coal Creek, and other surface effects from mine operations within this drainage should be insignificant or non-existent.

The southern boundaries of the CIA are defined by the inclusion of major portions of Deadman and Coal Creeks, and arbitrarily drawn along the south perimeter to include the ephemeral drainages and pediment deposits of the Mancos Shale.

The western extent of the CIA was drawn to include the drainages such as Alred Canyon, Mathis Canyon and Deep Canyon, which are within the influence of mining operations.

The surface facilities of the Centennial Project are located entirely within the watershed flowing to the south into Deadman Creek. The eastern boundary of the CIA is designated by Coal Creek, a perennial stream. Mining in the Centennial Project will not occur beneath Coal

Creek and therefore the limits of the CIA do not extend to the east of Coal Creek.

III. HYDROLOGIC SYSTEM

Scope of Mining

Initial mining operations of the Centennial Project began in October 1980, in the Pinnacle Mine on the Zions fee lease. The original Mining and Reclamation Plan was approved in January, 1982, and mining progressed onto the federal leases. In June 1982, the Apex Mine was opened.

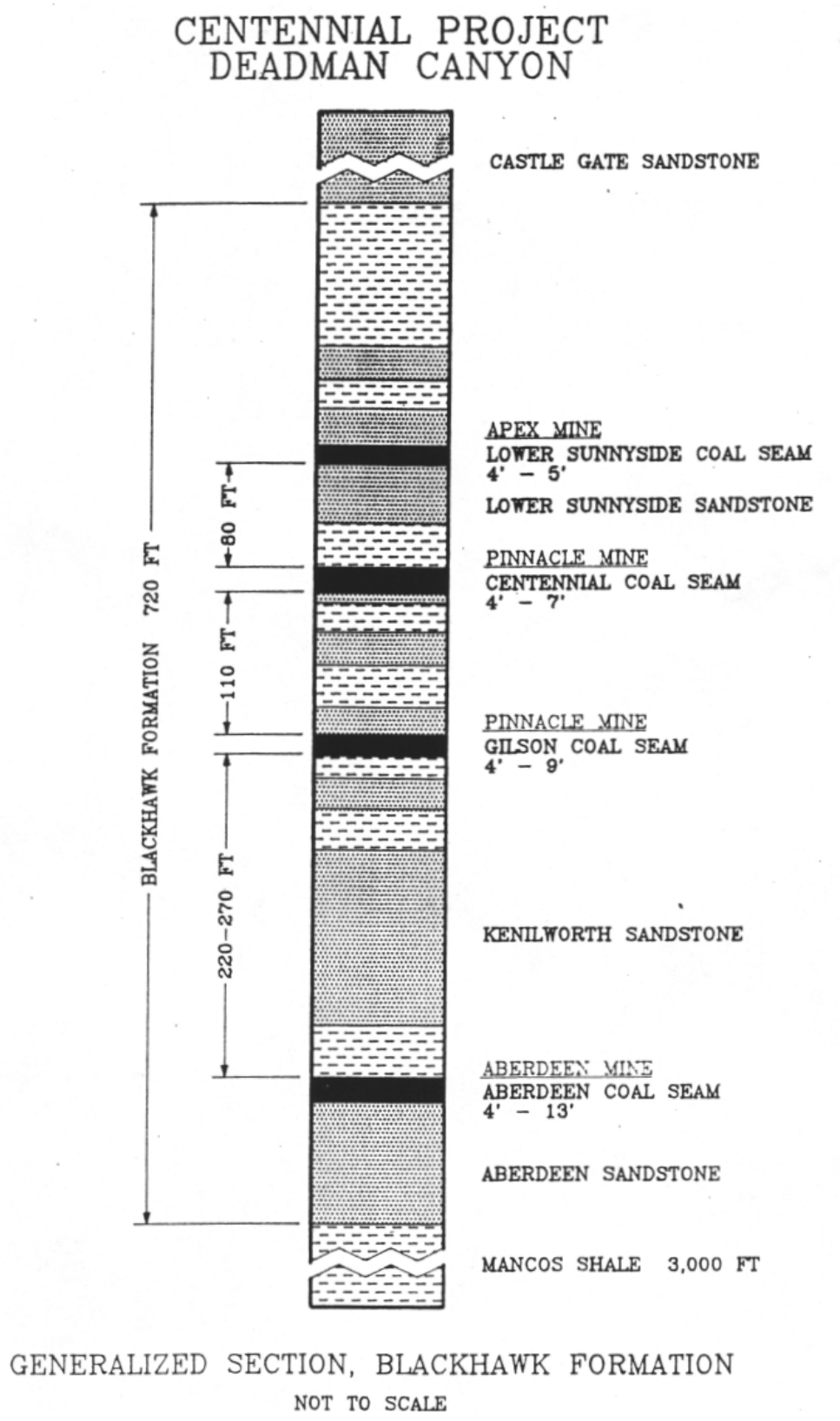
With the addition of the Mathis/Summit Creek expansion (), the Federal holdings totaled 4481.21 acres and fee holdings of 830 acres. Andalex has also acquired a Right-of Way (UTU-62045) from the Bureau of Land Management consisting of ten acres below the entrance of the mine facilities. Estimated coal reserves as of March 24, The 2005 addition increases the total permit area to 6517.53 acres, with additional land within the leases not currently under permit totaling 7712.23 acres.

Surface disturbance continues to be contained within the Right Fork of Deadman Canyon adjacent to the mines. The disturbed area acreage is currently at 35.27 acres.

Four seams (Figure 1) of mineable coal are located within the permit area. The approved Mining and Reclamation Plan for the Centennial Project calls for development of all four seams. Three mines, the Pinnacle Mine in the Gilson Seam and Apex Mine in the Lower Sunnyside Seam and the Aberdeen Mine in the Aberdeen seam have been developed to varying degrees. The Centennial seam is accessessed by rockslopes from the Gilson seam (Pinnicle Mine). A the time of this writing production is taking place in the Pinnicle Mine where room and pillar extraction is used. The Aberdeen seam will be the only seam mined in the Mathis/Summit mine plan modification area. Longwall mining is planned for the area, Plate 5.

Production from room and pillar mining methods with secondary pillaring began in 1982. Longwall mining began in August 1994. Overburden thickness ranges from approximately 0 to 3000 feet. Due to the strike and dip of the bedding planes, mining in the Aberdeen seam becomes progressively deeper as mining moves north, creating mining challenges. Due to the overlying massive Kenilworth Sandstone and the affects of buckling, large barrier panels exist between the longwall panels. The extensive amount of overburden and paucity of surface water resources present a low risk of subsidence or for surface waters being adversely affected.

Figure 1


CENTENNIAL PROJECT
DEADMAN CANYON
CASTLE GATE SANDSTONE
APEX MINE
LOWER SUNNYSIDE COAL SEAM
4' – 5'
LOWER SUNNYSIDE SANDSTONE
PINNACLE MINE
CENTENNIAL COAL SEAM
4' – 7'
PINNACLE MINE
GILSON COAL SEAM
4' – 9'
KENILWORTH SANDSTONE
ABERDEEN MINE
ABERDEEN COAL SEAM
4' – 13'
ABERDEEN SANDSTONE
MANCOS SHALE 3,000 FT
BLACKHAWK FORMATION 720 FT
80 FT
110 FT
220–270 FT
GENERALIZED SECTION, BLACKHAWK FORMATION
NOT TO SCALE

Geology

The Book Cliffs are basically a homocline (dip slope) dipping into the Uintah Basin with the cliff front roughly paralleling the strike of the feature. The beds are mostly uniform with dips of 3^0 to 8^0 to the north and northeast (Plate 3). Occasional faults cut the coal measures in the Book Cliffs but are of small displacement and have been of little consequence in mining. There are no faults known to exist within the Centennial Project. No major faults exist in the area adjacent to the mine plan area, however, Doelling (1972) shows that one minor fault may exist about one-half mile south of the portal area.

Geologic formations exposed within the mine plan area are the Blackhawk and Price River Formation of the Mesa Verde Group and the North Horn and Flagstaff members of the Wasatch Formation. The Blackhawk Formation, which directly overlies the Mancos Shale in the vicinity of the Centennial Project (Doelling, 1972) is the middle and coal bearing unit of the Mesa Verde Group. The Blackhawk consists of a basal sandstone (the Aberdeen Sandstone) overlain by massive beds of gray to buff sandstone with alternating beds of sandy shale, shale and coal (Clark, 1928). In the vicinity of the Centennial Project, the Blackhawk Formation is approximately 1000 feet thick (Doelling, 1972).

Overlying the Blackhawk Formation is the Price River Formation. The Price River Formation is composed of a massive basal sandstone (referred to as the Castlegate Sandstone) and upper beds overlying the Castlegate (Clark, 1928). The Castlegate Sandstone consists of massive, fine-grained to medium-grained sandstone beds (Doelling, 1972) which are gray to buff and composed mainly of semi-rounded quartz grains (Clark, 1928). The Castlegate Sandstone is approximately 250 feet thick near the Centennial Project (Doelling, 1972). The upper portion of the Price River Formation consists of two or more thick beds of sandstone, interbedded with thin-bedded shale and sandy shale (Clark, 1928).

The North Horn Formation, the lower most member of the Wasatch Formation, consists of a series of shale, mudstone sandstone, minor conglomerate and freshwater limestone. Near the Centennial Project, the North Horn Formation is approximately 600 feet thick.
The Flagstaff Limestone, also a member of the Wasatch Formation, consists of thin-bedded limestones, shales, and sandstones (Doelling, 1972). The Flagstaff Limestone is exposed in the northern portion of the mine plan area on the Plateau.

Topography and Precipitation

The southern topography of the Bookcliffs escarpment in the area is generally very steep and rugged, with elevations ranging from approximately 6400 feet to 8500 feet above sea level. Slopes vary from vertical cliffs to less than 2 percent. The south half of the CIA is characterized by ephemeral drainage systems that originate above 8400 feet and progressively traverse nonmarine and marine Cretaceous rocks and alluvial fan deposits. The Right and Left Forks of Deadman Canyon and an unnamed ephemeral drainage drain the western portion of the CIA.

Straight Canyon, an unnamed ephemeral drainage and Hoffman Creek drain the southeastern portion of the CIA and are tributary to Coal Creek. Coal Creek and Deadman Canyon are both tributary to the Price River. The north half of the CHIA is a broad valley, Emma Park, formed between the dip slope of the Book Cliffs and the escarpment of the Roan Cliffs escarpment. The dip slope is dissected by the drainages of Deep Creek, Clearwater Creek and Coal Creek which have eroded through the thick soils deep into the underlying sandstone formations.

Precipitation in the Book Cliffs Coal Field ranges from 5 inches to a maximum of 20 inches annually. For the most part along the coal outcrops, 10 to 12 inches of rain are expected (Doelling, 1972). Mine personnel have typically had a rain gauge on site to document the intensity of individual storms in the event an individual storm exceeded the design capacity of the drainages in the disturbed area. During the 2004 mid-term permit review, the Mine committed to documenting and submitting all precipitation information as part of the annual report. This will provide sites specific information for the future.

Vegetation

Mountain-Brush, Desert-Shrub, Pinyon-Juniper Woodland, Sagebrush-Grass, Conifer-Aspen and minor stream side vegetative types cover the total CIA. Most of the area is covered by the Mountain-Brush type while the Pinyon-Juniper Woodland type is predominant in the mine mouth area as well as the access routes and utility corridors.

Ground Water Resources

The principle factor controlling the occurrence and availability of groundwater in any area is geology. As noted by Price and Waddell (1972), nearly all of the region in the CIA is underlain by rocks of continental and marine origin, consisting predominantly of interbedded sandstones and shales. Although some of the sandstones in the region serve as the principle water-bearing strata, their ability to yield water for extended periods of time is largely controlled by the fact that the sandstone beds are relatively impermeable and by the existence of the impermeable interbedded shale layers, which prevent the downward movement of a significant amount of water. According to the U. S. Geological Survey (USGS, 1979), groundwater in the region exists under water table, artesian and perched conditions. Water table conditions exist primarily in shallow alluvial deposits along larger perennial streams and in relatively flat lying sedimentary rocks. Artesian conditions exist at greater depths where a confining layer overlies a more permeable strata. However, pressures are generally not sufficient to produce flowing wells.

Snowmelt at higher elevations provides most of the groundwater recharge, particularly where permeable lithologies such as fractured or solution limestone are exposed at the surface. Vertical migration of groundwater occurs through permeable rock units and/or along zones of faulting and fracturing. Lateral migration initiates when ground water encounters

impermeable rocks and continues until either the land surface is intersected (and spring discharge occurs) or other permeable lithologies or zones are encountered that allow further vertical flow.

The Kenilworth Member, Sunnyside Member and Upper Mudstone Member of the Blackhawk Formation, Castlegate Sandstone, Bluecastle Sandstone Member of the Price River Formation, undifferentiated North Horn/Flagstaff Formation, and Quaternary deposits are potential reservoirs or conduits for groundwater in the CIA. Reservoir lithologies are predominantly sandstone and limestone. Sandstone reservoirs occur as channel and overbank lenticular and tabular deposits, whereas limestone reservoirs have developed through solution processes and fracturing. Shale, siltstone and cemented sandstone beds act as aquacludes to impede ground-water movement. The Mancos Shale is a regional aquaclude that delimits downward flow within the CIA. Localized aquacludes include the Aberdeen Member and Lower Mudstone Member of the Blackhawk Formation, Lower Unnamed Member of the Price River Formation and relatively thin impermeable lithologies occurring within overlying units

Well test data from two water wells completed in the Blackhawk Formation near the portal area have been obtained from pumping tests. Well #1 is 130 feet deep and had a static water level of 58 feet below land surface prior to testing. After four hours of pumping at 50 gallons per minute, the water level had been lowered to 67 feet below land surface. In January 1981, after about three months use, this well was almost dry. These facts indicate that the aquifer may yield up to 5.5 gallons per minute per foot of drawdown but cannot produce a sustained yield over a period of time. Since 1991 the depth-to-water in Well #1 has varied from 60- to 75-ft below the surface. The well is used only periodically, typically only for water monitoring purposes. Figure 2 illustrates how the depth to water started dropping in June 2001, but has apparently stabilized in at approximately 73 feet. This drop may be attributed to current drought conditions being experienced in the area as illustrated with the Surface Water Supply Index (SWSI) for the Price River drainage basin. This hasn't been attributed to any mining operations. Figure 3 illustrates the water quality associated with Well #1. Although the water level has dropped, water quality has improved. TDS values ranging from 1700 mg/l to 2500 mg/l are not uncommon for water found immediately below a coal seam.

Well #2 was initially drilled to a depth of 155 feet and had a static water level of 57 feet below land surface. After two hours of pumping at 30 gallons per minute, the water level was lowered to 88 feet below land surface. The well was then drilled to a depth of 230 feet and pumped again. After only one hour of pumping at a rate of 30 gallons per minute the water level was lowered from 57 feet to 100 feet below land surface. After three weeks of pumping, in February of 1981, this well also almost dried up. The test results from well #2 indicate that the water bearing zone is less transmissive than well #1 but like well #1, it is very limited in areal extent.
The testing program of wells #1 and #2 was very limited and as a result the data from these tests must be regarded as such. However, estimates of transmissivity and areal extent of the aquifers in which these wells were completed indicate zones of low to moderate transmissivity of limited areal extent. In general these facts substantiate the lenticular habit of the Blackhawk Formation

and the fact that the water bearing zones are perched with a limited amount of recharge.

In 1983 Tower Resources encountered groundwater in an area of burned coal during mining operations adjacent to the emergency lease. The water exists in the burn area between the underlying and overlying sandstones. The burn area, consisting of burned coal and rubble, acts as a reservoir with limited storage capacity. Recharge is from direct infiltration of precipitation and runoff directly into the outcrop. Due to the permeable nature of the burned outcrop, water easily percolates into the strata, flowing down grade until the maximum available storage capacity of the burn area is achieved. Further movement downgrade is prevented by the existence of the relatively impermeable unburned coal. Tower estimates that approximately seven million gallons of water are contained in the burn area.

In-Mine Water

Very little water has been encountered in the Pinnacle and Aberdeen Mines. Water that has been encountered has been in the form of small roof leaks that dry up within a few days or weeks after mining progresses downdrift. Mine inflow is most likely attributed to localized zones of saturation in the Blackhawk Formation. The Pinnacle Mine discharged fairly consistently from September 1990 through March 1994 at a rate of approximately 75 gpm. Only one exceedance of the UPDES permit for Total Dissolved Solids (TDS) was documented during that time. The Pinnacle Mine has not had any mine discharge since March 1994.

Similar minimal mine inflow conditions have existed in the Aberdeen Mine. From 1990 through June 2004 the only time the mine had documented discharge was from November 2002 through 2005. The average discharge was approximately 60 gpm, with only one boarder-line non-compliant situation for TDS being documented. As the mine extends deeper into the ground there is a chance more water will be encountered. Any water encountered will either be used in coal production or pumped to the surface. The operator is currently seeking an individual UPDES for the Aberdeen Mine.

Ground Water Monitoring

A spring and seep survey conducted in 1980 of the Summit Creek and North Mathis tract areas was conducted during normal to mildly wet conditions while surveys conducted in 2001 and 2003 were conducted during periods of moderate to severe drought (Figure 4 PHDI / SWSI). Thus, some springs or seeps may have been flowing in 1980 were not in 2001 and 2003. Data from the surveys indicates during wet climatic conditions, groundwater naturally discharges from the Flagstaff Limestone and North Horn Formations in the area, in meager quantities and for short durations. The seeps and springs in the region show rapid response to both season and climate, suggesting short flowpaths and shallow circulation depths. This is supported by the rapid response to the wet conditions in the late 1990's and the lack of flow observed in the early 2000's. The abundant shale and mudstone horizons in the North Horn Formation and the underlying Price River Formation effectively prohibit the downward

migration of groundwater into deeper horizons. The fact that seeps in the area commonly dry-out during the summer months indicates that the groundwater travel time from recharge area to discharge area is less than one year. Figure 5 is a graph shows the springs being monitored by the Mine from 1990 through 2003 (Plate 4 – Monitoring Locations). The graph illustrates that there is very little groundwater in the area, and when water is available it moves through the system quite rapidly.

The graph also illustrates the very dry nature of the area, and how important any water is to wildlife and grazing activities. Numerous stock ponds and water rights are associated with springs located on the plateau within the Flagstaff formation. Included with the Mathis Creek and Summit Creek tracts are numerous ponds that are being added to the water monitoring plan to assess any impacts to surface waters in the unlikely event subsidence should have an impact on these areas.

Surface Water Resources

The Centennial Project CIA is situated in the Book Cliffs near the headwaters of the Price River Basin. In general, the chemical quality of water in the headwaters of the Price River Basin is excellent, with this watershed providing most of the domestic water needs of the people below. However, this quality rapidly deteriorates downstream as the streams cross shale formations (particularly the Mancos Shale in and adjacent to Castle Valley) and receive irrigation return flows from lands situated on Mancos-derived soils (Price and Waddell, 1973). Within the Price River Basin, for example, Mundorff (1972) reports that the Price River and its tributaries generally have a dissolved solids concentration of less than 400 milligrams per liter upstream from Helper, Utah. The water in this area is of a calcium-bicarbonate type. Between this point and the confluence with Miller Creek, most of the flows originate on or tranverse Mancos shales. Much of the flow is derived from irrigation return flows. The Price River at Wellington, which is near the center of the basin, has an average dissolved solids content of about 1700 milligrams per liter and is of a mixed chemical type (calcium-magnesium-sodium-sulfate). At Woodside, which is about 22 miles upstream from the confluence of the Price River with the Green River, the weighted average dissolved solids content has generally been between 2000 and 4000 milligrams per liter, with the water type being strongly sodium-sulfate.

Sediment yield from the upper portion of the basin is probably negligible (Mundorff, 1972). According to the U. S. Soil Conservation Service (1975), erosion rates in the Price and San Rafael River basins vary from 0.1 to 3.0 acre-feet per square mile per year. The bulk of the sediment yielded each year at the mouth of the Price River comes from limited areas covered with highly erodable shales (Mundorff, 1972).

The Centennial Project area is drained by ephemeral drainages heading primarily in a southerly direction off the Book Cliffs, with a few draining to the north – down dip. The Right and Left Forks of Deadman Canyon and an unnamed ephemeral drainage drain the western

portion of the CIA including the area of the surface facilities. Straight Canyon, Hoffman Creek, and an unnamed ephemeral drainage drain the eastern portion of the CIA and are tributary to Coal Creek, a perennial stream. Coal Creek and Deadman Canyon are both tributary to the Price River. Mathis Canyon, Antone Creek, and Summit Creek drain north, then into Willow Creek, and eventually into the Price River.

Surface disturbances related to coal mining occurs only in the Right Fork of Deadman Canyon. Interaction between the surface disturbances and this ephemeral drainage are minimized due to sediment control facilities that are in place. Mining has occurred beneath the Right Fork of Deadman Canyon, two unnamed ephemeral drainages, and Straight Canyon.

The ephemeral drainages flow in response to snowmelt and rainfall events. Figure 6 shows the streams being monitored by the mine in relation to the Palmer Hydrologic Drought Index (PHDI). The figure illustrates the ephemeral nature of the streams and the hydrologic system (Plate 4 – Monitoring Locations). Although the area has been monitored for 15 years, little flow information is available; independent of wet and dry periods. In 15 years of monitoring, flows have been so sporadic no flows have been documented draining south from the permit area. Field observations of the stream channels support this finding. During wet periods the streams will show a spring runoff, then rapidly dry up. The occasional thunderstorms are often not monitored because the monitoring personnel typically not on site. Water quality analyses of snowmelt runoff in the ephemeral drainages generally indicate major dissolved chemical constituents of magnesium, sodium, sulfate and bicarbonate. Flow from the Flagstaff Formation draining to the north prior to entering the Price River (sites B-263 and B-353, respectively), range from 0 to 1.5 cfs, but often flow 50 to 150 gpm seasonally. Water quality for these streams have Sulfate concentrations averaging approximately 21 mg/l and TDS concentrations averaging 320 mg/l. Photo 1 illustrates the upper reaches of Mathis Creek, Photo 2 illustrates the upper reaches of Summit Creek at the IBC boundary, and Photo 3 illustrates the northern reaches of the Summit tract in Summit Creek (looking south).

Figure 6 indicates flow in the Left Fork of Deadman's Creek, but that flow was associated to mine discharge from UPDES 004. The averaged approximately 60 gpm, with TDS concentrations in excess of 2,000 mg/l but remained within the limits of the UPDES permit concentrations. The water was generated by dewatering the lowest portion (down dip) of the mine. Water accumulated after a number of years of draining miles of underground workings

IV. POTENTIAL HYDROLOGIC IMPACTS

Ground Water

Dewatering and subsidence related to mining have the greatest potential for impacting groundwater resources in the CIA.

Dewatering

Minor inflows of water have been encountered within the mine. Andalex Resources (Mike Glasson, Senior Geologist) stated that interception of burnt coal areas has produced 90% of the water which flows into the mine in the early 1990s. Other sources that are encountered have been in the form of small roof leaks that dry up within a few days or weeks after mining progresses downdrift. The inflows from burnt areas produce large volumes of water which is stored in the mine and then pumped out at irregular intervals. One such encounter produced around 100,000 gallons per day for about a month. Andalex acquired a UPDES permit (UTG-040008, site 002) for the discharge.

The probable hydrologic impacts to the ground water are distinct and independent at the Centennial Project. There appears to be no hydrologic connection between the alluvial aquifer underlying local creeks and the operations at the Centennial Project. While the mining operations occur in the Blackhawk Formation, the aquifers associated with this formation are perched and lenticular in nature. Pump test data in the Blackhawk Formation and monitoring of ground water inflow at local mines has demonstrated the absence of a regional aquifer that contributes medium or high groundwater tranmissivities. Hydrologic impacts of the Centennial Project with respect to ground water have not been observed, or anticipated by the mining activities at the Centennial Project.

Subsidence

Subsidence impacts are largely related to extension and expansion of the existing fracture system and upward propagation of new fractures. Inasmuch as vertical and lateral migration of water appears to be partially controlled by fracture conduits, readjustment or realignment in the conduit system will inevitably produce changes in the configuration of groundwater flow.

Potential changes include increased flow rates along fractures that have "opened" and diverting flow along new fractures or permeable lithologies. Subsurface flow diversions may cause the depletion of water in certain localized aquifers, whereas increased flow rates along fractures would reduce groundwater residence time and potentially improve water quality. To date, there has been no documented interruption of ground water or surface water flows due to subsidence. As mining continues, the depth of the workings gets progressively deeper; further reducing the likelihood of encountering impacts caused by subsidence.

The operator does not expect subsidence impacts for the Mathis/Summit Creek modification area. Mining will take place under 2600 to 3100 ft. of overburden. At those depths caving and fractures should not reach the surface to affect surface water sources. The operator has compiled data from surface water resources to identify potential impacts and material damage potential. Water quality and quantity data has been collected and submitted to the DOGM Water quality database. The information identifies that surface waters on the permit area are mostly ephemeral. A subsidence monitoring survey will be conducted annually to identify subsidence areas, and any impacts, should it occur.

Surface Water

The main concern in terms of impact to surface water is water quality deterioration downstream from the minesite. To date, there has been no impact to the quality of water due to the ephemeral nature of the drainages**.** All drainages in the CIA flow only in response to snowmelt runoff and rainfall events. Infiltration rate and runoff volumes will not be affected by the mining operations. Sediment control of the disturbed area has remained compliant to the design specifications. There has been only minimal discharges from the site over the entire life of the operation to date.

The area influenced by surface disturbance is of limited areal extent and confined only to the Right Fork of Deadman Canyon. Surface sediment controls currently are in place and continue to function as designed. The water quality impacts associated with reclamation are minimal or nonexistent since all drainage from the disturbed area is routed through sediment controls and treated via the use of sedimentation ponds prior to any release of disturbed area drainage. As stated earlier, the Right Fork of Deadman Creek has not flowed for a number of years, independent of wet or dry environmental conditions.

Influence of Other Mining

The Centennial Project is the only active coal mine in the CIA. The Soldier Canyon Mine is located approximately six miles to the east in Soldier Canyon and the Willow Creek Complex is located approximately nine miles to the west in the Price River Canyon. The eastern border of the mine plan area is contiguous to the western border of Soldier Creek Coal Company' mine plan area. In 2004, Soldier Creek is currently idled and Willow Creek is being actively reclaimed.

A Cumulative Hydrologic Impact Assessment was originally prepared in December of 1984 for the Soldier Canyon Mine and addressed the hydrologic impacts for the anticipated mining in the Soldier Creek drainage. The CHIA was then updated in 1998 and 2000 with the addition of the Dugout Canyon mine and again in 2004 with additional leases. The greatest ground water concern with respect to the Soldier Canyon Mine is the undermining of Soldier Creek and the potential for stream flow to be lost into the mine via subsidence fractures through a minimum of 150 feet of overburden material. Three springs overlying the mine could be affected by subsidence associated with mining. These effects are possible but

unlikely because the springs are located in the Flagstaff Limestone and the North Horn Formation and separated from the coal seams by approximately 900 feet of overburden. While active, Soldier Canyon Mine experienced various inflows during mining, but no affects were observed on the surface. In 2004, Soldier Canyon Mine is not discharging any water.

The probable hydrologic impacts to the ground water are distinct and independent at the Centennial Project and at the Soldier Canyon Mine. There is no hydrologic connection

between the alluvial aquifer underlying Soldier Creek and the operations at the Centennial Project. While both mining operations occur in the Blackhawk Formation, the aquifers associated with this formation are perched and lenticular in nature. Pump test data in the Blackhawk Formation and monitoring of ground water inflow at each of the mines has demonstrated the absence of a regional aquifer in this Formation. The hydrologic impacts of the Centennial Project with respect to ground water will therefore not affect or be affected by the mining activities at the Soldier Canyon Mine.

The Cumulative Hydrologic Impact Assessment prepared for the Soldier Canyon Mine indicates that the greatest impacts to the surface water resource are related to changes in water quality caused by discharge of mine waters with a relatively high total dissolved solids (TDS) concentration.

The Centennial Project has encountered very little water in the perched aquifers associated with the Blackhawk Formation. Water out of an area of burned coal was discharged in 1983. Andalex Resources, Inc. has obtained a UPDES Permit and has a monitoring plan in the event that any unexpected mine water is encountered and must be discharged from the mine. Hydrologic impacts resulting from any treated discharge will be minimized and will not affect or be affected by the mine water discharge at the Soldier Canyon Mine.

A Cumulative Hydrologic Impact Assessment for the Willow Creek / Castlegate mines, west of the CIA, was last modified in 1996; addressing the hydrologic impacts for the anticipated mining with respect to the Price River Basin. The CHIA has determined that the hydrologic effects of the Price River Coal Company (PRCC) mining operation will have no cumulative impacts with existing or proposed coal mining operations. Intercepted ground water from the Blackhawk Formation during mining operations has been determined to be approximately 0.64 to 0.96 cubic feet per second. This would reduce base flow to springs and streams in the area by a lesser amount because water is discharged from the mine. Pump test data in the Blackhawk Formation and monitoring of ground water inflow into the mine at the PRCC Complex as well as at the Centennial Project demonstrate that there is no hydrologic connection in the Formation between the two mining operations. Therefore, the hydrologic impacts associated at the two mining operations will not affect each other. In 2004, portions of the Willow Creek / Castlegate mines have been reclaimed or are being actively reclaimed.

The Centennial Project has and will continue to treat surface water runoff from disturbed areas and any unexpected mine water discharge. The hydrologic impacts of the

Centennial Project with respect to the surface water will therefore not affect or be affected by mining operations at the PRCC Complex.

The operational design proposed for the Centennial Project is herein determined to be consistent with preventing damage to the hydrologic balance outside the mine plan area.

V. MATERIAL DAMAGE CRITERIA– Relevant Standards Against Which Predicted Impacts Can Be Compared

Water within the CIA is used for watering livestock and wildlife, and mining coal. Land within the CIA is used for wildlife habitat and grazing. The area is so dry and ephemeral in nature, very little water ever enters the Price River.

Quality

Water quality standards for the State of Utah are found in R317-2, Utah Administrative Code. The standards are intended to protect the waters against controllable pollution. Waters, and the applicable standards, are grouped into classes based on beneficial use designations.

Coal Creek, Deadman Creek, and Willow Creek are classified as:
- protected for agricultural uses including irrigation of crops and stock watering.

The Utah Department of Environmental Quality, Division of Water Quality (DEQ – DWQ) authorizes a coal mine to discharge into surface waters under the Utah Pollutant Discharge Elimination System (UPDES). The permits for mines contain site-specific limitations on total dissolved solids, total suspended solids (or total settleable solids for precipitation events), iron, oil and grease, pH. The Centennial Project mines have a UPDES permit. Over the life of the mine to date, discharges from the mine have been infrequent.

Potential impacts to water quality will be assessed combining the baseline and operational water quality sampling conducted by the Mine, and water quality parameters limits established by the DEQ-DWQ. The Mine has committed to adhering to these standards.

Quantity

As described earlier, water that does flow in the CIA area is limited and ephemeral in nature, as illustrated by the number of dry sampling events from 1990 – 2005. However, Water Rights are filed and exist on the limited number of springs and stock ponds in the area. The Mine has made the commitment to monitor springs and ponds for any potential loss of water caused by mining due to subsidence. The Mine has also made the commitment to either monitor specific water rights or replace the amount of water designated in the filed water right.

VI. STATEMENT OF FINDINGS

No evidence of material damage from the actual mining operations has been found. No probability of material damage from actual or anticipated mining operations has been found. The actual and proposed coal mining and relamation operations have been designed to prevent material damage to the hydrologic balance outside the permit area.

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