Spring 2023 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:
Jonathan M. Kelly, P.E., Project Manager
Wright Water Engineers, Inc.

Wright Water Engineers, Inc.

September 2023

831-032.914

Spring 2023 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:
Jonathan M. Kelly, P.E.
Project Manager
Wright Water Engineers, Inc.

September 2023
831-032.914

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: jkelly@wrightwater.com

September 29, 2023

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

Re: Spring 2023 Subsidence Monitoring Report Preparation – Mountain Coal Company, LLC.

Dear Mr. Simmons,

The following report entitled *Spring 2023 Subsidence and Geologic Field Observations – Southern Panels and Sunset Trail Mining Areas*, was prepared by Jonathan M. Kelly (a licensed professional engineer) and employee of Wright Water Engineers, Inc.

Sincerely,

WRIGHT WATER ENGINEERS, INC.

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

TABLE OF CONTENTS

MAPS

APPENDICES

SPRING 2023 SUBSIDENCE AND GEOLOGIC FIELD OBSERVATIONS SOUTHERN PANELS AND SUNSET TRAIL MINING AREAS[1]

1.0 BACKGROUND

This subsidence report is the first of two detailed documents on this subject to be generated based on 2023 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 by September 30 (for preceding spring monitoring) of each year.

Prior field observations and experience in the West Elk Mine area over the last twenty-eight years[2] (1996 to 2023 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.

Spring 2023 subsidence observations were performed on July 13, 2022, in the Southern Panels Mining Area with specific focus on the E-seam Longwall Panel 14 and in the Sunset Trail Mining Area relative to the last two E-seam Longwall Panels (SS3 and SS4). Traverse names used in the previous reports may not coincide with those used in this report. Observations associated with E-

[1] The Southern Panels Mining Area includes the E-seam Longwall Panels E1 through E8 included in the South of Divide Mining Area, some of which were included in the Dry Fork Mining Area. Also included in the Southern Panels Miing Area are E-seam Longwall Panels E14 through E17. 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).

seam longwall mining of Panels E1 through E8 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 spring 2023 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 July 13, 2022, 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 spring 2023, 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 were generally 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 complete at the time of WWE's fall 2021 field visit. E-seam Longwall Panel SS2 was initiated in June 2021 and was complete at the time of the spring 2022 field visit. Mining of E-seam Longwall Panel E14 was initiated in April 2022 and was complete at the time of our spring 2023 site visit. At the time of our spring 2023 site visit, mining of Longwall Panel SS3 was complete and mining of Longwall Panel SS4 was nearly complete based on the revised panel length (Map 1).

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 spring 2023 field visit were focused on areas above mined E-seam Longwall Panel E14 in the Southern Panels Mining Area and on E-seam Longwall Panel SS2 through SS4 of the Sunset Trail Mining Area. We also performed initial reconnaissance observations over a portion of the proposed E-seam Longwall Panel E15.

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. 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 for these areas are provided in Appendices A and B, respectively. Note that the term "displacement," as used in Appendix C, is the difference in the measurements recorded in the last two surveys.

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 2023 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. Dam Inspection Forms for Monument Dam from January 2023 through spring 2023 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 height and longitudinal displacement data is obtained by MCC. However, with advancing technology and more stringent regulations, MCC updated the Survey Monitoring System. Appendix C shows a new base point, using the new technology that was required for MCC to obtain in order to comply with Dam monitoring requirements. Fall 2023 data will become the new base point data for future displacement, as opposed to the 2006 data that was previously used.

4.0 SPRING 2023 SUBSIDENCE OBSERVATIONS

During WWE's spring 2023 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. However, WWE has ceased visiting historical features over Longwall Panel E7 that had been mined years ago and have been thoroughly documented in previous reports without significant changes. Similarly, previous traverses over Longwall Panels E3 through E8 were replaced with new traverses over active mining or proposed mining areas. 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 spring 2023 field visit above recent mining Longwall Panels E14, SS3 or SS4.

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. Observations previously made over Longwall Panel SS2 from the northeast were replaced by a new traverse E-E' from the south to observe the area overlying the western portion of the panel that was mined since the fall 2021 field visit.

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 G-G' (see Maps 1 and 2) as observed during the spring 2022 field visit. Details associated with these observations can be found in Sections 4.1 through 4.7 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.

4.1 Traverse A-A'

This traverse overlies portions of mined E-seam Longwall Panels E1 through E4. 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 spring 2023 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 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 C-C′.

No subsidence-related features were observed along this traverse during the spring 2023 field visit.

4.3 Traverse C-C’

Traverse C-C’ is bisected by the end of Traverse B-B’ and extends from the proposed E-Seam Longwall Panel E15 to the northwest to the E-Seam Longwall Panels SS2 and SS3 to the southeast. En route the traverse runs along the north side of E-Seam Longwall Panel E14, which was actively being mined at the time of the spring 2022 site visit. The traverse also crosses Lick Creek and South Prong stream channels, providing an opportunity to observe whether there has been any observable longwall-mining induced subsidence impact to these drainages.

Traverse C-C’ extends to the northwest over the proposed E-seam Longwall Panel E15. The road was passible for the initial stretch in our four-wheel drive vehicle, after which we had to perform the rest of the observations on foot.

The traverse provided the best opportunity to observe areas that had most recently been mined beneath. The segment southeast of the intersection with Traverse B-B' was immediately adjacent to the active longwall mining occurring in Longwall Panel E14. Locations 1 and 2 are located over the E14 Headgate as shown in Map 1.

4.3.1 Location 1

Cracks were observed along the existing road over the E14 Headgate between Crosscuts 23 and 22 during our spring 2022 site visit (Figure 1). No cracks had been observed along this traverse prior to mining in Longwall Panel E14. Therefore, the cracks were deemed to be subsidence-related features. The E-seam overburden thickness at this location is approximately 650 to 700 feet.

Figure 1: Southeast view of subsidence crack parallel to road on Traverse C-C' located over the E14 Headgate, between crosscuts 23 and 22 during spring 2022 visit.

During the fall 2022 site visit, about 100 feet to the southeast along the road, small residual cracking was observed near Location 1 with similar orientation to those previously observed nearby. Prior to the spring 2023 site visit, significant road work and heavy truck traffic had occurred on the stretch of road containing Location 1 (Figure 2). As a result, no cracks were observed at this location.

Figure 2: Access road along Longwall Panel E14 Headgate follow roadwork.

4.3.2 Location 2

New cracks were observed south of the access road overlying the north end of E-seam Longwall Panel E14 during the fall 2022 site visit. As shown on Map 1, the cracks were observed at Location 2 adjacent to cross cut 17 of the E14 Headgate. A series of parallel cracks were observed roughly parallel to the E14 Headgate with an orientation of South 40° East. The largest of the observed cracks followed the topographic contour for approximately 100 feet (Figure 3).

Figure 3: The largest of the cracks observed at Location 2, south of the across road on Traverse C-C'.

The location of these cracks is consistent with locations where the tilt and horizontal displacement are largest near the edge of the panel as shown in Figure 3 of Exhibit 60E (WWE 2018). The existence of the series of parallel cracks was likely a combination of these horizontal strains in combination with the natural sloped hillside. In total, there were 5 cracks observed with the dimensions of the cracks generally decreasing in the downhill direction towards the center of the longwall panel.

During the spring 2023 site visit, these cracks were still evident but were much less prominent. The smaller cracks had largely healed/sealed, especially where cattle or large game trails occurred. The largest crack was still open and roughly 2.5 feet in maximum depth (Figure 4).

Figure 4: The largest of the cracks at Location 2, south of the across road on Traverse C-C' during spring 2023 visit.

4.4 Traverse D-D’

This new traverse branches off Traverse C-C’ to the southwest across E-seam Longwall Panel E14. We were able to drive the initial portion of this traverse across Panel E14 and then proceeded on foot to the end of the traverse as shown in Map 1.

The mining of Panel E14 occurred underneath this traverse during June 2022. No discernable subsidence features were observed along this traverse during either our fall 2022 or spring 2023 site visits.

4.5 Traverse E-E'

This new traverse begins at Traverse C-C′ and continues north toward mined E-seam Longwall Panel SS2 before turning southeast toward E-seam Longwall Panel SS3 and terminating at MVB SS3-2 (see Map 1). Overburden along this traverse varies from about 250 feet over the mains up to just under 1,000 feet at the drill pad.

Cracks were observed along the access road to MBV SS3-2 overlying E-seam Longwall Panel SS3 in between Locations 3 and 4 as shown in Map 1 during the spring 2023 field visit.

4.5.1 Locations 3 to 4

New cracks were observed along the north side of the access road overlying the north end of E-seam Longwall Panel SS3 during the spring 2023 site visit. As shown on Map 1, the cracks were observed between Location 3 and 4. A series of parallel cracks were observed roughly parallel each other with an orientation of South 37° East. The cracks had no discernable depth or width and were not perpendicular to the road (Figure 5). It is unclear whether these observed cracks were related to mining subsidence; however, their consistent orientation was noteworthy and merited documentation. Longwall mining occurred under Locations 3 to 4 during the months of December 2022 and January 2023.

Figure 5: Example of a newly observed crack along
the north side of E-seam Longwall Panel SS3

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 spring 2023 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

west across mined portions of E-seam Longwall Panel SS1 to several MVB pads (i.e., SS1-1 through SS1-7).

Longwall mining of E-seam Longwall Panel SS1 began in January 2020. As of our spring 2023 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 (on the road leading to the MVB pad SS1-7) could not be located during our spring 2023 field visit. In addition, another subsidence feature first observed during our spring 2021 field visit on MVB pad SS1-6 was no longer visible during our spring 2023 field visit due to reclamation activities.

No other subsidence-related features were observed along this traverse during our spring 2023 field visit.

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 through spring 2023 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 longwall 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 spring 2023 field visit at the following location(s):

    - Just south of the access road near the chain pillars on the north side of E-seam Longwall Panel E14. While the cracks showed evidence of healing and/or sealing since the fall 2022 site visit, the larger cracks were still noticeable features within the brush.

    Previously observed subsidence effects were not observed during the spring 2023 field visit at the following locations:

    - Along the access road over the chain pillars on the north side of E-seam Longwall Panel E14 in between Crosscuts 21 and 23.

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.

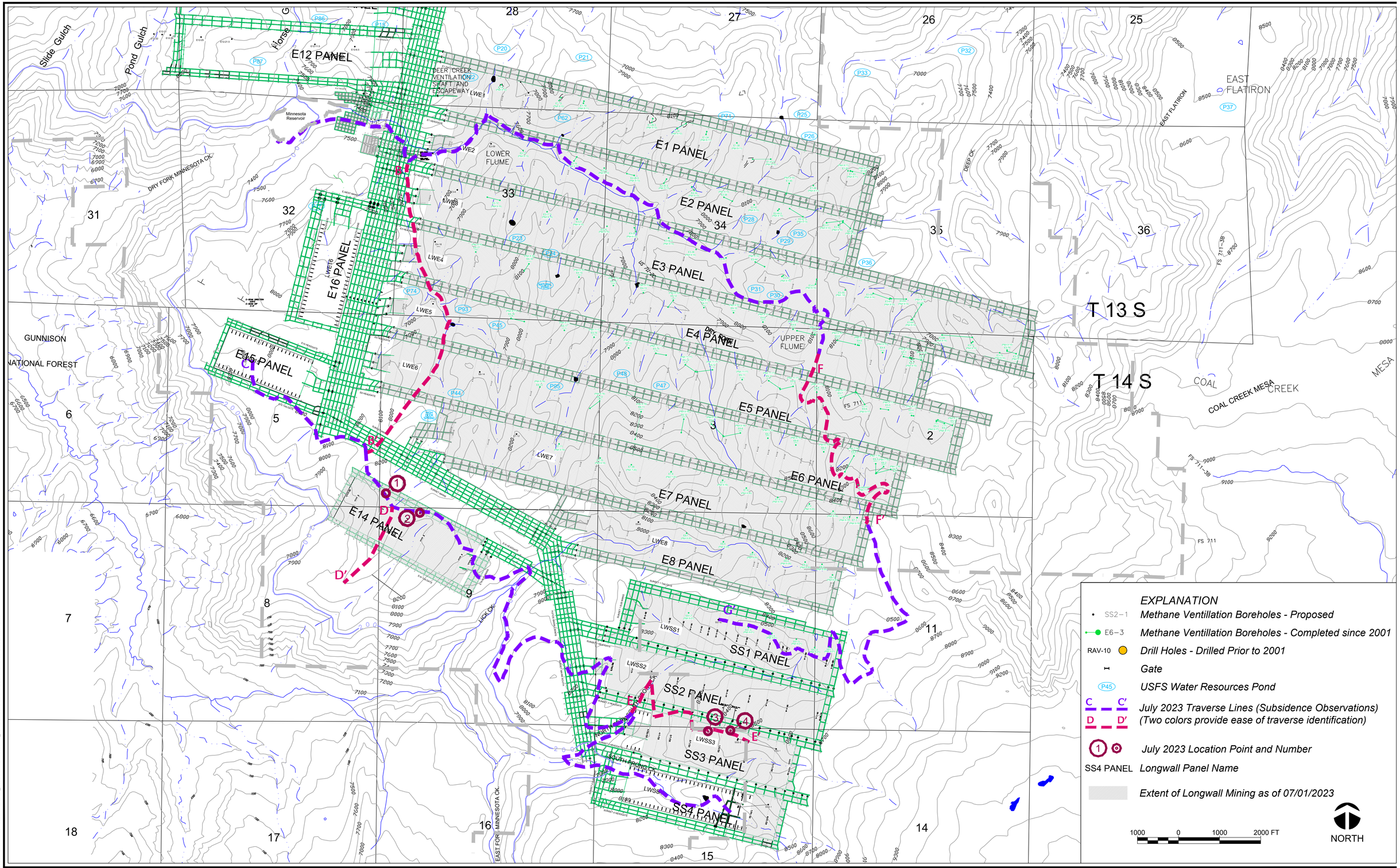
____. 2021a. *Spring 2021 Subsidence and Geologic Field Observations Southern Panels and Sunset Trail Mining Areas (E-Seam)*. Denver, CO: Wright Water Engineers, Inc.

____. 2021b. *Fall 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

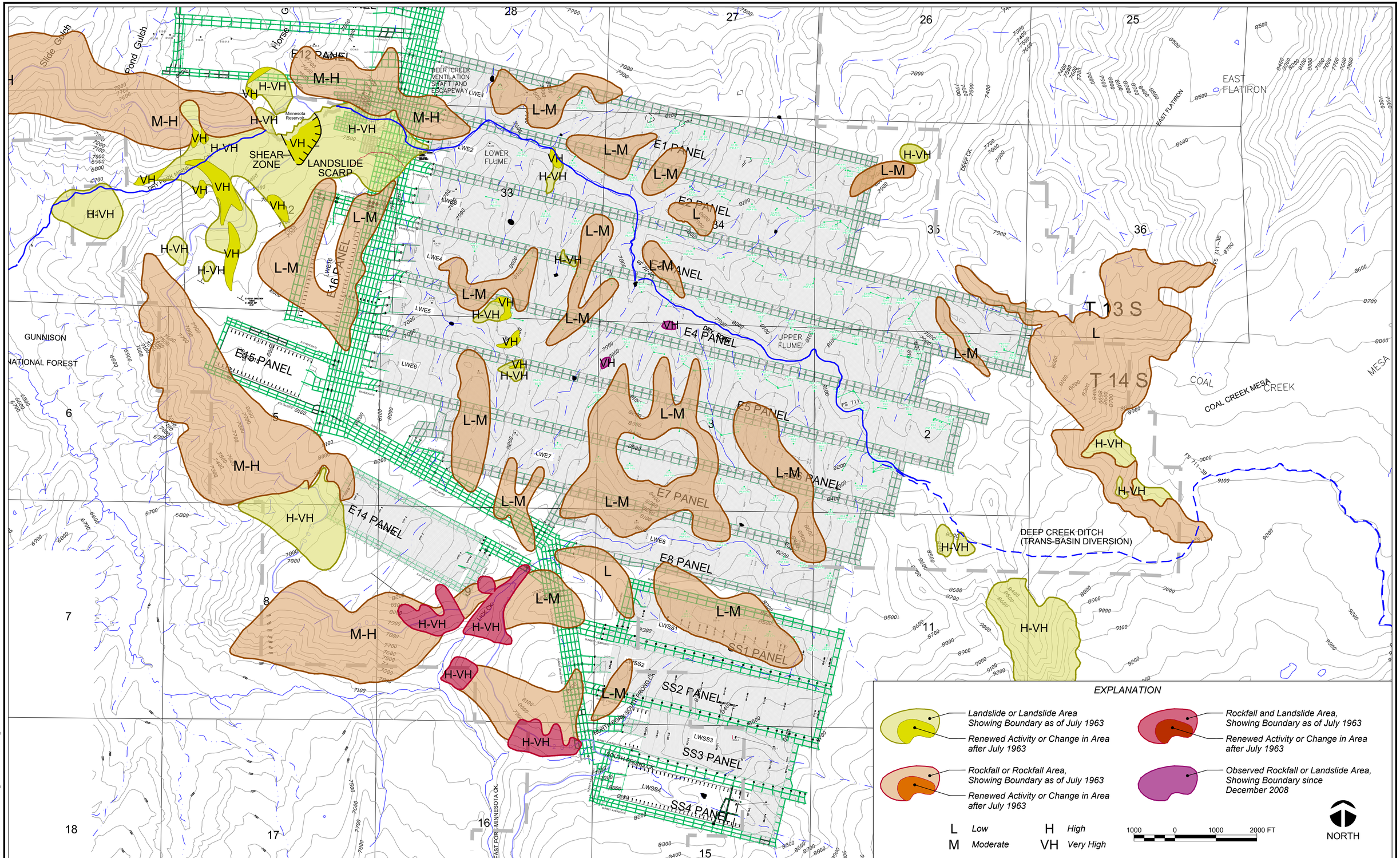
MOUNTAIN COAL COMPANY WEST ELK MINE

LOCATIONS OF OBSERVATIONS IN THE SOUTHERN PANELS AND SUNSET TRAIL MINING AREAS - JULY 2023

DESIGN	DETAIL	CHECK	DATE	SCALE
JMK	LMC	JMK	09/29/23	1"=1000'

PROJECT NUMBER	DATE	MAP
831-032.914	9/29/23	1

Plot Date/Time: 09/29/2023, 02:38:30 PM; G:\WWE\831-032\914\CAD\01_DWGS\WWE-WORKING_05-02-23.DWG<MAP 1 LOCATIONS OF OBSERVATIONS



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 -JULY 2023

DESIGN	JMK
DETAIL	LMC
CHECK	JMK
DATE	09/20/23
SCALE	1"=1000'

PROJECT NUMBER	DATE	MAP
831-032.914	9/20/23	2

Plot Date/Time: 09/20/2023, 02:35:46 PM, G:\WWE\831-032\914\CAD\01_DWG\SWWE-WORKING_05-02-23.DWG-MAP 2 LANDSLIDES AND ROCKFALL

APPENDIX A

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

Forest Service Roads
Inspection Form

Date: 1-12-23
Time:
Name of Inspector: N. Poulos
Current Panel and XC Being Mined: 333
Road(s) Being Inspected:

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:

no access - winter conditions

Signature of Inspector: Nico Poulos

* 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: 2-28-23
Time: 12:00P
Name of Inspector: N. Poulos
Current Panel and XC Being Mined: 553
Road(s) Being Inspected: N/A

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:
no access - winter conditions

Signature of Inspector: Nicole Poulos

* 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: 3-13-23
Time:
Name of Inspector: N. Paulos
Current Panel and XC Being Mined: 553
Road(s) Being Inspected:

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:

no access - winter conditions

Signature of Inspector: Nicole Paulos

* 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: 4-26-23
Time: 10:00?
Name of Inspector: N Roulo
Current Panel and XC Being Mined: Longwall move 353 - 554
Road(s) Being Inspected:

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:

No access - winter conditions

Signature of Inspector: Nicole Roulo

* 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: 5-24-23
Time: 7:15a
Name of Inspector: N. Poulos
Current Panel and XC Being Mined: SS4
Road(s) Being Inspected: Deer Creek / 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:
normal spring run off ruts only

Signature of Inspector: Nicole Poulos

* 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: 6-29-23
Time: 1:00
Name of Inspector: N. Poulos
Current Panel and XC Being Mined: SS4
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: Nicole Poulos

* 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: 7.19.23
Time: 1:00 P
Name of Inspector: N. Roulos
Current Panel and XC Being Mined: SS4
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: Nicole Roulos

* 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: 8-10-23
Time: 12:00
Name of Inspector: NPaulos
Current Panel and XC Being Mined:
Road(s) Being Inspected: Deer Creek, 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:

hunting season is next month - lots of traffic

Signature of Inspector: Nicole Paulos

* 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: 1-12-23
Time:
Name of Inspector: N. Poulos
Current Panel and XC Being Mined: SS3
Stock Pond(s) Being Inspected:

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:

no access - winter

Signature of Inspector: Nicole Poulos

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

Stock Pond
Inspection Form

Date: 2-28-23
Time: 12:00P
Name of Inspector: N. Poulos
Current Panel and XC Being Mined: 333
Stock Pond(s) Being Inspected: N/A

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:

no access - winter conditions

Signature of Inspector: N. Poulos

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

Stock Pond
Inspection Form

Date: 3-13-23
Time:
Name of Inspector: N. Poulos
Current Panel and XC Being Mined: SS3
Stock Pond(s) Being Inspected:

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:

no access - winter conditions

Signature of Inspector: N. Poulos

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

Stock Pond
Inspection Form

Date: 4-26-23
Time: 10:00a
Name of Inspector: N. Poulos
Current Panel and XC Being Mined: Longwall move 553 - 552
Stock Pond(s) Being Inspected:

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:

no access - winter conditions

Signature of Inspector: Nicole Poulos

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

Stock Pond
Inspection Form

Date: 5-24-23
Time: 7:15a
Name of Inspector: N Poulos
Current Panel and XC Being Mined: 554
Stock Pond(s) Being Inspected: 109

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:

no access - winter/spring conditions

Signature of Inspector: Nicole Poulos

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

Stock Pond
Inspection Form

Date: 6-29-23
Time: 1:30
Name of Inspector: N. Poulos
Current Panel and XC Being Mined: 334
Stock Pond(s) Being Inspected: 109

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: Nicole Poulos

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

Stock Pond
Inspection Form

Date: 7-19-23
Time: 1:00p
Name of Inspector: N.Poulos
Current Panel and XC Being Mined: 334
Stock Pond(s) Being Inspected: 109

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: Nicole Poulos

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

Stock Pond
Inspection Form

Date: 8-10-23
Time: 1:00p
Name of Inspector: N. Poulos
Current Panel and XC Being Mined: LW move from 533 → LWE15
Stock Pond(s) Being Inspected:

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: Nicole Poulos

* 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

Monument Dam
Inspection Form

Date: 1-12-23
Time:
Name of Inspector: N. Poulos
Current Panel Being Mined: SS3
☐ 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:

no access - winter conditions

Signature of Inspector: Nicole Poulos

Inspections are performed under the direction of Mike Peacock, P.E.

If cracks or other potentially damaging features occur, notify Mike Peacock or Kathy Welt immediately.

Monument Dam
Inspection Form

Date: 2.28.23
Time: 12:00P
Name of Inspector: N. Poulos
Current Panel Being Mined: SS3
☐ 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:

Slopes covered in snow

Signature of Inspector: Nicolas Poulos

Inspections are performed under the direction of Mike Peacock, P.E.

If cracks or other potentially damaging features occur, notify Mike Peacock or Kathy Welt immediately.

Monument Dam
Inspection Form

Date: 3-13-23
Time:
Name of Inspector: N. Poulos
Current Panel Being Mined: 533
☐ 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:

No access - snow

Signature of Inspector: Nicole Poulos

Inspections are performed under the direction of Mike Peacock, P.E.

If cracks or other potentially damaging features occur, notify Mike Peacock or Kathy Welt immediately.

Monument Dam
Inspection Form

Date: 4.26.23
Time: 10:00a
Name of Inspector: N. Poulos
Current Panel Being Mined: Longwall move 553 to 554
☐ 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:

no access - winter conditions

Signature of Inspector: Nicole Poulos

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: 5-24-23
Time: 7:15a
Name of Inspector: N. Poulos
Current Panel Being Mined: SS4
☐ 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: Nicole Poulos

Inspections are performed under the direction of Mike Peacock, P.E.

If cracks or other potentially damaging features occur, notify Mike Peacock or Kathy Welt immediately.

Monument Dam
Inspection Form

Date: 6-29-23
Time: 2:00
Name of Inspector: N. Poulos
Current Panel Being Mined: 354
☐ 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: Nicole Poulos

Inspections are performed under the direction of Mike Peacock, P.E.

If cracks or other potentially damaging features occur, notify Mike Peacock or Kathy Welt immediately.

Monument Dam
Inspection Form

Date: 1-19-23
Time: 12:00p
Name of Inspector: N. Poulos
Current Panel Being Mined: S54
☐ 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: Nicole Poulos

Inspections are performed under the direction of Mike Peacock, P.E.

If cracks or other potentially damaging features occur, notify Mike Peacock or Kathy Welt immediately.

Monument Dam
Inspection Form

Date: 9.30.23
Time: 2:00P
Name of Inspector: N. Poulos
Current Panel Being Mined: LWE15
☐ 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: Nicole Poulos

Inspections are performed under the direction of Mike Peacock, P.E.

If cracks or other potentially damaging features occur, notify Mike Peacock or Kathy Welt immediately.

Monument Dam
Inspection Form

Date: 9-19-23
Time: 12:30p
Name of Inspector: N. Poulos
Current Panel Being Mined: LWE1S
☐ 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:

Key to peizo. holes was found

Signature of Inspector: Nicole Poulos

Inspections are performed under the direction of Mike Peacock, P.E.

If cracks or other potentially damaging features occur, notify Mike Peacock or Kathy Welt immediately.

APPENDIX C

Monument Dam Monitoring Data

Name	Easting	Northting	Height	HR	Constant	Type	ID	Coord. ID
6001	1438801.116	387917.866	7337.973	0	0	current	47	195
6002	1438840.883	387802.609	7338.575	0	0	current	48	199
6003	1438781.075	387855.554	7323.544	0	0	current	49	203
6004	1438734.98	387773.304	7305.932	0	0	current	50	207
6005	1438584.52	387703.759	7290.598	0	0	current	51	211
6006	1438479.769	387648.583	7257.398	0	0	current	52	215
6007	1439013.429	387697.271	7337.804	0	0	current	53	219
6008	1438922.344	387687.468	7340.42	0	0	current	54	223
6009	1438807.335	387652.81	7329.87	0	0	current	55	227
6010	1438656.84	387652.281	7291.339	0	0	current	56	231
6011	1438566.166	387543.893	7265.54	0	0	current	57	235
6012	1438847.029	387563.858	7335.103	0	0	current	58	239
6501	1441367.079	387525.011	7499.399	0	0	current	46	191
6502	1439617.762	388740.513	7387.877	0	0	current	85	347
6503	1440269.203	388520.52	7332.463	0	0	current	86	351
6504	1438363.752	385924.469	7627.153	0	0	current	87	355
7000	1438587.102	387402.427	7324.003	0	0	current	59	243
7001	1438836.219	387316.766	7361.456	0	0	current	60	247
7002	1438986.964	387197.799	7399.592	0	0	current	61	251
7003	1439086.018	387351.454	7381.866	0	0	current	62	255
7004	1439265.176	387577.938	7351.468	0	0	current	63	259
7005	1439353.454	387712.018	7349.82	0	0	current	64	263
7006	1439508.953	387790.584	7343.485	0	0	current	65	267
7007	1439681.981	387965.783	7358.706	0	0	current	66	271
7008	1439833.808	388030.986	7367.489	0	0	current	67	275
7009	1439781.508	387822.463	7402.529	0	0	current	68	279
7010	1439961.314	388080.701	7369.265	0	0	current	69	283
7011	1439812.442	387959.181	7400.229	0	0	current	70	287
7012	1439832.123	387765.152	7426.829	0	0	current	71	291
7013	1439927.145	387644.188	7494.824	0	0	current	72	295
7014	1439823.33	387604.8	7446.172	0	0	current	73	299
7015	1439878.823	387528.434	7498.567	0	0	current	74	303
7016	1439687.204	387517.105	7447.83	0	0	current	75	307
7017	1439777.968	387423.374	7498.468	0	0	current	76	311
7018	1439193.504	387386.727	7385.655	0	0	current	77	315
7019	1438689.451	387187.701	7367.896	0	0	current	78	319
7020	1438878.534	386892.192	7464.498	0	0	current	79	323
7021	1439258.055	387240.867	7417.876	0	0	current	80	327
7022	1439408.842	387207.747	7466.278	0	0	current	81	331
7023	1439326.183	387134.428	7458.601	0	0	current	82	335
7024	1438990.64	386701.519	7517.982	0	0	current	83	339
7025	1439690.561	386958.612	7605.786	0	0	current	84	343

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.