Fall 2021 Subsidence and Geologic Field Observations

Southern Panels and Sunset Trail Mining Areas

PREPARED FOR:
Mountain Coal Company, LLC
West Elk Mine
P.O. Box 591
Somerset, CO 81434

PREPARED BY:
Gary D. Witt, P.G., Hydrogeologist/Geological Engineer
Jonathan M. Kelly, P.E., Project Manager
Wright Water Engineers, Inc.

Wright Water Engineers, Inc.

March 2022

831-032.912

Wright Water Engineers, Inc.
2490 West 26th Ave., Suite 100A
Denver, Colorado 80211
(303) 480-1700 TEL
(303) 480-1020 FAX

www.wrightwater.com
e-mail: gwitt@wrightwater.com

March 17, 2022

Mr. Leigh Simmons
Colorado Division of Reclamation, Mining and Safety
1313 Sherman St., Rm. 215
Denver, CO 80203

Re: Fall 2021 Subsidence Monitoring Report Preparation – Mountain Coal Company, LLC.

Dear Mr. Simmons,

The following report entitled *Fall 2021 Subsidence and Geologic Field Observations – Southern Panels and Sunset Trail Mining Areas*, was prepared by Gary D. Witt (a licensed professional geologist) under the supervision of Jonathan M. Kelly (a licensed professional engineer). Both individuals are employees of Wright Water Engineers, Inc.

Sincerely,

WRIGHT WATER ENGINEERS, INC.

By _____
Gary D. Witt, P.G., CPG
Hydrogeologist/Geological Engineer

By _____
Jonathan M. Kelly, P.E.
Vice President/Project Manager

Z:\Project Files\72-99\831-032\831-032.912\Engineering\Fall 2021\Report\Covers, Dividers and Signature Page\signaturepage.doc

Fall 2021 Subsidence and Geologic Field Observations

Southern Panels and Sunset Trail Mining Areas

PREPARED FOR:
Mountain Coal Company, LLC
West Elk Mine
P.O. Box 591
Somerset, CO 81434

PREPARED BY:
Gary D. Witt, P.G., CPG
Sr. Hydrogeologist/Geological Engineer
Jonathan M. Kelly, P.E.
Project Manager
Wright Water Engineers, Inc.

March 2022
831-032.912

TABLE OF CONTENTS

MAPS

APPENDICES

FALL 2021 SUBSIDENCE AND GEOLOGIC FIELD OBSERVATIONS SOUTHERN PANELS AND SUNSET TRAIL MINING AREAS[1]

1.0 BACKGROUND

This subsidence report is the second of two detailed documents on this subject to be generated based on 2021 calendar year observations. These reports of subsidence-related observations associated with the West Elk Mine have occurred annually between 1996 and 2006, and biannually since spring 2007. In accordance with Mountain Coal Company, LLC's (MCC) Colorado Division of Reclamation, Mining and Safety (CDRMS) permit, these subsidence reports are to be submitted by April 30 (for preceding fall monitoring) and September 30 (for preceding spring monitoring) of each year.

Prior field observations and experience in the West Elk Mine area over the last twenty-six years[2] (1996 to 2021 inclusive) indicate that subsidence-related features (cracks and bulges) are most visible on roads, well pads, and trails, where the ground is compact and free of brush. These areas have been, and will continue to be, the focus of the biannual observations. Other subsidence features such as rockfalls and landslides are generally observable from overview locations along roads or on well pads and have been, and will continue to be, noted when they occur.

Fall 2021 subsidence observations were performed on October 3, 2021, in the Southern Panels Mining Area with specific focus on the last two mined E-seam Longwall Panel (E7 and E8) and in the Sunset Trail Mining Area relative to the first two E-seam Longwall Panels (SS1 and SS2). Traverse names used in the previous reports may not coincide with those used in this report. Observations associated with E-seam longwall mining of Panels E1 through E7 (mined and

[1] The Southern Panels Mining Area includes the E-seam Longwall Panels E1 through E8 (originally planned through E9) included in the South of Divide Mining Area, some of which were included in the Dry Fork Mining Area. The Southern Panels Mining Area also includes planned B-seam Longwall Panels B26 through B29 that underlie E-seam Longwall Panels E1 through E5. The term Southern Panels Mining Area will be used throughout this report to identify what was formerly referred to as the South of Divide and Dry Fork Mining Areas. The Sunset Trail Mining Area represents four panels (SS1 through SS4) located to the south of E-seam Longwall Panel E8 of the Southern Panels Mining Area.

[2] Annual subsidence and geologic hazard reports are maintained at Mountain Coal Company, LLC, and at the Colorado Division of Reclamation, Mining and Safety, and are exhibits to the permit document (Exhibits 60, 60A, 60B, 60C, 60D, and 60E).

subsided more than two years previous) can be found in earlier reports. Observations of the Apache Rocks and Box Canyon B-seam Mining Areas are covered in reports prior to 2013.

During the fall 2021 field visit, accessible areas within the Southern Panels and Sunset Trail Mining Areas were visited, examined, and photographed to document subsidence-related features observed since the last field visit and to record newly observed features for future reference (see Maps 1 and 2). Field observations were made from a four-wheel drive vehicle and by foot as needed.

Thirteen photographic observation points with number designations were established and used starting in 2007 to view and assess changes that may occur as a result of mining. In 2016, all references to number designations for these locations were dropped. These historical photographic observation points are now checked only occasionally to assess substantial changes (i.e., no rockfalls or landslides). However, repeated visits and photographic documentation over several site visits are commonly performed once a subsidence feature is observed to track either further exacerbation of the feature or, more typically, ongoing weathering and disappearance.

2.0 GENERAL SUBSIDENCE OBSERVATION AND REPORTING

On October 3, 2021, Wright Water Engineers, Inc. (WWE) observed surface subsidence and geologic field conditions of the Southern Panels and Sunset Trail Mining Areas (consistent with current Exhibit 60E) for MCC relative to their coal mining activities. Mining in the area is performed below the surface within the West Elk Mine using longwall mining methods. Similar surface observations have been made annually since 1996 and semi-annually since 2007 to assess potential longwall mining effects on the environment.

Based on field observations from 1996 to fall 2021, the effects of longwall mining above the West Elk Mine have been less than initially projected as reported in Exhibit 60 (Dunrud et al., 1998 rev.) and 60E (WWE, 2012). Rockfalls and/or landslides have generally been observed only sporadically in the Box Canyon Mining Area since 2006 where the steep, upper reaches of Sylvester Gulch and Box Canyon abut the large geographic feature known as West Flatiron. In the flatter and more rounded topography of the Apache Rocks, Southern Panels, and Sunset Trail Mining Areas, the rockfall and landslide potential is much smaller. However, subsidence-related tension cracks have occurred in these mining areas, particularly above the active longwall mining face.

E-seam longwall mining in the Southern Panels Mining Area was initiated on Panel E1 in December 2008 beginning at the east end and progressing westward. All mining in the Southern Panels Mining Area has been planned to progress from the east to west across the panels. As of 2020, mining was complete in E-seam Longwall Panels E1 through E8. Mining of the E-seam Longwall Panel SS1 in the Sunset Trail Mining Area was initiated in January 2020 and was 100% complete at the time of WWE's fall 2021 field visit. E-seam Longwall Panel SS2 was initiated in June 2021 and was approximately 33% complete at the time of the fall 2021 field visit.

Beginning with the Spring 2011 Subsidence Report, an effort was made to reduce the size of the semi-annual subsidence reports by eliminating much of the regularly included background and historical information (e.g., subsidence projections). For this reason, specific details associated with subsidence projections and field recognition of subsidence and non-subsidence features were eliminated. Since that time, readers have been directed to Sections 1.0 and 2.0, respectively, of the

Spring 2011 Subsidence Report and to Exhibits 60 and 60E of the West Elk Mine permit for this information.

Also, in keeping with the goal of reducing document size, the reports since 2011 have focused on the identification and discussion of those observations that reflect an obvious change in the conditions overlying the active portion of the mine and on documenting baseline conditions in areas that have yet to be mined. For this reason, observations from our fall 2021 field visit were focused on areas above mined E-seam Longwall Panel E7 and E8 in the Southern Panels Mining Area and on E-seam Longwall Panel SS1 and SS2 of the Sunset Trail Mining Area.

Readers should note that observations are discussed relative to traverses along segments of drill roads providing access to drilling pads containing mine ventilation boreholes (MVBs). Given the dynamic nature of the mining activities (i.e., adding and reclaiming of road segments and MVB pads), future naming of traverses will likely vary from report to report. Efforts will be made, as practical, to keep traverse names the same. Specific nomenclature for observed features will be regularly represented on Map 1 of each report.

3.0 SUBSIDENCE MONITORING

MCC has been collecting data from monitoring locations near Minnesota Reservoir and Monument Dam, as well as numerous locations within the mining areas for many years. Ongoing monitoring by MCC personnel includes the U.S. Forest Service (USFS) roads and stock ponds, as well as the Monument Dam and Minnesota Reservoir area. Inspection forms and survey data for these areas are provided in Appendices A and B, respectively. Note that the term "displacement," as used in Appendix B, is the difference in the measurements recorded in the last two surveys. Historically, MCC has provided an aerial photo of Monument Dam and Minnesota Reservoir (Appendix C) every year, however due to Monument Dam not being within the permitted 1-mile radius of longwall mining activities no photo was taken in 2021. In addition, MCC monitors USFS water resources in the vicinity of mining and generates an annual report that is included as Appendix D. Included in Appendix E of this report is a map, entitled *E-Seam Projected Operations*, that presents the extent of the mined E-seam longwall panels within the " Maximum Projected Areal Extent of Potential Mineable E-seam" as of the date of the map. Data and discussions associated with ongoing MCC monitoring are provided by MCC and included in this WWE report for convenience.

3.1 USFS Roads and Stock Pond Monitoring

Observations by MCC personnel of the USFS roads and stock ponds in the vicinity of active mining activities have occurred for many years. Inspection forms from observations conducted during 2021 are included with this report in Appendix A.

3.2 Monument Dam/Minnesota Reservoir Monitoring

As described in previous subsidence reports, MCC has conducted monitoring of the Monument Dam and strategic locations around Minnesota Reservoir since 2006. Currently, MCC has monitoring and reporting responsibilities for the land survey stations. Data collected from various monitoring locations on the Monument Dam (including Dam Inspection Forms) during 2021 are provided in Appendix B.

Quarterly land surveys of the monuments (monthly when mining is within one mile of the dam) were completed. A summary of both average height and longitudinal displacement data obtained from spring 2021 to fall 2021 is provided in Table 1 of Appendix B.

3.3 Monument Dam/Minnesota Reservoir Aerial Photograph Comparison

Each year, MCC performs an annual aerial photographic survey of the landslides located north and south of Minnesota Reservoir. Annual comparisons have been performed each year since 2004, which are included in Appendix C of the fall report using the July 2004 photograph as a baseline reference. As stated earlier, MCC did not photograph Monument Dam and Minnesota Reservoir in 2021 due to active longwall mining not being within a one-mile radius of Monument Dam.

As a place holder, Map C-1 (July 2004) and C-14 (June 2020) are included with this report. Maps C-2 (September 2008), C-3 (June 2009), C-4 (May 2010), C-5 (May 2011), C-6 (June 2012), C-7 (May 2013), C-8, (June 2014), C-9 (June 2015), C-10 (June 2016), C-11 (May 2017), C-12 (May 2018), and C-13 (November 2019) are not included herein but can be found in the previous fall reports.

3.4 U.S. Forest Service Water Resources Survey

MCC is required, as part of its permit, to monitor USFS water resources (i.e., reservoirs and stock ponds). Appendix D of this report is the 2021 Water Resources Project Survey Report generated for this purpose.

3.5 Mineable Extent Map

Also included with this report is a map entitled *E-Seam Projected Operations* (Appendix E) which presents the extent of the mined E-seam longwall panels within the "Maximum Projected Areal Extent of Potential Mineable E-seam" as of the date of the map.

4.0 FALL 2021 SUBSIDENCE OBSERVATIONS

During WWE's fall 2021 field visit, pre-existing subsidence-related tension cracks were observed at various locations along the established traverses above mined E-seam longwall panels in both the Southern Panels and Sunset Trail Mining Area as accessed by USFS Road 711 (Dry Fork Road) and on MVB pads, particularly where they exist above current mining activities. The most notable subsidence features included continued observation of cracks in the road along Traverse C-C' south of MVB E7-12 above mined E-seam Longwall Panel E7 and north of MVB E6-14 above mined E-seam Longwall Panel E6. Subsidence features previously observed along Traverse G-G' over mined E-seam Longwall Panel SS1 were no longer visible or have been lost due to reclamation. No new subsidence-related features were noted during the fall 2021 field visit.

It should also be noted that reclamation had occurred along Traverse G-G' west of MVB SS1-6, requiring Traverse G-G' to be accessed by foot. The previously-observed subsidence features on the road and on the MVB SS1-7 pad could no longer be located due to the reclamation activities. In addition, Traverse H-H′ also required foot access as it was behind a locked gate to which WWE had no key. Reclamation had occurred prior to our site visit along the access road west of the easternmost of the two prepared, but unused, MVB pads. Based on mapping provided by MCC, the active longwall face was located between the two unused MVB pads at the time of our fall 2021 field visit.

The subsidence features observed and discussed in the most recent subsidence reports were revisited and most were noticeably weathered and less discernible. No subsidence-related features were observed in alluvium, even above active longwall mining activities.

The remainder of this report provides a detailed discussion of new or recent observations associated with Traverses A-A' through I-I' (see Maps 1 and 2) as observed during the fall 2021 field visit. Details associated with these observations can be found in Sections 4.1 through 4.9 of this report. Map 1 shows the outline of E-seam mine workings along with surface topography and other surface features, including the named traverses. Map 2 shows the same area and detail as Map 1 (minus traverses) along with recently active, or potentially active, landslide and rockfall areas as delineated from aerial photo research and field observations. Also on Map 1, note that a

designation such as E6-1/2/3 indicates one MVB pad containing three drill holes. The surface and termination points of each drill hole are shown by small and large filled green circles, respectively, that are connected by green lines.

Some of the numerous photographs obtained during the fall 2021 field visit have been included as figures in the following text. Where these images have notable differences from photographs obtained from previous visits, the older image has been included for comparison purposes. To reduce the overall size of this document, narrative text and photographs are excluded for traverses where no noticeable change was observed.

4.1 Traverse A-A'

This traverse overlies portions of mined E-seam Longwall Panels E1 through E6. Traverse A-A' originates just south of Monument Dam (and Minnesota Reservoir) and proceeds in a southeasterly direction along Dry Fork Road a distance of approximately three miles. The western end of this traverse is adjacent to Minnesota Reservoir and outside the proposed E-seam longwall mining influences. The eastern end of this traverse is adjacent to the upper flume on the Dry Fork of Minnesota Creek.

Traverse A-A' is included in this report to provide context for other traverses that originate along this path and continue southward across the Southern Panels and Sunset Trail Mining Areas (see Maps 1 and 2).

No subsidence-related features were observed along this traverse during our fall 2021 field visit.

4.2 Traverse B-B'

Traverse B-B′ begins where the Deer Creek drainage meets the Dry Fork Road (Traverse A-A′). It continues southward up the Deer Creek drainage, past a gate located near two manufactured stock watering troughs (fed by a nearby spring), to an intersection with another road located between the E-South Mains and unmined E-seam Longwall Panel E14, a distance of approximately one and a half miles (see Map 1). Two additional stock ponds (P74 and P93) with earthen embankments are located lower in the drainage. Both of these ponds are also fed by nearby springs.

This traverse is mostly located between the E-South Mains and the western ends of mined E-seam Longwall Panels E3, E4, E5, E6, and E7. The termination of this traverse (B′) is the starting point for Traverse I-I′.

No subsidence-related features were observed along this traverse during the fall 2021 field visit.

4.3 Traverse C-C'

Traverse C-C′ originates in the Deer Creek drainage adjacent to the lower stock pond (P74) and proceeds southward (after initially heading north and then east) over mined E-seam Longwall Panels E2, E3, E4, E5, E6, and E7 (see Map 1). E-seam overburden depths along this traverse vary from a low of 450 feet in the Deer Creek drainage to a high of approximately 900 feet over mined E-seam Longwall Panels E4 and E5.

Numerous MVB pads have been historically accessible from this traverse including E3-6, E3-12, E3-17.5, E3-21, E3-25, E4-15, E4-16, E4-17, E4-18, E5-17, and E5-18 over mined E-seam Longwall Panels E3 through E5. Each of these pads has now been reclaimed.

In 2016 and again in 2017, this traverse was extended southward across what is now mined E-seam Longwall Panel E6 and E7 to access MVB pads E6-13, E6-14, and E7-12. The MVB on pad E6-13 has now been plugged and the access road and pad have been reclaimed. MVB pads E6-14 and E7-12 remain.

During the fall 2018 field visit, a series of parallel subsidence cracks was observed in the road north of the MVB E7-12 pad. These cracks have continued to heal and seal to the point that they are difficult to identify. Parallel subsidence cracks with a N60°W orientation were also observed during the fall 2018 field visit along the road south of the E7-12 MVB pad. These subsidence features have also healed and sealed over time but are still distinguishable. Observations from our fall 2021 visit to this location are provided below as Location 1.

Lastly, a subsidence crack with an elevation offset was observed during the fall 2019 field visit on the road leading to MVB E6-14 about 1,000 feet south of the pad. Details associated with our fall 2021 visit to this location are provided below as Location 2.

4.3.1 Location 1

Two parallel subsidence cracks were observed approximately 300 feet south of the E7-12 MVB pad during WWE's fall 2018 field work (Figure 1). These cracks had a N60°W orientation and a separation distance of 13 feet. Observational evidence at that time (i.e., sharpness of crack edges) suggested that the cracks formed independently. The northern crack had rounded edges while the southern crack had sharp edges. E-seam overburden thickness at this location is about 800 feet.

Observations made during the fall 2021 field visit found that the northern crack was nearly completely filled, while the southern crack was still present with a measurable width and depth at the edges of the road. Both cracks showed signs of healing and weathering (Figure 2). Future discussion of this feature is not likely unless there is a significant change.

Figure 1. Fall 2018 southeastward view two parallel subsidence cracks (see white arrows) that appeared as a result of recent longwall mining beneath the area. Crack edge features suggested the two cracks were created at different times.

Figure 2. Southeastward view during the fall 2021 field visit of the same area shown in Figure 1.

4.3.2 Location 2

During the spring 2019 field visit, a new subsidence crack was observed approximately 1,000 feet north of the E6-14 MVB pad (Figure 3). This crack had a pronounced elevation offset across the crack of 6 inches (higher on the north) and extended completely across the road and beyond (20+ feet in length) in a N70°W orientation. The maximum dimensions were observed to be 24 inches both in width and depth. This location is over the tailgate entries of E-seam Longwall Panel E7 where tensional stresses are somewhat greater. E-seam overburden thickness at this location is about 800 feet.

Observations made during the fall 2021 field visit found that the crack was still evident with continued signs of healing (Figure 4). Future discussion of these features is not likely unless there is a significant change.

Figure 3. Northward view during the spring 2019 field visit of a subsidence crack (see white arrow) with 6-inch elevation change from north to south observed approximately 1,000 feet north of the MVB E6-14 pad.

Figure 4. Northwestward view during the fall 2021 field visit of the same subsidence crack shown in Figure 3.

4.4 Traverse D-D'

This traverse originates along the south side of the Dry Fork Road (Traverse A-A′) and proceeds southward up Poison Gulch (i.e., the drainage east of Deer Creek). This traverse crosses mined E-seam Longwall Panels E3, E4, E5, E6, and E7 (see Map 1). The E-seam overburden depth along this traverse varies from less than 700 feet to almost 900 feet. This traverse leads southward from Traverse A-A′, crosses the Dry Fork, and eventually leads to four MVB pads above mined E-seam Longwall Panel E7 (i.e., E7-8, E7-9, E7-10, and E7-11). All MVP pads have been plugged and reclaimed. Road access to MV pads E7-8, E7-9, and E7-10 from D′ has been reclaimed.

No subsidence features were observed along this traverse during our fall 2021 field visit.

4.5 Traverse E-E'

This traverse begins at Traverse A-A′ and continues southward to an intersection with Traverse F-F′, then west and south above mined E-seam Longwall Panels E5, E6, E7, and E8 (see Map 1). All MVB pads above mined E-seam Longwall Panels E5, E6, E7, and E8 have now been reclaimed with the exception of MVB E5-11, E7-6, and E8-8, which are immediately adjacent to the road. Overburden along this traverse varies from about 900 to 1,020 feet.

No subsidence features were observed along this traverse during the fall 2021 field visit.

4.6 Traverse F-F'

Traverse F-F′ departs Traverse E-E′ in a southeasterly direction over the east end of mined E-seam Longwall Panels E5, E6, and E7. All MVB pads along this traverse have been reclaimed except E6-4. The E-seam overburden depth along this traverse varies from 1,000 feet to 1,200 feet.

No subsidence features were observed along this traverse during the fall 2021 field visit.

4.7 Traverse G-G′

Traverse G-G′ departs Traverse F-F′ in a southerly direction from the east end of mined E-seam Longwall Panel E7 (see Map 1). This traverse continues south over Lick Creek and to the east end of E-seam Longwall Panel SS1 of the Sunset Trail Mining Area. From this location, the traverse

splits and continues either west across mined portions of E-seam Longwall Panel SS1 to several MVB pads (i.e., SS1-1 through SS1-7) or south to a coal exploration well east of unmined E-seam Longwall Panel SS3.

Longwall mining of E-seam Longwall Panel SS1 began in January 2020. As of our fall 2021 field visit, mining of this panel was complete and that portion of the traverse west of MVB pad had been reclaimed. As a result of reclamation, subsidence features originally observed during our spring 2021 field visit (both on MVB pad SS1-7 and the road leading to the pad) could not be located (Figure 5).

Figure 5. Westward view of reclaimed portion of Traverse G-G′ west of the MVB SS1-6 pad as observed during our fall 2021 field visit.

The location associated with another subsidence feature first observed during our spring 2021 field visit on MVB pad SS1-6 was visited during our fall 2021 field visit. This location is discussed below as Locations 3, along with follow-up observations.

No other subsidence-related features were observed along this traverse during our fall 2021 field visit.

4.7.1 Location 3

Multiple sub-parallel subsidence cracks were first observed on the MVB SS1-6 pad during the spring 2021 field visit. The E-seam overburden thickness beneath this pad is approximately 1,090 feet. The most dominant of those cracks appeared to be spaced approximately 6 to 8 feet apart, had an orientation of between N20°W and N40°W, and was located north of the well head. No evidence of these subsidence features could be found during our fall 2021 field visit. For example, Figure 6 shows two subsidence cracks located on the south side of the MVB SS1-6 pad as observed during our spring 2021 field visit and Figure 7 shows the same area as observed during our fall 2021 field visit.

Figure 6. Northward view during the spring 2021 field visit of two smaller subsidence cracks (see white arrows) on the southern portion of the MVB SS1-6 pad.

Figure 7. Northward view during the fall 2021 field visit of the same approximate area shown in Figure 6. Note that the previously-observed subsidence cracks are no longer visible.

4.8 Traverse H-H′

Traverse H-H' departs Traverse G-G' from a location just west of the intersection with a road leading to MVB pads SS1-2 and SS1-3. This traverse was visited on foot because vehicle access is restricted. This traverse follows a drill road, which leads south, then east, and eventually west around the headwaters of North Prong Creek and across partially mined E-seam Longwall Panel SS2 (see Map 1). Previous observations made along this traverse were performed as reconnaissance because mining had not yet commenced. Two MVB pads had been completed but no ventilation boreholes were ever drilled. For purposes of our Spring 2021 Subsidence Report, the pads were denoted as MVB SS2-3 and SS2-5 because these were the closest proposed MVBs to the pad locations. As of our spring 2021 field visit, the road across unmined E-seam Longwall Panel SS2 terminated at the MVB SS2-5 pad.

During our fall 2021 field visit, it was observed that MVB SS2-5 and the access road to it from MVB SS2-3 had been reclaimed. The reclaimed access road and MVB pad were observed by foot in an effort to identify subsidence-related features. No such features were observed along the reclaimed or existing portions of this traverse during our fall 2021 field visit.

4.9 Traverse I-I′

Traverse I-I' begins at the termination of Traverse B-B' and proceeds across unmined E-seam Longwall Panel E14 to the crossing of South Prong Creek. This traverse had been observed on several occasions from a pre-mining reconnaissance perspective. It is anticipated that this traverse will be included as a regular part of future subsidence reports.

5.0 CONCLUSIONS

1. The conceptual B- and E-seam mining model presented in the Exhibit 60 series of the mining permit has been verified by annual field observations in the various West Elk Mine mining areas. With the use of longwall mining methods in which the uniform downwarping of the overburden rocks and unconsolidated material act as laterally constrained plates, cracks in zones under tensile stress narrow with depth and close at the neutral surface. Below the neutral surface, the materials are therefore in compression. This has an important bearing on the hydrologic consequences of longwall mining. Any groundwater or surface water in contact with a given subsidence crack is prevented from traveling downward beyond the neutral surface of the deformed plate. Annual field observations from 1996 to fall 2021, inclusive, verify this conceptual model in bedrock and surficial material (colluvium, alluvium, mudflow, and debris flow deposits) where the overburden is laterally constrained.

2. Typically, uniform downwarping occurs in association with longwall mining when there is lateral constraint. Where there are steep slopes and cliffs, there is little lateral support in at least one direction, which causes the associated rocks and unconsolidated materials to deform like unconstrained beams, plates, or cantilevers as the longwall mining faces move beneath them. This lack of lateral constraint allows subsidence cracks to commonly extend completely through sandstones and other brittle units, and groundwater or surface water present near or within these cracks will likely flow through and exit into existing surface drainages. The relatively few cliffs and over-steepened slopes in the Southern Panels and Sunset Trail Mining Areas tend to provide the lateral constraint needed to produce a more uniform downwarping with fewer significant subsidence cracks observable at the surface.

3. To date, there have been no reported impacts on surface flow or induced inflows to the underground mine workings even while mining directly beneath surface water features including those associated with the Southern Panels and Sunset Trail Mining Areas. A roof failure that happened while driving the E Mains southward in 2020 (temporarily capturing flow from South Prong Creek) did not occur as a result of subsidence. Details surrounding

this occurrence are discussed in TR-149 and resulted in revisions to Exhibit 60E regarding main entry development.

4. Continuous annual observations find substantial weathering of previously-observed subsidence cracks with edges rounding, widths reducing, and depths filling with eroded material. The only exception to these observations has been those cracks in thick, exposed, brittle sandstone units above previously mined B-seam panels (i.e., Apache Rocks) where rounding of edges and filling of cracks have occurred over time, but widths have remained relatively constant.

5. The length of time that tension cracks are expected to be visible before the effects of erosion and deposition, mass wasting, infilling, and revegetation obliterate them (duration of cracks), is a function of their location with respect to the mine geometry and type of material in which the cracks formed. Crack duration in zones of permanent tensile stress, such as above mine boundaries and unmined pillars between longwall panels, commonly last: 1) from one to three years in colluvium, 2) from three to six years in soft, friable sandstone, and 3) many decades in hard, durable sandstone. However, cracks that form in the zone of temporary tensile stress, such as above moving longwall faces, commonly close again when the longwall moves out of their area of influence.

6. Observed mine-induced subsidence effects have been less in the Southern Panels and Sunset Trail Mining Areas than were observed annually in the Box Canyon and Apache Rocks B-seam Mining Areas dating back to 1996. The more subdued topography and the fewer cliffs and ledges of the Southern Panels and Sunset Train Mining Areas reduce the potential for rockfall/landslide areas where E-seam mining has been underway since December 2008.

7. Field visits have revealed the healing and sealing capacity of cracks in surficial material by weathering, mass wasting, and crack infilling over time. This is particularly true in the colluvium that covers much of the surface of the Southern Panels and Sunset Trail Mining Areas. The healing and sealing capacity of these materials causes softening and rounding

of the crack edges as well as reduction of crack continuity and depth to a point of being nearly imperceptible within a year or two.

8. Subsidence-related effects were observed during the fall 2021 field visit at the following locations:

   - above mined E-seam Longwall Panel E7 (i.e., along Traverse C-C′ on the access road south of MVB E7-12 [Location 1] and on the access road south of E6-14 [Location 2]). These locations continue to show signs of healing and sealing.

   Previously observed subsidence effects were not observed during the fall 2021 field visit at the following locations:

   - along 60 feet of roadway approximately 240 feet east of mined E-seam Longwall Panel SS1 (i.e., on Traverse G-G′ between MVB pad E8-5 and E8-6 [Location 3]). No evidence of subsidence effects could be identified.

   - along the access road east of MVB SS1-7 and on the MVB pad itself. This area had been reclaimed between our spring and fall 2021 field visits.

   All subsidence-related features were within the expected angle of draw for the E-seam and were generally focused in areas of maximum temporary tensile stress, such as above current or recent longwall mining activities.

6.0 BIBLIOGRAPHY

DeGraff, J.V., and C.H. Romesburg. 1981. Subsidence Crack Closure; Rate, Magnitude, and Sequence. *International Association of Engineering Geology Bulletin 23*.

Dunrud, C.R. 1976. *Some Engineering Geologic Factors Controlling Coal Mine Subsidence in Utah and Colorado.* Professional Paper 969. Denver, CO: U.S. Geological Survey.

____. 1989. *Geologic Map and Coal Stratigraphic Framework of the Paonia Area, Delta and Gunnison Counties, Colorado*. Coal Investigations Map C-115. Denver, CO: U.S. Geological Survey.

____. 1999. Subsidence Field Observations – September 15-17, 1999. Memorandum to Christine Johnston, Mountain Coal Company, LLC. Denver, CO: Wright Water Engineers, Inc.

____. 2000. Subsidence Field Observations – August 28-30, 2000. Memorandum to Henry Barbe, Mountain Coal Company, LLC. Denver, CO: Wright Water Engineers, Inc.

____. 2001. *Subsidence Field Observations, West Elk Mine, August 28 and 29, 2001*. Denver, CO: Wright Water Engineers, Inc.

____. 2002. *Subsidence Field Observations, West Elk Mine, August 27-29, 2002*. Glenwood Springs, CO: Wright Water Engineers, Inc.

____. 2003. *Subsidence Field Observations, West Elk Mine, July 22-24, 2003*. Glenwood Springs, CO: Wright Water Engineers, Inc.

____. 2004a. *Subsidence and Geologic Field Observations: Apache Rocks and Box Canyon Mining Areas, July 12-15, 2004*. Glenwood Springs, CO: Wright Water Engineers, Inc.

____. 2004b. *Exhibit 60C: Subsidence Evaluation and 2004 Geologic Hazard Field Observations for the West Flatiron Lease Area*. Glenwood Springs, CO: Wright Water Engineers, Inc.

____. 2004c. *Exhibit 60D: 2004 Geologic Hazard Field Observations for the South of Divide Mining Area*. Glenwood Springs, CO: Wright Water Engineers, Inc.

____. 2005. *2005 Subsidence and Geologic Field Observations Box Canyon, West Flatiron, Apache Rocks, and South of Divide Mining Areas*. Glenwood Springs, CO: Wright Water Engineers, Inc.

____. 2006. *2006 Subsidence and Geologic Field Observations Box Canyon, West Flatiron, Apache Rocks, and South of Divide Mining Areas*. Glenwood Springs, CO: Wright Water Engineers, Inc.

Dunrud, C. Richard, et al. 1996. *Exhibit 60A: Subsidence Evaluation of the Revised Mine Panel Layouts in Section 21 and Sections 26 and 27*. Denver, CO: Wright Water Engineers, Inc.

____. 1998 rev. *Exhibit 60: Subsidence Evaluation for the Apache Rocks Mining Area and Box Canyon Lease Tract*. Denver, CO: Wright Water Engineers, Inc.

____. 2006 rev. *Exhibit 60B: Subsidence Evaluation for the South of Divide Mining Area*. Glenwood Springs, CO: Wright Water Engineers, Inc.

Dunrud, C.R., and F.W. Osterwald. 1980. *Effects of Coal Mine Subsidence in the Sheridan, Wyoming Area*. U.S. Geological Survey Professional Paper 1164. Denver, CO: U.S. Geological Survey.

Dunrud, C.R., and G.D. Witt. 2007a. *Spring 2007 Subsidence and Geologic Field Observations Box Canyon, Apache Rocks, and South of Divide Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2007b. *Fall 2007 Subsidence and Geologic Field Observations Box Canyon, Apache Rocks, and South of Divide Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

Liu, T.Q. 1981. *Surface Movements Overburden Failure and its Application.* Co, China: Coal Industry Publishing (in Chinese).

National Coal Board. 1975. *Subsidence Engineers' Handbook*. National Coal Board, United Kingdom, Mining Department.

Peng, S.S. 1992. *Surface Subsidence Engineering*. Littleton, CO: Society for Mining, Metallurgy, and Exploration.

Peng, S.S., and D.Y. Geng. 1982. Methods of Predicting the Subsidence Factors, Angle of Draw and Angle of Critical Deformation. *Proceedings of State-of-the-Art of Ground Control in Longwall Mining and Mining Subsidence Conference.* New York: Society of Mining Engineers of the American Institute of Mining.

Tetra Tech. 2007. *Exhibit 60E: Subsidence Evaluation for the South of Divide and Dry Fork Mining Areas*. Missoula, MT: Tetra Tech. Revised Wright Water Engineers, Inc., February 2011.

Wardell, K. 1971. The effects of mineral and other underground excavations on the overlying ground surface. In *Symposium [on] geological and geographical problems of areas of high population density, Washington, DC, 1970, Proceedings*, 201-217. Denver, CO: Association of Engineering Geologists.

Witt, G.D., and C.R. Dunrud. 2008a. *Spring 2008 Subsidence and Geologic Field Observations Box Canyon, Apache Rocks, and South of Divide Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2008b. *Fall 2008 Subsidence and Geologic Field Observations Box Canyon, Apache Rocks, and South of Divide Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2009a. *Spring 2009 Subsidence and Geologic Field Observations Box Canyon, Apache Rocks, and South of Divide Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2009b. *Fall 2009 Subsidence and Geologic Field Observations Box Canyon, Apache Rocks, and South of Divide Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2010a. *Spring 2010 Subsidence and Geologic Field Observations Box Canyon, Apache Rocks, and South of Divide Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2010b. *Fall 2010 Subsidence and Geologic Field Observations Box Canyon, Apache Rocks, and South of Divide Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2011a. *Spring 2011 Subsidence and Geologic Field Observations Box Canyon, Apache Rocks, and South of Divide Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2011b. *Fall 2011 Subsidence and Geologic Field Observations Box Canyon, Apache Rocks, and South of Divide Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2012a. *Spring 2012 Subsidence and Geologic Field Observations Box Canyon, Apache Rocks, and South of Divide Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2012b. *Fall 2012 Subsidence and Geologic Field Observations Box Canyon, Apache Rocks, and South of Divide Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2013a. *Spring 2013 Subsidence and Geologic Field Observations South of Divide and Dry Fork Mining Areas (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

____. 2013b. *Fall 2013 Subsidence and Geologic Field Observations South of Divide and Dry Fork Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2014a. *Spring 2014 Subsidence and Geologic Field Observations South of Divide and Dry Fork Mining Areas (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

____. 2014b. *Fall 2014 Subsidence and Geologic Field Observations South of Divide and Dry Fork Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2015a. *Spring 2015 Subsidence and Geologic Field Observations South of Divide and Dry Fork Mining Areas (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

____. 2015b. *Fall 2015 Subsidence and Geologic Field Observations South of Divide and Dry Fork Mining Areas*. Denver, CO: Wright Water Engineers, Inc.

____. 2016. *Spring 2016 Subsidence and Geologic Field Observations South of Divide and Dry Fork Mining Areas (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

Witt, G.D. 2016. *Fall 2016 Subsidence and Geologic Field Observations South of Divide and Dry Fork Mining Areas (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

____. 2017a. *Spring 2017 Subsidence and Geologic Field Observations South of Divide and Dry Fork Mining Areas (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

____. 2017b. *Fall 2017 Subsidence and Geologic Field Observations South of Divide and Dry Fork Mining Areas (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

____. 2018a. *Spring 2018 Subsidence and Geologic Field Observations South of Divide and Dry Fork Mining Areas (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

____. 2018b. *Fall 2018 Subsidence and Geologic Field Observations Southern Panels Mining Area (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

____. 2019a. *Spring 2019 Subsidence and Geologic Field Observations Southern Panels Mining Area (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

____. 2019b. *Fall 2019 Subsidence and Geologic Field Observations Southern Panels Mining Area (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

____. 2020a. *Spring 2020 Subsidence and Geologic Field Observations Southern Panels and Sunset Trail Mining Areas (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

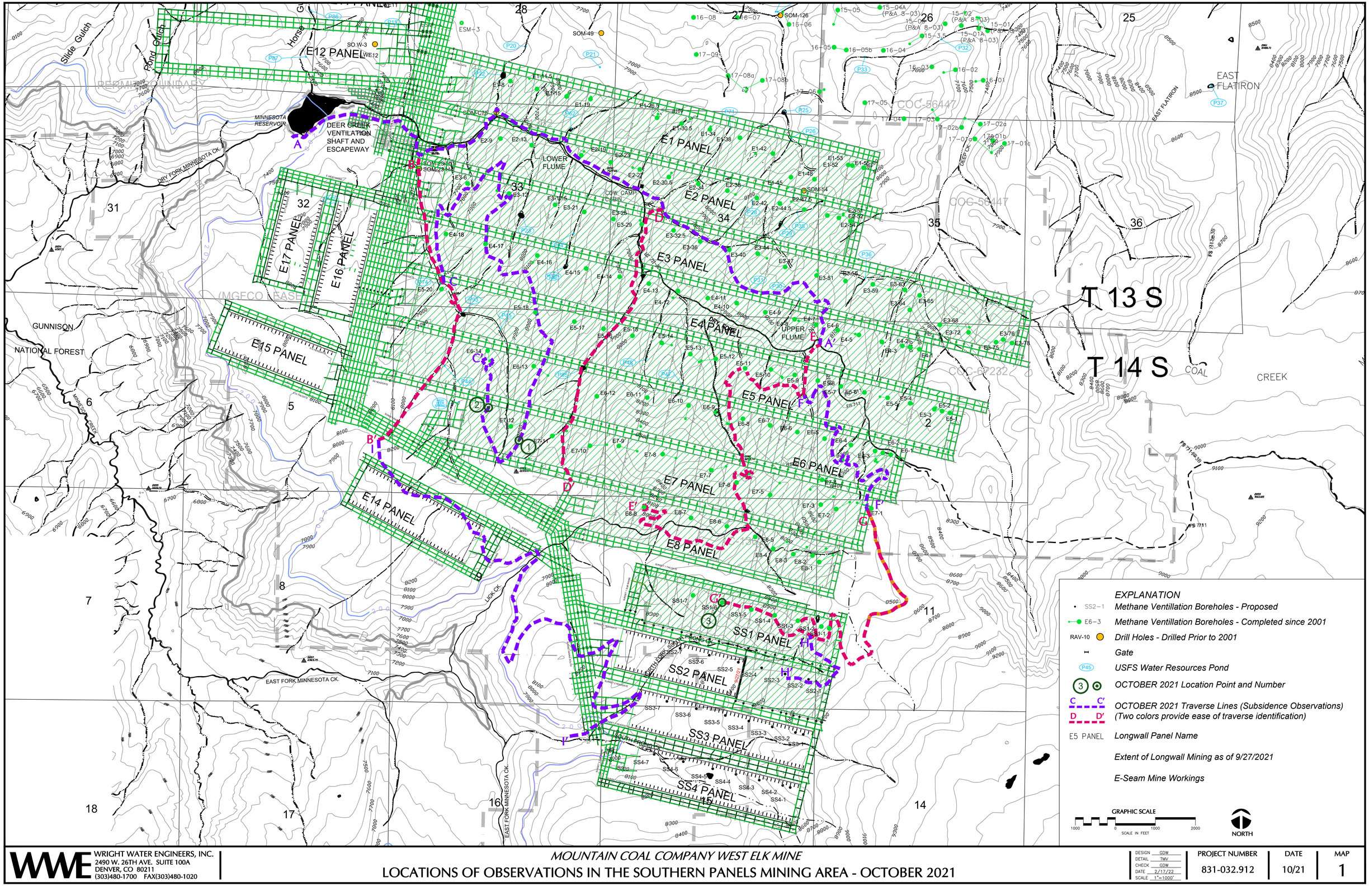
____. 2020b. *Fall 2020 Subsidence and Geologic Field Observations Southern Panels and Sunset Trail Mining Areas (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

____. 2021a. *Spring 2021 Subsidence and Geologic Field Observations Southern Panels and Sunset Trail Mining Areas (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

Wright Water Engineers, Inc. 2012. *Exhibit 60E: Subsidence Evaluation and Geologic Hazard Field Observations for the South of Divide and Dry Fork Mining Areas*. Glenwood Springs, CO: Wright Water Engineers, Inc.

____. 2021. *Exhibit 60E: Subsidence Evaluation for the Southern Panels, Apache Rocks West, & Sunset Trail Mining Areas*. Glenwood Springs, CO: Wright Water Engineers, Inc.

MAPS



WRIGHT WATER ENGINEERS, INC.
2490 W. 26TH AVE. SUITE 100A
DENVER, CO 80211
(303)480-1700 FAX(303)480-1020

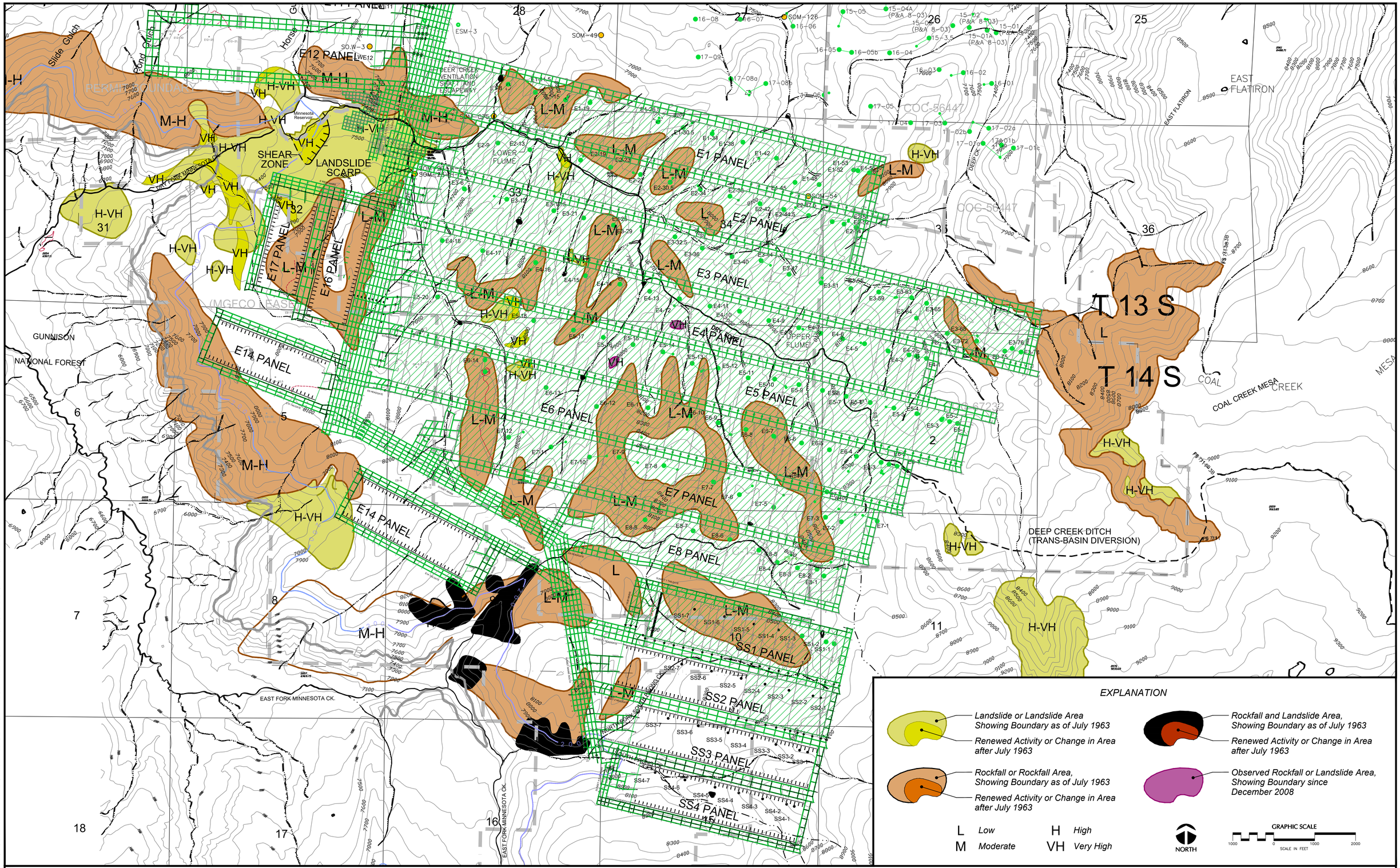
MOUNTAIN COAL COMPANY WEST ELK MINE

LOCATIONS OF OBSERVATIONS IN THE SOUTHERN PANELS MINING AREA - OCTOBER 2021

DESIGN	GDW
DETAIL	TMV
CHECK	GDW
DATE	2/17/22
SCALE	1"=1000'

PROJECT NUMBER	DATE	MAP
831-032.912	10/21	1

Plot Date/Time: 03/14/2022, 03:39:21 PM; Z:\PROJECT FILES\V2-99\831-032\831-032.912\CAD-GIS\CAD\FALL 2021\01_DWGS\BASE-2021-FALL.DWG-SOUTH OF DIVIDE (24X36)



EXPLANATION

- *Landslide or Landslide Area Showing Boundary as of July 1963*
- *Renewed Activity or Change in Area after July 1963*
- *Rockfall and Landslide Area, Showing Boundary as of July 1963*
- *Renewed Activity or Change in Area after July 1963*
- *Rockfall or Rockfall Area, Showing Boundary as of July 1963*
- *Renewed Activity or Change in Area after July 1963*
- *Observed Rockfall or Landslide Area, Showing Boundary since December 2008*

L *Low* H *High*
M *Moderate* VH *Very High*

NORTH

GRAPHIC SCALE
1000 0 1000 2000
SCALE IN FEET

WWE
WRIGHT WATER ENGINEERS, INC.
2490 W. 26TH AVE. SUITE 100A
DENVER, CO 80211
(303)480-1700 FAX(303)480-1020

MOUNTAIN COAL COMPANY WEST ELK MINE

LANDSLIDES AND ROCKFALLS IN THE SOUTHERN PANELS MINING AREA - OCTOBER 2021

DESIGN	GDW
DETAIL	TMV
CHECK	GDW
DATE	02/17/22
SCALE	1"=1000'

PROJECT NUMBER	DATE	MAP
831-032.912	5/21	2

Plot Date/Time: 03/14/2022, 03:44:15 PM; Z:\PROJECT FILES\72-99\831-032\831-032.912\CAD-GIS\CAD\FALL 2021\01_DWGS\LSRF 2021-FALL.DWG-SOUTH OF DIVIDE (24X36)

APPENDIX A

U.S. Forest Service Road and Stock Pond Inspection Forms

Forest Service Roads
Inspection Form

Date: 1/29/2021
Time:
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LWSS1 Approx. 16 XC in SS1 HG
Road(s) Being Inspected: Dry Fork and Deer Creek

Yes	No	
☐	☐	Is the Forest Service road within the projected angle of draw of subsidence? If yes, which road(s): _____
☐	☐	Are there visible surface cracks on the road? If yes, describe (location, width, length, etc.): _____ _____ _____
☐	☐	Is there any recent evidence of potential subsidence induced slope failure? If yes, describe: _____
☐	☐	Are there any other potentially damaging, subsidence induced features on or near the road? If yes, describe: _____
☐	☐	Is mitigation needed? If yes, list suggestions: _____

Notes: Unable to complete inspection due to snow cover.

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the public or operations, notify Jessica Wilczek immediately.

Forest Service Roads
Inspection Form

Date: 2/26/2021
Time:
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW 551 Approx 16 XC in 551 HG
Road(s) Being Inspected: Dry Fork and Deer Creek

Yes	No	
☐	☐	Is the Forest Service road within the projected angle of draw of subsidence? If yes, which road(s): _____
☐	☐	Are there visible surface cracks on the road? If yes, describe (location, width, length, etc.): _____ _____ _____
☐	☐	Is there any recent evidence of potential subsidence induced slope failure? If yes, describe: _____
☐	☐	Are there any other potentially damaging, subsidence induced features on or near the road? If yes, describe: _____
☐	☐	Is mitigation needed? If yes, list suggestions: _____

Notes: Unable to complete inspection due to snow cover

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the public or operations, notify Jessica Wilczek immediately.

Forest Service Roads
Inspection Form

Date: 3/26/2021
Time:
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW SS1 Approx 15XC in SS1 HG
Road(s) Being Inspected: Dry Fork and Deer Creek

Yes	No	
☐	☐	Is the Forest Service road within the projected angle of draw of subsidence? If yes, which road(s): _____
☐	☐	Are there visible surface cracks on the road? If yes, describe (location, width, length, etc.): _____ _____ _____
☐	☐	Is there any recent evidence of potential subsidence induced slope failure? If yes, describe: _____
☐	☐	Are there any other potentially damaging, subsidence induced features on or near the road? If yes, describe: _____
☐	☐	Is mitigation needed? If yes, list suggestions: _____

Notes: Unable to inspect due to snow cover.

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the public or operations, notify Jessica Wilczek immediately.

Forest Service Roads
Inspection Form

Date: 4/29/2021
Time: 11:30
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW 551 12-13 XC
Road(s) Being Inspected: Dry Fork

Yes	No	
☐	☒	Is the Forest Service road within the projected angle of draw of subsidence? If yes, which road(s): _____
☐	☒	Are there visible surface cracks on the road? If yes, describe (location, width, length, etc.): _____ _____ _____
☐	☒	Is there any recent evidence of potential subsidence induced slope failure? If yes, describe: _____
☐	☒	Are there any other potentially damaging, subsidence induced features on or near the road? If yes, describe: _____
☐	☒	Is mitigation needed? If yes, list suggestions: _____

Notes:

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the public or operations, notify Jessica Wilczek immediately.

Forest Service Roads
Inspection Form

Date: 5/27/2021
Time: 12:30
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW 531 ≈10XC
Road(s) Being Inspected: Dry Fork

Yes	No	
☐	☒	Is the Forest Service road within the projected angle of draw of subsidence? If yes, which road(s): _____
☐	☒	Are there visible surface cracks on the road? If yes, describe (location, width, length, etc.): _____ _____ _____
☐	☒	Is there any recent evidence of potential subsidence induced slope failure? If yes, describe: _____
☐	☒	Are there any other potentially damaging, subsidence induced features on or near the road? If yes, describe: _____
☐	☒	Is mitigation needed? If yes, list suggestions: _____

Notes:

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the public or operations, notify Jessica Wilczek immediately.

Forest Service Roads
Inspection Form

Date: 6/21/21
Time: 12:30
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW552 26XC
Road(s) Being Inspected: DRY Fork & Deer Creek.

Yes	No	
☐	☒	Is the Forest Service road within the projected angle of draw of subsidence? If yes, which road(s): _____
☐	☒	Are there visible surface cracks on the road? If yes, describe (location, width, length, etc.): _____ _____ _____
☐	☒	Is there any recent evidence of potential subsidence induced slope failure? If yes, describe: _____
☐	☒	Are there any other potentially damaging, subsidence induced features on or near the road? If yes, describe: _____
☐	☒	Is mitigation needed? If yes, list suggestions: _____

Notes:

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the public or operations, notify Jessica Wilczek immediately.

Forest Service Roads
Inspection Form

Date: 7/29/2021
Time: 11:00
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW 552 21 XC 552 HG.
Road(s) Being Inspected: Dry Fork.

Yes	No	
☐	☒	Is the Forest Service road within the projected angle of draw of subsidence? If yes, which road(s):
☐	☒	Are there visible surface cracks on the road? If yes, describe (location, width, length, etc.):
☐	☒	Is there any recent evidence of potential subsidence induced slope failure? If yes, describe:
☐	☒	Are there any other potentially damaging, subsidence induced features on or near the road? If yes, describe:
☐	☒	Is mitigation needed? If yes, list suggestions:

Notes:

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the public or operations, notify Jessica Wilczek immediately.

Forest Service Roads
Inspection Form

Date: 8/27/2021
Time: 12:00
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW SS2 [redacted] SS2 HG 19xc
Road(s) Being Inspected: Dry Fork

Yes	No	
☐	☒	Is the Forest Service road within the projected angle of draw of subsidence? If yes, which road(s): _____
☐	☒	Are there visible surface cracks on the road? If yes, describe (location, width, length, etc.): _____ _____ _____
☐	☒	Is there any recent evidence of potential subsidence induced slope failure? If yes, describe: _____
☐	☒	Are there any other potentially damaging, subsidence induced features on or near the road? If yes, describe: _____
☐	☒	Is mitigation needed? If yes, list suggestions: _____

Notes:

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the public or operations, notify Jessica Wilczek immediately.

Forest Service Roads
Inspection Form

Date: 9/30/2021
Time: 10:30
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW552 17xc in 552HG
Road(s) Being Inspected: Dry Fork

Yes	No	
☐	☒	Is the Forest Service road within the projected angle of draw of subsidence? If yes, which road(s): _____
☐	☒	Are there visible surface cracks on the road? If yes, describe (location, width, length, etc.): _____ _____ _____
☐	☒	Is there any recent evidence of potential subsidence induced slope failure? If yes, describe: _____
☐	☒	Are there any other potentially damaging, subsidence induced features on or near the road? If yes, describe: _____
☐	☒	Is mitigation needed? If yes, list suggestions: _____

Notes:

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the public or operations, notify Jessica Wilczek immediately.

Forest Service Roads
Inspection Form

Date: 10/29/2021
Time: 11:00
Name of Inspector: Robert G. Munz
Current Panel and XC Being Mined: LW552 15 XC in SS2 HG
Road(s) Being Inspected: Dry Fork.

Yes	No	
☐	☒	Is the Forest Service road within the projected angle of draw of subsidence? If yes, which road(s):
☐	☒	Are there visible surface cracks on the road? If yes, describe (location, width, length, etc.):
☐	☒	Is there any recent evidence of potential subsidence induced slope failure? If yes, describe:
☐	☒	Are there any other potentially damaging, subsidence induced features on or near the road? If yes, describe:
☐	☒	Is mitigation needed? If yes, list suggestions:

Notes:

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the public or operations, notify Jessica Wilczek immediately.

Forest Service Roads
Inspection Form

Date: 11/30/2021
Time: 11:00
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW552 approximately 12-13kc in 552 HG.
Road(s) Being Inspected: Dry Fork.

Yes	No	
☐	☒	Is the Forest Service road within the projected angle of draw of subsidence? If yes, which road(s): _____
☐	☒	Are there visible surface cracks on the road? If yes, describe (location, width, length, etc.): _____ _____ _____
☐	☒	Is there any recent evidence of potential subsidence induced slope failure? If yes, describe: _____
☐	☒	Are there any other potentially damaging, subsidence induced features on or near the road? If yes, describe: _____
☐	☒	Is mitigation needed? If yes, list suggestions: _____

Notes:
Poor road conditions in areas

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the public or operations, notify Jessica Wilczek immediately.

Forest Service Roads
Inspection Form

Date: 12/31/2021
Time: 12:00
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW SS 2 approximately 10 XC in SS2 46
Road(s) Being Inspected: Dry Fork / Bear Creek

Yes	No	
☐	☐	Is the Forest Service road within the projected angle of draw of subsidence? If yes, which road(s): _____
☐	☐	Are there visible surface cracks on the road? If yes, describe (location, width, length, etc.): _____ _____ _____
☐	☐	Is there any recent evidence of potential subsidence induced slope failure? If yes, describe: _____
☐	☐	Are there any other potentially damaging, subsidence induced features on or near the road? If yes, describe: _____
☐	☐	Is mitigation needed? If yes, list suggestions: _____

Notes: Unable to inspect due to snow cover

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the public or operations, notify Jessica Wilczek immediately.

Stock Pond
Inspection Form

Date: 1/29/2021
Time:
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW551 Approx 16xc in 551 HG
Stock Pond(s) Being Inspected: DF 35

Yes	No	
☐	☒	Is the stock pond within twice the projected angle of draw of subsidence? If yes, which pond(s):
☐	☐	Are there visible surface cracks in or near the stock pond? If yes, describe (location, width, length, etc.):
☐	☐	Is there any evidence of potential subsidence induced water loss? If yes, describe:
☐	☐	Is there water in the pond? If yes, describe:
☐	☐	Is mitigation needed? If yes, list suggestions:

Notes: unable to complete inspection due to snow cover

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the pond, notify Jessica Wilczek immediately.

Stock Pond
Inspection Form

Date: 2/26/2021
Time: '
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW 551 Approx 16 XC in 551 HG
Stock Pond(s) Being Inspected: DF35

Yes	No	
☐	☒	Is the stock pond within twice the projected angle of draw of subsidence? If yes, which pond(s):
☐	☐	Are there visible surface cracks in or near the stock pond? If yes, describe (location, width, length, etc.):
☐	☐	Is there any evidence of potential subsidence induced water loss? If yes, describe:
☐	☐	Is there water in the pond? If yes, describe:
☐	☐	Is mitigation needed? If yes, list suggestions:

Notes: Unable to complete inspection due to snow cover

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the pond, notify Jessica Wilczek immediately.

Stock Pond
Inspection Form

Date: 3/26/2021
Time:
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW 551 approx 15 xc in 551 HG
Stock Pond(s) Being Inspected: DF35

Yes	No	
☐	☒	Is the stock pond within twice the projected angle of draw of subsidence? If yes, which pond(s):
☐	☐	Are there visible surface cracks in or near the stock pond? If yes, describe (location, width, length, etc.):
☐	☐	Is there any evidence of potential subsidence induced water loss? If yes, describe:
☐	☐	Is there water in the pond? If yes, describe:
☐	☐	Is mitigation needed? If yes, list suggestions:

Notes: Unable to complete inspection due to snow cover.

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the pond, notify Jessica Wilczek immediately.

Stock Pond
Inspection Form

Date: 4/29/2021
Time: 12:00
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW 551 between 12 & 13 XC
Stock Pond(s) Being Inspected: DF ~~35~~ 35

Yes	No	
☐	☒	Is the stock pond within twice the projected angle of draw of subsidence? If yes, which pond(s):
☐	☒	Are there visible surface cracks in or near the stock pond? If yes, describe (location, width, length, etc.):
☐	☒	Is there any evidence of potential subsidence induced water loss? If yes, describe:
☐	☒	Is there water in the pond? If yes, describe:
☐	☒	Is mitigation needed? If yes, list suggestions:

Notes:

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the pond, notify Jessica Wilczek immediately.

Stock Pond
Inspection Form

Date: 5/27/2021
Time: 12:00
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW 551 approximately 10 xc
Stock Pond(s) Being Inspected: DF-~~35~~ 35

Yes	No	
☐	☒	Is the stock pond within twice the projected angle of draw of subsidence? If yes, which pond(s):
☐	☒	Are there visible surface cracks in or near the stock pond? If yes, describe (location, width, length, etc.):
☐	☒	Is there any evidence of potential subsidence induced water loss? If yes, describe:
☐	☒	Is there water in the pond? If yes, describe:
☐	☒	Is mitigation needed? If yes, list suggestions:

Notes:

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the pond, notify Jessica Wilczek immediately.

Stock Pond
Inspection Form

Date: 6/21/2021
Time: 12:00
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW 552 26 XC
Stock Pond(s) Being Inspected: ~~DF-15~~ 35

Yes	No	
☐	☒	Is the stock pond within twice the projected angle of draw of subsidence? If yes, which pond(s):
☐	☒	Are there visible surface cracks in or near the stock pond? If yes, describe (location, width, length, etc.):
☐	☒	Is there any evidence of potential subsidence induced water loss? If yes, describe:
☐	☒	Is there water in the pond? If yes, describe:
☐	☒	Is mitigation needed? If yes, list suggestions:

Notes:

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the pond, notify Jessica Wilczek immediately.

Stock Pond
Inspection Form

Date: 7/29/2021
Time: 12:00
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW 552 552 146 21XC
Stock Pond(s) Being Inspected: DF35

Yes	No	
☐	☒	Is the stock pond within twice the projected angle of draw of subsidence? If yes, which pond(s):
☐	☒	Are there visible surface cracks in or near the stock pond? If yes, describe (location, width, length, etc.):
☐	☒	Is there any evidence of potential subsidence induced water loss? If yes, describe:
☒	☐	Is there water in the pond? If yes, describe: ≈1 ft deep
☐	☒	Is mitigation needed? If yes, list suggestions:

Notes:

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the pond, notify Jessica Wilczek immediately.

Stock Pond
Inspection Form

Date: 8/27/2021
Time: 11:00
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW 552 SSR 46 19 KC
Stock Pond(s) Being Inspected: DF 35

Yes	No	
☐	☒	Is the stock pond within twice the projected angle of draw of subsidence? If yes, which pond(s):
☐	☒	Are there visible surface cracks in or near the stock pond? If yes, describe (location, width, length, etc.):
☐	☒	Is there any evidence of potential subsidence induced water loss? If yes, describe:
☒	☐	Is there water in the pond? If yes, describe: ≈ 2 ft deep
☐	☒	Is mitigation needed? If yes, list suggestions:

Notes:

Signature of Inspector: [signature]

* If any potential subsidence induced features are observed that could cause harm to the pond, notify Jessica Wilczek immediately.

Stock Pond
Inspection Form

Date: 9/30/2021
Time: 1:30 PM
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW552 17xc in SS2 HG
Stock Pond(s) Being Inspected: DF 29

Yes	No	
☐	☒	Is the stock pond within twice the projected angle of draw of subsidence? If yes, which pond(s):
☐	☒	Are there visible surface cracks in or near the stock pond? If yes, describe (location, width, length, etc.):
☐	☒	Is there any evidence of potential subsidence induced water loss? If yes, describe:
☐	☒	Is there water in the pond? If yes, describe:
☐	☒	Is mitigation needed? If yes, list suggestions:

Notes:

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the pond, notify Jessica Wilczek immediately.

Stock Pond
Inspection Form

Date: 10/29/2021
Time: 1:00 PM
Name of Inspector: Robert G. Munz
Current Panel and XC Being Mined: LW552 1S XC in 552HG
Stock Pond(s) Being Inspected: DF 29

Yes	No	
☐	☒	Is the stock pond within twice the projected angle of draw of subsidence? If yes, which pond(s): _____
☐	☒	Are there visible surface cracks in or near the stock pond? If yes, describe (location, width, length, etc.): _____ _____ _____
☐	☒	Is there any evidence of potential subsidence induced water loss? If yes, describe: _____
☐	☒	Is there water in the pond? If yes, describe: _____
☐	☒	Is mitigation needed? If yes, list suggestions: _____

Notes:

Signature of Inspector: Robert G. Munz

* If any potential subsidence induced features are observed that could cause harm to the pond, notify Jessica Wilczek immediately.

Stock Pond
Inspection Form

Date: 11/30/2021
Time: 12:00
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW 552 XC 12 to 13 in SSZ HG.
Stock Pond(s) Being Inspected: DF 29

Yes	No	
☐	☐	Is the stock pond within twice the projected angle of draw of subsidence? If yes, which pond(s): _____
☐	☐	Are there visible surface cracks in or near the stock pond? If yes, describe (location, width, length, etc.): _____ _____ _____
☐	☐	Is there any evidence of potential subsidence induced water loss? If yes, describe: _____
☐	☐	Is there water in the pond? If yes, describe: _____
☐	☐	Is mitigation needed? If yes, list suggestions: _____

Notes:
Unable to access due to road conditions

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the pond, notify Jessica Wilczek immediately.

Stock Pond
Inspection Form

Date: 12/31/2021
Time: 12:00
Name of Inspector: Robert Munz
Current Panel and XC Being Mined: LW552 approx 10 xc in 552 HG.
Stock Pond(s) Being Inspected: DF29

Yes	No	
☐	☐	Is the stock pond within twice the projected angle of draw of subsidence? If yes, which pond(s): _____
☐	☐	Are there visible surface cracks in or near the stock pond? If yes, describe (location, width, length, etc.): _____ _____ _____
☐	☐	Is there any evidence of potential subsidence induced water loss? If yes, describe: _____
☐	☐	Is there water in the pond? If yes, describe: _____
☐	☐	Is mitigation needed? If yes, list suggestions: _____

Notes:

Unable to inspect due to snow cover

Signature of Inspector: _____

* If any potential subsidence induced features are observed that could cause harm to the pond, notify Jessica Wilczek immediately.

APPENDIX B

Monument Dam Inspection Forms and Survey Data

Monument Dam
Inspection Form

Date: 1/29/2021
Time:
Name of Inspector: Robert Munz
Current Panel Being Mined: LW551
☐ Weekly Inspection ☒ Monthly Inspection

Yes	No	
☐	☒	Is mining within 1 mile of Monument Dam?
☐	☐	Are there visible surface cracks on the dam? If yes, indicate length and size of crack. _____.
☐	☐	Is there evidence of subsided areas on or around the dam? If yes, indicate where and degree. _____.
☐	☐	Are there bulges on the dam? If yes, indicate where and degree. _____.
☐	☐	Are there signs of seeps on the dam? If yes, indicate where and estimated flow._____.
☐	☐	Are there any other potentially damaging features on the dam? If yes, describe. _____.
☐	☐	Are there any recent evidences of slope failure on the landside south of the dam (perform visual inspection and data analysis of inclinometers)? If yes, describe. _____.

Notes: Unable to complete due to snow cover

Signature of Inspector: _____

Inspections are performed under the direction of Jessica Wilczek, P.E.

If cracks or other potentially damaging features occur, notify Jessica Wilczek immediately.

Monument Dam
Inspection Form

Date: 2/26/2021
Time:
Name of Inspector: Robert Munz
Current Panel Being Mined: LW551
☐ Weekly Inspection ☒ Monthly Inspection

Yes	No	
☐	☒	Is mining within 1 mile of Monument Dam?
☐	☐	Are there visible surface cracks on the dam? If yes, indicate length and size of crack. _____.
☐	☐	Is there evidence of subsided areas on or around the dam? If yes, indicate where and degree. _____.
☐	☐	Are there bulges on the dam? If yes, indicate where and degree. _____.
☐	☐	Are there signs of seeps on the dam? If yes, indicate where and estimated flow._____.
☐	☐	Are there any other potentially damaging features on the dam? If yes, describe. _____.
☐	☐	Are there any recent evidences of slope failure on the landside south of the dam (perform visual inspection and data analysis of inclinometers)? If yes, describe. _____.

Notes: Unable to complete inspection due to snow cover.

Signature of Inspector: _____

Inspections are performed under the direction of Jessica Wilczek, P.E.

If cracks or other potentially damaging features occur, notify Jessica Wilczek immediately.

Monument Dam
Inspection Form

Date: 3/26/2021
Time:
Name of Inspector: Robert Munz
Current Panel Being Mined: LW551
☐ Weekly Inspection ☒ Monthly Inspection

Yes	No	
☐	☒	Is mining within 1 mile of Monument Dam?
☐	☐	Are there visible surface cracks on the dam? If yes, indicate length and size of crack. _____.
☐	☐	Is there evidence of subsided areas on or around the dam? If yes, indicate where and degree. _____.
☐	☐	Are there bulges on the dam? If yes, indicate where and degree. _____.
☐	☐	Are there signs of seeps on the dam? If yes, indicate where and estimated flow._____.
☐	☐	Are there any other potentially damaging features on the dam? If yes, describe. _____.
☐	☐	Are there any recent evidences of slope failure on the landside south of the dam (perform visual inspection and data analysis of inclinometers)? If yes, describe. _____.

Notes: Unable to complete inspection due to snow cover

Signature of Inspector: _____

Inspections are performed under the direction of Jessica Wilczek, P.E.

If cracks or other potentially damaging features occur, notify Jessica Wilczek immediately.

Monument Dam
Inspection Form

Date: 4/29/2021
Time: 11:00
Name of Inspector: Robert Munz
Current Panel Being Mined: LW551
☐ Weekly Inspection ☒ Monthly Inspection

Yes	No	
☐	☒	Is mining within 1 mile of Monument Dam?
☐	☒	Are there visible surface cracks on the dam? If yes, indicate length and size of crack. _____.
☐	☒	Is there evidence of subsided areas on or around the dam? If yes, indicate where and degree. _____.
☐	☒	Are there bulges on the dam? If yes, indicate where and degree. _____.
☐	☒	Are there signs of seeps on the dam? If yes, indicate where and estimated flow._____.
☐	☒	Are there any other potentially damaging features on the dam? If yes, describe. _____.
☐	☒	Are there any recent evidences of slope failure on the landside south of the dam (perform visual inspection and data analysis of inclinometers)? If yes, describe. _____.

Notes:

Signature of Inspector: _____

Inspections are performed under the direction of Jessica Wilczek, P.E.

If cracks or other potentially damaging features occur, notify Jessica Wilczek immediately.

Monument Dam
Inspection Form

Date: 5/27/2021
Time: 1:00 PM
Name of Inspector: Robert Munz
Current Panel Being Mined: LW551
☐ Weekly Inspection ☒ Monthly Inspection

Yes	No	
☐	☒	Is mining within 1 mile of Monument Dam?
☐	☒	Are there visible surface cracks on the dam? If yes, indicate length and size of crack. _____.
☐	☒	Is there evidence of subsided areas on or around the dam? If yes, indicate where and degree. _____.
☐	☒	Are there bulges on the dam? If yes, indicate where and degree. _____.
☐	☒	Are there signs of seeps on the dam? If yes, indicate where and estimated flow._____.
☐	☒	Are there any other potentially damaging features on the dam? If yes, describe. _____.
☐	☒	Are there any recent evidences of slope failure on the landside south of the dam (perform visual inspection and data analysis of inclinometers)? If yes, describe. _____.

Notes:

Signature of Inspector: _____

Inspections are performed under the direction of Jessica Wilczek, P.E.

If cracks or other potentially damaging features occur, notify Jessica Wilczek immediately.

Monument Dam
Inspection Form

Date: 6/21/21
Time: 3:00PM
Name of Inspector: Robert Munz
Current Panel Being Mined: LW 552
☐ Weekly Inspection ☒ Monthly Inspection

Yes	No	
☐	☒	Is mining within 1 mile of Monument Dam?
☐	☒	Are there visible surface cracks on the dam? If yes, indicate length and size of crack. _____.
☐	☒	Is there evidence of subsided areas on or around the dam? If yes, indicate where and degree. _____.
☐	☒	Are there bulges on the dam? If yes, indicate where and degree. _____.
☐	☒	Are there signs of seeps on the dam? If yes, indicate where and estimated flow._____.
☐	☒	Are there any other potentially damaging features on the dam? If yes, describe. _____.
☐	☒	Are there any recent evidences of slope failure on the landside south of the dam (perform visual inspection and data analysis of inclinometers)? If yes, describe. _____.

Notes:

Signature of Inspector: _____

Inspections are performed under the direction of Jessica Wilczek, P.E.

If cracks or other potentially damaging features occur, notify Jessica Wilczek immediately.

Monument Dam
Inspection Form

Date: 7/29/2021
Time: 10:00
Name of Inspector: Robert Munz
Current Panel Being Mined: LW 552
☐ Weekly Inspection ☒ Monthly Inspection

Yes	No	
☐	☒	Is mining within 1 mile of Monument Dam?
☐	☒	Are there visible surface cracks on the dam? If yes, indicate length and size of crack. _____.
☐	☒	Is there evidence of subsided areas on or around the dam? If yes, indicate where and degree. _____.
☐	☒	Are there bulges on the dam? If yes, indicate where and degree. _____.
☐	☒	Are there signs of seeps on the dam? If yes, indicate where and estimated flow._____.
☐	☒	Are there any other potentially damaging features on the dam? If yes, describe. _____.
☐	☒	Are there any recent evidences of slope failure on the landside south of the dam (perform visual inspection and data analysis of inclinometers)? If yes, describe. _____.

Notes:

Signature of Inspector: _____

Inspections are performed under the direction of Jessica Wilczek, P.E.

If cracks or other potentially damaging features occur, notify Jessica Wilczek immediately.

Monument Dam
Inspection Form

Date: 8/27/2021
Time: 1:00 PM
Name of Inspector: Robert Munz
Current Panel Being Mined: LW552
☐ Weekly Inspection ☒ Monthly Inspection

Yes	No	
☐	☒	Is mining within 1 mile of Monument Dam?
☐	☒	Are there visible surface cracks on the dam? If yes, indicate length and size of crack. _____.
☐	☒	Is there evidence of subsided areas on or around the dam? If yes, indicate where and degree. _____.
☐	☒	Are there bulges on the dam? If yes, indicate where and degree. _____.
☐	☒	Are there signs of seeps on the dam? If yes, indicate where and estimated flow._____.
☐	☒	Are there any other potentially damaging features on the dam? If yes, describe. _____.
☐	☒	Are there any recent evidences of slope failure on the landside south of the dam (perform visual inspection and data analysis of inclinometers)? If yes, describe. _____.

Notes:

Signature of Inspector: _____

Inspections are performed under the direction of Jessica Wilczek, P.E.

If cracks or other potentially damaging features occur, notify Jessica Wilczek immediately.

Monument Dam
Inspection Form

Date: 9/30/2021
Time: 12:00
Name of Inspector: Robert Munz
Current Panel Being Mined: LW 552
☐ Weekly Inspection ☒ Monthly Inspection

Yes	No	
☐	☒	Is mining within 1 mile of Monument Dam?
☐	☒	Are there visible surface cracks on the dam? If yes, indicate length and size of crack. _____.
☐	☒	Is there evidence of subsided areas on or around the dam? If yes, indicate where and degree. _____.
☐	☒	Are there bulges on the dam? If yes, indicate where and degree. _____.
☐	☒	Are there signs of seeps on the dam? If yes, indicate where and estimated flow._____.
☐	☒	Are there any other potentially damaging features on the dam? If yes, describe. _____.
☐	☒	Are there any recent evidences of slope failure on the landside south of the dam (perform visual inspection and data analysis of inclinometers)? If yes, describe. _____.

Notes:

Signature of Inspector: _____

Inspections are performed under the direction of Jessica Wilczek, P.E.

If cracks or other potentially damaging features occur, notify Jessica Wilczek immediately.

Monument Dam
Inspection Form

Date: 10/29/2021
Time: 11:30 am
Name of Inspector: Robert Munz
Current Panel Being Mined: LW 552
☐ Weekly Inspection ☒ Monthly Inspection

Yes	No	
☐	☒	Is mining within 1 mile of Monument Dam?
☐	☒	Are there visible surface cracks on the dam? If yes, indicate length and size of crack. _____.
☐	☒	Is there evidence of subsided areas on or around the dam? If yes, indicate where and degree. _____.
☐	☒	Are there bulges on the dam? If yes, indicate where and degree. _____.
☐	☒	Are there signs of seeps on the dam? If yes, indicate where and estimated flow._____.
☐	☒	Are there any other potentially damaging features on the dam? If yes, describe. _____.
☐	☒	Are there any recent evidences of slope failure on the landside south of the dam (perform visual inspection and data analysis of inclinometers)? If yes, describe. _____.

Notes:

Signature of Inspector: _____

Inspections are performed under the direction of Jessica Wilczek, P.E.

If cracks or other potentially damaging features occur, notify Jessica Wilczek immediately.

Monument Dam
Inspection Form

Date: 11/30/2021
Time: 11:30
Name of Inspector: Robert Munz
Current Panel Being Mined: LW 552
☐ Weekly Inspection ☒ Monthly Inspection

Yes	No	
☐	☒	Is mining within 1 mile of Monument Dam?
☐	☒	Are there visible surface cracks on the dam? If yes, indicate length and size of crack. _____.
☐	☒	Is there evidence of subsided areas on or around the dam? If yes, indicate where and degree. _____.
☐	☒	Are there bulges on the dam? If yes, indicate where and degree. _____.
☐	☒	Are there signs of seeps on the dam? If yes, indicate where and estimated flow._____.
☐	☒	Are there any other potentially damaging features on the dam? If yes, describe. _____.
☐	☒	Are there any recent evidences of slope failure on the landside south of the dam (perform visual inspection and data analysis of inclinometers)? If yes, describe. _____.

Notes:

Signature of Inspector: _____

Inspections are performed under the direction of Jessica Wilczek, P.E.

If cracks or other potentially damaging features occur, notify Jessica Wilczek immediately.

Monument Dam
Inspection Form

Date: 12/31/2021
Time: 12:00 PM
Name of Inspector: Robert Munz
Current Panel Being Mined: LW 552
☐ Weekly Inspection ☒ Monthly Inspection

Yes	No	
☐	☐	Is mining within 1 mile of Monument Dam?
☐	☐	Are there visible surface cracks on the dam? If yes, indicate length and size of crack. _____.
☐	☐	Is there evidence of subsided areas on or around the dam? If yes, indicate where and degree. _____.
☐	☐	Are there bulges on the dam? If yes, indicate where and degree. _____.
☐	☐	Are there signs of seeps on the dam? If yes, indicate where and estimated flow._____.
☐	☐	Are there any other potentially damaging features on the dam? If yes, describe. _____.
☐	☐	Are there any recent evidences of slope failure on the landside south of the dam (perform visual inspection and data analysis of inclinometers)? If yes, describe. _____.

Notes: Unable to inspect due to snow cover

Signature of Inspector: _____

Inspections are performed under the direction of Jessica Wilczek, P.E.

If cracks or other potentially damaging features occur, notify Jessica Wilczek immediately.

Fall 2021 Semi- Annual Subsidence Report
Appendix B
Table 1
Monument Dam Survey Data

		Spring 2021 to Fall 2021 Easting Displacement (X)	Spring 2021 to Fall 2021 Northing Displacement (Y)	Spring 2021 to Fall 2021 Elevation Displacement (Z)
	Survey Points	Displacement (ft)	Displacement (ft)	Displacement (ft)
Monument Dam	6001	0.18	0.13	-0.06
	6003	0.24	0.15	-0.06
	6004	0.05	0.30	0.02
	6005	0.12	0.17	-0.07
	6006	Not Surveyed*	Not Surveyed*	Not Surveyed*
	6007	0.28	0.12	-0.11
	6008	0.23	0.10	-0.12
	6009	0.17	0.15	-0.07
	6010	0.62	-0.10	0.03
	6011	0.19	0.20	-0.01
	6012	0.26	0.24	-0.07
Hillside south of road past Monument Dam	7000	0.20	0.20	-0.07
	7001	0.16	0.15	-0.11
	7002	0.25	0.24	-0.06
	7003	0.27	0.22	-0.06
	7004	0.25	0.13	-0.09
	7005	0.22	0.13	-0.01
	7006	0.25	0.10	-0.07
	7007	0.40	0.11	-0.08
	7008	0.36	0.07	-0.04
	7009	0.35	0.11	-0.05
	7010	0.00	0.00	0.00
	7011	0.38	0.08	-0.05
	7012	0.39	0.19	-0.03
	7013	0.52	0.22	-0.03
	7014	0.48	0.27	-0.03
	7015	0.50	0.27	-0.10
	7016	0.50	0.26	-0.09
	7017	0.53	0.27	-0.07
	7018	0.31	0.25	-0.09
	7019	0.26	0.26	-0.09
	7020	0.28	0.36	-0.10
	7021	Not Surveyed*	Not Surveyed*	Not Surveyed*
	7022	0.43	0.37	-0.03
	7023	0.00	0.00	0.00
	7024	Not Surveyed*	Not Surveyed*	Not Surveyed*
	7025	0.55	0.43	-0.10
	6501	0.18	-0.59	0.41
	6502	-0.14	-0.34	0.06
	6503	Not Surveyed*	Not Surveyed*	Not Surveyed*
	6504	Not Surveyed*	Not Surveyed*	Not Surveyed*

* Survey monument not avalible in spring due to damage, obstruction, ect.

APPENDIX C

Minnesota Reservoir Aerial Photograph Comparison (Maps C-1 and C-14)

MOUNTAIN COAL COMPANY
WEST ELK MINE

MINNESOTA RESERVOIR AREA
AERIAL PHOTOGRAPH COMPARISON
PHOTO DATE: JULY 2, 2004

		DATE
REVIEW	GDW	11/16/10
CHECK	CRD	11/16/10
APPROVAL		
DATE OF PHOTOGRAPHY		7/2/04
APPROXIMATE SCALE		1"=120'
2004.dwg		

NORTH

JOB NO. 831-032.792

REVISION NO. 1

MAP C-1

MOUNTAIN COAL COMPANY
WEST ELK MINE

MINNESOTA RESERVOIR AREA
AERIAL PHOTOGRAPH COMPARISON
PHOTO DATE: JUNE 24TH, 2020

		DATE
REVIEW	GDW	12/21/20
CHECK		
APPROVAL		
DATE OF PHOTOGRAPHY		06/24/20
APPROXIMATE SCALE		1"=120'
2020.dwg		

NORTH

JOB NO.
831-032.911

REVISION NO.
0

MAP
C-14

APPENDIX D

U.S. Forest Service 2021 Water Resources Survey

MOUNTAIN COAL COMPANY, LLC
WEST ELK MINE
2021 WATER RESOURCES PROJECT

Prepared by
Mountain Coal Company, LLC
West Elk Mine

March 2021

TABLE OF CONTENTS

MOUNTAIN COAL COMPANY, LLC
WEST ELK MINE
2019
U.S. FOREST SERVICE
WATER RESOURCES PROJECT

INTRODUCTION

As part of Mountain Coal Company, LLC's West Elk Mine permit, a requirement to monitor reservoirs and stock ponds is set forth on page 2.04-70 (See Attachment A). The requirement, with regard to the U.S. Forest Service water resources states:

> *"In addition, the West Elk Mine, in cooperation with the U.S. Forest Service (USFS), Paonia Ranger District in Paonia, Colorado, has agreed to informally monitor the USFS surface water resources (stock ponds), as depicted on Map 37, that are located directly over longwall panels to be mined or within the angle-of-draw per the agreement letter in Exhibit 19C. In addition to the commitments provided in Exhibit 19C, MCC will also photograph on a yearly basis the resources that are located over longwall panels to be mined or within the angle-of-draw. The results of the monitoring will be included in the Annual Hydrology Report. Table 8 lists the USFS water resources within or adjacent to the West Elk Mine permit area."*

Each pond has only one number; it was determined to use the "P" number in the Range Resource Improvement Numbers column as delineated in the Infra-Range Data-base. (For example: 803P10 shows the Range Management Unit {RMU}, 803, and the pond number, P10. The RMU is not shown in the report since all resources inventoried are in the same RMU). Table 8 (See Attachment B) has been revised to reflect these numbers.

To satisfy the permit requirement (See Attachment C), Mountain Coal Company located and photographed these water resources and prepared reports presenting these findings. In an effort to reduce the size of this report in 2014, Mountain Coal Company removed ponds from the report where subsidence had completed or were further than a year out from being undermined (See Attachment C, bullet two). This document is a follow-up to the Mountain Coal Company, West Elk Mine Water Resources Project reports 2005 through 2015.

PROJECT AREA

The 2019 project area is located on lands managed by the USDA Forest Service, Rocky Mountain Region, Grand Mesa-Uncompahgre-Gunnison National Forest, Paonia Ranger District. It encompasses Sections Sections 3, 4, 9 and 10, T. 14 S., R. 90 W. 6th PM. See Attachment D, Map 37 of the West Elk Mine Permit for locations.

WATER RESOURCES

DF-35

This pond is located in the upper reaches of Lick Creek. The coordinates are N 38°50’55.0939”, W 107°25’29.0538” and the elevation is approximately 8,500’. The pond is located above longwall panel LWSS1 that will be longwall mined during 2021.

Monument Dam

Monument Dam was not within the angle of draw per MCC’s CDRMS permit there was no aerial image of the Dam taken in 2021.

SUMMARY AND CONCLUSION

There was only one pond inspected and photographed in 2021. No effects from subsidence were observed at the pond locations.

Attachment A

Analyses are completed as outlined in the *Guidelines for Collection of Baseline Water Quality and Overburden Geochemistry Data* (CDMG 1982). Results are reported in the Annual Hydrology Reports. If not already provided in the AHRs, baseline data will be provided to CDRMS prior to longwall mining under or within the angle-of-draw of a monitored resource.

Spring Monitoring

Spring Quantity

In 1977, MCC began a spring water monitoring program that incorporated monthly, quarterly and semi-annual monitoring of flow and/or water quality. Map 37 shows the springs identified within the coal lease area and the locations of the decreed springs. Springs that are included in the monitoring program are presented in Exhibit 71 and 71A. Annual Hydrology Reports provide a graphic representation of the flow data available for the springs monitored from 1984 to date.

Spring Quality

The springs included in the current monitoring plan are presented in Exhibit 71 and 71A. Seasonal baseline measurements are obtained to characterize the water. As with stream water quality, mining-related changes in water quality that are known to mobilize metals would cause iron or manganese to be released in readily detectable quantities, and changes in conductivity and TDS will indicate changes in water quality. If not already provided in AHRs, baseline data will be provided to CDRMS prior to longwall mining under or within the angle-of-draw of a monitored water resource.

Spring water quality samples (Exhibit 19 and Exhibit 19A) were obtained from selected locations. These springs were chosen for water sampling on the basis of geographic distribution, generally reliable flow, availability of previous water quality data, and ease of access. Springs were selected to provide sampling points in each of the major watersheds in the project area, and to provide coverage throughout the lease area. In addition, Mayo and Associates conducted a hydrogeologic analysis of the permit and adjacent area in 1999. The complete report is included in Exhibit 18. To summarize Dr. Mayo's findings: the groundwater systems are localized, are not areally extensive, and tend to form discrete groundwater bodies that are not in hydrodynamic communication with each other. Therefore, impacts to the water quality of a spring due to underground mining are highly unlikely.

Monitoring of Reservoirs and Stock Ponds

Although water level measurements are not taken on Minnesota Reservoir, the Upper and Lower Dry Fork flumes provide an estimate of the reservoir inflows and outflows. The addition of the ditch company's flume (Middle Dry Fork) upstream of the reservoir has improved the accuracy of the reservoir inflow measurement.

In addition, MCC, in cooperation with the U.S. Forest Service (USFS), Paonia Ranger District, informally monitors the USFS surface water resources (stock ponds), as depicted on Map 37, that are located directly over longwall panels to be mined or within the angle-of-draw per the

agreement letter in Exhibit 19C. MCC also annually photographs stock ponds that are located over longwall panels to be mined or within the angle of draw. The results of this monitoring are provided in the AHRs. Table 12 lists the USFS water resources within or adjacent to the West Elk Mine permit area.

Table 12
Summary of U.S. Forest Service Water Resources Near the West Elk Mine

Resource Number	Name	Source	Current Amount of Use[1]
131	Dry Fork 44	Gribble Gulch	0.5 AF
132	Dry Fork 42	Minnesota Creek	0.5 AF
133	Dry Fork 43	Minnesota Creek	0.5 AF
134	Dry Fork 41	Minnesota Creek	0.5 AF
135	Dry Fork 26	Minnesota Creek	0.5 AF
136	Dry Fork 40	Minnesota Creek	0.5 AF
137	Dry Fork 13	Minnesota Creek	0.5 AF
138	Dry Fork 17	Minnesota Creek	0.5 AF
139	Dry Fork 37	Minnesota Creek	0.5 AF
140	Dry Fork 16	Minnesota Creek	0.5 AF
141	Dry Fork 38	Minnesota Creek	0.5 AF
142	Dry Fork 4	Minnesota Creek	0.5 AF
143	Dry Fork 39	Minnesota Creek	0.5 AF
144	Dry Fork 7	Minnesota Creek	0.5 AF
145	Dry Fork 32	Minnesota Creek	0.5 AF
146	Dry Fork 8	Sylvester Gulch	0.5 AF
147	Dry Fork 49	Sylvester Gulch	0.5 AF
148	Dry Fork 36	Minnesota Creek	0.5 AF
149	Dry Fork 9	Minnesota Creek	0.5 AF
150	Dry Fork 22	Minnesota Creek	0.5 AF
151	Dry Fork 23	Minnesota Creek	0.5 AF
152	Dry Fork 18	Minnesota Creek	0.5 AF
153	Dry Fork 28	Minnesota Creek	0.5 AF
154	Dry Fork 48	Sylvester Gulch	0.5 AF
155	Dry Fork 47	Deep Creek	0.5 AF
156	Dry Fork 45	Minnesota Creek	0.5 AF
157	Dry Fork 46	Deep Creek	0.5 AF
158	Dry Fork 27	Deep Creek	0.5 AF
159	Dry Fork 24	Deep Creek	0.5 AF
179	Cow Camp	Spring	0.001 CFS
180	Dry Fork	Raven Gulch	0.1 AF
181	Dry Fork	Raven Gulch	0.5 AF
182	Dry Fork	Deep Creek	0.5 AF
183	West Flatiron	West Flatiron	1.0 AF
185	Dry Fork	Sylvester Gulch	0.5 AF
186	Dry Fork	Sylvester Gulch	0.5 AF
187	Dry Fork	Sylvester Gulch	0.5 AF
188	Dry Fork	Sylvester Gulch	0.5 AF
200[2]	Cowboy	Sylvester Gulch	1.0 AF
201[2]	Indian	Sylvester Gulch	1.0 AF
260	Dry Fork	Long Draw	0.3 AF
261	Dry Fork	Sylvester Gulch	0.3 AF
265	NA[3]	Sylvester Gulch	NA
266	NA	Sylvester Gulch	NA
279	NA	Minnesota Creek	NA
280	NA	Minnesota Creek	NA
281	NA	NA	NA
282	NA	Sylvester Gulch	NA

[1]AF=Acre Feet (Storage) and CFS=Cubic Feet per Second (Flow)

[2]Future foreseeable use.

[3]NA – Information has not been provided by the U.S. Forest Service

[4]Resources, except No. 185 and 186 have a June through October season of use. Resources 185 and 186 have a May through October season of use.

Attachment B

Summary of U.S. Forest Service Water Resources Near the West Elk Mine				
Number/Name	**Date**	**Location**	**Elevation (Feet)**	**High Water Line (Feet)**
Gribble Gulch				
P-10	7/27/2010	N 38° 53' 50.3", W 107° 28' 47.1"	7820	60' x 60'
Lone Pine Gulch				
SLP-1	7/27/2010	N 38° 54' 03.5", W 107° 27' 48.4"	7685	3' x 10' Tank
Horse Gulch				
P-11	7/27/2010	N 38° 53' 36.7", W 107° 28' 23.5"	7785	48' x 39'
P-12	7/27/2010	N 38° 53' 35.9", W 107° 28' 07.1"	7700	45' x 36'
P-13	7/27/2010	N 38° 53' 32.0", W 107° 28' 12.7"	7635	51' x 66'
P-86	7/27/2010	N 38° 53' 22.3", W 107° 28' 13.0"	7595	75' x 39'
P-87	7/27/2010	N 38° 53' 07.4", W 107° 28' 14.9"	7475	60' x 60'
Drainage East of Horse Gulch				
P-15	7/27/2010	N 38° 53' 18.6", W 107° 27' 41.9"	7860	30' x 30'
Lower Apache Rocks Road				
P-19	7/16/2010	N 38° 53' 26.1", W 107° 27' 23.9"	7920	60' x 54'
P-20	7/16/2010	N 38° 53' 13.4", W 107° 27' 06.1"	7805	39' x 39'
P-22	7/16/2010	N 38° 53' 06.6", W 107° 27' 12.1"	7755	192' x 108'
West Flatiron Road				
P-18	7/16/2010	N 38° 53' 44.2", W 107° 27' 02.4"	7500	125' x 65'
P-96	7/16/2010	N 38° 53' 51.0", W 107° 27' 03.2"	7450	42' x 39'
Sly Spring	7/16/2010	N 38° 53' 39.3", W 107° 26' 35.7"	7160	
P-77	7/16/2010	N 38° 53' 30.2", W 107° 26' 25.0"	7390	75' x 63'
P-69	7/15/2010	N 38° 53' 23.7", W 107° 25' 46.1"	7540	69' x 60'
P-70	7/15/2010	N 38° 53' 24.6", W 107° 25' 44.4"	7565	75' x 54'
P-72	7/15/2010	N 38° 53' 33.8", W 107° 25' 55.1"	7830	66' x 42'
P-55	7/15/2010	N 38° 53' 58.4", W 107° 25' 08.1"	8290	120' x 90'
P-56	7/15/2010	N 38° 54' 03.2", W 107° 24' 45.4"	8430	102' x 69'
P-57	7/15/2010	N 38° 54' 15.5", W 107° 24' 36.4"	8375	150' x 75'
P-67	7/15/2010	N 38° 54' 07.4", W 107° 25' 14.0"	8430	54' x 42'
P-80	7/15/2010	N 38° 54' 02.5", W 107° 25' 25.7"	8470	75' x 39'
P-81	7/15/2010	N 38° 54' 03.9", W 107° 25' 25.5"	8478	120' x 67'
Long Draw				
P-32	7/15/2010	N 38° 53' 17.4", W 107° 24' 57.3"	7650	45' x 30'
P-33	7/15/2010	N 38° 53' 14.0", W 107° 25' 15.6"	7835	48' x 45'
Dry Fork Road North				
P-62	7/16/2010	N 38° 52' 54.6", W 107° 26' 49.9"	7720	72' x 63'
P-21	7/21/2010	N 38° 53' 10.2", W 107° 27' 38.7"	7980	72' x 54'
Lower Cow Camp Spring	7/16/2010	N 38° 52' 40.4", W 107° 26' 27.3"	7760	
P-71	7/21/2010	N 38° 52' 56.0", W 107° 25' 59.8"	8010	90' x 60'
P-25	7/21/2010	N 38° 53' 00.4", W 107° 25' 43.8"	7745	99' x 93'
P-26	7/21/2010	N 38° 52' 54.2", W 107° 25' 41.1"	7805	80' x 80'
P-28	7/28/2010	N 38° 52' 36.7", W 107° 25' 53.8"	8120	60' x 42'
P-29	7/28/2010	N 38° 52' 33.1", W 107° 25' 42.8"	7970	114' x 80'
P-35	7/28/2010	N 38° 52' 37.9", W 107° 25' 30.7"	8050	54' x 48'
P-36	7/16/2010	N 38° 52' 18.8", W 107° 25' 16.2"	7950	48' x 45'
P-37	7/19/2010	N 38° 53' 08.3", W 107° 23' 29.2"	8495	153' x 108'

Drainage West of Deer Creek				
P-17	7/28/2010	N 38° 52' 30.7", W 107° 28' 01.6"	7760	66' x 45'
Deer Creek				
P-74	7/28/2010	N 38° 52' 16.0", W 107° 27' 30.0"	7675	60' x 60'
P-93	7/28/2010	N 38° 52' 09.0", W 107° 27' 23.6"	7740	63' x 60'
P-44	7/28/2010	N 38° 51' 57.3", W 107° 27' 28.3"	7805	
High Deer Creek Spring	7/28/2010	N 38° 51' 47.1", W 107° 27' 23.6"	7890	20' x 10'
P-45	7/28/2010	N 38° 52' 01.1", W 107° 27' 09.1"	7840	60' x 45'
Dry Fork Road South				
P-23	7/29/2010	N 38° 52' 34.0", W 107° 27' 05.4"	7770	120' x 99'
P-24	8/4/2010	N 38° 52' 21.2", W 107° 26' 50.5"	7880	135' x 120'
Natural Pond	7/29/2010	N 38° 52' 16.3", W 107° 26' 52.2"	7910	40' x 40'
P-95	7/19/2010	N 38° 51' 56.5", W 107° 26' 44.8"	7970	155' x 130'
P-47	7/28/2010	N 38° 51' 51.7", W 107° 26' 13.2"	8090	30' x 30'
P-48	7/28/2010	N 38° 51' 58.6", W 107° 26' 24.1"	7920	30' x 30'
P-30	7/16/2010	N 38° 52' 14.6", W 107° 25' 44.5"	8080	48' x 39'
P-31	7/16/2010	N 38° 52' 15.9", W 107° 25' 52.8"	8020	30' x 30'
DF-30	7/15/2017	N 38° 51' 21.16", W 107° 25' 52.09"	8080	40' x 30'
DF-35	05/29/2019	N 38°50’55.09”, W 107°25’29.05”	8500	

Attachment C

EXHIBIT 19C

Mountain Coal Company
West Elk Mine
Post Office Box 591
Somerset, Colorado 81434
Telephone 303 929-5015
Fax 303 929-5595

April 26, 1995

Mr. Raymond Kingston
U. S. Forest Service, Paonia Ranger District
P.O. Box 1030
Paonia, CO 81428

Re: Monitoring of U. S. Forest Service Water Resources

Dear Mr. Kingston,

To update and clarify Mountain Coal Company's (MCC) 1986 agreement with the U.S. Forest Service, Paonia Ranger District (USFS) to monitor the USFS surface water resources that are located above panels to be retreat mined (i.e., longwall mined or secondary recovery), I met with Mike Ward at your office on February 07, 1995. In summary, MCC shall:

- Maintain Map 37 that contains the locations of the USFS surface water resources (stock ponds) within the West Elk Mine area of interest. MCC shall contact the USFS at least annually for updated USFS surface water resource information (i.e., add ponds constructed or moved, etc.) If updated, a copy of Map 37 shall be submitted by revision application for incorporation into MCC's Permit document. A current map shall also be included in Annual Hydrology Reports (provided annually to the USFS.)

- Monitor for effects of subsidence by visually inspecting (access permitting) USFS surface water resources with planned seasonal livestock use that are within the surface area defined by the angle-of-draw from longwall mined areas and areas of active secondary recovery. These inspections shall typically be conducted monthly during the grazing season only (unless changing conditions require a more frequent or less frequent monitoring interval as determined by the District Ranger.) This monitoring shall typically begin one year prior to planned retreat mining (for baseline condition) and end after complete subsidence of the area [i.e., two consecutive subsidence surveys with no measured movement not attributable to natural forces (e.g., frost heave, sloughage, etc.)] MCC shall contact the USFS each year to determine the areas and start and end dates (duration) of planned seasonal livestock use.

- Promptly report to the USFS any subsidence "impacts" observed by MCC inspection. MCC shall also promptly inspect (access permitting) a reported "impact" to a "use" by a grazing permittee or USFS official.

- Implement a contingency plan to mitigate those "impacts" as follows. 1) repair of the damaged water resource (i.e., repair of a leaking pond, etc., if possible,) 2) development of an alternate supply, 3) consult with users, the USFS, and other involved parties as to necessary repairs, construction plans, access or mitigative action to be taken, and 4) to provide a temporary water supply, should it be necessary, until such time as permanent supply can be provided.

By means of Technical Revision No. 71 to MCC's permit document, MCC will incorporate this letter as Exhibit 19C. To indicate your concurrence with the above updated clarification of the monitoring agreement, please sign one copy of this letter and return it to me at the above address.

Please contact me should you have questions.

Sincerely,

Kathleen G. Welt

Kathleen G. Welt,
Environmental Supervisor

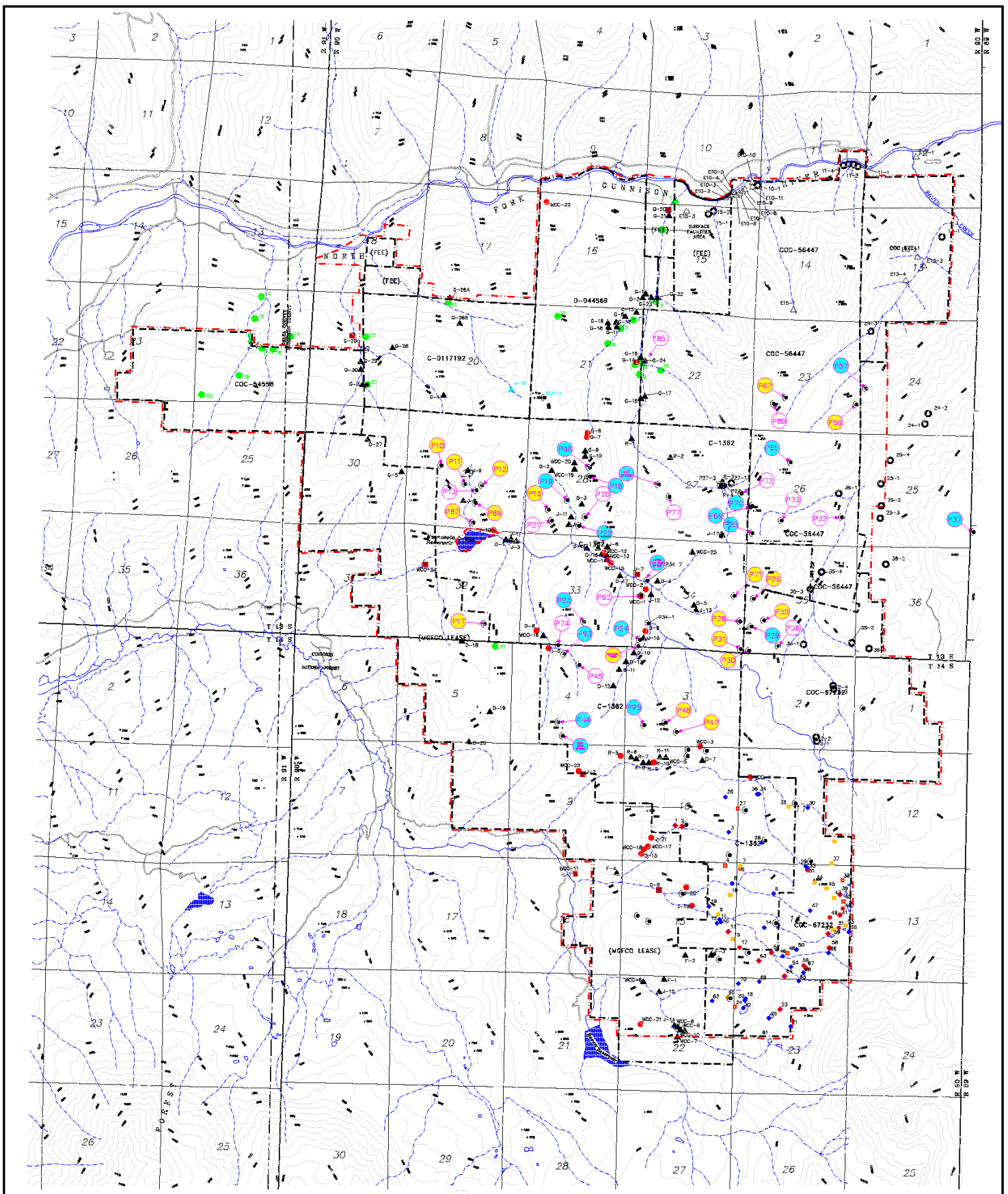
Concurrence Acknowledged:

Raymond Kingston

Raymond Kingston, Acting District Ranger

cc: Christine Johnston, CDMG
Phil Schmidt, MCC
Mike Ward, USFS

Attachment D



LEGEND

- *Partial Record of Spring Flow*
- *Intermittent Springs*
- *Perennial Springs*
- *Ephemeral Springs*
- *Springs found flowing at every visitation 1975, 1977, 1978, 1979, and 1980*
- P45 → *Some water*
- P18 → *Water all season*
- P45 → *Dry*
- *Stock Ponds*
- *Approximate Location of Decreed Springs*
- *Spring Related Feature*[3]
- *Spring Related Feature (Significant)*[3]
- *Pond Related Feature*[3]
- *Pond Related Feature (Significant)*[3]
- *Other*[3]
- *Proposed Dry Fork LBA*
- *Permit Area Boundary*
- *Coal Lease Boundary (Federal Lease C-1362 Excludes 24.8 Acres In Independent Reservoir A.K.A. Minnesota Reservoir)*

NOTES:
1. EXHIBIT 71, MAP NO. 1 AND ANNUAL HYDROLOGY REPORT SHOW THE RESOURCES CURRENTLY MONITORED
2. EXHIBIT 19C AND ANNUAL WATER RESOURCES PROJECT ADDRESS USFS WATER RESOURCES AND PHOTO MONITORING
3. SPRINGS AND PONDS IN SOUTH PERMIT AREA FROM EXHIBIT 19E AND B/2017 SFEIS.

EXPLANATION FOR DECREED SPRINGS

1	Chipmunk Ditch						
	3/20/1954	6/1/1937	S	1.0 cfs			
			S,TF	0.43 cfs			
	5/28/1937	6/10/1917	S	0.90 cfs			
			S,C	1.00 cfs			
2	Walter Callab Headgate No. 1						
	3/20/1954	6/1/1908	S	0.75 cfs			
3	Tony Bear Pipeline – Yuma Spring						
	3/20/1954	6/1/1937	S,AP	0.00 cfs			
4	Tony Bear Pipeline – Brose Spring						
	3/20/1954	6/1/1937	S,AP	0.00 cfs			
5	Tony Bear Pipeline – Chief Spring						
	3/20/1954	6/1/1937	S,AP	0.00 cfs			
6	Tony Bear Pipeline – Papoose Spring						
	3/20/1954	6/1/1937	S,AP	0.00 cfs			
7	Tony Bear Pipeline – Squaw Spring						
	3/20/1954	6/1/1937	S,AP	0.00 cfs			
8	Tony Bear Pipeline – Hagan Spring						
	3/20/1954	6/1/1937	S,AP	0.00 cfs			
9	Tony Bear Pipeline – Wigwam Spring						
	3/20/1954	6/1/1937	S,AP	0.00 cfs			
10	Tony Bear Pipeline – Wampum Spring						
	3/20/1954	6/1/1937	S,TT	0.00 cfs			
11	Tony Bear Pipeline – Chipeta Spring						
	3/20/1954	6/1/1937	S,AP	0.00 cfs			
12	Jumbo Spring No. 3 Pond						
	12/31/1975	1/31/1975	S,C	----			
	12/31/1975	12/31/1943	S,C	0.10 cfs			
13	Jumbo Spring and Pipeline						
	12/31/1972	5/1/1972	S	0.05 cfs			
14	Wilcox Reservoir						
	1/31/1964	7/6/1909	S	3.6 AF			
15	Wilcox Ditch						
	2/10/1930	4/13/1914	S	2.6 cfs			
16	Wilcox Reservoir No. 1						
	1/31/1964	8/7/1909	S	5.5 AF			
17	Jumbo Spring No. 7 Pond						
	12/31/1975	12/31/1903	S	0.10 cfs			
18	Jumbo Pipeline and Spring No. 5						
	12/31/1975	6/30/1973	S	0.70 cfs			
19	Raymond Wilcox Reservoir No. 2						
	1/31/1964	12/13/1913	S	1.4 AF			
20	Jumbo Spring No. 6 Pond						
	12/31/1975	12/31/1943	S	0.10 cfs			
21	Deer Creek Domestic Springs Pipeline						
	3/20/1954	5/13/1950	S,C	0.10 cfs			
22	Jumbo Spring No. 2 Pond						
	12/31/1975	1/31/1975	S,C	----			
	12/31/1975	12/31/1943	S	0.10 cfs			
23	Jumbo Spring No. 4 Pond						
	12/31/1975	12/31/1975	S,C	----			
	12/31/1975	12/31/1943	S	0.10 cfs			

LEGEND

Name of Spring — 12/31/1975 | 12/31/1943 | S | 0.10 cfs
(Adjudication Date | Priority Date | Type of Adjudication (1) | Quantity)

(1) S=Supplemental
C=Conditional
TT=Transfer To
TF=Transfer From
AP=Alternate Point

THE STOCK POND AND ASSOCIATED SPRINGS PORTION OF THIS DRAWING WAS PREPARED UNDER MY SUPERVISION & REPRESENTS INFORMATION THAT IS ACCURATE TO THE BEST OF MY KNOWLEDGE

N

Mountain Coal Company

West Elk Mine, Mountain Coal Company, L.L.C. An Arch Coal Company
5174 HWY. 133 Somerset, CO 81434

MAP 37
Spring and Stock Pond Location Map

DRAWN BY:	SCALE:	DATE REV - REV. NO
GBG	1"=2000'	03-28-08 - PR-12 GBG 03-19-18 - PR-15-GBG
APPROVED BY:	ACAD DWG NO.:	
HAB/KW	PR-15-M37.DWG	

APPENDIX E

Extent of E-seam Longwall Mining Map – Fall 2021

R 91 W
R 90 W
R 89 W
DELTA COUNTY
GUNNISON COUNTY
T 13 S
T 14 S
R 91 W
R 90 W
DRY FORK
MINNESOTA CREEK
DEEP CREEK
DEEP CREEK DITCH
LWE10
LWE11
LWE12
LWE17
LWE16
LWE15
LWE14
LWE8
LWE9
LWE1
LWE2
LWE3
LWE4
LWE5
LWE6
LWE7
LWSS3
LWSS1

LEGEND

- Permit Area Boundary
- Coal Lease Boundary (Federal Lease C–1362 Excludes 24.8 Acres Under Minnesota Reservoir a.k.a. Independent Reservoir or Monument Dam)
- Approximate limit of the maximum predicted 19° E–seam angle of draw.[1]
- Maximum Projected Areal Extent of Potential Mineable E–seam.[2]
- Projected E Seam mining
- – MINED AREAS
- – PROJECTED POTENTIAL MINING AREA 2021–2025
- – AREA OF IN–MINE EXPLORATION

NOTES:

- Gateroad entries for longwall panels LWE1 through LWE8 were generally developed from west to east and then longwall mined from east to west. These longwall panels were mined in order from north to south within the coal lease areas shown.
- The proposed western longwall panels LWE9 through LWE12 will likely be the last E Seam panels mined due to the locations along the main entries.
- The projected panel layout and timing were based on the best available exploration data, professional judgement, and markets at the time this map was prepared. Pillar and panel dimensions may be adjusted within the Projected Potential Mining Area and permit boundary if warranted by actual mining conditions, including coal thickness, coal quality, and geotechnical conditions to fulfill federal coal lease maximum economic recovery requirements.

1. See Exhibit 60E. The actual E–seam angle–of–draw has been conservatively calculated as 16.3°. (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.
2. Also referred to as the "Projected Potential Mining Area." Although not anticipated (based on available data, as above), should mining be extended in this area and beyond the projected E–seam mining shown, the associated projected impacts of subsidence have been evaluated in Exhibits 55B & 60E.

THIS DRAWING WAS PREPARED UNDER MY SUPERVISION AND REPRESENTS INFORMATION THAT IS ACCURATE TO THE BEST OF MY KNOWLEDGE

DRAWN	
DATE	BY
12/31/17	TR-143 JAW
REVISED	
DATE	BY
1-19-18	TR-144 GBG
3-19-18	PR-15 GBG
6-29-18	PR-15 EDL
2-1-21	TR-149 GBG
3-14-22	Fall Subsidence-NP

ARCH WEST ELK
5174 Highway 133
Somerset, CO 81434
Operated by Mountain Coal Company, L.L.C.
A subsidiary of Arch Resources, Inc.

Subsidence Report as of 9-27-21
E-SEAM PROJECTED OPERATIONS

COORDINATE SYSTEM: NAD 27

SCALE: 0 2000 feet

FILE NO.
WWE SUBSIDENCE MAP_RECOVER.DWG
Path: E:\ENVIRONMENTAL (EV)\AGENCIES\CDRMS\QUARTERLY REPORTS\SUBSIDENCE

DENVER
2490 W. 26th Avenue Suite 100A
Denver, Colorado 80211
Phone: 303.480.1700
Fax: 303.480.1020

GLENWOOD SPRINGS
818 Colorado Avenue
P.O.Box 219
Glenwood Springs, Colorado 81602
Phone: 970.945.7755
Fax: 970.945.9210

DURANGO
1666 N. Main Avenue Suite C
Durango, Colorado 81301
Phone: 970.259.7411
Fax: 970.259.8758

www.wrightwater.com

Wright Water Engineers, Inc.