



April 4, 2024

Craig Myers
On-Scene Coordinator
U.S. Environmental Protection Agency, Region 8
1595 Wynkoop Street
Denver, CO 80202

Subject: Final Koehler Junction 2023 Construction Completion Report, Revision 0
Bonita Peak Mining District OU1 RS
San Juan County, Colorado
U.S. EPA Region 8 START V, Contract No. 68HE0820D0001 Task Order
No. 68HE021F0043
Technical Direction No. 2143-2307-01
Task Monitor: Craig Myers, EPA On-Scene Coordinator

Dear Mr. Myers:

Tetra Tech, Inc. Superfund Technical Assessment and Response Team (START) is submitting the enclosed Final Koehler Junction 2023 Construction Report, Revision 0, for your review. The report summarizes Koehler Tunnel maintenance, repository run-off control channel re-establishment, and the Koehler Tunnel portal and bulkhead assessment performed at the Koehler Junction site in San Juan County, Colorado, in 2023.

If you have any questions or comments, please contact the START Task Order Manager, Annie Eiseman, at (816) 824-6140.

Sincerely,

A handwritten signature in black ink, appearing to read 'Annie Eiseman'.

Annie Eiseman, CHMM
START Task Order Manager

BONITA PEAK MINING DISTRICT
KOEHLER JUNCTION 2023 CONSTRUCTION REPORT

SAN JUAN COUNTY, COLORADO

Revision 0

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY
1595 Wynkoop Street
Denver, CO 80202

Prepared by:

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April 2024
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ACRONYMS AND ABBREVIATIONS

ACT	ACT Environmental
amsl	Above mean sea level
BPMD	Bonita Peak Mining District
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	U.S. Environmental Protection Agency
ERRS	Emergency and Rapid Response Services
gpm	Gallons per minute
IROD	Interim record of decision
MIW	Mine-influenced water
NPL	National Priorities List
Schnabel	Schnabel Engineering, LLC
START	Superfund Technical Assessment and Response Team
SPLP	Synthetic Precipitation Leaching Procedure
Tetra Tech	Tetra Tech, Inc.
WQCC	Water Quality Control Commission
XRF	X-ray fluorescence

1.0 INTRODUCTION

U.S. Environmental Protection Agency (EPA) Region 8 tasked the Tetra Tech, Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) V to provide technical assistance, sludge removal, and oversight of construction activities at the Koehler Junction site within the Bonita Peak Mining District (BPMD) in San Juan County, Colorado (Figure 1). This construction report has been prepared under Technical Direction Number 2143-2307-01, Contract Number 68HE0820D0001.

1.1 BACKGROUND

The BPMD site consists of 48 historic mines or mining-related sources along Mineral Creek, Cement Creek, and Upper Animas River drainages in San Juan County, Colorado. Mining operations were active in the area from the 1870s to the 1990s. Metals contamination of soils, groundwater, and surface water has occurred due to historical and ongoing releases of mine-influenced water (MIW) and sediments. EPA and the Colorado Department of Public Health and Environment (CDPHE) conducted a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site assessment in the 1990s but decided not to list BPMD on the Superfund National Priorities List (NPL) to allow for the existing community-based cleanup effort to continue. The water quality in the Animas River downstream of the site showed signs of improvement, but after 2005, it began to decline. EPA contributed resources for water quality sampling, ecological risk assessment, and data analysis, as well as grant funding. The BPMD site was listed on the NPL in 2016, following a large accidental release of MIW from the Gold King Mine in 2015.

The Koehler Junction site is within the BPMD Superfund Site and consists of three mines: Koehler Tunnel, Junction Mine, and Longfellow Mine (Figures 1 and 2). The Koehler Junction site is a popular recreational area and is commonly used for dispersed camping. Visitors to the area may be exposed to hazardous substances and contaminated mine waste that is present on site. The three mines are co-located at the headwaters of Mineral Creek, approximately 6 miles north-northwest of Silverton, San Juan County, Colorado, and are situated along Red Mountain Pass just east of Highway 550 at latitude 37°53'45.25" N and longitude 107°42'42.46" W at an elevation of approximately 11,100 to 11,600 feet above mean sea level (amsl).

Longfellow Mine is the northernmost mine and highest in elevation at 11,600 feet amsl. The Longfellow Mine consists of a waste rock pile, a wooden structure, and a shaft. Surface water flows into a run-off control channel, around the waste rock pile, and into the Mineral Creek headwaters (Figure 2). According to the interim record of decision (IROD) for BPMD Superfund Site Operable Unit 1, Sunnyside Gold Corps removed approximately 32,000 cubic yards of mine waste from the Longfellow Mine from 1996 to 1997 and placed the mine waste in the Mayflower repository near Silverton (EPA 2019). Approximately 5,500 cubic yards of waste rock are assumed to

remain on site at the Longfellow Mine, most of which has been capped (Herron and others, 1997). MIW flow rates from the Longfellow Mine adit vary from 4.9 to 15 gallons per minute (gpm). Longfellow Mine MIW has a pH of around 6.7; however, copper and aluminum concentrations in the MIW exceed the acute aquatic life standards (acute standards) based on a site-specific hazard quotient defined by the IROD (EPA 2019). In addition, synthetic precipitation leaching procedure (SPLP) test results on waste rock from the Longfellow Mine waste rock pile exceeded the chronic aquatic life standard for lead and the human health risk-based level for arsenic.

Junction Mine is located between Longfellow Mine and Koehler Tunnel and consists of an adit. MIW from the Junction Mine adit and Koehler Tunnel flows into a settling pond that drains into the headwaters of Mineral Creek. Flow rates of MIW from the Junction Mine adit vary from 2.9 to 12 gpm, and the pH varies over time from 3.86 to 6.15 as measured from October to June respectively. MIW from Junction Mine exceeds the acute standards based on the site-specific hazard quotient defined by the IROD for cadmium, copper, and zinc and chronic standards for aluminum, arsenic, lead, and iron. Waste rock SPLP test results from Junction Mine exceeded the acute standards for cadmium, copper, lead, and zinc; the chronic standard for aluminum; and the human health risk-based level as defined by the IROD for arsenic (EPA 2019).

Koehler Tunnel is the southernmost mine and consists of an adit that drained the Carbon Lakes Mine. Koehler Tunnel was bulkheaded in 2003, with additional grouting around the bulkhead occurring in 2011 (Colorado Division of Reclamation, Mining, and Safety 2011); however, water still discharges from the tunnel. MIW from Koehler Tunnel flows from the tunnel, down the talus slope, and into the settling pond (Figure 2). In 1997, Koehler Tunnel MIW was responsible for 52 to 56 percent of the iron loading and over 90 percent of the zinc loading in Mineral Creek (Herron and others, 1997). Installation of the bulkhead improved water quality; however, metals from the tunnel's MIW still contribute to the metals concentrations in Mineral Creek headwaters. In June 2016, MIW flow rates from Koehler Tunnel were measured at 4.5 gpm, with a pH of 6.12. The water was measured to exceed acute standards for aluminum, arsenic, cadmium, copper, manganese, and zinc; and the chronic standard for iron. Waste rock samples from Koehler Tunnel exceeded the human health risk-based level for arsenic (EPA 2019).

The settling pond for Junction Mine and Koehler Tunnel is used to reduce metals concentrations from adit MIW discharges. Although Longfellow Mine is nearby, it does not drain into the settling pond. The settling pond allows metals to settle out of the MIW through either the formation of iron oxyhydroxides and subsequent co-precipitation (such as the case with arsenic) or through the physical settling of undissolved metals. This process has produced residual sludge in the settling pond. After sufficient sludge and sediment accumulates in the pond to reduce the residence time of adit discharge into the pond, the ability for metals to settle out of the adit discharge water is diminished. In 2016, sediment from the settling pond was measured to exceed sediment ecological screening levels (sediment screening levels) for arsenic, cadmium, copper, lead, mercury, and zinc.

Concentrations of arsenic, cadmium, copper, and zinc measured in a pond sediment sample were the highest among Mineral Creek’s mining-related sources (EPA 2019).

From 2020 to 2021, Emergency and Rapid Response Services (ERRS) contractor Environmental Restoration, LLC, created two temporary repositories (Repositories 1 and 2) to the north of the settling pond in which to place sludge removed from the settling pond (Figure 2). During sludge removal, quick lime was used to adjust the pH of the sludge to between 9 and 10. After the temporary repositories were filled, they were capped with 12 inches of common fill material and hydroseeded with a preapproved seed mixture of variable native species. Based on the survey conducted by Southwest Land Surveying and Consulting, LLC, in August 2021, Temporary Repository 1 has a volume of 611 cubic yards, and Temporary Repository 2 has a volume of 104 cubic yards.

During the 2020 to 2021 construction, environmental monitoring and sampling were conducted by START. START conducted portable X-ray fluorescence (XRF) analysis of waste rock, sampled and monitored water issuing from Junction Mine and Koehler Tunnel, and sampled sludge from the settling pond. The waste rock had concentrations of lead and arsenic over applicable human health risk-based levels identified in the IROD. Analytical results of water samples indicated that MIW exiting Koehler Tunnel exceeded CDPHE Water Quality Control Commission (WQCC) standards for arsenic, cadmium, copper, lead, and zinc. Analytical results for the sludge from the settling pond indicated that the sludge had exceedances of lead, arsenic, and copper over the IROD Sediments Metals Screening Levels. Additional details can be found in the 2020-2021 Koehler Junction Construction Completion Report (Tetra Tech 2023).

In 2022, a bulkhead inspection was conducted at Koehler Tunnel by Schnabel Engineering under a separate contract, resulting in identifying five recommendations for action. The action list included the following: 1) remove sludge (12 to 36 inches deep), 2) replace the sampling valve and pressure gauge downstream of the bypass valve as these were observed to be degraded and corroded, 3) re-establish drainage in the mine to reduce ponding, 4) replace failing ground support, and 5) exercise the bypass valve after cleaning to determine integrity (extreme caution must be used as this hasn’t been performed in over 10 years). Additionally, bubbles were observed rising to the surface of pooled water at the base of the bulkhead, which could indicate MIW reacting with the concrete bulkhead and generating carbon dioxide.

1.2 OBJECTIVES

The objectives included for 2023 work at the Koehler Junction site were based on the recommendations resulting from the 2022 bulkhead inspection. These objectives are:

- remove sludge from Koehler Tunnel from the portal to the bulkhead;

- re-establish the conveyance channel leading from the Koehler Tunnel bulkhead to the Koehler Junction settling pond;
- assess the condition of Koehler Tunnel from the portal to the bulkhead and the condition of the bulkhead itself;
- provide proposed assessment methodology for bulkhead evaluation; and
- provide design drawings for replacing failing ground support and making other modifications to the workings required for bulkhead assessment.

An additional objective included repairing the run-off control channel downslope of the temporary repositories for improved run-off control. The construction activities conducted in 2023 are discussed in Section 2.0. The construction quality assurance activities are described in Section 3.0. The Koehler Tunnel rehabilitation design drawings are included in Appendix A, and the Technical Memorandum prepared by Schnabel Engineering, LLC (Schnabel) on bulkhead assessment is included in Appendix B. A photograph log is provided in Appendix C, and daily activity reports are presented in Appendix D.

2.0 CONSTRUCTION ACTIVITIES

This section describes construction activities performed during the 2023 field season at the Koehler Junction site. Activities included removing sludge in Koehler Tunnel drainage, re-establishing the conveyance channel from the Koehler Tunnel bulkhead to the Koehler Junction settling pond, assessing the Koehler Tunnel bulkhead and tunnel, and repairing the run-off control channel downslope of the temporary repositories. Table 1 summarizes the chronology of major events between July 2023 and September 2023.

Work began on July 24, 2023, when the EPA, START, ERRS, and ERRS' contractor ACT Environmental (ACT) mobilized to the Koehler Junction site. On July 26, 2023, ERRS and ACT completed construction activities, and all parties demobilized from the Koehler Junction site. On September 20, 2023, START and Schnabel mobilized to the Koehler Junction site and completed the Koehler Tunnel bulkhead and portal assessment.

TABLE 1:
CHRONOLOGICAL SUMMARY OF THE KOEHLER JUNCTION SITE ACTIVITIES, JULY 2023 TO SEPTEMBER 2023

Event	Dates
Site Preparation	July 24, 2023
Koehler Tunnel Sludge Removal and Conveyance Channel Re-Establishment	July 25 – 26, 2023
Repository Run-Off Control Repair	July 26, 2023
Koehler Tunnel Bulkhead and Portal Assessment	September 20, 2023

2.1 MOBILIZATION AND PREPARATION

Site preparation occurred on July 24, 2023, when ERRS and ACT mobilized a mini excavator, skid steer, water trailer, and water pump to the Koehler Junction site. The boulders blocking the road up to Koehler Tunnel were moved to allow equipment to be transported to the tunnel. To prepare for the removal of MIW and sludge from Koehler Tunnel, water was first pumped out of the Koehler Junction settling pond to help prevent sludge from draining out of the settling pond during subsequent work. Water was pumped from the settling pond into the culvert that naturally drains the settling pond, shown in Figure 2. The water level in the settling pond decreased by approximately 3 feet over 8.5 hours of pumping near the settling pond's outlet.

2.2 KOEHLER TUNNEL MAINTENANCE

Koehler Tunnel maintenance activities, including sludge removal and re-establishment of the conveyance channel, occurred from July 25 through July 26, 2023. Prior to sludge removal, a shovel was used to dig a drainage ditch down to and between the sill beams of the portal, to aid in emptying standing water from the tunnel. Sludge and MIW were removed from Koehler Tunnel using a high-pressure water hose to push the sludge and MIW through and out the tunnel and into the Koehler Junction settling pond. Sludge removal was conducted until the rock sill (floor) was encountered.

After completing sludge removal from Koehler Tunnel, the conveyance channel from the Koehler Tunnel portal to the talus slope was re-established. The Koehler Tunnel conveyance channel was re-established approximately 15 feet southwest of the original channel through which the MIW drained prior to the 2023 construction (Figure 2). The Koehler Tunnel conveyance channel flows into the talus slope, where flow disappears under the rocks and eventually flows out of the rocks into the Koehler Junction settling pond.

Once construction work was completed at Koehler Tunnel, the boulders were replaced to block the access road to the tunnel. The settling pond was checked a few days after construction activities were completed to check that the sludge removed from Koehler Tunnel was not discharging with any water flowing out of the settling pond. The water level of the settling pond was observed to still be below the invert of the outlet, and all sludge had settled.

2.3 REPOSITORY RUN-OFF CONTROL REPAIR

Re-establishment of the channel used for run-off control that runs directly south of the two temporary repositories at the Koehler Junction site, shown in Figure 2, was completed on July 26, 2023. A mini-excavator and skid steer were used to deepen the repository run-off control channel and add native soil to the berms bordering the channel. The excavator bucket was used to compact the native soil added to the berms. Small native boulders were added along the berm to add stability and improve erosion control. Daily activity reports (Appendix D) refer to the repository run-off control channel as run-on controls for the Longfellow Mine.

All personnel demobilized from the site on July 26, 2023.

2.4 BULKHEAD ASSESSMENT AND INSPECTION AT KOEHLER TUNNEL

On September 20, 2023, START and Schnabel mobilized to Koehler Tunnel to assess the condition of the portal and tunnel and to take measurements for the design to replace failing ground support. It was observed that the drainage ditch excavated in July just inside the Koehler Tunnel portal had filled in with silt, backing up water in the mine again. To re-establish outward drainage of water from the tunnel, the ditch was re-dug. Sediment was also removed from beneath the six sill beams at the portal to further improve outward drainage of water and lower the water level within the tunnel. Once the water level was lowered, the sill beams and footers were exposed and assessed. Stations were measured and marked out in 25-foot intervals from the Koehler Tunnel portal back to the bulkhead. The total length of the tunnel measured from the portal to the bulkhead was 279 feet. Shears and areas of discrete water flow were documented in addition to noting the existing support and its condition. During the visit, Schnabel performed a photo/lidar scan from the portal to the bulkhead to create a digital scale model. Measurements, notes, scans, and photos from the visit were used to develop the 2024 Koehler Tunnel

Rehabilitation Design drawings included in Appendix A and the Koehler Tunnel Assessment Technical Memorandum in Appendix B.

As stated earlier, during the bulkhead inspection in 2022, bubbles were observed rising to the surface of pooled water at the base of the bulkhead, which could indicate MIW reacting with the concrete bulkhead and generating carbon dioxide. A Technical Memorandum providing details on how the assessment of the bulkhead should be completed, including further addressing this observation, is included in Appendix B.

3.0 CONSTRUCTION QUALITY ASSURANCE ACTIVITIES

Construction activities that occurred at the Koehler Junction site in 2023 adhered to general site requirements and material conformance.

3.1 GENERAL SITE REQUIREMENTS AND DOCUMENTATION

The goal of this project was to conduct maintenance activities on Koehler Tunnel and its conveyance channel, assess the condition of Koehler Tunnel up to its bulkhead and the condition of the bulkhead itself, provide design drawings for rehabilitating the Koehler Tunnel, and re-establish the run-off control channel under the temporary repositories.

To address health and safety requirements, ambient air was tested prior to entering Koehler Tunnel, to check that it was safe for human occupation and site activities. During sludge removal activities in July 2023, air monitoring equipment in the tunnel indicated oxygen levels had dropped below 19.5 percent. Personnel exited Koehler Tunnel and returned the next day when oxygen levels had recovered to above 19.5 percent. Low oxygen levels were not encountered within the tunnel during the September 20, 2023 assessment.

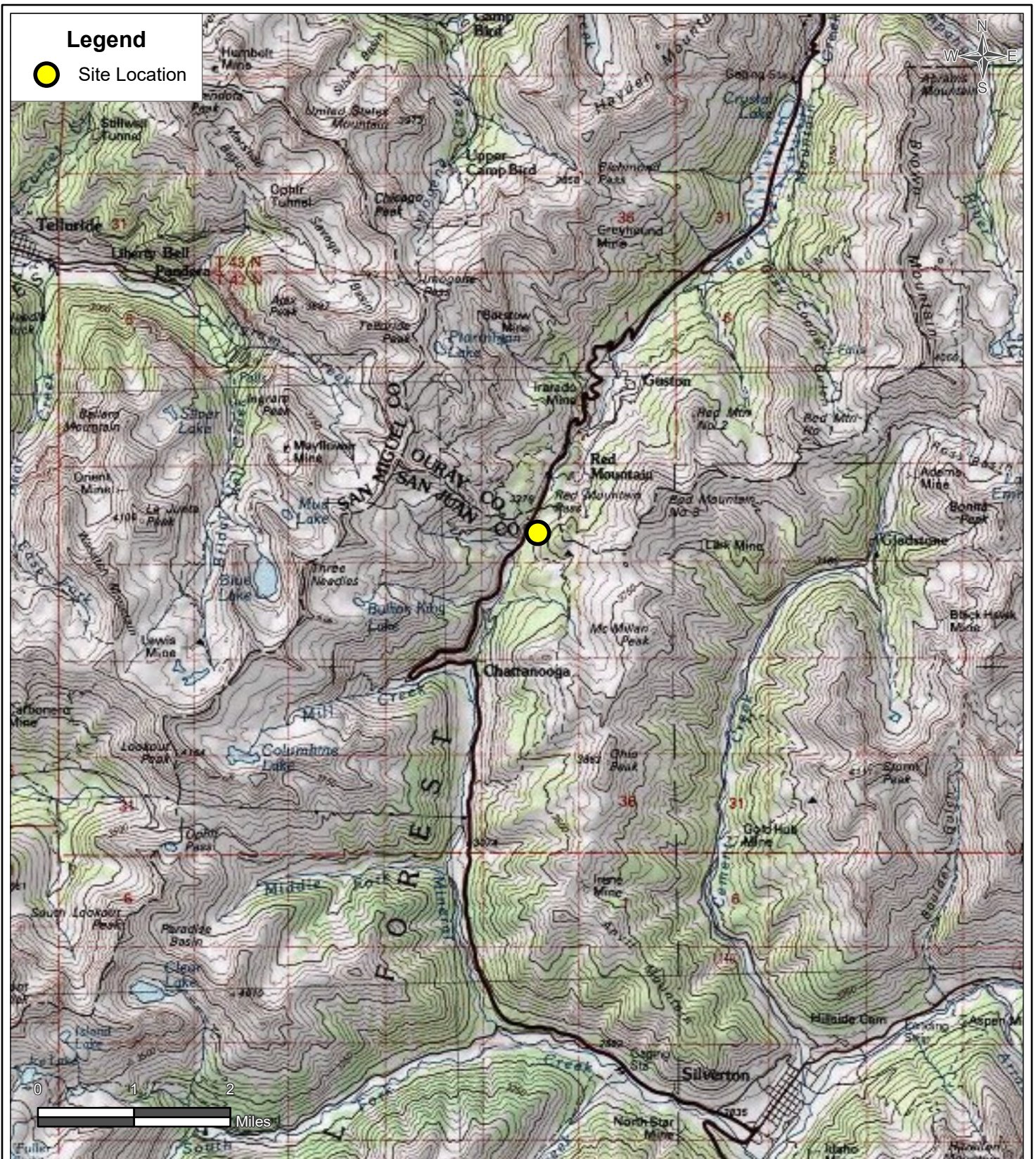
Documentation includes a photographic log (Appendix C) and daily activity reports (Appendix D).

4.0 REFERENCES

- Colorado Division of Reclamation, Mining, and Safety. 2011. “Koehler Two Drilling and Grouting, Animas River Stakeholders Group, Non-Point Source 319 Project.”
- Herron, J., B. Stover, P. Krabacher, and D. Bucknam. 1997. “Mineral Creek Reclamation Feasibility Report.” Colorado Division of Minerals and Geology. Unpublished.
- Tetra Tech, Inc. 2023. “Koehler Junction 2020-2021 Construction Completion Report.” March 20.
- U.S. Environmental Protection Agency (EPA). 2019. “Interim Record of Decision for Bonita Peak Mining District Superfund Site Operable Unit 1, San Juan County, Colorado.” May 20.

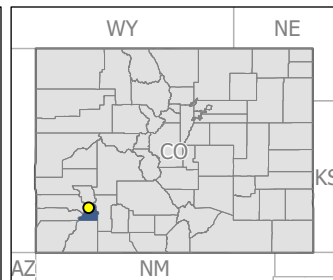
FIGURES

FIGURE 1:
SITE LOCATION



Notes:

Spatial Reference:
WGS 1984 Web Mercator Auxiliary Sphere
Coordinate System



United States
Environmental
Protection Agency

Region 8 START V
TD: 2143-2307-01



TETRA TECH

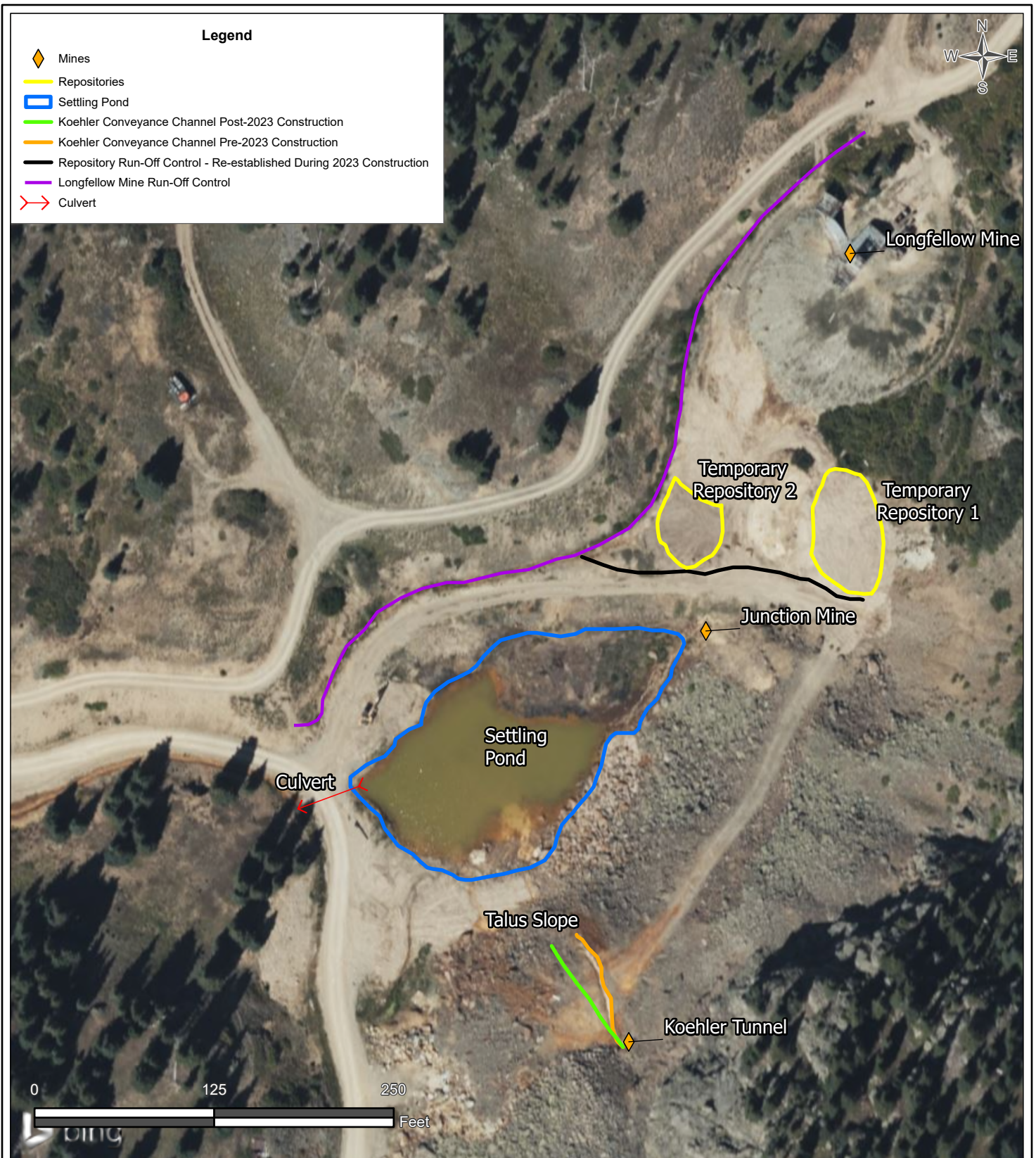
Analyst: J. Webster
Date: 3/21/2024

Koehler Junction

Silverton, San Juan
County, Colorado

**Figure 1
Site Location**

FIGURE 2:
SITE FEATURES

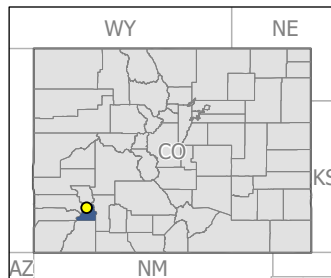


Notes:

The locations for all conveyance channels were not surveyed and are approximated.

Spatial Reference:

WGS 1984 Web Mercator Auxiliary Sphere
Coordinate System



United States
Environmental
Protection Agency

Region 8 START V
TD: 2143-2307-01



TETRA TECH

Analyst: J. Webster
Date: 4/2/2024

Koehler Junction

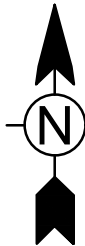
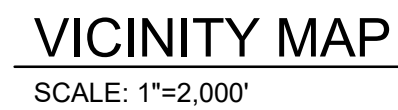
Silverton, San Juan
County, Colorado

**Figure 2
Site Features**

APPENDIX A
2024 KOEHLER TUNNEL REHABILITATION DESIGN

A — B — C — D — E — F

Sheet List Table



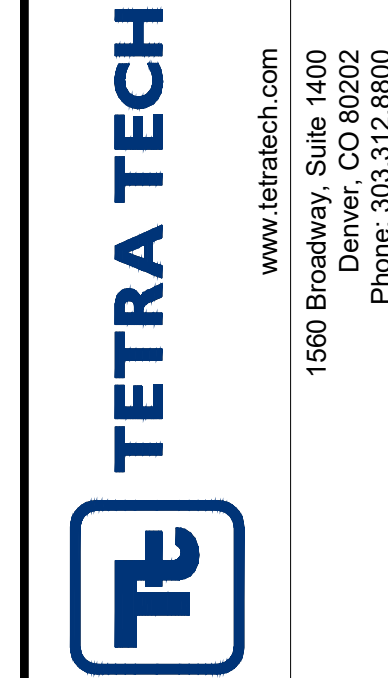
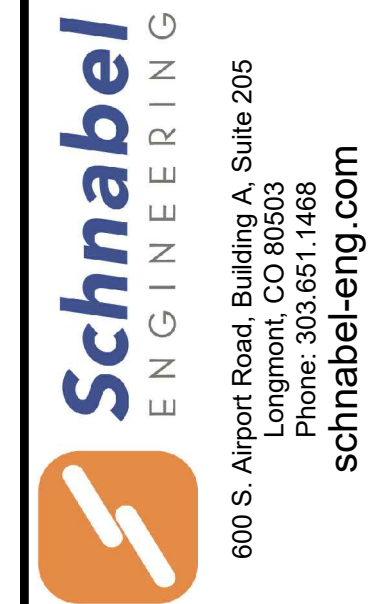
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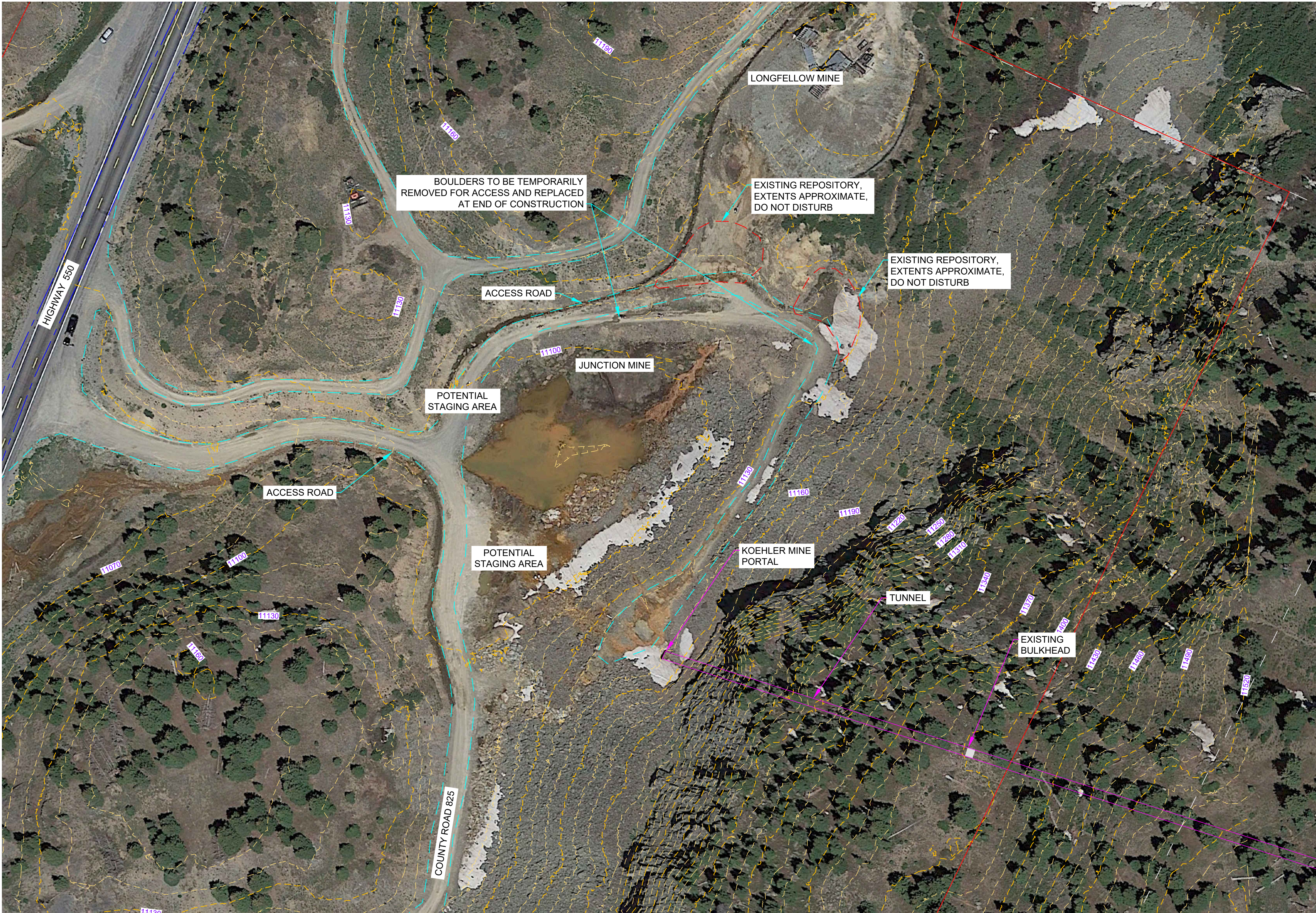
KOEHLER MINE REHABILITATION SAN JUAN COUNTY, COLORADO	DESIGN DRAWINGS	COVER SHEET
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PROJ:	103X903521F004323070
DESN:	C.GOSS
DRWN:	C.PEARSON
CHKD:	C.GOSS

G-001



3/19/2024 2:21:56 PM - S:\CAD\FEDERAL\PEASTART V REGION 8\BONITA PEAKS MINING DISTRICT\KOEHLER MINE\SHEETS\C-01_SITE PLAN DWG - PEARSON, CASEY

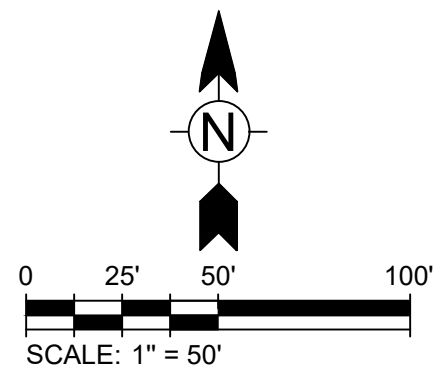


NOTES:

- TOPOGRAPHIC FROM USGS LIDAR SURVEY FLOWN
SEPTEMBER-OCTOBER 2017
- HORIZONTAL DATUM UTM NAD83 (2011), ZONE
13, VERTICAL DATUM NAVD 1988 (GEOID12B),
INTERNATIONAL FOOT

LEGEND

MAJOR CONTOUR (30' INTERVAL)	-----
MINOR CONTOUR (10' INTERVAL)	-----
BAUMGARTNER TRUST PROPERTY LINE	-----
EXISTING REPOSITORY EXTENTS	-----
HIGHWAY	-----
ACCESS ROAD	-----
KOEHLER MINE TUNNEL	-----



MARK	DATE	DESCRIPTION	BY
01	03/19/24	ISSUED FOR BIDDING	CNG

KOEHLER MINE REHABILITATION
SAN JUAN COUNTY, COLORADO
DESIGN DRAWINGS
**SITE PLAN
AERIAL**

PROJ:	103X903521F0043230701
DESN:	C. GOSS
DRWN:	C. PEARSON
CHKD:	C. GOSS

C-101

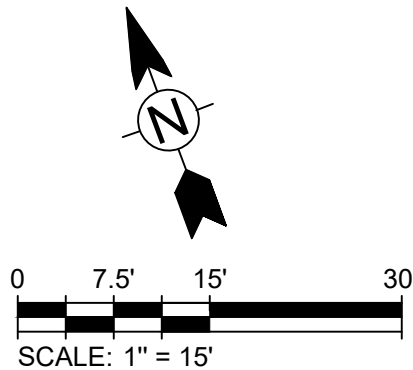


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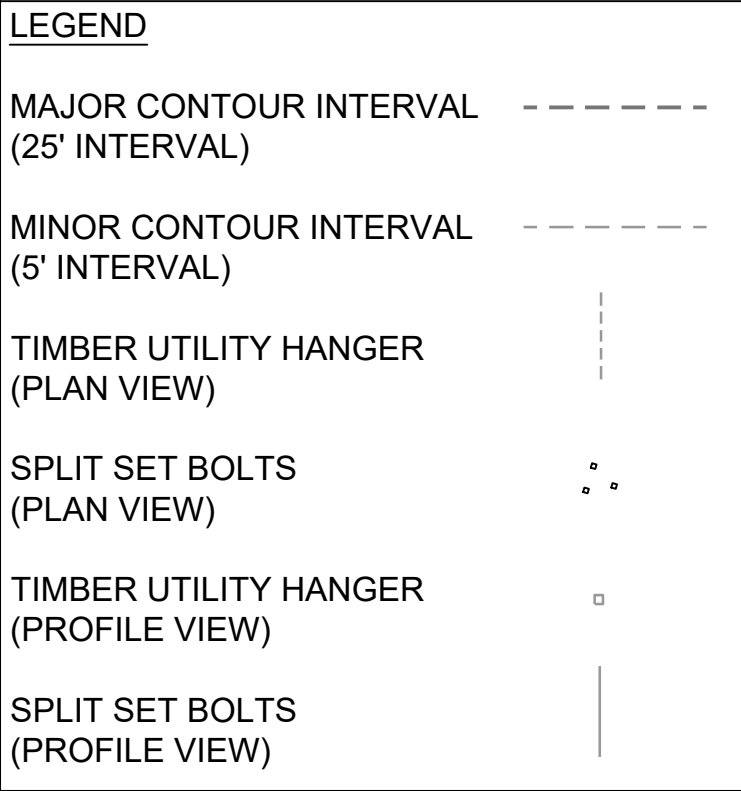
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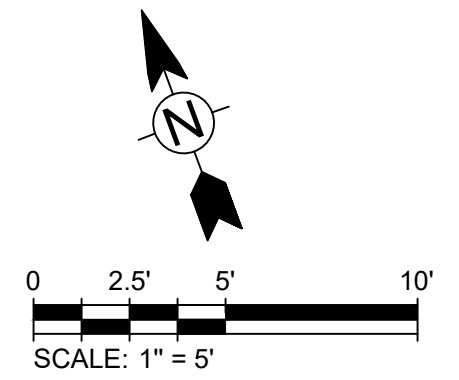


PROFILE KOEHLER TUNNEL

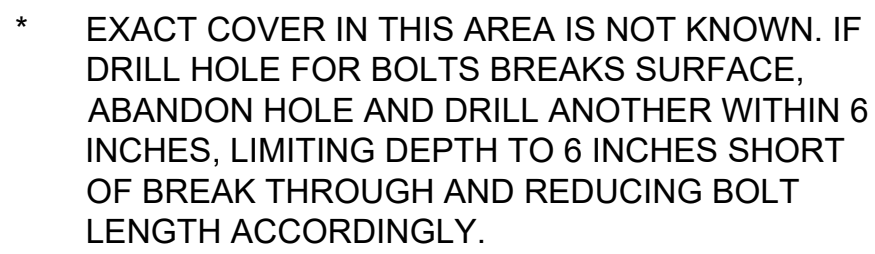


1. TOPOGRAPHIC FROM USGS LIDAR SURVEY FLOWN SEPTEMBER-OCTOBER 2017
2. HORIZONTAL DATUM UTM NAD83 (2011), ZONE 13, VERTICAL DATUM NAVD 1988 (GEOID12B), INTERNATIONAL FOOT

Bar Measures 1 inch, otherwise drawing not to scale



PROFILE KOEHLER TUNNEL



PROFILE KOEHLER TUNNEL

<u>LEGEND</u>	
MAJOR CONTOUR INTERVAL (25' INTERVAL)	-----
MINOR CONTOUR INTERVAL (5' INTERVAL)	-----
TIMBER UTILITY HANGER (PLAN VIEW)	
SPLIT SET BOLTS (PLAN VIEW)	• •
ROCK BOLTS (PLAN VIEW)	o
TIMBER UTILITY HANGER (PROFILE VIEW)	□
SPLIT SET BOLTS (PROFILE VIEW)	
ROCK BOLTS (PROFILE VIEW)	
SPILES	-----

NOTES:

1. TOPOGRAPHIC FROM USGS LIDAR SURVEY FLOWN SEPTEMBER-OCTOBER 2017
2. HORIZONTAL DATUM UTM NAD83 (2011), ZONE 13, VERTICAL DATUM NAVD 1988 (GEOID12B), INTERNATIONAL FOOT

Bar Measures 1 inch, otherwise drawing not to scale



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COEHLE MINE REHABILITATION
SAN JUAN COUNTY, COLORADO

DESIGN DRAWINGS

PLAN AND PROFILE
STA. 0+80 TO 1+60

PROJ: 103X903521F0043230701

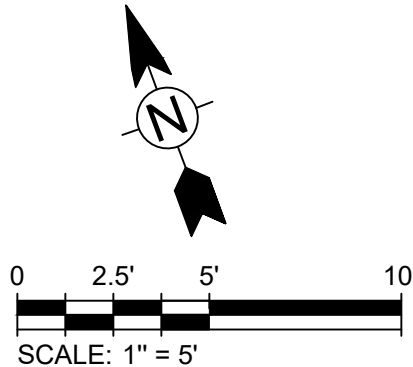
DESN:	C. GOSS
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DRWN: C.PEARSON

CARD:	C. GOSS
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C-104

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The diagram is a cross-section profile view of a tunnel. The vertical axis represents ELEVATION (FT) from 11135 to 11180. The horizontal axis represents STATION (FT) from 1+60 to 2+40. A horizontal line at approximately 11142.5 FT represents the TUNNEL INVERT. A solid line represents the ground surface, which is relatively flat at an elevation of about 11151.5 FT. Vertical dashed lines indicate the locations of rock bolts. Annotations specify the installation of 6' long pattern rock bolts, 4' on center staggered with synthetic mine mesh. Existing chain link mesh, split set bolts, 2' on center, are also indicated. A timber utility hanger is shown at station 1+80. Matchlines are shown at stations 1+60 and 2+40.

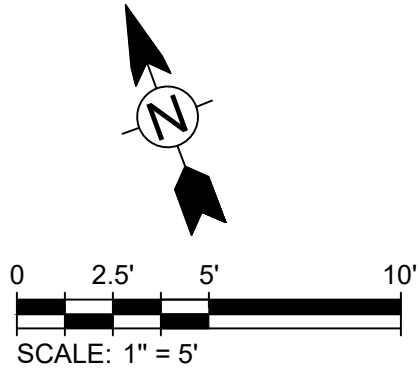
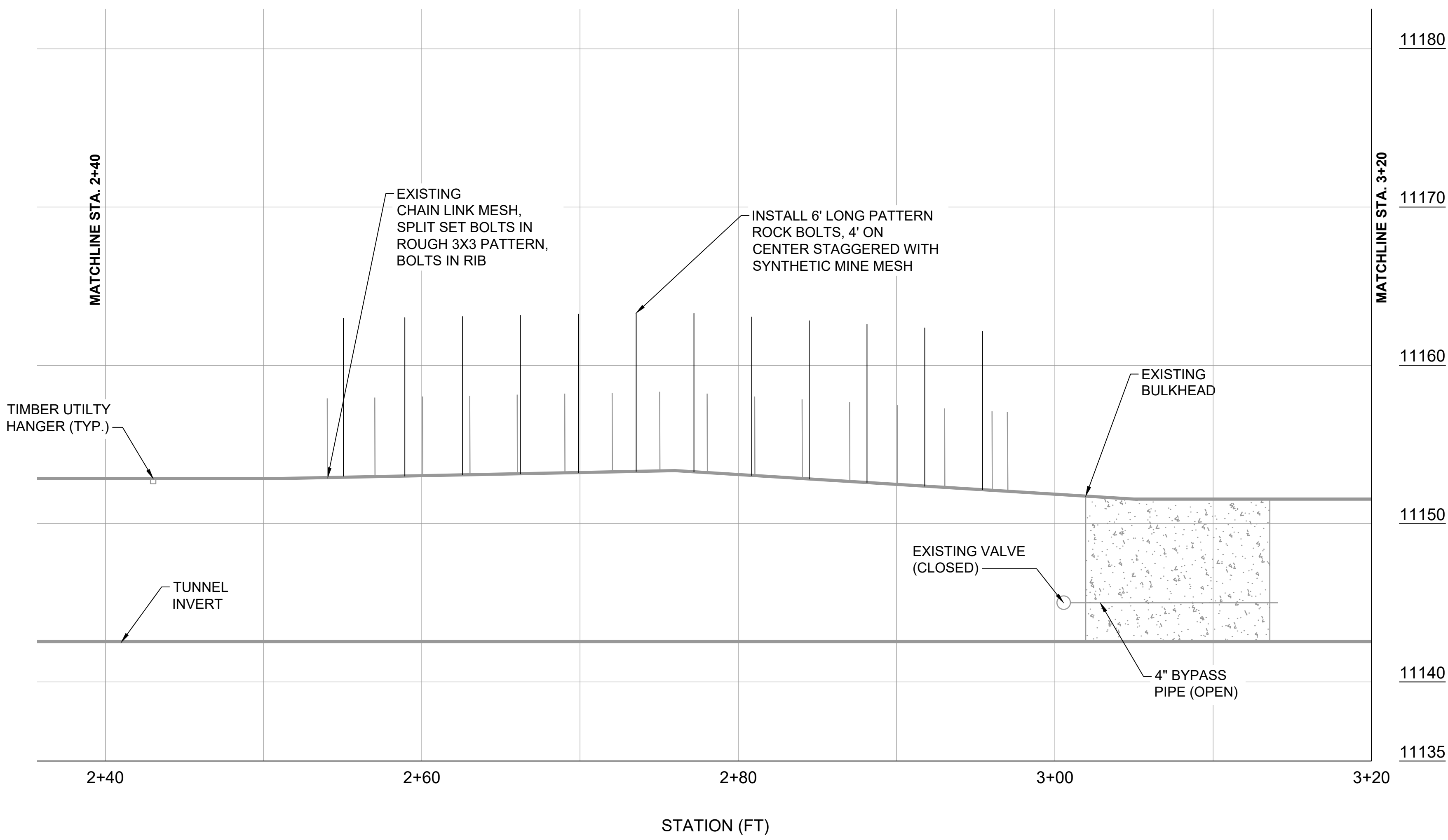
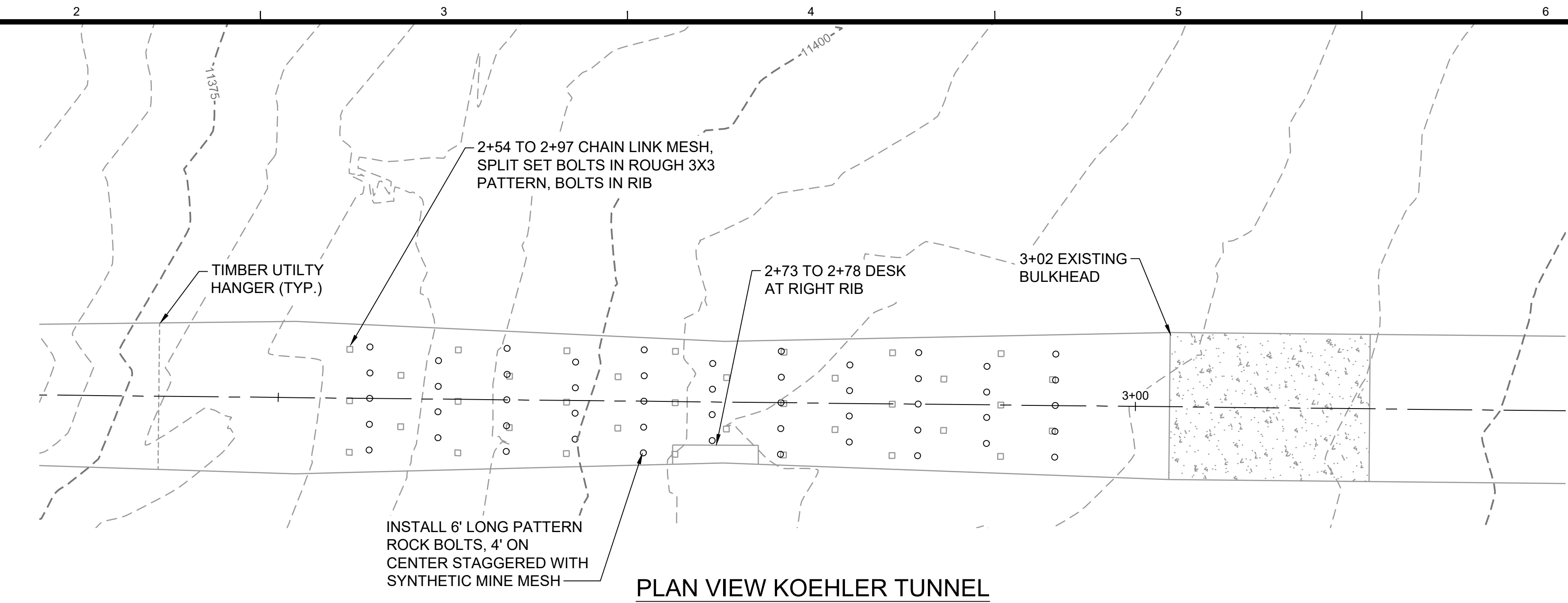
PROFILE KOEHLER TUNNEL

<u>LEGEND</u>	
MAJOR CONTOUR INTERVAL (25' INTERVAL)	-----
MINOR CONTOUR INTERVAL (5' INTERVAL)	-----
TIMBER UTILITY HANGER (PLAN VIEW)	
SPLIT SET BOLTS (PLAN VIEW)	
ROCK BOLTS (PLAN VIEW)	
TIMBER UTILITY HANGER (PROFILE VIEW)	
SPLIT SET BOLTS (PROFILE VIEW)	
ROCK BOLTS (PROFILE VIEW)	

1. TOPOGRAPHIC FROM USGS LIDAR SURVEY FLOWN SEPTEMBER-OCTOBER 2017
2. HORIZONTAL DATUM UTM NAD83 (2011), ZONE 13, VERTICAL DATUM NAVD 1988 (GEOID12B), INTERNATIONAL FOOT

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4/3/2024 10:45:45 AM - S:\CAD\FEDERAL\PEA START V REGION 8\BONITA PEAKS MINING DISTRICT\KOEHLER MINE\SHEET\SC-102-106_Plan and Profile.DWG - PEARSON, CASEY



LEGEND			
MAJOR CONTOUR INTERVAL (25' INTERVAL)			
MINOR CONTOUR INTERVAL (5' INTERVAL)			
TIMBER UTILITY HANGER (PLAN VIEW)			
SPLIT SET BOLTS (PLAN VIEW)			
ROCK BOLTS (PLAN VIEW)			
TIMBER UTILITY HANGER (PROFILE VIEW)			
SPLIT SET BOLTS (PROFILE VIEW)			
ROCK BOLTS (PROFILE VIEW)			


- NOTES:
- TOPOGRAPHIC FROM USGS LIDAR SURVEY FLOWN SEPTEMBER-OCTOBER 2017
 - HORIZONTAL DATUM UTM NAD83 (2011), ZONE 13, VERTICAL DATUM NAVD 1988 (GEOID12B), INTERNATIONAL FOOT



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MARK	DATE	DESCRIPTION	BY
01	03/19/24	ISSUED FOR BIDDING	CNG

KOEHLER MINE REHABILITATION
SAN JUAN COUNTY, COLORADO

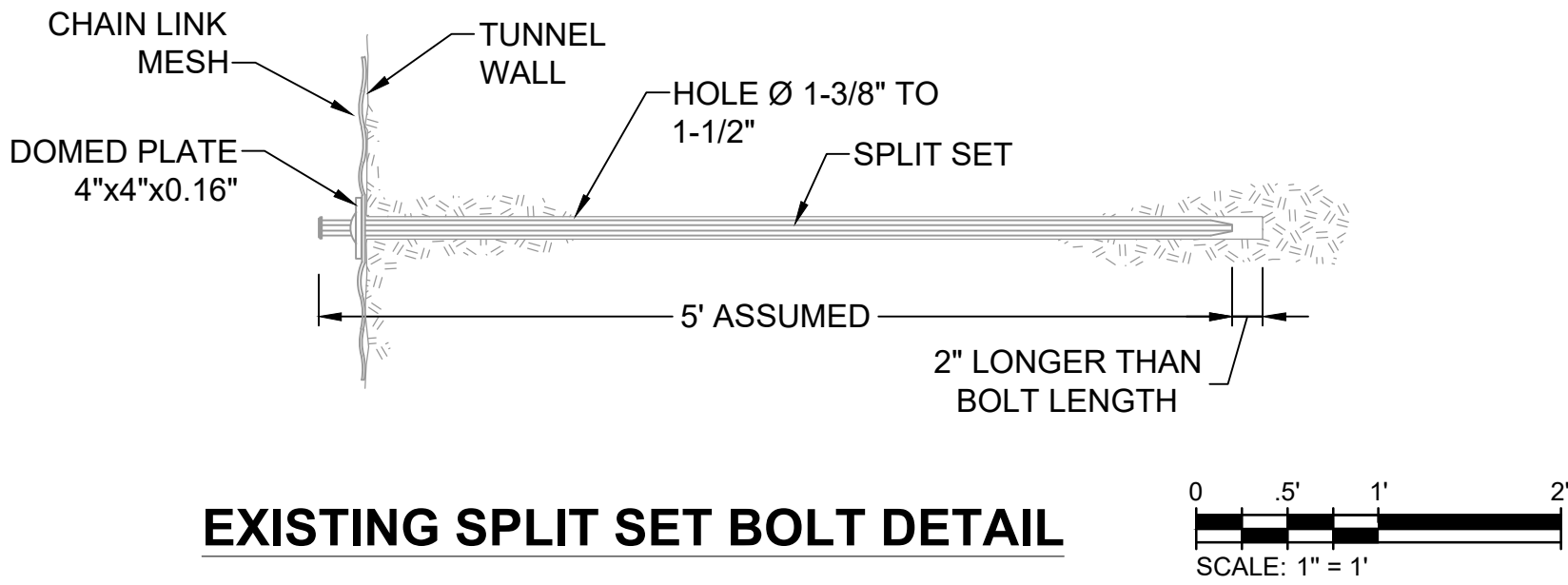
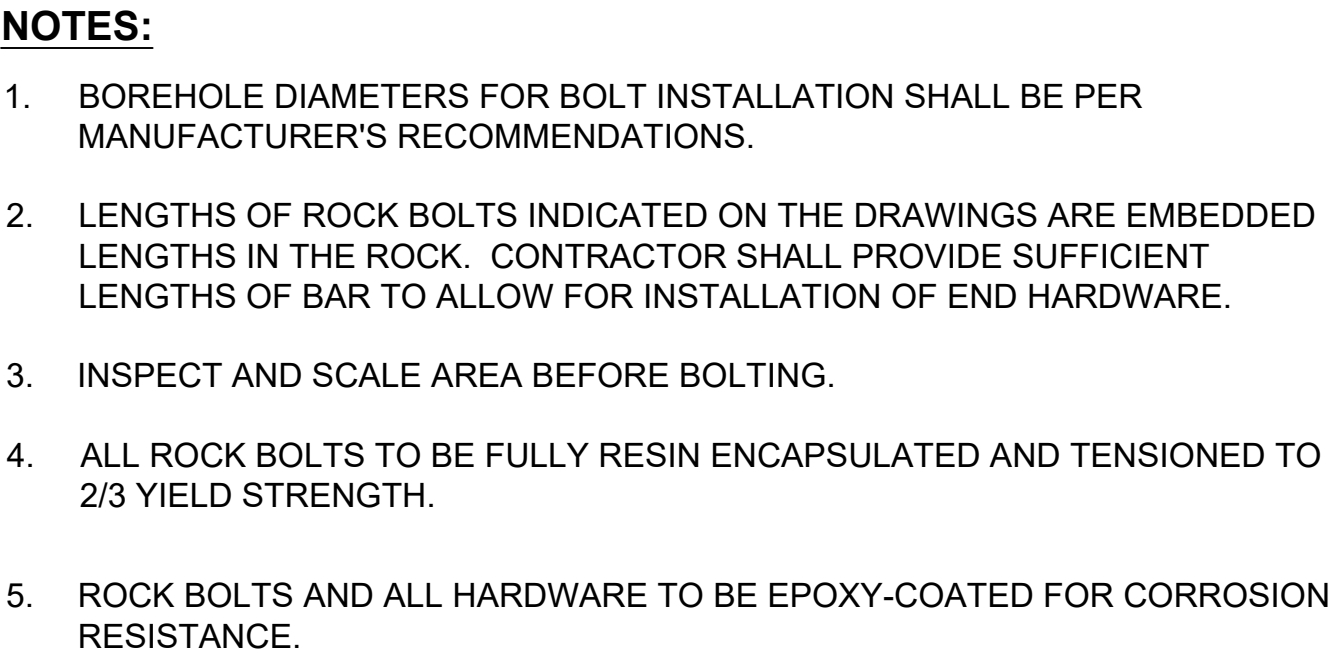
DESIGN DRAWINGS

PLAN AND PROFILE
STA. 2+40 TO 3+20

PROJ:	103X903521F0043230701
DESN:	C. GOSS
DRWN:	C. PEARSON
CHKD:	C. GOSS

C-106

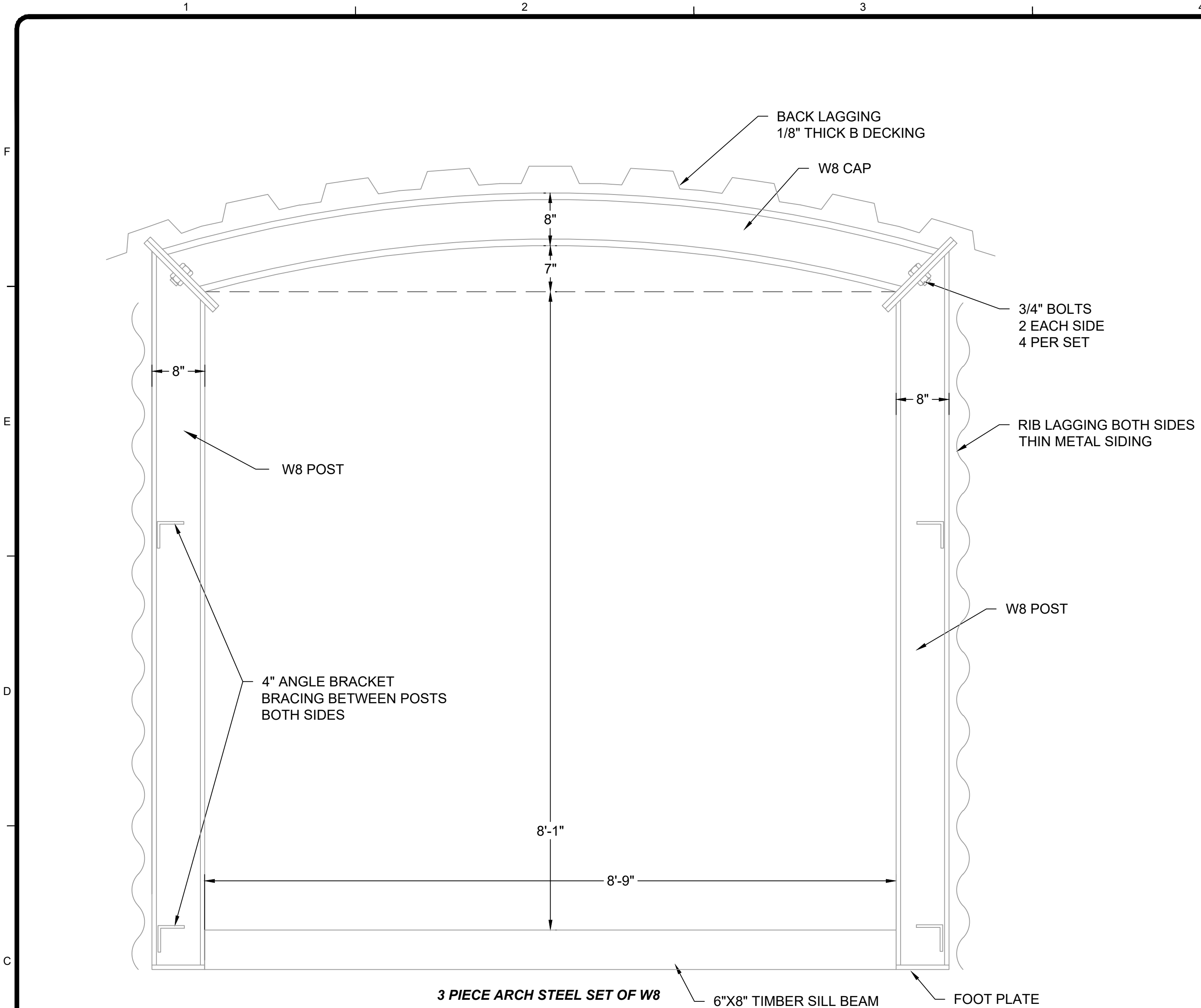
1. NEW ROCK BOLTS ON 4' CENTER EACH WAY.
2. BOLT PATTERN IS STAGGERED 4 BOLT BY 5 BOLT.
3. ADJUST BOLT LOCATION AS NEEDED TO AVOID EXISTING SPLIT SET BOLTS.
4. LOCALLY INSTALL SPOT BOLTS AS DIRECTED.



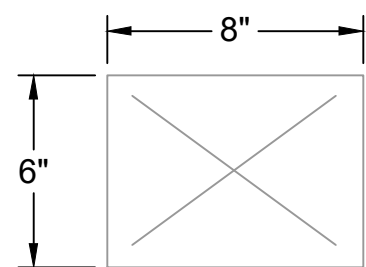
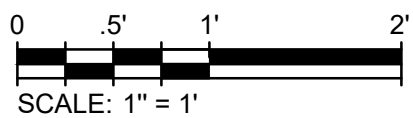
MARK	DATE	DESCRIPTION	BY
01	03/19/24	ISSUED FOR BIDDING	CMS

KOEHLER MINE REHABILITATION SAN JUAN COUNTY, COLORADO	DESIGN DRAWINGS	PORTAL GROUND SUPPORT
PROJ: 103X903521F0043230701	DESN: C. GOSS	DRWN: C. BRANSON
CHKD: C. GOSS	DESN: C. GOSS	DRWN: C. BRANSON

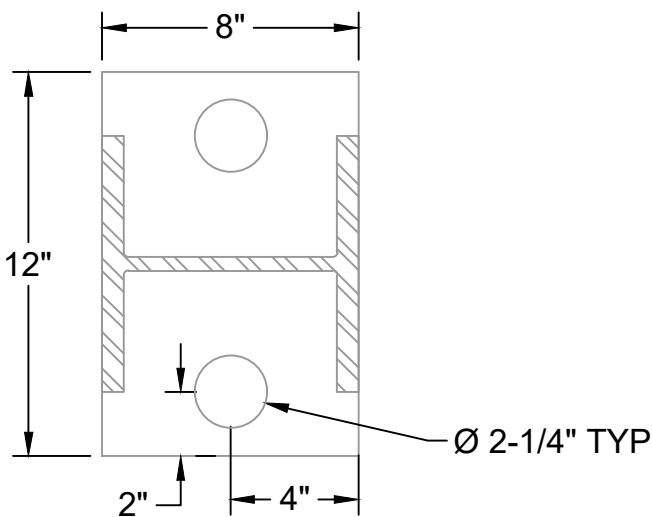
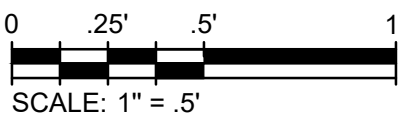
3/19/2024 2:56:15 PM - S:\CAD\FEDERAL\EPASTART V REGION 8\BONITA PEAKS MINING DISTRICT\KOEHLER MINES\SHEETS\C-108-109_DETAILS.DWG - PEARSON, CASEY



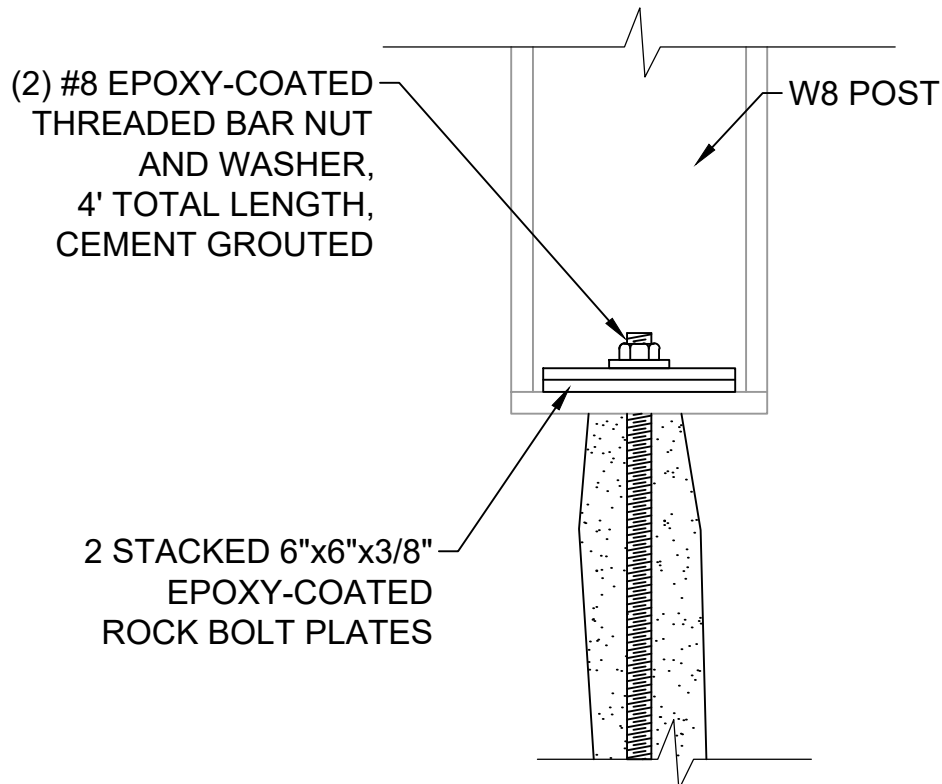
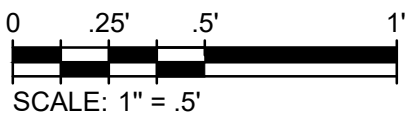
EXISTING STEEL SET DETAILS



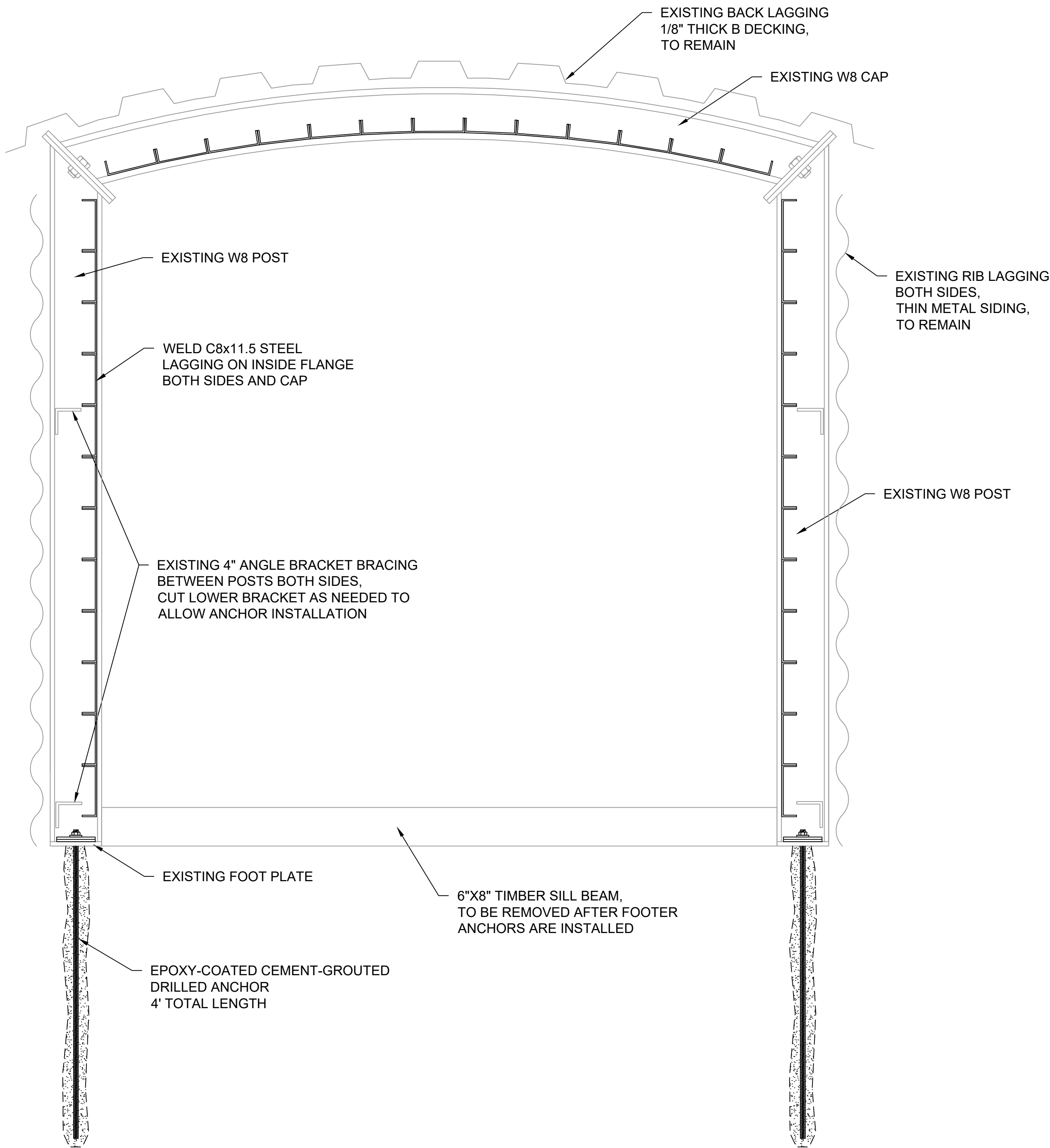
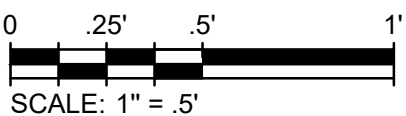
EXISTING TIMBER SILL BEAM
CROSS-SECTION DETAIL



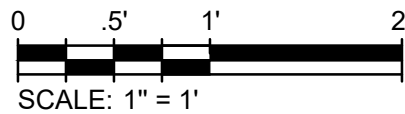
EXISTING FOOT PLATE DETAIL




PROPOSED FOOTING DETAIL




PROPOSED STEEL SET MODIFICATIONS






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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY



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Longmont, CO 80503
Phone: 303.651.1468
schnabel-eng.com

MARK	DATE	DESCRIPTION	BY
01	03/19/24	ISSUED FOR BIDDING	CMG

KOEHLER MINE REHABILITATION
SAN JUAN COUNTY, COLORADO

DESIGN DRAWINGS

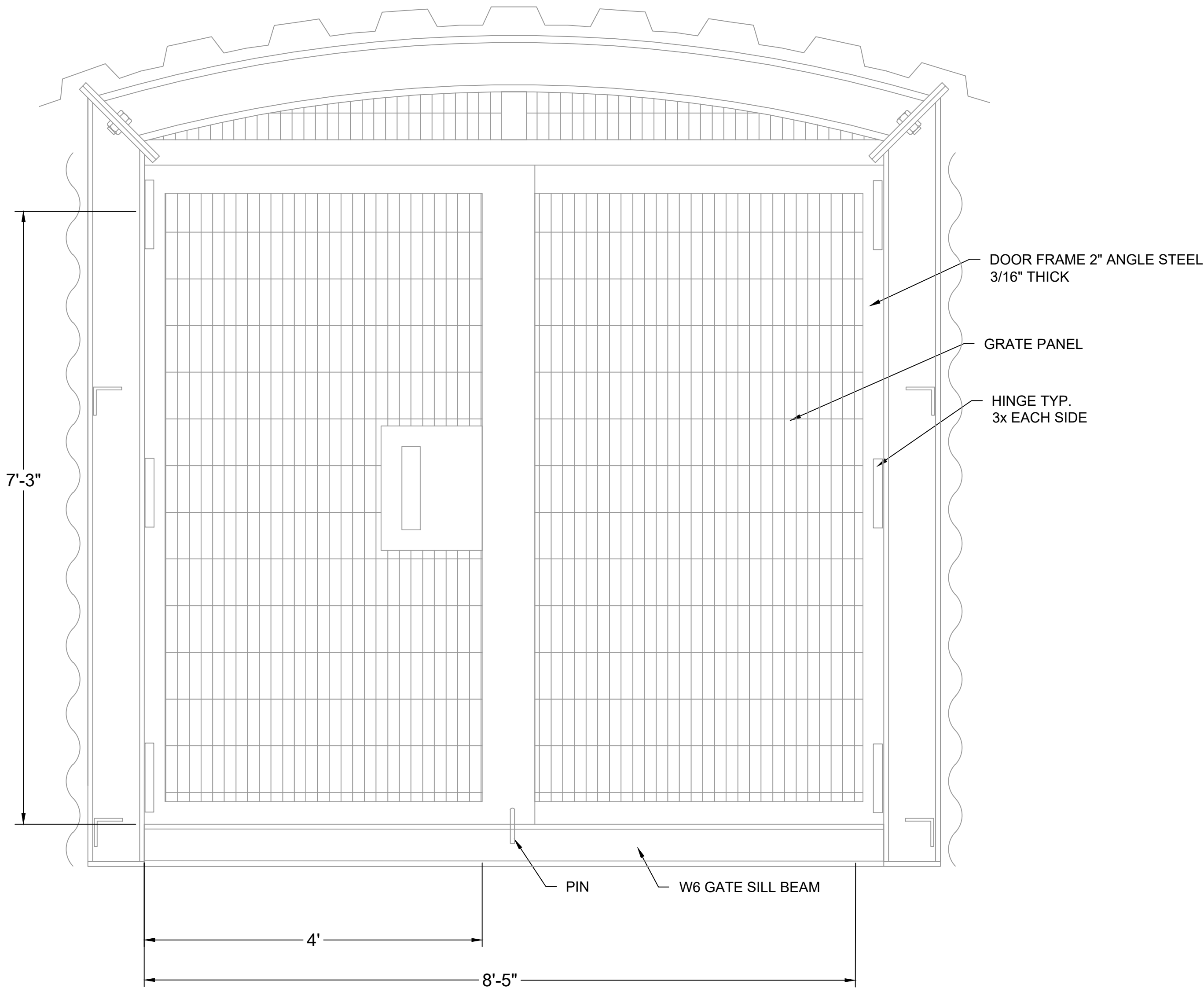
STEEL SET DETAILS

PROJ:	103X903521F0043230701
DESN:	C. GOSS
DRWN:	C. BRANSON
CHKD:	C. GOSS

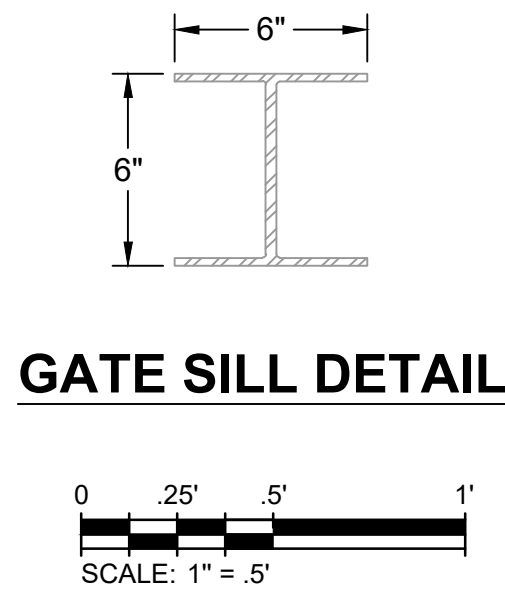
C-108

Copyright: Tetra Tech

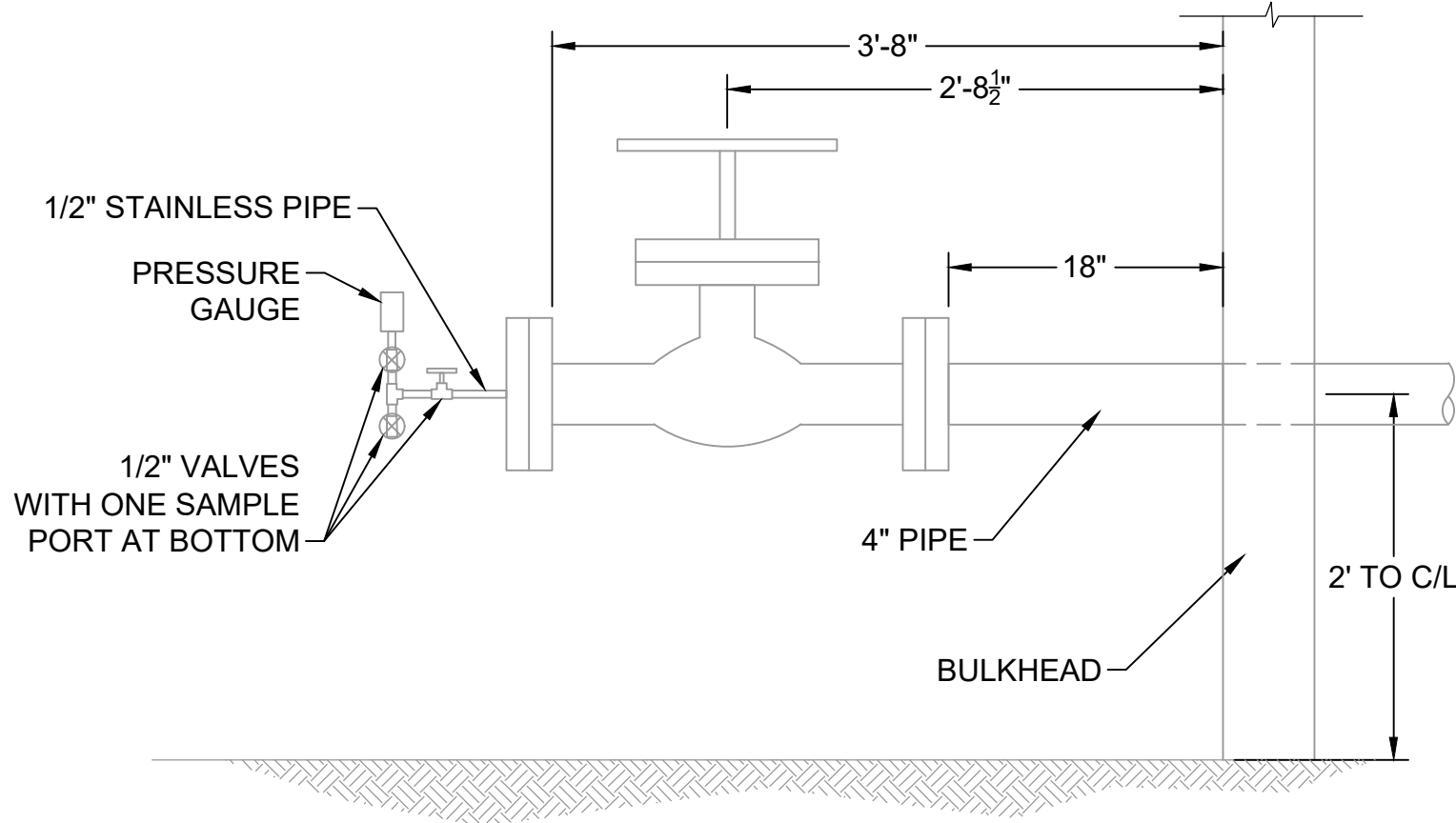
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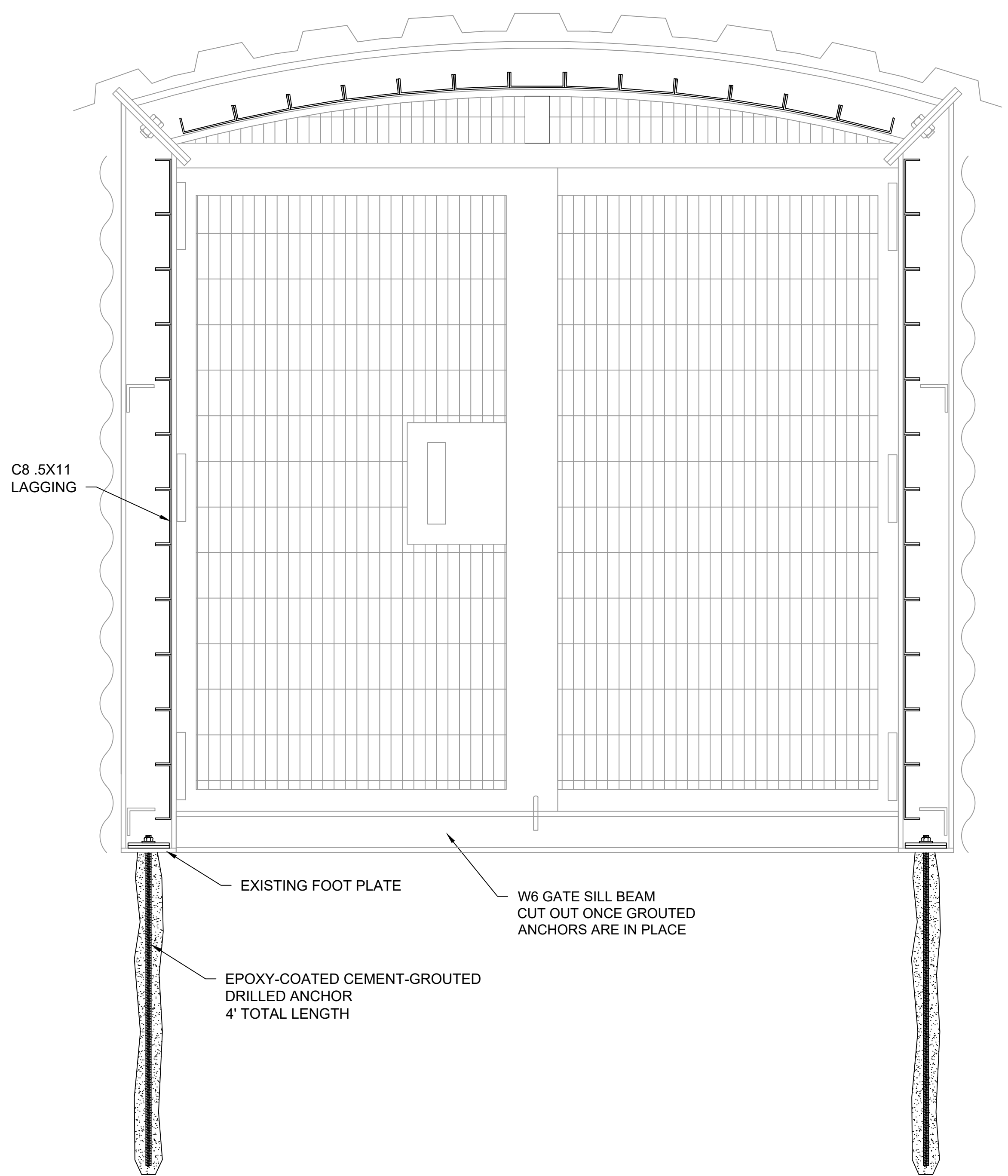
EXISTING GATE DETAILS



GATE SILL DETAIL

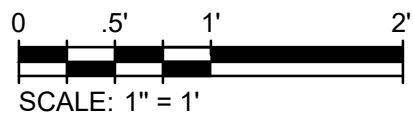




EXISTING VALVE DETAIL
CONTRACTOR TO PRESERVE AND PROTECT




PROPOSED GATE MODIFICATIONS

NOTE:
PROTECT AND PRESERVE GATE
DURING CONSTRUCTION







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KOEHLER MINE REHABILITATION
SAN JUAN COUNTY, COLORADO
DESIGN DRAWINGS

PORTAL GATE
& VALVE DETAILS

PROJ: 103X903521F0043230701
DESN: C. GOSS
DRWN: C. BRANSON
CHKD: C. GOSS

C-109

ISSUED FOR BIDDING

Bar Measures 1 inch, otherwise drawing not to scale

Copyright: Tetra Tech

APPENDIX B
SCHNABEL ENGINEERING, LLC KOEHLER TUNNEL ASSESSMENT TECHNICAL
MEMORANDUM

TECHNICAL MEMORANDUM

TO:	Annie Eiseman	DATE:	3/21/2024
COMPANY:	Tetra Tech	SUBJECT:	Koehler Tunnel Assessment
ADDRESS:	1560 Broadway, Suite 1400 Denver, CO 80202	PROJECT NAME/NO.:	20C26033.090 Koehler and Mogul
FROM:	Christoph Goss, PhD, PE	CC:	Craig Myers EPA, Rob Burton ER

This memo documents the Koehler Tunnel rehabilitation design as shown on the drawing sheets and provides recommendations on how to assess the condition of the bulkhead in the future. The site visit and evaluation are described in the Tetra Tech 2023 Koehler Junction Construction Report. For background information, maps, photographs, and additional bulkhead inspection details, please see *Bonita Peak Mining District Superfund Site San Juan County, Colorado Draft-Final Bulkhead Inspection Report* by Schnabel Engineering and CDM Smith/Bay West JV dated March 2024.

1.0 TUNNEL REHABILITATION DESIGN

The Koehler Tunnel is a cross-cut haulage tunnel to the highly mineralized Carbon Lakes breccias pipes and vein complex 2,000 feet from the portal. The tunnel itself is not on a vein structure and no known stopes are in the vicinity. While several steeply dipping shears cross the tunnel, the ground is not significantly altered. The Koehler Tunnel was collapsed at the portal and covered by recent talus rock fall until 1996 when Sunnyside Gold crews excavated it. In 2003 Sunnyside Gold Corporation installed a concrete bulkhead as part of their reclamation requirements with the State of Colorado to offset environmental damages at the Sunnyside Mine.

In 2010, in advance of a grouting program, the Colorado Division of Reclamation, Mining, and Safety prepared a ground support plan. It called for spot bolting in the first 250 feet. In the shear zone at 151 feet from the portal, the plan called for "pattern bolting with four foot split sets on four foot centers, requiring seven split sets per row and two rows, or 14 to 16 split sets with a four foot wide strip of mesh (112 square feet) to cover the shear and gouge area from near the floor, up the rib, across the back, and down the other rib". From 250 feet to 300 feet (Bulkhead Location) the plan listed pattern bolting with "4-foot split sets; including 5 bolts per row, rows on 4 foot centers, installing 65 to 70 bolts and 800 square feet of mesh". Actual ground support consisted of 5-foot-long split set bolts on a rough 3x3 pattern with chain link fencing between stations 0+43-0+52, 1+54-1+63, and 2+54-2+97. This is shown on the drawings.

We generally agree with the ground support but note that it is not permanent, particularly in a very acidic mine environment. Degradation of both bolts and mesh is evident, particularly in areas where seeping mine water has corroded the metal. Long term stability of and continued safe access to Koehler Tunnel will require additional engineered support, specifically longer permanent rock bolts with synthetic mesh. This is shown on the drawings. The bolts are longer (6 foot) to extend past the zone of disturbance from the previous bolting. The bolts are also solid grade 75 threadbar with epoxy coating to resist corrosion. The mesh between the bolts is specified as synthetic and thereby not prone to corrosion. The current support will not be removed. The new bolts and mesh will be installed at the same stationing between existing bolts. In addition, 12-foot-long steel spiles will be installed in

the rock brow at the transition from the steel sets to tunnel. The rotten timber posts will be removed. At the portal, the steel sets from 2010 will remain, but be modified to have the footers pinned for lateral support (instead of sill beams/invert struts). In addition, more robust lagging will be added.

2.0 BULKHEAD ASSESSMENT RECOMMENDATIONS

When designing or evaluating mine bulkheads, one must consider the possible failure modes. These include hydraulic jacking of the surrounding rock mass, shear failure around the plug, structural failure of the plug, excessive seepage past the plug, and long-term disintegration (chemical decomposition) of the concrete.

- Hydraulic jacking occurs when the water pressure behind the bulkhead is higher than the confining pressure of the ground in the area. The hydraulic jacking causes joints in the rock mass to open, allowing more flow through them.
- Shear failure occurs when the bulkhead moves along the concrete/rock interface or adjacent rock due to water pressure from the mine pool.
- Structural failure occurs when the concrete plug itself fails due to deep beam bending or shear failure through the reinforced concrete due to water pressure or earthquake induced water hammer.
- Excessive seepage past the plug occurs when the higher upstream head finds fractures in the downstream rock mass or concrete-rock interface and bypasses the bulkhead. The worst case would be where the gradient and seepage are high enough to wash out material in joints, leading to a piping failure.
- Concrete degradation occurs when the acidic mine waters chemically break down the cement paste. It can be avoided by using sulfate resistant cement, pozzolans, and permeability reducing admixtures in the mix.

To assess the overall design of the Koehler bulkhead, we recommend running hydraulic jacking, shear, and structural failure calculations to check design assumptions and factors of safety. This would be a minor effort. During the 2024 field season, we also recommend locating the Carbon Lake shaft to see if it can function as an overflow (this was a design assumption for the Koehler Bulkhead).

To assess the seepage, we need to know the pressure behind the bulkhead and monitor flow from the Koehler Tunnel more accurately. The bulkhead is penetrated by a 4-inch bypass pipe, which is still open to the mine pool. At the end of the pipe is a stainless-steel flanged gate valve, likely 150 psi pressure class. A ½ inch diameter sampling valve and pressure gauge were added to the blind flange downstream of the bypass valve in 2011. The main valve, sampling valve, and gauge have not been exercised since 2011. The sampling valve handles and pressure gauge are degraded and corroded. The main bypass valve was covered in precipitate.

Due to the unknown internal condition of the existing hardware, we recommend replacing the sampling valve system with a ½ inch stainless steel pipe, tee, pressure gauge and sampling valve like that installed at Mogul in 2023. The 4-inch bypass valve should first be cleaned with a pressure washer and wire brush/wheel brush. Once the bypass valve is clean, it can be examined for structural integrity and damage to the stem and seals. If the valve appears serviceable, it can be greased and carefully opened. It is possible that the valve packing has been compromised and that water may leak through the valve stem. To minimize the impact of additional flow, the Koehler Junction Pond should be pumped down and potentially mucked out to that flow can be collected there. If water leaks through the stem, the pipe behind the valve would be hot tapped, like at Mogul, and an inflatable packer set in the pipe to stop the flow. At that point the valve would be removed, and a blind flange installed. Future pressure monitoring and sampling would be conducted through the side tap. The same hot tap would be installed if

the valve was found to be inoperable. Note that historical pressures have ranged from 40 to 62 psi (92-143 feet of head).

Accurate water flow monitoring is also important for evaluating the seepage, specifically if it is increasing over time. The rehabilitation drawings modify the portal steel sets to remove the sill beams and allow free drainage. Once the new ground support is in place, the invert has been fully mucked out, and the portal is freely draining, a flume can be set to allow accurate measurement. The 2023 clean up revealed that there is no drainage ditch in the Koehler Tunnel. This means that a flume would have to be set in or outside of the portal structure. Due to the tendency of the discharge to sludge up, we recommend using temporary flumes to check flows during the field season. This could be done in the portal area drainage ditch or by using sandbags in the portal structure.

The final step of the assessment is the concrete integrity. During the 2023 inspection, we used a scaling bar to scrape precipitate on the air side face of the bulkhead along the right rib. The concrete underneath was found to be degrading. It could be easily scraped off by hand to a depth of about 0.5 inches. The cause of the face degradation is the seepage of highly acidic (pH 2.47 at Station 2+92 "Big Dripper" borehole) water through the rib leading to cement dissolution. It suggests that the same acidic mine water is degrading the concrete on the upstream/water side as well.

Consistent with conditions noted in the 2022 inspection, the bottom foot of the bulkhead face was submerged. At the base of the bulkhead, small bubbles could be seen rising to the surface of the pooled water. These bubbles, first noticed in 2011, may indicate acidic mine water is reacting with the concrete bulkhead and generating CO₂. The bubbles appear to be consistent with what was observed during entries in 2017 and 2022. While several theories have been proposed, the continuing bubbling and observed degradation on the face strongly suggest that the bubbles are coming from concrete degradation.

To assess the impact of concrete degradation on the bulkhead integrity, the depth of degradation must be determined. We recommend the following approach. Scrape precipitant off the face. Pump the water out of the bulkhead pool. Mark a 4" by 4" grid pattern on the bulkhead face and measure penetration with a steel awl, documenting locations to look for patterns. This will show the extents of the most severe degradation. Evaluating the less extreme degradation and measuring concrete strength will require concrete coring to obtain samples. To avoid the rebar cage, a handheld ground penetrating radar scan should be conducted on the face. This practice is common in concrete construction where walls or beams are scanned to locate reinforcing and thereby allow proper placement of new penetrations (electrical conduits for example). Once the rebar has been found and marked, six cores should be taken. Two from low, in the pool area, two from the spring line elevation and two from near the top. These would likely be 2" diameter and 8-12 inches deep/long (note that the bulkhead is 12 feet thick). The samples would be taken to a concrete lab for strength testing at several depths. This would show the current compressive strength near the face and further inside. Permeability testing should also be conducted on the lab samples to estimate the likely depth of degradation on the mine pool side. The sample locations would be filled with dry pack grout.

The results of this testing and the seepage monitoring will be used to make an informed decision about future bulkhead rehabilitation work. Future work could include additional grouting at the base of the bulkhead or constructing a bulkhead extension including grout ring. If it is determined that no bulkhead extension is needed in the near future, we recommend filling the bulkhead pool with concrete and establishing drainage away from the face.

APPENDIX C
PHOTOGRAPHIC LOG

Koehler Junction 2023 Construction Completion Report
Appendix C: Photograph Log



Photo: 1	
Description: Water being pumped from the Koehler Junction settling pond in preparation for sludge removal from Koehler Tunnel. Water is being pumped into the culvert shown at center.	
Date: 07/24/2023	

Photo: 2	
Description: Pumped water from the Koehler Junction settling pond passing through the culvert towards Mineral Creek.	
Date: 07/24/2023	

Koehler Junction 2023 Construction Completion Report
Appendix C: Photograph Log



Photo: 3	
Description: Koehler Junction settling pond after 6.5 hours of pumping water out of it. The orange-colored shore has been exposed as a result. Junction Mine can be seen left of center, beyond the back shore of the pond.	
Date: 07/24/2023	

Photo: 4	
Description: View inside of the Koehler Tunnel portal prior to maintenance activities.	
Date: 07/25/2023	

Koehler Junction 2023 Construction Completion Report
Appendix C: Photograph Log



Photo: 5	
Description: The Koehler Tunnel portal prior to maintenance activities.	
Date: 07/25/2023	

Photo: 6	
Description: View inside of Koehler Tunnel looking toward the bulkhead, prior to maintenance activities.	
Date: 07/25/2023	

Koehler Junction 2023 Construction Completion Report
Appendix C: Photograph Log



Photo: 7	
Description: View inside of Koehler Tunnel looking toward the tunnel's exit, prior to maintenance activities.	
Date: 07/25/2023	

Photo: 8	
Description: The drainage ditch that was created just inside the Koehler Tunnel portal prior to sludge removal, intended to improve outward drainage of mine-influenced water (MIW) and sludge. Note timber sill beams inhibiting flow.	
Date: 07/25/2023	

Koehler Junction 2023 Construction Completion Report
Appendix C: Photograph Log


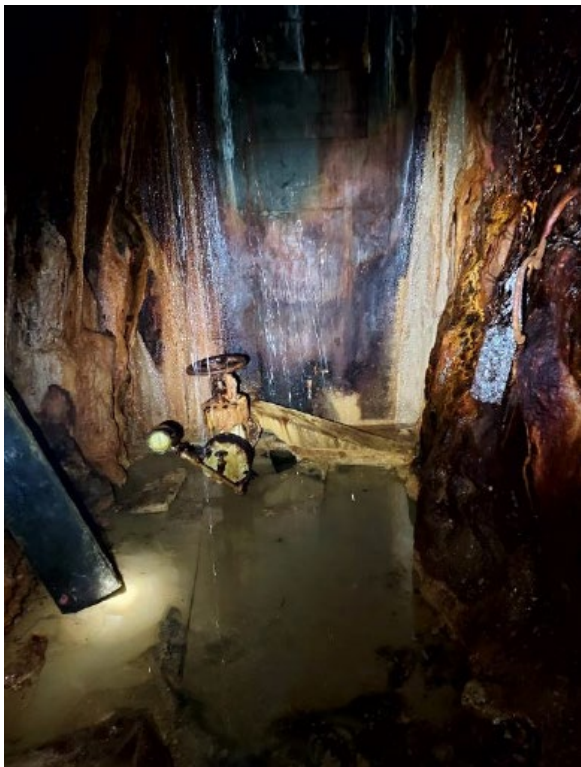
Photo: 9	
Description: View inside of Koehler Tunnel after sludge removal, looking toward the bulkhead.	
Date: 07/26/2023	

Photo: 10	
Description: Closer view of the Koehler Tunnel bulkhead following sludge removal.	
Date: 07/26/2023	

Koehler Junction 2023 Construction Completion Report
Appendix C: Photograph Log



Photo: 11	
Description: The run-off control channel downslope of the temporary repositories being re-established by deepening the channel and heightening its berm.	
Date: 07/26/2023	

Photo: 12	
Description: The re-established run-off control channel downslope of the temporary repositories, after deepening the channel and heightening its berm. The boulders were placed along the berm to add stability and improve erosion control.	
Date: 07/26/2023	

Koehler Junction 2023 Construction Completion Report
Appendix C: Photograph Log



Photo: 13	
Description: Sediment being removed from beneath timber sill beams laying across the drainage ditch just inside the Koehler Tunnel portal. Water was previously forced to flow over the sills, inhibiting its flow, and this work was intended to further improve outward drainage of water flowing from the bulkhead.	
Date: 09/20/2023	

Photo: 14	
Description: Measuring and marking out stations at 25-foot intervals along Koehler Tunnel.	
Date: 09/20/2023	

Koehler Junction 2023 Construction Completion Report
Appendix C: Photograph Log




Photo: 15	
Description: View of the Koehler Tunnel bulkhead upon completing measurements, showing its distance of 279 feet from the current portal. Note that the 2024 Koehler Tunnel portal rehabilitation design sheets show original stationing for historical consistency.	
Date: 09/20/2023	

Photo: 16	
Description: Close up view of Koehler Tunnel portal, showing a timber sill beam, thin lagging, steel strut, steel post, and foot plate with predrilled holes.	
Date: 09/20/2023	

Koehler Junction 2023 Construction Completion Report
Appendix C: Photograph Log

Photo: 17	
Description: Overview of Koehler Tunnel looking toward its portal, showing sill, dripping water, chain link mesh, split set rock bolts, and debris.	
Date: 09/20/2023	

APPENDIX D
DAILY ACTIVITY REPORTS

MEMO

To: Craig Myers, EPA; Eric Sandusky, EPA

Cc: Annie Eiseman, Project Manager, START V; Rob Burton, ER

From: Nora Dwyer, Geologist, START V

Date: 7/24/2023

Subject: Daily Activities Report: Koehler Tunnel, TD 2143-2307-01

<u>Personnel</u>	<u>Company/Organization</u>	<u>Tasks</u>
Nora Dwyer	START V (Tetra Tech)	Oversight
Craig Myers	EPA	Oversight
Rob Burton	ER	Oversight
Dan	ACT Enviro	Construction
Juan	ACT Enviro	
Juan	ACT Enviro	
Finley	ACT Enviro	

Weather

High of 76, low of 50. Clear skies with chance of afternoon rain.

Site construction activities conducted July 24, 2023

- ACT Enviro and ER staged the mini excavator, skid steer, water pump, water tailer, and the porta potty at Koehler.
- ACT Enviro and ER started pumping down the settling pond at 10:30am. Water was pumped from the pond into the culvert that naturally drains the settling pond. The settling pond was pumped down approximately 1 meter over 8.5 hours.
- The boulders blocking the road to Koehler Tunnel were moved to the side to allow equipment to be transported to the tunnel.

Site construction activities planned for July 25, 2023

- ACT Enviro and ER will begin mucking out the Koehler Tunnel.

Photo: 1	
Description: ACT Enviro pumping water from the settling pond at Koehler Tunnel through the culvert.	
Date: 7/24/2023	


Photo: 2	
Description: Water being pumped from the settling pond through the culvert at Koehler Tunnel.	
Date: 7/24/2023	



Photo: 3	
Description: The boulders that ACT Enviro moved off the road that accesses the Koehler Tunnel. The boulders are to the right and left of the road.	
Date: 7/24/2023	

Photo: 4	
Description: The Koehler Tunnel settling pond after 6.5 hours of pumping. Note the orange shore that is now exposed.	
Date: 7/24/2023	

MEMO

To: Craig Myers, EPA; Eric Sandusky, EPA

Cc: Annie Eiseman, Project Manager, START V; Rob Burton, ER

From: Nora Dwyer, Geologist, START V

Date: 7/25/2023

Subject: Daily Activities Report: Koehler Tunnel, TD 2143-2307-01

<u>Personnel</u>	<u>Company/Organization</u>	<u>Tasks</u>
Nora Dwyer	START V (Tetra Tech)	Oversight
Craig Myers	EPA	Oversight
Rob Burton	ER	Oversight
Tim Mosher	ER	Health and Safety
Dan	ACT Enviro	Construction
Juan	ACT Enviro	
Juan	ACT Enviro	
Finley	ACT Enviro	

Weather

High of 78, low of 50. Clear skies with chance of afternoon rain.

Site construction activities conducted July 25, 2023

- ACT Enviro and ER began mucking out Koehler Tunnel using a hose.
 - Removed the majority of the muck from the portal back to the bulkhead.

Site construction activities planned for July 26, 2023

- ACT Enviro and ER will finish mucking out the Koehler Tunnel, re-excavate the drainage ditch leading out of Koehler, and excavate the run on control below the Longfellow mine.

Photo: 1	
Description: ACT Enviro and ER created a drainage ditch to help dewater the Koehler Tunnel.	
Date: 7/25/2023	



Photo: 2	
Description: The Koehler Tunnel looking towards the bulkhead. The floor of the Tunnel before it had been mucked out.	
Date: 7/25/2023	

Photo: 3	
Description: The Koehler Tunnel looking towards the Portal. The floor of the Tunnel after it had been mucked out.	
Date: 7/25/2023	

MEMO

To: Craig Myers, EPA; Eric Sandusky, EPA

Cc: Annie Eiseman, Project Manager, START V; Rob Burton, ER

From: Nora Dwyer, Geologist, START V

Date: 7/26/2023

Subject: Daily Activities Report: Koehler Tunnel, TD 2143-2307-01

<u>Personnel</u>	<u>Company/Organization</u>	<u>Tasks</u>
Nora Dwyer	START V (Tetra Tech)	Oversight
Jimmy Webster	START V (Tetra Tech)	Oversight
Craig Myers	EPA	Oversight
Megan Schuette	EPA	Oversight
Rob Burton	ER	Oversight
Tim Mosher	ER	Health and Safety
Dan	ACT Enviro	Construction
Juan	ACT Enviro	
Juan	ACT Enviro	
Finley	ACT Enviro	

Weather

High of 79, low of 49. Clear skies with chance of afternoon rain.

Site construction activities conducted July 26, 2023

- ACT Enviro (ACT) and ER finished mucking out Koehler Tunnel using a hose. ACT reestablished the drainage ditch out of Koehler Tunnel.
- ACT cleaned off equipment.
- ACT and ER fixed run-on controls for the Longfellow Mine.

Site construction activities planned for July 27, 2023

- No work at Koehler Tunnel is planned. ACT Enviro and ER will conduct maintenance work at the North Start Mine.


Photo: 1		
Description: The Koehler Tunnel prior to any mucking activity.		
Date: 7/25/2023		


Photo: 2		
Description: The Koehler Tunnel prior to any mucking activity.		
Date: 7/25/2023		


Photo: 3		
Description: The Koehler Tunnel looking towards the bulkhead after mucking activities were completed.		
Date: 7/26/2023		


Photo: 4		
Description: The Koehler Tunnel looking towards the portal after mucking activities were completed.		
Date: 7/26/2023		



Photo: 5	
Description: The Koehler Tunnel looking towards at the bulkhead. Note the value in front of the bulkhead.	
Date: 7/26/2023	

Photo: 6	
Description: Repairs made to run-on controls for the Longfellow Mine. ACT and ER made the berm next to the ditch taller and the ditch deeper.	
Date: 7/26/2023	

Photo: 7	
Description: Repairs made to run-on controls for the Longfellow Mine. ACT and ER made the berm next to the ditch taller and added rocks.	
Date: 7/26/2023	

MEMO

To: Craig Meyers, EPA

Cc: Annie Eiseman, Project Manager, START V; Christoph Goss, Schnabel Engineering

From: Jimmy Webster, Field Team Lead, START V

Date: 9/20/2023

Subject: Daily Activities Report: BPMD OU1RS 2023, Koehler Mine, TD 2143-2307-01

<u>Personnel</u>	<u>Company/Organization</u>	<u>Tasks</u>
Jimmy Webster	Tetra Tech	Oversight/Portal Attendant
Christoph Goss	Schnabel Engineering	Bulkhead Inspection
Mark Kroncke	Schnabel Engineering	Bulkhead Inspection

Weather

High of 62, low of 36. Mostly sunny.

Site activities conducted September 20, 2023

- Schnabel Engineering (SE) removed sediment from beneath the 5 sill beams in the portal to improve flow, lower the water in the mine and expose the sill beams and footers for inspection.
 - The foot plates are 8"x12" steel with predrilled holes.
 - Sill beams are 6"x8" timbers wedged between steel posts
 - Sill beam at gate is W6 I-beam
 - Bracing between steel sets is angle iron or square tube steel at spring line and sill
 - No drainage ditch in tunnel
- SE measured out and marked stations in 25' intervals from portal to bulkhead.
 - Total length of tunnel from portal to bulkhead is 279'.
- SE documented ground conditions including existing support and its condition.
- SE documented shears and areas of discrete water inflow
- SE performed photo/lidar scan from portal to bulkhead to create a digital scale model.
- Measurements and field notes will be used in the 2024 rehabilitation design.

Site activities planned for September 21, 2023

- None on-site. Schnabel Engineering will produce photo/lidar model.

Photo: 1	
Description: SE removing sediment from beneath sill beams to improve flow from bulkhead. Water was flowing over beams rather than under before sediment removal.	
Date: 9/20/2023	


Photo: 2	
Description: Water flowing from Koehler Tunnel and down slope into settling pond.	
Date: 9/20/2023	


Photo: 3	
Description: SE marking station at 25' intervals from portal to bulkhead.	
Date: 9/20/2023	


Photo: 4	
Description: Bulkhead measured at 279' from portal.	
Date: 9/20/2023	


Photo: 5	
Description: Timber sill beam, steel post, and foot plate with predrilled holes outby side	
Date: 9/20/2023	


Photo: 6	
Description: Timber sill beam, steel post, and foot plate with predrilled holes inby side	
Date: 9/20/2023	



Photo: 7	
Description: 6" steel sill beam at gate	
Date: 9/20/2023	

Photo: 8	
Description: Tunnel overview showing sill, dripping water, chain link mesh, split set rock bolts and debris	
Date: 9/20/2023	