2.0 BACKGROUND

2.1 Site Description

2.1.1 General setting: The study site is located near Inez (Martin County), Kentucky. The approximate coordinates are N 37° 44' 30" latitude and W 82° 32' 18" longitude. The pertinent rock units comprise the Breathitt Group of the Princess Formation and include the Coalburg and Stockton coal seams, which were mined in the area. The Coalburg coal seam dips locally to the south at the minesite near the impoundment.

The subject impoundment lies in Big Branch, a south-southeast flowing, tributary of Wolf Creek. The impoundment covers an area of 68 acres, with a shoreline of about 9,400 feet (Figure 2 [Page 4]). A coarse coal refuse embankment serves as a dam to the impounded slurry. The crest of the embankment is approximately 256 feet above the downstream toe. The embankment currently has a surface elevation of 1,096 feet mean sea level (msl) and was designed to reach an elevation of 1,200 feet msl. The slurry level behind the embankment was at 1,060 feet msl[1] before the breakthrough and is presently at 1,046 feet msl. The impoundment has a 333-acre watershed. The watershed includes the pool area and embankment as well as the areas that drain toward the pool and embankment. At the time of the 2000 breakthrough, only about 90 of the 333 acres drained into the impoundment. Both the slurry in the impoundment and the coarse refuse in the embankment are by-products of the coal preparation facility associated with cleaning coal from underground and surface mining in the Coalburg and other coal seams.

2.1.2 Underground mine: The impoundment is bounded by the MCCC 1-C underground mine on all sides except the valley of Big Branch south-southeast of the embankment (Figure 2 [Page 4]). The mine consists of the active North Mains and inactive room-and-pillar extraction areas. The mine areas adjacent to the North Mains have been sealed. No pillar recovery was conducted in the underground mine adjacent to the impoundment. The underground mine flanks the impoundment to the north, east, and west. The North Mains contain a conveyer system that carried coal from adjacent mines to the preparation plant south of the embankment until the 2000 breakthrough. Two extraction areas, mined during 1981 and 1982, abut the impoundment to the north and south, and at some points, extend short distances underneath the impoundment. Both the 1994 and 2000 breakthroughs occurred over the extraction areas of the mine. Additional features of the underground mine pertinent to the study include:

- Ventilation seals constructed in 1981 at the entrance to Area #2. (These seals required repair in 1984 or 1985, having been damaged by slurry injected into the mine for disposal purposes.)

- The Mill Branch Portals south of the impoundment where water discharged after the 1994 breakthrough.

- The South Mains Portal and Number 2 North Portals west and north of the impoundment, respectively, from which slurry discharged during the 2000 breakthrough.

[1] As discussed in Appendix 3, MCCC had exceeded the slurry (pool) elevation approved by DSMRE for Phase III of the Big Branch slurry impoundment.

- Reinforced concrete bulkheads off of the North Mains, constructed in 1996 as part of the approved impoundment sealing plan[2] to prevent breakthrough water from flooding the conveyor system (the bulkheads were built against existing ventilation seals constructed in 1987).

The sealing plan map shows three areas where slurry was injected into the underground mine. This was apparently conducted prior to 1985. This investigation did not find any other documentation concerning the location, timing, and quantity of slurry injected into the underground mine.

2.1.3 Outcrop barrier: The outcrop barrier, the material between the underground mine void and the ground surface, is composed of both weathered and solid rock and in-place coal seam. Within the impoundment area, the horizontal thickness of the underground mine outcrop barrier, as shown on the mine maps, ranges from about 35 feet to more than 300 feet. Vertical overburden thickness at the edge of the mine ranges from about 13 feet to greater than 100 feet. OSM's estimates of the barrier are based on the coal cropline drawn on the map attached to the sealing plan. The coal cropline appears to be based on the horizontal projection of the mine floor or coal seam to the surface. MCCC did not conduct a geotechnical investigation to confirm the outcrop barrier width or its composition. The map indicated that the outcrop barrier is about 60 feet wide at the 1994 breakthrough and about 70 feet wide at the 2000 breakthrough (Figures 3 and 4 [Pages 17 and 18]). At the west side of the impoundment, one mine entryway "punched through" the outcrop to the ground surface. The permit does not address the punchout. The narrowest barrier is at the entry adjacent to the punchout. Reportedly, the punchout was sealed with concrete, but OSM could not find written documentation of the closure. Presently, the seepage barrier covers both areas.

Interviews conducted by MSHA with miners who worked in the underground mine indicated that:

- The mining height exceeded ten feet in some areas.

- The underground mine was extended towards the coal outcrop until poor roof conditions or poor coal quality were encountered. As a general practice, mining projections (i.e., the delineation of areas to be mined and drawn on the mine maps) extend to the 50-foot overburden cover line. Actual mined-out area varies from these projections based on localized conditions.

- The mine roof was generally composed of massive sandstone, which could be unstable from weathering and fractures near the outcrop. Natural vertical to near vertical fractures with one to two inches of separation were present in the mine increasing with greater frequency near the outcrop.

[2] As a result of the 1994 breakthrough, MCCC prepared the sealing plan referenced in this report. This plan was approved by MSHA on October 20, 1994. MCCC also submitted the plan to DSMRE as part of minor permit revision number 5. The permit revision was approved December 7, 1994. This report refers to the MSHA and DSMRE approved plan and revision collectively as the "sealing plan."

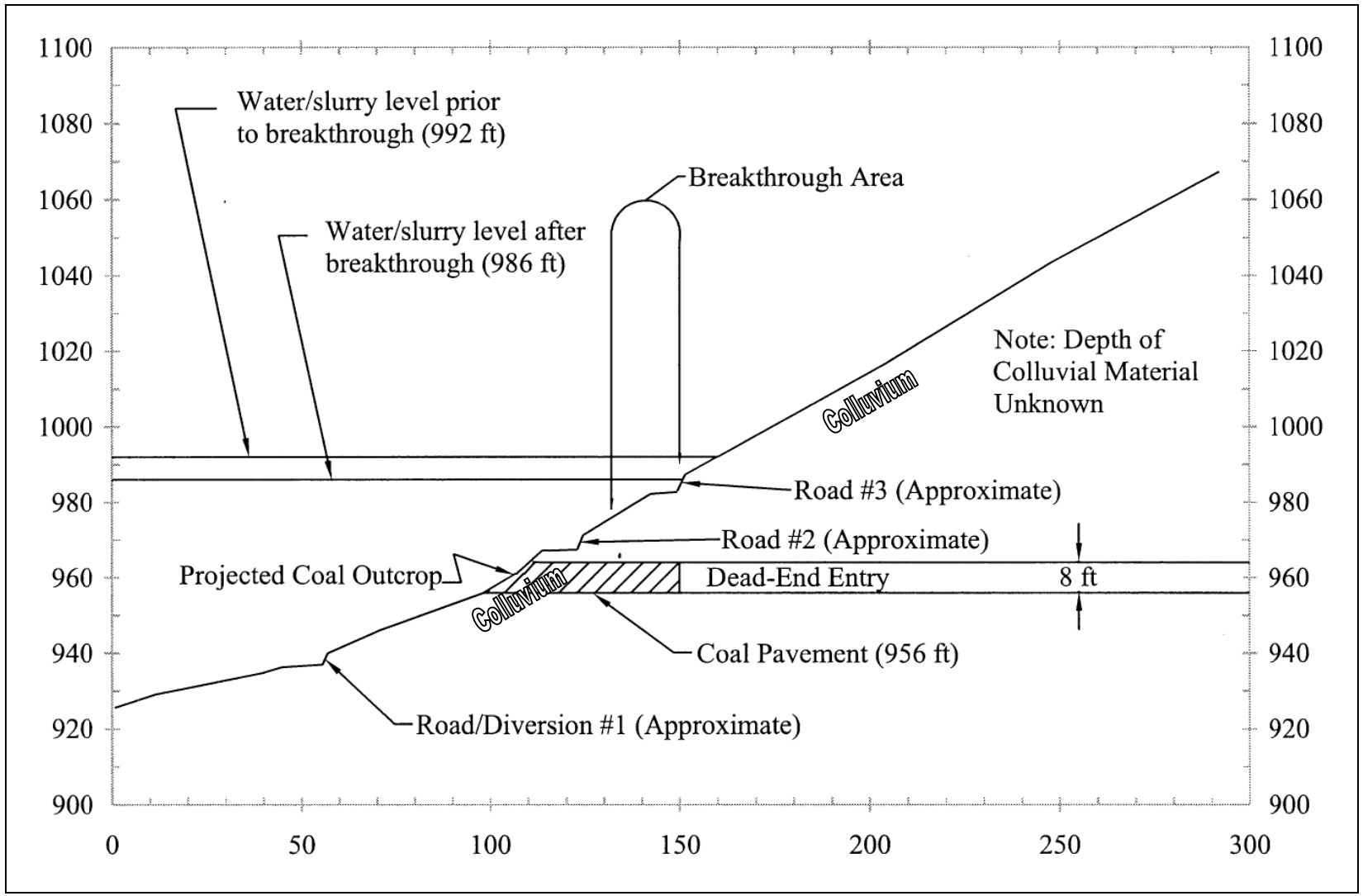

Figure 3. Cross-Section A-A' at May 1994 Breakthrough. Drawn by OSM.

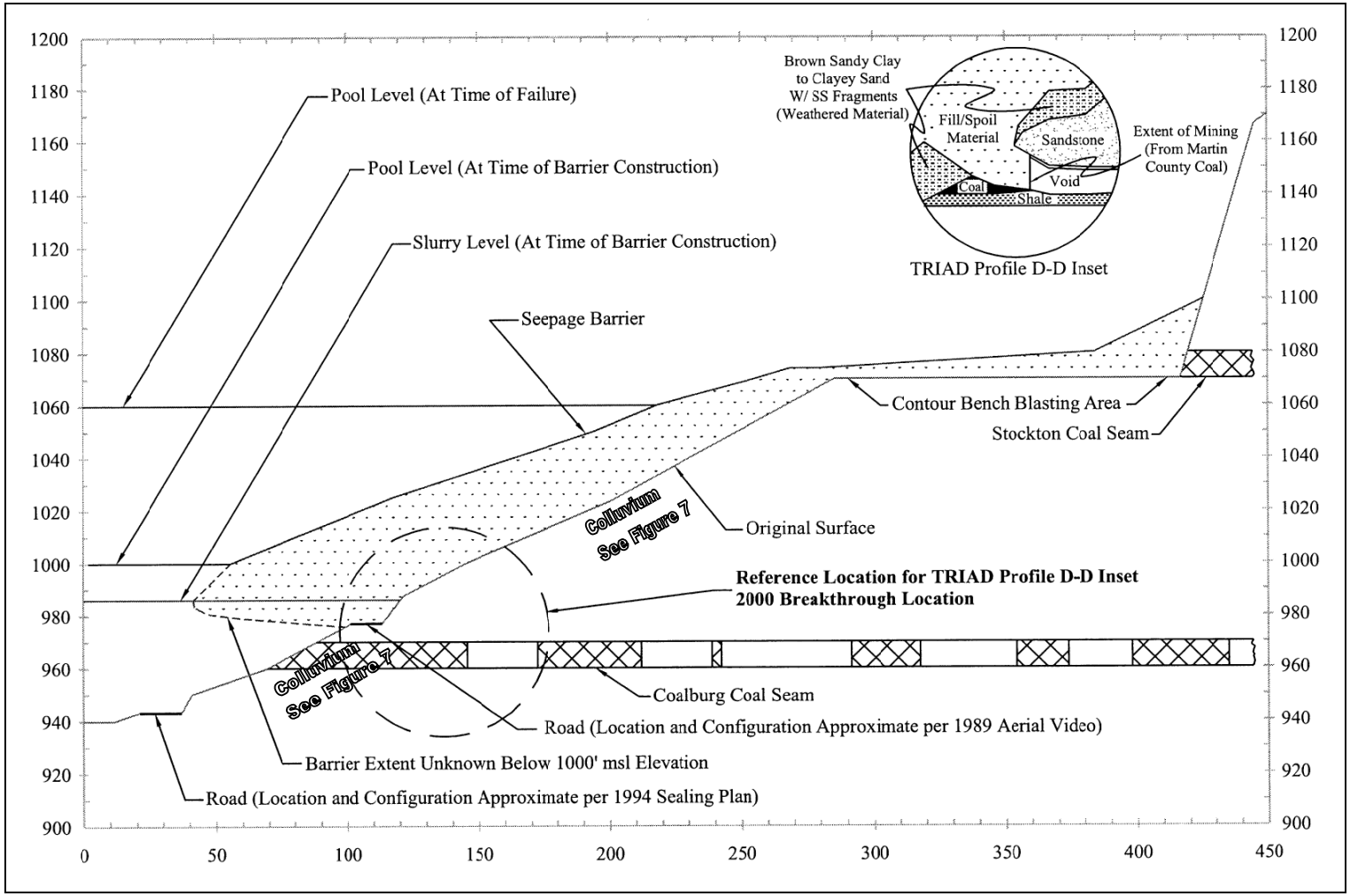

Figure 4. Cross-Section B-B' of Seepage Barrier Constructed at 2000 Breakthrough. Drawn by OSM with Triad Profile D-D inserted.

Roof fall notations in the North Mains on DMM mine maps may be indicative of poor roof conditions that could occur adjacent to the outcrop barrier.

2.1.4 Seepage barrier: As a result of the 1994 breakthrough, MCCC developed the sealing plan to "reduce the potential of a breakthrough and limit the rapid release of impounded water in the mine." The approved seepage barrier proposed covering a portion of the outcrop barrier with 12 to 25 feet of spoil material (Figure 5 [Page 20]). Upon approval of the sealing plan, MCCC constructed the seepage barrier (Photo 6 [Page 21]) by blasting a contour bench while mining the Stockton coal seam. Blasted material (spoil material) was pushed downslope to cover the Coalburg coal seam outcrop barrier. Consequently, the seepage barrier is composed primarily of sand, small sandstone fragments, and sandstone boulders.

The seepage barrier was constructed around the north, west, and southwest sides of the impoundment. MCCC did not extend the barrier to the eastern side, where the Coalburg coal seam outcrop barrier is in excess of 300 feet wide. The construction of the seepage barrier resulted in a contour bench at about 1,075 feet msl. West of the embankment, the seepage barrier has been covered with coarse refuse.

2.1.5 Surface features around the impoundment: At various times, clearing and grubbing, construction of roads and drainage ditches, and other activities have been performed around the impoundment. The size and stability of an outcrop barrier can be affected by cut and/or fill activities on the surface. OSM noted evidence of such surface modifications at the locations of the 1994 and 2000 breakthroughs. According to a map attached to the sealing plan, there was a road or diversion ditch about 20 feet below the Coalburg coal seam cropline near the 1994 breakthrough (Figure 3 [Page 17]). The map is based on 1985 aerial photography. It is not clear whether the road was excavated into the hillside or constructed on fill material obtained from clearing and grubbing operations. A June 1, 1989, aerial video shows another road a few feet above the top of the projected Coalburg coal seam and a road higher up the hillside (Figure 3 and Photo 7 [Pages 17 and 22]). These roads appear to have been excavated into the hillside.

The map also shows either a road or a diversion ditch about 13 feet below the Coalburg coal seam cropline near the 2000 breakthrough point. A June 1, 1989, aerial video shows another road approximately ten feet above the coal seam (Figure 4 and Photo 8 [Pages 18 and 23]). The permit maps and aerial photographs do not provide sufficient clarity to allow a determination whether this road was excavated into the hillside or constructed on fill material.

2.2 Site History

A detailed chronology of the impoundment and underground mine is provided in Appendix 3. A brief chronology of mining-related events at the study site up to the 2000 breakthrough event is presented below.

MCCC opened the underground mine in the Coalburg coal seam in October 1971. The room-and-pillar mining commenced at the North Mains Portals located near the preparation plant. The North and South Mains had been established by mid-1973 and late 1979, respectively. Mine Area #1, adjacent to the 1994 breakthrough, was mined in 1981 and 1982. Mine Area #2,

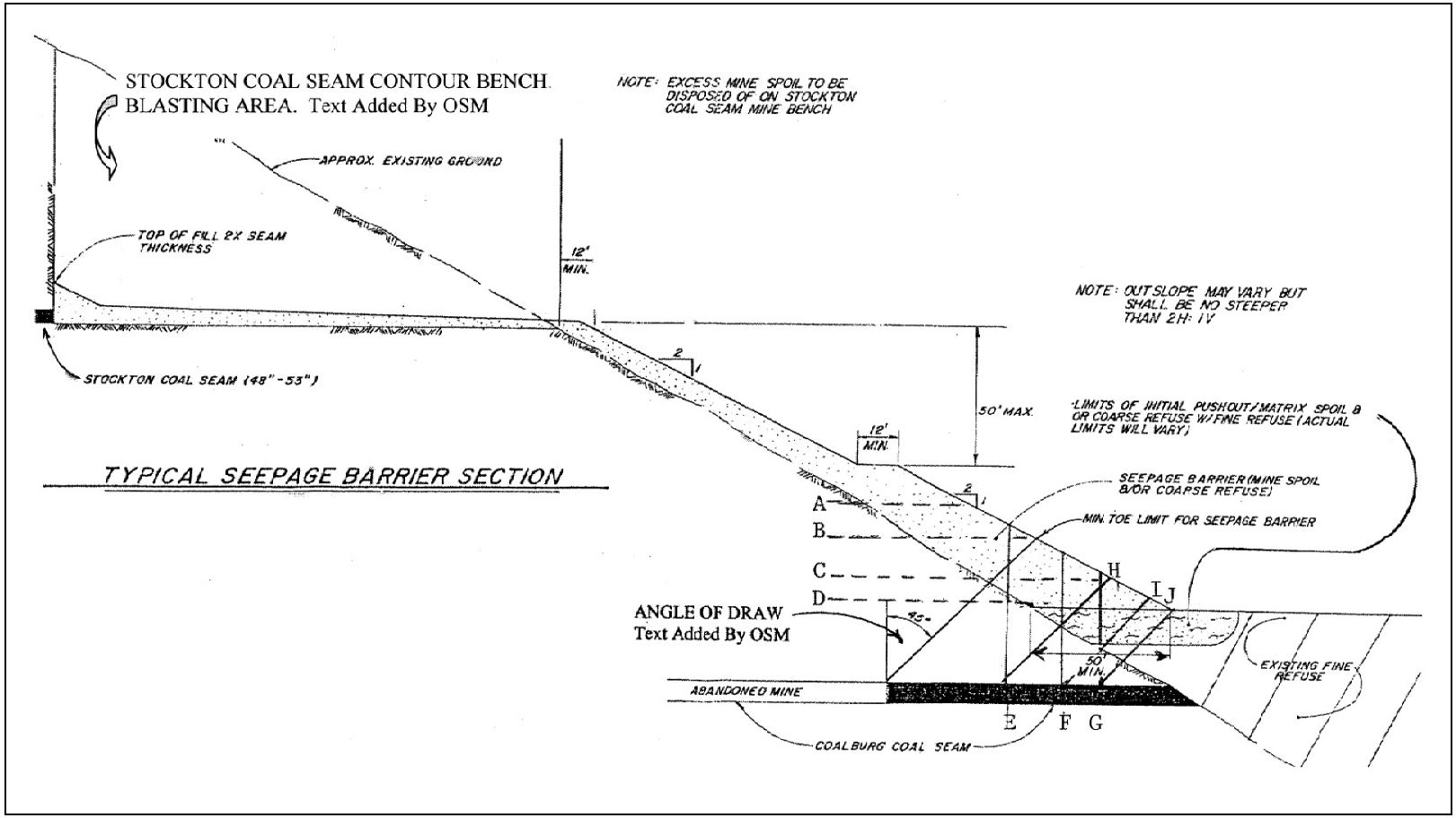

Figure 5. Cross-Section of Designed Seepage Barrier. Source: Sealing Plan, Details Sheet. Information added by OSM: 1) Mine roof caving height based on five times the mining height--line A for 12-foot mining height, line B for 10-foot mining height, line C for 7.5-foot mining height, and line D for 6-foot mining height; 2) Outcrop barrier width—vertical line E for 70-foot width, vertical line F for 50-foot width, and vertical line G for 35-foot width; 3) Lateral extent of subsidence based on a 45-degree angle of draw per MCCC —slanted line H based on a 70-foot wide outcrop barrier, slanted line I based on a 50-foot wide outcrop barrier, and slanted line J based on a 35-foot wide outcrop barrier.

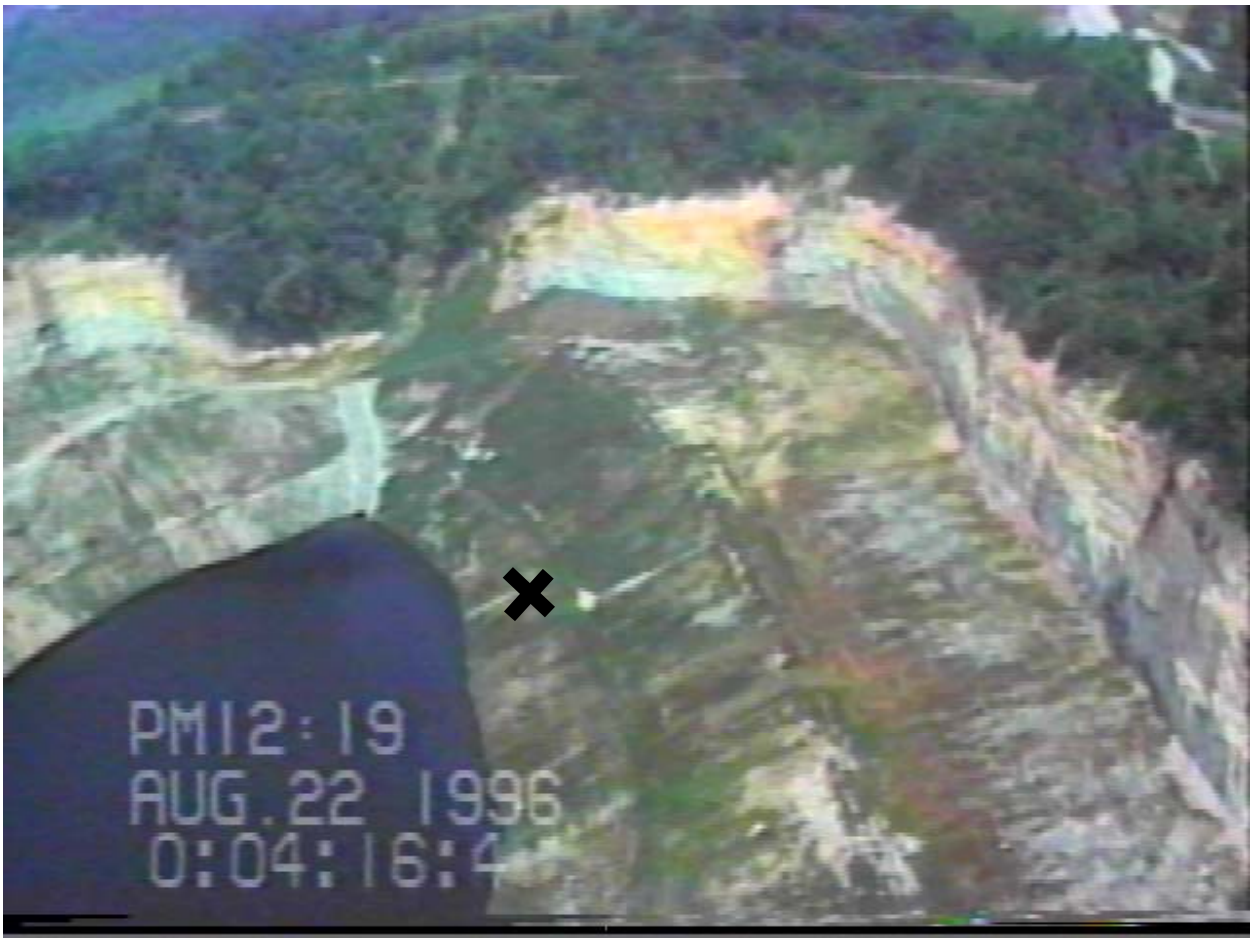

Photo 6. Seepage Barrier by 2000 Breakthrough (After Construction) - August 22, 1996. Source: DSMRE aerial video. The X marks the approximate location of the 2000 breakthrough. Pool elevation 1,018 feet msl. Mine roof elevation 973 feet msl. Contour bench elevation 1,075 feet msl.

Photo 7. Surface Conditions at 1994 Breakthrough - June 1, 1989. Source: DSMRE aerial video. The X marks the approximate location of the 1994 breakthrough. Pool elevation 958 feet msl. Mine roof elevation 964 feet msl.

Photo 8. Surface Conditions at 2000 Breakthrough – June 1, 1989. Source: DSMRE aerial video. Pool elevation 958 feet msl. Mine roof elevation 973 feet msl.

adjacent to the 2000 breakthrough, was mined in 1981. No known pillar extraction was conducted in these mining areas.

On August 26, 1984, DSMRE approved Permit Number 680-8002 as a permanent program permit under the approved state program. This permitting action brought the Big Branch site under all performance standards of SMCRA. A permit amendment for the construction of the coal slurry impoundment was approved by DSMRE on July 30, 1986. Construction of the impoundment commenced shortly afterwards. The impoundment pool elevation reached the level of the Coalburg coal seam in 1989.

On May 22, 1994, as the pool level reached 28 feet above the Coalburg coal seam, a major breakthrough into the underground mine occurred at the southwest side of the impoundment (Figures 2 and 3 [Pages 4 and 17] and Photo 1 [Page 3]). An unusual amount of water from the underground mine was observed in Big Branch at about 11:30 p.m. The exact location of the impoundment breakthrough was not discovered until about 2:55 a.m. on May 23, 1994. Emergency repairs were started at 3:30 a.m., and the flow was stopped at 6:30 a.m.

On August 8, 1994, MCCC submitted the sealing plan to MSHA. The purpose of the sealing plan, which was developed by Ogden Environmental and Energy Services (Ogden), was to reduce the potential for future breakthroughs. On August 18, 1994, Summit Engineering, Inc, (Summit), on behalf of MCCC, submitted Minor Permit Revision No. 5 (the permit revision) to DSMRE. The permit revision included the sealing plan as well as additional information required by the DSMRE permitting process. The sealing plan covered the seepage barrier, bulkheads adjacent to the North Mains, wet seals at the South Mains Portal, and monitoring of the drainage from the South Mains Portal. MSHA approved the sealing plan on October 20, 1994, and DSMRE approved the permit revision on December 7, 1994.

MCCC commenced construction of the seepage barrier in February 1995. Based on photos taken by Ogden during weekly inspections[3], construction of the barrier appears to have reached the location of the 2000 breakthrough in late March to early April 1995. The July 1996 annual certification reported that the seepage barrier was completed around September 1995.

2.3 2000 Breakthrough Event

A detailed recounting of observations and actions pertaining to the 2000 breakthrough are presented below.

At 7:00 p.m. on October 10, 2000, a dozer operator observed that the face of the coarse refuse fill sank about eight to ten feet into the pool. This coarse refuse disposal area is located at the southwest end of the impoundment, across the pool from the impending breakthrough and is not part of the impoundment embankment. OSM could not correlate this condition with the breakthrough.

[3] Weekly inspections by the mining company are required by the MSHA regulations. Ogden, and later Geo/Environmental Associates, Inc. (GAI), conducted the weekly inspections for MCCC.

At about 11:45 p.m., the conveyor belt examiner inspected the bulkheads off the North Mains of the underground mine (Figure 2 [Page 4]). He did not identify any drainage through the bulkheads. The conveyor belt examiner left the underground mine shortly after 11:45 p.m. However, twenty minutes later, at about 12:05 a.m. on October 11, 2000, MCCC's underground coal conveyor beltline monitor indicated that the Number 2 beltline in the North Mains had shut down. The dispatcher called the beltline electrician and instructed him to investigate the cause of the shutdown. Around 12:10 a.m., the electrician notified the dispatcher that "gray stuff," about two to three feet deep, was exiting the Number 2 North Portals. A short time later, MCCC personnel also observed a high discharge of water and slurry coming out of the South Mains Portal. The general mine foreman was notified of the situation at about 12.15 a.m.

About 12:20 a.m., the return water pump, used to recycle water from the impoundment for use in the preparation plant, stopped operating. Around the same time, the belt examiner radioed the dispatcher to report slurry three to four feet deep at the Number 2 North Portals. The preparation plant supervisor heard this call to the dispatcher and, at approximately 12:30 a.m., went to inspect the impoundment. The dispatcher notified the MCCC president of the problem at 12:30 a.m., and the president notified the plant superintendent, chief of security, and safety manager.

The preparation plant supervisor arrived at the impoundment at about 12:35 a.m., and observed that the pool level had dropped approximately three feet. At 1:00 a.m., the preparation plant supervisor located the breakthrough and observed water in the impoundment converging at the breakthrough location (Figure 2 [Page 4]). By then, the water level had dropped an additional three to five feet. MCCC security personnel established a roadblock on the country road along Wolf Creek sometime close to 1:15 a.m. Flow increases were observed in both Coldwater Fork (downstream of the Number 2 North Portals) and Wolf Creek (downstream of the South Mains Portal) by around 1:40 a.m.

At about 2:20 a.m., the preparation plant supervisor notified the impoundment coarse refuse dozer operator of the breakthrough and instructed him to take his dozer to the site. The dozer operator arrived at the site at approximately 2:40 a.m. and began pushing spoil into the breakthrough. Additional dozers subsequently arrived at the site to assist. MCCC notified MSHA, Kentucky's Disaster and Emergency Services (DES), and Department of Fish and Wildlife Resources of the breakthrough around 3:00 a.m. MCCC notified DMM approximately 20 minutes later. MCCC discussed the need for site evacuation with DES and the Martin County Sheriff's Office.

By 4:42 a.m., MCCC observed that flow through the breakthrough area had stopped. The pool elevation of the 68-acre impoundment had dropped approximately 14 feet. An estimated 306 million gallons of slurry had drained from the impoundment. MCCC called the Prestonsburg DSMRE office before 7:30 a.m. and left a message on the answering machine that they had a "black water" discharge. MCCC made a follow-up call later that morning.

2.4 Effects of the 2000 Breakthrough Event

The slurry discharge from the Number 2 North Portals immediately filled and overtopped a sediment control pond. As the discharge moved downstream along the upper reaches of

Coldwater Fork, slurry filled and overtopped the stream channel for the first eight miles, covering the narrow valley flood plain and property of some of the residents. Seven homes became inaccessible. Coldwater Fork empties into Rockcastle Creek, which runs through Inez, Kentucky. While the spill remained largely within the stream channel, it continued to discolor the stream beyond Inez.

The South Mains Portal discharge eroded a very large gully a short distance from the portal and destroyed a sediment control pond. The slurry then entered Big Andy Branch and Panther Fork before entering Wolf Creek. Wolf Creek drains into the Tug Fork of the Big Sandy River. Overtopping of the stream banks occurred in the first four miles of the Wolf Creek drainage. The movement of the slurry down Wolf Creek, Tug Fork, and the Big Sandy River caused significant problems with the downstream water supplies. As a result, on October 16, 2000, Kentucky Governor Paul Patton declared a state of emergency in ten counties in northeast Kentucky. The ten counties included Martin, Lawrence, Boyd, Carter, Greenup, Lewis, Fleming, Mason, Robertson, and Bracken. Within one week of the breakthrough, over 75 miles of stream below the impoundment had been impacted. By October 17, 2000, the spill reached the Ohio River at Catlettsburg, Kentucky.

The visibility of the slurry diminished as it flowed down stream. By the time the slurry reached the Ohio River, most of the coal refuse had settled out of suspension. The slurry impacted municipal water supplies at:

- Kermit, West Virginia, located on the Tug Fork just below the mouth of Wolf Creek.
- Crum, West Virginia, located downstream of Kermit on the Tug Fork with municipal water supplied by Kermit.
- Louisa, Kentucky, which withdraws water from the Levisa Fork of the Big Sandy River.
- Fort Gay, West Virginia, which withdraws water from the Tug Fork at the Big Sandy River confluence located across the river from Louisa.
- Kenova, West Virginia, which withdraws water from the Big Sandy River.
- Inez, Kentucky, located on Rockcastle Creek.

No comprehensive listing of impacts was prepared as part of this study. Media reports indicated that Lawrence County and Martin County public schools were closed after the breakthrough due to the municipal water supply impacts. Also, American Electric Power, which uses water from the Big Sandy River, shut down its power plant due to the spill.

Only minor impacts to the embankment occurred as a result of the breakthrough. Minor sloughing occurred on the upstream side of the embankment, presumably as a result of the sudden drawdown of the pool during the breakthrough.

Massey Energy Company, the MCCC's parent company, in its May 29, 2001, second quarter corporate news report for fiscal year 2001, discussed the clean-up effort. The report stated that "over 500 people and 300 pieces of equipment were mobilized to clean up the Martin County Coal slurry spill, which has now been completed. Total cost for the clean up is now estimated at $56 million dollars, with all but approximately $3 million expected to be covered by insurance." On September 14, 2001, Massey Energy Company reported that 36.9 million dollars had been spent on the clean-up effort through July 31, 2001. A number of civil suits are pending, involving numerous citizens of the area alleging impacts and seeking damages from MCCC.

2.5 Responses by Federal and State Agencies

The release of waste materials into the waters of the United States without a permit violates the Clean Water Act. Region 4 of the United States Environmental Protection Agency (EPA) was contacted by the National Response Center (NRC)[4] and responded immediately to the release along with the Commonwealth of Kentucky. An On Scene Coordinator (OSC) from EPA was dispatched to the site immediately. As required by the National Oil and Hazardous Substances Pollution Contingency Plan[5], the EPA OSC established the Unified Command/Incident Command to coordinate the response. All agencies with regulatory jurisdiction agreed to participate in a Unified Incident Command Organization (Unified Command). The Unified Command was charged with assisting in the coordination of clean-up efforts and ensuring the safety of the public and clean-up workers. Within the Unified Command, the Environmental Unit was established to address environmental issues. The Stream Bank Assessment and Cleanup Survey Team was formed as an integral part of the Environmental Unit to address specific removal needs of individual stream segments. This team consisted of representatives of EPA, Kentucky, West Virginia, and MCCC. All actions relative to the cleanup were reviewed and approved by each of the representatives.

During this time, DSMRE monitored site conditions and reviewed MCCC's plans for the removal and storage of the slurry spill. DSMRE's approval was required prior to implementation of the remedial plans. DSMRE also assisted the MSHA investigation by conducting down-hole videotaping of the drill holes, attended the MSHA interviews, and conducted its own investigation of the breakthrough. OSM also monitored the cleanup and provided assistance and support to DSMRE.

The MSHA investigation began shortly after the 2000 breakthrough. MSHA interviewed a total of 44 people, including past and present MCCC employees, contractors and consultants to MCCC, and property owners adjacent to the affected streams. The interviews began December

[4] The NRC is the federal government's national communications center, which is staffed 24 hours a day by U.S. Coast Guard officers and marine science technicians. The NRC receives all reports of releases involving hazardous substances and oil that trigger the federal notification requirements under several laws. Reports to the NRC activate the National Contingency Plan and the federal government's response capabilities.

[5] The National Oil and Hazardous Substances Pollution Contingency Plan, more commonly called the National Contingency Plan (NCP), is the federal government's blueprint for responding to both oil spills and hazardous substance releases. The NCP, promulgated pursuant to 42 U.S.C. Section 9605, codified at 40 CFR Part 300, is the result of the government's efforts to develop a national response capability and promote overall coordination among the hierarchy of responders and contingency plans.

5, 2000, and were completed February 1, 2001. MSHA also contracted with Triad Engineering, Inc. (Triad) to conduct a subsurface investigation of the seepage and outcrop barriers (Appendix 4). This involved drilling and core logging of 47 holes at the 2000 breakthrough location and the performance of electrical conductivity surveys (Appendix 5) at various points along the barriers. The field work was completed on January 23, 2001.