2.05.5 Post-Mining Land Uses

The pre-mining and adjacent land use is rangeland and wildlife habitat. It is desired to provide final reclamation of the disturbed areas that is self-sustaining and provides habitat suitable for domestic livestock and wildlife.

As a result of concentrating the refuse disposal to as few acres as possible, only minimal impact will occur. The disposal areas will occupy a maximum of approximately 65 acres. Refuse disposal will occupy less than one percent of the total life-of-mine plan area (see Exhibits 50, 51 and 52). Post-mining topography of the affected area is indicated on Map 58 and Map 59. Except within the landslide area (if the upper refuse disposal site is constructed) and the lower refuse disposal site described in Exhibit 51, the reclaimed slopes will be similar to the pre-mining topography or less, if necessary, to assure a 1.3 factor of safety after reclamation. Cut-and-fill terraces are not anticipated nor proposed at this time.

Rangeland and wildlife habitat was selected as the post-mining land use because of the pre-mining conditions in the area. Reclamation at the West Elk Mine will provide grazing for livestock as well as develop cover, food, and nesting areas for wildlife. The surrounding heavily shrubbed areas will provide adequate edge effect to assure a diverse wildlife habitat within a rangeland meadow plant community of the main mine site.

2.05.6 Mitigation of Surface Coal Mining Operation Impacts

Air Pollution Control Plan - 2.05.6(1)

Air quality protection will be provided by the following measures:

Conveyor Systems

All conveyors outside the mine portal are designed to prevent particulate dispersion of coal by wind. That portion of the loadout conveyor over the North Fork of the Gunnison River is totally enclosed to prevent discharge of coal dust to the river. Water sprays, using surfactant if appropriate, have been mounted at key transfer points to minimize dust generation from conveyors, if needed.

Loadout

The loadout uses a telescoping chute to load railroad cars, to help prevent dust generation and eliminate spillage.

Transfer Points

All transfer points between conveyors, screens, crusher, rotary breaker, and silo(s) are designed to control particulate emissions from these sources, if needed.

Fugitive Dust

Water is applied to any active unpaved roadways, parking areas, and refuse disposal area to control dust emissions from these areas, if required, on a seasonal basis.

Open Coal Stockpiles

The stockpiles are compacted and may be sprayed as necessary to eliminate particulate emissions created during coal handling.

Fish and Wildlife Plan - 2.05.6(2)

The baseline wildlife information collected on the property indicates that the mine facilities area is not of prime significance to major wildlife species. The affected area is not known to be critical habitat for big game, except small areas of critical winter range for elk and mule deer along the North Fork and Minnesota Creek. The North Fork corridor also provides winter concentration areas for federally listed (threatened) bald eagles, but no roost sites or other critical habitat features for bald eagles exist in the permit area. Fragmentary and relatively low-quality habitat for federally listed (threatened) Canada lynx is identified in the permit area, but lynx are not known to occur there and at best an occurrence or use would be peripheral to occupied range to the south. No identified critical habitat features exist in the permit area for other raptors, migratory birds, or other threatened or endangered species. Cliffs in the permit area are not known to provide important nesting or roosting habitat for raptors or other cliff-dependent wildlife. Water depletions to the Colorado River Basin, if they occur, could adversely affect populations and downstream critical habitat for four species of federally listed (endangered) Colorado River fish. Water depletions of less than 100 acre-feet per year are considered adequately mitigated by USFWS.

Using the best technology currently available and applying it to the extent reasonably feasible, disturbances and adverse impacts of mining and related operations on fish, wildlife, and related environmental impacts are minimized. Where practicable, enhancement of such resources is achieved. In so doing, MCC will report to the Colorado Division of Wildlife (CDOW) the presence of any threatened or endangered animal or plant species listed or proposed to be listed by the State or Secretary of the Interior; any critical habitat of any threatened or endangered animal or plant species listed or proposed to be listed by the State or Secretary of Interior; or any Bald or Golden Eagle, or nest thereof, of which MCC becomes aware and which was not previously reported to the CDOW. The electric power lines and other transmission facilities used for MCC's underground coal mining operation on the permit area will be designed and constructed to prevent electrocution hazards to large birds.

In compliance with the USFWS's "Windy Gap Process" (a determination of effect of water depletions in the Colorado River Basin on four endangered fish species), MCC has calculated the net depletion of water from the North Fork as a result of West Elk Mine's current and projected operations, including production from the Jumbo Mountain and Box Canyon lease tracts and South of Divide area (Exhibit 67). This calculation is affected by any significant increase in production rates, but not by an increase in the areal extent of coal to be mined. Should the rate of production or other factors affecting the net depletion calculations change, the calculations would be revised.

MCC has taken the following factors into account to protect wildlife on the affected area:

1. Since the area is not a prime wildlife area, it is generally possible to operate and locate roads so as to avoid and minimize impacts on fish and wildlife species.

2. Since no major migration routes have been identified on the permit area, it is not necessary to guide migratory wildlife species by the means of fencing so as to direct their movement

under roadways or other obstructions which might result from construction of the surface facilities.

3. There are no ponds containing toxic-forming materials; however, should such a facility be constructed, the pond will be fenced to exclude wildlife.

4. With regard to bald eagles and Canada lynx, the potential effects of surface-disturbing projects on populations and designated habitats (at the time specific surface disturbing projects are proposed) will be evaluated, and mitigation measures will be applied to avoid adverse impacts to these federally listed species, in compliance with the Endangered Species Act.

5. Aquatic communities existing in the North Fork will be protected by the use of 50-foot wide buffer zones of undisturbed land along stream channels.

6. The use of persistent pesticides is not anticipated.

7. Mountain Coal Company will, to the extent possible, prevent, control, and suppress range, forest, and coal fires that are not approved by CDOW as part of this or any other management plan.

8. Since wildlife habitat is to be the secondary post-mining land use, MCC has selected plant species to be used on reclaimed areas based on the following criteria:

    a. Their proven nutritional value for wildlife
    b. Their use for cover for wildlife species
    c. Their ability to support and enhance wildlife habitat after release of bond

These factors have been discussed in other portions of the permit document. As discussed, the intent of MCC is to distribute the plant species in clusters so as to maximize the benefit to wildlife. This will provide adequate edge effect, cover, and forage benefits for the wildlife species occurring on and adjacent to the site.

Protection of Hydrologic Balance – 2.05.6(3)

The hydrologic balance and probable hydrologic consequences are discussed after the Subsidence Survey, Subsidence Monitoring and Subsidence Control Plan in section 2.05.6. The surface effects of mining on the hydrologic balance in the SOD, Apache Rocks West, the Southern Panels and Sunset Trail Mining areas are anticipated to be minimal. Section 2.05.6 (6) in this document describes at length the anticipated impacts to the ground surface resulting from mining activities in these areas. It is acknowledged throughout this permit that numerous landslides and slumps are present throughout the MCC permit area and these features generally move in response to saturation by precipitation events. Monitoring plans included in 2.05.6 (6) describe how MCC will observe these features for effects due to mining related activities. Protection of the Hydrologic Balance and Probable Hydrologic Consequences are discussed as they relate to the effects of subsidence and follow the Subsidence Section of 2.05.6 (6).

Protection of Public Parks and Historic Places - 2.05.6(4)

Operations at the West Elk Mine are not located near public parks or historic places; therefore, this section does not apply.

Surface Mining Near Underground Mining - 2.05.6 (5)

There are no surface mining operations proposed near the West Elk Mine.

Subsidence Survey, Subsidence Monitoring- and Subsidence Control Plan - 2.05.6 (6) (a-f)

MCC continues its commitment to thoroughly understanding and describing the nature of subsidence that will occur in the West Elk Mine. MCC retained Wright Water Engineers, Inc. (WWE) of Denver, CO several years ago to evaluate subsidence and probable hydrologic consequences. WWE worked closely with Mr. C. Richard Dunrud for many years on this project. Mr. Dunrud was employed by the U.S. Geological Survey (USGS) throughout his career and is a recognized authority on subsidence. Of particular note with respect to the Exhibit 60E document, is the report prepared by Mr. Dunrud entitled, *Some Engineering Factors Controlling Coal Mine Subsidence in Utah and Colorado* (Dunrud 1976). In that report, Mr. Dunrud evaluated subsidence in the Mesaverde Formation at the Somerset Mine, less than two miles from the West Elk Mine.

Working closely with Mr. Dunrud, WWE has adopted the following multi-faceted approach to quantifying subsidence in the permit area:

1. The mined longwall panels have been extensively monitored and WWE has evaluated the relevant data. These data provided the basis for Mr. Dunrud's conceptual model, which is described in the Exhibit 60 series. Exhibit 60 addresses the Apache Rocks and Box Canyon mining areas and Exhibit 60B specifically addresses the South of Divide mining area. Exhibit 60C addresses the subsidence and geologic hazards for the West Flatiron lease tract. Exhibit 60D addresses Geologic Hazard Field Observations for the South of Divide (SOD) mining area. Exhibit 60E addresses the Dry Fork, SOD, Southern Panels, Apache Rocks West and Sunset Trail mining araeasLease.

2. WWE has utilized a computer model to quantify subsidence, and this model has been calibrated using the data collected at West Elk Mine. The model was developed by Dr. Syd Peng and Dr. Yi Luo at West Virginia University and is referred to as the "Comprehensive and Integrated Subsidence Prediction Model (CISPM)."

3. WWE has thoroughly reviewed the literature regarding subsidence and associated hydrologic consequences. We have checked the findings associated with Mr. Dunrud's conceptual model and the CISPM model with findings from case studies as described in the literature, and we have concluded that the results are consistent.

4. Finally, subsidence projections described herein were carefully reviewed by Mr. Dunrud for reasonableness. Mr. Dunrud has visited the West Elk Mine area on many occasions and he is familiar with key factors pertaining to subsidence as they relate to the South of Divide and other active mining areas. Consequently, Mr. Dunrud is well qualified to draw conclusions about the nature of subsidence that is likely to occur.

The extraction of coal from the B and E Seams in the SOD, Apache Rocks West, the Southern Panels and Sunset Trail Mining areas has and will be completed using longwall mining methods. The resulting disequilibrium due to longwall mining may result in surface subsidence, dependent on a number of inter-related factors. As stated by Peng in *Surface Subsidence Engineering* (1992), "When total extraction is used, it produces a large void in the coal seam and disturbs the equilibrium conditions of the surrounding rock strata. The rock strata bend downward while the floor heaves. When the excavated area (gob) expands to a sufficient size, the roof strata will cave. As a result, the overlying strata continue to bend and break until the piles of the fallen rock fragments are sufficiently high to support the overhanging strata. At this time, the overlying strata no longer cave, but bend and rest on the underlying strata. Strata bending in subsidence develop upward until reaching the surface and forming a subsidence basin. The whole overburden strata and the surface subsidence basin will further go through a period of compaction and gradually become stabilized."

The purpose of the Exhibit 60 through 60 E series of documents is to describe on a site-specific basis, and to quantify to the extent feasible, the various subsidence phenomena. These exhibits describe subsidence processes that have been observed from studies above longwall panels mined in the West Elk Mine and from other similar operations and studies. The subsidence information obtained from mining to date in the West Elk Mine has been used to project subsidence processes, amounts, and effects to the SOD, Dry Fork, Southern Panels, Apache Rocks West, and Sunset Trail mining areas within MCC's permit and affected area boundaries. Also included in this section is an inventory of structures and renewable resource lands in the current permit area.The focus of Exhibit 60 was to address subsidence in the Apache Rocks and Box Canyon mining areas, Exhibit 60B and 60D were focused on the South of Divide mining area and Exhibit 60C was on the West Flatiron mining area.

Subsidence Survey – 2.05.6(6)(b)(iii)(A) & (6)(e)

Exhibit 60E documents subsidence processes that have been observed from studies above longwall mining panels in the current West Elk Mine permit area. The subsidence data obtained in the current West Elk Mine area have been used to project subsidence processes, amounts, and effects in the SOD, Dry Fork, Southern Panels, Apache Rocks West, and Sunset Trail mining areas. These data have been used to calibrate the subsidence prediction models in the Exhibit 60 through 60E series.

Inventory of Structures and Renewable Resource Lands - 2.05.6 (6)(a)(i & ii)

In order to ascertain the impacts that subsidence will cause on structures and renewable resource lands, an inventory of these features was conducted. Projected impacts to surface and ground water resources are presented later in Section 2.05.6(3). These water resources are shown on Map 37. MCC's hydrologic monitoring stations are shown on Maps 34, 37 and Map 1 of Exhibit 71. The many trails and U.S. Forest Service roads utilized to access these sites are shown on Maps 67 and 68.

Table 42A, below, shows an inventory of all structures and renewable resource lands that exist in the permit area and adjacent area. Water-bearing bedrock stratigraphic units are not considered to be aquifers in the permit and adjacent area (Section 2.04.7(1)); therefore, renewable resource lands are not associated with these units. More site-specific discussion of various areas follows the table.

Table 42A - Inventory of Structures & Renewable Resource Lands in the Permit & Adjacent Areas		
Structure or Renewable Resource Land	**Location**	**Description**
Deep Creek Ditch Flume (raised culvert)	Adjacent to east side of permit area	
Deep Creek Ditch	Dry Fork Lease Area	Maps 66 and 67.
Minnesota Creek Ditch Rider's Cabin	Dry Fork Basin	Single-story, wood-framed building built in 1950s, 24 ft. 4 in. by 16 ft. 4 in.
Lower Cow Camp	Dry Fork Basin	Cabin and corrals. Seasonal living quarters for range cowboy. USFS-owned, leased to Dry Fork Cattle Pool. (Exhibits 60D and 73, Maps 66, 67, and 68). Wood-framed building on concrete slab, completed by landowner in 1994. Smaller wood-framed building and livestock enclosure, constructed November 1995 (Exhibit 73).
Monument Dam and Minnesota Reservoir	Dry Fork Minnesota Creek	Intermittent, seasonal use (Exhibit 74, Maps 66, 67, and 68).
Cabin	Sylvester Gulch	Deteriorated and collapsed (not usable).
Soil and stone foundations	Sylvester Gulch, overlooks mine portal	
Various abandoned structures	Various locations in permit area (none in West Flat Iron lease tract, COC-67011)	Cultural Resources Reports in Exhibits 10, 10A, 10B, 10C, 10D, and 10E.
State Highway 133	Northern edge of permit boundary	Asphalt-surfaced public highway. Maps 66, 67, and 68.
USFS Water Resources	Throughout permit area	Maps 68 and 73.
USFS Roads - 711 – Dry Fork Rd.; 711.A1 – West Flatiron Rd; 711.A3 – Upper Deep Creek Rd.; 711.2B – Horse Gulch Rd.	Dry Fork, West Flatiron, and Deep Creek	Maps 66, 67, and 68.
Alluvial aquifer of North Fork of the Gunnison River	Adjacent to north side of permit area	Map 66.
Alluvial aquifer of Minnesota Creek	Adjacent to west side of permit area	Map 66.

Man-made surface structures exist on the coal lease area and within the SOD mining area (Exhibit 32B and Map 67). The only known man-made structures which are currently used (intermittent seasonal use) are Monument Dam - Minnesota Reservoir (Exhibit 74) and a cattle camp on the Dry Fork of Minnesota Creek with a wood-framed building on a concrete slab completed by the landowner in October 1994 and a smaller wood-framed building and livestock enclosure constructed in November, 1995 (see Exhibit 73). A deteriorated and collapsed cabin exists in Sylvester Gulch, and the remnants of soil and stone foundations of two buildings exist on a small bench overlooking the mine portal. Other abandoned structures in the permit area, are described in

the Cultural Resources Reports in Exhibits 10, 10A, 10B, 10C, 10D, and 10E. Projected subsidence-related impacts to these "structures" are addressed under the permit section entitled "Effects of Subsidence and Mine-Induced Seismic Action on Man-Made Structures and Renewable Resources".

Description of Possible Subsidence Consequences – 2.05.6(6)(b)(I)

Pre- and Post-mining Land Uses -2.05.6 (6)(b)(i)(A)

As indicated in the Mountain Coal Company Coal Methane Drainage Project EA (February 2002), North Fork Coal EIS (2000), and Environmental Analysis U-94-37 (November 1994), prepared by the U.S. Forest Service (USFS) and U.S. Bureau of Land Management (BLM), in cooperation with the U.S. Office of Surface Mining (OSM) and other jurisdictional agencies, the permit area lands support wildlife use, dispersed recreation, and livestock grazing.

The *Forest Service Amended Land Resource Management Plan* prescribed land use designations of the Box Canyon lease tract, South of Divide permit revision area, and surrounding USFS lands as "5A", "6B," and "9A" which emphasize riparian, wildlife habitat, and livestock grazing, respectively, and may provide recreational opportunities for semi-primitive non-motorized, semi-primitive motorized and roaded natural settings. The Gunnison National Forest prohibits cross-country travel in motorized vehicles.

It is anticipated that little or no impacts to wildlife and domestic livestock uses, and their respective habitat will occur as a consequence of mining-induced subsidence on the permit area. In the unlikely event that subsidence effects adversely impact wildlife or domestic livestock uses associated mitigation measures will focus on returned disturbed areas to a capability and land use(s) which existed prior to mining. These mitigation measures are discussed in detail in Section 2.05.6(6)(f)(iv)(A-D) – Detailed Description of Mitigating Measures.

Effects of Mining on Surficial Geologic Features

The most current evaluations of subsidence impacts can be found in the quarterly subsidence monitoring reports each year. In past years, when evaluating the effects of mining in the permit revision area, the present land use, the post-mining land use and the effects of previous mining in the area were considered. Present land uses primarily include wildlife habitat, recreational hunting, and livestock grazing. Post-mining land uses will be essentially the same.

Given the long and extensive history of mining in the area, it is surprising the small number of subsidence related features that have been identified. It cannot be proved that these represent the only cracks associated with the mine, but given the regular survey activity, inspection of the subsidence profiles, and seasonal landowner, hunter, and U.S. Forest Service (USFS) personnel activity, additional cracks would have been noted if they existed. This lack of evidence of surface cracking would lend strong validation to the premise that longwall mining has had minimal surface impacts at West Elk Mine.

Landslides

The most current evaluations of subsidence impacts can be found in the quarterly subsidence monitoring reports each year. In past years, it could be expected that the changes in stress and strain

of the near-surface strata and possible near-surface fractures associated with the predicted subsidence could reactivate or initiate landslides. Mr. Dunrud observed that many of the existing landslides, including the landslides north and south of Minnesota Reservoir became unstable and moved during the period of high precipitation in the mid 1980s. The landslides on the southeast side of West Flatiron and on the west side of Deep Creek in the Apache Rocks area appear to have been unaffected by longwall mining beneath the areas. It therefore appears apparent that wet seasons affect landslides more than does longwall mining. During very wet periods, however, landslides that are already unstable may locally be triggered by mine subsidence. The landslides outside the projected longwall mining subsidence effects (i.e., 19 degree angle of draw) by more than 600 feet as described in Exhibit 60C, 60D and 60E.The following are known locations within the present permit area, the South of Divide and Dry Fork mining areas where the reactivation of a landslide could occur as a result of future mining:

South of Divide mining area:

An extensive landslide located south of Minnesota Reservoir above the northern part of projected Panel E9 in the NW¼ of Section 32.

Dry Fork mining area:

There are three slides identified on the Deep Creek Ditch in Section 2, of Township 14 South, Range 90 West, 6th P.M., one that warrants concern, this slide is located above the bleeder entries along the south side of Panel E 6 the other two land slides are outside the influence of mining. The slide will be monitored both visually and by survey methods.

A discussion regarding the monitoring plans for the landslide located on the south abutment of the Monument Dam are included in Section 2.05.6 (6)(e)(i)(D) - Detailed Description of Predicted Subsidence Phenomena, Subsection "Effects Of Subsidence And Mine-Induced Seismic Activity On Man-Made Structures And Renewable Resources", Monument Dam - Minnesota Reservoir. A discussion concerning the preventative measures to be employed to protect Monument Dam from mining induced impacts is contained in Section 2.05.6(6)(f)(iv)(A-D) - Detailed Description of Mitigating Measures.

Rockfall

The most current evaluations of subsidence impacts can be found in the quarterly subsidence monitoring reports each year. In past years, as discussed in Section 2.04.6, *Geology Description*, there are exposed rock faces on steep slopes where the potential for rockfall exists within the permit area. Theoretically, mining-induced changes in stress and strain and fracturing could trigger additional rockfall from the many sandstone cliffs.

Predicted Subsidence-Related Phenomena and Material Damage Which Would Occur as a Result of Subsidence - 2.05.6 (6)(b)(i)(B&C)

Predicted subsidence impacts for the mining area have been described in detail in the following section entitled "Subsidence Prediction" 2.05.6 (6)(e)(i). Also refer to the most current versions of Exhibit 60E and 55B. Given the magnitude of the subsidence projected in the above referenced section, the following outlines the material damage which could result as a consequence of the projected subsidence. Structures in the permit area are described in Section 2.05.6 (6)(a)(i & ii).

The discussions in Section 2.05-6(6)(e)(ii)(A-C) and Section 2.05.6(6)(f)(iv)(A-D) include the "worse possible consequence" to these structures, as well as mitigation commitments. There is one building in the South of Divide mining area and one outside the influence of mining in the Dry Fork mining area.

There are a few USFS stock ponds within the SOD, Southern Panels, Dry Fork and Sunset Trail mining areas. The stock pond embankments are not expected to be impacted, however, the ponds will be monitored and any subsidence impacts mitigated by MCC per the USFS agreement letter in Exhibit 19C.

The most significant surface impacts are expected to occur along the precipitous slopes and cliffs immediately north of the Minnesota Reservoir and in those areas within the influence of longwall mining. See the current Exhibit 60E for additional information on longwall panel cover depths and the modeling results to project subsidence at varying mining heights and cover depths.

As discussed in Section 2.05.6(6)(e)(i) *Potential Impacts from Local Seismic Activity*, subsidence could accelerate the naturally-occurring rockfall and landslide propensities that are already evident in the permit area, but this will not constitute a hazard to either people or property nor would this measurably impact the surface or ground water hydrology of the area.

Cracking of the earth along or across the trails or unimproved roads of the coal lease area already naturally occurs, but in the "worse case" could be accelerated by, or additional cracks created by, subsidence. As the trails and roads are unimproved, typically only all-terrain or four-wheel drive vehicles are utilized and rough terrain is expected, so the hazards created by any additional subsidence (rather than natural) cracking would be minimal. MCC will conduct visual inspections of primary public access to the USFS lands on a monthly basis, weather and ground conditions allowing, when these roads could be potentially impacted by undermining. MCC will mitigate all roads that may have been impacted due to subsidence and provide signage, particularly on public roads, warning of potential hazards.

Subsidence Prediction – 2.05.6 (6)(e)(i)

Brief Description of Mining Method - 2.05.6 (6)(e)(i)(A)

Southern Panels, Dry Fork, SOD and Sunset Trail Mining Areas - The longwall mining method was and will continue to be utilized in the Southern Panels, Dry Fork, SOD and Sunset Trail Mining Areas. . Refer to Exhibit 60E for the most current panel designs and subsidence modelling parameters.

Geologic Factors Influencing Subsidence - 2.05.6 (6)(e)(i)(B)

Subsidence is influenced by the local geology in the following ways: geologic structure, strength and behavioral properties of the rocks, stratigraphic sequence, and moisture content. See the Exhibit 60 through 60E series for further discussions on this topic.

Field Recognition of Subsidence and Non-subsidence Features in the West Elk Mine Area

There are four different types of features that have been observed in the West Elk mining area: (1) Subsidence cracks and bulges, (2) Construction cracks, (3) Desiccation cracks, and (4)

Gravity-induced tension cracks. They can be distinguished easily in some areas where, for example, no mining has occurred in that area. In other areas they may be difficult to distinguish, such as in areas that have been mined, but where conditions are also favorable for construction, desiccation, or gravity-induced tension cracks to occur. See the discussions of theses topics in the Exhibit 60 through 60E series.

Subsidence Prediction Based on Local Mining Experience - 2.05.6 (6)(e)(i)(C)

As is discussed in the most current version of Exhibit 60E, much information has been gathered regarding subsidence at West Elk Mine due to local mining of the F Seam (room-and-pillar method) and B and E seams (longwall method). Subsidence monitoring of a grid network was conducted from1985 to 1997, and provided considerable data regarding the effects of varying overburden thicknesses, mining heights, and mining methods on the subsidence network. The grid verified MCC's predicted subsidence, and established when subsidence occurs, where it occurs, and when it is complete. The grid demonstrated that the majority of longwall mining subsidence was seen within the first year after mining, and in most cases subsidence was completed within 12 to 18 months.

Detailed Description of Predicted Subsidence Phenomena – 2.05.6 (6)(e)(i)(D)

As is discussed in the most current version of Exhibit 60E, subsidence, as it relates to mining, is defined as the local downward displacement of the surface and the overburden rock in response to mining under the influence of gravity. General discussions of the various zones defined within the subsidence area; predicted maximum vertical and horizontal displacements, tilt, curvature and horizontal strain; predicted zones of tensile strain related to mine geometry; predicted rates and duration of subsidence; the effects of topography on subsidence; and the predicted angle of draw are summarized in the Exhibit 60 through 60E series.

Angle of Draw

The draw, or limit angle (ϕ, from a vertical reference) in the Somerset area ranges from about 8 to 21 degrees. See Exhibit 60E. The actual E-seam angle-of-draw has been conservatively estimated at 16.3 degrees (see appendix B of the Spring 2010 Subsidence Report.) The angle of draw is measured using the greatest vertical distance between the top of the E-seam at the nearest edge of each longwall panel and the ground surface elevation equal to the point of no discernable subsidence. As such, the conservative approximate limit of the maximum predicted E-seam angle-of-draw is 19 degrees.

Water and Methane

Observations of the north and west flanks of Mt. Gunnison during an October 1996 field trip, revealed numerous talus and rock glacier deposits that occur in the valleys and lower part of this intrusive body. Snow melt and rain can easily infiltrate these deposits, which may eventually enter any permeable rocks, faults, fractures, and joints near the mountain. Coal beds and rocks in the deformed zone around Mt. Gunnison might also contain increased methane where the coal is metamorphosed to a higher rank by the intrusive body. Great quantities of water and methane may therefore be expected as coal is mined closer to Mt. Gunnison.

Effects Of Subsidence And Mine-Induced Seismic Activity On Man-Made Structures And Renewable Resources

Man-made structures and renewable resources in the South of Divide mining area basically consist of 1) A dam and reservoir (Monument Dam - Minnesota Reservoir), 2) stock watering ponds, 3) streams (primarily Dry Fork and the upper part of Lick Creek), 4) roads, and 5) local cabins. Minnesota Reservoir, the ponds, and the Deep Creek Ditch diversion to Dry Fork serve the dual purpose of being both man-made structures and containment structures for the valuable water resources in the area. Based on past subsidence observations in the Jumbo Mountain, Apache Rocks, and Box Canyon mining areas during the last nine years, the following information is considered appropriate for the South of Divide mining area.

Monument Dam - Minnesota Reservoir

Monument Dam - Minnesota Reservoir, which provides storage water primarily for irrigation, is located between two landslides—one beginning at the north shore and the other beginning at the south shore. As explained above, landslide movement on Jumbo Mountain occurred during unusually wet periods before mining began, during mining, and after mining and subsidence was complete. The conclusions were that landslide movement occurs in response to ground saturation and is not noticeably affected by subsidence and seismic activity produced by longwall mining beneath, or near, landslide areas.

The landslides north and south of Minnesota Reservoir occur in surficial material (loose rock, gravel, sand, silt, clay, and soil) and local bedrock outcrops. The author therefore expects that the mining of longwall panel E9 will not noticeably affect the large landslide south of Minnesota Reservoir.

Mining of the longwall mining panels in the South of Divide mining area did not affect Minnesota Reservoir. The reservoir is located outside the area of mining influence, using the most conservative angle of draw. Measured ground subsidence nor seismicity caused by longwall mining affected Monument Dam and Minnesota Reservoir.

Water Resources

Stock Watering Ponds and U.S. Forest Service

The stock watering ponds are typically located in debris flows or colluvium derived from the debris flows (Dunrud 1989). Several stock watering ponds were mapped in the mining areas (for more information see Section 2.2 of Exhibit 71 & 71A). Some of these ponds were also classified as U.S. Forest Service water resources. The ponds in the permit area have been photographed on the ground on an annual basis beginning in 2005. The debris flows consist of a heterogeneous mixture of clay derived from the Wasatch Formation and boulders and gravels derived primarily from the Mount Gunnison intrusive (granodiorites and quartz monzanites). Based on observations made during geologic mapping in the area, these debris flows are even less likely to be affected by longwall mining than the alluvium The debris flows have a very low permeability and, because the clay matrix is armored by the interstitial gravel and boulders, are resistant to erosion (the Deep Creek Ditch locally flows in this material at steep gradients). Based on the above-mentioned observations, no effects are expected when ponds in the South of Divide mining area are undermined. The clay-rich material that lines these ponds is expected to provide a seal against any

subsidence effects. Stock watering ponds conditions will be surveyed, when accessible, before they are within twice the angle of draw. A second survey will be conducted within three months after they are no longer in the angle of draw. Stock ponds will be surveyed assuming climatic and ground conditions allow reasonable and safe access for this and other monitoring.

No impacts to stock watering ponds in the Apache Rocks,Box Canyon West Flatiron, Sylvester Gulch, SOD, Southern Panels, and Sunset Trail mining areas have been noticeably affected to date when longwall mining occurred beneath them.

Streams and Ditches

The primary streams in the Southern Panels and Dry Fork mining areas are Dry Fork of Minnesota Creek, Deer Creek, Poison Creek, and Lick Creek. South Prong Creek is in the Sunset Trail mining area. The primary source of water to Minnesota Reservoir comes from the Deep Creek Ditch, wherein a trans-basin diversion of water from the upper drainage of Deep Creek is transmitted to Dry Fork. The Deep Creek ditch was constructed in debris flows or colluvium and alluvium derived from the debris flow, as described above, this debris flow material is not expected to be impacted by longwall mining.

As is also discussed in the most current versions of Exhibits 55B and 60E, the end of Deep Creek Ditch, where it transitions into Dry Fork, lies above an area that was undermined by panel E5 gate entries. B seam mining may also occur in this area. Annual Hydrology Reports submitted to the CDRMS each year provide monitoring data and note potential impacts from mining. and will also be undermined in the B seam.

Springs, Aquifers, and Ground Water Wells

Map 37 and Exhibits 71 and 71A provide information on the springs located within the mining areas. Most springs likely have sources from local aquifers in surficial material (debris flows, colluvium, and possibly alluvium).

In contrast to surface water containment structures, such as reservoirs, ponds, streams and ditches, springs and aquifers may have water sources that are either in bedrock beneath the blanket of clay-rich surficial material (debris flows, alluvium, and colluvium), or have a source from within the surficial material. Subsidence may affect a spring or aquifer source located in bedrock, whereas effects may or may not be expected where the spring source is within the surficial material. Tension cracks produced in sandstone bedrock during the subsidence process, for example, may divert water to a lower rock layer and therefore change the flow location. However, local aquifers in permeable zones, which are interlayered with clay-rich zones (Wasatch clays) in the surficial deposit, may yield to tensile stresses without cracking. There is no field documentation known to Mr. Dunrud to either support or refute this statement. Annual Hydrology Reports submitted to the CDRMS each year provide monitoring data and note potential impacts from mining.

Roads

No significant effects from mining subsidence are expected on most of the access roads and drill roads in the mining areas. Also, no effects from landslide movements or rockfalls are expected, because the highest rockfall potential is mapped in the high category. Although no cracks are

expected in the soft, pliable alluvium, some cracks are expected to occur on the harder and more highly compacted Dry Fork access road, particularly in the area near the confluence of Deer Creek and Dry Fork.

Roads will be monitored six months before they are within the angle of draw and on a weekly basis while they are within the angle of draw. After the roads are outside the angle of draw, monitoring will continue on a monthly basis for six months. All road monitoring is dependant upon accessibility. Results of the monitoring will be submitted with the semi-annual subsidence reports. The report will include a description of observations, date of observations, and needed repairs, if any.

Buildings

Baseline information on buildings, such as foundations, walls, chimneys, and roofs, were obtained prior to any mining on the Dry Fork Cow Camp in July 2004. A pre-mining survey of the Cow Camp structures was performed Wright Water Engineers and was reported in Exhibit 60D, and another survey was conducted by West Elk Land Surveying in February 2006 and is included in Exhibit 73. No buildings will be impacted in the Dry Fork Lease area (Ditch Rider's Cabin).

Impacts Beneath the Mined Coal Seam

Based on mapping and observations by Mr. Dunrud in the B Seam of the Somerset Mine, impacts to the coal and rocks below the mined coal bed are expected to be limited to about one mining thickness. Impacts to the floors of the mine workings are expected to be limited to the chain pillars, because the floors of the longwall panels are loaded with caved roof rocks and overlying strata before deformation in the floor can occur.

Floor heaving, pillar punching (the pillar punches into the floor and roof rocks), and squeezing (plastic flowage, see Dunrud 1976 for more details) are the only expected deformation in the immediate mine floor, which consists of impure coal, shale, sandstone and claystone. Deformation in the floors of the chain pillars is expected to occur after the longwall panel is mined and the pillars begin to yield.

Possible Subsidence Consequences

Southern Panels, SOD, Apache Rocks West, Dry Fork and Sunset Trail Mining Areas –

Modeled and predicted subsidence impacts for the mining areas has been provided in the Exhibit 60 through 60E series.. Subsidence features observed to date have been reported in MCC's subsidence monitoring reports that have been submitted quarterly to the CDRMS as required.

Potential Impacts from Local Seismic Activity

Earth tremors have been recorded or felt by local residents in the Somerset area since the early 1960s. The tremors commonly are the result of coal mine bumps and rock bursts, which are spontaneous releases of strain energy in highly stressed coal and rock. In the Somerset Mine area before closure, the bumps and rock bursts were common in room-and-pillar mining areas where stresses concentrated within isolated pillars and blocks of coal (called bump blocks). Earth tremors have continued sporadically in the Somerset Mine area since the mine was closed.

Tremors generated by bumps and rock bursts in the Somerset Mine area attain magnitudes that have shaken structures in the West Elk Mine area and have been felt sometimes by West Elk Mine personnel. These local tremors may affect underground workings, landslide or potential rockfall areas, particularly during prolonged periods of increased precipitation. It is noteworthy, however, that the Rulison nuclear shot in 1969, which produced a tremor with a Richter magnitude of 5.2, was many times greater than the magnitudes of any recorded coal bump. To Mr. Dunrud's knowledge, the Rulison nuclear shot did not trigger any known landslides, rockfalls, did not affect the Somerset Mine, neither did it impact reservoirs, ponds, nor streams in the Southern Panels mining area.

In contrast to microseismic effects generated by bumps and rock bursts that are sometimes felt at the surface a mile or more from room-and-pillar mining operations, the initial cave in a longwall panel may well generate the largest seismic event. In some longwall mines which have thick and strong roof rocks, the initial cave may not occur for several hundred feet, and thus, can generate a shock wave through the mine and overburden that can be felt at the surface for considerable distances from the mine. However, the initial observed cave in the West Elk Mine has occurred in 0 to 45 feet from the start of the panel. MCC has experienced no measurable microseismic events at the surface due to initial longwall caving and bumps originating from the mine.

Detailed Description of Damage or Diminution of Reasonable Use Which Could Result from Subsidence Related Phenomena 2.05.6(6)(e)(ii)(A-C)

Based upon the anticipated subsidence phenomena previously described in this section, and the general scarcity of structures and renewable resource lands, MCC and WWE conclude that there will be little, if any, damage or destruction of reasonable use within the MCC permit area.

One structure that exists in the Dry Fork Basin and is known as Lower Cow Camp. This structure is used by the cattle pool as seasonal living quarters for the range cowboy. The cabin is owned by the USFS and leased to the Dry Fork Cattle Pool. This cabin and related corrals were inventoried and are included in Exhibits 60D and 73.

Mining in the B Seam occurred in the vicinity of the building in late 1994. Regular monitoring was conducted and no damage found. As MCC will compensate for, repair or replace this building or any other structure or resource in compliance with CMLRB Rule 4.20.3(2), no material subsidence damage will result, as defined by CMLRB Rule 2.05.6(6)(e)(ii)(A).

The "worst possible consequences" from mining to hydrologic resources, hydrology monitoring stations, and the many trails and unimproved U.S. Forest Service roads could be complete loss of surface water resources to the mine workings, total destruction of the stations and total destruction or blockage of the trails on roads. MCC will repair or replace these items as discussed later in this section.

Subsidence Monitoring Plan - 2.05.6 (6)(b)(ii), (6)(c)(i) and (6)(e)(iii)

A) Subsidence Monitoring

Until 1999, subsidence monitoring at West Elk Mine was accomplished using conventional survey methods of a monument grid. The grid was laid out over the first three B seam longwall

panels mined (panels 1-3NW), and successfully verified MCC's prediction about the amount of subsidence. The grid is shown on Map 29. As subsidence of the three longwall panels was completed and the surveys no longer showed movement, monitoring of the grid was discontinued in 1999. The past monitoring of MCC's subsidence grid established the amount of subsidence that occurs over a longwall panel, when it occurs, where it occurs, and when it is complete; therefore, there is no longer a need for additional grids. Instead, MCC visually inspects the ground over the areas that have been undermined to document any disturbance that may have occurred. MCC also visits new mining areas prior to any subsidence occurrence to document pre-existing conditions, and also visits locations where cracks have previously been documented to verify that the cracks are healing. MCC utilizes traditional survey methods, as necessary, to evaluate any structures of concern. Also, MCC continues to conduct subsidence monitoring observations of the following: roads, inverts of culverts, flumes, stock ponds, and buildings, Monument Dam, and Minnesota Reservoir.

Specific subsidence monitoring measures and plans included the verification of the subsidence angle-of-draw in the SOD and Dry Fork mining areas. The monuments established as part of the baseline survey were resurveyed at least three months after the longwall face had moved past the end of the longitudinal survey line to determine the amount of subsidence that has occurred and the angle of draw of subsidence. A report detailing the angle of draw observed during the aforementioned survey was submitted to the Division with the semi-annual subsidence report. To verify the subsidence angle-of-draw in the SOD mining area, MCC completed a baseline survey of the first E-seam panel, prior to the start of longwall mining, with survey-grade GPS equipment. Based on that survey the actual E-seam angle-of-draw has been conservatively estimated at 16.3 degrees (see appendix B of the Spring 2010 Subsidence Report.) The angle of draw is measured using the greatest vertical distance between the top of the E-seam at the nearest edge of each longwall panel and the ground surface elevation equal to the point of no discernable subsidence. As such, the conservative approximate limit of the maximum predicted E-seam angle-of-draw is 19 degrees.

To document subsidence features, MCC conducts visual surveys, and any necessary traditional surveys, semiannually each year and provides the information in a written subsidence report by the end of September and April each year. A summary of the visual observations and monitoring is provided in first and fourth quarter letter reports to CDRMS and to the USFS. If any mechanical response is detected during these visual inspections that is not consistent with what has been previously observed, MCC will notify CDRMS within ten working days of our observations.

The Spring and Fall reports of the visual surveys will include photographs to document any subsidence features, including cracks, rockfalls, landslides, revegetation, and other relevant features. A map will also be included that identifies the location of the photographer and the aspect of the image for each photograph. An additional map will be prepared that identifies the location and extent of the observed features. MCC will attempt to revisit previously identified subsidence features to note any changes that have occurred since the previous visit. MCC will also attempt to replicate the aspect of the photographs taken previously to document the progression of subsidence and subsequent healing. The discussion of the field observations will in particular address the development and healing of the subsidence features, utilizing the photographic documentation. In addition, MCC will discuss baseline conditions observed in

areas prior to undermining. The report will document how the inspection was conducted, and include such observations as weather and ground conditions.

In addition to performing the visual surveys, aerial or other type photos will be taken prior to beginning mining in an area, periodically during mining, and after mining when subsidence is complete to document landslides, rockfalls, vegetation, etc. over the areas being mined. This documentation will provide a broader, more extensive view from which to associate or assess landslide and other surface activity due to mining.

1)Verification and Accuracy of Predictions

In order to verify and demonstrate the accuracy of subsidence predictions, based on the results of past subsidence observations in prior mining areas, MCC will implement the following procedures to monitor Monument Dam prior to mining. The following procedures will be implemented as soon as permitting allows, in order to account for seasonal precipitation changes.

1. Conduct annual aerial photo surveys of the landslides located north and south of the reservoir, using the July 2004 photos as a baseline reference. Surveys will continue while mining is occurring within *Panels E1 through E9*

2. Install, and measure, survey monuments strategically located on the dam and on the north, south, and east edges of the reservoir to monitor any movement prior to, during, and after mining in the area. During the monument surveys, conduct visual inspections along the monument transects for surface cracks. Monitoring (surveying and inspections) of stations in the Minnesota Reservoir area and across the crest of the Monument Dam will be initiated at least one month prior to mining of Panel E12 and continue for two to three months after mining is complete in the panel. MCC will initially survey the monuments on the dam axis quarterly and then monthly when E-seam longwall mining is occurring within one mile of the dam. The results of the surveys will be submitted in the semi-annual subsidence reports. While mining is occurring within the one mile radius, weekly inspections will be made of the dam for cracks or other potentially damaging features and the inspection reports will be included with the semi-annual subsidence reports. The monuments along the dam and reservoir basin will be resurveyed as soon as possible if a seismic event occurs that exceeds the "threshold event" as described below. If, during the inspections, cracks or other potentially damaging features are noted to be occurring in the reservoir basin or dam structure, CDRMS, the Minnesota Reservoir Company, SEO, USFS and other appropriate agencies will be notified by MCC immediately and, depending on the severity of the damage, mining may cease until a new mine plan can be approved and mitigation performed.

3. Mining of Panel E9 will be from the south to the north. Monitoring (surveying) of stations to the south of the Minnesota Reservoir and across the crest of the Monument Dam will be re-initiated at least one month prior to mining of Panel E9 and continue for two to three months after mining is complete in the panel. MCC will initially survey the monuments on the dam axis quarterly and then monthly when E-seam longwall mining is occurring within one mile of the dam. The results of the surveys will be submitted in the semi-annual subsidence reports. While mining is occurring within the one mile radius,

weekly inspections will be made of the dam for cracks or other potentially damaging features and the inspection reports will be included with the semi-annual subsidence

reports. The monuments along the dam and reservoir basin will be resurveyed as soon as possible if a seismic event occurs that exceeds the "threshold event" as described below. If, during the inspections, cracks or other potentially damaging features are noted to be occurring in the reservoir basin or dam structure, CDRMS, the Minnesota Reservoir Company, SEO, USFS and other appropriate agencies will be notified by MCC immediately and, depending on the severity of the damage, mining may cease until a new mine plan can be approved and mitigation performed.

4. The landslide feature that is located on and is part of the left (south) abutment will be monitored for movement when mining is within the angle of draw. MCC will install survey monuments within the landslide on the hill to the south of the dam and within the toe of the landslide. These monuments will be surveyed monthly, when accessible, during the months of February through July (if accessible) when movement due to high soil moisture content would be expected. The monuments will be surveyed once every three months in the period of August to January (if accessible) when soil moisture content is expected to be lower. If a seismic event equal to or greater than the threshold event for the Monument Dam as described below occurs, the monuments will be inspected for movement. The results of the survey will be submitted to CDRMS in the semi-annual subsidence report. If movement along the landslide appears to potentially damage the dam itself, CDRMS, the Minnesota Reservoir Company, SEO, USFS and other appropriate agencies will be notified by MCC******immediately***.***

2)Frequency and Reporting

Monument Dam will be surveyed and the monuments on the dam axis monthly when E-Seam longwall mining is occurring within one mile of the dam and the information will be reported semi-annually. If mining is occurring outside the one-mile radius of the dam, the dam monuments will be surveyed on an annual basis.

B) Seismic Monitoring

In June of 2005, the mine installed one seismic monitoring station in the axis of the Monument Dam, another in Sylvester Gulch, and two more above B seam longwall panel 24. The purpose of installing these stations was to observe the seismic events actually related to mining longwall panels at the West Elk Mine. Monitoring of the four seismographs commenced in June of 2005, and information developed to characterize seismic response from mining activity in the vicinity of the Monument Dam and Minnesota Reservoir.

Prior to the commencement of longwall mining in either the E-seam E10, E11, and E12 longwall panels, an array of seismic stations to monitor microseismicity generated by subsidence will be created. This array will consist of at least 4 to 5 strategically placed accelerometers and seismometers that will collect seismic data. The accelerometer/seismometer already in place in the area of the Monument Dam will be used as part of this new array. The array will consist of equipment in cooperation with NIOSH or similar to other arrays established by NIOSH in the North Fork Valley to monitor mining induced microseismicity, including those previously

established in Sylvester Gulch and over B seam longwall panel 24. This data will be transmitted to data storage devices and to a central location where the data can be monitored on a real-time basis. The final number, locations and installation of the seismometers and data storage devices will be determined by an expert in the field of collecting and interpreting mining induced seismicity

Monitoring information from the MCC seismic stations and NIOSH and USGS- generated data collected from 1977 through 2005 was used to develop a stability analysis of the Monument Dam by GEI Consultants, Inc of Englewood, Co (Exhibit 72, Material Damage Prevention Measures). This stability analyses indicated the stability safety factor of the Monument Dam at that timewas less than 1.0. In January 2008, MCC completed the reconstruction of Monument Dam increasing the static safety factor of the dam to 1.5 through the implementation of the measures discussed in a subsequent Section 2.05.6(6)(f)(iv)(A-D), Detailed Description of Mitigating Measures. These measures included, among other activities, the construction of a stability berm and buttress to reduce the risk of movement of the dam itself and damage due to movement of the landslide located on the left abutment of the dam. The construction and implementation of these structures and activities will allow the dam to withstand a seismic event of at least magnitude 2.3 (Richter scale) generating a peak ground acceleration (pga) of 0.16 g. As stated in the GEI report, a maximum seismic event and pga anticipated to be generated by mining in the SOD will be M_L 2.3 and 0.06 g, respectively. Barr Engineering evaluated the stability of the newly constructed dam during the Summer of 2008 (see Exhibit 76) and verified that the safety factor of 1.5 and would not be impacted by mining-induced seismicity.

Subsidence Control Plan - 2.05.6 (6)(b)(iii)(B), (6)(d)(i&ii), (6)(e)(iv) & (6)(f)(i-vii)

Description of Mining Methods – 2.05.6 (6)(f)(iv)(A& B)

As discussed in Section 2.05.6(6)(e)(i)(A), *Brief Description of Mining Method*, the longwall mining method is planned for the SOD, Apache Rocks West, Southern Panels and Sunset Trail mining areas. A general east-west panel layout, is planned except for the E-seam longwall panel E9 that will be in a north-south orientation. Although longwall mining may initially induce more caving and fracturing of the roof rocks, it offers the advantages of maximizing resource recovery. The longwall method also causes more uniform subsidence (full extraction of panel) and causes equilibrium conditions to be reached in a shorter period of time (i.e., there is no additional, lingering pillar crushing in panels). See further discussions in the current version of Exhibit 60E.

Although subsidence is primarily a result of the secondary recovery of coal from a longwall coal panel, subsidence type features may occur when developing main entries/roadways under shallow, unconsolidated and saturated cover. Such was the case in October 2020 when developing main entries under South Prong Creek. To avoid similar issues in the future, MCC has performed an analysis of the minimum depth of cover required for development mining in the West Elk Mine to avoid the potential for this type of surface subsidence impacts. MCC will adhere to the recommendations for development mining beneath perennial streams as detailed in Appendix A of Exhibit 60E.

Preventive Measures – 2.05.6(6)(f)(iii)

State-of-the-art longwall mining technology will continue to be utilized for extraction of the B Seam and E Seam coal within the permit area. Although longwall mining may initially induce more caving and fracturing of the roof rocks, as compared to the room-and-pillar method, it offers the advantages of maximizing resource recovery; more complete subsidence; equilibrium conditions occurring in a shorter period of time; more uniform and predictable parameters necessary for the evaluation of probable hydrologic consequences; and in general, fewer and less significant adverse hydrologic impacts than room-and-pillar mining.

A small portion of Deep Creek Ditch may be undermined by E seam and B Seam longwall panels. (As mining approaches the ditch, the pre-mining condition of the ditch will be documented in a pre-subsidence survey. This survey will be added to the permit application in the semi-annual subsidence reports. Before, during and after mining, the amount of the ditch that is subsided will be determined by surveying reflector stations in the ditch, as set forth in Section 2.05.6(6) (c). In addition to the surveying, changes in the ditch caused by subsidence will be detected by visually inspecting the ditch on a weekly basis while active longwall mining is within 1000 feet of the ditch. MCC will repair any mining-caused damage found during the monitoring or during visual inspections, in accordance with the agreement between MCC and the Minnesota Canal and Reservoir Company. If mining activity disrupts flow in the ditch, MCC will apply methods set out in the subsidence mitigation plan or injured parties will be compensated with water resources that are owned by MCC per its adjudicated water augmentation plan.. These water resources are identified in Exhibit 52.

Anticipated Effects – 2.05.6 (6)(f)(iii)(A)

Long-term impacts on the surface are predicted to be minimal above the mined longwall panels. The few surface cracks over the mining panels that may occur are expected to close once the longwall face moves past the surface area of influence. Surface cracks present above the chain or barrier pillars or mine boundaries may remain open where permanent tensile strains remain after mining is completed. However, at least several hundred feet of unfractured rock will typically exist between any mine-induced surface fractures and the upper part of any mine-induced fractures above the caved zone in the mining panels. Therefore, from a practical standpoint, no interconnection between the surface fractures and the mine workings is anticipated. Again, under a worst case scenario, if a surface fracture were to occur concurrently within an area controlled by faults or bedrock lineaments, there could be interconnection between adjacent sandstones. However, even under these conditions, the fractures would most likely not extend through the claystones and shales present in the overburden.

Monument Dam and Minnesota Reservoir are located outside of the angle of mining influence of the nine longwall panels (panels E1 through E9) within the South of Divide mining area (see Map 51). The northwest corner of panel E9, which is nearest to the reservoir, is located several hundred feet away. The angle of draw to this nearest area of mining is 69º. The angle is much greater than the maximum of 19º projected for the SOD mining area. This means that Minnesota Reservoir will not be affected by longwall mining in projected panel E9.

Reduction Measures (Underground) - 2.05.6 (6)(f)(iii)(B)(I-III)

Underground measures that may be taken to reduce surface strains above the chain pillars could include, but are not limited to; (1) Designing the pillars to yield and crush after mining (thus minimizing humps in the subsidence profile), and/or (2) Planning a rapid and uniform mining rate. Any plans in order to reduce chain pillar dimensions to reduce subsidence impacts must, of course, be balanced with health and safety conditions in the mine. Plans for a rapid and uniform mining rate are affected by market demands (or lack there of) for constant, high volumes of coal. MCC will notify CDRMS if plans that may affect the subsidence profile are implemented.

As discussed in previously in section 2.05.6, Wright Water Engineers has completed detailed subsidence modelling and evaluations from longwall mining in the SOD, Southern Panels, Apache Rocks West, Dry Fork and Sunset Trail mining areas and provided recommendations for longwall mining heights and cover depths. MCC will adhere those recommendations as detailed in Exhibit 60E.

Preventive Measures (Surface) - 2.05.6 (6)(f)(iii)(C)(I-V)

Surface measures that may be taken to reduce or prevent damage to applicable structures or water resources could include, but are not limited to; (1) Engineering, design, and construction of structures to withstand varying ground stresses, (2) Re-locating structures or ponds to mid-panel or outside the angle of mining influence, and/or (3) Enhancing or reinforcing water resource production or delivery systems (e.g., pipeline), respectively.

A total of five reflector stations will be placed in the ditch at the transition of Deep Creek Ditch to the Dry Fork Basin. They will be surveyed on the following schedule.

1) Pre-mining – At least one baseline survey will be conducted within the 30-day period before the longwall mining under the ditch starts. If the ditch will be undermined during winter conditions this survey may be done at the end of the period of seasonal access prior to the expected start of mining in panel E5.
2) During Mining – Monthly surveying will be conducted while the longwall face is within 1000 feet of being underneath the ditch (if seasonal access permits).Post-mining – Monthly surveys will be completed for the first two months after each longwall face has proceeded to more than 1000 feet from being underneath the ditch (or only one final survey will be done if seasonal access is unavailable during the 30-day period immediately following undermining of the ditch). Data from the surveys will be reported in the semi-annual subsidence report.

Detailed Description of Mitigating Measures – 2.05.6(6)(f)(iv)(A-D)

Impacts to structures (buildings) and ground and surface water resources will be monitored and mitigated, if necessary, as presented later in this section, in Sections 2.04.7(3) and 2.05.6(6)(e)(ii)(A-C), in Exhibit 19C, and in Exhibit 52. Monitoring personnel (e.g. hydrology, subsidence survey) are regularly in the field throughout the permit area and note observations of cracking, landslides, rockfalls, or other natural and/or subsidence hazards or impacts. Roads will be repaired through regrading or filling if adversely affected by subsidence. Should cracking or blockage of a trail or an unimproved road that is open for use (i.e. is not blocked, reclaimed, or

otherwise "closed" from use) occur from subsidence, the damage would be repaired (i.e. fill crack, buttress, install drains, or remove blockage etc.) or the area barricaded or blocked to prevent access. MCC will also place an informational sign along the primary public access to the USFS lands for mining and/or natural hazards awareness.

MCC recognizes that proposed mitigation to surface waters, roads, vegetation, wetlands, etc. on Forest System (USFS) lands will be accomplished in accordance with the USFS stipulations specified in MCC's coal leases. These lease documents contain the stipulations agreed to by MCC with the Forest regarding, in part, the mitigation requirements for mining related impacts within the Forest.

MCC will repair impacts of subsidence on surface drainages on private or USFS lands, including revegetation as necessary to control erosion. For any impacts occurring on USFS lands, MCC will consult the USFS immediately to determine; a) the level of mitigation needed, and b) the feasibility of employing the proposed mitigations. Should these impacts occur on USFS lands, MCC, in conjunction with the USFS, will evaluate the impacts on a case by case basis to assess the most appropriate mitigation. MCC will seek Forest Service approval for any mitigation(s) on USFS lands.

If stream channels are impacted by subsidence, efforts will be made to repair the channel to ensure that flow continues in the channel. If cracking, headcutting or significant channel incising occurs, MCC will evaluate the channel morphology and prepare a mitigation plan. Mitigation may require the sealing of fractures, if they occur in the stream channel, with bentonite/soil mixes to stop water loss, excavating ridges or high areas created by subsidence within the stream channel that impede flow, and redirecting flow, if necessary, back into the original channel if diverted due to subsidence. Temporary culverts in ditches and streams may also be used to bridge surface cracks while the best method to seal the fractures is determined. A 0.6 acre area of subsidence on South Prong Creek at the confluence with the North Fork of South Prong Creek (see Map 34) on MCC property was repaired 2020 by backfilling with nearby native soils, injecting the backfill with cementitious grout and sealing the area with a bentonite cap.

If stream courses are blocked by mining induced slide movement, MCC will use hand tools or appropriate heavy equipment to reopen affected channels. The necessary permits to perform such work will be obtained prior to performing mitigation. Other mitigation may include the placement of straw bale dikes or silt fences below slide areas to reduce sediment loading. If ponding occurs due to rockfalls or slides within the stream channels and is not determined to create a hazard to the public, no additional mitigation is proposed. However, if the ponding creates hazardous conditions, the structure creating the ponding may be breached or bypass channel(s) built. The mitigation work will only be accomplished after the appropriate permits are obtained.

If ponding occurs within the stream channels due to differential subsidence and is not determined to create a hazard to the public, no additional mitigation is proposed. However, if the ponding creates hazardous conditions, the structure creating the ponding may be breached or bypass channel(s) built. The mitigation work will only be accomplished after the appropriate permits are obtained.

If subsidence of existing wetlands raises the water table to a point where the wetlands are in danger of destruction, the CDRMS and Forest will be notified and appropriate actions taken. These actions may include excavating the portion of the channel that has created the damming effect on the wetlands. No action may be appropriate where the ponding would result in an overall increase in wetlands and creation of habitat that would benefit waterfowl and other wildlife.

If subsidence in the area of wetlands creates a change in the gradient that would result in a lowering of wetland water table, modifications to the stream channel to stabilize the water table may be necessary. The mitigation efforts may include the construction of rock dams or weirs that would act as impediments to stream flow and result in the re-establishment of the wetland water table levels. The Best Currently Available Technology will be used to restore the water levels of the wetlands if necessary and only implemented after obtaining approval(s).

Additional mitigation of mining impacts may be necessary if loss or diversion of flow or a significant change in the stream profile will significantly impact vegetation. Efforts will be made to re-establish riparian vegetation in areas negatively impacted by changes in flow locations. These re-establishment efforts may include, but not be limited to, planting of new seedlings or reseeding with appropriate species. The appropriate permits and approvals of plant or seed mixes will be obtained prior to performing mitigation activities.

It is anticipated that little or no impacts to wildlife and domestic livestock uses, and their respective habitat will occur as a consequence of mining-induced subsidence within the permit area. In the unlikely event that subsidence effects adversely impact wildlife or domestic livestock uses associated mitigation measures will focus on returned disturbed areas to a capability and land use(s) which existed prior to mining. These mitigation measures may include, but not be limited to, repairs of surface cracks that are deemed dangerous to humans, wildlife, or livestock. The repairs of the cracks may include backfilling with available native soils, gravels, concrete block, etc. Livestock fences damaged by mining related activities will be repaired as soon as possible.

In 2007, MCC worked with the Minnesota Ditch and Reservoir Company to obtain the appropriate permits and approvals, and implemented a preventative measures construction project to modify and improve the Monument Dam. These dam modifications (completed in January 2008) were consistent with the reservoir company's existing Forest-issued Special-Use Permit. The objective of this project was to prevent damage to the dam/reservoir from the potential of mining-induced microseismicity, strengthen the dam against damage due to naturally occurring seismicity, and control damage due to past and future periodic movement of the landslide located on the left (south) abutment of the dam. Exhibit 72, Prevention Measures, contains the general design of the measures implemented that now allow the dam to reach a static safety factor of 1.5 and safely withstand any mine-induced microseismic event. The plans included the construction on the downstream face of the dam of a sand chimney drain covered by stability berm. Additionally, a buttress constructed of erosion resistant fill was placed at the toe of the dam. The purpose of the berm and buttress is to increase the stability of the dam fill itself and to impede further movement of the landslide located in the left abutment. Other preventative measures to increase dam and landslide stability included the slip-lining of the existing outlet conduit with HDPE pipe to eliminate the possibility of further damage to the existing cast iron

pipe, replacement of the inlet structure to outlet conduit to eliminate leakage around the existing structure, and construction of dewatering trench to further stabilize a portion of the landslide.

MCC in addressing 2.05.6(6)(f)(iv)(A-D), will complete preventative measures on Monument Dam (Exhibit 76) and may do one or more of the following: replace, repair, and otherwise restore structures downstream or will purchase insurance policies addressing downstream damage and will be in effect at the time of longwall mining, should catastrophic failure of the dam occur as a result of mine-induced impacts.

Detailed Description of Measures to Determine Degree of Damage – 2.05.6 (6)(f)(v)(A & B)

As discussed previously, all structures and renewable resources in the permit area have been located, inventoried and/or mapped (see Maps 34, 37, 67, 68, and Exhibits 10, 10A, 10B, 10C, 10D, 10E, 60B, 60E, 72, 73, and 74, as part of the baseline analysis. The location of past, current and planned mine workings is shown on Maps 50, 51, and 52. The subsidence monitoring program is discussed in Section 2.05.6(6)(c)(i)(A-C), and monitoring of the only building undermined is discussed in Section 2.05.6(6)(e)(ii)(A-C). This baseline analysis establishes the status of these features prior to mining. Departures from this baseline resulting from mining impacts will be evaluated and mitigated in accordance with the regulations.

Schedule of Submittal of Detailed Plan of Underground Working – 2.05.6(6)(f)(v)(A&B)

The F Seam workings in West Elk Mine are depicted on Map 50. MCC's B Seam workings and mine plans are shown on Map 52. E Seam workings and mine plans are shown on Map 51. Longwall panels will continue to be developed and recovered as described earlier in this section.

Pages 2.05-124 through 2.05-173

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