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COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR SURFACE MINING RECLAMATION & ENFORCEMENT
FRANKFORT, KENTUCKY 40601
CARL E. CAMPBELL
COMMISSIONER

January 25, 2000

TELETYPE

JAN 27 2000

FIELD

Mr. William J. Kovacic, Field Office Director
Office of Surface Mining
2675 Regency Road
Lexington, Kentucky 40503-2922

Dear Mr. Kovacic:

Enclosed is the Final Report of the Joint OSM Special Study on Drainage Control. This report concludes the Special Study that was initiated by the 1996 Performance Agreement. Although the report does not find any major programmatic issues with drainage control structures in Kentucky, we have taken steps to improve the modeling of drainage areas above drainage control structures as well as improve inspection processes to ensure drainage areas are in conformance with the approved permit.

Thank you for the participation of your staff in the conduct of the study as well as their assistance in the compilation of the Final Report. If you or your staff have any questions, please contact me or Mark Thompson.

Sincerely,

Handwritten signature of Carl E. Campbell in black ink.

Carl E. Campbell
Commissioner

CEC/mwt/chs

C: Mark Thompson
Jeff Taylor
Keith Smith
Fred Craig

Enclosure



**JOINT OSM-DSMRE SPECIAL STUDY
REPORT ON DRAINAGE CONTROL**

FINAL REPORT

DECEMBER, 1999

FINDINGS

The joint OSM-DSMRE Drainage Control Study Team (DCST) conducted investigations into 10 mine sites that were alleged, via citizen's complaints, to have caused or significantly contributed to downstream flooding and/or flood related adverse impacts to citizens, property or the environment.

The study team found no corroborating evidence to support the allegation that surface mining operations had an adverse impact on the flooding potential for citizens and residences downstream, when DSMRE's hydrologic policies and procedures were followed. The problems discovered in the course of this study appeared to result from a failure to follow set guidelines either in the permitting process or in the on ground reclamation process, or a combination of the two. In addition some areas of the SEDCAD hydrology and flood potential modeling as presently applied were found to have possible weaknesses. *Also* field personnel should more closely monitor the mining operations to ensure that approved drainage schemes are being followed and that proper erosion control devices are installed below spillways on steep slope areas.

Factual results garnered from the study indicate that the majority of the alleged downstream flooding problems were more a result of localized, extremely heavy precipitation events that led to flash flooding, which would have occurred with or without the mining operations being present.

BACKGROUND

A joint special study was initiated, via the 1996 Oversight Agreement, to review the adequacy of drainage control in watersheds impacted by surface mining. The pre-determined focus of the study was to ascertain if mine drainage was causing or contributing to off-site impacts to downstream areas. The field investigation parameters included delineation and measurements of watershed boundaries, then comparing pre-mine versus post-mining drainage patterns and volumes. Field reconnaissance would also include verification that the sediment structures were properly built and certified, review of the approved hydrology scheme in the permit, and an on-site inspection of the alleged off-site damage. The data collected was then evaluated to determine if the mining operations had any effect on the downstream hydrology, particularly the flood potential for the downstream citizens and property.

Team members were selected from both OSM and DSMRE as a mixture of engineers and environmental specialists from both agencies, all with a minimum of at least 15 years experience in mining reclamation and enforcement. Team members from the Lexington Field Office of OSM were Gail Smith and Ralph Blumer. Field inspectors George Morgan and Charles Saylor also participated in several of the investigations. Team members from Kentucky DSMRE included Jesse Gilpin, Paul Travis, Jeff Hall and Jeff Taylor.

The study was initiated after both OSM and DSMRE received an increase in citizen complaints that often involved life threatening, property damaging “washouts”. Several complainants were alleging that the large volumes of water they observed were caused by the upstream mining operations.

The original intent of this study was to investigate 15 citizen complaints that alleged flood damage caused by mining operations. However after three years of monitoring complaints, only 10 sites with possible flood related damage have been reported, therefore the team concluded the study at this point.

REVIEW FINDINGS

The basic responsibility of the DCST was to determine whether there was any relationship between surface mining and reclamation processes and an increase in the flood potential for areas downstream of these mining operations.

The DCST conclusions are based on factual data gleaned from the on-site investigations, as well as “Best Available Technology” (BAT) hydrology modeling and any other sources of obtainable information. Sources other than those previously mentioned include the approved drainage plan in the permit, rainfall data for the dates of the flooding events and any first-hand eyewitness reports of these events.

Of the ten sites investigated in the course of the study, three of the cases resulted in an actual increase in flood potential and enforcement action being taken by DSMRE. In each of these three instances the mine operation had significantly increased the volume of precipitation runoff flowing into an off-permit natural drain as compared to the pre-mining baseline runoff. In each of these cases the permittee/operator failed to properly follow the approved drainage plan in their reclamation operations. For more detailed information on the individual site investigations, please see the synopsis attached to this report.

Statutes and regulations governing mining require that runoff from disturbed areas as defined in 405 KAR 16:070, Section 1 (1)(d), pass through a sediment control structure prior to leaving the site. In order to comply with these requirements mine operators usually permit and construct diversion ditches to divert any runoff to an approved structure. This situation often causes a larger acreage of runoff than natural to be concentrated to a narrow outlet, which is usually the spillway of the sediment structure. Although energy dissipators such as riprap are used to prevent the eroding effects below the spillway that sometimes occurs in these instances, heavy rainfall events sometimes produce such large volumes of runoff that gully erosion occurs below the spillway nevertheless. The study team found five of the ten sites investigated to have sufficient erosion below the spillway to warrant issuance of a non-compliance (Note: Two of these permits cited were a result of extreme rainfall events and not due to an increase in the flood potential).

The Division of Permits requires each permit applicant to prove by BAT hydrology modeling that the drainage plan for each sediment structure will not have a significant adverse impact on the hydrological balance of adjoining areas. This is usually done by a computer program called SEDCAD, which has been utilized by mining engineers in different forms for the last couple of decades. SEDCAD is a nationally recognized computer hydrology modeling system developed by the University of Kentucky- Biosystems and Agriculture Engineering Department. Mining engineers and the Division of Permits reviewers use SEDCAD to determine the sizes, locations and drainage areas of sediment structures in order to prevent any adverse impact to the areas downstream from mining.

Data results from the study found no evidence that mining increased the flood potential or had any adverse hydrological impact when a correctly permitted drainage scheme was followed. The three study sites on which enforcement actions were taken had experienced an increase in the drainage area due to the post-mining backfilling and grading configurations and/or extension of the diversions beyond designed limits, which increased the watershed of the sediment structure to a level in excess of what was approved in the permit package.

The regulations require that all mine operations control drainage to prevent an increase of flooding potential. Mine engineers and Division of Permits reviewers accomplish this by:

- 1) Estimating the premining drainage for the watersheds within the mine area using BAT, and
- 2) Designing mine drainage and ponds in order that drainage from the impoundments will not exceed the premining drainage from the watershed.

If the premining drainage is overestimated, drainage from the permitted ponds may cause localized flooding that would not have occurred prior to mining. The accuracy of the findings and conclusions of this report are dependent upon the accuracy of the SEDCAD modeling, particularly the pre-mining data. As SEDCAD and other mine engineering technologies advance, improvements in flood potential prediction and analysis decrease any likelihood that mining might adversely impact a downstream landowner or community. Recommendations # 1 through 4 in the concluding section of this report hopefully will help to make flood potential prediction and modeling more accurate for future mining permits.

A synopsis with the situations and conclusions of each site investigation is attached as an addendum to this report.

RECOMMENDATIONS

Although the study team found no major flaws in the methods DSMRE utilizes in its hydrology modeling, some concerns and potential areas for improvement were noted.

(1) The study team recommends that the Division of Permits consider refusing to allow permittees to use “instantaneous time of concentration” (I-Tc) in the pre-mining SEDCAD hydrology modeling. Discussions with Dr. Richard Warner of the University of Kentucky, a co-creator of SEDCAD, and recent projects under the direction of Dr. Warner have confirmed that the use of “instantaneous” can often cause elevated pre-mine estimates of average runoff. When (I-Tc) is used in pre-mining hydrology modeling, the model runs its program such that any and all rainfall that hits within the model watershed is projected to be at the watershed outlet immediately. While this scenario is appropriate for certain SEDCAD modeling situations, it artificially increases pre-mining peak flows and thus does not provide an appropriate base for comparison of post-mining discharge. Obtaining the most precise pre-mine runoff data possible is essential to ensure that the mine drainage schemes are designed to prevent adverse impacts to the hydrologic balance and citizens and property downstream.

(2) The three sites from which enforcement actions (for an increase in flood potential) were cited all had the same problem; a significant increase in the sediment’s watershed after backfilling and grading was completed. It is recommended that permittees and especially field inspection personnel be reminded to ensure that the approved drainage plan in the permit is followed, including diversion ditches.

(3) The DCST recommends that the permit ‘method of operation’ section be expanded to include drainage scheme information that is pertinent to the proposed mining plan. For example, it was noted and discussed on a few of the study sites that the approved drainage plan was designed for only a maximum of 10% disturbed area in a watershed. Team members and Division of Permits representatives agreed that this is rarely an accurate on-ground scenario. A majority agreed that the Division of Permits should include information from the drainage plan that is associated with the method of operation into both sections of the permit, making it easier for everyone to understand the approved mining plan.

(4) The DCST’s final recommendation (4) is that closer scrutiny is given to ensure that adequate energy dissipator/erosion control devices are used below spillways of dugout structures, especially those that flow out to steep slope areas. The study team found some areas that had moderate to severe erosion when the spillway emptied onto natural ground where there was no previous natural drain, causing sediment deposition problems downstream where the topography leveled off. A check of these areas on complete inspections and/or after severe storm events should not be overly burdensome on inspectors and could prevent damage to downstream landowners. It is recommended that dugout structures be placed in pre-existing natural drains unless there is a substantial reason it should be placed otherwise.

It should be noted that the Division of Permits has already implemented one recommendation of this team. In the early portion of this study it was discovered that permittees were sometimes allowed to use different modeling programs for the pre-mining versus the during-mining hydrology data. This appeared to be a possible loophole for 'tweaking' of the hydrology data to allow a greater volume of runoff than would otherwise be permitted. Paul Travis, an engineer and team member from the Division of Permits, enacted a new reviewer policy to ensure that the pre and post-mining hydrologic data were designed by the same methods.

DCST SITE SPECIFIC RESULTS

1. **Holston Mining P.N. 898-0349-** Danny May Complaint- Flooding and sediment deposition damage to property was alleged to be the result of Holston Mining's operations approximately 1700 feet up the mountainside from Mr. May's residence.

The Drainage Control Study Team (DCST) could find no evidence to support **Mr. May's** allegation that the mining and in particular SS# 38 was responsible for the flooding and sedimentation deposits on his property. The team conducted a thorough investigation of the mined watershed, SS# 38, and an on-ground reconnaissance of the hillside between the minesite and Mr. Mays property. There was substantial erosion and debris spread all along this area of Pike County, apparently due to an intense storm cell that dumped approximately 3 inches of rain in less than four hours. It appears that the flood damage was due to the large precipitation event that flowed down the mountainside carrying sediment and debris with it. The drainage area above Mr. May's property included both a gas well and a logging operation, which contributed to the sediment and debris deposited on Mr. May's yard.

SEDCAD modeling was conducted comparing pre-mine to post-mining effluent for a 25yr/24hr storm to determine if Holston Mining was responsible for increasing the flood potential for the area downstream of SS# 38. The data results are as follows:

Pre-mine flow17.17 cfs
During-mining.16.37 cfs

This data suggests that Holston Mining had a negligible effect on the flood potential for the area downstream of SS# 38.

2. **Coal Mac Inc. P.N. 836-0229-**Amarine Conn Complaint- Three silt structures were involved, SS# 2, 2A, and 4. Alleged that mining had caused severe flooding in Ned's Fork area of Floyd Co.

Residents of the Ned's Fork area alleged that two separate severe flood events had occurred within the past year. The latest had occurred on August 8th, 1996, with floodwaters jumping the ditchlines and almost washing away a car driven by Mrs. COM. The study team conducted a thorough investigation of the mining area and the immediate downstream area, including the Ned's Fork community. A video of the August 8th event was provided by Mrs. Conn. A thorough investigation was initiated involving comparison of the pre-mine versus the post-mining watershed, verification of the correct design and construction of the sediment structures, accumulation of any local rainfall data, and interviews with citizens and mine personnel.

As a precautionary measure the team did a cross-sectional profile survey of the Ned's Fork area where floodwaters had overtopped the county road culvert just upstream from Mrs. Conn's residence. Using a video taped by Mrs. Conn on the day of the flooding to determine the height and volume of the floodwaters, the engineering results determined that the county road culverts in this area were inadequate to handle a large storm event.

SEDCAD results totaled at a point just below the confluence of all three structures found

Pre-mining = 441.28 cfs
During mining = 365.02 cfs

The team could find no violations or negligence on the part of Coal Mac, Inc., and its mining operations in this area. The mined watershed was not changed from the pre-mine configuration, and all silt structures appeared to be built and functioning adequately. Also there was a large unmined area adjacent to the minesite and upstream of Ned's Fork that apparently contributed to the flooding of the downstream community.

3. **Kentucky May Coal Co. P.N. 898-0475-** Marvin Bentley Complaint-Alleged that SS#4 deposited sediment in yard, created slumps and erosion on hillside below the pond, pond leakage..

An investigation of the site found a significant increase in the during mining as compared to the pre-mining effluent flow in the watershed of SS#4 directly above Mr. Bentley's residence. Survey results showed an increase in the affected drain acreage from 0.6 acres pre-mine to an acreage of 4.21 acres after mining and diversions were completed. **An** on-site inspection discovered that a diversion ditch feeding SS#4 had been extended approximately 150 feet further than approved in the permit plan, thereby causing the additional effluent.

SEDCAD runs taken at the discharge point of SS#4 were **Pre-mine. 1.36 cfs**
During mining... 8.92 cfs

An additional SEDCAD run was conducted to determine the increased hydrological impact at the toe of the slope behind the impacted residence, or approximately 800 feet below the SS#4 spillway. Results of the SEDCAD runs were **Pre-mine21.69 cfs**
During mining...29.59 cfs

Enforcement action was taken, and SS#4 and associated diversions have been eliminated, returning the area to the approximate pre-mine drainage scheme.

4. **Holston Mining P.N. 898-0349-**Columbia Gas Complaint- Gas company alleged that Holston caused slide and instability in gas-line bench from effluent and seepage emanating from SS#37.

The DCST could not find sufficient evidence to link the gas bench slide and instability to the mining operations, due in part to a photograph taken by the mine inspector showing the gas bench sliding several months prior to the construction of SS#37. However, effluent emanating from below the spillway outlet of SS#37 had caused gully erosion and exposure of the gas line. A survey comparing the pre-mine versus the post mining watershed showed a large increase in the post mining watershed of SS#37. SEDCAD data results for a 25 yr/ 24 hr event comparing the pre-mine vs. post-mine watershed were:

Pre-mine 1.65 cfs
During mining...25.91 cfs

Enforcement action was taken, and Holston Mining repaired the gas line and gully erosion on the gas bench, as well as returning the watershed of SS# 37 to pre-mine levels. No further problems have been reported.

- 5. Alley-Cassetty Coal Company PN 816-0105-** Earl Combs Complaint- Downstream private lake alleged mine sediment muddying up lake. *Also* was concerned that sediment might cause a fish kill.

Investigation found that an extremely heavy rain event (estimated between a fifty to one hundred year storm event) combined with a large disturbed area caused a temporary overload of the company's SS#1. This watershed area also had a considerable acreage of forested area between the minesite and the lake that had some logging activity in the past. **NO** violations were cited. Lake cleared up quickly with no further problems.

- 6. Lodestar Energy, Inc. P.N. 836-0231-**Raymond Ratliff Complaint- Mr. Ratliff alleged runoff from the minesite, specifically dugout no. **8**, caused erosion of his hillside and siltation of his paylake.

Investigation by study team found that the operator had allowed an approximate 6 acres increase in the drainage area feeding SS#8, thereby significantly contributing to erosion on the hillside below the structure and potential siltation of the paylake. SEDCAD modelling was based on the entire (mined and unmined) watershed of the paylake.

SEDCAD results were **Pre-mine..78.64 cfs**
Post-mine103.12 cfs

These results showed an approximate increase of runoff into the paylake of 31%. Based on these findings enforcement action was taken and Lodestar Energy quickly complied to return the drainage scheme to reflect the approved plan in the permit.

- 7. Miller Brothers Coal Inc. P.N. 897-0379-**Claude Coots Complaint-Mr. Coots alleged drainage from SS#2 caused erosion and water damage to his property.

Study team found the structure was leaking but **not** causing any erosion or other damage to Mr. Coot's property. Company had made two previous unsuccessful attempts to seal the structure. Decision was made to eliminate structure and return area to natural pre-mine drainage. No further problems reported. No SEDCAD data required.

- 8. Coal Mac, Inc. P.N. 898-0517-**Thacker and Woods Complaint-Alleged drainage from the minesite and SS#1 responsible for downstream flooding to property-.

Investigation results found no discernable mining related impacts to the downstream hydrological balance. The causation of the flooding appeared to be the combination of a large precipitation event (approximately 4.5 inches of rain in a 29 hr. period) and the junction of two large watersheds less than 100 feet from the Thacker residence. SEDCAD modeling was not necessary for this investigation.

- 9. **Colonial Coal Corporation P.N. 898-0467-Numerous Complainants-Alleged flooding due to mine and related silt structure.**

Study Team investigation could find no causal relationship between the mined area and the flooding downstream in relation to the hydrological aspects; however sedimentation and debris washed downstream from the minesite did contribute to property damage downstream. Some errors were found in the permit modeling in relation to sedimentology also. However, the study could not find sufficient evidence to show that either the mining or the silt structure involved had any effect on the flood potential for the affected areas downstream. The damage once again appears to be the direct result of a severe storm cell that dumped somewhere in the neighborhood of 5.5 to 6 inches of rainfall, according to local estimates. Since mining had not increased the drainage area for this watershed, SEDCAD runs were not needed. Problems with the permitted sedimentology modeling were forwarded to the Division of Permits for review.

No further problems on this site have been reported.

- 10. **Lodestar Energy, Inc. P.N. 836-0261-Confidential Complaint-Alleged flooding and sedimentation of Stratton Branch downstream from silt structure #7.**

The study teams investigation could find no evidence that Lodestar Energy's mining had any significant impact on the flood potential for the Stratton Branch community. It appears from talking to the inspector and the mine foreman that this particular flood event was the result of a high intensity storm cell that produced large volumes of precipitation within a relatively short period of time. A noii-compliance was issued by the state inspector for a settable solids violation as a result of these events. SEDCAD results were as follows:

Premine422.33 cfs
During mining..462.66 cfs

Although these results show a 9.5% increase in flow from the mined area during a precipitation event, this is not considered to be a significant increase and is within the accepted margin of error for this program. This minesite has since been revegetated and is presently under construction as a future golf course and residential area. No further problems have been reported.