

UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION
COAL MINE SAFETY AND HEALTH

REPORT OF INVESTIGATION
Underground Coal Mine
Nonfatal Entrapment
July 24, 2002

Quecreek #1 Mine, ID No. 36-08746
Black Wolf Coal Company, Inc.
Quecreek, Somerset County, Pennsylvania

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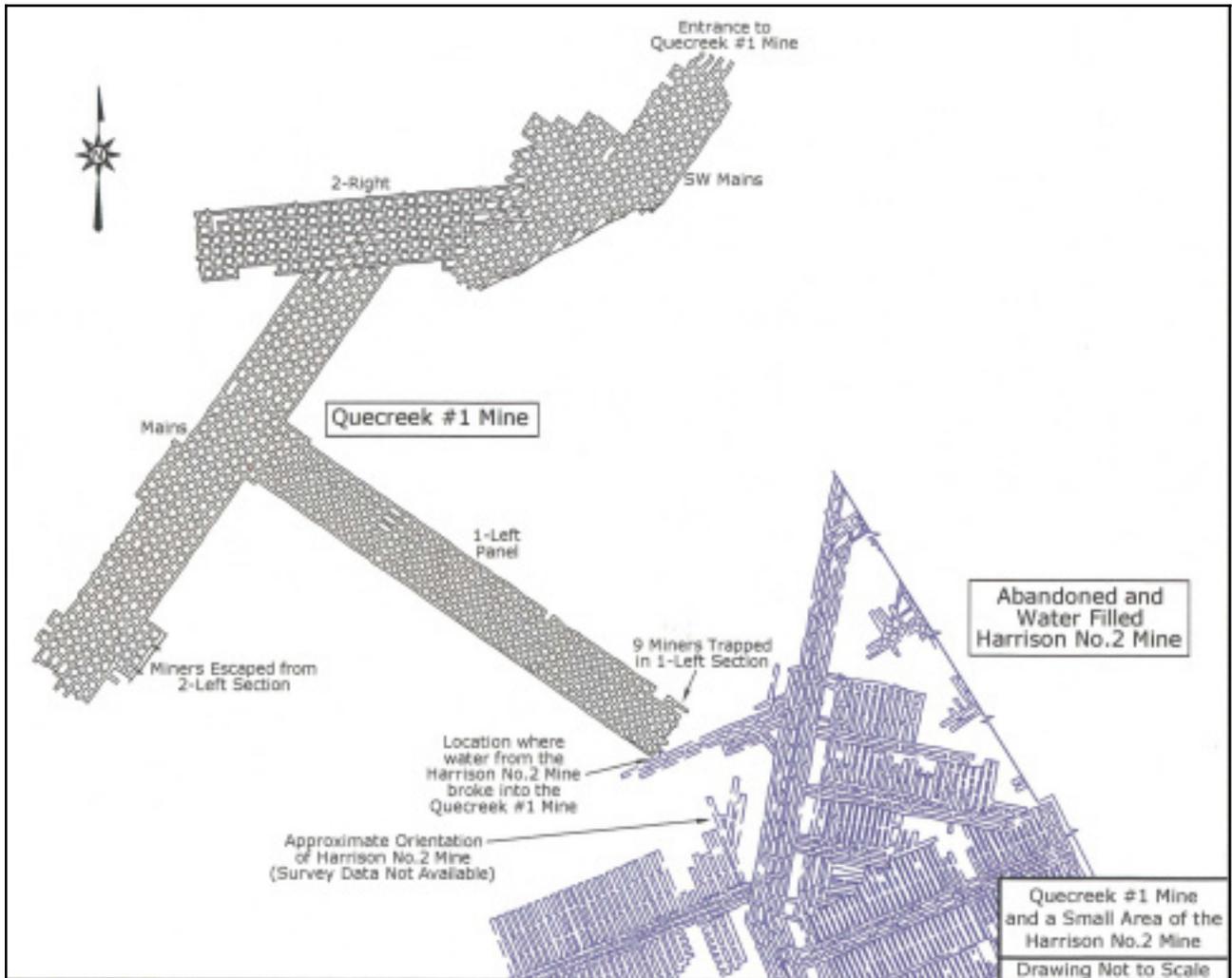
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Overview Map of Quecreek #1 Mine, ID No. 36-08746
Black Wolf Coal Company, Inc.
Quecreek, Somerset County, Pennsylvania
Nonfatal Entrapment
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OVERVIEW

On Wednesday, July 24, 2002, at approximately 8:45 p.m., a nonfatal entrapment accident caused by a water inundation occurred at Quecreek #1 mine, Black Wolf Coal Company, Inc., located at Quecreek, Somerset County, Pennsylvania. Water broke through the working face of No. 6 entry on 1-Left section from the abandoned Harrison No. 2 mine. At the time of the breakthrough, a cut had just been made in No. 6 entry. The 1-Left crew attempted to escape but was blocked by water at the mouth of 1-Left panel. The 1-Left miners were trapped from 76 to 78 hours. Seven miners from 2-Left section and two outby miners were able to escape.

Rescue efforts began immediately. A 6.5-inch hole was drilled from the surface into 1-Left section near the faces on Thursday morning, July 25, 2002. The trapped miners tapped on the drill steel to signal the surface, where it was acknowledged. Water continued to flow from the abandoned mine and eventually came out the Quecreek #1 mine portals, which were located in a pit, and rose approximately 17 feet above the highest elevation of 1-Left section. Pumps were installed in the pit, in boreholes into 1-Right, and into the low point of the Mains to remove water from the mine.

Drilling of a 30-inch rescue hole into 1-Left section started Thursday evening, July 25, 2002. Pumping of water continued to an elevation of 1829.0, which was considered necessary for safe entry of the rescue hole into the mine. The hole was drilled into the mine at 10:13 p.m., Saturday, July 27, 2002. At 10:53 p.m. communication equipment was lowered down the 6.5-inch hole and it was learned that all nine miners were alive. The miners were brought to the surface using the Mine Safety and Health Administration's mine rescue capsule. The first miner reached the surface at 12:55 a.m., Sunday, July 28, 2002, and the last arrived at 2:45 a.m.

The primary cause of the water inundation was the use of an undated and uncertified mine map of the Harrison No. 2 mine that did not show the complete and final mine workings. Using this map led to an inaccurate depiction of the Harrison No. 2 mine workings on the Quecreek #1 mine map required by the Mine Safety and Health Administration and on the certified mine map submitted to the State of Pennsylvania during the permitting process. The root cause of the accident was the unavailability of a certified final mine map for Harrison No. 2 mine in the State of Pennsylvania's mine map repository.

The investigation team concluded that water entering the section prior to the accident, which could have been a potential warning sign of an inundation, was indistinguishable from previously encountered conditions. Reports concerning hydrologic conditions indicated that water was present in overlying aquifers that resulted in generally wet conditions throughout the mine. In addition, the presence of a fault near the faces caused a worsening of conditions.

GENERAL INFORMATION

Quecreek #1 mine is located approximately one mile off State Route 985 at Quecreek, Somerset County, approximately six miles north of Somerset, Pennsylvania. The Upper Kittanning (C') coal seam was accessed by a pit (box cut) developed in 2000. The seam locally ranges in thickness from 38 to 62 inches and dips 3 to 4 percent to the northwest. In early 2001, four drift openings were developed from the box cut.

The mains and panels consisted of seven entries [[Appendix G, Map 1](#) contains a map of Quecreek #1 mine]. Nos. 1 and 2 entries were return entries. Nos. 3 and 5 were common with the No. 4 belt entry, and Nos. 6 and 7 were intake entries. No second mining had been done. The mine was ventilated by an Ingersoll Rand Model No. AMF 1600-70-3, 60-inch, 30-horsepower, axial vane, exhausting fan. The fan produced approximately 60,000 cubic feet per minute (cfm) of air. Air samples collected during Mine Safety and Health Administration (MSHA) regular inspections did not detect methane in the mine. The roof was supported by 36-inch-long to 48-inch-long fully grouted roof bolts on 4-foot by 4-foot centers. Supplemental supports including cribs, straps, longer resin bolts, and cable bolts were installed as necessary. Entries and crosscuts were driven 20 feet wide. The Mains and 2-Left panel were developed on 70-foot by 70-foot centers, while the 1-Left panel was developed on 60-foot by 60-foot centers.

The Upper Kittanning coal seam has been historically wet in this region. Since the initial development of Quecreek #1 mine, conditions were described as generally wet with water coming from the roof, ribs, and floor, which necessitated pumping from the mine. Several gathering pumps were installed throughout the mine, which fed an underground sump. At the sump, one 30-horsepower submersible pump relayed the water to the surface. Prior to the accident, 250 to 300 gallons per minute (gpm) of water were being pumped from the mine, a majority of which was pumped from the Mains/2-Left area. Typically, roof bolting machine operators wore rain gear for protection against water coming from the mine roof. In wetter areas of the mine, other crew members also wore rain gear.

The Mains was driven down dip from the portals. The lowest portal elevation was 1836.3 feet, which was higher than any known elevation in the mine at the time of the accident. [Note: Elevations have been rounded to the nearest tenth of a foot and referenced to Mean Sea Level.] Coal was produced from the 1-Left and 2-Left sections. The 1-Left panel was turned left off the

Mains approximately 4,500 feet inby the portals. A dip existed in the Mains and extended 22 crosscuts outby the mouth of 1-Left panel. The 1-Left panel was driven up dip from the Mains for approximately 3,100 feet. The section had a slight downward slope from left to right. The elevation at the mouth of 1-Left panel in No. 4 belt entry was 1742.3 feet. This was the lowest surveyed elevation on the panel. At the time of the accident, the last mapped elevation on 1-Left section was 1826.4 feet near survey station No. 587, approximately 290 feet outby the faces of 1-Left section. Development had just begun in the 2-Left section off the Mains, approximately 6,000 feet inby the portals. The lowest mapped elevation in this area was 1722.0 feet.

Mining equipment consisted of Eimco 2810-1 remotely controlled continuous mining machines, Joy 21SC shuttle cars, Fletcher twin-boom roof bolting machines Models DDO-17 and CDDO-13, Eimco 555 battery scoops, Stamler coal feeders, Pemco 1500 KVA power centers, A.L. Lee four-wheel drive mantrips, and Johnson golf carts. Belt conveyors were used for coal haulage.

The initial MSHA Legal Identity Report, dated August 26, 1998, gave the mine name as Quecreek mine operated by RoxCoal, Inc. (RoxCoal) of Friedens, Pennsylvania, a subsidiary of Mincorp, Inc. (Mincorp). On March 25, 1999, the mine name was changed to Quecreek No. 1 mine, operated by Quecreek Mining, Inc., a subsidiary of PBS Coals, Inc. (PBS), of Friedens, Pennsylvania. PBS was also a subsidiary of Mincorp. Quecreek Mining, Inc. developed the surface area and portals, and conducted initial in-seam mining. On May 3, 2001, Mincorp entered into a contract with Black Wolf Coal Company, Inc. (Black Wolf) to conduct mining operations. At that time, the mine name was changed to Quecreek #1 mine on the Legal Identity Report. David F. Rebuck, Mine Superintendent, was president and majority co-owner of Black Wolf. Charles E. Hankinson, Chief Electrician, was vice-president and minority co-owner of Black Wolf.

Black Wolf employed 61 persons with 6 on the surface and 55 underground at Quecreek #1 mine. Black Wolf reported that the mine produced 161,577 tons of coal for the first two quarters of 2002. Coal was produced on two 8-hour shifts, 5 days a week and on Saturday day shift, with crews rotating weekly between day and evening shifts. The midnight shift was an 8-hour maintenance/setup shift, which was worked 5 days a week.

A regular inspection of Quecreek #1 mine was completed by MSHA on June 12, 2002. A subsequent regular inspection began on July 1, 2002, and had not been completed at the time of the accident.

MSHA issued 22 Section 104(a) citations since Black Wolf assumed mining operations on May 3, 2001. Seven of these were designated as significant and substantial. The frequency of citations per inspection day was 0.22. For calendar year 2001, the national frequency was 0.89 for underground coal mines.

Black Wolf reported seven accidents, injuries, and illnesses to MSHA since it took over mining operations on May 3, 2001. Two of these were Non-fatal Days Lost (NFDL) injuries, one each in 2001 and 2002. This resulted in a NFDL incidence rate of 3.96 in 2001 compared to a national rate of 7.26. Black Wolf's NFDL rate for 2002, prior to the accident, was 4.20 compared to a national rate of 7.01.

Mine officials at the time of the accident were as follows:

David F. Rebuck	Mine Superintendent/President
Charles E. Hankinson	Chief Electrician/Vice-President
Joseph A. Hoffman	Mine Foreman
David A. Keller	Safety Director

A flooded abandoned mine was located immediately up dip of the Quecreek #1 mine permit boundary in the Upper Kittanning coal seam. The mine was opened by Quemahoning Creek Coal Company in 1913 as Quecreek No. 2 mine. Saxman Coal and Coke Company purchased the mine in 1925 and operated it until 1963 with an idle period from 1934 through 1941. Documents reviewed during the investigation revealed the mine had also been named Saxman, Harrison, and most recently Harrison No. 2.

DESCRIPTION OF THE ACCIDENT

1-Left Section, July 24, 2002, Day Shift

The 1-Left section day shift crew, supervised by Harry Gula, Section Foreman, entered the mine at 7:00 a.m. A review of the pre-shift examination records for the day shift revealed no record indicating hazardous conditions. Poor roof conditions in Nos. 6 and 7 entries made it necessary to mine shorter cuts in those entries. Because of this, these entries were not developed as deep as the other entries. Although the normal mining sequence was from right to left, the crew concentrated most of its mining efforts on the right side of the section to align it with the left side. The crew began mining in No. 6 right crosscut. The second cut was taken from the face of No. 5 entry. The third cut was mined in No. 6 right crosscut. Mining then

proceeded from right to left. At the end of the shift, the continuous mining machine was left in No. 1 entry, where the last cut was taken.

Roof bolting machine operators stated that they drilled into wet roof while installing roof bolts in the crosscut right off No. 5 entry. As they progressed into the cut, a small amount of water came from the bolt holes. Further into the cut, water increased until a couple of holes produced "a lot" of water; however, the last two rows of bolts were dry. One of the wet holes was also "dirty" with mud. The roof bolting machine operator who hit the dirty hole did not consider it as unusual because these conditions were previously encountered further outby on 1-Left panel. The dirty hole was mentioned to Gula because that information was used to make roof control and depth of cut decisions. It was also mentioned because dirty holes adversely affected the performance of the machine's dust collection system and resulted in longer bolting cycles. Gula told Joseph Hoffman, Mine Foreman, about the dirty hole while they were on the section around 1:30 p.m. Hoffman, however, stated he had "no specific recollection of being told about the bolt hole."

One roof bolting machine operator reported a slight odor to the water from a roof bolt hole. He stated it was not a "rotten egg" odor that he would have associated with old works. He said it was not a strong odor, just a slight odor in the water. He also stated that you had to be right there to smell it and that the odor went away when the roof bolt was installed in the hole. No odor was noticed in any of the other holes drilled. No other miners interviewed reported noticing any odor associated with the water.

The other operator of the twin-boom roof bolting machine indicated that he noticed nothing in the face area that might show water was under pressure. He stated the bottom was wet and it had been that way almost the entire time on 1-Left panel.

Near the end of day shift, Gula conducted a pre-shift examination for the on-coming shift and reported no hazardous conditions. Gula stated that conditions in No. 6 entry were normal with nothing unusual at the face. He also stated that some water was seeping from the roof, bottom, and the coal, but that was normal. The day shift crew left the section at 2:30 p.m. and arrived on the surface at 3:00 p.m.

1-Left Section, July 24, 2002, Evening Shift before Breakthrough

The 1-Left section crew started the evening shift on July 24, 2002, at 3:00 p.m., their normal starting time. The crew consisted of Randall L. Fogle, Section Foreman; John R. Phillippi, Continuous Mining Machine Operator; Robert E. Pugh, Shuttle Car Operator; Dennis J. Hall, Shuttle Car Operator; Ronald J. Hileman, Roof Bolting Machine Operator; John R. Unger, Roof Bolting Machine Operator; Thomas D. Foy, Mechanic/Electrician; Harry Blaine Mayhugh, Jr., Scoop Operator and Foy's son-in-law; and Mark E. Popernack, Utilityman/Miner Helper. The crew traveled to the section and Fogle examined the faces, which he said looked good. Fogle stated that there were no problems with the roof or anything else to alert him to a problem with water. He did not see any water seeping from the faces.

The continuous mining machine was in No. 1 entry, where the day shift crew had left it. They moved the machine to No. 7 entry and mined a 20-foot cut in the entry (cut A). [See [Appendix G, Map 2](#) for a map of cut sequences.] Phillippi operated the continuous mining machine until 8:00 p.m. and mined four cuts. While he did not recall where he had mined or the details of the cuts, Fogle's production records and testimony indicated that three of the cuts were 30 feet deep. These cuts were No. 6 right crosscut (cut B), No. 5 right crosscut (cut C), and No. 4 right crosscut (cut D). These crosscuts were the next to the last line of crosscuts projected for 1-Left section. After completing the next crosscut, the section was to be moved approximately 2,500 feet outby to develop a section to the left from the 1-Left panel.

Unger and Hileman operated a twin-boom roof bolting machine on the left side of the section in Nos. 2, 3, and 4 entries. They bolted three or four places that were left from the previous shift. The last place they bolted was in cut D, the first cut in No. 4 right crosscut. Unger bolted the turn-in on the right side of the cut. Because of the turn-in and angle of the roof bolting machine, Hileman could not bolt on the left side. The bolt holes that Unger drilled produced water. Unger described these holes as being "wet." Hileman, who did not drill any of these holes but observed Unger drilling them, described the holes as "a dozen, every one was full pipe." Hileman stated that this condition was not uncommon, that they had "hit it like that before..." but for just about twenty feet "and then all the holes would be dry." He also indicated that they did not encounter water in the roof in the other places they bolted during that shift.

Due to the slow bolting caused by plugged drill steels, a second twin-boom roof bolting machine was operated by Foy and Fogle on the right side of the section. They bolted cuts A, B, and C, then backed the roof bolting machine down No. 5 entry. Fogle stated that the bolt holes were dry in these places.

Mayhugh operated a scoop during the shift. His job entailed bringing roof bolting supplies to the roof bolting machine operators, pumping water with a hydraulic pump, and cleaning the faces after the cuts were bolted.

At 8:00 p.m., during mining of cut E, Phillippi went to eat and Popernack replaced him as operator of the continuous mining machine. Cuts A and B had been bolted prior to mining cut E. Cut E completed the crosscut between Nos. 6 and 7 entries. After cut E, Popernack backed the continuous mining machine out of the crosscut into No. 6 entry. He then mined an approximate 35-foot cut in the entry (cut F). The continuous mining machine was positioned on the right side of the entry to finish cleanup of the cut. Popernack was located to the right rear of the machine in the entrance to the crosscut to No. 7 entry from where he operated the machine with a radio remote control. Popernack had just loaded Hall's shuttle car and needed one more shuttle car to finish cleanup. Popernack turned to look at Hall as he was preparing to leave. When Popernack looked back toward the face, he could not see the continuous mining machine or its lights. Water had broken through the face and was inundating the entry. The time was approximately 8:45 p.m.

Hall was in his shuttle car and had just switched seats so that he was facing away from the continuous mining machine in preparation for leaving. He heard Popernack scream at him to leave. He hit the tram, pulled away, and water from the breakthrough hit him in the back. As he pulled into the crosscut near the feeder, power was lost and his shuttle car stopped. Hall observed water flowing down No. 5 entry toward the mouth of 1-Left panel.

Foy and Fogle were at the roof bolting machine in No. 5 entry when the breakthrough occurred. After Unger finished bolting the turn-in to No. 4 right crosscut, Hileman straightened the roof bolting machine to face the crosscut. While positioning the machine, it lost power. Pugh was in his shuttle car in the last open crosscut between Nos. 4 and 5 entries. He was waiting for Hall's shuttle car to be loaded when the breakthrough occurred. Mayhugh was in his scoop in a crosscut between Nos. 3 and 4

entries when he heard a "huge" noise. He didn't know what it was, but Foy came and told him they had to leave because they had cut into an old mine.

Fogle stated he heard the water rushing into the mine and he concluded they had cut into something. He instructed Foy to gather all the miners at the feeder. He yelled for Hall to call 2-Left section and outside and tell them they had water coming, that they hit something. Hall heard Fogle yelling at him and went to call. He called 2-Left section and when no one answered after repeated attempts, he called outside and got an immediate response from Gregory Walker, Outside Man. He told Walker that he needed to inform the other crew in 2-Left section that they had "major water" entering 1-Left section. At that time, Ronald Schad from 2-Left section answered. Hall told him they had water coming in, not to waste any time, and to get out now. He kept repeating the warning until he was sure Schad understood the urgency of the situation. In the meantime, Fogle went to find Popernack and Foy went to gather the miners.

1-Left Section after Breakthrough

Popernack was at the entrance to the crosscut between Nos. 6 and 7 entries and had just loaded Hall's shuttle car when the breakthrough occurred. When he saw the water, he thought about jumping into the rear of the shuttle car as it left, but did not because he was wearing the radio remote control unit. He also thought about following the shuttle car out, but knew the water was already too swift and would sweep him off his feet. He went through the crosscut, where water was up to his waist, to No. 7 entry and traveled outby to the next crosscut. He went through that crosscut to the water in No. 6 entry where he saw Fogle on the other side of the water. They tried to communicate, but the roar of the water was too loud. It was clear to both miners that Popernack was not able to cross No. 6 entry due to the raging water. Fogle yelled at Popernack to make his way out the No. 7 intake entry, but was not sure if Popernack heard him.

Fogle left Popernack and met the other seven miners at the feeder, which was in No. 4 entry at No. 53 crosscut. He told them to travel out the belt entry and he would catch up to them later. Fogle traveled out No. 5 entry so he could look through personnel doors in the stoppings to No. 6 entry in hope of finding Popernack. He traveled approximately 700 feet out No. 5 entry while making three or four unsuccessful attempts to find Popernack. Due to the rising water in No. 6 entry and his desire

to join the other miners, he moved to No. 4 belt entry. [See [Appendix G, Map 3](#) for a map of the miners' travel routes.]

Fogle proceeded outby and caught up to Hall, the last miner of the seven making their way down the belt entry. The water was rushing down the entry and was over the top belt. Hall was having trouble keeping his footing in the swift water. He told Fogle he could not hold on, that he wasn't going to make it. Fogle grabbed him and threw him onto the belt, which made it easier to move outby through the water. Hall and Fogle continued out the panel on the belt until they met the other miners, who had encountered roofed water and were returning on the belt. Those miners reported that the water was rising so fast that they had a hard time turning around on the belt before the water roofed. The miners had traveled approximately 2,500 feet (No. 4 crosscut) out the belt entry before turning around.

The miners retreated inby on the belt to No. 13 crosscut where they went into No. 3 entry. This was at a belt drive that was being installed for a projected panel to the left approximately 600 feet inby the mouth of 1-Left panel. They knocked a hole in a stopping at No. 12 crosscut, crossed into No. 2 return entry, and traveled outby in the return approximately 500 feet to the regulator in No. 1 entry. Fogle stated that water covered the regulator and was "sucking hard" through it. He then swam to the stopping across No. 2 entry. He could see one row of blocks above the water and tried to knock a block out with his hammer. After he tired from hitting the block, others helped and they eventually knocked it out. While doing this, water overtook them and they had to leave the area.

The miners regrouped and decided to go inby to the section. They traveled in No. 2 entry approximately 700 feet checking the water level at the doors and stoppings to find a way back into the belt entry. They passed the crosscut where they had entered the return and re-entered the belt entry through a personnel door at No. 15 crosscut. They knew it was safe to re-enter at this point because they no longer saw water seeping through the stoppings.

While the other miners were attempting their escape, Popernack tried to travel out No. 7 entry, but the water was too swift. He was able to travel to the third crosscut outby (No. 53 crosscut) by hanging onto the roof bolts for balance. This crosscut had very little water going through it. He traveled through the crosscut to No. 6 entry and looked for a way across the water. A stopping was in the crosscut on the other side of No. 6 entry and blocked Popernack's view across the section. He traveled back to

the second crosscut where he had last seen Fogle. When he saw no one after a while, he assumed the crew had left.

Popernack returned to the third crosscut outby knowing that he had to get across the water, which he referred to as a "river." The mechanic's golf cart with some tools and supplies was in the crosscut. He sat down there to collect his thoughts and consider his options. He considered jumping in and letting the water "wash me out" but decided that was not a good idea. He said that it was hard to breathe at that time. He calmed himself, and tried to think of a way to get across. He found a raincoat on the mechanic's cart and put it on because he was cold. He found the water hose to the continuous mining machine and took it apart. He looped a hydraulic hose around his waist and taped it to the water hose. He then entered the water and took two steps hoping the hose would hold him to get across. The hose loop slid down around him and he decided it wouldn't work. He returned to the crosscut to plan a better method of escape.

Popernack noticed some J-hooks hanging on the roof bolt plates in the No. 6 entry over the water. He taped some tools together as a pole and fished the hooks off the plates. He decided to use the hooks to try to cross the water by hooking the J-hooks on the roof bolt plates. He taped them to his wrists and practiced hooking the bolt plates in the crosscut. He said it was difficult, but he managed to do it. He again looped the hydraulic hose around his chest, this time taping it under his armpits so that it wouldn't slide. He also taped his hard hat on and taped a hammer to his belt because he would need it to knock the stopping out on the other side of the water. He went into the water, took two steps, and tried to take a third, but the water was too swift to put his foot down. He was ready to lie down and try to skim across the water by grabbing the roof bolt plates with the J-hooks when he saw a light through a hole in the stopping. He then moved back into the crosscut.

When the miners returned to the section, they looked for Popernack and found him still across No. 6 entry in the third crosscut (No. 53 crosscut) outby the breakthrough. They knocked a hole in the stopping separating them and went through the crosscut to No. 6 entry. Fogle waded into the water and tried talking to Popernack. He decided to try to rescue him by throwing a line across the water. He took a length of small diameter plastic coated steel cable, tied it to a shear pin, and tossed it across. After several tries, Popernack caught the cable and tied it off. Fogle then cut the power cable to the roof bolting machine and tied and taped it to the steel cable.

He thought that Popernack could pull the power cable across the water, tie it around his waist, and they could pull him back. Popernack tried to pull the power cable across, but the water was too swift and swept it away. At that time, Fogle told Popernack to wait because it seemed that the water had slowed and might slow more.

Although Fogle thought the inflow was slowing, he was concerned about how fast the water was rising into 1-Left panel. He left Popernack and took the scoop down the return entry to check the water level. Fogle found that the water had risen to approximately No. 13 crosscut (No. 4 entry elevation 1756.6 feet). He returned to Popernack and decided to use the battery powered scoop to attempt a rescue. Because the electric shuttle cars, which could not be moved, blocked the route to Popernack, they had to cut the belt and remove the belt structure to cross the entry.

Fogle brought the scoop across the belt entry in No. 52 crosscut and traveled in by in No. 5 entry to No. 53 crosscut. He used the scoop to knock out the stopping separating him from Popernack and took the scoop to the water's edge. Fogle and Popernack stated that by this time the flow of water in No. 6 entry had slowed somewhat. He eased the scoop into the water, testing it. It seemed stable, so he continued out as far as he thought was safe. He asked Popernack if he could make it into the bucket, and he said he couldn't. Fogle then moved the scoop out a couple more feet. Popernack entered the swift water as far as he could, then jumped into the bucket. Fogle backed the scoop out of the water and brought Popernack to the other side. During Popernack's rescue, Hall moved the phone to the last open crosscut of No. 4 entry and continued calling in an attempt to communicate with the surface.

After rescuing Popernack, Fogle took all the miners in the scoop and tried to escape out No. 5 entry. They traveled out by approximately 1,700 feet to No. 24 crosscut. Fogle used the scoop to knock out the stopping between Nos. 5 and 6 entries and traveled across to No. 7 entry. He stated that he crossed the water in No. 6 entry with ease because the water "wasn't too bad at that time." They traveled in the scoop an additional 300 feet out by in No. 7 entry to where the water was roofed. They now knew that all the entries were blocked and that they had no way to escape. With the water rising, they had no choice but to return to the section. On the way back, they picked up three cases of distilled water in one-gallon plastic containers.

When they arrived back at the section, the miners were cold and wet. They gathered around the roof bolting machine in No. 4 entry because it was still warm. Hall went to the mine phone and tried to establish communication with the surface without success. Fogle took the scoop and went out the return entry to check the water level again. It had been about three hours since he first checked and the water level was now approximately 1,300 to 1,600 feet into the panel, at about No. 22 crosscut.

Fogle returned to the section, rested, and talked to the crew. He thought the water was approximately 2,000 feet away and that they had a couple hours before it reached the section. He told the crew they needed to barricade themselves from the water by building block walls. It was difficult for him to make this decision because he had always said he would never barricade himself in a mine. Several pallets of solid four-inch-thick interlocking concrete blocks were on the section for use in building ventilation stoppings. The crew also knocked out existing stoppings to get blocks for the barricade walls. Fogle planned to build six walls to hold back the rising water. The walls were to be dry-stacked and sealed on the inside surface. The first two walls were to be built in Nos. 53 and 54 crosscuts, between Nos. 4 and 5 entries. The third, fourth, and fifth walls were to be built across Nos. 4, 3, and 2 entries, respectively, between Nos. 51 and 52 crosscuts. The No. 1 entry in this line of pillars was not mined through and did not require a wall. The sixth wall was to be built in No. 52 crosscut between Nos. 4 and 5 entries.

While building the barricade walls, Fogle heard the surface drill and thought it would intersect the mine closer to the faces than it eventually did. On Thursday, July 25, 2002, at 5:06 a.m., approximately 8 hours after the breakthrough, the 6.5-inch hole drilled into No. 4 entry outby the location of the barricade wall, which was under construction in that entry. To keep the hole within the barricaded area, this wall had to be taken down and rebuilt one crosscut further outby. This also required the planned locations of the fourth and fifth walls to be revised. The miners were able to build the first five walls, but the rising water reached the location of the sixth wall as it was being built. The miners worked in the water and tried to finish the last wall, but the rising water forced them to abandon it.

After the 6.5-inch drill broke into the mine, drilling stopped with the drill bit on the mine floor. Fogle knew he needed to notify the surface and wanted to use MSHA established rescue signals. They looked at the rescue/barricade stickers inside

their hats for instructions. In accordance with instructions, Fogle hit the drill steel three times, followed by someone else hitting it nine times to indicate nine miners. In an attempt to signal the miners, the drill steel was lifted, slowly rotated, and lowered back to the floor by the drill operator. Because of this Fogle assumed their signals were heard on the surface. The time was 5:12 a.m. on Thursday, July 25.

The drill steel was left in the hole and air from the drill rig compressor continued to be directed through the steel pipe into the mine. Initial surface measurements of the air exhausting from the annular space of the hole indicated an oxygen level of approximately 17 percent. Before the hole drilled into the mine, miners complained of difficulty in breathing, chest pains, an inability to breathe through their noses, and a lack of energy. The miners gathered near the hole and said that the air from the drill steel immediately helped them to breathe easier. The oxygen level of the air exhausting from the hole at the surface quickly rose to 19.3 percent, indicating that the air quality was improving around the bottom of the hole. However, Fogle complained that oil vapors, which were present from the compressor system, caused "burning in his esophagus and heartburn." The oil mist caused him to cough, become nauseated, and not able to swallow for a long time. Fogle was the only miner who mentioned any ill effects from the compressed air. All of the miners complained about the extremely loud noise of the air coming from the drill steel. They said it was screaming out of the drill steel like a jet engine. Some of the miners retreated from the area due to the noise. Others stayed at the hole and continued to tap on the drill steel.

The rising water eventually caused the miners to stop tapping on the drill steel and retreat. At 11:40 a.m., Thursday, July 25, 2002, the last tapping was heard on the surface. The water rose to an elevation above the bottom of the drill hole. The drill hole was located 130 feet outby the maximum shoreline the water reached in the section. The water was roofed approximately 70 feet inby the hole location. [See [Appendix G, Map 5](#).] Compressed air continued to be pumped through the drill steel into the water at the bottom of the hole.

All the miners eventually retreated to the roof bolting machine in No. 4 entry. They estimated they had about an hour left based on the rate the water was rising. The miners took some time to reflect on their situation and prepared for the worst. Some of the miners tied themselves together so they could be found together in the event they were drowned. They wrote notes to

their families and placed them in a plastic bucket. The bucket was closed with a lid, sealed with electrical tape, and secured near the roof bolting machine to prevent it from floating away.

Popernack stated they should move to No. 1 entry. Fogle had considered going to No. 2 entry since it had a little more space but agreed since No. 1 entry was located at the highest elevation on the section. At the time they moved, the water level was at the last open crosscut in No. 4 entry. Upon reaching No. 1 entry, the miners hung two plastic curtains six inches apart across the entry in by the last open crosscut. They piled coal on the bottom of the curtains as a last effort to dam the water. They huddled together, sat back to back, and wrapped themselves with curtain in an attempt to stay warm. Every 30 minutes, they hammered on a roof bolt to signal the surface.

They noticed that the sides of the capped plastic water containers, which they brought with them for drinking water, were compressed, indicating their atmosphere was under pressure. They also heard a noticeable hissing of air going through the open roof test holes. The miners conserved their cap lights by using them one at a time and only as necessary. Anticipating the need for additional lighting, they also took the nine-volt battery and paging light from the mine telephone. They kept track of time by referring to their watches and relating times to the different shifts.

Fogle continued to check the water level and later found that it was only about 70 feet from their location. He marked the shoreline and went back to the group. He rechecked the water level 15 minutes later and it seemed to be holding. Fogle continued his examination of the water level for several hours and there was no change. He estimated that the water stabilized on the 1-Left section at approximately 12:30 a.m., Friday, July 26, while others thought it was noon on Thursday. This water elevation was later surveyed to be 1835.2 feet. Water in the pit reached this elevation at approximately 9:00 a.m., Thursday, July 25. The floor elevation of the miners' location in the No. 1 entry was 1839.5 feet. Fogle was experiencing chest pains and others began to check the water level. After many hours, the water began to slowly recede. While in No. 1 entry, the miners heard additional drilling and knew rescuers were trying to reach them. On Friday, July 26, drilling stopped for about 18 hours. They were concerned, but assumed that something must have broken on the drill.

The water receded to where the miners could reach the 6.5-inch drill steel on Saturday night, about an hour before the rescue hole broke through. They began to beat on the drill steel as soon as they could reach it. Foy and Hileman were at the drill steel when the rescue hole drilled into the mine. It came in approximately 20 feet outby the 6.5-inch drill steel in No. 4 entry and on the other side of the barricade wall. When the rescue hole broke through into the mine, Foy told Hileman to get the others so they could "get the heck out of here." By that time, the water level had receded to just outby the rescue hole. The miners arrived on the surface between 12:55 and 2:45 a.m., Sunday, July 28, 2002.

2-Left Section, July 24, 2002, Evening Shift

Mining in the Mains was stopped on July 12, 2002, due to low coal, water, and adverse roof conditions. The 2-Left section was developed left off the Mains just outby the abandoned faces of the Mains. The same crews and equipment from the Mains were employed on 2-Left section. At the time of the accident, coal was still being dumped on a feeder located on No. 5 belt in the Mains at No. 44 crosscut. The belt conveyor drive for the 2-Left section belt was under construction at No. 43 crosscut. Miners referred to the area as either the Mains or 2-Left.

The 2-Left section crew started the evening shift at 4:00 p.m. The regular section foreman, Greg Solomon, was off work and was replaced by Frank Stewart, Mine Examiner. Stewart examined the faces while the crew prepared to begin production. Ronald Schad, Mechanic/ Shuttle Car Operator, greased the feeder and tailpiece, checked his shuttle car, and replaced a weak battery in the mine phone. After Stewart completed his examinations, he instructed Schad to energize the equipment. Other members of the 2-Left section crew were Joseph Kostyk, Continuous Mining Machine Operator; Wendell Horner, Shuttle Car Operator; Ryan Petree, Scoop Operator; David Petree, Roof Bolting Machine Operator and father of Ryan Petree; and Douglas Custer, Roof Bolting Machine Operator. In addition, two outby miners, Barry Carlson, Outby Scoop Operator, and Lawrence Summerville, Floating Mechanic, were working on the 2-Left section belt. The crew began production at approximately 4:45 p.m.

Summerville and Carlson began their shift at 3:00 p.m. Carlson proceeded underground and, using a scoop, began retrieving belt structure from along No. 5 belt in the Mains. Summerville, after working at the surface shop, later proceeded underground to begin

electrical wiring of the 2-Left section belt drive at No. 43 crosscut in the Mains.

At approximately 8:00 p.m., Stewart left the section on his golf cart to conduct required examinations of outby areas. As he was leaving, he met Carlson and Summerville near the 2-Left belt drive construction area. Part of his required examination was to check pumps, three of which were located in the outby areas of 1-Left panel. Stewart traveled into 1-Left panel along No. 5 travelway entry, which was common with the belt entry. He first went to check the pump in No. 7 intake entry at No. 18 crosscut, approximately 1,000 feet into the panel. He parked the cart and went through a personnel door into No. 6 entry. As he passed through the door, he heard the 1-Left belt conveyor stop. Stewart left the door open. He noticed that there was no water in the pump discharge line, and when he got to the pump, it wasn't running.

At 8:50 p.m., Stewart posted his initials, date, and time on the date board at the pump. While at the pump, he heard a noise, which he described as sounding like a scoop coming down the entry. Then he heard the personnel door that he had left open slam shut. He knew something was wrong so he proceeded back to No. 6 entry. There he heard a loud roaring noise followed by a rush of air in the outby (not normal) direction. The surge of air almost knocked his hard hat off. His first impression was that an explosion occurred which had reversed the airflow. He looked inby toward 1-Left section and saw water coming down No. 6 entry. He quickly passed back through the door into No. 5 entry. While there, the pump discharge line was pulled through the stopping into No. 6 entry and water started coming through the hole where the line had been and around the door. He noted that the air direction and velocity in No. 5 entry appeared to be normal.

Stewart quickly drove to the 1-Left belt drive. There was no water at the drive when he arrived. He used the mine phone located at the drive and called for 2-Left and then 1-Left sections, but received no response. Walker got on the phone and told Stewart that Hall from 1-Left had already called 2-Left and told them that a large body of water was coming toward them. By that time, water was coming down 1-Left belt entry toward Stewart, and he was forced to leave. He traveled outby along No. 5 entry travelway of the Mains to No. 5 belt drive. There he called on the phone again trying to reach 1-Left section.

At the time of the accident, the 2-Left section crew was preparing to mine the third cut of coal of the shift. Kostyk was moving the continuous mining machine for the next cut. Schad had dumped a shuttle car of coal at the feeder and backed about a crosscut away to eat his lunch. He heard someone page on the phone and drove back to the feeder to answer it. The call was from Dennis Hall on 1-Left section. Hall's tone and choice of words left no doubt as to the serious nature of his message. Schad said that Hall told them to get out; they had hit lots of water. The time was approximately 8:50 p.m.

Schad drove back to where he was eating and warned Horner, the other shuttle car operator. He yelled at Horner to warn D. Petree and Custer, who were roof bolting in No. 3 entry, about the water. Schad went to get Kostyk and R. Petree, the relief miner helper, who had just moved the continuous mining machine into No. 5 entry. He told them about the water and said not to worry about backing the machine up or turning off the power, but to just get out. They all went to the mantrip, except Schad who went to the 2-Left belt drive construction site to get Summerville. Summerville and Schad talked about finding Carlson and started out of the section on Summerville's golf cart. They found Carlson, told him to leave his scoop, and to get in the mantrip that was coming behind them. Kostyk, D. Petree, R. Petree, Custer, and Horner took the mantrip and followed Summerville and Schad. They picked up Carlson and both groups headed toward the surface along No. 5 travelway entry. [See [Appendix G, Map 4](#) for travel path of the 2-Left crew.]

As Summerville and Schad approached the mouth of 1-Left panel, they saw Stewart come out of the 1-Left belt drive area on his golf cart going toward the outside. When they arrived at the mouth of 1-Left, they looked up 1-Left travelway and saw water rolling down the entry. A dip extending 22 crosscuts and approximately 15 feet deep was located in the Mains just outby 1-Left panel. They started down the dip following Stewart's path and found it blocked with water to the roof. Realizing the water was coming from 1-Left, which was on their right, they decided the only other way out was through the Nos. 6 and 7 intake entries on their left. Schad and Summerville backed the golf cart to the first personnel door into No. 6 entry, which was at No. 19 crosscut. They abandoned the cart, went through the door into No. 6 entry, and left the door open to alert the others to where they had gone. No. 6 entry, which was the designated intake escapeway, was lower in elevation than No. 5 entry. It was separated from No. 5 entry by a line of stoppings. These stoppings slowed the flow of water into No. 6 entry.

Schad and Summerville traveled out No. 6 entry and almost immediately encountered the same dip that was roofed with water in the adjacent No. 5 entry. The men had to crouch or crawl through knee to waist deep water as they traveled through No. 6 entry, which was only 36 to 42 inches high in the area of the dip. Water sprayed through small holes around the perimeter of stoppings and around personnel doors into No. 6 entry. Summerville fell in the water and crawled to the other side of the water. As the two left the water, they saw the lights of the other miners from 2-Left behind them. Schad continued to the outside by following the green reflectors in the intake escapeway. Summerville went back into the travelway at No. 13 crosscut of 2-Right, where he met Stewart. He reported to Stewart that he and Schad had made it out, but was not sure if the other 2-Left miners had made it or not.

The miners on the mantrip lagged behind since the mantrip was slower than the golf cart. As they approached 1-Left panel, they could hear the water, which R. Petree described as sounding "like a freight train coming." When they arrived at the mouth of 1-Left, they saw the abandoned golf cart and the personnel door open into No. 6 entry. Horner checked the belt entry for a possible escape route and observed that No. 5 belt conveyor was still running and water was coming over the top of the belt conveyor. They also saw water roofed ahead in No. 5 travelway. D. Petree said to go to the intake entries, so they proceeded through the open personnel door into No. 6 entry.

By this time, water was even deeper in No. 6 entry than it was for Summerville and Schad, and was roofed in No. 7 entry. In the area of low roof, the six miners crouched or crawled with only their heads above water. The miners could hear the roar of the water. Water sprayed from around the perimeter of the stoppings as it accumulated behind them. After several crosscuts of crawling, the miners were able to get back on their feet. As they passed the personnel door in No. 14 crosscut, water blew the door open. The water current was strong enough that several miners were knocked off their feet and were assisted by others through the water. The miners left the water within a few crosscuts. Further outby at approximately No. 10 crosscut, they opened a personnel door to No. 5 entry and found the area dry. They went through the door back into No. 5 travelway entry and continued toward the mine openings.

The miners met Stewart and Summerville near No. 5 belt drive in the Mains. They talked briefly before the miners continued

walking out the travelway toward the surface. Stewart and Summerville remained a short time longer, calling on the phone and waiting for the 1-Left section miners. Unable to contact 1-Left, and with the water rising, they also decided to leave. As they left on the golf cart, they picked up the other miners and all eight exited the mine. Schad arrived first on the surface shortly before the other eight. The arrival time on the surface was not recorded but it was estimated to be approximately 9:10 p.m. This time was based on Hoffman talking to the 2-Left miners on the surface and Hoffman and Summerville entering the mine at approximately 9:15 p.m. The miners waited briefly in the pit for the 1-Left section crew to emerge. Since the ventilation was interrupted underground, the miners decided it would be safer to leave the pit and go to the bathhouse/office to wait.

RESCUE OPERATIONS

Reports of the accident spread quickly via the media worldwide. Offers of assistance, equipment, supplies, materials, food, and support came from all over the state and country. This report provides an overview of events and does not attempt to document all the organizations, companies, and individuals that assisted in the rescue operation.

Rescue Efforts - Wednesday, July 24, 2002

At approximately 9:00 p.m., Walker called David Rebeck, Mine Superintendent, and then Hoffman at their homes and told them that 1-Left section had cut into water. He told them that the 2-Left section crew was on their way out and there had been no further word from 1-Left since the initial contact. Hoffman immediately left for the mine and arrived as the 2-Left crew came out of the mine. He spoke with the miners and learned what happened. Knowing the mine layout and general contours, Hoffman thought he could get to 1-Left panel through the return entries in the Mains since they were considerably higher than the other entries.

Before going underground, Hoffman checked the fan and noted that the water gauge was higher than normal, which indicated that there were restrictions in the entries. Hoffman, accompanied by Summerville, then took a golf cart and entered the mine along the main travelway. They stopped at the mine phones located at each belt conveyor drive and called outside to report their progress. Hoffman went into the return entries at Nos. 1, 2, and 3 belt tailpieces to check the airflow and quality. [See [Appendix G](#),

Map 1.] Since the inby entries were filling with water, Hoffman left the personnel doors open that he passed through to prevent the fan from going into a stall. They arrived at No. 4 tailpiece at approximately 9:30 p.m. and checked the intake entries. The water level was about 500 feet inby the tailpiece (approximately 3,200 feet from the portals) and at an approximate elevation of 1750.0 feet.

Hoffman went into No. 7 return entry at No. 4 tailpiece while Summerville waited at the phone. He traveled inby toward the mouth of 1-Left panel and checked air quality as he went. He traveled to within two crosscuts of the 1-Left regulator but was stopped by high water. While looking at the area, he heard something and turned to see that water had come in behind him and was almost to the roof. He dropped his equipment, went under the water and crawled/swam along the ribline. He came out the other side of the flooded area and returned to No. 4 tailpiece. Hoffman and Summerville then left the mine.

Rebuck arrived at the mine at 9:25 p.m. He notified Lynn Jamison, Mine Inspector, Pennsylvania Bureau of Deep Mine Safety (PA BDMS), of the accident at 9:35 p.m., and James Beisinger, Inspection Supervisor, MSHA District 2, Johnstown, Pennsylvania, at 9:42 p.m. While determining which miners were missing, there was some uncertainty as to whether a tenth miner, who normally worked on 1-Left section, was also in the mine. An examination of the mine check in/out board, the cap lamp rack, and the miner's clothes confirmed that he was not in the mine.

At 9:45 p.m., a local homeowner, William Razsewski, called Rebuck to report a loss of water in his well and a severe suction pressure down the well. This well was located in the Harrison No. 2 mine pool. In all, six wells went dry that were located in the pool.

At 9:50 p.m., Rebuck notified Joseph Gallo, Vice President of Operations for PBS, of the accident. He asked him to bring maps and surveying information from the PBS offices since PBS provided engineering services to the mine. They discussed drilling a hole into the mine. Calls were also made to "911" for ambulance service and the Pennsylvania State Police. Gallo contacted Bartels Drilling Company (Bartels) of Somerset, Pennsylvania, to mobilize a drill for possible drilling at the mine.

At 10:20 p.m., Jamison arrived at the mine. Sergeant Patrick Madigan and Corporal Robert Barnes from the Pennsylvania State Police, Troop A, Somerset, arrived at 10:25 p.m. Madigan and

Barnes recommended establishing an off-site location for family members to wait and a separate site for media personnel. Barnes established the Sipesville Fire Hall as the site for the family members and a shopping center parking lot five miles away for the media. The State Police also provided guards at mine access roads for traffic and crowd control in the area of the rescue operations.

At 10:45 p.m., Ellsworth Pauley, Supervisory Mine Inspector, PA BDMS, arrived. MSHA inspector Donald Huntley, Jr. arrived at the mine at 10:55 p.m. and issued a Section 103(k) order to Black Wolf to ensure the safety of all persons at the mine involved in the rescue and recovery operations. Beisinger and other MSHA personnel arrived at 11:05 p.m.

At 11:05 p.m., Hoffman and Jamison checked the water level in the mine and found it at survey station No. 155 in the belt entry, which was approximately 2,200 feet from the portals and at an elevation of 1779.0 feet. Also at 11:05 p.m., Gallo contacted two surveying/engineering companies to assist in surveying a hole location for drilling into the mine. Gallo wanted two separate surveys to double check the location of the proposed hole. CME Engineering (CME), Somerset, PA, was contacted to perform a GPS (global positioning system) survey. Musser Engineering, Inc. (Musser), Central City, PA, was contacted to perform a survey by traditional methods. Both companies had previously surveyed at the mine.

Suppliers were contacted for pumps, piping, pumping accessories, and other supplies and materials. Heavy equipment contractors were called to the mine to prepare drill sites and to open the water discharge at Harrison No. 2 mine portal area to improve drainage from the mine. At 11:30 p.m., Bartels confirmed that a drill rig was mobilized from New Florence, PA.

Rescue Efforts - Thursday, July 25, 2002

Other MSHA officials arrived on site. Kevin Stricklin, Assistant District Manager-Technical Services, arrived at 12:10 a.m. Jerry Davis, Assistant District Manager-Inspection Programs, and John Urosek, Chief, Ventilation Division for Technical Support, arrived at 12:51 a.m. Additional PA BDMS personnel also began arriving. Don Eppley, Mine Rescue Instructor, arrived at 1:00 a.m. with the Pennsylvania mine rescue vehicle. Joseph Scaffoni, Division Chief, and Thomas McKnight, Mining Engineer, arrived at 2:05 a.m. A command center was established at the mine office.

The mine operator proposed drilling a hole into 1-Left panel to locate, communicate with, and provide supplies to any entrapped miners. The mine map was reviewed for a location to drill a 6.5-inch hole. The location in the belt entry having the last survey control was selected (survey station No. 599). The proposed hole location was approximately 200 feet outby the face of No. 4 entry. The location on the surface was in an open farm field and was easily accessible, with minimal drill site preparation needed. At 12:00 a.m., Bartels' drill rig arrived on site.

At 12:15 a.m., Jamison reported to the command center that the water was two crosscuts inby No. 4 belt drive. This was approximately 300 feet outby and 9 feet higher (elevation 1788.0 feet) than reported at 11:05 p.m. The water shoreline was approximately 1,900 feet from the portals. At 12:55 a.m., water was at No. 4 belt drive (elevation 1795.0) and approximately 1,700 feet from the portals.

At 12:35 a.m., Rebuck and Joseph Yuhas, attorney for Black Wolf, met with the miners' families who were assembling at the Sipesville Fire Hall. This meeting lasted until 1:20 a.m. The families were told of a plan to provide them with updates every hour.

Shortly after midnight, a second drilling company, Yost Drilling and Excavation Company (Yost), was contacted for additional drilling services, including a large-diameter rescue hole. Yost confirmed having a drill rig capable of drilling a 30-inch hole and mobilized that drill. This diameter hole would accommodate MSHA's 21.5-inch-diameter rescue capsule.

When the Harrison No. 2 mine was sealed, a 36-inch drainage pipe was installed in one of the portal entries. A backhoe was used to uncover the discharge pipe outlet to ensure water continued to flow from the mine. Later in the day, additional excavation was done to remove debris downstream from the discharge that was pooling water over the outlet and to deepen the stream channel. Once this debris was removed, the pool lowered and water continued to flow from the outlet.

Surveyors from CME and Musser arrived between 12:35 and 12:45 a.m. and were provided coordinates of the proposed 6.5-inch drill hole. CME completed the GPS survey by 1:30 a.m. Musser completed their survey by 2:00 a.m. and verified CME's location within 6 inches. The site was prepared and Bartels began drilling the 6.5-inch hole at 2:50 a.m. The hole broke into the

mine at a depth of 231 feet at 5:06 a.m., taking 2 hours and 16 minutes to drill.

After the drill cut into the mine, surface personnel tapped on the drill steel three times and received a response from underground. Additional tapping on the surface was answered from underground. Tapping on the drill steel from underground was heard on the surface until about 11:40 a.m. and was not heard again until Saturday night, July 27, shortly before the rescue.

Personnel at the drill site advised the company, MSHA, and State personnel at the command center that air was continuously exhausting from the hole. Immediately after the hole penetrated the mine, measurements by MSHA indicated the air contained approximately 17 percent oxygen. The oxygen level quickly rose to 19.3 percent, indicating that the air quality was improving around the bottom of the hole.

A discussion was held at the command center concerning the air escaping from the mine through the drill hole. It was decided to leave the drill steel in the hole, to seal around the top of the hole, and to leave the compressor on the drill rig running to provide air into the mine. This was a change in plans, as the hole was originally intended to be used for communications and to provide supplies to the miners.

At approximately 9:00 a.m., rubber inflatable bags from the local fire department rescue vehicles were placed around the drill steel at the top of the hole in an attempt to block the air escaping from the mine. The air bags reduced the amount of air escaping from the hole but did not stop it completely. The air stopped escaping from around the drill steel around noon on Thursday, July 25, due to the rising water in the mine sealing the bottom of the hole.

Water continued to rise in the mine during the morning hours of Thursday, July 25. An 88-horsepower, 4,500-gpm electric pump was delivered and a decision was made to reestablish power in the mine for a pumping station. Work progressed at installing the pump underground. Due to the rising water, it had to be relocated several times and was operated only briefly. During this time period, water levels rose as follows:

WATER LEVELS - THURSDAY, JULY 25, 2002		
TIME	ELEVATION (ft.)	LOCATION
12:15 a.m.	1788.0	1,900' inby portals
12:55 a.m.	1795.0	1,700' inby portals
3:10 a.m.	1805.0	1,450' inby portals
4:54 a.m.	1810.0	1,350' inby portals
6:11 a.m.	1820.0	1,000' inby portals
6:35 a.m.	1822.0	900' inby portals
8:40 a.m.	1836.0	40' inby portals
9:15 a.m.	Water coming out portals. 1836.0+	

Hoffman turned off the mine fan at 8:47 a.m. as water neared the portals. Additional locations were surveyed on the surface for holes to be drilled into the mine in the Mains near 2-Left section, the lowest area in the mine. Drilling the first hole (No. 1 hole) in the Mains started at approximately 6:30 a.m. This hole intersected the mine at 11:00 a.m., Thursday, at a depth of 290 feet. This 6-inch hole was later increased in size to 15 inches and a 2,000-gpm pump installed down the hole. This drill site was located in a cornfield and was subsequently referred to as the "cornfield" drill area. [See [Appendix G, Map 8](#) for locations of the Mains de-watering boreholes.]

At 8:33 a.m., Thursday, within 12 hours of the breakthrough, the first of several diesel pumps arrived at the mine site. Work proceeded immediately to install them in the pit as they arrived. Before this pump arrived, only two submersible pumps were operating in the sump area of the pit. At 11:05 a.m., water was four to five feet deep in the pit.

At 9:40 a.m., the MSHA escape capsule arrived from the mine rescue station at the National Mine Health and Safety Academy in Beckley, West Virginia. It was stored near the site of the proposed 30-inch rescue hole. At 11:30 a.m., Dr. Kelvin Wu, MSHA's Chief, Mine Waste and Geotechnical Engineering Division, arrived at the mine.

Additional holes were drilled into the Mains at the cornfield. A second 15-inch hole reached the mine level, but failed to intersect the mine workings because it apparently drilled into a coal pillar. Attempts were made to blast the hole into the mine, but were unsuccessful.

Water in the pit reached a maximum elevation of 1856.8 feet at approximately 4:00 p.m., Thursday, July 25. This was 20.6 feet above the lowest portal elevation (1836.3 feet), 21.6 feet higher than the maximum water elevation (1835.2 feet) near the miners'

location on 1-Left section, and 17.3 feet higher than the miners' location in the No. 1 entry (1839.5 feet). [See [Appendix G, Map 5](#) for water location on 1-Left section.]

High-capacity diesel pumps were installed in the pit and put into operation in the afternoon. A 6-inch drop in the water level was reported between 4:00 and 6:00 p.m. The size and number of pumps and the pumping capacity fluctuated constantly as new pumps arrived and changes were made. The maximum pumping rate achieved was approximately 27,000 gpm. Musser established an elevation benchmark in the pit on Friday morning, July 26, and the receding water levels were then more accurately measured. After the benchmark was established, water elevations were surveyed at least every 30 minutes.

John Kuzar, MSHA District Manager, District 1, arrived at the mine at 2:00 p.m. Cheryl McGill, MSHA District Manager, District 2, arrived at the mine at 3:00 p.m. Ray McKinney, MSHA's Administrator for Coal Mine Safety and Health, arrived at approximately 4:00 p.m., Thursday, July 25, 2002.

At 6:45 p.m., Thursday, July 25, Yost started drilling the 30-inch rescue hole to intersect 1-Left section. It was located in No. 4 entry approximately 20 feet outby the 6.5-inch hole.

Rescue Efforts - Friday, July 26, 2002

The 30-inch rescue hole was drilled to a 105-foot depth by 1:12 a.m., Friday, July 26. The distance from this point to the mine was estimated at 139 feet. At that time, a problem occurred. While retrieving the drill steel, the 30-inch drill bit was lost down the hole. The drill crew retrieved part of the bit, but a special "grabbing" tool was needed from Clarksburg, West Virginia, to retrieve the remainder. The tool arrived by helicopter at approximately 7:00 a.m. Initial attempts to grab the bit failed. It was finally removed from the hole at 4:09 p.m. A new 30-inch bit arrived at 7:00 p.m., but due to its slightly larger size, the hole had to be enlarged from the top down. This operation started at approximately 8:40 p.m.

Due to the problems with the first rescue hole, a second rescue hole location was surveyed and a second drill rig with a 30-inch drill bit was brought to the mine. The hole was located to intersect No. 2 entry at crosscut No. 52 and work on the hole began at approximately 10:25 a.m. This hole was projected to reach the mine at 241 feet. The hole was drilled to a depth of 28 feet by 11:30 a.m. Drilling proceeded without major

interruptions to a depth of 204 feet, when the bit broke on Saturday, July 27, at 1:15 p.m. The bit and other components were lost in the hole.

On Friday, July 25, it was decided to drill a small-diameter hole into Harrison No. 2 mine to determine if any of the miners had entered the old mine trying to escape the rising water in 1-Left section. The hole was located in a nearby residential area approximately 800 feet east and up dip of 1-Left section. The hole reached mine level at 10:30 a.m., but hit coal. A second hole intersected the mine at 1:33 p.m. No response was received when the drill steel was tapped on the surface. A camera, two-way communication device, and piezometer were lowered down the hole. A two-foot void was observed at mine level with water flowing one foot deep. The equipment did not detect any responses. The quality of the air exhausting from the hole was reported as good with no methane.

In addition to the cornfield drill holes in the Mains, two additional holes were drilled into the mine at 1-Right. The pumps installed in these holes had a total capacity of 550 gpm. This pumping capacity was later increased to a total of 800 gpm. Also on Friday, July 26, a third 17.5-inch hole into the Mains was completed and a 2,500-gpm pump was put into operation down this hole at 9:40 a.m. The original 2,000-gpm pump in No. 1 hole failed and was replaced at 9:05 p.m.

Mark Skiles, MSHA's Director of Technical Support, arrived at the mine at 9:00 a.m., on Friday, July 26, 2002. At 4:00 p.m. on the same day, David Lauriski, U.S. Department of Labor's Assistant Secretary of Labor for Mine Safety and Health, arrived at the mine.

At the end of Friday, July 26, enlarging of the No. 1 rescue hole continued. The water level had been lowered two crosscuts into the mine and was at elevation 1835.4 feet.

Rescue Efforts - Saturday/Sunday, July 27 & 28, 2002

Enlarging the first rescue hole with the new 30-inch bit continued until 2:30 a.m., Saturday, July 27. The operation damaged the outer cutting bits and a new bit assembly was needed. A comparable size bit was not available. Since a 26-inch bit was available and would drill a hole large enough to accommodate the rescue capsule, it was brought to the mine. The 26-inch bit was installed and drilling resumed at 7:00 a.m.

Drilling of three new dewatering holes was started in the cornfield on Saturday morning, July 27. The Nos. 4 and 6 holes were to be 12.25-inch holes and then enlarged to 24 inches. The No. 6 hole was drilled into the mine at 10:00 a.m. Saturday, and was enlarged. Work to install a pump down the hole started at about 10:45 p.m., Saturday, July 27. Mechanical problems occurred while drilling the No. 4 hole and it was not completed before the rescue occurred. The No. 5 hole was to be a 24-inch hole. It was completed by 2:35 p.m. and a down-hole 3,000-gpm pump was put into operation at about 7:15 p.m., Saturday, July 27.

Based on known elevations in 1-Left section, a target water elevation of 1829.0 feet was considered necessary for safe entry of the rescue drills into the mine without using an airlock device. [See [Rescue Efforts - Technical Aspects: Rescue Considerations](#) for a discussion of the target elevation.] By noon Saturday, July 27, the water level was lowered to 1832.1 feet. To minimize the potential of flooding the miners' location, procedures were established on Thursday, July 25, at 6:00 p.m., for notifying the command center at 30 feet above the mine opening and then stopping the rescue holes 20 feet above the mine.

The following chart shows the depths established by the command center:

	No. 1 Rescue Hole	No. 2 Rescue Hole
Estimated Cut-through Depth	244 feet	241 feet
Depth to Notify	214 feet	211 feet
Depth to Stop/Wait	224 feet	221 feet

Drilling was to proceed more cautiously once the notification depth was reached. No. 1 rescue hole reached the notification depth at 12:35 p.m., and the stop depth at 1:38 p.m. At that time, the water elevation was at 1831.6 feet, and it was necessary to wait for it to reach 1829.0 feet. No. 2 rescue hole reached a depth of 204 feet at 1:05 p.m. when mechanical problems occurred. The drill steel was pulled and it was found that the bit and other components were lost in the hole. This drill did not resume operations.

Additional discussions occurred and concerns were raised regarding drilling into the miners' atmosphere. Rescuers thought that the miners could be located in a pressurized atmosphere and feared that connecting the atmosphere with the surface could result in loss of the atmosphere and water rising into the

miners' location. To prevent this, a seal plate was placed on top of the No. 1 rescue hole during final drilling.

The target water elevation was reached at 7:50 p.m., Saturday, July 27, and drilling resumed on the No. 1 rescue hole. After drilling approximately two feet, a ring on the seal plate blew out and was repaired. Drilling resumed at 8:58 p.m. Cut-through into the mine occurred at 10:13 p.m. at a depth of 239.6 feet. Immediately after the rescue hole drilled into the mine, all equipment was shut down in order to take an accurate relative air pressure reading between the mine and surface atmospheres. A pressure gauge was attached at the discharge pipe for the cuttings to allow for this reading. The reading was zero, indicating the mine atmosphere was not pressurized and airlock procedures would not be needed for the miners' rescue. Soon after, tapping on the 6.5-inch drill steel was heard from underground. The zero air pressure differential allowed the drill steel to be removed from the 6.5-inch hole. A two-way communication system was established down the hole. At 11:10 p.m., Saturday, July 27, it was confirmed that all nine miners were alive. Due to the reported condition of the miners, it was decided that mine rescue team members, who had been preparing to enter the mine, would not be needed.

The drill steel and bit were removed from the rescue hole and the rescue capsule prepared. Blankets, rain suits, cap lamps, chewing tobacco, food, water, and a gas detector were put in the capsule and sent down at 12:30 a.m., Sunday, July 28. Because of the reduction in the diameter of the rescue hole, there were concerns that the rescue capsule could become lodged in the hole. The capsule arrived at the bottom at 12:40 a.m. without incident. An air quality reading at the bottom determined the oxygen level to be 20.3 percent.

Early Sunday, July 28, the miners were hoisted to the surface one at a time via the rescue capsule. Rescue times for all miners were as follows:

Randy Fogle	12:55 a.m.
Blaine Mayhugh	1:15 a.m.
Thomas Foy	1:30 a.m.
John Unger	1:45 a.m.
John Phillippi	1:58 a.m.
Ronald Hileman	2:10 a.m.
Dennis Hall	2:23 a.m.
Robert Pugh	2:32 a.m.
Mark Popernack	2:45 a.m.

The rescue capsule was equipped with a system to maintain communication with the miners as they were hoisted to the surface. Once on the surface, the miners received immediate medical attention and were taken to local hospitals.

Rescue Efforts - Technical Aspects: Hydraulic Considerations

The rate of flow into Quecreek #1 mine, the storage capacity of the mine, projected water levels, and pumping needs were critical hydraulic factors to be determined to assist in rescue planning. MSHA Technical Support engineers Donald Kirkwood, Supervisory Civil Engineer, and Michael Stark, Civil Engineer, from the Mine Waste and Geotechnical Engineering Division, Pittsburgh Safety and Health Technology Center, were dispatched to the MSHA District 2 office in Hunker, Pennsylvania, to assist the rescue operation. They arrived at the district office at 12:20 a.m., Thursday, July 25, and were relieved by other Technical Support engineers on Friday, July 26.

The Quecreek #1 mine map required by MSHA to comply with 30 CFR 75.372, dated January 15, 2002, showed mine floor elevation contours at 10-foot intervals [See [Appendix G, Map 6](#)]. This map was used to calculate storage volumes of the mine and box cut. An average mine entry height of 48 inches and entry width of 20 feet were used for these calculations. Entry and crosscut lengths between contours on the map were measured and totaled. These values were used to compute the storage volume below the 1800.0-foot elevation contour to be 47.4 million gallons. Based on the 6 hours it took the water to reach the 1800.0-foot elevation, an average inflow of 132,000 gpm was calculated. Since this was the average inflow over the time period, and the inflow rate would decrease as the available head above the opening was reduced, the peak inflow would have been considerably higher.

Based on calculated inflow rates, it was estimated that the water would reach the lowest elevation portal by 9:00 a.m. Water actually reached that portal at 9:15 a.m.

A stage/storage curve was developed for the mine and pit. Net inflow rates were calculated by using the mine storage volume, water elevation rates of change, and pumping rates. Decreasing inflow rates would be expected as the water elevation dropped in Harrison No. 2 mine resulting in a decrease in hydraulic head. Inflow rates dropped from an average of 64,000 gpm early Thursday to 18,000 gpm early Friday to 6,000 gpm early Saturday to 3,500 gpm late Saturday.

PBS provided their map of Harrison No. 2 mine and the volume of water originally stored in the abandoned mine was estimated. Review of the map showed a nearly continuous barrier between lower and upper portions of the mine. The volume was calculated for areas lying down dip of this barrier. The storage volume of this area was estimated at 92 to 110 million gallons. Based on the stage/storage curves developed for the Quecreek #1 mine, it was later estimated that at least 72 million gallons of water flowed into the Quecreek #1 mine.

Rescue Efforts - Technical Aspects: Rescue Considerations

Discussions with company officials regarding mining sequence and the last known location of mining led rescuers to believe that the breakthrough most likely occurred in No. 4 or 5 entry. Company officials knew that the left side of 1-Left section was higher in elevation than the right side. Since the entire 1-Left panel had been driven up grade, the rescuers believed that an air pocket may have formed on the left side of 1-Left section as the water level rose into the 1-Left panel. [See [Appendix G, Map 7](#) for a drawing depicting water levels in the mine.] As water continued to rise above the highest known elevations on 1-Left section, rescuers knew air in the pocket would become pressurized and the pocket would decrease in size in relation to the rising water level. It was thought that the pressurized air supplied down the 6.5-inch hole would be sufficient to maintain the quality of air in the pocket. After the rescue, it was discovered that the breakthrough occurred in No. 6 entry, which meant that a larger pressurized air pocket was actually present than originally thought.

The 30-inch rescue hole was located approximately 20 feet outby the 6.5-inch hole. Early in the rescue efforts, drilling of the hole advanced fairly quickly and dewatering of the mine was slow. Because of this early success in drilling, it appeared that the rescue hole would enter the mine before the water level was pumped below the 1829.0-foot elevation. Issues concerning the rescue hole penetrating the mine were discussed and evaluated. The primary issue concerned the hole penetrating a pressurized air pocket that could result in the water rising over the miners' probable location. At that point in the rescue efforts, the first option to prevent this was to perform rescue operations through an airlock chamber located at the top of the hole. An alternate solution was to lower the water level to an elevation below the miners' probable location. This option would require a

delay in rescuing the miners until the water was pumped down to the 1829.0 elevation.

A consideration in using the airlock chamber was that the miners, when brought to the surface, would possibly need recompression therapy, similar to a diver brought up from under water. To address this issue, the U.S. Navy's assistance was requested. The Navy brought eight recompression chambers to the site and provided more than 50 active duty, reservists, and civilian personnel from eight different commands. The majority of the equipment and personnel were from the Norfolk, Virginia, area. One other chamber was provided by a civilian facility in Ohio. The Navy equipment included three Transportable Recompression Chamber Systems (TRCS) mounted in standard modular CONEX boxes with air banks and air conditioning; four free-standing Transportable Recompression Chambers, which are the single-lock components of the TRCS; one Mobile Transfer Lock and a standard Navy two-lock chamber in a CONEX box.

Discussions with medical personnel indicated a need to get the miners out of the mine as soon as possible due to exposure and hypothermia considerations. An initial decision was made to follow the first option and an airlock device was constructed on site. The airlock could be pressurized such that when it was opened to the rescue hole, it wouldn't allow air to escape from the mine. The chamber within the device had to be big enough to accommodate removal of the drill steel and use of the rescue capsule. A door was built at the bottom of the chamber to isolate the mine from the outside atmosphere when the chamber was opened to remove or put in items. The process of pressurizing the chamber, opening the door to the hole, and raising drill steel or lowering and raising the rescue capsule later, would have been a time consuming process. In addition, an airlock had never been tested or used in a mine rescue situation in the United States and uncontrolled leakage around the airlock could allow water to rise in the area of the air pocket. Ultimately, the airlock chamber was not used.

The maximum water level for safe entry of the rescue hole into the mine without using the airlock rescue chamber was discussed at the command center. It was known that the water level in the portal area had risen approximately 30.4 feet above the last surveyed elevation in 1-Left, which was 1826.4 feet at survey station No. 587. The mining height on 1-Left section was 4 to 5 feet, resulting in a roof elevation of at least 1830.0 feet at that surveyed point. A water elevation of 1829.0 feet was established as the elevation at which safe penetration could be

made. At that level, there would be at least 1 foot of air space between the roof and the water. In addition, a discrepancy existed between the plotted mine floor elevation contours and the actual elevations. Company personnel reported that this discrepancy existed because the contours were based on exploratory drill hole information and were plotted prior to mining, but were not updated with underground survey data. This discrepancy led to the belief that the miners could be at a higher elevation than the available mine map showed. As a safety factor to avoid premature penetration into the mine, procedures were established such that the drillers would notify the command center when they were 30 feet above the mine and would stop at 20 feet above the mine. Drilling would not resume until the 1829.0 water level was achieved.

A seal plate was manufactured on site to seal around the rotating drill steel and seal the hole during drilling operations. This plate was used until it could be determined whether or not the mine was pressurized. A differential pressure reading was to be taken between the mine and surface atmospheres immediately after the hole penetrated the mine. This reading would determine if the mine was still pressurized and whether the airlock was needed.

When the hole intersected the mine, the water elevation was approximately 1.5 feet lower than the target elevation of 1829.0 feet. It was expected that if the underground elevations as shown on the mine map were accurate, the atmosphere would not be pressurized at the target elevation. The differential pressure reading was taken and found to be zero, confirming that the mine atmosphere was no longer pressurized. Therefore, no special air locking precautions were needed during the remainder of the rescue operation.

Rescue Efforts - Technical Aspects: Seismic Listening Equipment

An established communication method for trapped miners and surface rescuers is to produce a sound on the surface with three small explosive charges and the miners to respond by tapping. MSHA maintains two seismic listening systems to aid in detecting the tapping and in locating miners trapped in underground mines. One system is very noise sensitive and is capable of detecting faint distant sounds. This system requires total quiet on the surface for a 30-minute period. It was decided that the drilling and the air compressor supplying air underground could not be shut down for that long of a time period.

The second system is more compact than the first and can be used in mine rescue and urban search and rescue. This system was deployed and was able to detect the miners tapping on the drill steel after the water had receded.

The miners stated that while they were entrapped in 1-Left section they waited for the three-shot signal from the surface. Although no signals were sent from the surface, the miners continued to pound on a roof bolt in an attempt to signal the surface. Their signaling by pounding on the roof bolt was not heard on the surface, even with the seismic listening equipment, due to the high levels of background noise.

Rescue Efforts - Technical Aspects: Mine Rescue Teams

The physical condition of the miners was unknown until just prior to their rescue. Based on discussions with medical personnel regarding possible hypothermia and exhaustion, it was thought that mine rescue personnel would need to assist the trapped miners. Mine rescue teams from Consol Energy, Inc.'s Enlow Fork mine were present for that purpose. Two members of the team were prepared to enter the mine through the rescue hole to explore for and assist the miners. If necessary, additional team members would enter the mine to assist the trapped miners. The mine rescue teams were not required since the miners were able to enter the rescue capsule on their own.

INVESTIGATION OF THE ACCIDENT

MSHA was notified of the accident at 9:42 p.m., July 24, 2002, and MSHA personnel began arriving at the mine at 10:55 p.m. A Section 103(k) order was issued to Black Wolf at 11:00 p.m. to ensure the safety of all persons at the mine involved in the rescue and recovery operations. A command center was established at the Quecreek #1 mine and a log maintained of the rescue activities. Preliminary information was obtained and MSHA District 2 personnel conducted initial interviews with available miners on the surface.

Following the rescue of the miners on July 28, 2002, an investigation team was established with Edwin P. Brady, District Manager/Mining Engineer, District 4, assigned as accident investigation team leader. The other team members were James F. Bowman, Conference/Litigation Officer, District 4; Kelvin K. Wu, Chief, Mine Waste and Geotechnical Engineering Division, Technical Support; Glenn R. Tinney, Accident Investigation

Coordinator, Headquarters; William G. Denning, Staff Assistant, District 9; Stanley J. Michalek, Supervisory Civil Engineer, Mine Waste and Geotechnical Engineering Division, Technical Support; Howard C. Epperly, Jr., Mining Engineer, Accident Reduction Program, Technical Support; Richard T. Stoltz, Supervisory Mining Engineer, Ventilation Division, Technical Support; and Arnold D. Carico, Mining Engineer, District 5. The investigation was started on July 30, 2002.

The investigation was coordinated with the Pennsylvania Department of Environmental Protection, Bureau of Deep Mine Safety (PA BDMS). The first joint meeting was held on August 1, 2002. The State's investigation team consisted of Ellsworth R. Pauley, Bituminous Underground Mine Inspector Supervisor; Brad R. Cole, Mining Engineer; and Thomas D. Shumaker, Bituminous Underground Mine Inspector. Although separate investigations were conducted, MSHA and the PA BDMS shared information and records when joint meetings were held. Common tasks such as field work and witness interviews were conducted jointly. Each agency prepared and issued separate reports.

Information was gathered through debriefings of MSHA personnel involved in the initial investigative efforts and rescue. An administrative file was established, which included press releases, television video clips, and other available public information. A search was begun for engineering records related to the abandoned Harrison No. 2 mine. Contacts were made with potential witnesses including the general public to determine the nature of their information and whether an interview would be needed.

On August 14-16, 2002, the first interviews were conducted with mine personnel involved in the accident and recovery, including the nine miners who escaped and the nine miners who were trapped. These interviews were conducted at the mine site. Interviews of engineering personnel were conducted on August 27 and 28 at the PA BDMS' Uniontown, Pennsylvania, office. Interviews and statements were voluntary and witnesses could terminate the interviews at any time. Witnesses were allowed to have a personal/legal representative present. The 34 interviews conducted at the mine office and PA BDMS office were recorded by a court reporter. Other persons were interviewed in person or by telephone and these interviews were recorded by summary memorandum. On December 4 through 6, 2002, a continuation of the initial interviews was conducted with ten of the previously interviewed persons. Two additional miners were also

interviewed. These interviews were recorded by a court reporter. [See [Appendix A.](#)]

Recovery of the mine started on July 28, 2002. As the water level dropped, recovery teams comprised of MSHA, State, and company personnel entered the mine. Recovery of the mine involved pumping water, rebuilding ventilation controls, and mapping conditions as the recovery team advanced into the mine toward 1-Left section. [See [Appendix G, Maps 8 and 9](#) for damage on 1-Left section and outby areas.] On September 5, 2002, members of the investigation team traveled underground to photograph, videotape, and map conditions on 1-Left section. MSHA contracted Mine Surveying, Inc., Kingwood, West Virginia, to conduct a survey at Quecreek #1 mine. The survey was conducted on September 20-24, 2002, with accident investigation team members and MSHA inspectors accompanying the survey crews. The survey included mapping the locations of the rescue hole, the 6.5-inch hole, and points along the Mains and in 1-Left section, including the breakthrough into Harrison No. 2 mine. [See [Discussion, Mine Mapping/Surveying](#) for survey results.]

DISCUSSION

Conditions in the Mine Prior to Breakthrough

The conditions prior to the breakthrough, as discussed below, are based on company records and the statements of miners, company officials, and MSHA personnel.

Coal was mined from two active working sections, 1-Left and 2-Left. Both sections advanced seven entry systems. The mining height in 1-Left ranged from 4 to 5 feet while in the Mains and 2-Left area it was approximately 3 feet. The mining sequence on both sections was from right to left (No. 7 to No. 1 entry).

The mine had a history of wet ribs, bottom, and water dripping from some roof bolt holes. During development, wet and dry areas were encountered in the Mains from the portals to the 1-Left intersection. Roof bolting machine operators observed wet, muddy, and dry bolt holes in the same cut, with no apparent pattern. Some miners regularly wore rain gear due to wet conditions in the mine. However, other miners only wore rain gear periodically during the wettest conditions.

Conditions in the Mains became wetter inby the intersection of 1-Left panel. Due to mining down dip in the Mains, water followed the working faces as they advanced. Mining had stopped on the Mains due to low coal, bad roof, and water problems. It was expected that conditions would improve in 2-Left section as it was developed up dip. The investigation team observed conditions in the Mains inby the 1-Left panel to be generally wet with water dripping and flowing from roof bolts and roof joints.

At the time of the accident, the 2-Left section had just turned off the Mains near the faces of the Mains. Miners referred to this section as either 2-Left or the Mains. Only two crosscuts had been completed in 2-Left section. Employees considered 2-Left/Mains section as having the less desirable mining conditions. It had a lower mining height and was wetter than 1-Left. Water was reported to be a constant problem on 2-Left/Mains section.

When 1-Left panel was turned off the Mains, water conditions generally improved, but wet and muddy holes were still encountered. Roof bolting machine operators occasionally drilled into clay pockets. The clay would plug drill steels when little water was present and would cause "dirty" holes when a lot of water was present.

At approximately No. 18 crosscut, roof conditions required the installation of cribs in No. 5 entry and the crosscut was not mined between Nos. 1 through 4 entries. Statements indicated that an increase of water flowing from roof bolt holes occurred near No. 20 crosscut. Other statements indicated that the increased water was encountered mid-panel, at approximately No. 27 crosscut. Mining advanced through the wetter area and conditions returned to normal until No. 37 crosscut where No. 1 entry was not mined for one crosscut due to poor roof conditions. Eight- to twelve-foot-long cable roof bolts, longer resin bolts (48 and 72 inches long), and straps were installed in this area. [See [Appendix G, Map 10](#) for roof support information.]

Statements indicated that water from roof bolt holes again increased approximately 500 to 600 feet outby the location of the breakthrough (approximately No. 48 crosscut). This area was developed approximately 2 to 3 weeks before the accident. Straps and longer resin bolts were used in No. 6 entry and adjoining crosscuts from just outby No. 48 crosscut to No. 49 crosscut.

During this 2 to 3 week period, an inclined gouge- or clay-filled fault was present on 1-Left section. It traversed the section

from approximately No. 51 crosscut in No. 1 entry to just outby No. 55 crosscut in No. 7 entry. [See [Appendix C](#) for a discussion of geologic factors and conditions and [Appendix G, Map 9.](#)] Water from roof bolt holes increased in frequency and quantity near and inby the fault line. Roof conditions worsened and required the use of straps and longer resin bolts near the fault. Two cable bolts were installed in No. 50 crosscut of No. 4 entry. These were the only cable bolts installed inby No. 37 crosscut. No. 1 entry was not mined from Nos. 51 to 53 crosscuts due to the roof conditions. As the section was advanced, nearly every shift encountered these adverse conditions associated with the fault in at least one entry due to its diagonal orientation.

The maximum depth of cut allowed by the mine's roof control plan was 35 feet. Roof drilling information and observations made during the cut were used to adjust the depth of cut. Conditions near the fault resulted in shorter mining cuts being taken across the section.

Thirty-five-foot cuts resumed in Nos. 1 through 3 entries shortly after the fault. Because the fault intersected the section on an angle, the face areas on the right side of the section were near the fault line at the time of the accident. Those places were experiencing similar roof problems that the left side had experienced when it crossed the fault. For this reason, the right side of the section lagged behind the left side.

The 1-Left section was driven up dip resulting in water flowing away from the faces. However, water accumulated in localized depressions and in crosscuts turned to the right that were driven down dip. Intermittent use of pumps was necessary to drain these areas. Statements regarding the number (1 to 4) and type (electric and hydraulic) of pumps on the section were inconsistent. Maintenance personnel involved in setting pumps stated that no electric pumps were inby the section loading point at the time of the accident. Some miners reported that a portable pump powered by the hydraulic system on the scoop was used on the section.

Roof bolting machine operators from 1-Left section reported that some holes would be wet while others would be dry in the same working place. Flow ranged from a drip to a full stream. During the day shift prior to the accident, the crosscut right off No. 5 entry was roof bolted. Roof bolt holes near the start of the crosscut produced water ranging from "a little" to "a lot" while the holes drilled for the last two rows of bolts were completely dry. The miners indicated that there appeared to be no pattern

to the water in the roof, except that water was often present with clay seams in the roof. It was not uncommon throughout 1-Left panel for "dirty holes" to be drilled indicating that a clay seam had been intersected. On July 24, 2002, roof bolting machine operators on 1-Left drilled several dirty holes. Clay in the roof coupled with low water flow would plug the drill steel resulting in bolting cycles taking up to three hours. About two days prior to the accident, wet (auger) steels were brought to the section to use in the clay zones. These steels were tried with little success.

In summary, statements indicated that water conditions varied throughout the length of 1-Left panel. Some areas were extremely wet and were similar to the water conditions on the working section just prior to the accident. Water conditions on 1-Left section the day of the inundation were reported to be no different than those encountered the previous two to three weeks.

Evaluation of Conditions in the Mine Prior to Breakthrough

The 1-Left section was generally regarded as a good place to work in the Quecreek #1 mine until two to three weeks prior to the accident when the section approached and mined through a fault. At that time, two conditions made mining more difficult - the water entering the section increased and the roof deteriorated. An evaluation was made by the investigation team to determine whether these two conditions could have been a warning or an indication that 1-Left section was approaching dangerously close to the flooded workings of the Harrison No. 2 mine.

Water Conditions

As noted in [Appendix C-1](#), the Freeport sandstone located above the Quecreek #1 mine is an aquifer. Aquifers are formations that contain enough water to be used as a supply source, such as through wells. The formation is capable of producing 10 to 45 gallons per minute and water wells are present in the strata. Further evidence that there was groundwater in the overlying strata was confirmed by observations of water flowing into the mine from the 6.5-inch-diameter drill hole and the 30-inch-diameter rescue hole soon after the accident. Five months after the accident, substantial quantities of water were still flowing from the 6.5-inch hole (the 30-inch hole had been grouted). Recent holes drilled from the surface into Nos. 6 and 7 entries for bulkhead construction also produced substantial water.

As a condition for reopening the mine after the July breakthrough, horizontal holes were drilled into the coal seam to establish the presence or absence of additional old works in the areas to be mined. One hole was drilled north from No. 1 entry to a depth of 2,100 feet and reportedly left the coal seam in several places. When observed by the investigation team on December 5, 2002, this hole was producing water at approximately 10 gallons per minute. The other hole was drilled south from No. 7 entry to a depth of 2,000 feet and reportedly stayed in seam more than the other hole. This hole did not produce water, even though it was located down dip from the still flooded portion of Harrison No. 2 mine. Neither hole intercepted abandoned mine workings.

There were two potential sources for water entering Quecreek #1 mine: the overlying aquifer and the Harrison No. 2 mine pool. The general principle of ground water flow is that water moves from a higher level or potential to a lower. The Quecreek #1 mine openings created a low potential area that water would have flowed toward. Water from the aquifer was transmitted to the mine through formation pore spaces and geologic discontinuities such as joints and faults. Water from the Harrison pool could be transmitted horizontally through roof and floor strata, the coal seam, or discontinuities.

The primary source of water entering the mine was the overlying sandstone formation aquifer, which is separated from the Upper Kittanning coal seam by layers of shale. Based on statements by roof bolting machine operators, numerous clay pockets were found in the roof during roof bolting operations. The floor of the mine consisted of limestone. [See [Appendix C](#) for geologic description.]

The permeability, or hydraulic conductivity, of a material is a measure of the relative ease with which a liquid (or gas) can flow through the material. Permeability is affected by a material's porosity, the presence of discontinuities (such as joints, faults, and bedding), and other factors. Materials will typically have different horizontal and vertical permeabilities. Since the Freeport sandstone was an aquifer with a reported medium- to coarse-grained structure, its permeability would have been relatively high. Formations with a low permeability are not good aquifers because wells placed in them are not capable of producing water at a useful rate. Shales and clays are materials generally characterized as having a low permeability. Coal seam permeability is highly dependent on its cleat structure.

The shales immediately above the coal seam acted as a barrier to vertical water flow and restricted groundwater flowing through the roof into the mine. However, when the shale was penetrated, such as by a roof bolting drill, water was able to flow through the hole into the mine. Pockets or seams of clay present in the roof could also create horizontal and vertical barriers to water flow. This was demonstrated when roof bolting machine operators separated by only a few feet could find that a drill hole penetrating the roof on one side of a clay barrier could be extremely wet while a drill hole penetrating the other side of the barrier could be dry.

Test holes were required to be drilled into the roof at every intersection to evaluate the strata. These holes were required to be drilled one foot deeper than the longest roof bolt being used. The holes were typically not plugged after drilling. Often, a piece of cardboard would be rolled up and pushed into the hole to mark its location. Nearly five months after the accident, the cardboard in test holes on 1-Left section was intact and still in the holes. This indicated that either the water exiting these holes stopped prior to inserting the cardboard or a sufficient flow was not present to wash the cardboard out. No water flow was noted from these holes during the investigation.

Water also could have entered the mine through the fault present on 1-Left section. The fault dipped through the mine roof and most likely would have intersected the water bearing strata. The fault and associated jointing could have provided preferential vertical flow paths since these features are typically more open and continuous than pore spaces through the same formation. This is especially true for shales and other low permeability materials. Water following the fault or a joint would flow downward toward the mine openings.

The presence of the fault located diagonally across the section exposed the miners to the water conditions associated with the fault in one entry or another during each shift for the two to three weeks prior to the breakthrough. Miners' statements varied as to the amounts of water that flowed from the fault prior to the breakthrough. Observations after the breakthrough showed little water flow from or around the fault. In addition, statements by personnel who observed the 1-Left section before and after the breakthrough indicated there was no change in the amount of water associated with the fault. Miners had encountered adverse water conditions further outby on the panel and had mined through them successfully. Miners stated that they

considered conditions on the section immediately prior to the breakthrough to be consistent with conditions that existed throughout development of the 1-Left panel.

The second source for water entering the Quecreek #1 mine was the Harrison No. 2 mine pool. Over time, this pool would have become a part of the local hydrologic conditions. Flow paths for this water to the Quecreek #1 mine were through the roof, floor, coal strata, and geologic discontinuities. Water was impounded in the Harrison No. 2 mine such that a hydraulic head of approximately 52 feet was present at the location of the breakthrough. According to Darcy's Law, the quantity of discharge through porous media is directly proportional to the hydraulic gradient and permeability and inversely proportional to the flow distance. For example, if the flow distance was halved the discharge would double, and vice-versa. Because the right side of the section was closer to the mine pool, seepage conditions should have been more pronounced in that area with other factors being equal.

Due to the low permeability of the roof shale, water would have had difficulty flowing from the Harrison No. 2 mine pool into the roof strata. Water from the mine pool and the aquifer would eventually saturate the shale and become part of the general ground water conditions and flow horizontally toward the Quecreek #1 mine. However, as described earlier, shales and clay seams in the roof may have blocked or partially blocked this flow path resulting in reduced or negligible flow rates. Miners stated that side-by-side roof bolt holes in the active mine often produced drastically different amounts of water and that test holes did not continuously produce water. In addition, bolt holes drilled closer to the mine pool would be expected to produce more water than holes drilled farther away. There were instances where holes at the face produced no water while outby holes produced substantial flows.

There were no reports of obvious seepage exiting from the mine floor. This apparently was the case even when the No. 6 entry was approaching within a few feet of the mine pool. The conclusion that can be drawn is that the permeability of the limestone was low enough to reduce the seepage through that stratum to negligible quantities. The same can be concluded for the floor/coal seam interface.

The most direct flow path for water from the mine pool would have been through the coal seam itself. Water from the mine pool and aquifer would have saturated the coal seam. This saturation would cause the coal to appear wet and water would tend to run

from any fractures in the coal as fresh faces were opened. No obvious concentrations of seepage discharge were noticed in the coal faces and ribs, even as the No. 6 entry approached to within a few feet of the mine pool. This supports a conclusion that the seam permeability was too low to allow substantial seepage flow and there were no connecting fractures present.

There were reports of water seeping from the coal/shale interface near the roof line. This condition would not be a warning sign unless there were significant increases in the flow as the face approached the mine pool. Water exiting from this location also could have been from the overlying sandstone aquifer flowing through joints in the roof strata.

In summary, there were two distinct sources for the water that was entering Quecreek #1 mine. Those sources were the regional aquifer and the Harrison No. 2 mine pool. The 1-Left crews had previously experienced adverse water conditions similar to the conditions that were being experienced in the weeks prior to the breakthrough, even though they were more than one thousand feet from the flooded Harrison No. 2 mine at the time they were experiencing those conditions. Geologic conditions were present at 1-Left section that could have caused the observed water conditions regardless of the source. It is concluded that mine examiners and others would have had difficulty determining that the water conditions experienced in the weeks prior to the breakthrough were a sign that they were approaching dangerously close to the flooded workings of Harrison No. 2 mine. The water conditions reported were as likely to come from the aquifer.

Roof Conditions

The second condition that made mining difficult on 1-Left section in the two to three weeks prior to the breakthrough was the deteriorating roof conditions. An examination of information collected during this investigation provides an explanation for this deterioration.

The first cause of poor roof conditions was the presence of water in the roof. The immediate roof on the 1-Left section was shale. Shales are susceptible to softening when wetted. Miners stated that occurrences of draw rock falling during coal extraction increased. This occurrence is common to the extraction process. Examination of the roof after the breakthrough revealed that only a few areas of small extent had actually fallen. The thickness of the draw rock varied up to a few inches.

The second cause of poor roof conditions was the fault crossing the section. Useful information was obtained by examining the "Section Foreman's Shift Report," particularly the part where the length of each cut was provided. When the lengths of mining cuts were plotted for July 2002, it was evident that 35-foot cuts were prevalent until the left side of the section approached the fault at about No. 50 crosscut. Cut lengths on the left side dropped to 20 feet and occasionally lower while cut lengths of 35 feet were still being achieved on the right side of the section. At about No. 54 crosscut, the right side of the section reached the fault zone and the cut lengths fell below 35 feet. In the meantime, the left side of the section returned to 35-foot-deep cuts within one crosscut of passing the fault and maintained those cut depths up to the time of the breakthrough. More evidence of the fault's influence on the roof conditions was obvious when the mine's roof support methods were examined by the accident investigation team. Standard 42- to 48-inch-long roof bolts were used except along the fault line. Along the fault line, straps, longer bolts, and two cable bolts were installed. [See [Appendix G, Map 11](#) for cut depth information.]

Finally, an examination of the 1964 map from the Windber Coal Heritage Center of the Saxman Coal and Coke Company's Harrison No. 2 mine [[Appendix G, Map 12](#)] showed that areas below the mains entries were not mined and were labeled as having "Bad Roof." When the trend direction of these "Bad Roof" areas was plotted, it could be seen that the trend intersects Quecreek #1 mine in the vicinity of the 1-Left section. The crews on the 1-Left section were most likely experiencing the same conditions that the miners in Harrison No. 2 mine experienced over 40 years prior.

The conditions contributing to bad roof were saturated shale strata, the presence of a fault crossing the section, and a local trend of bad roof extending from Harrison No. 2 mine across the 1-Left panel. Because of these conditions, it is concluded that mine examiners and others would have had no reason to believe the roof conditions experienced in the days and weeks prior to the breakthrough were a sign that they were approaching dangerously close to the flooded workings of Harrison No. 2 mine.

Examinations and Potential Warning Signs of Water Inundation

The Federal Mine Safety and Health Act of 1977 and Title 30, Code of Federal Regulations, Part 75, require mine operators to conduct regular examinations for hazardous conditions at underground coal mines. In particular, active working sections

are required to be examined during preshift examinations (30 CFR 75.360) and on-shift examinations (30 CFR 75.362). Those and other areas are required to be examined during weekly examinations (30 CFR 75.364). Statements by mine examiners and a review of the records indicated that no hazardous conditions were observed during these examinations.

The Upper Kittanning coal seam, which locally dips 3 to 4 percent to the northwest, is generally wet. After the Harrison No. 2 mine was abandoned, the down dip portions became flooded. Quecreek #1 mine was located down dip from the abandoned Harrison No. 2 mine. The flooded parts of the Harrison No. 2 mine created a hydraulic head of approximately 52 feet at the eventual breakthrough location.

Title 30 CFR 75.1200 requires all mine workings within the same coal seam and lying within 1,000 feet of existing mine workings be shown on the mine map. Quecreek #1 mine projections showed that 1-Left panel would mine no closer than 250 feet of the abandoned Harrison No. 2 mine workings, based on the Consol map used for the original mine permit application.

The shift before the accident, Joseph Hoffman, Mine Foreman, David Rebeck, Mine Superintendent, and Joseph Gallo, Vice-President for PBS, were on 1-Left section. They stated that the water inflow was not unusual. The day and evening shift foremen reported similar findings. These officials reportedly did not observe conditions that alerted them to a possible breakthrough into the flooded Harrison No. 2 mine.

Miners also stated that conditions on 1-Left section did not alert them to a possible breakthrough. They had experienced similar water conditions outby on 1-Left panel and had mined through those areas. According to a mining machine operator on 1-Left section, conditions in No. 6 entry immediately prior to the breakthrough were dry. Reportedly, there was no water coming from the roof, ribs, or face in that entry. Regarding general conditions on the section, miners stated that the ribs ranged from damp to wet with barely perceptible water flow. There were some comments regarding water trickling from the coal/shale interface at the roof line and running down the ribs. When drilling bolt holes, roof bolting machine operators encountered dry and wet holes with water outflows ranging from dripping to full flow.

Miners had talked with company officials about the adverse conditions on 1-Left section and how these resulted in low

production. Miners stated they were paid a monthly bonus based on production and the low production affected this bonus. Some miners discussed with Fogle that they should relocate the section due to the wet conditions and low production. Fogle stated that he and Rebeck discussed relocating the section. He stated that this discussion was brought on because of slow mining, adverse conditions, and the fact that mining was only going to advance one more crosscut. He had no concern about mining into the Harrison No. 2 mine because of its indicated location on the mine map. Fogle stated that he relayed his discussion with Rebeck to the miners while they were trapped in 1-Left section. Fogle also stated that he told the miners that he wished upper management had listened to him, and if they had, then they wouldn't be trapped. Fogle contended that this discussion was solely concerned with pulling out of the section due to conditions slowing production and not because of any concern with cutting into the abandoned mine.

It is reasonable that there would be noticeable increases in the water seepage rate as flooded areas are approached. In the case of Quecreek #1 mine, the strata surrounding the coal seam consisted of a limestone floor and a shale roof overlain by the Freeport sandstone formation. The coal seam itself appeared tight. These conditions would not be conducive to large amounts of water seeping through from the flooded Harrison No. 2 mine into Quecreek #1 mine. Miners did not report anything unusual regarding the water conditions or inflows prior to the breakthrough. The reports of "dirty holes" would not necessarily be an indication that the mining was approaching flooded workings. Clay seams are commonly associated with coal seams, and when located in the roof strata they can cause trapped water and "dirty holes." [See [Appendix C](#) for a discussion of geologic factors and conditions.]

Some miners stated that they were not told by management that they were mining toward the Harrison No. 2 mine or that the mine was full of water. Training and instructions related to warning signs for approaching flooded abandoned workings are a good practice. Black Wolf did not provide such training since mine officials relied on their map and did not expect to mine within 200 feet of the flooded Harrison No. 2 mine. The investigation team determined that whatever warning signs may have existed were shrouded by mining conditions previously encountered on the 1-Left panel. Training most likely would not have helped in this instance.

Analysis of Water Flow after Breakthrough

The size of the breach into the old mine was measured by the investigation team to be approximately 4.6 feet wide by 4.0 feet high. Based on information on available maps of Harrison No. 2 mine, an initial hydraulic head of 52 feet was determined. Applying these numbers, along with a factor for flow resistance losses, results in an initial peak inflow rate of approximately 334,000 gpm. The continuous mining machine was located at the breakthrough location and would have reduced initial inflow rates to below this calculated value. MSHA engineers determined the average inflow rate over the first six hours of the breakthrough to be approximately 132,000 gpm.

When the breakthrough occurred in No. 6 entry, water rushed down that entry for approximately three crosscuts and struck the mantrip vehicle, golf cart, and the 1-Left section power center. This equipment was pushed by the flow an additional two crosscuts outby until it became wedged in the entry. The equipment blocked most of No. 6 entry and was angled such that the majority of the water flow was directed toward No. 7 entry at that point. [See [Appendix G, Map 9](#) for map of damage.] This flow would have blocked Popernack's escape in No. 7 entry. Beyond this restriction, the water flowed down Nos. 6 and 7 entries until reaching a severe dip in the seam at approximately No. 10 crosscut. The dip caused the water to back up in Nos. 6 and 7 entries until the pressure blew out the stopping between Nos. 5 and 6 entries at No. 14 crosscut.

Several conditions observed in the mine support this scenario. First, no indications of water were present in Nos. 6 and 7 entries from Nos. 7 through 10 crosscuts, which was up grade from No. 14 crosscut. Second, the stopping at No. 14 crosscut was found to have been blown toward No. 5 entry and concrete blocks believed to be from that stopping were found in the crosscut near No. 3 entry. Third, the conveyor belt from No. 20 crosscut outby was pushed toward No. 3 entry.

Once the water blew through the stopping, it spread out through Nos. 3, 4, and 5 entries and traveled the remaining distance to the mouth of 1-Left panel. At the intersection of 1-Left and the Mains, the water was able to flow into the belt and travelway entries of the Mains. A large dip extended approximately 22 crosscuts in the Mains outby 1-Left panel. Due to this dip, water initially flowed in an outby direction in the Mains flooding the belt entry and travelway. As water pooled in the dip, escape from 1-Left quickly became impossible. After the dip

filled to approximately elevation 1752.3 feet, the water would have flowed in by toward the faces in the Mains.

Analysis of Miners' Environment after Breakthrough

Review of the evening shift pre-shift examination records indicated the mine atmosphere was at or near normal (20.9 percent oxygen) prior to the inundation. The water in Harrison No. 2 mine would have been relatively oxygen poor due to a lack of circulation and a relatively small area of the pool exposed to the atmosphere. Any organic materials present in Harrison No. 2 mine would decay in an anaerobic atmosphere, which produces noxious byproducts such as hydrogen sulfide and methane. The result is a rotten egg, swampy smell associated with stagnant water.

When the breakthrough occurred, the stagnant water entered No. 6 entry of Quecreek #1 mine. Because the continuous mining machine was present at the breakthrough location, the water had to flow over the machine as it entered the mine. The churning and tossing of the water over the machine and other obstructions was an aeration process. Aeration is a method by which the surface area of contact between water and air is increased resulting in oxygen being transferred across the air-water interface. The amount of oxygen that can be held by the water depends on the water temperature and other variables. In general, colder water is capable of holding more oxygen. The oxygen transferred into the water would have come from the atmosphere of Quecreek #1 mine, thereby lowering the oxygen content in the miners' atmosphere. It is unknown how much the oxygen content would have dropped due to this process. However, the mine atmosphere exiting the 6.5-inch hole immediately after the hole broke into the mine was measured at the surface to have 17 percent oxygen. This was approximately 8 hours after the accident occurred. Due to the dilution effect of the compressed air from the drill hole, the investigation team concluded that the mine atmosphere contained less than 17 percent oxygen prior to the hole breaking into the mine. At the same time, noxious gasses could have been released from the stagnant water into the miners' atmosphere.

This assessment is supported by statements from the entrapped miners that breathing was becoming increasingly difficult as the inundation progressed. The miners' exertion and anxiety levels also could have contributed to their breathing difficulties. They reported that breathing conditions improved immediately after the 6.5-inch drill hole punched into the mine, thereby

providing an oxygen source. This indicates the problems were more related to oxygen deficiency than exertion levels.

Another possible health situation developed as the water rose to its maximum elevation on 1-Left section. The rising water created an entrapped air pocket in No. 1 through No. 5 entries. The confined air pocket had a limited amount of oxygen. Based on calculations of the air pocket volume and miner exertion levels within the closed environment, it was possible to estimate the drop in oxygen content and rise in carbon dioxide content caused by breathing. For at-rest exertion levels, calculations indicated that the oxygen content would drop approximately 1 percentage point over the 78 hours of entrapment, while the carbon dioxide level would rise nearly 0.5 percentage point. For moderate exertion levels, the oxygen content would drop approximately 3.5 percentage points and the carbon dioxide level would rise approximately 3 percentage points. These figures were considered worst-case estimates because the air pocket in the section was at its minimum size for only a portion of the time. These potential conditions did not arise because air was continuously pumped into the mine through the 6.5-inch drill hole.

Another health concern for the entrapped miners was hypothermia. The miners' exposure to cold water, coupled with the typical mine temperature of 55°F, would have resulted in a loss of body heat. Statements made by the miners indicate that hypothermia was occurring. To warm themselves, the miners reportedly gathered in the No. 4 entry at the roof bolting machine, which was still warm from being used before the inundation. Later they huddled together and wrapped themselves with brattice cloth in the No. 1 entry.

The air entering the mine from the 6.5-inch drill hole was heated by the compression process. The rescuers believed that this heated air would help the trapped miners. However, miners stated that they felt no effects from the heated air. Regardless, once the rising water overtook the drill hole and the air bubbled through the cold water, any heating effect would have been lost.

The air from the compressor contained an oil mist. Also, the air exiting the drill steel at high velocity created excessive noise. Miners indicated in their statements that these two conditions made it uncomfortable for them to stay near the drill hole for long periods of time.

Background of Harrison No. 2 Mine

State of Pennsylvania annual production and employment reports indicated that Quemahoning Creek Coal Company opened the Quecreek No. 2 mine in 1913. The mine's two drift openings were located in Quecreek, Somerset County, Pennsylvania. The mine was opened into the Upper Kittanning coal seam. Mining generally progressed in an easterly direction from the drift openings. Coal was initially produced by hand-loading methods. The workings depicted on the mine maps confirmed the mining method.

Seam thickness varied, but records listed the coal seam thickness as averaging 44 inches. Mine maps indicated that the seam regionally dipped toward the southwest. The Boswell Dome is present along the western boundary of the mine. The fold axis of the dome strikes N 0-5° E with seam floor elevations falling on either side of the axis.

Annual reports indicated that the mine was sold in 1925 to the Saxman Coal and Coke Company (Saxman), owned by P.M. Saxman. Saxman's main office was located in Philadelphia, Pennsylvania. The mine was renamed the Harrison mine and remained open until 1934. Employment varied from a low of 100 to as high as 235 persons during those years. Mine production ceased and the mine was closed from 1934 through 1941.

Saxman reopened the mine in 1942. Annual reports dated 1946 and 1947 indicated that the mine name was changed from Harrison mine to Harrison No. 2 mine in 1947. Edwin F. Saxman, son of P.M. Saxman, became president in 1948 or 1949. The mine produced coal through 1963. A former employee of the mine confirmed that coal production occurred through mid-December 1963. Annual reports indicated production occurred on 80 days during 1963. Another person interviewed during the investigation also stated that the mine was idled in 1963 and the company's assets were liquidated in 1965. Employment varied from 1942 through 1963 from a low of 34 to a high of 252 persons.

John E. Kimmel was identified by former employees and in annual reports as the Harrison No. 2 mine's superintendent and engineer. The survey legend on the 1964 Harrison No. 2 mine map [See [Appendix D, Table 2, Number 13](#) and [Appendix G, Map 12](#)] found at the Windber Coal Heritage Center (Windber) also identified Kimmel as the engineer and draftsman. Kimmel's mapping updates ranged from July 1, 1947, to January 1, 1964. Kimmel was also the superintendent and engineer at Saxman's E No. 1 and E No. 2 mines which were located in the Lower Freeport coal seam. Records

indicate that he supplied mine closure information to the State prior to 1961 for the above two mines.

The investigation team found no evidence to indicate that Kimmel did not comply with the mine closure requirements in Pennsylvania for the Harrison No. 2 mine, other than the State's failure to find a final mine map in its archives of old mine maps. Clearly, the Windber map establishes that Kimmel gave the State Mine Inspector a final map for the mine in January 1964, and as noted above, he also supplied mine closure information and final mine maps for two other mines prior to the 1961 Pennsylvania mining law's requirement to file a final map with the State.

Mining systems used in the mine varied and became fully mechanized toward the end of the mine's life. Two former Harrison No. 2 mine employees stated that Wilcox auger-type continuous mining machines were used in later years. Use of auger-type continuous mining machines was verified when the investigation team observed Harrison No. 2 mine workings through the breakthrough from Quecreek #1 mine. [See [Appendix F](#) for photograph.]

Statements by former mine officials indicated that Saxman leased coal from Consolidation Coal Company (Consol) and that Saxman made monthly royalty payments and biannually provided updated maps to Consol. The details of survey updates from the 1964 Windber map found by the investigation team and a 1957 map [See [Appendix D, Table 2, Numbers 10 and 11](#), and [Appendix G, Map 13](#)] that shows property lines confirms that coal was mined from the Consol property. A map obtained from Consol [See [Appendix D, Table 1, Number 1](#) and [Appendix G, Maps 14 and 15](#)] shows a lease line with a reference to a lease to "Saxman C & C Co." Based on this information, it appears Saxman mined within their leased boundaries and mine works were mapped and indexed with dates of mining. Consol officials stated they had no dated maps or any other records concerning leases with Saxman.

Saxman provided annual reports of production to the State for the Harrison No. 2 mine. The records from the last nine years are presented below:

<u>Production Year</u>	<u>Annual Tonnage</u>
1955	118,273
1956	108,275
1957	80,917
1958	65,457
1959	97,523
1960	89,344
1961	71,611
1962	72,369
1963	25,234

The total tonnage of coal reportedly produced at the Quecreek No. 2/Saxman/Harrison/Harrison No. 2 mine during its production life was 4,174,972 tons. The annual reports for 1964 and later contained no reference to the Harrison No. 2 mine.

Reportedly, mines in this area in the Upper Kittanning seam have been generally wet. Based on mine maps, the presence of water wells drilled into the mine, and water flow from the old portal, it was known during the permitting process that Harrison No. 2 mine contained a significant volume of water. During the Quecreek #1 mine permitting process, a hydrological study was conducted and the results were included in the permit application submitted to the Pennsylvania Department of Environmental Protection. The purpose of this study was to determine whether the new mine would impact the hydrology of the area. The approved permit map showed an estimated water level in Harrison No. 2 mine at an elevation of 1888.0 feet. Based on that elevation, a significant area of the mine was flooded.

The Harrison No. 2 mine map found at Windber indicated that a coal barrier divided older workings from newer workings that were developed after 1947. The barrier separated the mine into two large interconnected pools of water, one up dip from the barrier (upper pool) and the other down dip (lower pool). The breakthrough resulted in a portion of both pools draining into Quecreek #1 mine. Water remained impounded in a portion of the upper pool. Water also remained in the down dip portion of the lower pool, which would not have drained during the inundation. The older workings contained the two portal drift openings. The outlet of a 36-inch concrete drain pipe in the portal area had a surveyed elevation of 1870.4 feet.

During the investigation, it was discovered that elevations shown on the Windber map were approximately 28 feet higher than the elevation surveyed at the breakthrough. The MSHA contract survey determined that the Windber map elevations were not correct. The floor elevation at the breakthrough was surveyed as 1834.1 feet. An elevation on the Windber map at a nearby crosscut was 1862.0 feet. There were no survey records available for Harrison No. 2 mine to determine the base benchmark for the Windber map elevations.

Plans Submitted for Mining Permits and Plan Approvals

Prior to opening a new mine, mining permits and plan approvals are required from state and federal authorities, respectively. The State permit application was started in 1994 under the Pennsylvania Small Operator Assistance Program (SOAP) for the Double C Coal Company. This program provided funding for one round of background water sampling. Musser Engineering, Inc. (Musser), Central City, Pennsylvania, prepared the original permit application. PBS assumed the project in 1995 from Double C Coal Company. Later, the project was transferred to Quecreek Mining, Inc.

The initial permit application was submitted to the Pennsylvania Department of Environmental Protection in December 1998. The State "DEP Coal Mining Activity Permit," number 56981301, was issued to Quecreek Mining, Inc. on March 13, 1999. The location and extent of workings within 1,000 feet were required to be included in the permit application. These workings were identified and located on a permit map prepared by Musser. A registered professional engineer employed by Musser certified this map. [See [Appendix G, Map 16.](#)]

Information in the permit application stated that the adjacent Harrison No. 2 mine was up dip from the proposed Quecreek #1 mine and would not be affected by the mine. The Consol No. 120 mine was over 1,300 feet from the mine at its closest point as measured along the strike. In a down dip direction, the Consol mine was at least 3,000 feet from the proposed mine.

The permit was amended six times prior to the breakthrough. These amendments included increasing the area to be mined and notification that Black Wolf Coal Company, Inc. had become the contract operator. Registered professional engineers from PBS certified maps for these amendments.

MSHA mandatory safety standards contained in Title 30 CFR 75.372 and 75.1200 require an accurate and up to date map of the mine showing the location of adjacent mine workings within 1,000 feet of the mine or projected mine workings. A registered professional engineer or surveyor must certify these maps. The 30 CFR 75.1200 map must be maintained at the mine, and the 30 CFR 75.372 map must be submitted annually to MSHA.

Musser, RoxCoal, and PBS conducted searches for information and maps to locate and determine the extent of workings in adjacent mines. The search was reportedly conducted for mines with the name "Saxman" and "Harrison" since the adjacent mine frequently was referenced by either name. [Table 1 in Appendix D](#) summarizes the Musser/RoxCoal/PBS search and the information found. After a thorough review of sources for mapping information, the investigation team concluded that the sources which Musser/RoxCoal/PBS contacted during their search were the expected sources for such information.

Many of the maps located by Musser/RoxCoal/PBS were just single-line depictions of the Harrison No. 2 mine workings. One map showed actual workings, but it was not a full map of the entire Harrison No. 2 operation. Musser/RoxCoal/PBS selected the map from Consol [[Appendix D, Table 1, Number 1](#) and [Appendix G, Map 14](#)] to be used for their mapping project since it showed the most extensive workings of the mine.

Once the limits of Harrison No. 2 mine were established using this undated and uncertified Consol map, the mine outline was transferred to the state plane coordinate system, which was used for Quecreek #1 mine. The transfer was performed by first adjusting the scale of the Consol map to the scale of the Quecreek map. The Consol map had a scale of 1 inch equals 1,000 feet and the Quecreek map had a scale of 1 inch equals 100 feet. Then common landmarks on the two maps were matched and the map was overlaid and the outline transferred. Aerial photographic maps were also used to assist in the alignment. Musser used two common points to perform this step. However, it was stated that additional common points were also compared. Persons from Musser stated that it would be preferable to actually survey points in the old mine but this was not possible in this case since the original survey records were not available to identify the surface control survey points and the abandoned mine was inaccessible. After this step, the transfer of the location and orientation of Harrison No. 2 mine onto the Quecreek #1 mine map was complete.

The method used by Musser to transfer the location of Harrison No. 2 mine onto the Quecreek #1 mine map was performed according to generally accepted engineering practice in the absence of surveying information common to both maps. However, if Harrison No. 2 mine was not surveyed and mapped correctly and completely, no method of transfer could have resulted in an accurate depiction of the Harrison No. 2 mine workings on the Quecreek #1 mine map.

After plotting the outline of Harrison No. 2 mine on the Quecreek #1 mine map, the hydraulic barrier was established. A 200-foot-wide barrier was chosen although the barrier thickness required by the State was only 98 feet. This 98-foot barrier width was based on the rule-of-thumb equation requiring the barrier thickness to be a minimum of 50 feet plus the hydraulic head. Musser determined the hydraulic head to be 48 feet. The 200-foot-wide barrier was chosen so that exploratory drilling in advance of mining as required by state and federal (30 CFR 75.388) regulations would not apply. No consideration was given to de-watering the old mine to eliminate the potential hazard.

The Musser engineer who stamped and certified the original permit map reported that he was confident the most complete map of adjacent mines had been located. He stated, "We felt very strongly that --- felt very comfortable that it was a final map, particularly when you consider that we had gotten it from Consolidation Coal, the mineral owner who would stand to benefit from having a mine in the area, and the fact that it had the most extensive workings, and there was no information available anywhere to dispute it." PBS engineers who certified subsequent submittals of the Quecreek #1 mine map stated they did not recheck the location of the Harrison No. 2 mine because this work had been previously performed and certified by others.

Neither Musser, RoxCoal, nor PBS conducted a search of production records for Harrison No. 2 mine. Engineers involved in the permitting process stated that yearly production records would not have been beneficial since they had found no recent dated map to compare to production records. They also stated that production records were not a normal part of the information collected during their map/information search.

A public comment meeting was held by the State during a permit amendment application review. State representatives addressed comments from concerned citizens at the meeting. The majority of the comments dealt with potential mine subsidence and loss of water supplies. One comment pertained to the presence of voids

found during exploratory drilling. These same concerns were voiced during public hearings following this inundation accident. It was reported in the Quecreek #1 mine permit application that voids were found in the proposed portal area. A borehole camera was used in one hole and it was concluded that the voids were possibly solution cavities. Drill hole information was obtained and examined by the investigation team. This information indicated that no PBS drill holes were placed in the vicinity of the abandoned Harrison No. 2 mine. Data from old holes showed that voids were hit in areas where old workings were known to exist but were outside the projected boundaries of Quecreek #1 mine. Examination of the drill logs of holes near the proposed Quecreek #1 mine portal area indicated voids. However, these holes were not located near the Harrison No. 2 mine area.

Map Search by Investigation Team

Following the accident, the investigation team conducted a search for Harrison No. 2 mine maps. [Table 2 in Appendix D](#) summarizes the information found. The following is a summary of observations from information obtained by the investigation team:

1. Review of the United States Department of Interior Office of Surface Mining (OSM) mine map repository located in Greentree, PA, reports [[Appendix D, Table 2, Number 24](#)] revealed the following:
 - a. Documents are given a 17-character identification code. However, computer lists of search results only display the last 6 characters.
 - b. The search by mine name containing "Saxman" resulted in several documents including number 358045. The mine name was listed as "Saxman E No. 2 Mine" and the company was listed as "Unknown." Examination of this map showed that the document was the map label portion of the mine map for the Harrison No. 2 mine and did not show any actual mine workings. It is concluded that this map was mislabeled in the OSM repository records.
 - c. The search by mine name containing "Harrison" resulted in three documents: 306885, 349467, and 358045. Confusion resulted when this and the search described in Item b. above indicated the same document - 358045. When both documents were printed, it was clear that the documents were not the same despite the same reference number. It was learned that one map was submitted that required two

photographic frames. One document was labeled as frame number 188 and the other as frame number 189. Frame 188 contained Harrison No. 2 mine workings while frame 189 contained the title block with date of "7-1-57." This map is referred to as the 1957 Harrison No. 2 mine map in this report.

- d. Musser/RoxCoal/PBS did not obtain frame number 189 during their search and thus did not have a complete map which contained the date and title. As a result, they had no date to attach to the Harrison No. 2 workings shown on frame number 188.
2. The actual map used by Musser/RoxCoal/PBS to represent the extent of workings in Harrison No. 2 mine was a map obtained from Consol [Appendix D, Table 1, Number 1]. This map contained a detailed outline of Harrison No. 2 mine but was undated. Consol officials stated to investigators that the origin of the outline was unknown. MSHA obtained the map from Consol and determined that Musser had received approximately half the map during their search. Examination of the entire map revealed no useful dates or information beyond what was contained on the partial map used by Musser/RoxCoal/PBS. The Consol map contained more extensive mine workings for Harrison No. 2 mine than the 1957 OSM map. The investigation team later determined that this map contained workings only through 1960.
 3. Musser stated that they normally do not use production records to help verify maps. However, since production records for Harrison No. 2 mine were available up to 1963, use of these records with the complete 1957 map and the Consol map could have helped Musser decide on the accuracy of their information.
 4. The importance of having a dated map is critical and cannot be overstated. In this case, Musser needed the complete 1957 map, including the dated portion of the map, as noted in Item 1.c., above. With this 1957 date and production records, Musser/RoxCoal/PBS might have been able to determine an approximate date for the undated map received from Consol, which was ultimately used for the mine permitting process. To do this, the complete OSM 1957 map must be compared to the Consol map and yearly production data for Harrison No. 2 mine must be used. The two maps must be compared to determine the additional mined area shown on the Consol map. Then, production data can be used

to determine the approximate area mined after 1957. If the Consol map did not show sufficient mined areas to account for this production, it might be concluded that the map was not up to date. When this type of analysis was performed by the investigation team, it indicated that approximately 1 million square feet of area was needed to be accounted for in addition to the area shown on the Consol map. Of course, Musser/RoxCoal/PBS did not obtain the portion of the OSM map with a date. Musser did obtain a 1948 map [Appendix D, Table 1, Number 2], but this map was not used as it was considered too old. Without at least one recent date, no analysis could be performed.

5. One map found in the OSM repository for the Saxman Coal & Coke Co. E No. 2 mine contained a letter dated April 11, 1960, from the company's superintendent, J.E. Kimmel, to the State of Pennsylvania. This letter indicated mining had ceased and the attached mine map was true and accurate. Submitting this map to the State was consistent with regulations at the time that the mine closed. A second map with a statement submitted by Kimmel in 1953 indicating that mining in the E No. 1 mine had been suspended was also found in the OSM repository.
6. One map from the OSM repository [Appendix D, Table 1, Number 3] contained more detailed workings for Harrison No. 2 mine, including the first 1,500 feet of the South Mains. It did not cover the mine workings closest to Quecreek #1 mine. The investigation team could not find the adjoining section of this map at the repository.
7. Consol provided maps [Appendix D, Table 2, Number 27] to prospective buyers when they were selling coal holdings in Somerset County. These maps did not show the complete workings of Harrison No. 2 mine. Some coal previously mined in Harrison No. 2 mine was shown as unmined. Musser/RoxCoal/PBS used these maps when developing the mine plan for Quecreek #1 mine. Information and maps pertaining to coal purchases and sales was obtained from Consol [Appendix D, Table 2, Number 26]. These maps dated 1979 showed less extensive workings in the Harrison No. 2 mine than the 1957 map.
8. The 1964 map [Appendix D, Table 2, Number 13] that was found by the investigation team at Windber was not available to the public prior to June 2002. Prior to that date, the map was in the possession of former state mine inspector C.H.

Maize, now deceased, and his survivors. Maize was the inspector for the district in which Harrison No. 2 mine was located. State regulations since 1961 required mine operators to provide a final certified mine map to the State Department of Mines and Mineral Industries office. The regulations also required the mine operator to extend the final worked out and abandoned territories on the district inspector's map. This map was confirmed as Maize's as evidenced by his signature and date on the back of the map. The State could not find the map or a record of having received it. The investigation team found copies of certified final maps for other Saxman mines that Saxman engineer, J.E. Kimmel, had provided to the Department prior to the reported final mining at Harrison No. 2 mine.

Mine Mapping/Surveying

Musser Engineering, Inc. (Musser) was contracted to help prepare the original permit application for Quecreek #1 mine. This work included researching and showing the location of old mine works adjacent to the planned mine. PBS also assisted Musser with these activities.

PBS contracted CPS Surveys, Inc. (CPS) of Ebensburg, PA, to install and locate the mine's permanent baseline points. The origin of the survey for these points was from the United States Geological Survey (USGS) quadrangle of Somerset, Pennsylvania, at monument stations identified as Schaffer, Stanton, and Somerset. Horizontal and vertical controls were established at the baseline points using Global Positioning System (GPS) methods. These initial points were set and then later verified by CPS on March 16, 2001.

Using aerial photography in 1996, PBS mapped the surface area of Quecreek #1 mine. The map grids were based on the Pennsylvania State Plane Grid System 1927 Datum. The underground survey was carried from the two baseline points located near the portals. The points were located above the portal area at elevations of 1921.1 (pin No. 1) and 1946.7 (pin No. 2) feet. Floor elevations of the portal entries were 1843.2 (No. 1 portal), 1841.0 (No. 2 portal), 1838.1 (No. 3 portal), and 1836.3 (No. 4 portal) feet.

Underground mining began in early March 2001. The underground mine surveying for Quecreek #1 mine was done by engineering staff of PBS. On occasions, Musser provided surveying or surveyors to assist PBS in surveys. The survey lines of sight were carried underground using single angle traverses. Equipment used for

surveying consisted of a Topcon theodolite and a Chicago steel tape. Survey stations were set in the mine roof and identified with brass tags having a survey station number. The numbers were indexed on the mine map that complied with 30 CFR 75.1200. The belt entry (No. 2 portal) line or azimuth was used as the base line for the survey and the survey traverse extended as mine works were advanced.

Horizontal and vertical survey controls were established for the underground survey. The vertical control was maintained with the Topcon theodolite at each crosscut in the belt entries as mining progressed. The elevations were surveyed to a point about 300 feet from the faces of 1-Left section. The elevation in the belt entry at the last survey point was 1826.4 feet. Notes in the surveyor's books regarding elevations appeared to match the elevations on the maps. However, the computerized traverse printout did not have elevations matching the elevation at the respective survey station underground. The investigation team questioned PBS about this and was told to disregard the elevations. They indicated that the elevations generated by the computer software were not correct because PBS did not input data needed to calculate elevations. Elevations were maintained separately in the surveyor's field notes and were manually calculated and transferred to the mine map.

In February 2002, Musser conducted a check survey in the Mains to a point approximately 4,000 feet from the portals. A "total station" survey instrument was used for the check survey. This instrument measured distances electronically, which eliminated the need to use steel tape measurements. The survey started from the two baseline points (pin Nos. 1 and 2). From those two points, two additional points were set in the pit and from those two points the check survey was carried underground. A double angle, triple distance method was used during the check survey. The survey was carried in the Mains to where 1-Left panel started. The survey was performed on February 6 and 8, 2002, while the intersection area of Mains and 1-Left was being developed. Calculations were completed on February 11, 2002. The survey data was not sent to PBS until August 6, 2002. Delivery of this information was untimely, but did not contribute to the inundation accident as indicated below.

MSHA regulations (30 CFR 75.1200-2(b)) require mine traverses be advanced by closed loop methods of traversing or other equally accurate methods of traversing. A closed loop survey was not performed by the mine operator. MSHA District 2 cited this violation during a spot inspection since it did not contribute to

the accident. PBS records did not show how the check survey was used, if the results were acceptable, or whether the survey line or azimuth was adjusted as a result of the check survey. MSHA investigators compared the traverse of the PBS survey and the Musser check survey. The surface baseline pin No. 1 was within 0.001 feet in the Y (northerly) direction and 0.003 feet in the X (easterly) direction. The elevation was within 0.1 feet. The surface baseline pin No. 2 was within 0.001 feet in the northerly direction and 0.002 feet in the easterly direction. The elevation at pin No. 2 was within 0.3 feet. However, check survey elevations were expressed in whole numbers and PBS elevations were to the nearest tenth of a foot, making the precision of the comparisons questionable.

Twenty-five underground points were used in the Musser check survey. The survey included a traverse check of seven existing survey stations (Nos. 49, 56, 120, 260, 308, 309 and 313). A comparison of stations furthest from the surface was made on stations 308, 309, and 313. The comparison was from the PBS survey to the check done by Musser. The 308 station was within 0.795 feet northerly and 1.728 feet easterly. The 309 station was within 0.790 feet northerly and 1.728 feet easterly. The 313 station was within 0.759 feet northerly and 1.748 feet easterly. Using the differences in values calculated by the two surveys for survey station No. 308 and the approximate total traverse distance, the error was calculated by the investigation team to be 1:2281. Based on research of survey standards, this closure was found to be inadequate. A closure of 1:5000 was found to be minimally acceptable. An elevation check survey was not carried underground. These factors were found not to have contributed to the accident.

The operator did not conduct another check survey even though the mine advanced approximately 4,000 feet in the 1-Left entries and approximately 1,700 feet in the Mains since the last coordinate check. The need for accurate mine mapping is important and increases in importance as a mine approaches known hazards.

As part of the investigation, MSHA contracted Mine Surveys, Inc. of Kingwood, WV, to conduct a survey. A coordinate and elevation survey of the surface points at the portal area, the rescue and ventilation holes, and underground in the Mains, 1-Left and the breakthrough area was performed. The survey was carried into the mine through the travelway (No. 5) entry and a closed loop was achieved by surveying a parallel line from the face areas of the 1-Left section to the surface through the No. 3 entry. The closed loop was tied to the original points of the survey into

the mine. The closure of the survey was 1:16671 for the horizontal distance and 0.064 feet vertical control, both of which exceeded MSHA contract specifications for survey accuracy. The vertical was closed by survey from the surface and extended underground by trigonometric methods. Elevations were carried to the bottom of the No. 1 rescue hole and subsequently to the face area of 1-Left section. A vertical measurement was made through No. 1 rescue hole by steel chain, which was the closure method for the vertical control.

The contractor's survey was compared to the operator's survey at the last stations surveyed near the face area of 1-Left. The comparison was made on the stations in five of the seven entries (survey station Nos. 599, 600, 601, 603, and 605). The No. 1 entry was not compared because no operator's station was located near the face area. The No. 7 entry was not compared because no data could be found in the operator's survey notes for the last station in that entry (survey station No. 606). In addition, this station was not plotted on the operator's map even though it was present in the mine.

The contractor's survey was conducted by closed-loop methods and therefore was considered the controlling coordinates and elevations. Comparison of the coordinates determined by the contractor to those determined by the operator for the five stations listed previously indicated the operator's coordinates were off by an average of -4.8 feet in the northerly direction and 1.6 feet in the easterly direction. Coordinates for survey station No. 603 showed the largest difference: -5.4 feet northerly and 2.6 feet easterly. This indicated the faces on the 1-Left section were slightly less advanced than as shown on the operator's mine map.

Comparison of the surveyed elevations was made at the bottom of No. 1 rescue hole on 1-Left section. The contractor surveyed the floor at the bottom of the rescue hole as 1827.7 feet. The operator's nearest surveyed elevation, which was approximately 105 feet outby the rescue hole, was 1826.4 feet. This indicates the operator's surveyed elevations were relatively accurate. The operator's survey results did not contribute to the breakthrough. Mining was only going to advance another 80 feet, which would have left the active workings 250 feet from the indicated location for the Harrison No. 2 mine as shown on the mine map.

View into Harrison No. 2 Mine from Breakthrough

The breakthrough was approximately 4 feet high and 4.6 feet wide and was in the face of No. 6 entry near the right rib. The view into the old works was not obstructed. [See [Appendix F](#) for photograph.] The ribs of the breakthrough opening were narrow; approximately one foot of coal existed on either side of the opening. Projection of continuous mining machine cutter bit marks near the floor of the breakthrough across the opening indicates that a thin barrier between the two mines may have existed prior to the water breakthrough. The floor of the Quecreek #1 mine had been cut 8 to 12 inches lower than the floor of the old mine. The mining height in the old mine was approximately 4 feet.

There appeared to be two entries in the old mine, which corresponded with the 1964 map found at Windber. The Quecreek #1 mine No. 6 entry appeared to have broken into a room that had been mined to the right and down dip from the two entries of Harrison No. 2 mine. The room had been roof bolted and appeared to be approximately 30 feet long and 30 feet wide. This short room was not shown on the 1964 map.

Roof bolts and timbers were visible in the old mine entries, crosscut, and room. Roof bolts protruded about 12 inches from the roof. The roof bolts had deteriorated during the approximate 40-year period of inactivity and had no visible heads. It is believed these were mechanical bolts due to the era of mining. The floor of the old mine appeared to be clear of debris at the time the investigation team initially visited the mine. Subsequent observations showed that additional immediate roof, or "draw rock," had fallen in the crosscuts and entries that were visible. Timbers and other material washed in from the Harrison No. 2 mine were found in the Quecreek #1 mine after the inundation.

The Quecreek #1 mine ventilation system was extended to the breakthrough location by line curtain to provide a good atmosphere for investigators. At the breakthrough, air was flowing from the Harrison No. 2 mine into the Quecreek #1 mine due to the exhausting ventilation system used by Quecreek #1 mine. Low levels of oxygen and high levels of carbon dioxide were detected in the Harrison No. 2 mine.

In viewing the ribs, there appeared to be markings of the Wilcox auger-type miner, confirming statements by previous miners from Harrison No. 2 mine. It was desirable to explore the old mine

and determine the extent of its workings and obtain surveying information. The use of mine rescue teams and mechanical robots were considered for exploration purposes. These were eventually not used due to safety concerns. There would have been a need to ventilate and to re-support the roof in the intended exploration area. This was not feasible. The mechanical robots were not electrically permissible as required by MSHA and State regulations for use in return air (abandoned mine) atmospheres.

A transit used by the MSHA contract surveyor was set in No. 6 entry near the breakthrough opening in an attempt to use the electronic distance features of that instrument to survey points in the old mine. This effort was not very successful due to the lack of a reflective instrument or surface at the points in the old mine. The contractor was able to locate three timbers due to their reflective nature. However, the efforts to establish coordinates along the entry line in the old mine were not possible.

Root Cause Analysis of Breakthrough

The investigation team performed a root cause analysis of the breakthrough. The flow chart of the analysis can be found in [Appendix E](#).

CONCLUSION

The entrapment of nine miners in Queecreek #1 mine began when water broke into the mine from the abandoned Harrison No. 2 mine on July 24, 2002. At the time of the breakthrough, a cut of coal had just been made with a continuous mining machine in the No. 6 entry on 1-Left section. The 1-Left crew attempted to escape, but was blocked by water at the mouth of the panel. These nine miners were trapped in the mine from 76 to 78 hours. Seven other miners who worked on the 2-Left section and two outby miners were able to escape the inrush of water.

The primary cause of the water inundation was the use of an undated and uncertified mine map of the Harrison No. 2 mine that did not show the complete and final mine workings. Using this map led to an inaccurate depiction of the Harrison No. 2 mine workings on the Queecreek #1 mine map required by the Mine Safety and Health Administration and on the certified mine map submitted to the State of Pennsylvania during the permitting process. The root cause of the accident was the unavailability of a certified final mine map for Harrison No. 2 mine in the State of Pennsylvania's mine map repository.

Contributing factors include the following:

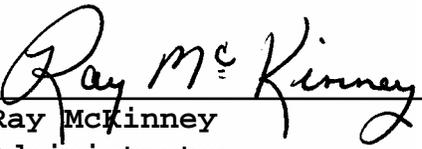
- Inadequate systems for collecting, maintaining, documenting, and providing old mining records and maps.

- In the absence of a certified and dated final map of the Harrison No. 2 mine, the parties involved in permitting and operating the mine did not take additional steps to confirm or address the potential hazard. Methods such as drilling to determine the extent of mining or de-watering the abandoned mine could have been used.

The rescue of the trapped miners was a major success. Fogle's decision and Hall's persistence to immediately notify the miners in 2-Left section was life saving because of the rapid inflow of water. Without that timely warning they would not have been able to escape. Additionally, the 1-Left section crew's decisions to stay together, work as a team, and go to the highest ground were crucial for their survival. The miners who escaped the inrush of water made similarly good decisions. Their knowledge of escapeways and escape procedures aided their escape. The fast actions of company officials in calling for assistance of expert personnel and appropriate equipment, and the rapid response of those contacted played a major role in the success of this

rescue. The rescue was a joint effort between Company, State,
and Federal government representatives and many other volunteers.

Approved:



Ray McKinney

Administrator

for Coal Mine Safety and Health

ENFORCEMENT ACTIONS

1. Order, 103(k), No. 7051555, issued on 07/24/2002. The mine has experienced an inundation of water in the 1-Left section on July 24, 2002. This order is issued to assure the safety of all persons in the mine, until the mine is recovered, the affected areas are returned to normal, and an examination and investigation is made to determine that the mine is safe.

2. Citation, 104(a), 75.1200, No. 7322481, issued to Black Wolf Coal Company, Inc., S&S, Low Negligence. It was determined during an investigation of the July 24, 2002, inundation/entrapment accident at the Quecreek #1 mine that the adjacent mine workings of the Harrison No. 2 mine, within 1000 feet of the Quecreek #1 mine, were not accurately and completely shown on the mine map. A continuous mining machine operator had just completed a cut of coal when water from the abandoned Harrison No. 2 mine broke through the face of the No. 6 entry in the 1-Left section, inundating the mine and trapping nine miners. The nine miners were trapped from 76 to 78 hours following the inundation, and nine other miners narrowly escaped the mine. At the breakthrough point, the operator's mine map showed the Harrison No. 2 mine to be located approximately 450 feet away. The use of an inaccurate and not up-to-date mine map was the primary reason for the accidental inundation.

3. Citation, 104(a), 75.1200, No. 7322487, issued to Musser Engineering Inc., S&S, Moderate Negligence. It was determined during an investigation of the July 24, 2002, inundation/entrapment accident at the Quecreek #1 mine that the adjacent mine workings of the Harrison No. 2 mine, within 1000 feet of the Quecreek #1 mine, were not accurately and completely shown on the mine map. A continuous mining machine operator had just completed a cut of coal when water from the abandoned Harrison No. 2 mine broke through the face of the No. 6 entry in the 1-Left section, inundating the mine and trapping nine miners. At the breakthrough point, the operator's mine map showed the Harrison No. 2 mine to be located approximately 450 feet away. The nine miners were trapped from 76 to 78 hours following the inundation, and nine other miners narrowly escaped the mine. The primary cause of the accident was the use of an undated and uncertified mine map of the Harrison

No. 2 that did not show the complete and final mine workings.

Musser Engineering, Inc., under contract to PBS Coals, Inc./RoxCoal, Inc., researched, located, mapped, and certified the Harrison No. 2 mine boundary. This information was provided to PBS Coals, Inc. (PBS) and used by PBS to show the Harrison No. 2 boundary on the map required by 30 CFR 75.1200 for the Quecreek #1 mine.

Musser/PBS used a map that was undated and uncertified to show the extent of the Harrison No. 2 mine. One map obtained from the United States Office of Surface Mining (OSM) map repository at Greentree, Pennsylvania, required two photographic frames to record the map. One frame was labeled as the Saxman E No. 2 mine and contained the map legend and date (July 15, 1957) information, while the second frame contained the mine workings of the Harrison No. 2 mine. Musser didn't obtain the frame with the legend and 1957 date. Musser relied on a map provided by Consolidation Coal Company (Consol) as the most up-to-date map. The Consol map was a property map that was not dated or certified. The Consol map showed more extensive mine workings than the OSM map. The map was not offered or represented as the final map by Consol officials. Production reports from 1958 through 1963, when the mine closed, revealed that 421,000 tons of coal had been mined during that period. Calculations would reveal that a much more extensive area was mined than shown on the Consol map and as plotted on the 30 CFR 75.1200 map.

The investigation team discovered a map of the Harrison No. 2 mine in the Windber Coal Heritage Center (Windber). This map was very detailed and contained a survey index of mining from July 1, 1947, through January 1, 1964. A note on the outside of the map indicated it was the final map with a date of 1964. The map from Windber was donated to the Center in June 2002. The final map may not have been available for Musser to show the extent of mining, but other information as cited above would indicate that the boundaries used were questionable.

4. Citation, 104(a), 75.1200, No. 7322488, issued to PBS Coals Inc., S&S, Moderate Negligence. It was determined during an investigation of the July 24, 2002, inundation/entrapment accident at the Quecreek #1 mine that the adjacent mine workings of the Harrison No. 2 mine, within 1000 feet of the

Quecreek #1 mine, were not accurately and completely shown on the mine map. A continuous mining machine operator had just completed a cut of coal when water from the abandoned Harrison No. 2 mine broke through the face of the No. 6 entry in the 1-Left section, inundating the mine and trapping nine miners. At the breakthrough point, the operator's mine map showed the Harrison No. 2 mine to be located approximately 450 feet away. The nine miners were trapped from 76 to 78 hours following the inundation, and nine other miners narrowly escaped the mine. The primary cause of the accident was the use of an undated and uncertified mine map of the Harrison No. 2 that did not show the complete and final mine workings.

PBS Coals Inc., and RoxCoal, Inc., both wholly owned subsidiaries of MinCorp Inc. Contracted with and assisted Musser Engineering Inc. to research, locate, map, and certify the Harrison No. 2 mine boundary. This information was provided to PBS Coals, Inc. (PBS) and used by PBS to show the Harrison No. 2 boundary on the map required by 30 CFR 75.1200 for the Quecreek #1 mine.

PBS/Musser used a map that was undated and uncertified to show the extent of the Harrison No. 2 mine. One map obtained from the United States Office of Surface Mining (OSM) map repository at Greentree, Pennsylvania, required two photographic frames to record the map. One frame was labeled as the Saxman E No. 2 mine and contained the map legend and date (July 15, 1957) information, while the second frame contained the mine workings of the Harrison No. 2 mine. PBS/Musser didn't obtain the frame with the legend and 1957 date. PBS/Musser relied on a map provided by Consolidation Coal Company (Consol) as the most up-to-date map. The Consol map was a property map that was not dated or certified. The Consol map showed more extensive mine workings than the OSM map. The map was not offered or represented as the final map by Consol officials. Production reports from 1958 through 1963, when the mine closed, revealed that 421,000 tons of coal had been mined during that period. Calculations would reveal that a much more extensive area was mined than shown on the Consol map and as plotted on the 30 CFR 75.1200 map.

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outside of the map indicated it was the final map with a date of 1964. The map from Windber was donated to the Center in June 2002. The final map may not have been available for Musser to show the extent of mining, but other information as cited above would indicate that the boundaries used were questionable.

ADDENDUM

The investigation team reviewed information at the Somerset County Assessment Office and spoke to the Chief Assessor, John Riley, Jr., C.P.E. This review showed that the Elias Bittner property contained the coal near where it is believed the last mining had occurred at the Harrison No. 2 Mine in 1963. The tract was referred to as tract 121A and was listed at 121 acres. Mr. Riley stated the records for the tracts did not delineate by seam.

The record review began with a deed of 1902 for the sale of the surface. The deed referred to the original purchase in 1883 of the surface and minerals by Bittner from Norman Knepper and others. The other records reviewed included the tax assessment sheets of 1961, 1962 and 1963. These records showed the depletion of coal acreage each year on the property. Page 148 of the 1963 records showed the exhaustion of the 121 acres. The next set of records reviewed was for 1980 and 1981 and listed "Consolidation Coal Co." as the owner. Records for 1980 showed the property as exhausted; however, in 1981 the reserves were again listed by the Assessment Office as having 121 acres. Mr. Riley said the records were changed by the Assessment Office. He did not know who or why the records were changed.

As this accident investigation reached its final stages, a State of Pennsylvania employee involved in the State mine-permitting process indicated that he had been told that a certified map of the Harrison No. 2 Mine existed prior to the inundation. He stated that he had been advised of this on more than one occasion between the pre-permit filing in 1998 and January 2001. Based on the available evidence, the investigation team concludes that no certified or final map was available to the mining community prior to the accident investigation team finding a map at the Coal Heritage Museum in Windber, Pennsylvania, after the inundation [[Appendix D, Table 2, Number 13](#)]. All of the engineers involved in the permitting process testified that they based the location of the Harrison No. 2 mine on the undated and uncertified Consol map [[Appendix D, Table 1, Number 1](#)].

The MSHA accident investigation team concurs with the State of Pennsylvania that it is the responsibility of the State to analyze and evaluate the mine permitting process, both in general, and as applied to the Quecreek #1 Mine. Should the other ongoing investigations at the State and Federal level provide information that might modify any of MSHA's findings and conclusions in this matter, a supplement to this report will be issued as appropriate.

APPENDIX A

The following persons either participated in or were interviewed during the investigation. (* indicates those persons interviewed and transcript available.)

Black Wolf Coal Company, Inc. Officials

Randall L. Fogle*	Section Foreman-Evening/1-Left
Harry D. Gula*	Section Foreman-Day/1-Left
Charles E. Hankinson*	Chief Electrician/Vice-President
Joseph A. Hoffman*	Mine Foreman
David A. Keller*	Safety Director
David F. Rebuck*	Mine Superintendent/President
Frank E. Stewart*	Mine Examiner/Section Foreman-Evening/2-Left

Black Wolf Coal Company, Inc. Employees, 1-Left Section(Evening)

Thomas D. Foy*	Mechanic/Electrician
Dennis J. Hall*	Shuttle Car Operator
Ronald J. Hileman*	Roof Bolting Machine Operator
Harry Blaine Mayhugh, Jr.*	Scoop Operator
John R. Phillippi*	Continuous Mining Machine Operator
Mark E. Popernack*	Miner Helper/Utilityman
Robert E. Pugh*	Shuttle Car Operator
John R. Unger*	Roof Bolting Machine Operator

Black Wolf Coal Company, Inc. Employees, 2-Left Section(Evening)

Barry C. Carlson*	Outby Scoop Operator
Douglas L. Custer*	Roof Bolting Machine Operator
Wendell L. Horner*	Shuttle Car Operator
Joseph A. Kostyk*	Continuous Mining Machine Operator
Ryan S. Petree*	Scoop Operator
David R. Petree*	Roof Bolting Machine Operator
Ronald J. Schad*	Mechanic/Shuttle Car Operator
Lawrence A. Summerville*	Floating Mechanic

Black Wolf Coal Company, Inc. Employees, 1-Left Section (Day)

William K. Kisel*	Roof Bolting Machine Operator
William E. Lambert*	Continuous Mining Machine Operator
Lawrence Petree*	Roof Bolting Machine Operator

PBS Coals, Inc.

Joseph A. Gallo, Jr.*	Mining Engineer/Vice President
James A. Hickman, P.E.*	Mining Engineer/President, Sarah Resources, Inc./ Superintendent, Longview Mine
Chad A. Mostoller*	Surveyor
Kenneth P. Yingling*	Mining Engineer/Manager of Exploration
John W. Yonkoske, P.E.*	Chief Mining Engineer (Retired 12/18/2001)

CME Engineering, Inc.

Mark R. Tercek, P.E.*	Mining Engineer/Vice President
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Mine Surveying, Inc.

Kenneth L. Moran, P.S., P.L.S.	Owner
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Musser Engineering, Inc

David D. Lucas*	Vice President, Deep Mine Operations
David J. Zwick*	Industrial Engineer

EADS Group, Inc.

Edwin S. Secor, P.E.*	Projects Manager/Former Manager of Mining Projects, Musser Engineering, Inc.
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William McIntire Coal, Oil and Gas

William J. McIntire*	Owner
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Other Persons Providing Information/Participating in the
Investigation

Chris Barkley	Director, Windber Coal Heritage Center, Windber, PA
Carlton D. Barron	Former Clerk, Saxman Coal and Coke Co.
Louis Bartels	President, Bartels Drilling Company
Jeffrey L. Berkey, Esq.	Counsel for Musser Engineering

Royce Boyd	Step-granddaughter of C.H. Maize, deceased State Mine Inspector
Elizabeth S. Chamberlin	Safety Director, Consol Energy, Inc.
Marshall Hunt	Vice-President, Consol Energy, Inc.
Joseph Jashienski	Former Miner, Saxman Coal and Coke Co.
Jerry Johnson, Esq.	Counsel for Black Wolf Coal Company, Inc.
William F. Manifesto, Esq.	Counsel for Fogle, Popernack, L. Petree, & Hankinson
Howard F. Messer, Esq.	Counsel for Foy, Hall, Hileman, Mayhugh, Phillippi, Pugh, & Unger
George H.P. Popper and William C. Ehler, P.G.	US Department of Interior, Office of Surface Mining, Mine Map Repository, Greentree, PA
William Saxman	Son of Edwin Saxman, deceased former President of Saxman Coal and Coke Co.
Julia K. Shreve, Esq.	Counsel for PBS Coals, Inc.
Joseph Yuhas, Esq.	Counsel for Black Wolf Coal Company, Inc.

Pennsylvania Department of Environmental Protection
Bureau of Deep Mine Safety

Brad R. Cole, P.E.	Mining Engineer/Engineering Services Division, Uniontown, PA
Michael J. Heilman, Esq.	Counsel
Thomas McKnight*	Mining Engineer/Engineering Services Division, Uniontown, PA
Ellsworth R. Pauley	Bituminous Underground Mine Inspector Supervisor, Portage, PA
Thomas D. Shumaker	Bituminous Underground Mine Inspector, Clarksville, PA

Pennsylvania Department of Environmental Protection
Bureau of District Mining Operations, McMurray, PA

William Plassio	District Manager
Joseph Leone	Section Chief, Bituminous Mining Permit Section
Joel Koricich	Engineering Supervisor
Jay Winter	Hydrogeologist

Mine Safety and Health Administration

James F. Bowman	Conference Litigation Officer, District 4, Mt. Hope, WV
Edwin P. Brady	District Manager, District 4, Mt. Hope, WV
Arnold D. Carico	Mining Engineer, District 5, Norton, VA
William G. Denning, P.E.	Staff Assist./Civil Engineer, District 9, Denver, CO
Howard C. Epperly, Jr., P.E.	Mining Engineer, Accident Reduction Program, Technical Support, Triadelphia, WV
Edward H. Fitch, IV, Esq.	Office of the Solicitor, Arlington, VA
Donald W. Huntley, Jr.	Coal Mine Safety and Health Inspector, Johnstown, PA
Stanley J. Michalek, P.E.	Supervisory Civil Engineer, Mine Waste and Geotechnical Engineering Division, Technical Support, Pittsburgh, PA
Roy W. Milam	Electrical Engineer/Instructor, Mining Technology Branch, National Mine Health and Safety Academy, Beaver, WV
Sandin Phillipson, Ph.D.	Geologist, Roof Control Division, Technical Support, Pittsburgh, PA
Kenneth M. Scott	Team Leader/Instructor, Safety Management Branch, National Mine Health and Safety Academy, Beaver, WV
Richard T. Stoltz	Supervisory Mining Engineer, Ventilation Division, Technical Support, Pittsburgh, PA

Stanley T. Schaeffer, Jr.	Civil Engineer, Mine Waste and Geotechnical Engineering Division, Technical Support, Pittsburgh, PA
Kevin G. Stricklin	Assistant District Manager-Technical Services
Glenn R. Tinney	Accident Investigations Coordinator, Arlington, VA
Paul L. Tyrna	Geologist, Roof Control Division, Technical Support, Pittsburgh, PA
John E. Urosek	Chief, Ventilation Division, Technical Support, Pittsburgh, PA
Kelvin K. Wu, Ph.D., P.E.	Chief, Mine Waste and Geotechnical Engineering Division, Technical Support, Pittsburgh, PA

APPENDIX B

ACCIDENT INVESTIGATION DATA SHEETS

MSHA FORMS 7000-50

Accident Investigation Data

U.S. Department of Labor
Mine Safety and Health Administration



Event Number: 4 1 0 1 6 0 1

A. Mine Information									
1. Mine ID Number: 3 6 - 0 8 7 4 6			2. Mine Name: QUECREEK #1 MINE			3. Operating Company Name: BLACK WOLF COAL COMPANY, INC.			
4. Mine Location: (Town, County, and State) QUECREEK, SOMERSET, PA 15555					b. Union Affiliation: 9999 None (No Union Affiliation)				
5. Mine Type: U Underground			6a. Material Mined/Processed: 122200 Bituminous Coal Underground Mining			b. Part 48? X Part 46? <input type="checkbox"/>		7. Name Of Seam: (Coal Only) Upper Kittanning (C)	
8. Mining Data: a. Mining Method: 0 4 Room/Pillar			b. Extraction Method: 0 4 Continuous Miner (Deep-cut)						
c. Haulage Method(s): 0 6 Shuttle Car			0 1 Conveyor Belt				0 3 Truck from mine		
d. Are explosives used in the extraction of material? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>									
9. Employment: At Time of Accident:		a. Underground: 18		b. Surface: 1		10. Production:(Coal only)		11. Hours of Operation:	
Avg Mine Employment:		a. Underground: 55		b. Surface: 6		Avg Tons per Day: 1400		b. Shifts per Day: 3	
								c. Days per Week: 5	
12. Number of Active MMU's:(Coal Only)			13. Methane Liberation:			14. Average Mining Height:			
a. Development 0 2			b. Retreat: 0 0			Cubic Feet in 24 hours: 0			
						Feet: 4 Inches: 0 0			
15. Management/Labor Officials:									
Title		Name			Address				
Mine Superintendent/President		David F. Rebeck			P.O. Box 240, Friedens, PA 15541				
Chief Electrician/Vice-President		Charles E. Hankinson			Box 91, New Baltimore, PA 15553				
Mine Foreman		Joseph A. Hoffman			P.O. Box 240, Friedens, PA 15541				
Safety Director		David A. Keller			P.O. Box 240, Friedens, PA 15541				

B. Accident Information										
16. Date(MM/DD/YY)/Time(24Hr.) of Accident:			17. Type of Investigation:				18. Accident Classification:		19. Number of	
a. Date: 07/24/2002			b. Time: 20:45		Fatal <input type="checkbox"/> Non-Fatal <input checked="" type="checkbox"/> Non-injury <input type="checkbox"/>		3 2 Stress: entrapment/inundation		Deg. 1-5 Injuries: 14	
20. Location of Accident/Injury/Ill. a. Surface Location:						21. Number of Independent Contractor				
b. Underground Location: 0 3 Face						Companies Involved in Accident: 1				
22. Equipment Involved:			a. Type: 120000 Continuous mining machine			b. Manufacturer: 0508 Eimco				
#1 c. Model No: 2810-1			d. Serial Number: 70880096R			e. Controls: R Remote				
#2 c. Model No:			d. Serial Number:			e. Controls:				

23. Description of the Accident:

On Wednesday, July 24, 2002, at approximately 8:45 p.m., a nonfatal entrapment incident caused by a water inundation occurred at Quecreek #1 mine, Black Wolf Coal Company, Inc., located at Quecreek, Somerset County, Pennsylvania. Water broke through the working face of No. 6 entry on 1-Left section from the abandoned Harrison No. 2 mine. At the time of the breakthrough, a cut had just been made in No. 6 entry. The 1-Left crew attempted to escape but was blocked by water at the mouth of 1-Left panel. The 1-Left miners were trapped from 76 to 78 hours. Seven miners from 2-Left section and two outby miners were able to escape.

Rescue efforts began immediately. A 6.5-inch hole was drilled from the surface into 1-Left section near the faces on Thursday morning, July 25, 2002. The trapped miners tapped on the drill steel to signal the surface, where it was acknowledged. Water continued to flow from the abandoned mine and eventually came out the Quecreek #1 mine portals, which were located in a pit, and rose approximately 17 feet above the highest elevation of 1-Left section. Pumps were installed in the pit, in boreholes into 1-Right, and into the low point of the Mains to remove water from the mine.

Drilling of a 30-inch rescue hole into 1-Left section started Thursday evening, July 25, 2002. Pumping of water continued to an elevation of 1829.0, which was considered necessary for safe entry of the rescue hole into the mine. The hole was drilled into the mine at 10:13 p.m., Saturday, July 27, 2002. At 10:53 p.m. communication equipment was lowered down the 6.5-inch hole and it was learned that all nine miners were alive. The miners were brought to the surface using the Mine Safety and Health Administration's mine rescue capsule. The first miner reached the surface at 12:55 a.m., Sunday, July 28, 2002, and the last arrived at 2:45 a.m.

24. Conclusion:

The primary cause of the water inundation was the use of an undated and uncertified mine map of the Harrison No. 2 mine that did not show the complete and final mine workings. Using this map led to an inaccurate depiction of the Harrison No. 2 mine workings on the Queecreek #1 mine map required by the Mine Safety and Health Administration and on the certified mine map submitted to the State of Pennsylvania during the permitting process. The root cause of the incident was the unavailability of a certified final mine map for Harrison No. 2 mine in the State of Pennsylvania's mine map repository.

The investigation team concluded that water entering the section prior to the incident, which could have been a potential warning sign of an inundation, was indistinguishable from previously encountered conditions. Reports concerning hydrologic conditions indicated that water was present in overlying aquifers that resulted in generally wet conditions throughout the mine. In addition, the presence of a fault near the faces caused a worsening of conditions.

25. Enforcement Actions: Indicate P for procedure type violation, C for condition type, or T for training type.

Violation Type	Citation Number	Regulation Cited	Section of the Act
<input type="checkbox"/> C <input type="checkbox"/>	7051555		
Citation	Order <input checked="" type="checkbox"/>	Type/Action: 103(k)	Summary of Violation: The mine has experienced an inundation of water. This order is issued to assure the safety of all persons until the mine is recovered, the affected areas are returned to normal, and an investigation is made to determine that the mine is safe.
			IC:
<input type="checkbox"/> P <input type="checkbox"/>	7322481	75.1200	
Citation	Order <input checked="" type="checkbox"/>	Type/Action: 104(a)	Summary of Violation: Issued to Black Wolf Coal Co. - The investigation of the 7/24/2002 entrapment determined that the workings of Harrison No. 2 mine within 1000 feet of Queecreek #1 mine were not accurately and completely shown on the mine map.
			IC:
<input type="checkbox"/> P <input type="checkbox"/>	7322487	75.1200	
Citation	Order <input checked="" type="checkbox"/>	Type/Action: 104(a)	Summary of Violation: Issued to Musser Engineering. - The investigation of the 7/24/2002 entrapment determined that the workings of Harrison No. 2 mine within 1000 feet of Queecreek #1 mine were not accurately and completely shown on the mine map as certified by Musser.
			IC: KQN
<input type="checkbox"/> P <input type="checkbox"/>	7322488	75.1200	
Citation	Order <input checked="" type="checkbox"/>	Type/Action: 104(a)	Summary of Violation: Issued to PBS Coals - The investigation of the 7/24/2002 entrapment determined that the workings of Harrison No. 2 mine within 1000 feet of Queecreek #1 mine were not accurately and completely shown on the mine map. PBS assisted in preparing this map.
			IC:
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			
Citation	Order	Type/Action:	Summary of Violation:
			IC:
<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>			
Citation	Order	Type/Action:	Summary of Violation:
			IC:

C. MSHA Information

26. Last Quarter NFDL Injury Incidence Rate (PEIR) for:			27. Did Technical Support participate in this investigation ?		28. Part 50 Document Control Number:(Form 7000-1):				
Industry: 7.01	This Mine: 4.2	Contractor: 0	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		[] [] [] [] [] [] [] [] [] []				
29. MSHA District Office: New Stanton			30. MSHA Field Office: Johnstown, PA		31. Date Last Regular Inspection Completed: 06/12/2002				
32. Lead Accident Investigator: Name; AR No; Date :			33. Date On-site Investigation Started:		34. Formal Report:		35. Report Release Date:		
Name: Edwin P. Brady			AR No.: 20703 Date: 01/24/2003		07/30/2002		Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		08/12/2003

Accident Investigation Data - Victim Information

U.S. Department of Labor
Mine Safety and Health Administration



Event Number: 4 1 0 1 6 0 1

Victim Information: 4

1. Name of Injured/III Employee: Dennis J. Hall 2. Sex: M 3. Victim's Age: 48 4. Last Four Digits of SSN: 6287 5. Degree of Injury: 07 Occ Illnesses not classified 01 - 06

6. Date(MM/DD/YY) and Time(24 Hr.) Of Death: _____ 7. Date and Time Started: _____
a. Date: 07/24/2002 b. Time: 15:00

8. Regular Job Title: 050 Shuttle car operator 9. Work Activity when Injured: 022 Escaping hazard - entrapment by water 10. Was this work activity part of regular job?
Yes No X

11. Experience: Years Weeks Days a. This b. Regular c. This d. Total
Work Activity: 0 0 0 Job Title: 20 0 0 Mine: 1 8 0 Mining: 28 0 0

12. What Directly Inflicted Injury or Illness? 029 Water entrapment; wet, cold 13. Nature of Injury or Illness: 230 Possible hypothermia, stress

14. Training Deficiencies:
Hazard: _____ New/Newly-Employed Experienced Miner: _____ Annual: _____ Task: _____

15. Company of Employment: (if different from production operator) Operator Independent Contractor ID: (if applicable) _____

16. On-site Emergency Medical Treatment:
Not Applicable: First-Aid: CPR: EMT: Medical Professional: None:

17. Part 50 Document Control Number: (form 7000-1) _____ 18. Union Affiliation of Victim: 9999 None (No Union Affiliation)

Victim Information: 5

1. Name of Injured/III Employee: Ronald J. Hileman 2. Sex: M 3. Victim's Age: 49 4. Last Four Digits of SSN: 9336 5. Degree of Injury: 07 Occ Illnesses not classified 01 - 06

6. Date(MM/DD/YY) and Time(24 Hr.) Of Death: _____ 7. Date and Time Started: _____
a. Date: 07/24/2002 b. Time: 15:00

8. Regular Job Title: 012 Roof bolting machine operator 9. Work Activity when Injured: 022 Escaping hazard - entrapment by water 10. Was this work activity part of regular job?
Yes No X

11. Experience: Years Weeks Days a. This b. Regular c. This d. Total
Work Activity: 0 0 0 Job Title: 20 0 0 Mine: 1 16 0 Mining: 27 0 0

12. What Directly Inflicted Injury or Illness? 029 Water entrapment; wet, cold 13. Nature of Injury or Illness: 230 Possible hypothermia, stress

14. Training Deficiencies:
Hazard: _____ New/Newly-Employed Experienced Miner: _____ Annual: _____ Task: _____

15. Company of Employment: (if different from production operator) Operator Independent Contractor ID: (if applicable) _____

16. On-site Emergency Medical Treatment:
Not Applicable: First-Aid: CPR: EMT: Medical Professional: None:

17. Part 50 Document Control Number: (form 7000-1) _____ 18. Union Affiliation of Victim: 9999 None (No Union Affiliation)

Victim Information: 6

1. Name of Injured/III Employee: Harry B. Mayhugh, Jr. 2. Sex: M 3. Victim's Age: 31 4. Last Four Digits of SSN: 2611 5. Degree of Injury: 07 Occ Illnesses not classified 01 - 06

6. Date(MM/DD/YY) and Time(24 Hr.) Of Death: _____ 7. Date and Time Started: _____
a. Date: 07/24/2002 b. Time: 15:00

8. Regular Job Title: 028 Scoop operator 9. Work Activity when Injured: 022 Escaping hazard - entrapment by water 10. Was this work activity part of regular job?
Yes No X

11. Experience: Years Weeks Days a. This b. Regular c. This d. Total
Work Activity: 0 0 0 Job Title: 1 27 0 Mine: 0 16 0 Mining: 5 0 0

12. What Directly Inflicted Injury or Illness? 029 Water entrapment; wet, cold 13. Nature of Injury or Illness: 230 Possible hypothermia, stress

14. Training Deficiencies:
Hazard: _____ New/Newly-Employed Experienced Miner: _____ Annual: _____ Task: _____

15. Company of Employment: (if different from production operator) Operator Independent Contractor ID: (if applicable) _____

16. On-site Emergency Medical Treatment:
Not Applicable: First-Aid: CPR: EMT: Medical Professional: None:

17. Part 50 Document Control Number: (form 7000-1) _____ 18. Union Affiliation of Victim: 9999 None (No Union Affiliation)

Accident Investigation Data - Victim Information

U.S. Department of Labor
Mine Safety and Health Administration



Event Number: 4 1 0 1 6 0 1

Victim Information: 7

1. Name of Injured/III Employee: <i>David R. Petree</i>		2. Sex <i>M</i>	3. Victim's Age <i>57</i>	4. Last Four Digits of SSN: <i>2693</i>	5. Degree of Injury: <i>07 Occ Illnesses not classified 01 - 06</i>											
6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:				7. Date and Time Started: a. Date: <i>07/24/2002</i> b. Time: <i>16:00</i>												
8. Regular Job Title: <i>014 Roof bolting machine operator</i>			9. Work Activity when Injured: <i>022 Escaping hazard - water inundation</i>			10. Was this work activity part of regular job? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>										
11. Experience a. This		Years	Weeks	Days	b. Regular	Years	Weeks	Days	c. This	Years	Weeks	Days	d. Total	Years	Weeks	Days
Work Activity:		<i>0</i>	<i>0</i>	<i>0</i>	Job Title:	<i>21</i>	<i>0</i>	<i>0</i>	Mine:	<i>0</i>	<i>14</i>	<i>0</i>	Mining:	<i>32</i>	<i>0</i>	<i>0</i>
12. What Directly Inflicted Injury or Illness? <i>126 Water inundation</i>				13. Nature of Injury or Illness: <i>400 Stress from escaping inundation</i>												
14. Training Deficiencies: Hazard: <input type="checkbox"/> New/Newly-Employed Experienced Miner: <input type="checkbox"/> Annual: <input type="checkbox"/> Task: <input type="checkbox"/>																
15. Company of Employment: (If different from production operator) <i>Operator</i>				Independent Contractor ID: (if applicable)												
16. On-site Emergency Medical Treatment: Not Applicable: <input checked="" type="checkbox"/> First-Aid: <input type="checkbox"/> CPR: <input type="checkbox"/> EMT: <input type="checkbox"/> Medical Professional: <input type="checkbox"/> None: <input type="checkbox"/>																
17. Part 50 Document Control Number: (form 7000-1)				18. Union Affiliation of Victim: <i>9999 None (No Union Affiliation)</i>												

Victim Information: 8

1. Name of Injured/III Employee: <i>Ryan S. Petree</i>		2. Sex <i>M</i>	3. Victim's Age <i>26</i>	4. Last Four Digits of SSN: <i>6123</i>	5. Degree of Injury: <i>07 Occ Illnesses not classified 01 - 06</i>											
6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:				7. Date and Time Started: a. Date: <i>07/24/2002</i> b. Time: <i>16:00</i>												
8. Regular Job Title: <i>028 Scoop operator</i>			9. Work Activity when Injured: <i>022 Escaping hazard - water inundation</i>			10. Was this work activity part of regular job? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>										
11. Experience a. This		Years	Weeks	Days	b. Regular	Years	Weeks	Days	c. This	Years	Weeks	Days	d. Total	Years	Weeks	Days
Work Activity:		<i>0</i>	<i>0</i>	<i>0</i>	Job Title:	<i>3</i>	<i>0</i>	<i>0</i>	Mine:	<i>0</i>	<i>14</i>	<i>0</i>	Mining:	<i>8</i>	<i>0</i>	<i>0</i>
12. What Directly Inflicted Injury or Illness? <i>126 Water inundation</i>				13. Nature of Injury or Illness: <i>400 Stress from escaping inundation</i>												
14. Training Deficiencies: Hazard: <input type="checkbox"/> New/Newly-Employed Experienced Miner: <input type="checkbox"/> Annual: <input type="checkbox"/> Task: <input type="checkbox"/>																
15. Company of Employment: (If different from production operator) <i>Operator</i>				Independent Contractor ID: (if applicable)												
16. On-site Emergency Medical Treatment: Not Applicable: <input checked="" type="checkbox"/> First-Aid: <input type="checkbox"/> CPR: <input type="checkbox"/> EMT: <input type="checkbox"/> Medical Professional: <input type="checkbox"/> None: <input type="checkbox"/>																
17. Part 50 Document Control Number: (form 7000-1)				18. Union Affiliation of Victim: <i>9999 None (No Union Affiliation)</i>												

Victim Information: 9

1. Name of Injured/III Employee: <i>John R. Phillippi</i>		2. Sex <i>M</i>	3. Victim's Age <i>36</i>	4. Last Four Digits of SSN: <i>6362</i>	5. Degree of Injury: <i>07 Occ Illnesses not classified 01 - 06</i>											
6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:				7. Date and Time Started: a. Date: <i>07/24/2002</i> b. Time: <i>15:00</i>												
8. Regular Job Title: <i>036 Continuous mining machine operator</i>			9. Work Activity when Injured: <i>022 Escaping hazard - entrapment by water</i>			10. Was this work activity part of regular job? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>										
11. Experience a. This		Years	Weeks	Days	b. Regular	Years	Weeks	Days	c. This	Years	Weeks	Days	d. Total	Years	Weeks	Days
Work Activity:		<i>0</i>	<i>0</i>	<i>0</i>	Job Title:	<i>1</i>	<i>27</i>	<i>0</i>	Mine:	<i>1</i>	<i>16</i>	<i>0</i>	Mining:	<i>11</i>	<i>40</i>	<i>0</i>
12. What Directly Inflicted Injury or Illness? <i>029 Water entrapment; wet, cold</i>				13. Nature of Injury or Illness: <i>230 Possible hypothermia, stress</i>												
14. Training Deficiencies: Hazard: <input type="checkbox"/> New/Newly-Employed Experienced Miner: <input type="checkbox"/> Annual: <input type="checkbox"/> Task: <input type="checkbox"/>																
15. Company of Employment: (If different from production operator) <i>Operator</i>				Independent Contractor ID: (if applicable)												
16. On-site Emergency Medical Treatment: Not Applicable: <input type="checkbox"/> First-Aid: <input type="checkbox"/> CPR: <input type="checkbox"/> EMT: <input type="checkbox"/> Medical Professional: <input checked="" type="checkbox"/> None: <input type="checkbox"/>																
17. Part 50 Document Control Number: (form 7000-1)				18. Union Affiliation of Victim: <i>9999 None (No Union Affiliation)</i>												

Accident Investigation Data - Victim Information



Event Number: 4 1 0 1 6 0 1

Victim Information: 10

1. Name of Injured/Ill Employee: <i>Mark E. Popernack</i>			2. Sex <i>M</i>	3. Victim's Age <i>41</i>		4. Last Four Digits of SSN: <i>7057</i>			5. Degree of Injury: <i>07 Occ illnesses not classified 01 - 06</i>						
6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:						7. Date and Time Started: <i>a. Date: 07/24/2002 b. Time: 15:00</i>									
8. Regular Job Title: <i>035 Continuous mining machine helper/utility</i>				9. Work Activity when Injured: <i>022 Escaping hazard - entrapment by water</i>					10. Was this work activity part of regular job? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>						
11. Experience a. This	Years	Weeks	Days	b. Regular	Years	Weeks	Days	c. This	Years	Weeks	Days	d. Total	Years	Weeks	Days
Work Activity:	<i>0</i>	<i>0</i>	<i>0</i>	Job Title:	<i>15</i>	<i>0</i>	<i>0</i>	Mine:	<i>1</i>	<i>8</i>	<i>0</i>	Mining:	<i>20</i>	<i>0</i>	<i>0</i>
12. What Directly Inflicted Injury or Illness? <i>029 Water entrapment; wet, cold</i>								13. Nature of Injury or Illness: <i>230 Possible hypothermia, stress</i>							
14. Training Deficiencies: Hazard: <input type="checkbox"/> New/Newly-Employed Experienced Miner: <input type="checkbox"/> Annual: <input type="checkbox"/> Task: <input type="checkbox"/>															
15. Company of Employment: (If different from production operator) <i>Operator</i>								Independent Contractor ID: (if applicable)							
16. On-site Emergency Medical Treatment: Not Applicable: <input type="checkbox"/> First-Aid: <input type="checkbox"/> CPR: <input type="checkbox"/> EMT: <input type="checkbox"/> Medical Professional: <input checked="" type="checkbox"/> None: <input type="checkbox"/>															
17. Part 50 Document Control Number: (form 7000-1)								18. Union Affiliation of Victim: <i>9999 None (No Union Affiliation)</i>							

Victim Information: 11

1. Name of Injured/Ill Employee: <i>Robert E. Pugh</i>			2. Sex <i>M</i>	3. Victim's Age <i>50</i>		4. Last Four Digits of SSN: <i>9915</i>			5. Degree of Injury: <i>07 Occ illnesses not classified 01 - 06</i>						
6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:						7. Date and Time Started: <i>a. Date: 07/24/2002 b. Time: 15:00</i>									
8. Regular Job Title: <i>050 Shuttle car operator</i>				9. Work Activity when Injured: <i>022 Escaping hazard - entrapment by water</i>					10. Was this work activity part of regular job? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>						
11. Experience a. This	Years	Weeks	Days	b. Regular	Years	Weeks	Days	c. This	Years	Weeks	Days	d. Total	Years	Weeks	Days
Work Activity:	<i>0</i>	<i>0</i>	<i>0</i>	Job Title:	<i>18</i>	<i>0</i>	<i>0</i>	Mine:	<i>1</i>	<i>8</i>	<i>0</i>	Mining:	<i>31</i>	<i>0</i>	<i>0</i>
12. What Directly Inflicted Injury or Illness? <i>029 Water entrapment; wet, cold</i>								13. Nature of Injury or Illness: <i>230 Possible hypothermia, stress</i>							
14. Training Deficiencies: Hazard: <input type="checkbox"/> New/Newly-Employed Experienced Miner: <input type="checkbox"/> Annual: <input type="checkbox"/> Task: <input type="checkbox"/>															
15. Company of Employment: (If different from production operator) <i>Operator</i>								Independent Contractor ID: (if applicable)							
16. On-site Emergency Medical Treatment: Not Applicable: <input type="checkbox"/> First-Aid: <input type="checkbox"/> CPR: <input type="checkbox"/> EMT: <input type="checkbox"/> Medical Professional: <input checked="" type="checkbox"/> None: <input type="checkbox"/>															
17. Part 50 Document Control Number: (form 7000-1)								18. Union Affiliation of Victim: <i>9999 None (No Union Affiliation)</i>							

Victim Information: 12

1. Name of Injured/Ill Employee: <i>Frank E. Stewart</i>			2. Sex <i>M</i>	3. Victim's Age <i>53</i>		4. Last Four Digits of SSN: <i>0310</i>			5. Degree of Injury: <i>07 Occ illnesses not classified 01 - 06</i>						
6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:						7. Date and Time Started: <i>a. Date: 07/24/2002 b. Time: 16:00</i>									
8. Regular Job Title: <i>049 Mine examiner/section foreman</i>				9. Work Activity when Injured: <i>022 Escaping hazard - water inundation</i>					10. Was this work activity part of regular job? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>						
11. Experience a. This	Years	Weeks	Days	b. Regular	Years	Weeks	Days	c. This	Years	Weeks	Days	d. Total	Years	Weeks	Days
Work Activity:	<i>0</i>	<i>0</i>	<i>0</i>	Job Title:	<i>20</i>	<i>0</i>	<i>0</i>	Mine:	<i>0</i>	<i>12</i>	<i>0</i>	Mining:	<i>30</i>	<i>0</i>	<i>0</i>
12. What Directly Inflicted Injury or Illness? <i>126 Water inundation</i>								13. Nature of Injury or Illness: <i>400 Stress from escaping inundation</i>							
14. Training Deficiencies: Hazard: <input type="checkbox"/> New/Newly-Employed Experienced Miner: <input type="checkbox"/> Annual: <input type="checkbox"/> Task: <input type="checkbox"/>															
15. Company of Employment: (If different from production operator) <i>Operator</i>								Independent Contractor ID: (if applicable)							
16. On-site Emergency Medical Treatment: Not Applicable: <input checked="" type="checkbox"/> First-Aid: <input type="checkbox"/> CPR: <input type="checkbox"/> EMT: <input type="checkbox"/> Medical Professional: <input type="checkbox"/> None: <input type="checkbox"/>															
17. Part 50 Document Control Number: (form 7000-1)								18. Union Affiliation of Victim: <i>9999 None (No Union Affiliation)</i>							

Accident Investigation Data - Victim Information

U.S. Department of Labor
Mine Safety and Health Administration



Event Number: 4 1 0 1 6 0 1

Victim Information: 13

1. Name of Injured/Ill Employee: <i>Lawrence A. Summerville</i>		2. Sex <i>M</i>	3. Victim's Age <i>53</i>	4. Last Four Digits of SSN: <i>9578</i>	5. Degree of Injury: <i>07 Occ Illnesses not classified 01 - 06</i>										
6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:				7. Date and Time Started: <i>a. Date: 07/24/2002 b. Time: 15:00</i>											
8. Regular Job Title: <i>004 Floating mechanic/electrician</i>			9. Work Activity when Injured: <i>022 Escaping hazard - water inundation</i>		10. Was this work activity part of regular job? Yes No <input checked="" type="checkbox"/>										
11. Experience a. This	Years	Weeks	Days	b. Regular	Years	Weeks	Days	c. This	Years	Weeks	Days	d. Total	Years	Weeks	Days
Work Activity:	<i>0</i>	<i>0</i>	<i>0</i>	Job Title:	<i>26</i>	<i>0</i>	<i>0</i>	Mine:	<i>0</i>	<i>12</i>	<i>0</i>	Mining:	<i>33</i>	<i>0</i>	<i>0</i>
12. What Directly Inflicted Injury or Illness? <i>126 Water inundation</i>				13. Nature of Injury or Illness: <i>400 Stress from escaping inundation</i>											
14. Training Deficiencies: Hazard: New/Newly-Employed Experienced Miner: Annual: Task:															
15. Company of Employment: (If different from production operator) <i>Operator</i>						Independent Contractor ID: (if applicable)									
16. On-site Emergency Medical Treatment: Not Applicable: <input checked="" type="checkbox"/> First-Aid: CPR: EMT: Medical Professional: None:															
17. Part 50 Document Control Number: (form 7000-1)						18. Union Affiliation of Victim: <i>9999 None (No Union Affiliation)</i>									

Victim Information: 14

1. Name of Injured/Ill Employee: <i>John R. Unger</i>		2. Sex <i>M</i>	3. Victim's Age <i>52</i>	4. Last Four Digits of SSN: <i>9314</i>	5. Degree of Injury: <i>07 Occ Illnesses not classified 01 - 06</i>										
6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:				7. Date and Time Started: <i>a. Date: 07/24/2002 b. Time: 15:00</i>											
8. Regular Job Title: <i>014 Roof bolting machine operator</i>			9. Work Activity when Injured: <i>022 Escaping hazard - entrapment by water</i>		10. Was this work activity part of regular job? Yes No <input checked="" type="checkbox"/>										
11. Experience a. This	Years	Weeks	Days	b. Regular	Years	Weeks	Days	c. This	Years	Weeks	Days	d. Total	Years	Weeks	Days
Work Activity:	<i>0</i>	<i>0</i>	<i>0</i>	Job Title:	<i>12</i>	<i>0</i>	<i>0</i>	Mine:	<i>1</i>	<i>8</i>	<i>0</i>	Mining:	<i>28</i>	<i>0</i>	<i>0</i>
12. What Directly Inflicted Injury or Illness? <i>029 Water entrapment; wet, cold</i>				13. Nature of Injury or Illness: <i>230 Possible hypothermia, stress</i>											
14. Training Deficiencies: Hazard: New/Newly-Employed Experienced Miner: Annual: Task:															
15. Company of Employment: (If different from production operator) <i>Operator</i>						Independent Contractor ID: (if applicable)									
16. On-site Emergency Medical Treatment: Not Applicable: First-Aid: CPR: EMT: Medical Professional: <input checked="" type="checkbox"/> None:															
17. Part 50 Document Control Number: (form 7000-1)						18. Union Affiliation of Victim: <i>9999 None (No Union Affiliation)</i>									

Victim Information:

1. Name of Injured/Ill Employee:		2. Sex	3. Victim's Age	4. Last Four Digits of SSN:	5. Degree of Injury:										
6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:				7. Date and Time Started:											
8. Regular Job Title:			9. Work Activity when Injured:		10. Was this work activity part of regular job? Yes No										
11. Experience a. This	Years	Weeks	Days	b. Regular	Years	Weeks	Days	c. This	Years	Weeks	Days	d. Total	Years	Weeks	Days
Work Activity:				Job Title:				Mine:				Mining:			
12. What Directly Inflicted Injury or Illness?				13. Nature of Injury or Illness:											
14. Training Deficiencies: Hazard: New/Newly-Employed Experienced Miner: Annual: Task:															
15. Company of Employment: (If different from production operator)						Independent Contractor ID: (if applicable)									
16. On-site Emergency Medical Treatment: Not Applicable: First-Aid: CPR: EMT: Medical Professional: None:															
17. Part 50 Document Control Number: (form 7000-1)						18. Union Affiliation of Victim:									

Accident Investigation Data - Independent Contractor Information
 Event Number: 4 1 0 1 6 0 1

U.S. Department of Labor
 Mine Safety and Health Administration



Independent Contractor Information: 1

1. Company Name: <i>Musser Engineering, Inc.</i>		2. MSHA ID Number: K Q N	3. Type of Independent Contractor: <i>10 Surveying/engineering</i>
4. Nature of Contract Work: <i>Mine surveying, mine map and permit preparaton/certification</i>		5. Number of Independent Contractor employees On-Site at Time of Accident: a. Underground: 0 b. Surface: 0	
6. Independent Contractor Officials:			
	Title	Name	Address
	<i>[Other] President</i>	<i>Rabdy Musser</i>	<i>7785 Lincoln Highway, Central City, PA 15926</i>

Independent Contractor Information:

1. Company Name:		2. MSHA ID Number:	3. Type of Independent Contractor:
4. Nature of Contract Work:		5. Number of Independent Contractor employees On-Site at Time of Accident: a. Underground: b. Surface:	
6. Independent Contractor Officials:			
	Title	Name	Address

Independent Contractor Information:

1. Company Name:		2. MSHA ID Number:	3. Type of Independent Contractor:
4. Nature of Contract Work:		5. Number of Independent Contractor employees On-Site at Time of Accident: a. Underground: b. Surface:	
6. Independent Contractor Officials:			
	Title	Name	Address

APPENDIX C-1

General Description of Lithologic and Hydrologic Properties of the Freeport Sandstone

SANDIN E. PHILLIPSON, GEOLOGIST
PAUL L. TYRNA, GEOLOGIST
Roof Control Division, Pittsburgh Safety
and Health Technology Center

The Quecreek #1 mine is developed in the Upper Kittanning coal seam, which occurs stratigraphically in the Kittanning Formation of the Middle Pennsylvanian-aged Allegheny Group (Figure 1). The Allegheny Group consists primarily of sandstone and shale, with lesser amounts of clay, coal, and limestone, and includes the Kittanning and Freeport Formations. The Upper Kittanning coal seam occurs near the top of the Kittanning Formation, near the contact with the overlying Freeport Formation. The Freeport Formation consists dominantly of the Freeport sandstone, which represents an aquifer in Somerset County, and extends upward nearly to the base of the Lower Freeport coal seam (Figure 1).

Based on mine maps provided by the Ventilation Division of MSHA Technical Support, the Upper Kittanning coal seam strikes approximately N 0-5° E and dips 2.2° W in the 1-Left section of the mine. The strike roughly follows the fold axis of the nearby Boswell Dome, which trends approximately N 30° E, consistent with the structural grain of the Appalachian Basin, defined by fold axes and thrust faults that formed during the Late Pennsylvanian-Permian Alleghenian Orogeny. The mine is developed in the west flank of the Boswell Dome, an anticlinal structure bounded on the west by the Johnstown Syncline and on the east by the Somerset Syncline, representing a series of anticline-syncline pairs.

The Freeport sandstone is commonly interpreted to represent laterally-accreting fluvial systems and channel-margin levee-crevasse environments, with finer-grained clastics and coal deposited in floodplain environments. This depositional environment may host interbedded siltstone, sandstone, shale, and coal that are interpreted as levee-crevasse facies. Multiple cycles of shale with ironstone nodules and plant debris grade upward into underclays with rootlets and coal seams, and levee-crevasse deposits may interfinger with more massive channel sandstones. Sandstone is medium- to coarse-grained, and basal medium- to large-scale trough sets are overlain by tabular sets of cross stratification. Large scour surfaces indicate

erosion that resulted from a shift in channel position, with associated development of a second cycle of lateral, channel-fill accretion. Multiple cycles of channel shifting are indicated by laterally-accreting sandstones that are overlain by wedges of interbedded siltstone, sandstone, and shale that, in turn, grade laterally into more massive sandstone. Cycles of floodplain mud and swamp deposits above and below this lateral accretion sequence suggest cyclic floodplain-lake fill, followed by lake-margin swamp progradation. Gray and black shale with ironstone nodules and plant debris, representing floodplain-lake or well-drained swamp fill grade upward repeatedly into underclay and coal.

Groundwater in the area of the mine circulates in both deep and shallow systems (Poth, 1963). Locally, topographic highs bounded by streams form discrete hydrological islands in which the shallow groundwater system is recharged wholly from the surface of the island and discharge occurs in the bounding streams or in springs above the stream elevation. A deeper regional system circulates independently from the shallower system. It is recharged from major drainage divides such as the Boswell Dome, east of the mine and extends downward to the saline water contact. Flow in the shallow systems tends to vary with fluctuations in rainfall while the deep regional systems have a more constant flow pattern.

The base of the Freeport sandstone above the Quecreek reserves varies in proximity to the land surface from outcrop at the portals to roughly 250 feet below Quemahoning Creek and thus, may intersect both the shallow and deeper ground water systems. Although the Freeport sandstone is a known aquifer, variations in groundwater flow at any point in the formation are difficult to predict for two main reasons: 1. Due to the dynamics of the depositional environment, rocks in the Freeport sandstone unit are expected to exhibit a large variability in porosity, permeability, and hydraulic conductivity; 2. The Freeport sandstone probably intersects both the shallow and deep groundwater systems and is subject to varying recharge rates.

Inspection of topographic maps suggests that the Freeport sandstone, which in this area hosts wells producing 10-45 gallons per minute, is unconfined above an elevation of approximately 1900 feet, where the Allegheny Group outcrops near the town of Quecreek, in the Quemahoning Creek stream valley. It is expected that water in the Freeport sandstone above an elevation of approximately 1900 feet would migrate laterally toward the unconfined outcrop, discharging as a spring. Water

in the Freeport sandstone below an elevation of approximately 1900 feet, which is down dip from the face areas and down dip from the western flank of the Boswell Dome, is expected to represent a confined aquifer.

Miners' statements indicate that sporadic dripping was encountered during bolting operations. As reported by a MSHA investigation team member, conditions were dryer when sandstone was encountered in the immediate roof, and wetter when shale with "mud streaks" or "clay streaks" was encountered. These statements suggest a possibility that either sandstone bodies were isolated by surrounding, low permeability shale, or that formation water above the mining elevation had migrated to a discharge point at outcrop. Statements by miners that water was encountered in shale, especially where "mud seams," or clay gouge, occurred, suggest that the source of water was possibly of secondary permeability (i.e. joints, faults, or bedding planes) or that perhaps the water represented a "perched" source. A perched zone of groundwater may form where underlain by a clay layer that did not allow the water to continue to seek its lowest horizon under the force of gravity.

The occurrence of clay gouge is consistent with the development of fault zones, which form as rock is subjected to grinding action along a fault plane. Laterally discontinuous lenses of clay may also occur in the shale units that represent floodplain deposits interspersed between sandstone channels. Although faults are generally considered as high angle features, the Appalachian Basin hosts extensive development of low-angle faults and drag folds that are associated with a style of faulting along bedding planes known as coal bed decollement. Drag folds and low-angle faults were described in Upper Kittanning coal mine roof rocks in Somerset County by Iannacchione et al. (1981) during a study of the controls on roof instability.

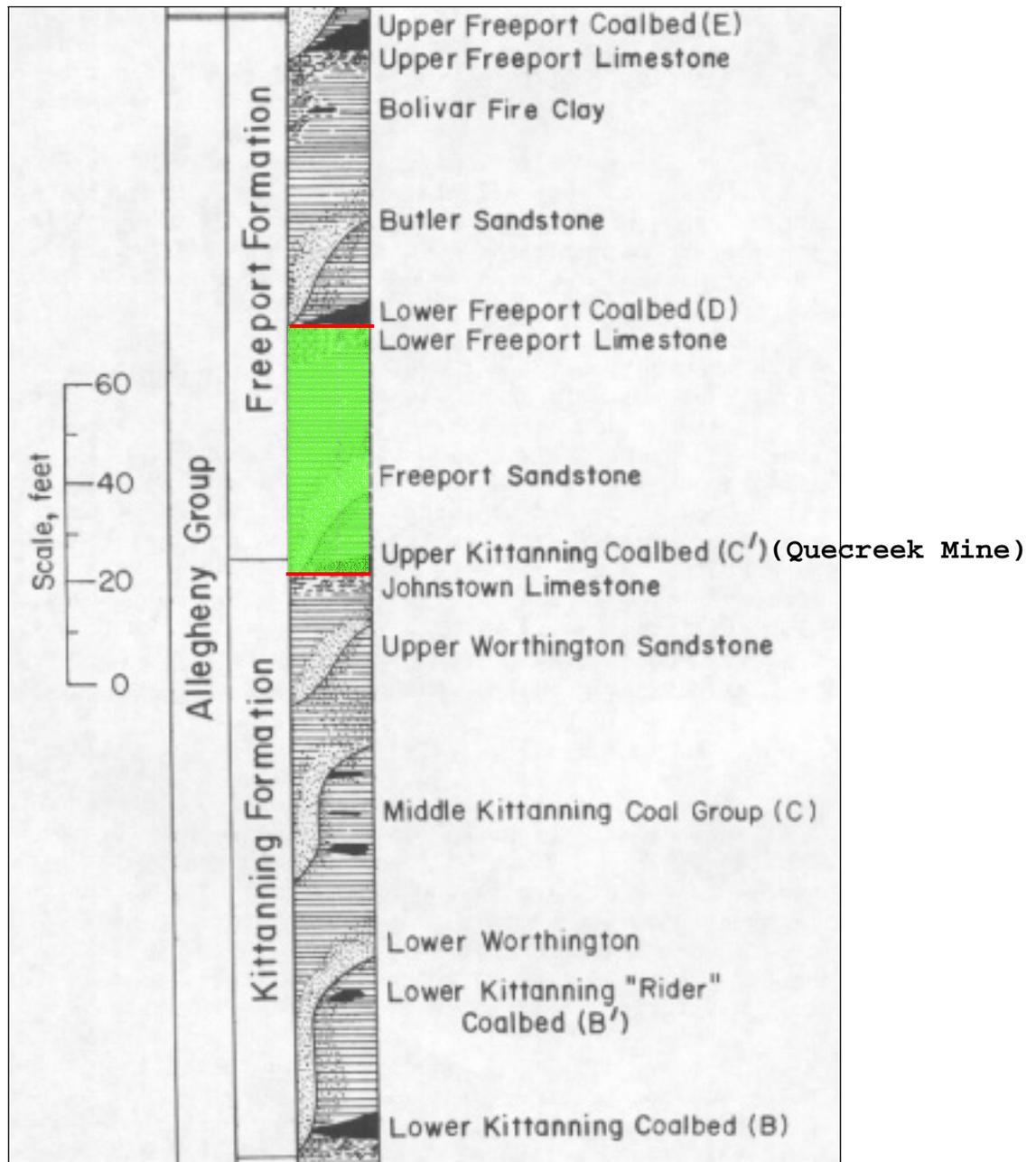


Figure 1. Stratigraphic column of the Middle Pennsylvanian-aged Allegheny Group, showing thickness of rock units in the Kittanning and Freeport Formations. Shaded area represents interburden between the Upper Kittanning coal seam, where Queecreek #1 mine is developed, and the overlying Lower Freeport coal seam. Modified From Iannacchione, A.T., Ulery, J.P., Hyman, D.M., and Chase, F.E., 1981, Geologic Factors in Predicting Coal Mine Roof-Rock Stability in the Upper Kittanning Coal bed, Somerset County, PA: U.S. Bureau of Mines, RI 8575.

APPENDIX C-2

Field Observations of 1-Left Section, Face Area

SANDIN E. PHILLIPSON, GEOLOGIST
Roof Control Division, Pittsburgh Safety
and Health Technology Center

Geologic observations were conducted near the face areas of the 1-Left section, Quecreek #1 mine on November 26, 2002. Three different kinds of structural geologic features are present in the studied area: 1) joints, which are vertical and strike 105-115°; 2) wedge-shaped slickensides, which represent drag folds with fold axes of 170-190°; 3) a normal fault, which strikes 170° and dips 30° E. The wedge-shaped slickensides and the fault are nearly coincident, forming a fault zone that trends diagonally across the mining section at approximately N 0-10° W. The fault extends from the limestone floor, through the coal, and into the shale roof, whereas wedge-shaped slickensides are restricted to the shale roof along the strike of the fault. Light water dripping, 1-3 drips per second, was observed issuing from the fault zone across the section, whereas no water was observed dripping from joints. The studied area was characterized by sufficient moisture to cause rock dust on the roof and ribs to feel sticky to the touch, although dripping water was restricted to the fault zone. Although several low areas in the observed area hosted shallow (<3 inches) water ponds, water did not appear to be issuing from the floor. It appears that the N 0-10° W-striking fault zone represents a preferential conduit for groundwater, localizing seepage in the observed area.

Observations

Observations began three crosscuts outby the faces, in the crosscut that connects Nos. 4 and 5 entries ([Drawing 1](#)). A prominent wedge-shaped slickenside (drag fold), with a strike of 170° and limb dips of 30° E and 60° W occurs in this crosscut, and hosts local roof degradation characterized by pot-outs of fossiliferous black shale. The drag fold's limbs were very moist, and light water dripping of approximately 1 drip per second was observed along the apex of the fold, which represents the spine of the wedge.

Observations resumed in No. 1 entry. At Location 1 ([Drawing 1](#)), a directional drilling hole with a reported length of approximately 2,100 feet was present. At the time of the field

observation, a steady stream of water approximately 1 inch in diameter was flowing from the 4-inch-diameter pipe.

Observations proceeded to Location 2 ([Drawing 1](#)), where the entry was reportedly dropped due to locally adverse ground conditions. The intersection was characterized by slabby roof conditions in the shale immediate roof, and sporadic dripping of approximately 3 drips per second. Slabby conditions were a result of the intersection between a series of 105-115°-striking micro joints that are spaced 2-9 inches apart, and 1½-inch spaced partings in thinly laminated black shale. Horsetail shear zones commonly occur between joints that are spaced 2-3 inches apart. Bedding partings in the black shale host carbonized plant debris and small "dollars" of pyrite or marcasite. Although the bedding partings in black shale are very smooth and represent planes of preferential weakness, they are not slickensides.

Observations progressed to the face of No. 1 entry, where a series of vertical, 105°-striking micro joints are present, spaced 18-36 inches apart. No seepage was observed from the joints or in the roof of the No. 1 entry face area. The faces of Nos. 2-4 entry, and the last open crosscut, were observed, and found to host variably spaced micro joints that strike approximately due east. At Location 3, in the No. 5 entry face, light water dripping of approximately 1 drip per second to 1 drip per 2 seconds was observed from the roof at the face, and the presence of east-striking micro joints continued.

At Location 4, adjacent to the seals installed just outby the last open crosscut between Nos. 6 and 7 entries, a prominent fault zone was observed ([Drawing 1](#)). The fault zone extends through the hard limestone floor, upward through the coal seam, and disappears into the shale roof. The fault plane strikes 170° and dips 30° E, and is downthrown by approximately 12-18 inches to the east, defining a normal fault. The shale roof hosts a zone of stacked wedge-shaped slickensides in the footwall, or bottom block of the fault. The apices of drag folds in the footwall strike 190°, with limbs that dip 25° W and 30° E, parallel to the plane of the normal fault. The highly polished, slickensided drag fold limbs host slickenlines that are perpendicular to the fold axis, and discreet chatter marks that are highlighted by rock dust. The coal seam is fractured and eroded out in the fault's footwall. Consequently, the fault surface is very well exposed in the rib and hosts concentrations of smeared-out iron hydroxide that may represent altered pyrite.

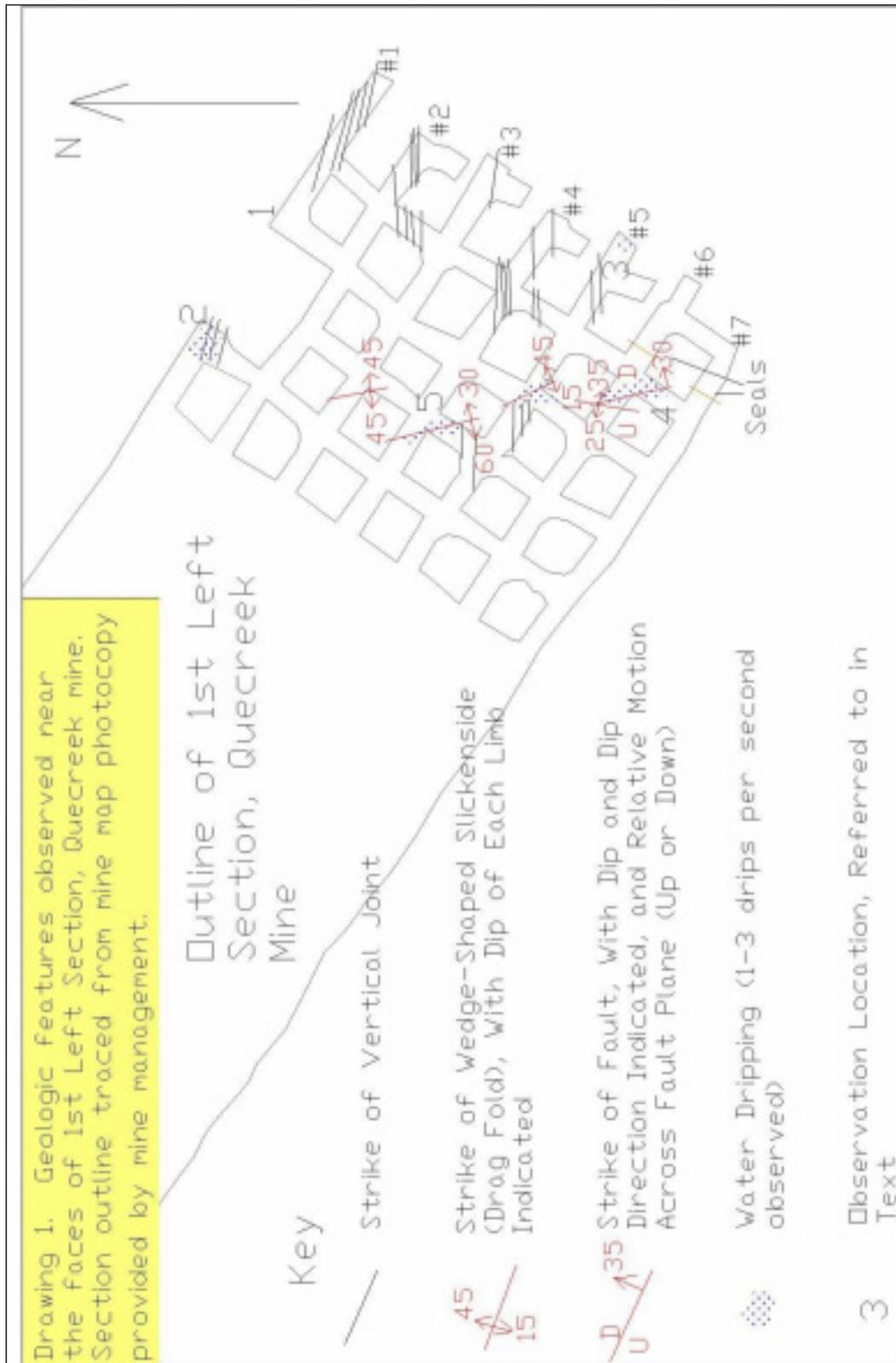
Observations were concluded in this area at Location 5, near a 6-inch borehole. When observations began on the section, a length of pipe had been present in the borehole, and extended to the mine floor. At the conclusion of observations, the pipe had been removed, leaving the visible portion of the borehole empty. A steady rain of water was observed issuing from the borehole, and was estimated at approximately 50 drips per second. Assuming a volume of 1 mL per water droplet, this rate would be equivalent to approximately 0.8 gallons per minute.

Discussion

The area within approximately five crosscuts of the face in the 1-Left section is characterized by very low water seepage, which is very preferentially localized along a fault zone. Although consistently oriented micro joints are common throughout the observed area, they were not associated with water seepage except at Location 2, which is also along the trend of the fault zone. Although rock dust on the roof and ribs was characterized by a sticky texture, indicating some moisture content, it was not clear that the source of this moisture was from groundwater. Instead, a general condition of moist air is common in mines with some temperature gradient where cold air comes into contact with warm air, and is not often noteworthy. Additionally, no water was observed issuing from the ribs or from bolt holes, and no iron-hydroxide "stalactites" were present on bolt heads.

The observation that water seepage was preferentially concentrated along the trend of the fault zone suggests that the fault zone represents a conduit between the mine and groundwater in overlying strata. The fault is very well exposed in No. 6 entry, 2½ crosscuts outby the face, and shows strata offset in the pillar rib. Because strata in the hanging wall of the fault were shifted down relative to the footwall, the fault can be classified as a "normal fault." The fault plane is not well exposed as the zone trends diagonally across the section, but the zone is instead prominently characterized by a series of wedge-shaped slickensides (drag folds) in the shale immediate roof. Wedge-shaped slickensides are indicative of a style of bedding-parallel faulting in which sequences of coal measure strata slide on a layer of shale above a coal seam. The shale commonly represents the most easily deformed layer between the relatively hard, underlying coal seam, and a hard, overlying sandstone. This style of bedding-parallel faulting above coal seams is known as "coal bed decollement" and is commonly observed in coal mines throughout the Appalachian basin. Thus, the wedge-shaped slickensides represent a tectonic style of

slickenside, and differ from "clay veins" or other slickensides that are commonly attributed to compaction mechanisms.



APPENDIX D - TABLE 1

The symbol "[?]" signifies that information was not readable on the document.

Table 1. Results of Map Search by Musser/RoxCoal/PBS

Potential Source	Information Obtained
<p>1. Consol Energy, Inc., formerly Consolidation Coal Company Pittsburgh, PA</p> <p>[Appendix G, Maps 14 & 15]</p>	<p>Consol property map, 1"=1000', no date, no title block or legend; detailed workings of a portion of Consol No. 120 mine; detailed workings on the eastern side of Harrison No. 2 mine; detailed outline of workings on the western side of Harrison No. 2 mine; two locations noted by Musser as locations used to transfer Harrison No. 2 mine onto coordinate system used by Quecreek #1 mine. This was the map used by Musser to locate and transfer the outline of Harrison No. 2 mine to the Quecreek #1 mine map.</p>
<p>2. Carlton Barron Boswell, PA</p>	<p>Titled as "Property Map, The Saxman Coal & Coke Co., Lincoln Twp., Somerset Co., PA," 1"=400', map is labeled with "Posted to 12-31-48;" single line depiction of workings on the eastern side of Harrison No. 2 mine with hatched areas denoting pillar recovery; approx. 3000 feet of the South Mains is shown. Also shows Harrison No. 1 mine north of Harrison No. 2 mine.</p>
<p>3. Office of Surface Mining map repository. Greentree, PA</p>	<p>Map #03129-225-35X-349467, hand written title "Harrison No. 2, Saxman Coal & Coke, Quecreek, Somerset Co.;" no scale; detailed drawing of a portion of the northern and eastern areas of Harrison No. 2 mine; approx. 1500 feet of the South Mains is shown.</p>
<p>4. Office of Surface Mining map repository. Greentree, PA</p>	<p>Map #03157-188-29X-358045, no title, approx. scale 1"=800'; single line drawing depicting workings in Harrison No. 2 mine east of the South Mains with hatched areas denoting pillar recovery; approx. 9100 feet of the South Mains is shown; single line drawing depicting one panel of workings west of the South Mains and toward their southern limit. Also shows the Harrison No. 1 mine north of the Harrison No. 2 mine.</p>

Potential Source	Information Obtained
<p>5. PA Department of Environmental Protection McMurray, PA</p>	<p>Map #03046-321-30X-316626; labeled as "The Saxman Coal & Coke Co., E No. 2, Lincoln Twp, Somerset Co., Scale 1 in.=100 ft.;" Upper Freeport coal seam; shows detailed workings of the mine; contains "Index to Surveys" showing dates specific areas were mined; contains notarized statement from mine engineer [Kimmel] that print is a "true and correct copy of original map;" contains letter dated April 11, 1960, from mine superintendent [Kimmel] to PA Department of Mines indicating that mine is closed indefinitely as of March 1, 1960; contains letter dated April 14, 1960, from PA Department of Mines and Mineral Industries acknowledging receipt of map and informing Saxman that no statement was included certifying the map as true and correct.</p>
<p>6. Office of Surface Mining Map Repository. Greentree, PA</p>	<p>Map #03055-80-22X-319334; labeled as "Saxman E No. 1;" no scale; Upper Freeport coal seam; shows detailed working of mine; contains Kimmel's "Index to Surveys" showing dates specific areas were mined; contains Kimmel's hand-written statement that mining was suspended as of May 9, 1953.</p>
<p>7. PA Department of Environmental Protection McMurray, PA</p>	<p>Map #03014-69-24X-304012; labeled as "Mines Nos. 120 & 121, The Consolidation Coal Co Inc., Penna. Division, [scale bar unreadable], July [??], C'-Seam Coal-3'-10"," detailed and single line drawing depiction of workings in the referenced mines; detailed workings in mines south of Nos. 120/121, possibly Harrison No. 1 and No. 2.</p>
<p>8. PA Department of Environmental Protection McMurray, PA</p>	<p>Map #0301[?]-97-66X-04202[?]; labeled as "Consolidation No. 123, Consolidation Coal Company, Inspection No. [?], February 26 to March 2, 1942;" shows detailed workings in referenced mine; several nearby small, unidentified mines.</p>

Potential Source	Information Obtained
<p>9. Office of Surface Mining map repository. Greentree, PA</p>	<p>Map #03022-78-30X-306885; labeled as "Topographical Map, Quemahoning Creek Coal Company Property, Situated in Lincoln Township, Somerset County, Pennsylvania, Scale 1"=400', True Meridian, Contour Interval 1=20', Engr. Dept. Somerset, Pa., May 31, 192[?];" contains legend with mineral and surface ownership by various coal companies; shows shaded area of mines that are possibly Harrison No. 2 and Consol 118/119.</p>
<p>10. Office of Surface Mining map repository. Greentree, PA</p>	<p>Map #03022-77-30X-306885; date May 31, 192[?], no label or scale; mine on map not identified by Musser/RoxCoal/PBS; shows detailed workings of Harrison mine.</p>
<p>11. Office of Surface Mining map repository. Greentree, PA</p>	<p>Map #03014-331-36X-304230; labeled as "Mine No. 120, Consolidation Coal Co, Penna. District, [scale unreadable], December [?];" shows several small abandoned mines; shows extreme northern portion of Harrison No. 2 mine.</p>
<p>12. Jim Allenbaugh, owner of coal properties in Somerset area, Friedens, PA</p>	<p>No maps provided.</p>
<p>13. MSHA District 2 office Hunker, PA</p>	<p>No maps provided.</p>

APPENDIX D - TABLE 2

The symbol "[?]" signifies that information was not readable on the document.

Table 2. Results of Information/Map Search by Investigators

Potential Source	Information Obtained
1. PA Deep Mine Safety Uniontown, PA	Blow-up of map number 4 in table 1, Map #03157-188-29X-358045.
2. Berwind Natural Resources Corporation. Windber, PA	Map labeled as "Barron-Saxman Coal & Coke, Scale 1"=500', C'-Mine; no date; map showed a red shaded area depicting areas mined in early years in Saxman/Harrison/Harrison No. 2 mine.
3. Musser Engineering Central City, PA	Same as map number 2 in table 1.
4. Office of Surface Mining map repository. Greentree, PA	Same as map number 5 in table 1, Map #03046-321-30X-316626.
5. Office of Surface Mining map repository. Greentree, PA	Same as map number 10 in table 1, Map #03022-77-30X-306885.
6. Office of Surface Mining map repository. Greentree, PA	Map #03157-198-33X-358053, titled "The Saxman Coal & Coke Co, E No. 2, Lincoln Twp, Somerset Co., Pa., Scale 1in=100ft;" Upper Freeport coal seam; appears to be older than map number 5.
7. Office of Surface Mining map repository. Greentree, PA	Map titled "C-Prime, Somerset Sheet No. 9, Upper Kittanning u.k." created by Works Progress Administration; dated 1936; scale 1 in=1/2 mile; shows early workings in mine operated by the Quemahoning Creek Coal Company, which became part of Harrison mine.
8. Office of Surface Mining map repository. Greentree, PA	Same as map number 3 in table 1, Map #03129-225-35X-349467.
9. Office of Surface Mining map repository. Greentree, PA	Same as map number 4 in table 1, Map #03157-188-29X-358045.

Potential Source	Information Obtained
<p>10. Office of Surface Mining map repository. Greentree, PA</p> <p>[Appendix G, Map 13]</p>	<p>Map #03157-188-29X-358045 shows single-line depiction of mine workings of Harrison No. 1 and No. 2 mine. This map is undated and contains no title block. It is a part of map 11, below.</p>
<p>11. Office of Surface Mining map repository. Greentree, PA</p> <p>[Appendix G, Map 13]</p>	<p>Map #03157-189-29X-358045 titled "Property Map, The Saxman Coal & Coke Co., Lincoln Twp., Somerset, Co., Pa., Scale 1"=400';" contains wording "Posted to 7-1-57" and legend showing surface and mineral ownership; contains an "Index to Tracts."</p>
<p>12. Office of Surface Mining map repository. Greentree, PA</p>	<p>Map #319334, no label, listed as Saxman E No. 1; Upper Freeport coal seam; shows detailed workings; contains "Index to Surveys" with last entry of March 8, 1953; contains written statement "Operations at this mine have been suspended indefinitely as of March 9, 1953. The Saxman Coal & Coke Co., J.E. Kimmel, Supt-Engineer;"</p>
<p>13. Windber Coal Heritage Center Windber, PA</p> <p>[Appendix G, Map 12]</p>	<p>No label, no scale index (appears to be 1"=100'); contains "Index to Surveys" with last entry date of January 1, 1964; outside corner of rolled map had hand-written label "C.H. Maize, Saxman C&C Co., Harrison No. 2, Final 1964;" shows detailed workings of Harrison No. 2 mine from 1947 to 1964. This map was in private possession until turned over to the Center in June 2002.</p>
<p>14. Consol Energy, Inc., formerly Consolidation Coal Company Pittsburgh, PA</p> <p>[Appendix G, Maps 14 & 15]</p>	<p>Property map labeled "Consolidation Coal Company, C Prime Upper Kittanning Seam, Somerset County Co., Scale 1"=1000';" no date; shows Consol ownership status of various areas; shows detailed workings of a portion of Harrison No. 2 mine east of the South Mains; shows detailed outline of workings west of the South Mains;</p>

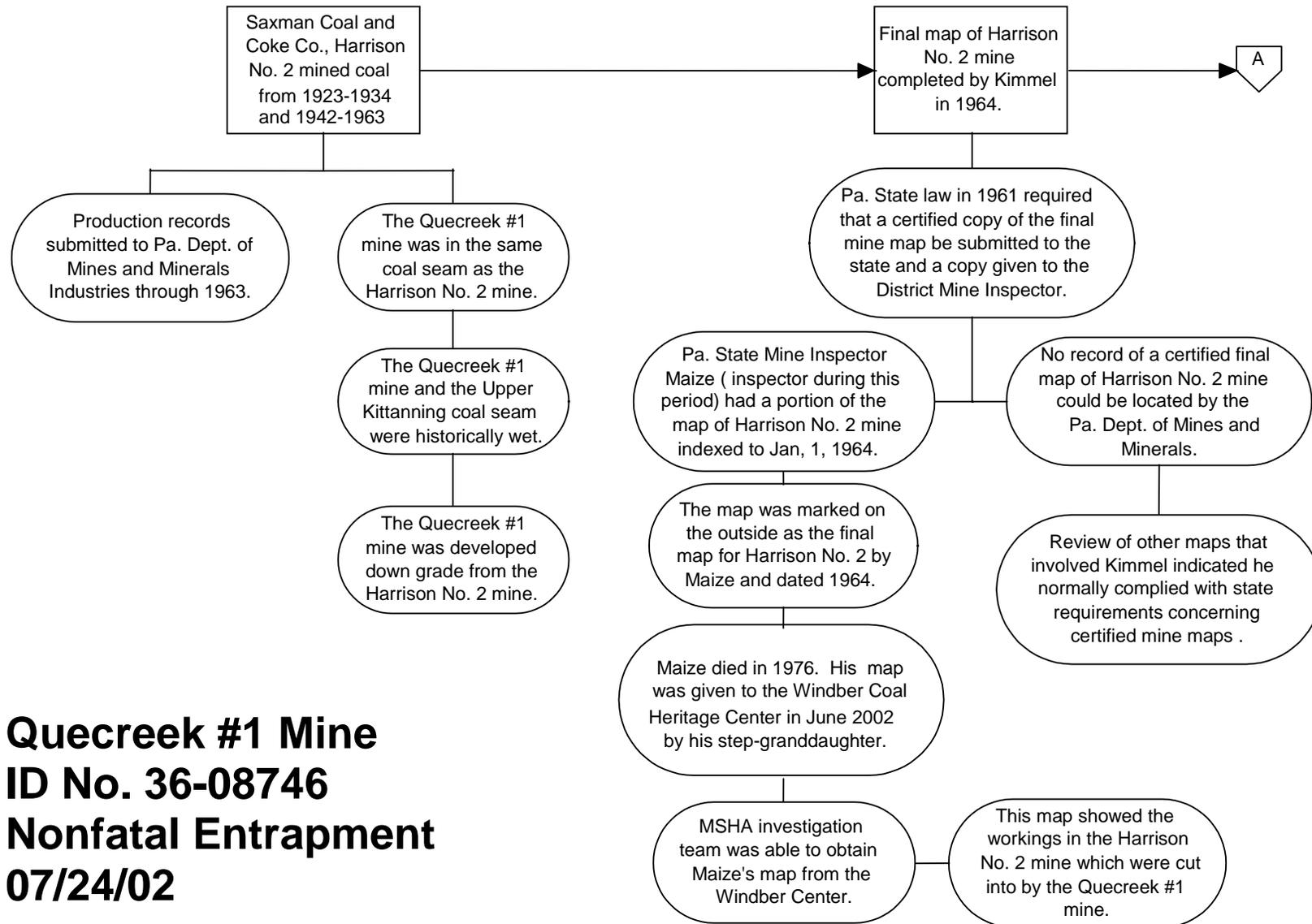
Potential Source	Information Obtained
<p>15. Consol Energy, Inc., formerly Consolidation Coal Company Pittsburgh, PA</p>	<p>Map labeled as "Consolidation Coal Company, Jennerstown Project, Summary Map, Scale 1"=1000', Contour Interval 20', Prepared by: C.Yurchick, Date: 5-26-78;" shows shaded area labeled as "(UK Deep)" in vicinity of Harrison No. 2 mine; no details other than outline; cross section drawing showing Upper Kittanning seam mined out in area west of Quemahoning Creek.</p>
<p>16. University of Pittsburgh Archive Service Center Pittsburgh, PA</p>	<p>Center contains "Historical Coal Mine Maps" received from Consolidation Coal Company for archiving. Maps found at this location showed general area features and a few portions of mines dating up to the 1930's and 1940's. Map "J-8-C" showed the extreme northern end of Harrison No. 2 mine. The adjoining map that would show the southern sections of the mine could not be located.</p>
<p>17. William McIntire William McIntire Coal, Oil & Gas Shelocta, PA</p>	<p>Purchased all of Consolidation Coal Company's Somerset County coal reserves in approximately 1992. He stated that any maps he had were given to Musser during the permitting process.</p>
<p>18. Wayne C. Shaulis Quecreek, PA</p>	<p>Owned coal rights near the entrance to Harrison No. 2 mine. Stated that Saxman never made royalty payments to him. Had no maps.</p>
<p>19. Thelma Casebeer Sipesville, PA</p>	<p>Relatives donated land to church presently named "Christ Casebeer Lutheran Church." Had no maps, but felt that church might. Discussions with church personnel revealed that the church had no maps.</p>
<p>20. The EADS Group Somerset, PA</p>	<p>Consulting engineering firm reportedly given maps/materials by granddaughter of C.H. Maize, State mine inspector. Had no information.</p>

Potential Source	Information Obtained
21. Mary S. Biesecker Public Library Somerset, PA	Materials reportedly donated to library by granddaughter of C.H. Miaze, State mine inspector. Had no information. Reported that all materials were subsequently turned over to Somerset County Library.
22. Somerset County Library Somerset, PA	Library possessed numerous annual reports of the PA Bituminous Coal Division that provide mine employment and production data by year. Name "C.H. Maize" written on inside cover of many books. Reports show the Harrison No. 2 mine produced coal into 1963. Reports J.E. Kimmel as the General Superintendent for most years. The 1964 report does not list the Harrison No. 2 mine.
23. Cambria County Courthouse - Recorder of Deeds Ebensburg, PA	Courthouse reportedly once housed an office of the State Bureau of Deep Mine Safety. Maps were found for mines in Cambria County.
24. Office of Surface Mining mine map repository Greentree, PA	Computer listings of map holdings. Searches performed by mine name (search range "Saxman to Saxmon" and "Harrison to Harrisu"); quadrangle (search range "Somerset").
25. Musser Engineering Central City, PA	Two property maps reported to be marketing maps provided by Consolidation Coal Company.
26. Consol Energy, Inc., formerly Consolidation Coal Company Pittsburgh, PA	Coal sale information from 1955 and 1992. Portion of 1976, 1977, and 1979 maps showing Consol property status in the area of the Harrison No. 2 mine. A 1955 Somerset property map showing the northern portions of the Harrison No. 2 mine with seam contours. Several reports regarding the coal reserves in the "Jenner Project."

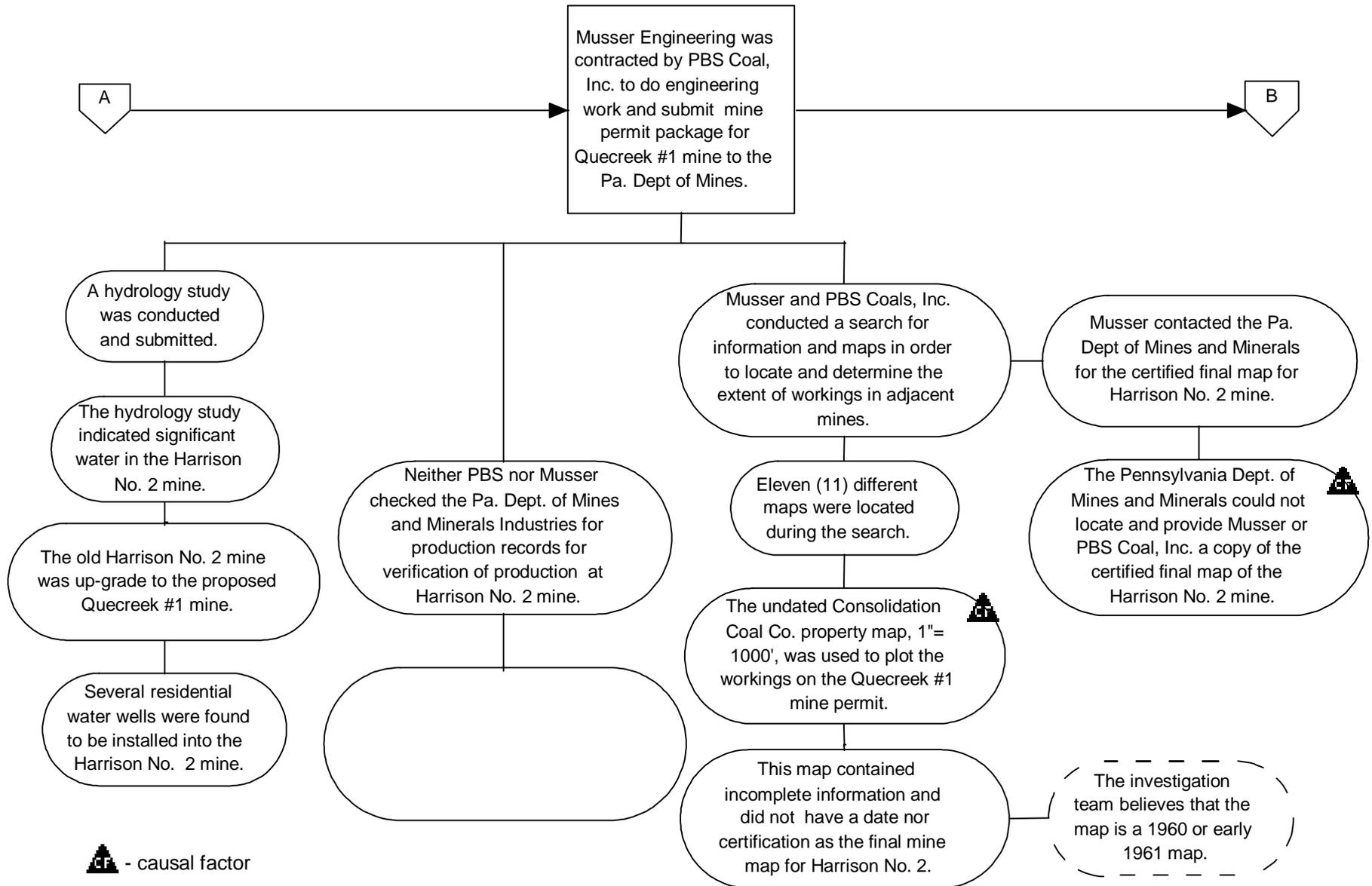
Potential Source	Information Obtained
<p>27. Musser Engineering Central City, PA</p>	<p>Two Consol maps that Musser received following sale of coal from Consol to McIntire. Labeled as "Consolidation Coal Company; Jennerstown Project; Upper Kittanning [C-Prime]; Reserve Areas." Contained a colored index to Consol coal properties; scale 1"= 1000'. One map shows workings in the northern portion of Saxman mine and original map contained penciled outline of Harrison No. 2 workings roughly matching outline shown in map listed in Number 1, Table 1.</p>
<p>28. Somerset County Assessment Office Somerset, PA</p>	<p>Two maps from assessment office. Maps were labeled as "Coal Property Map, Lincoln Township, Somerset County, Pennsylvania, District 24, Sheet 205 and 208." The maps contained the tract of property owned by Elias G. and Eve Bittner. The property was identified as 205-035 and was depicted in part on each of the two sheets - 205 and 208. The maps were obtained on June 5, 2003, along with other tax information. John Riley, Chief Assessor, provided copies of the information.</p>

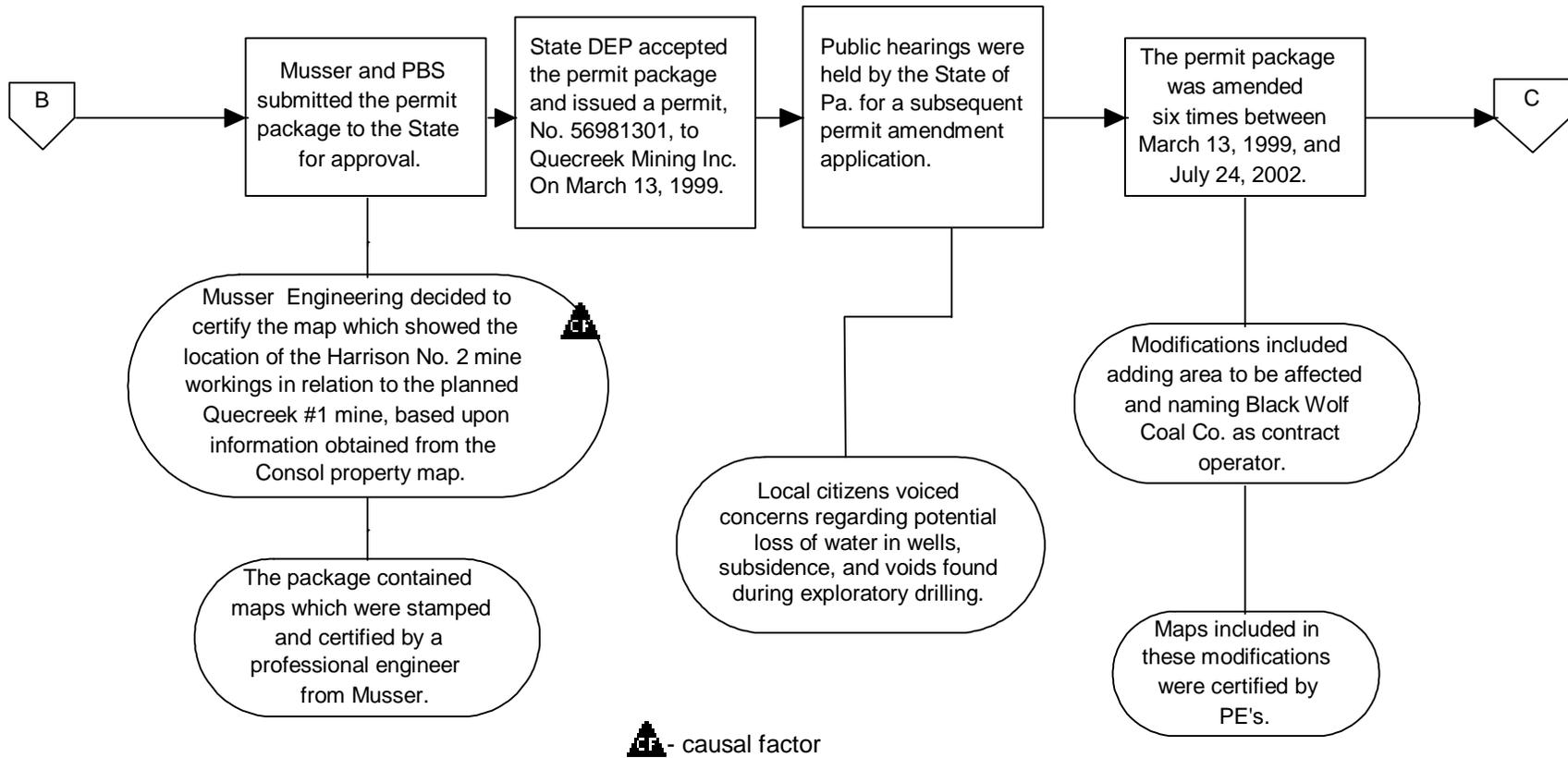
APPENDIX E

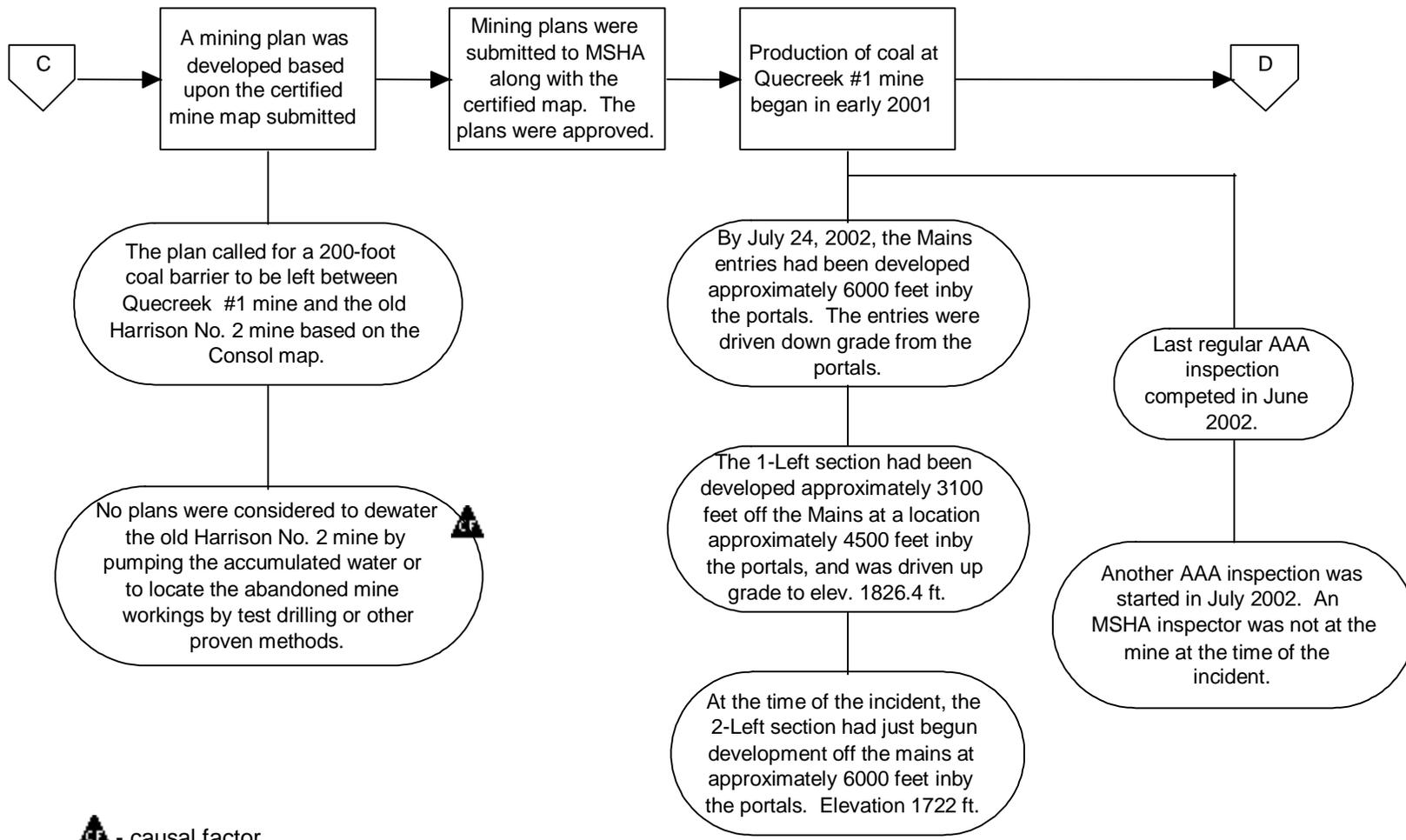
ROOT CAUSE ANALYSIS OF BREAKTHROUGH



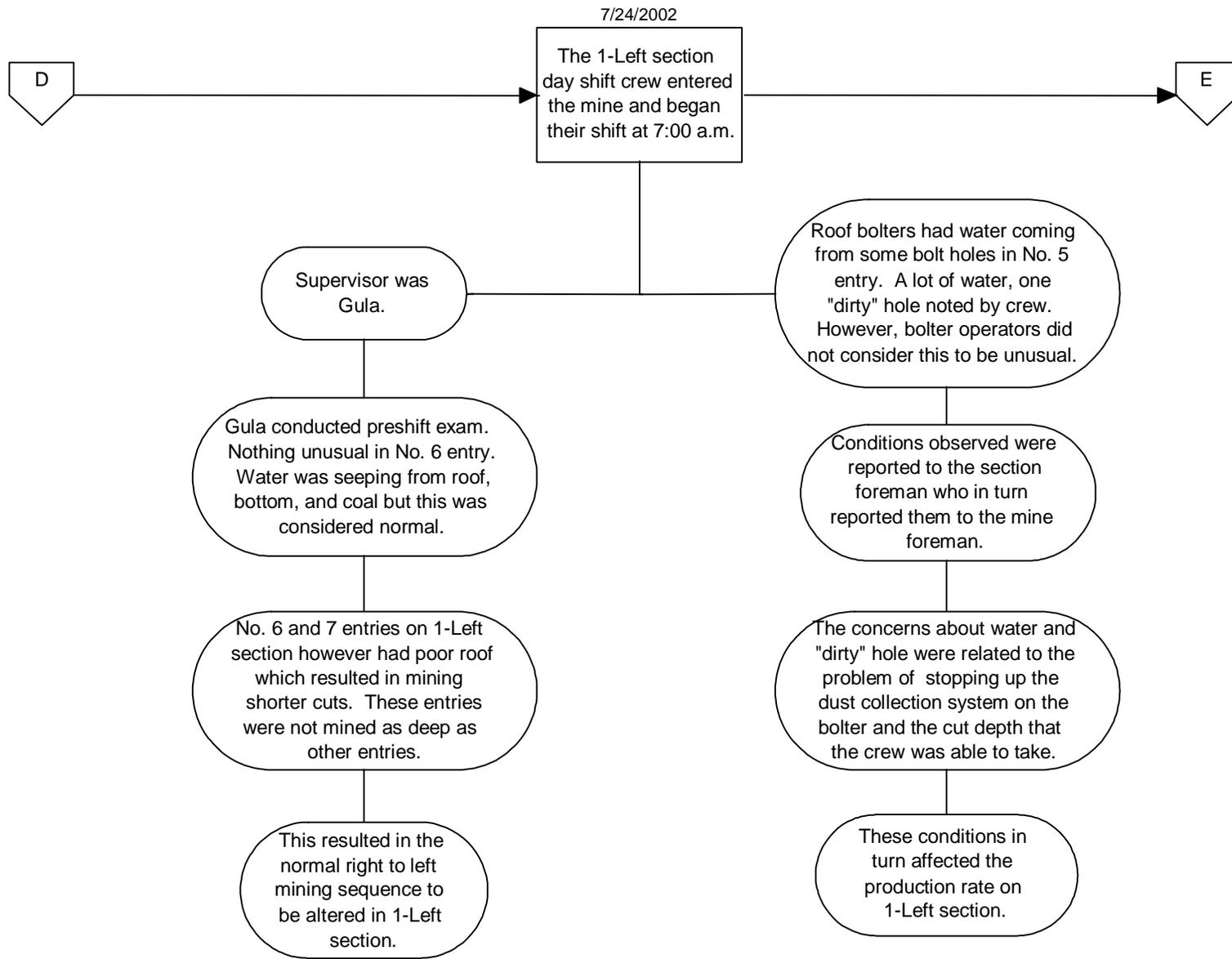
**Quecreek #1 Mine
ID No. 36-08746
Nonfatal Entrapment
07/24/02**

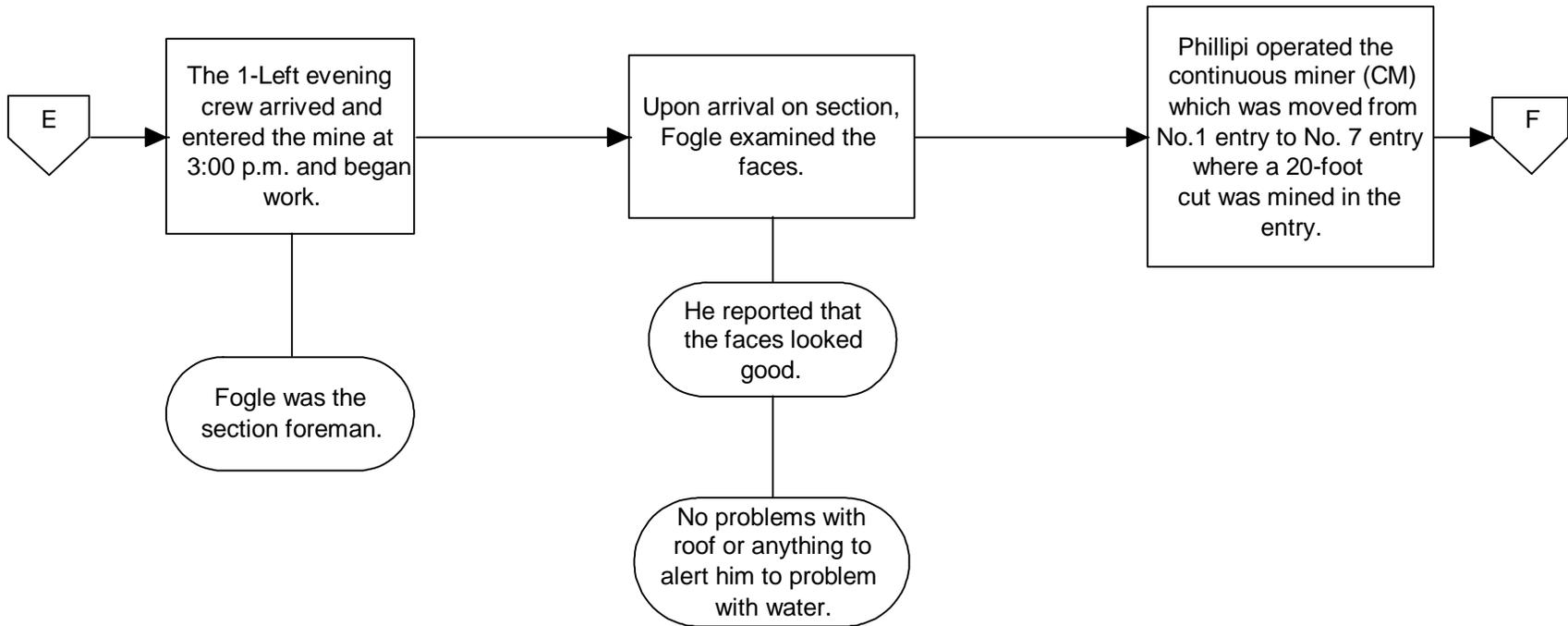


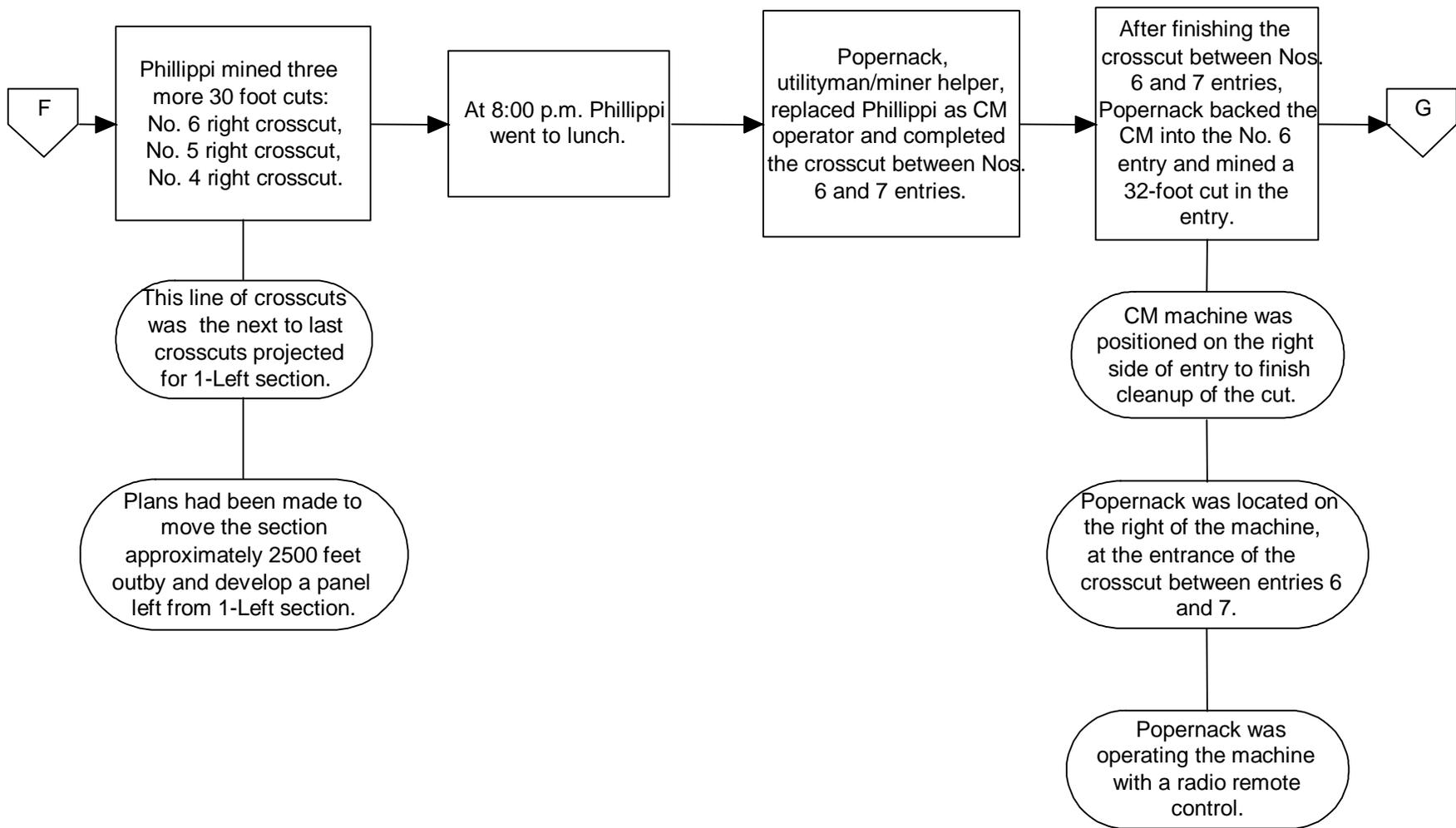


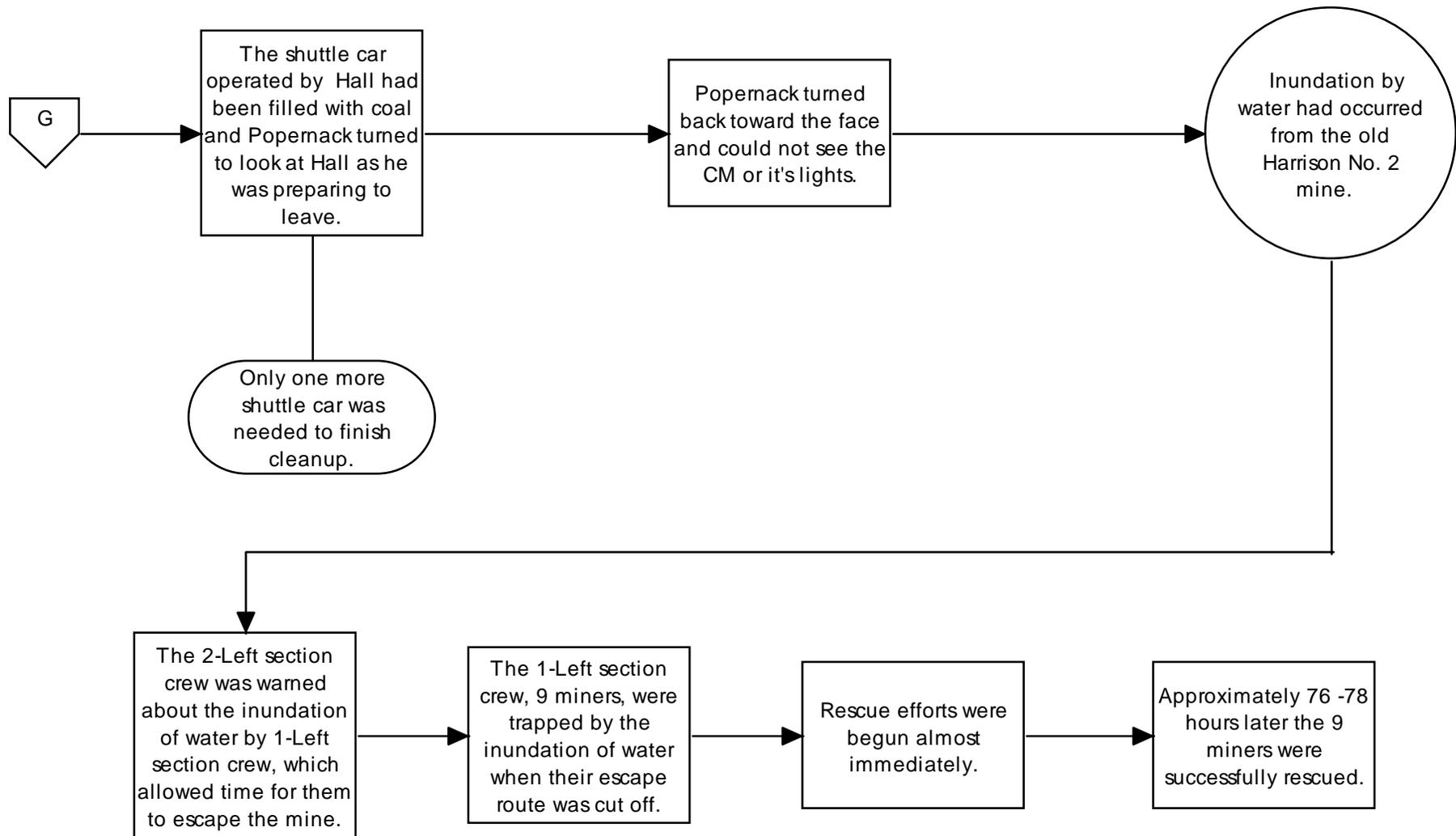


 - causal factor









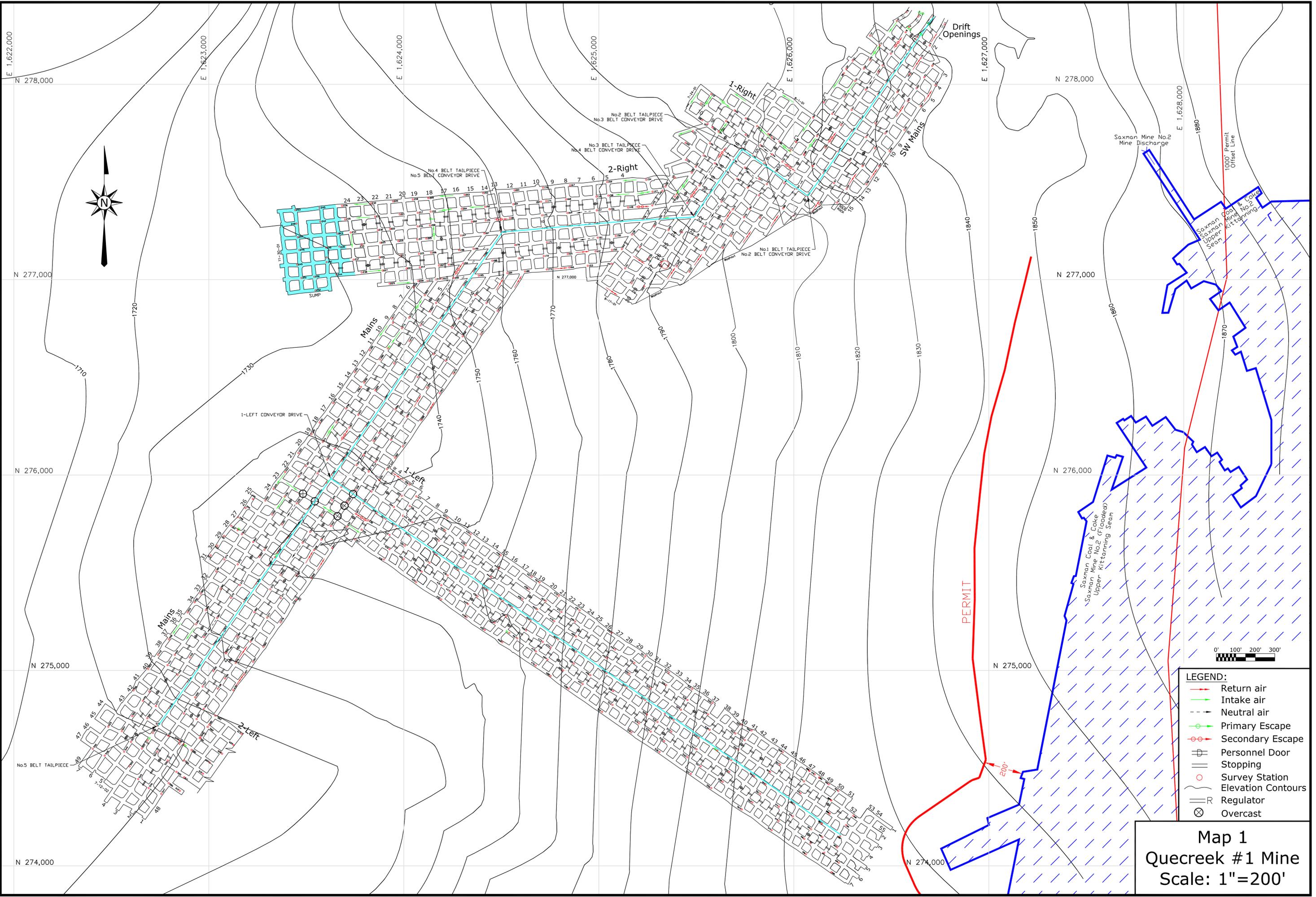
APPENDIX F

VIEW THROUGH BREAKTHROUGH INTO HARRISON NO. 2 MINE



APPENDIX G

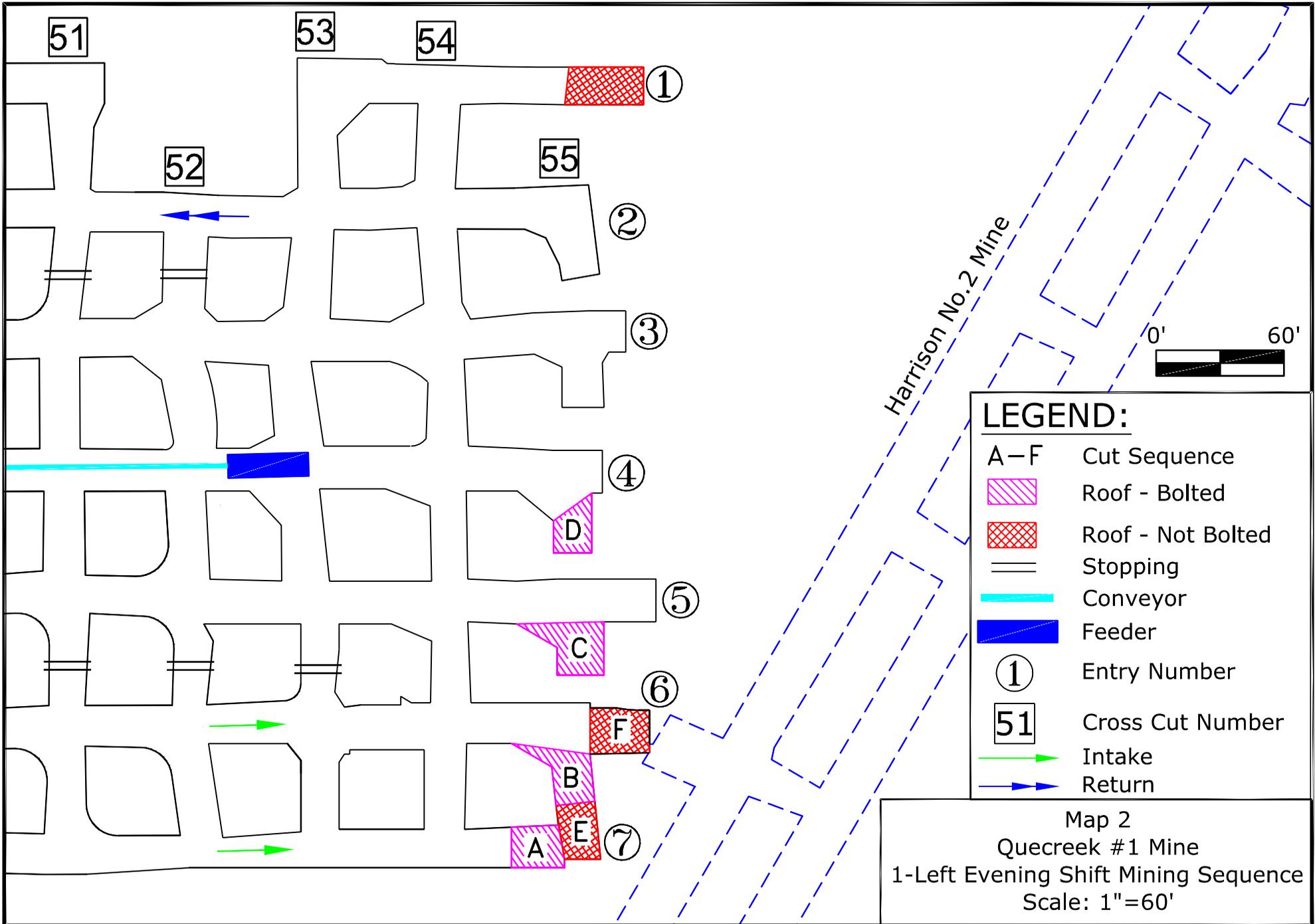
MAPS



LEGEND:

- Return air
- Intake air
- - - Neutral air
- Primary Escape
- Secondary Escape
- Personnel Door
- Stopping
- Survey Station
- Elevation Contours
- Regulator
- Overcast

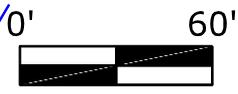
Map 1
Quecreek #1 Mine
 Scale: 1"=200'



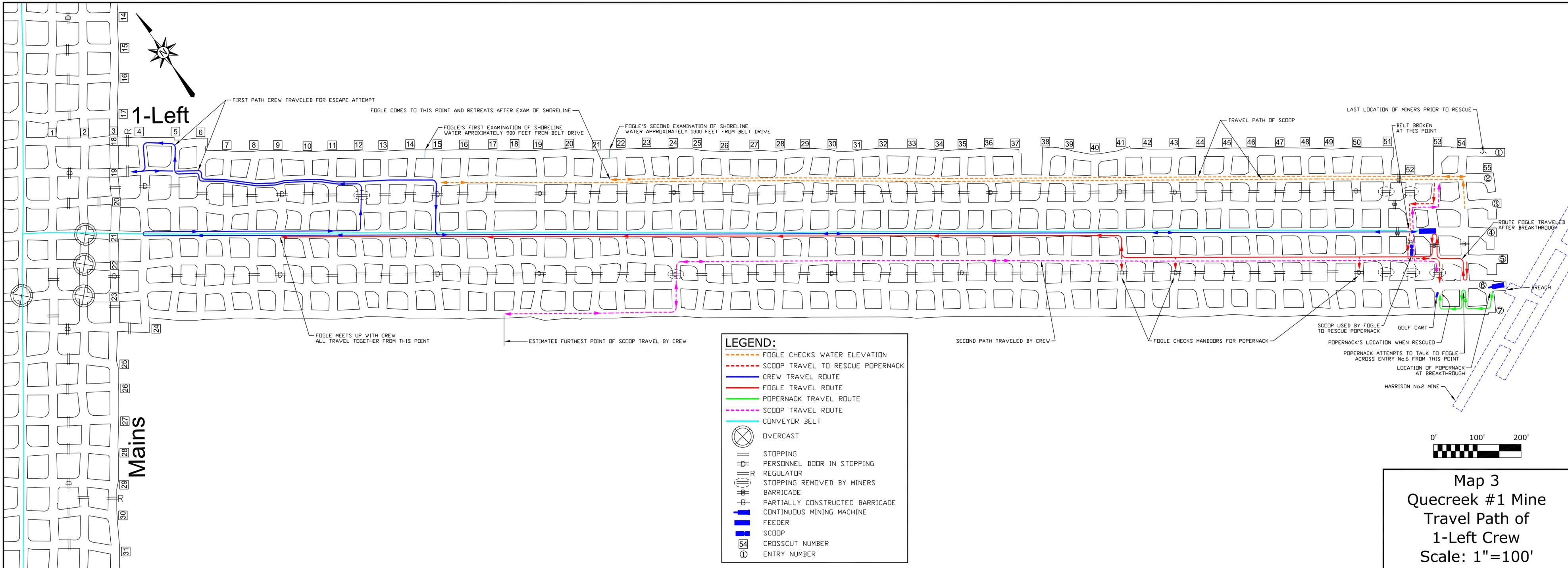
LEGEND:

- A-F Cut Sequence
-  Roof - Bolted
-  Roof - Not Bolted
-  Stopping
-  Conveyor
-  Feeder
-  Entry Number
-  Cross Cut Number
-  Intake
-  Return

Harrison No. 2 Mine



Map 2
 Quecreek #1 Mine
 1-Left Evening Shift Mining Sequence
 Scale: 1"=60'



1-Left

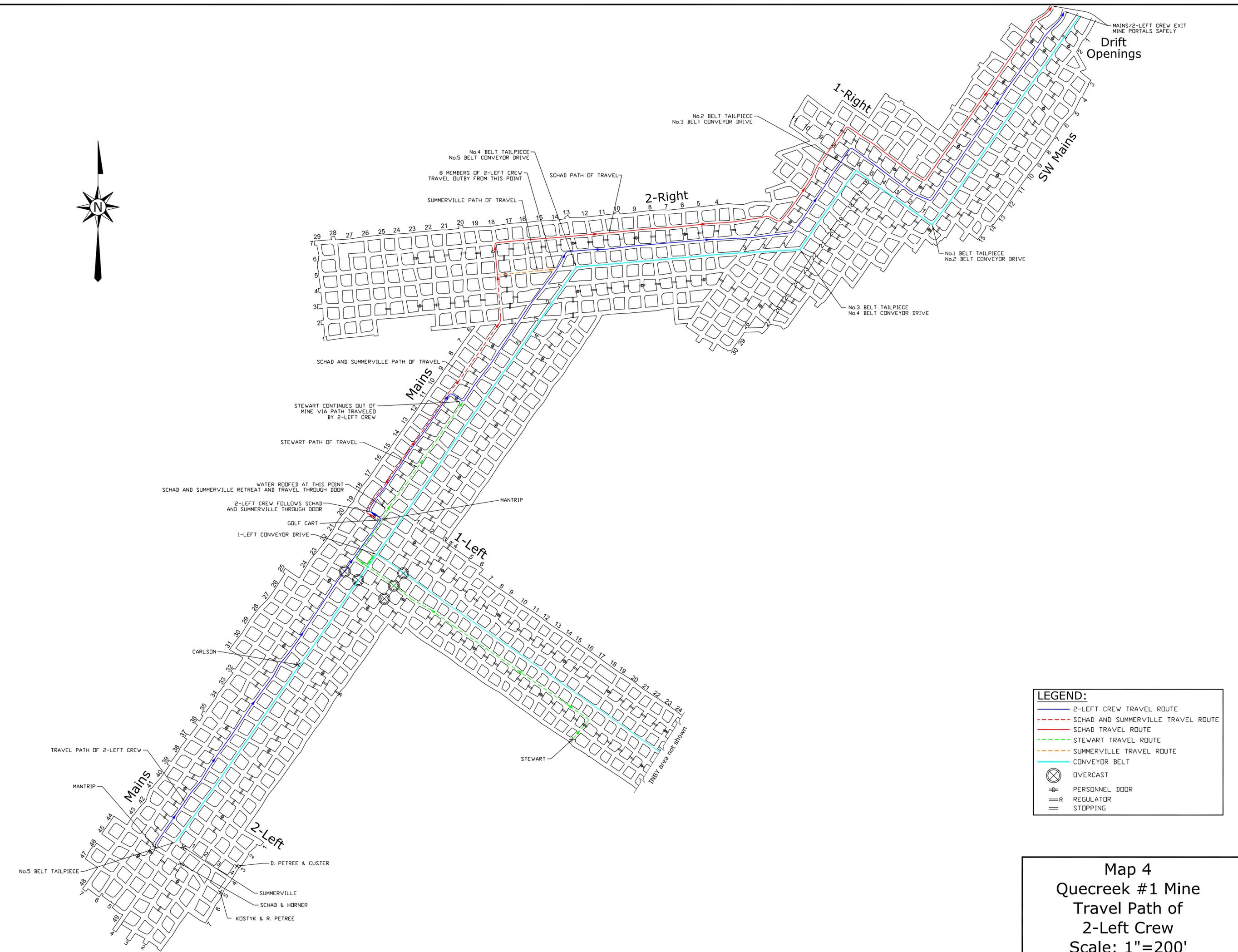
Mains

LEGEND:

- FOGLE CHECKS WATER ELEVATION
- SCOOP TRAVEL TO RESCUE POPERNACK
- CREW TRAVEL ROUTE
- FOGLE TRAVEL ROUTE
- POPERNACK TRAVEL ROUTE
- SCOOP TRAVEL ROUTE
- CONVEYOR BELT
- OVERCAST
- STOPPING
- PERSONNEL DOOR IN STOPPING
- REGULATOR
- STOPPING REMOVED BY MINERS
- BARRICADE
- PARTIALLY CONSTRUCTED BARRICADE
- CONTINUOUS MINING MACHINE
- FEEDER
- SCOOP
- CROSSCUT NUMBER
- ENTRY NUMBER



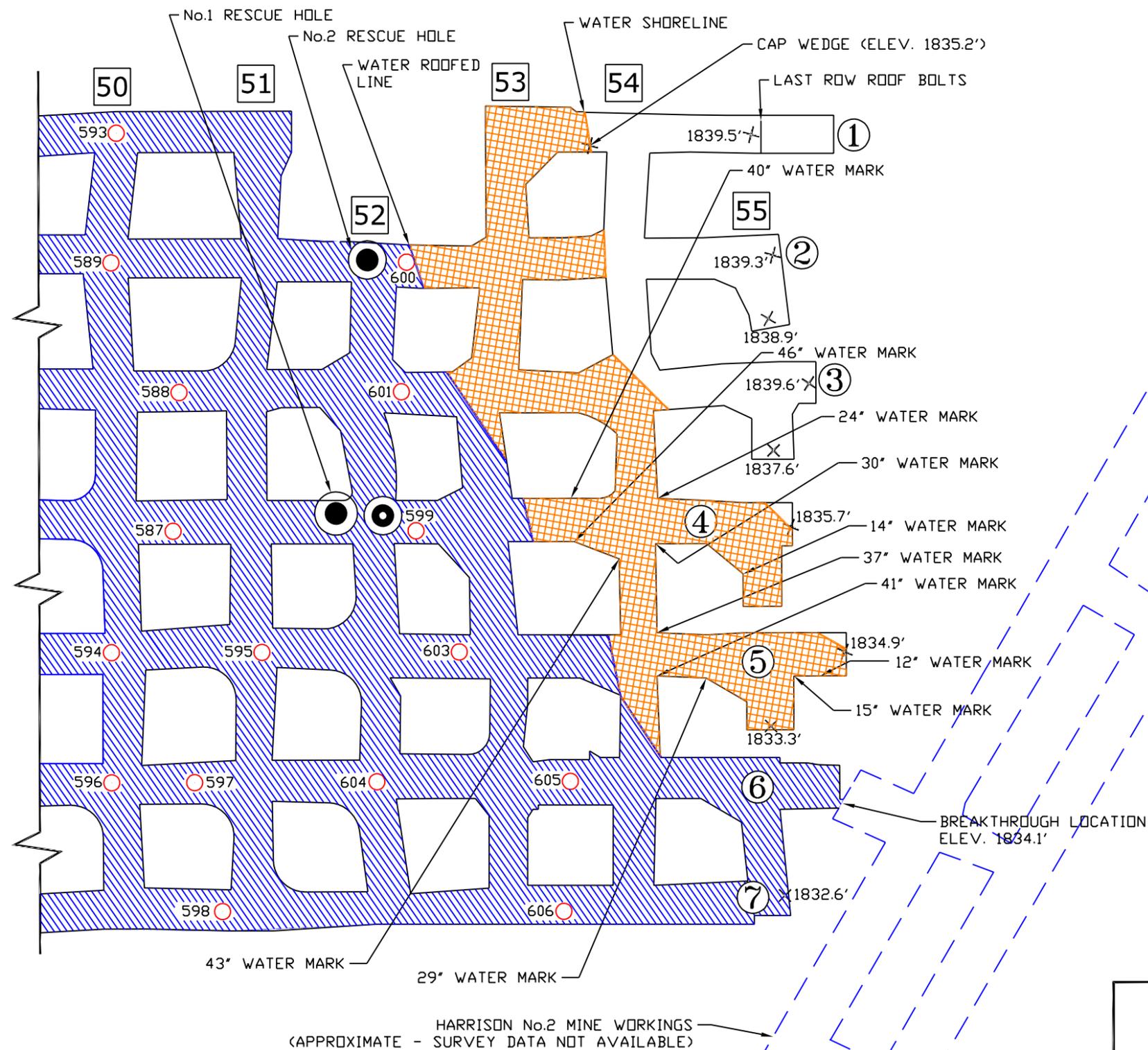
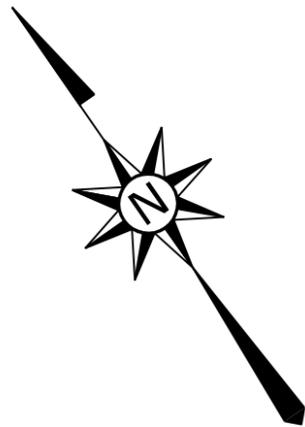
Map 3
Quecreek #1 Mine
Travel Path of
1-Left Crew
Scale: 1"=100'



LEGEND:

—	2-LEFT CREW TRAVEL ROUTE
- - -	SCHAD AND SUMMERVILLE TRAVEL ROUTE
—	SCHAD TRAVEL ROUTE
- - -	STEWART TRAVEL ROUTE
—	SUMMERVILLE TRAVEL ROUTE
—	CONVEYOR BELT
	OVERCAST
	PERSONNEL DOOR
	REGULATOR
	STOPPING

Map 4
Quecreek #1 Mine
Travel Path of
2-Left Crew
Scale: 1"=200'

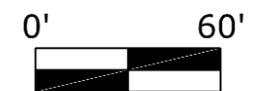


LEGEND:

-  Water roofed
-  Water not roofed
-  No water
-  6.5" Drillhole
-  Rescue Hole
-  Survey Station
-  Floor Elevation
-  Crosscut Number
-  Entry Number

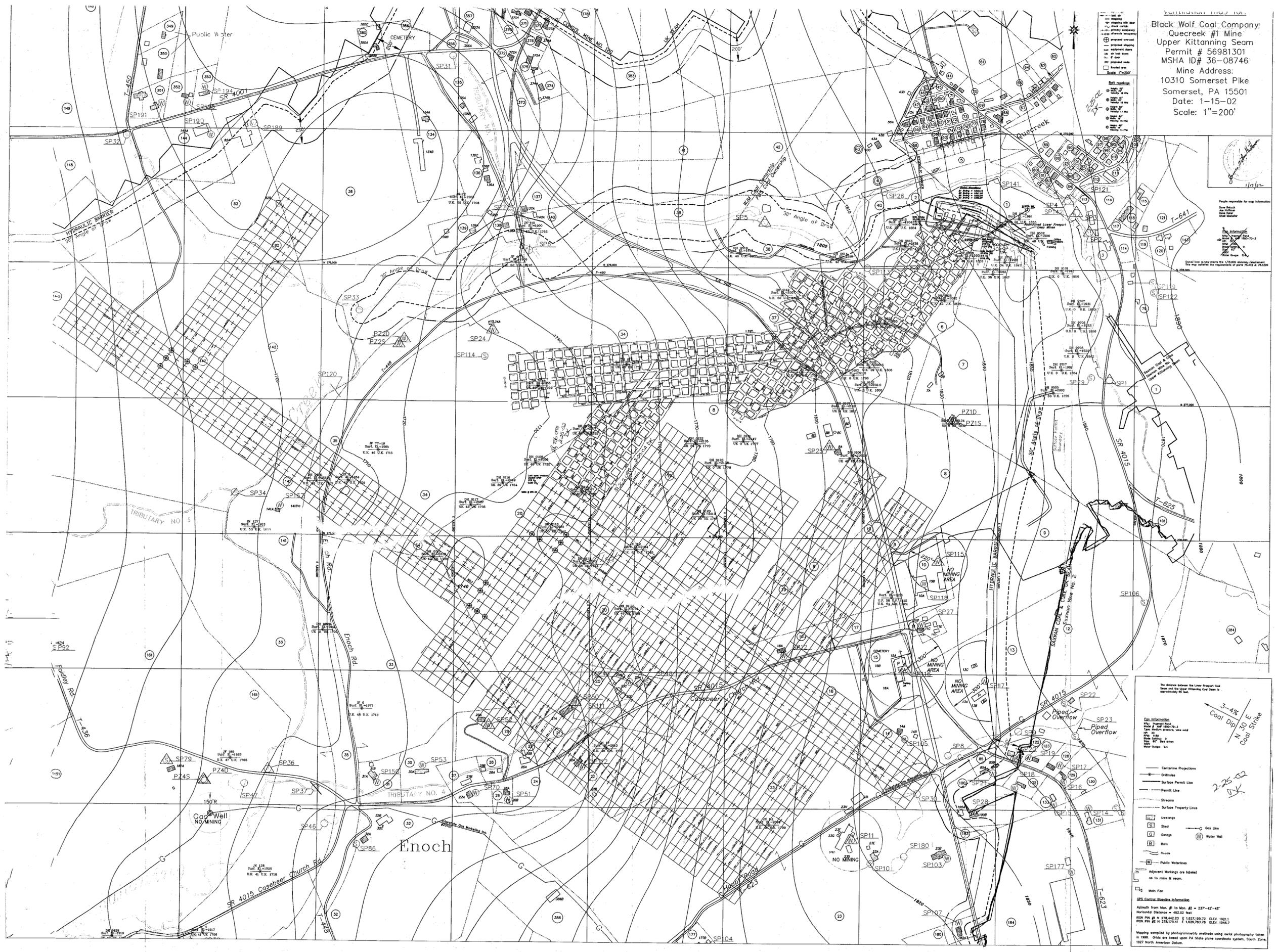
MINING HEIGHT \approx 53 INCHES

WATER MARKS MEASURED FROM FLOOR



Map 5
Quecreek #1 Mine
Water Locations on
1-Left Section
Scale: 1"=60'

VENTILATION PLAN FOR
 Black Wolf Coal Company
 Quecreek #1 Mine
 Upper Kittanning Seam
 Permit # 56981301
 MSHA ID# 36-08746
 Mine Address:
 10310 Somerset Pike
 Somerset, PA 15501
 Date: 1-15-02
 Scale: 1"=200'



The distance between the Lower Present Coal Seam and the Upper Kittanning Coal Seam is approximately 3-4%.

Coal Dip
 N 30 E
 Coal Strike

225 B
 SK

Map Information
 This map was prepared from a plan of the mine as shown on the permit. It is not to be used for any other purpose without the written consent of the Mine Operator.

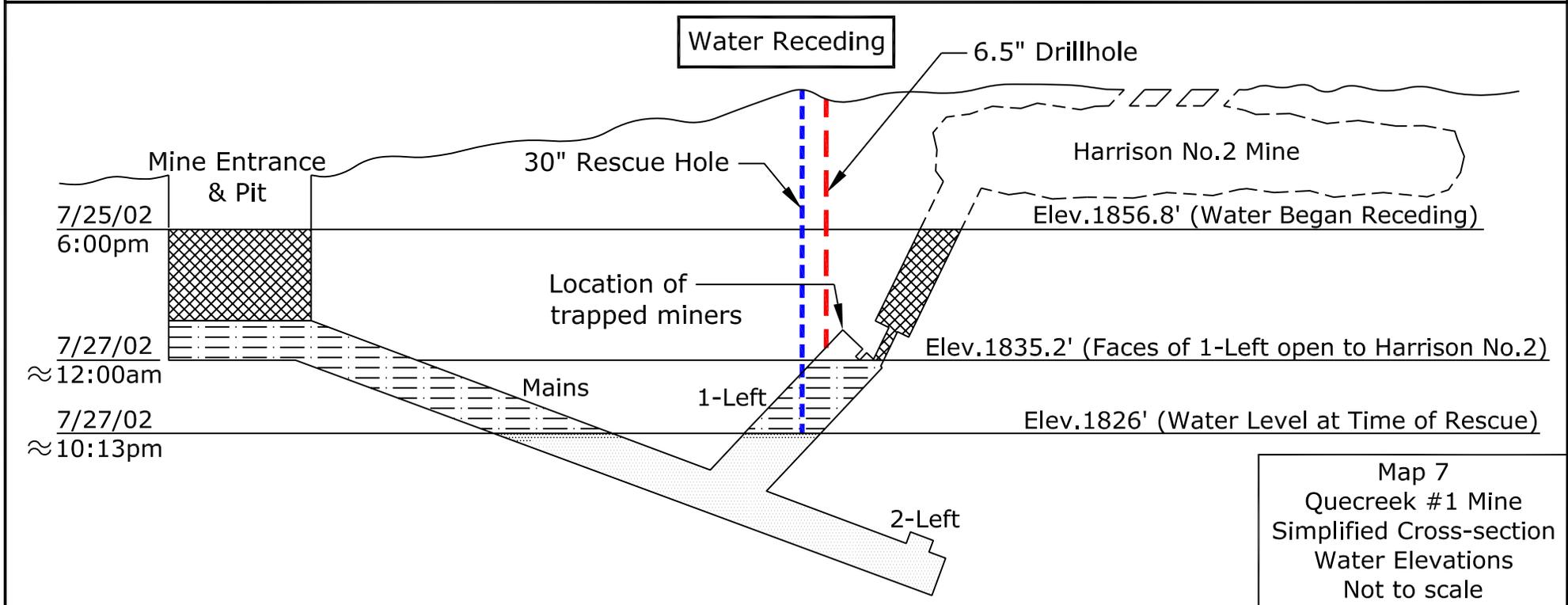
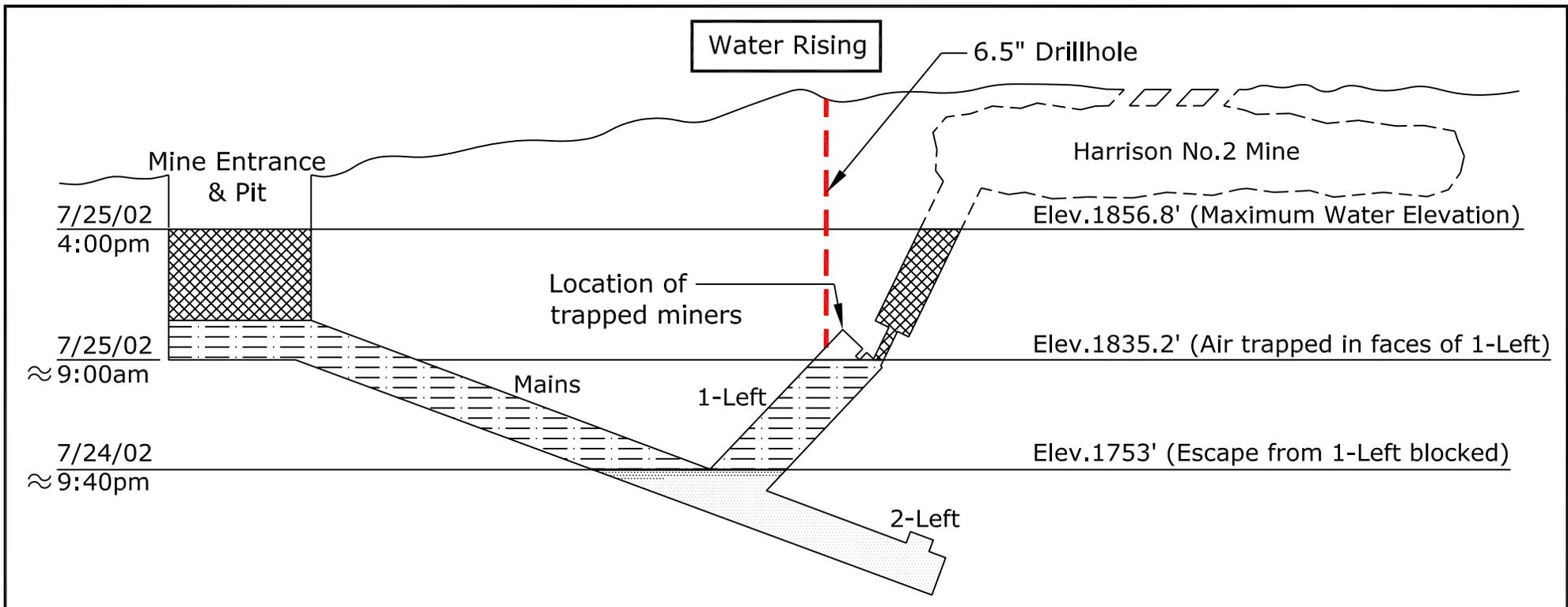
Legend

- Centerline Projection
- Drift
- Surface Permit Line
- Permit Line
- Streams
- Surface Property Lines
- Shaft
- Gas Line
- Well
- Water Well
- Public Waterlines
- Adjacent Workings are located as to mine & seam.
- Man Pan

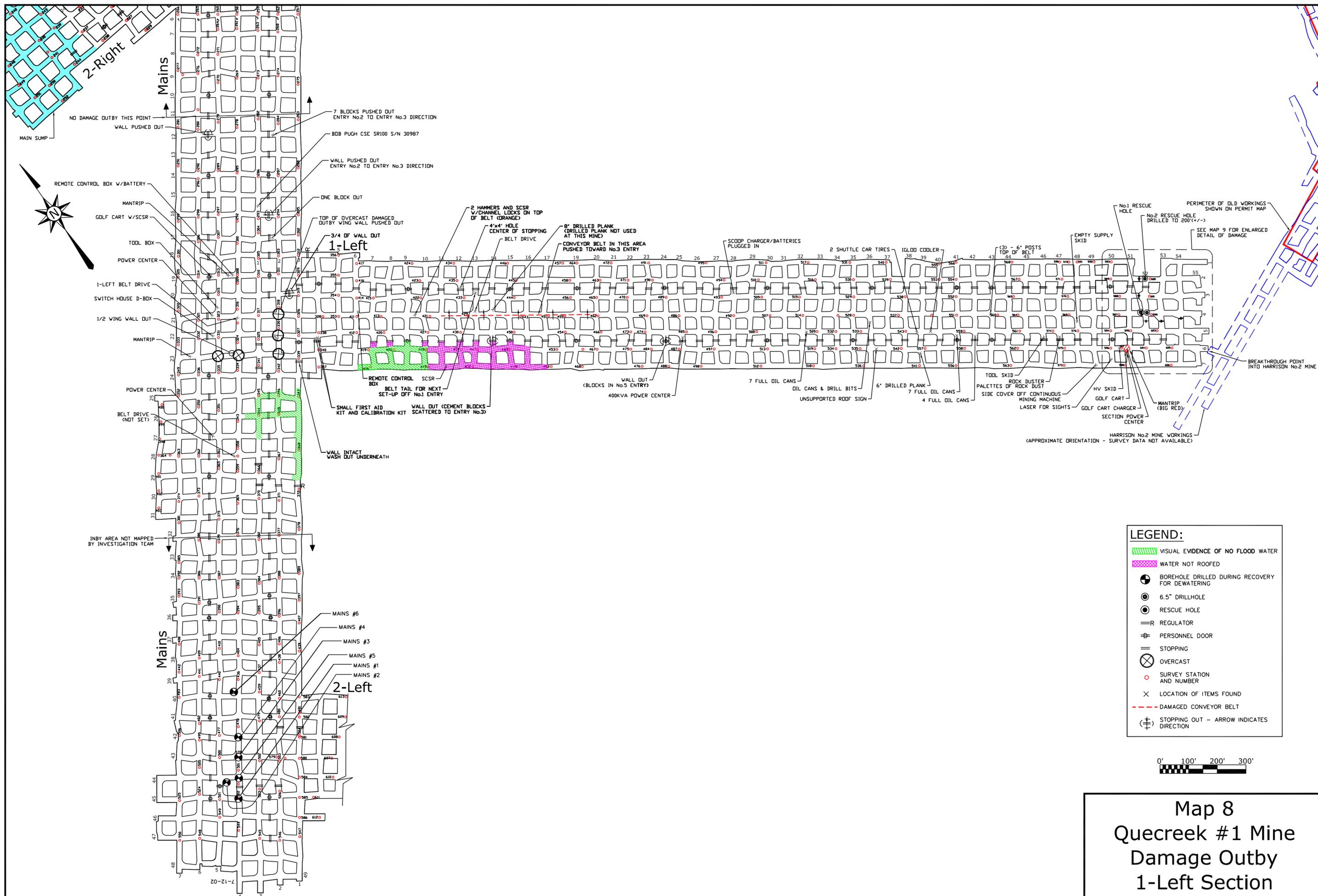
SPS Control, Boundary Information
 Admitted from Mon. #1 to Mon. #2 = 237'-42'-45"
 Horizontal Distance = 492.00 Feet
 MON PAN #1 N 278.442.23 E 1.027-189.72 ELEV. 1921.1
 MON PAN #2 N 278.375.41 E 1.026-183.78 ELEV. 1948.7

Mapping compiled by photogrammetric methods using aerial photography taken in 1988. Grids are based upon PA State plane coordinate system, South Zone, 1927 North American Datum.

Map 6
Quecreek #1 Mine
Ventilation Map
 Map Reproduced From Scanned Image
 Not to scale

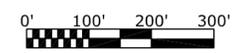


Map 7
Quecreek #1 Mine
Simplified Cross-section
Water Elevations
Not to scale

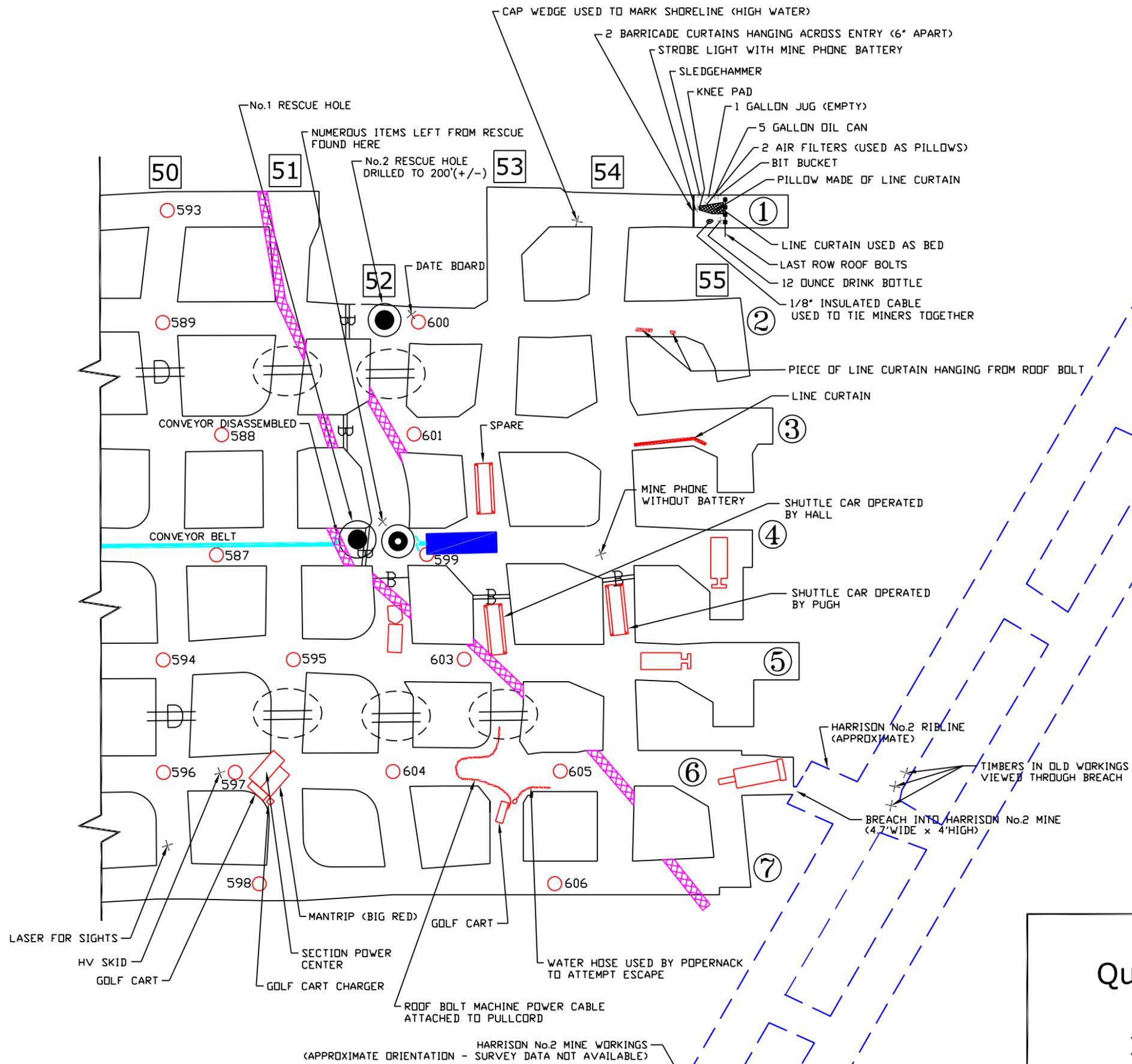
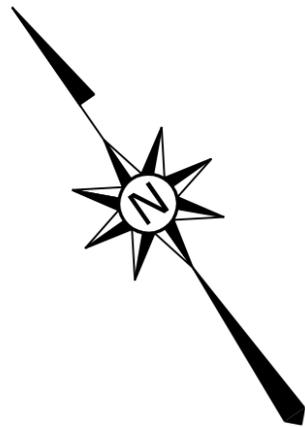


LEGEND:

- VISUAL EVIDENCE OF NO FLOOD WATER
- WATER NOT ROOFED
- BOREHOLE DRILLED DURING RECOVERY FOR DEWATERING
- 6.5" DRILLHOLE
- RESCUE HOLE
- REGULATOR
- PERSONNEL DOOR
- STOPPING
- OVERCAST
- SURVEY STATION AND NUMBER
- LOCATION OF ITEMS FOUND
- DAMAGED CONVEYOR BELT
- STOPPING OUT - ARROW INDICATES DIRECTION



Map 8
Quecreek #1 Mine
Damage Outby
1-Left Section
Scale: 1"=200'

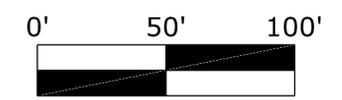
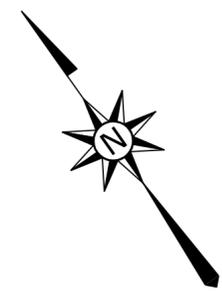
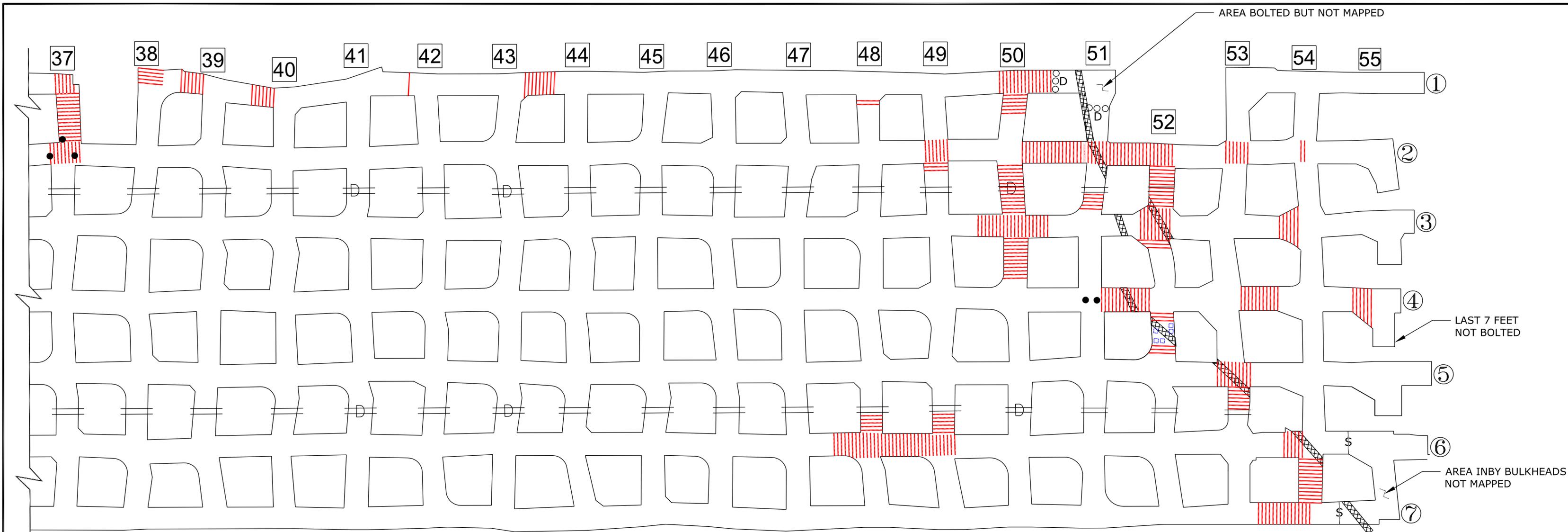


LEGEND:

-  6.5" DRILLHOLE
-  RESCUE HOLE
-  CONVEYOR BELT
-  PERSONNEL DOOR
-  BARRICADE
-  PARTIAL BARRICADE
-  STOPPING
-  MISCELLANEOUS EQUIPMENT
-  SCOOP
-  ROOF BOLTER
-  CONTINUOUS MINING MACHINE
-  SHUTTLE CAR
-  FEEDER
-  CLAY SEAM (FAULT)
-  STOPPING REMOVED
-  LOCATION OF ITEMS FOUND
-  SURVEY STATION & NUMBER
-  CROSSCUT NUMBER
-  ENTRY NUMBER



Map 9
Quecreek #1 Mine
Damage on
1-Left Section
Scale: 1"=60'

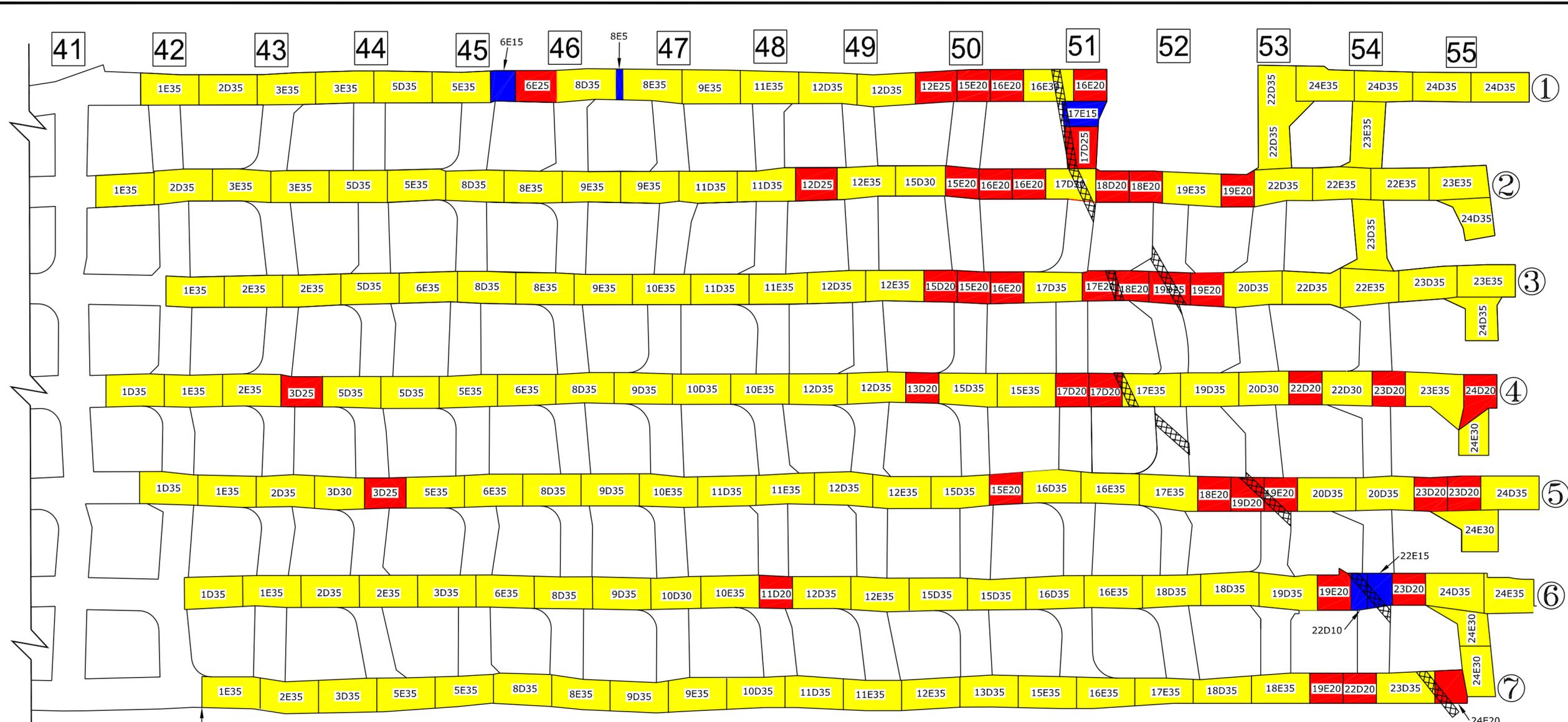


LEGEND:

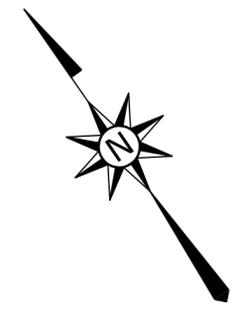
- METAL STRAPS OR T-2 CHANNELS WITH 48" AND/OR 72" RESIN BOLTS ON 3'x4' OR 4'x4' PATTERN
- CABLE ROOF BOLT, 8' TO 12' LENGTH
- WOODEN POST
- 48" & 72" ROOF BOLTS WITH HEADER BOARDS
- DANGER SIGN
- BULKHEAD
- STOPPING
- PERSONNEL DOOR
- CLAY SEAM (FAULT)
- 55 CROSSCUT NUMBER
- 1 ENTRY NUMBER

NOTE:
 ALL AREAS EXCEPT WHERE NOTED OR WHERE STRAPS ARE PRESENT: 42" & 48" FULLY-GROUTED RESIN ROOF BOLTS ON 4'x4' OR 4'x5' PATTERN. GOOD ROOF, NO DEFECTS EVIDENT.

Map 10
Quecreek #1 Mine
Roof Support
on 1-Left Panel
Scale: 1"=50'



Approximate location
of faces at end of June 2002



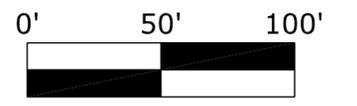
LEGEND:

XXYYZ CUT DEPTH NOTATION
 XX JULY DATE
 Y D - DAY SHIFT / E - EVENING SHIFT
 ZZ CUT DEPTH (FEET)
 Example:
 12D35 - July 12, Day Shift, 35-Foot Cut

- 30'-35' CUT DEPTH
- 20'-30' CUT DEPTH
- LESS THAN 20' CUT DEPTH
- CLAY SEAM (FAULT)
- 55 CROSSCUT NUMBER
- 1 ENTRY NUMBER

Mined Length*		
Date	Day Shift	Evening Shift
7-01-02	305'	300'
7-02-02	270'	305'
7-03-02	305'	195'
7-04-02	-	-
7-05-02	300'	300'
7-06-02	315'	-
7-07-02	-	-
7-08-02	265'	250'
7-09-02	280'	280'
7-10-02	190'	335'
7-11-02	305'	300'
7-12-02	345'	250'
7-13-02	245'	-
7-14-02	-	-
7-15-02	265'	210'
7-16-02	195'	255'
7-17-02	210'	175'
7-18-02	240'	195'
7-19-02	145'	225'
7-20-02	235'	-
7-21-02	-	-
7-22-02	240'	260'
7-23-02	300'	175'
7-24-02	260'	**

* Includes crosscuts and entries
 ** Date of incident



Map 11
 Quecreek #1 Mine
 Cut Depths on 1-Left Panel
 for July 2002
 Scale: 1"=50'

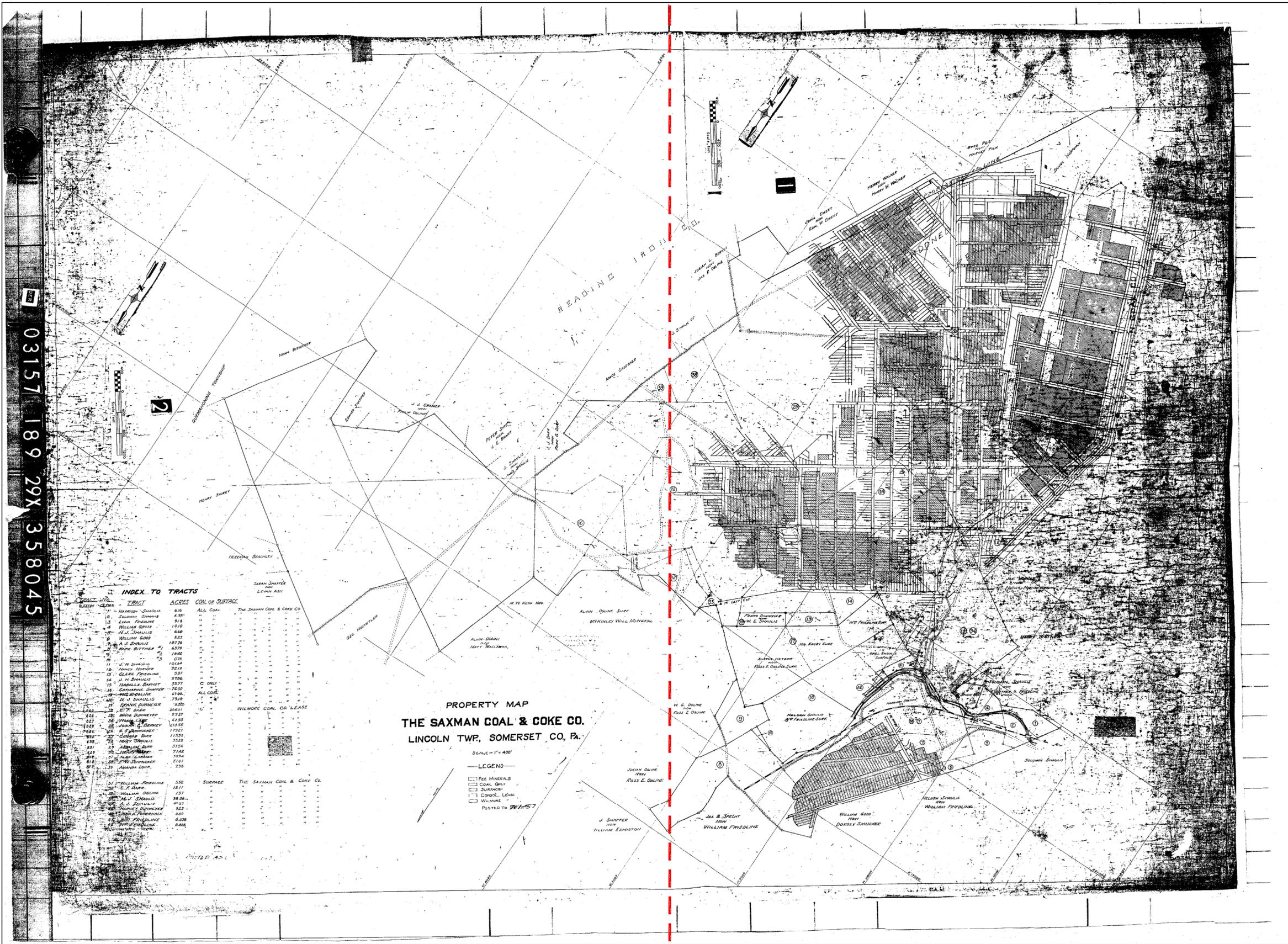
INDEX TO SURVEYS

LETTER	DATE	ENGINEER	DRAFTSMAN
D'	July 1, 1917	J.E. Kimmel	J.E. Kimmel
F'	Dec. 31, 1917	"	"
F"	July 1, 1918	"	"
G'	Dec. 31, 1918	"	"
H'	July 1, 1919	"	"
H"	Dec. 31, 1919	"	"
I'	July 1, 1920	"	"
I"	Dec. 31, 1920	"	"
J'	July 1, 1921	"	"
J"	Dec. 31, 1921	"	"
K'	July 1, 1922	"	"
K"	Dec. 31, 1922	"	"
L'	July 1, 1923	"	"
L"	Dec. 31, 1923	"	"
M'	July 1, 1924	"	"
M"	Dec. 31, 1924	"	"
N'	July 1, 1925	"	"
N"	Dec. 31, 1925	"	"
O'	July 1, 1926	"	"
O"	Dec. 31, 1926	"	"
P'	July 1, 1927	"	"
P"	Dec. 31, 1927	"	"
Q'	July 1, 1928	"	"
Q"	Dec. 31, 1928	"	"
R'	July 1, 1929	"	"
R"	Dec. 31, 1929	"	"
S'	July 1, 1930	"	"
S"	Dec. 31, 1930	"	"
T'	July 1, 1931	"	"
T"	Dec. 31, 1931	"	"
U'	July 1, 1932	"	"
U"	Dec. 31, 1932	"	"
V'	July 1, 1933	"	"
V"	Dec. 31, 1933	"	"
W'	July 1, 1934	"	"
W"	Dec. 31, 1934	"	"
X'	July 1, 1935	"	"
X"	Dec. 31, 1935	"	"
Y'	July 1, 1936	"	"
Y"	Dec. 31, 1936	"	"
Z'	July 1, 1937	"	"
Z"	Dec. 31, 1937	"	"
a	July 1, 1938	"	"
b	July 1, 1939	"	"
c	July 1, 1940	"	"
d	July 1, 1941	"	"
e	July 1, 1942	"	"
f	July 1, 1943	"	"
g	July 1, 1944	"	"
h	July 1, 1945	"	"
i	July 1, 1946	"	"

CH Maye
 SA + MAN CLCCO
 HARRISON #2
 FINAL 1964



Map 12
 1964 Harrison No.2
 Mine Map
 Map reproduced from scanned image
 Not to scale



03157 189 29X 358045

INDEX TO TRACTS

TRACT NO.	TRACT	ACRES	COAL OR SURFACE	OWNER
1	HARRISON SHAWLS	6.95	ALL COAL	THE SAXMAN COAL & COKE CO.
2	WILLIAM FRIEDLINE	9.18	"	"
3	WILLIAM SCOTT	10.10	"	"
4	WILLIAM GODD	6.40	"	"
5	A. J. SHAWLS	8.27	"	"
6	A. J. SHAWLS	18.78	"	"
7	JOSEPH BITTNER	6.37	"	"
8	A. J. SHAWLS	1.62	"	"
9	A. J. SHAWLS	1.25	"	"
10	A. J. SHAWLS	10.24	"	"
11	JOSEPH BITTNER	32.14	"	"
12	GLADYS FRIEDLINE	5.37	"	"
13	A. J. SHAWLS	9.56	"	"
14	WILLIAM SCOTT	3.37	"	"
15	WILLIAM SCOTT	7.50	"	"
16	CATHERINE SHIPPER	4.90	"	"
17	WILMORE COAL CO. LEASE	7.94	"	"
18	WILMORE COAL CO. LEASE	4.80	"	"
19	C. F. BARK	20.81	"	"
20	WILMORE COAL CO. LEASE	7.27	"	"
21	WILMORE COAL CO. LEASE	4.15	"	"
22	WILMORE COAL CO. LEASE	11.25	"	"
23	WILMORE COAL CO. LEASE	17.21	"	"
24	WILMORE COAL CO. LEASE	11.50	"	"
25	WILMORE COAL CO. LEASE	32.28	"	"
26	WILMORE COAL CO. LEASE	5.16	"	"
27	WILMORE COAL CO. LEASE	7.42	"	"
28	WILMORE COAL CO. LEASE	10.24	"	"
29	WILMORE COAL CO. LEASE	17.41	"	"
30	WILMORE COAL CO. LEASE	7.58	"	"
31	WILMORE COAL CO. LEASE	5.32	"	"
32	WILMORE COAL CO. LEASE	18.71	"	"
33	WILMORE COAL CO. LEASE	1.37	"	"
34	WILMORE COAL CO. LEASE	38.04	"	"
35	WILMORE COAL CO. LEASE	9.21	"	"
36	WILMORE COAL CO. LEASE	0.60	"	"
37	WILMORE COAL CO. LEASE	6.28	"	"
38	WILMORE COAL CO. LEASE	0.46	"	"

**PROPERTY MAP
THE SAXMAN COAL & COKE CO.
LINCOLN TWP., SOMERSET CO., PA.**

SCALE - 1" = 400'
LEGEND
 FREE MINERALS
 COAL ONLY
 SURFACE
 CONSOLE LEASE
 WILMORE
 POSTED TO 7-1-57

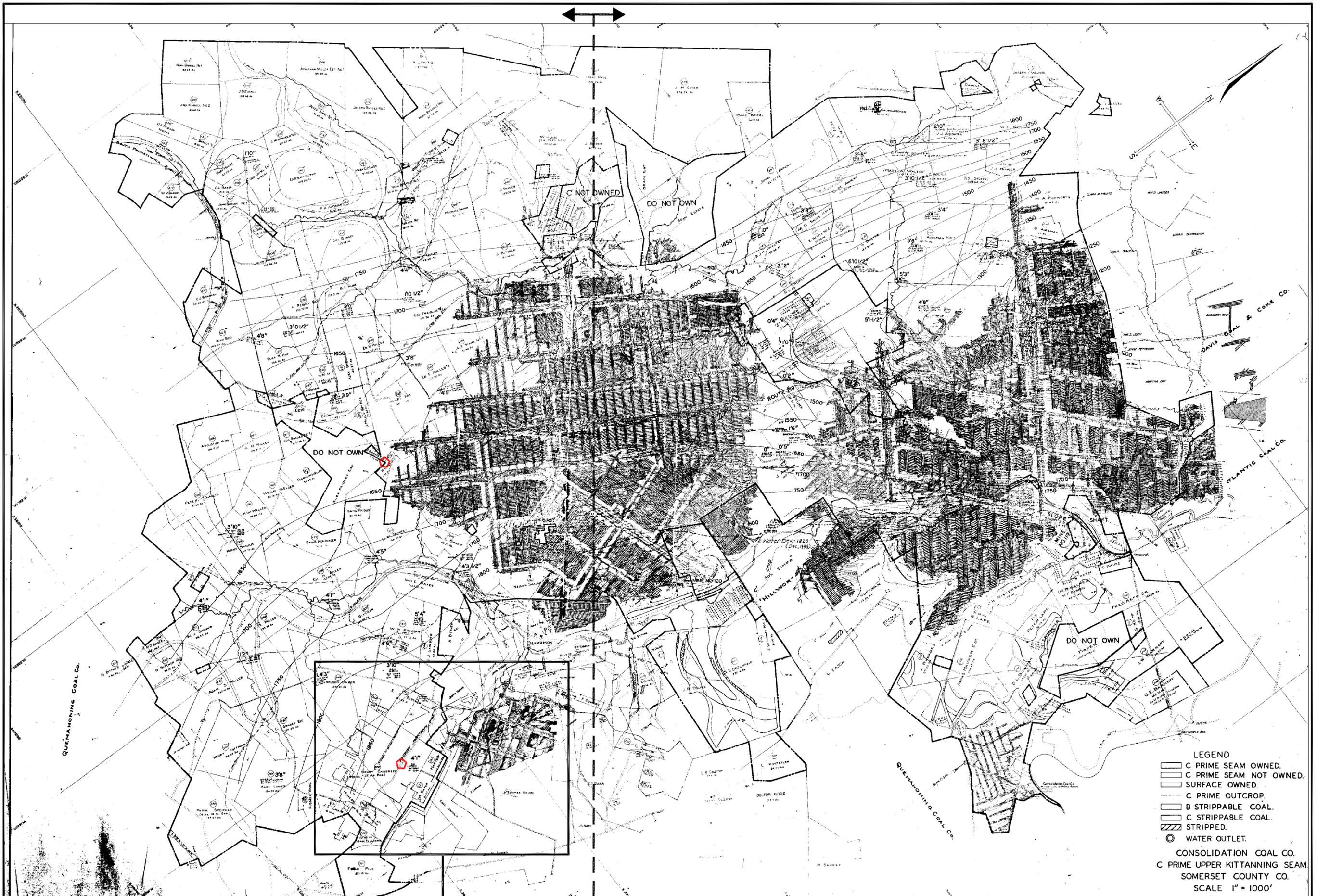
Office of Surface Mining
 Mine Map Repository
 Document No.03157-189-29X-358045
 (Portion that contains date)

Office of Surface Mining
 Mine Map Repository
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Map 13
 1957 Harrison No.2
 Mine Map

Map Reproduced From Scanned Images
 1 & 2 Not to scale

Break line between two scanned images



LEGEND
 [Symbol] C PRIME SEAM OWNED.
 [Symbol] C PRIME SEAM NOT OWNED.
 [Symbol] SURFACE OWNED.
 [Symbol] C PRIME OUTCROP.
 [Symbol] B STRIPPABLE COAL.
 [Symbol] C STRIPPABLE COAL.
 [Symbol] STRIPPED.
 [Symbol] WATER OUTLET.
 CONSOLIDATION COAL CO.
 C PRIME UPPER KITTANNING SEAM,
 SOMERSET COUNTY CO.
 SCALE 1" = 1000'

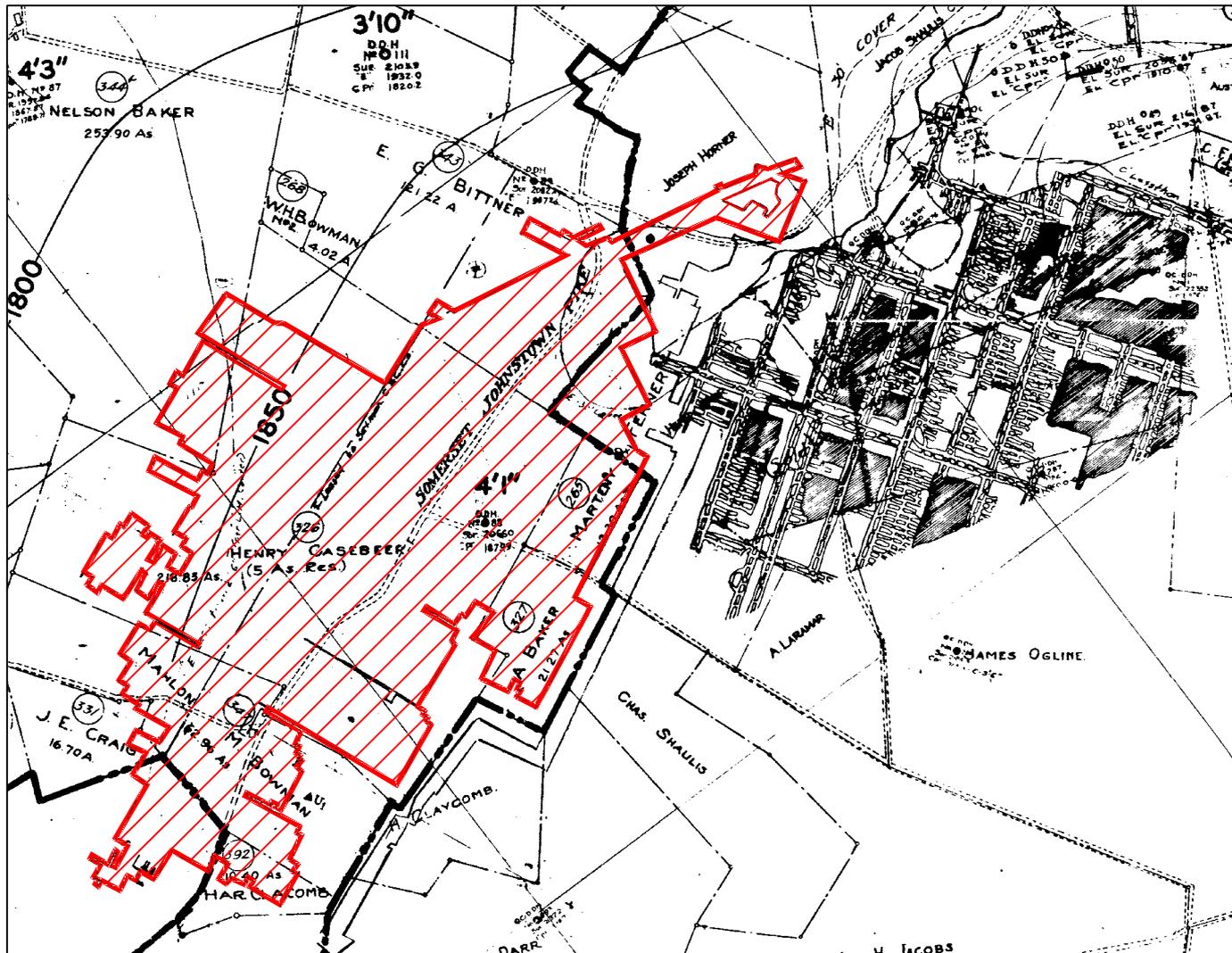
Area of Harrison No.2 Mine
(See Appendix G, Map 15)

Left side of map
received by Musser
from Consol

Right side of map
not received by Musser
from Consol

LEGEND:
 [Red Square Symbol] Points used by Musser
to transpose Harrison No.2 Mine
outline onto Quecreek #1 Mine Map

Map 14
Consolidation Coal Company
Property Map
 Map Reproduced From Scanned Image. Not to scale.



LEGEND:

 Area of Harrison No.2 Mine mined between 1947 through 1960

Map 15
 Outline of Harrison No.2 Mine
 from Consolidation Coal Company
 Property Map
 Map reproduced from scanned image. Not to Scale.



Entrance to Quecreek #1 Mine

2-Right

SW Mains

Quecreek #1 Mine

Mains

1-Left Panel

Abandoned and Water Filled Harrison No.2 Mine

9 Miners Trapped in 1-Left Section

Miners Escaped from 2-Left Section

Location where water from the Harrison No.2 Mine broke into the Quecreek #1 Mine

Approximate Orientation of Harrison No.2 Mine (Survey Data Not Available)

Quecreek #1 Mine and a Small Area of the Harrison No.2 Mine

Drawing Not to Scale

