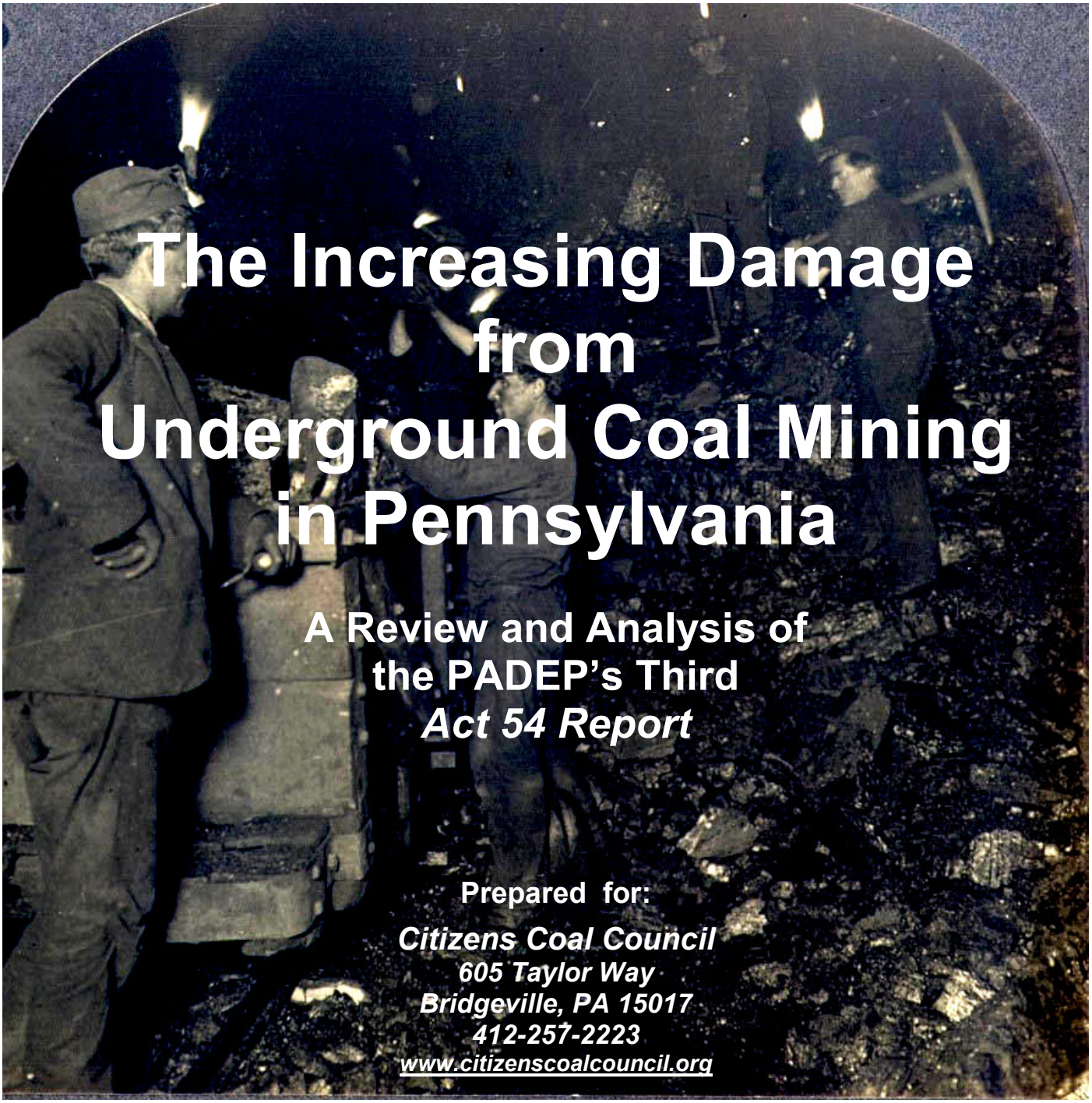

The Increasing Damage from Underground Coal Mining in Pennsylvania

A Review and Analysis of the PADEP's Third *Act 54 Report*

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I EXECUTIVE SUMMARY

In a press release on 4 January 2011, the Pennsylvania Department of Environmental Protection (PADEP) announced the availability on its website of the third Act 54 Five-Year Review Report. That Report was prepared in accordance with a mandate in the Act 54 amendments to the 1966 Pennsylvania Bituminous Mine Subsidence and Land Conservation Act.

Act 54, which was passed by the Pennsylvania General Assembly in 1994, stipulated that an analysis of the impacts of underground coal mining must be prepared by PADEP at five-year intervals beginning in 1993. This is the third such five-year analysis, and it was prepared for PADEP by researchers from the University of Pittsburgh. It covers the period 21 August 2003 to 20 August 2008. It provides a large amount of statistical information on underground coal mining during the review period along with maps and photographs of impacts to land, surface structures, interstate highways, water supplies, streams, and wetlands.

This latest Act 54 Report has been reviewed in detail by experienced Schmid & Company staff on behalf of the Citizens Coal Council (CCC). This evaluation attempts to distill and supply context for the information presented in the third Act 54 Report. It draws significant conclusions that the Act 54 Report itself failed to provide. It also makes appropriate recommendations for moving forward, which this Act 54 Report likewise did not. Some of the key observations, conclusions, and recommendations, which are elaborated in the following pages, are as follows:

- The acreage of room-and-pillar mines in operation during this third Act 54 assessment period more than doubled as compared with the second review period, while the acreage of active longwall mines decreased by 11%. Longwall mines undermined fewer properties than room-and-pillar mines (1,571 vs. 1,738), yet longwall mining accounted for 100% of reported effects to streams, 95% of the reported effects to land, and 94% of the adverse impacts to surface structures. Comparisons and evaluations of differences between the longwall and room-and-pillar mining methods, however, are not well articulated in the Act 54 Report.

- Miles of streams undermined during this review period are tabulated by mine, but stream impacts are analyzed only in terms of “incidents” rather than miles. No data are presented regarding miles of streams impacted, the nature of those impacts (flow loss, pollution, etc.), or the resolution status of those impacts. Thus, a crucial element of the Act 54 analysis -- how much actual stream damage is occurring -- remains unknown.

- Data presented in this third Act 54 Report demonstrate that significant impacts to structures, land, and water resources are increasingly occurring as a result of underground coal mining. The Report notes a 14% overall increase in reported effects during this review period (2003-2008) compared with the previous (1998-2003) period. The number of reported land impacts increased by 86% and the number of structure impacts increased by 31%.

- Many of the same concerns that previously were raised by the Citizens Advisory Council (CAC) and others about each of the first two Act 54 review reports and the regulation of underground coal mining by PADEP remain unresolved and are central concerns in this third Report, including the inadequacy of pre-mining baseline data, unacceptably long times to final

resolution of impacts, a failure to quantify regional hydrologic impacts, and a failure to address cumulative hydrologic impacts.

- The Report provides an inordinate number of statistics, but it is not particularly analytical. It presents many facts, using a multitude of statistical tools, but generally fails to actually *analyze* as required by law, failing to draw important distinctions and conclusions from the data presented.

- This third Report fails to acknowledge or address most of the recommendations of the prior Act 54 report. By its silence it suggests that no progress toward implementing them has occurred. Unlike the second Act 54 report, this Report offers no recommendations regarding either needed improvements in PADEP regulation of underground mining or ways to improve the efficiency and effectiveness of future Act 54 reports.

- Of the 269 private water supplies reported as damaged by mine operations during the review period, only 7% were deemed to have recovered and only 2% were repaired *in situ*. About half of the water supply damage claims were settled by private agreement or mine company purchase of the damaged property. Such "resolutions", although possibly helpful to individuals, do nothing to correct the damages to regional hydrogeologic systems or the impacts to broader public resources suffered by present and future generations of Pennsylvanians.

- Recognized impacts continue to require unacceptably long times to resolve. Of the 275 reported impacts (mostly to water supplies) unresolved at the end of the second Act 54 review period, 63 of them (23%) were still unresolved at the end of this third review period. Nearly two-thirds of the stream impacts newly reported during this third review period remained unresolved at the end of the period. For those streams where impacts were "resolved", final resolution required 688 days (nearly 2 years) *on average.* About one-third (34%) of reported impacts to people's water supplies were unresolved at the end of the assessment period. Resolution of water supply cases for which mining was found to be liable required 321 days *on average*.

- There was no attempt in this Report to segregate hydrologeologic impacts by method of underground mining. The entire discussion of hydrogeologic effects in Section VI is focused on longwall mining. There appear to have been no significant hydrogeologic impacts from room-and-pillar mining at all during the period, but no explicit comparison or analysis was made.

- No attention is paid in this Report to *water quality* impacts from mining, which can be due to: A) subsidence-induced changes in streamflow, B) direct discharges to streams of pollutants from surface facilities of underground mines, or C) hydrogeological disruptions from subsidence that cause migration of methane, radon, and other gases into surface and subsurface waters.

- The issue regarding a fixed angle of presumed impact versus a fixed horizontal distance from the edge of mine panels is not addressed in this Act 54 Report, despite the recommendation in the previous Act 54 report that it *should* be. The accuracy and adequacy of models currently being used to predict certain impacts (such as stream pooling) are not addressed, nor is the lack of predictive models for certain other impacts (such as water and wetland loss).

- While apparently accepting the characterization of longwall mining subsidence as being "planned and controlled", the Act 54 Report does not compile any statistics on how *many* of its tallied impacts were *predicted*, so it does not and cannot compare either the number or location of predicted impacts with the impacts that actually occurred.

- No effort was made in the Report to review important monitoring data contained in PADEP mine permit files, such as HMRs (hydrologic monitoring reports) and DMRs (discharge monitoring reports). Likewise, PADEP mine enforcement files were generally ignored as a data source.

This review of the PADEP's third Act 54 Report raises important issues which must be addressed concerning Act 54 itself, including:

- In 1994, Act 54 removed the nearly 30-year prohibition on damage to surface structures in Pennsylvania, and made provisions for restoration or compensation of certain structure and water supply damages. By removing the protections for structures, however, it enabled collateral damage to local and regional water resources which previously had been protected by the 1966 law, yet it mandated no compensation or restoration of those damages. At the same time Act 54 removed any incentive to avoid or minimize impacts when extracting the maximum percentage of coal.

- This third Act 54 Report, like the two prior ones, clearly shows that the damages associated with longwall mining, as currently allowed to be practiced, are significant and increasing, that restoration is only partial at best, and that practical alternatives much more protective of surface structures and water resources are readily available for coal extraction.

- Act 54 is fundamentally flawed because not all of the impacts being experienced are covered by the mandated remedies, nor are they being properly tallied and analyzed by PADEP. Furthermore, the remedies that *are* covered by Act 54 (in the form of mitigation, restoration, or compensation) are not being achieved fully or implemented in a timely manner.

- In light of the increasing damages being reported in these mandated analyses, Act 54 as presently administered by PADEP appears to be in direct conflict with Article 1, Section 27 of the Pennsylvania Constitution, and inequitably affecting the citizens and environment of southwestern Pennsylvania.

- Efforts must be undertaken promptly by CAC and the Legislature to revise Act 54 in light of the continuing unnecessary destruction increasingly being imposed on the residents of the coalfields and the public resources of the Commonwealth, as documented in this latest PADEP Act 54 Report.

II BACKGROUND FOR UNDERSTANDING ACT 54 REPORTS

The third Act 54 Report provides very little context for understanding the statistical data it presents. The following paragraphs seek to remedy that omission.

In 1966, the landmark Pennsylvania Bituminous Mine Subsidence and Land Conservation Act (BMSLCA, or Mine Subsidence Act) became law. The General Assembly determined that

> • *Damage to surface structures and the land supporting them caused by mine subsidence is against the public interest and may adversely affect the health, safety and welfare of our citizens.*

and

> • *The prevention of damage from mine subsidence is recognized as being related to the economic future and well-being of Pennsylvania.*

Under the BMSLCA, for the first time in Commonwealth history, there was a law "*forbidding damage to specified classes of existing structures from the mining of bituminous coal*". Structures built before April 1966, as well as public buildings, noncommercial structures customarily used by the public (such as churches and schools), and cemeteries were forbidden from being damaged by subsidence from underground coal mines, regardless of whether or not the landowner owned the coal itself beneath the structure. The Act's objective was to prevent damage from occurring in the first place. Subsequent revisions of the BMSLCA affirmed that its provisions were meant to be implemented in conjunction with federal and state environmental protection laws. Section 9.1(d) of the BMSLCA states:

> ***Nothing in this act shall be construed to amend, modify or otherwise supersede*** *standards related to prevailing hydrologic balance contained in [the federal Surface Mining Control and Reclamation Act of 1977]…… nor* ***any standard contained in*** *the act of June 22, 1937 (P.L.1987, No. 394), known as "****The Clean Streams Law," or any regulation promulgated thereunder*** *by the Environmental Quality Board.*
> (emphasis added)

In many respects, in 1966 Pennsylvania was leading the nation in its early acknowledgment of, and attempts to prevent, environmental damages from coal mining. Pennsylvania's leadership in this regard was due in no small part to the fact that it long had been a major coal-producing state and had suffered the negative environmental effects that distinction carried with it, including thousands of miles of streams impaired by acid mine drainage. SMCRA (Surface Mining Control and Reclamation Act), the comprehensive law regulating coal mining at the federal level, was not passed until 1977, and it drew heavily on the Pennsylvania legislation already in place (McElfish and Beier 1990).

When the BMSLCA was enacted in 1966, most underground coal in Pennsylvania was being mined as it had been for almost two centuries -- by room-and-pillar methods, whereby some coal is left in place to support the mine roof. Coal mines were operated under the investment-backed expectation that a profit could be made when approximately 50% of the coal in a seam was extracted, because that is how the room-and-pillar method worked. Surface impacts were minimal, and the Commonwealth subsidized insurance to protect surface owners from the unpredictable, accidental damage by unanticipated subsidence. After nearly 30 years of legal protection afforded to surface features under the BMSLCA, public and political awareness of damages due to underground mining was at a minimum.

With advances in technology for underground mining, the highly-mechanized longwall method promised to allow more coal to be removed from beneath a mine permit area, generally about 60 to 75% overall, including 100% of the coal in a panel. The longwall method thus became of great interest to major mining corporations. Because of the opportunity to utilize technology such as continuous shearers, conveyors, and hydraulic jacks, immense longwall mines achieve much greater coal production with considerably fewer workers per ton of coal than mines using only room-and-pillar technology, resulting in greater profits for large mining companies. Nevertheless, room-and-pillar-only mines still far outnumber longwall mines in Pennsylvania.

In the two decades following enactment of the 1966 BMSLCA, the more productive (and profitable) longwall mining method whose technical improvements had been developed primarily in Europe began attracting keen attention from domestic and foreign coal companies operating in Pennsylvania (EIA 1995). The 1966 law's prohibition on subsidence damage to surface structures presented a major economic obstacle to longwall mining until 1994. Even if they were relatively few and far between, the pre-1966 structures effectively controlled large areas, because a longwall mine operation is not designed to stop, move, and restart every time it comes close to undermining a protected surface feature.

Deep Mine Mediation Project

In 1986, in response to dissatisfaction by coal companies with the restrictions of the 1966 law, a Deep Mine Mediation Project was organized, bringing together representatives of the coal mine industry (Beth Energy Mines, Inc., Consolidation Coal Company, Rochester and Pittsburgh Coal Company, USX Corporation, Pennsylvania Coal Association), agricultural interests (Pennsylvania Farmers' Association), and some conservation groups (Pennsylvania Environmental Council, Western Pennsylvania Conservancy, Pennsylvania Federation of Sportsmen's Clubs) to discuss and attempt to reach consensus on ways to change BMSLCA.

After several years of work, the participants reached a consensus on a set of recommendations and specific statutory language to address water supply replacement, to enhance remedies for structural damage, and most important, to eliminate the prohibition on subsidence, thereby allowing longwall mining. The General Assembly adopted the recommendations and approved the statutory amendments in 1992. After a procedural problem was resolved, the mining law amendments, commonly referred to as Act 54, were reintroduced and passed in 1994. The bill was approved by Governor Casey on 22 June 1994 and became effective 60 days thereafter, on 21 August 1994.

Act 54 changed crucial language in the 1966 mining law. Where previously the "***prevention*** *of damage from mine subsidence*" was required, Act 54 required merely the "*prevention* ***or restoration*** *of damage from mine subsidence*" (emphasis added). Henceforth, structures or water supplies could be damaged, even severely damaged, provided there was some remedy in place "*for the restoration or replacement of or compensation for*" the damages. While it was clear in 1994 that some surface damage would occur, it was less clear how extensive that damage would be, how much damage would need to be repaired, or how effective any restoration might prove to be.

Most bituminous coal in Pennsylvania is found in thick seams that lie relatively parallel to the land surface (Figure 1). Mining companies long ago acquired extensive mineral rights (ownership of the coal) without acquiring the overlying surface properties or structures. The more coal that is extracted from an underground seam without replacement of support, the more likely there will be subsidence damage from broken rock layers extending all the way to the land surface. Thus, by its very nature

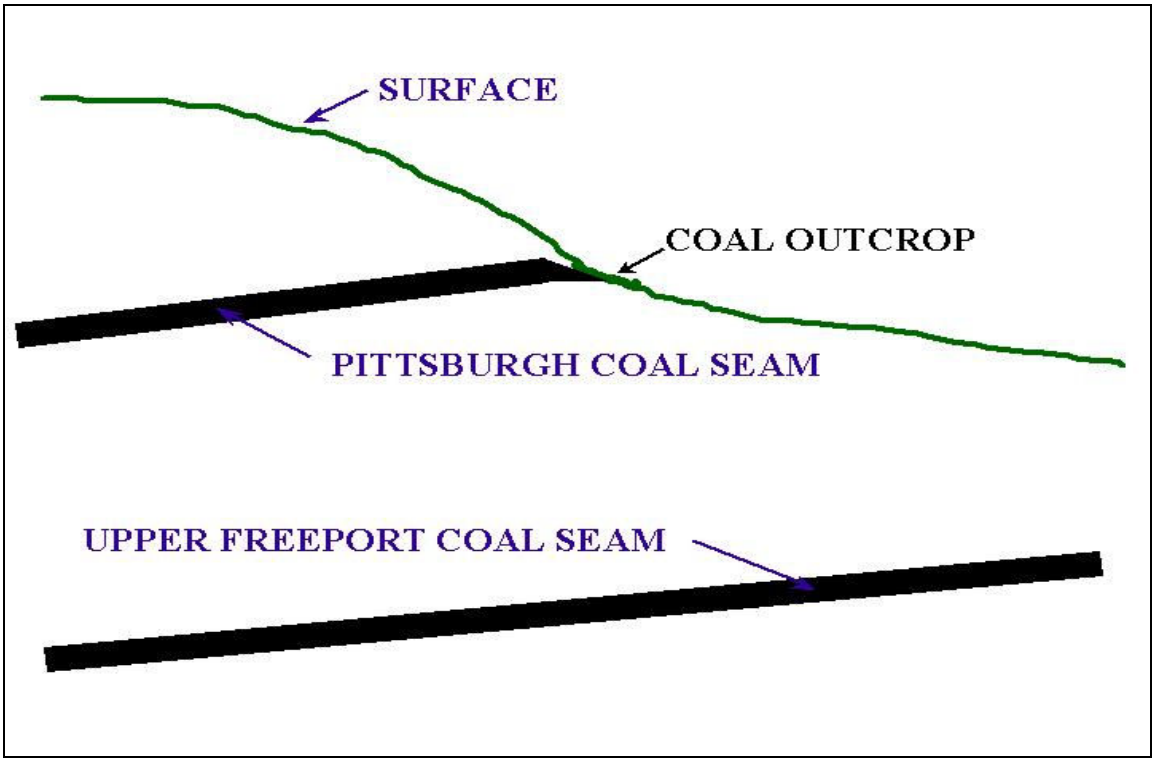

FIGURE 1. Schematic representation of Pittsburgh and Upper Freeport coal seams of relatively uniform thickness and relatively parallel to the ground surface. (Source: PADEP Bureau of Mining and Reclamation website)

the full extraction of coal from a longwall panel intentionally causes subsidence, once its entries and gates have been established by room-and-pillar mining. Subsidence renders any coal seams above longwall mines unmineable, whereas room-and-pillar mining does not.

Damage prevention is not necessarily inconsistent with longwall mining, even though it often is viewed that way by the coal mining industry. Both structural reinforcement and subsidence engineering could prevent material damage and thereby help maintain the value and foreseeable uses of surface lands and resources. One way this could be done is by replacing or supplementing the roof support traditionally provided by coal pillars left in place. Additionally, the voids created by the removal of coal could be refilled with clean solid waste material (backstowing[1]), thereby reducing the magnitude of subsidence. About one-third of the material extracted from a coal mine is waste rock, and its original volume increases when it is extracted. Backstowing would have the added advantage of cleaning up coal waste piles, eyesores that otherwise are left on the land surface where they directly impact streams and stream valleys as well as pose

[1] Per 25 *Pa. Code* § 89.142a(c) "*Backfilling or backstowing of voids*" is specifically cited as one of six available measures that mine operators are to employ if there is a possibility that subsidence will cause material damage to, or reduce the reasonably foreseeable use of certain structures and features. Such paper requirements are generally ignored and do not receive even lip service in longwall mine permit applications (Schmid & Company, Inc. 2000, 2010b).

water contamination problems for future generations. European countries long ago required backstowing. Not so in Pennsylvania.

Act 54 effectively removed any incentive that might have existed under the 1966 Pennsylvania mining law to either (A) improve underground mining technology so that a higher percentage of coal could be extracted while still providing the necessary surface support, or (B) incorporate practices such as backstowing efficiently into the underground mining process. Once the *prohibition* on subsidence damage had been removed, there was no longer any incentive to try to prevent it or to invest in the research and development needed to make practices such as backstowing cost-effective.

In anticipation of the major paradigm shift that was about to occur regarding surface damage, Act 54 prudently included a requirement for regular follow-up assessments. One of the more significant aspects of Act 54 was the requirement it established in Section 18.1 (box, below).

> ***Section 18.1. Compilation and analysis of data. - (a) The department shall compile, on an ongoing basis, the information contained in deep mine permit applications, in monitoring reports and other data submitted by operators, from enforcement actions and from any other appropriate source for the purposes set forth below.***
> ***(b) Such data shall be analyzed by the department, utilizing the services of professionals or institutions recognized in the field, for the purpose of determining, to the extent possible, the effects of deep mining on subsidence of surface structures and features and on water resources, including sources of public and private water supplies.***
> ***(c) The analysis of such data and any relevant findings shall be presented in report form to the Governor, the General Assembly and to the Citizens Advisory Council of the department at five-year intervals commencing in 1993.***
> ***(d) Nothing contained herein shall be construed as authorizing the department to require a mine operator to submit additional information or data, except that it shall require reporting of all water loss incidents or claims of water loss.***

According to the Citizens Advisory Council (2000), the need for this reporting requirement was laid out by the Deep Mine Mediation Project, which determined that:

> *… additional knowledge about the long term impact of full extraction mining on water resources is desirable to make public policy choices with confidence. Therefore, to enhance our state of knowledge and better assess the long term impacts of underground mining on the Commonwealth's water resources (as well as on the subsidence of surface features and structures), obligations are imposed on the Department … to more comprehensively compile and analyze data being generated by mining activity in Pennsylvania.*

In other words, the Act 54 analyses were to provide a periodic reality check on the attempt to balance high-extraction coal mining and environmental protection. PADEP was instructed to make a report to the Governor, the General Assembly, and the Citizens Advisory Council at five-year intervals.

III PREVIOUS ACT 54 REVIEW REPORTS

The first five-year Act 54 review report, covering the period 1993 to 1998, was prepared by PADEP staff and was released in 1999 (with a supplement in 2001). The second Act 54 report, covering the period 1998 to 2003, was prepared for PADEP by California University of Pennsylvania, and was released in February 2005.

In its review of the first five-year Act 54 report, the CAC identified a number of problems and issues of concern. In particular, the CAC (2000)

> *raised a number of concerns, including the Department's commitment to performing its obligations under the Act and the credibility of its 5-year report. Council was concerned about the quality and statistical validity of the data, the inability of the data to support some of the report's conclusions and the report's lack of a comprehensive evaluation of deep mining's impact upon water resources and their associated social costs.*
>
> *Council had previously expressed the need for solid baseline studies during pre-mining surveys to ensure the protection of water supplies in areas slated for mining.*
>
> *The [1st five-year] report only mentions stream impacts descriptively and briefly. There is no evaluation of the economic or environmental impacts of the reported flow diminution, ponding and diversion.*
>
> *Council had asked whether the department would be able to quantify how much effort has been made to prevent property damage and water loss compared to how much money has been spent to make repairs and replace water supplies. However, no cost information is included in the report.*

Upon completion of the second five-year Act 54 report, the CAC (2005) offered the following, by now familiar comments, among others:

- -- *the analysis is not very rigorous, and in some areas is more observational than analytical...*
- -- *need for further study was identified but not conducted...*
- -- *neutrality could be improved...*
- -- *The lack of adequate baseline information prevents any meaningful analysis of impacts...*
- -- *insufficient comparison and analysis of longwall vs. room and pillar...*
- -- *still concerned with the pace of the resolution process.*
- -- *each finding should have a recommended action or plan of action to resolve it...*
- -- *the Department needs to give serious consideration to conducting the next study contemporaneously with the study period in order to provide a clear, real-time picture of the situation...*

Regarding the second Act 54 report, the CAC (2007) also noted:

> *It appears that there is a paucity of information about how much water, overall, has been affected by longwall mining; water loss situations are dealt with on a piecemeal basis under Act 54 and even the 5-year report under Act 54 does not consider cumulative, regional impacts.*

Similar concerns with the deficiencies of each of the first two reports and the ongoing impacts from longwall mining were expressed by many others (*e.g.*, Kunz 2005c). Many, if not most, of the same deficiencies plague this third Act 54 Report and reflect the continuing refusal of PADEP to collect appropriate information, to request it from mine operators, or to store it in readily retrievable form.

To date there has been no concerted effort by PADEP to take seriously many of the concerns raised by the CAC and others regarding the first two Act 54 reports. For the most part, the response each time by PADEP has been predictably dismissive and condescending. After the CAC and others raise concerns about ongoing impacts and lengthy and often unsatisfactory resolution of specific damages, the Department responds that it either is working on changes or plans to work on changes; the issues of concern then are largely forgotten for another five years until the next assessment report is prepared which identifies many of the same old problems and concerns, and PADEP again claims it is working to address them and that things should be much improved in the next 5 years. The Act 54 assessment mandate presumably was not intended to be so roundly ignored.

IV THE THIRD ACT 54 REVIEW REPORT

The third Act 54 Report does an admirable job of compiling many statistics on underground coal mining in western Pennsylvania. The descriptions in its Section II about the University team's data collection and methods of analysis are informative. The discussion in Section III of the coalbeds mined and the county-by-county identification of mines also is enlightening. Excellent descriptions of the physics of subsidence, supplemented by drawings and photographs, are provided in this Act 54 Report, although they are scattered among several sections (*e.g.*, Section IV, VI, and VII). The maps in Appendix C provide particularly useful characterizations of each of the mines active during the third review period.

One of the biggest shortcomings of this Act 54 Report, unfortunately, is that it fails to draw important distinctions and conclusions from the wealth of statistics presented. It fails to identify or evaluate the significant differences in impacts between the two major methods of underground coal mining (longwall and room-and-pillar), differences that its data clearly document. The University team fails to review all of the relevant sources of data (particularly permit application, monitoring, and enforcement files) and it fails to fully acknowledge (or perhaps fully appreciate) how the lack of certain data impedes the overall assessment of impacts mandated by Act 54.

The Act 54 amendments stipulate no specific timetable for release of the five-year review reports, declaring only that they were to begin with the period 1993 to 1998. Presumably, the review reports are to be completed as quickly as possible following the end of the period under review so that their findings can be used by PADEP to improve its practices in underground mining regulation. Timely completion of these mandated five-year review reports has gotten progressively worse over time:

- the first report was released **10 months** after the end of the review period;
- the second report was released **18 months** after the end of the review period;
- this third Report comes **29 months** after the end of the review period (one month shy of being halfway through the *fourth* Act 54 review period.)

The 29-month lag time between the end of the most recent five-year review period and the release of this Act 54 Report is unexplained. It is directly contrary to the explicit recommendation of the authors of the previous five-year report (CUP 2005):

> *that the study period take place either contemporaneously with the assessment period or at increments during the assessment period. Such an approach would expedite the completion of the report upon the termination of the assessment period. (The contemporaneous writing of the report would, at the very least, aid in the accurate mapping of features).*

It is perhaps fortunate that this third Act 54 Review Report was prepared at all. In 2007, then-PADEP Secretary Kathleen McGinty (PADEP 2007) told the Center for Coalfield Justice, which had inquired about its status:

> *a funding shortfall ... prevents the hiring of an outside institution to perform any sort of review and analysis at this time. Unless this situation improves between now and the end of the reporting period, it may be necessary to forgo the preparation of the next report or have mining program staff prepare the report as time allows*.

Unlike the previous (second) five-year assessment, which included recommendations at the end of most of the individual report sections, as well as a separate section of "Recommendations" at the end of the report, this third Report provides no guidance or recommendations for improvement of mining regulations or for conducting and preparing future assessment reports. This is one of the numerous disappointments of the third Act 54 Report. Furthermore, this Report fails to follow *or even to acknowledge* many, if not most, of the recommendations of the second five-year Act 54 review report.

When this Report was first released online, its entire *References* section was missing. Several days later a 7-page *References* section was added to the others on the PADEP website. The Report is undated and poorly edited, with numerous typographical errors and grammatical mistakes. It is not the intention of this review to correct such errors, except to say that such lack of care is disappointing given that the Report was prepared by representatives of a prominent University, its preparation cost taxpayers more than $300,000, and its release was inordinately delayed. For purposes of this review the underlying data in this Act 54 Report have been presumed to be accurate, however inadequate the analysis appears in various sections of the text.

Six primary authors associated with the University of Pittsburgh are listed on the cover sheet of the Report, including two Associate Professors and four graduate students. One other Associate Professor, three other graduate students, and five undergraduate students also are listed as having participated in the preparation of the Report. There is no specific indication of who did what. Like its predecessor, this third Act 54 Report was reviewed by PADEP prior to its completion and release.

NOTE: It is not the intention of this review to cast aspersions on the University of Pittsburgh reviewers, either individually or collectively. The University team was operating under a contractual arrangement with the PADEP which specified the work tasks that were to be done, the files that were to be reviewed, and the time-frame and budget within which work was to be completed. If certain files were not reviewed, or if the focus of the study was inappropriately narrow, it is not necessarily a reflection on the University team, but rather on the PADEP. The mandates of Section 18.1 of Act 54 are directed to the PADEP. Any shortcomings of this third Act 54 Report, its analyses or evaluations, are ultimately the responsibility of the PADEP.

V SIGNIFICANT IMPACTS INCREASING

As with each of the two previous five-year review reports, this third Act 54 Report once again documents that significant impacts are occurring to structures, to land, and to water resources as a result of underground coal mining. More so than the two prior reports this Report provides statistics that highlight the stark contrast between the significant and increasing impacts associated with longwall mining and the much lesser impacts associated with room-and-pillar mining. Although countless statistics are presented, this third Report fails to elaborate on the relevant contrasts or draw appropriate conclusions in accordance with the Act 54 mandate.

The Report notes that 50 underground coal mines were active in Pennsylvania during the review period (21 August 2003 to 20 August 2008). Those operations included 36 traditional room-and-pillar-only mines (72%), 8 longwall mines (16%), and 6 "retreat" mines using room-and-pillar mining with pillar recovery (12%). The 8 longwall mines operating during the five-year review period encompassed 24,607 acres (38.4 square miles), or 64% of the total land area undermined in Pennsylvania.

Inasmuch as every longwall mine (LWM) uses room-and-pillar (R&P) mining methods in its main entries and gate road entries, the area actually undermined by longwall panels was much less, only 17,605 acres, or 46% of the total area undermined during the 5-year period. Despite their much smaller number, the longwall mines accounted for the great majority of reported impacts when compared to mines using traditional room-and-pillar methods.

ACREAGE UNDERMINED, 2003-2008

MINE TYPE	MINING METHOD Longwall	R&P	Retreat	TOTAL
LWM	17,605	7,002	--	24,607
R&P	--	11,552	--	11,552
Retreat	--	1,821	276	2,097
TOTAL	17,605	20,375	276	38,256

The third Act 54 Report records that longwall mines undermined fewer properties than room-and-pillar mines (1,571 vs. 1,738), but longwall mining accounted for 100% of the adverse effects to streams, 95% of the reported effects to land, and 94% of the adverse impacts to surface structures. The "retreat" mines accounted for a very small amount of land area undermined and volume of coal produced, and had few reported impacts during this latest Act 54 review period.

Overall, the Report notes a 14% increase in reported adverse effects of underground mining during this review period (2003-2008) as compared with the previous (1998-2003) period. The number of reported structure effects increased by 31 percent, and the number of reported land impacts increased by 86 percent. The University's team could not determine all of the factors contributing to these increases, but attributed them in part to better recordkeeping and to mining beneath more populous areas than during the second review period.

Nearly two-thirds of streams where flow loss or pooling was reported during this third review period did not have those issues resolved by the end of the assessment. For those streams where impacts were determined to be resolved, final resolution required 688 days (nearly 2 years) *on average* (page VIII-17).

The time required to reach resolution of impacts continues to be unacceptably long. The average time to resolve reported impacts for which underground mining was determined to be responsible was:

688 days (1.9 years) for streams
321 days for water supplies
207 days for structures
206 days for land.

A total of 234 cases (34%) involving water supply impacts remained unresolved at the end of the third assessment period. In addition, 32 separate water supply incidents which had been unresolved at the end of the second assessment period remained unresolved five years later at the end of the third assessment period (page VI-29); those still-unresolved cases were *averaging* 6.8 years since originally reported.

One of the most highly-publicized structural impacts attributed to longwall mining that occurred during this third five-year assessment period involved a dam in Ryerson Station State Park. In 2005, nearby longwall mining associated with the Bailey Mine caused ground movement and structural cracks in the Ryerson Station Dam (PADEP 2010b[2]), and resulted in the need to drain Duke Lake in the State Park. This 62-acre Lake, once a major recreational resource and tourist magnet (and the largest lake in Greene County), remains dry more than 5 years later. Only two brief references to this incident were made in the third Act 54 Report, and neither mentions the potential relevance of this impact to the adequacy of subsidence prediction models or presumptive angles of influence from longwall panels.

The third Act 54 Report noted (V-8) that the Ryerson Station Dam was one of *two* dams inventoried above underground mines during the review period. There was no mention or discussion of the other dam, whether it was affected, and why or why not.

[2] PADEP concluded, among other things, that "[p]revious documented incidents show that longwall mining has the potential to cause mining induced movements and damage at distances beyond the areas where customary subsidence theory would predict such impacts."

The tone of this Act 54 Report at times makes it sound as though impacts associated with coal mining are something new, that there is an ongoing learning curve, and that the coal companies and regulators are still feeling their way ahead as they try to get a sense of what the impacts may be and how to deal with them. For example (page EX-4):

> *... standards and protocols for dealing with stream* [sic] *and wetlands impacted by underground longwall mines have been developing over the last decade. Presently the coal companies, under the guidance of the PA DEP, are collecting necessary information on the pre and post-mining conditions of streams and wetlands. Some period of time will be required to fully understand these impacts and to measure how effectively they return to their previous states.*

The reality is that impacts from coal mining have been evident for centuries. Although longwall mining is a relatively new method in the 250-year history of coal mining in Pennsylvania, it has been operating full force since the passage of Act 54 nearly seventeen years ago, and elsewhere long before that.

Room-and-pillar mining is revealed in this third Act 54 Report to be much more compatible with protecting and preserving water resources and other natural and man-made features than longwall mining as currently practiced. The Report notes that, of 1,879 structures undermined by room-and-pillar mining, only 29 (1.5%) reported adverse effects. In contrast, of the 1,856 structures undermined by longwall mining, 427 (23%) reported damaging effects. The average time to final resolution was more than twice as long for structures impacted by longwall mining (238 days) as for structures impacted by room-and-pillar mining (107 days). Likewise for water supply impacts: of the 256 water supply impacts attributable to active underground mining for which final resolution was reached, nearly twice as many (163) were due to longwall mining as to room-and-pillar mining (83); the time to resolution for water supply impacts averaged 274 days for longwall mine impacts and 143 days for room-and-pillar mines.

According to the Report, the significantly lower incidence of reported effects associated with room-and-pillar mining is

> *largely due to the pervasive use of 'safe' pillar designs that minimize unplanned mine subsidence* (page V-18)

This observation, however, is not carried to its logical conclusion -- that because room-and-pillar mining has significantly fewer impacts, it should be viewed as a "best management practice" to be required routinely by PADEP wherever mining is proposed beneath or near sensitive natural resources or other surface features.

VI LACK OF DATA IN REVIEWED FILES AND FAILURE TO REVIEW ALL AVAILABLE FILES AND INFORMATION

This third Act 54 Report once again reveals a continuing lack of adequate baseline information, which in many cases made it difficult or impossible for the University of Pittsburgh team to evaluate impacts that had occurred to streams and wetlands during the five-year period. This reflects a clear failure on the part of PADEP to have mine

operators collect and disclose the minimum necessary data for effective permit review. The following quotes from the Report are revealing:

-- *there isn't enough pre-mining data to adequately determine which streams have been impacted and to what degree these impacts have occurred.* (page X-14)

-- *It is not possible to compare these* [stream quality] *values with pre-mining conditions since no TBS scores are available, therefore, ascertaining the effect of mining per se was not possible* (page VIII-17)

-- *Very little documentation* [regarding wetlands] *was provided* (page IX-2).

-- *Reasons for the lack of information in BUMIS regarding the remaining 195 properties found within 200-ft of active mining remains unknown*. (page II-10)

-- *Very little of the monitoring data presented by mining companies or the PADEP allows definitive objective conclusions* [regarding stream flow impacts] *to be drawn* (page VIII-10).

-- *Mining permits prior to 2007 contained very uneven data on wetland inventories* (page IX-7).

-- *Lack of existing* [baseline] *data made most undermined streams, pre- and post-mining within-stream comparisons impossible*. (page VIII-13).

-- *In 2007, PA DEP discontinued the use of stream investigation files if the mining company did not dispute a report of stream flow problems. Thus for the latter part of 2007 and all of 2008, there was much less information available for analysis*. (page VIII-8)

-- *Important gaps in data were supplemented with University field studies.* (page II-2)

For the third time now, the Act 54 assessment has been severely handicapped by the lack of baseline site inventory data in the PADEP permit files reviewed. Following each of the previous two Act 54 reports, the CAC and others loudly complained about this critically important issue -- that an evaluation of impacts requires suitable pre-mining and post-mining data about the resource(s) at risk. It now is nearly 17 years since Act 54 was passed and yet this basic deficiency continues to hamstring serious efforts to determine the full extent of impacts of underground mining.

One factor contributing to a lack of data being available for review of impacts is the ability of the coal companies to rely on confidential "agreements" with affected landowners. Those secret agreements effectively conceal the extent and severity of much longwall mining damage. In fully 70% of the 300 reported incidents where structures were damaged by longwall mining, the final "resolution" was either a pre-mining agreement (12%), an unspecified private agreement (27%), or company purchase of the property (31%) rather than actual repair of the damage. Private agreements with a landowner accounted for 36% of the final "resolutions" of water supply impacts where the mining company was deemed liable.

Possibly because of the scarcity of PADEP file information to review, the authors of this Act 54 Report (as with the previous five-year report) tried to collect first-hand data on the condition of selected streams that had been undermined during the review period. While this may appear to be laudable, the data should have been collected *during* the 2003-2008 timeframe, and they rightfully should have been collected by either the coal companies or the PADEP *prior to permit issuance and bond release*, with University

researchers simply compiling and evaluating the information as mandated by Act 54. Lacking comparable baseline data, the original stream data collected by the University team could not be credibly used for impact evaluation. This was a repeat of the largest problem encountered by the authors of the second Act 54 Report -- no baseline data.

This Act 54 Report is inconsistent in how strictly its evaluations focus on the specific five-year period under review. In the discussions on wetlands (Section IX) and on interstate highways (Section IV), considerable attention is devoted to incidents that occurred either before or after the official 21 August 2003 to 20 August 2008 review period. As pointed out above, the University researchers conducted their own stream surveys seeking to supplement what could be found in the files reviewed. Yet their stream evaluations were conducted as many as 20 months *after* the close of the third assessment period.

The Report reflects no effort to try to corroborate the data derived from BUMIS (Bituminous Underground Mining Information System) records and PADEP stream investigation files with input from affected citizens. The California District Mining Office files are replete with correspondence from coalfield residents, yet not even a small sampling of the affected public was interviewed for their perspective on the extent, severity, or resolution status of any reported impacts. Outside reports that deal with the subject of impacts from underground coal mining apparently were not reviewed either, or if they were, they are not discussed in the Report. A January 2010 PADEP "Report to the Citizens Advisory Council" (PADEP 2010a) notes that the University of Pittsburgh

> *researchers have reviewed reports prepared by the Center for Public Integrity as a means of gathering additional information on mining-related impacts and landowners' views regarding those impacts.*

Yet there is no mention of landowners' views or of those specific reports in the text or in the References section of this third Act 54 Report.

As specifically mentioned in Section 18.1 of the Act 54 amendments, one of the data sources to be used for the assessments is "*the information contained in deep mine permit applications*". The permit applications, as submitted by mining companies and as reviewed and evaluated by PADEP, provide a wealth of information about surface features and environmental resources occupying thousands of acres of land. The permit application process implements the laws and the regulations for mining and environmental protection. Thus, an examination of permit application files should provide a basis for evaluating how well the process is working and how accurately the resources "required" to be protected were identified, monitored, and actually protected. The permit application files also could provide a basis for comparing impacts predicted to occur (or not) and impacts that actually occurred. Yet, there was no attempt in this Act 54 review (or prior ones) to evaluate the effectiveness of the permit application process to prevent or minimize the impacts identified.

The effectiveness of the regulatory process is also reflected in PADEP enforcement activity. According to Section 17.1 of the 1966 Mine Subsidence Act, "*It shall be unlawful to fail to comply with any rule or regulation of the department or to fail to comply with any order or permit of the department...*" Section 18.1 of the Act 54 amendments

specifically mentions "*information contained in ... enforcement actions*" as one of the relevant data sources for these five-year assessments. Yet neither this Act 54 Report, nor any previous one, tabulated the number of violations of permit conditions, much less the violations of PADEP regulations or number or value of fines or other PADEP enforcement actions, which occurred at underground mines during the assessment period. Clearly, trends in the number and seriousness of underground mine permit violations, and the manner and timeframe in which they were resolved, would be an important consideration in assessing the effects of underground coal mining and comparing the results of mining methods. Yet the Act 54 reports continue to ignore the legislative mandate to incorporate information from enforcement actions.

Many important data on the water quality of streams currently are being compiled in PADEP mine permit applications, monitoring records, and enforcement files. Those data, however, are not being effectively integrated into either PADEP's environmental regulation/protection process or the Act 54 assessment process. This situation further compromises broader efforts to address water quality problems comprehensively in western Pennsylvania:

> …complete and up-to-date water quality data for decisionmaking purposes are not readily available. We should note with dismay what we don't know. … the availability of water quality data has declined during the last 20 years and … existing data are not stored in convenient repositories that are available to researchers, planners, and policy makers. (Jared Cohon, President of Carnegie Mellon University and Chair of the Regional Water Management Task Force, in Volz 2007)

The slow and partial accumulation of critical data impedes efforts to protect human health and welfare, as well as ecosystems, in the coalfields of Appalachia and throughout the Commonwealth (Volz 2007, Hendryx & Ahern 2009).

Data Associated with PADEP Technical Guidance Document 563-2000-655

A major Technical Guidance Document (TGD #563-2000-655) was adopted by PADEP in 2005 (PADEP 2005). It seeks to establish higher standards for the collection of pre-mining and post-mining information on streams and wetlands than previously had been followed (even though the regulations themselves on paper had long "required" protection of these resources). Yet the third Act 54 Report fails to take maximum advantage of this significant regulatory development, pushing any real evaluation of it onto the next five-year review:

> *In the future, these detailed monitoring plans may allow for more robust accounts of flow impacts on undermined streams.* (page VIII-10)

This Act 54 assessment thereby missed a golden opportunity to compare the identification and evaluation of water resource impacts before and after the use of that TGD and ascertain whether the new TGD is having any impact on the regulatory process. The TGD requirements were supposed to be fully implemented at least ten months before the end of the five-year review period. Indeed, PADEP actually had been implementing many of the baseline inventory requirements during 2006 and

2007, and so this third Act 54 assessment could have examined several years' worth of those data to make meaningful observations and comparisons.

This Act 54 Report also failed to evaluate how thoroughly the new TGD requirements were being implemented -- whether from the applicants' or the PADEP's or the public's perspective. Instead, these important analyses were either ignored or left for subsequent five-year reviews.

A recent investigation prepared for the Citizens Coal Council (CCC), which examined more than 75,000 pages of PADEP underground mine permit and enforcement files during the period 2007 to 2009 for three longwall mines (Schmid and Company 2010b), was not reviewed or mentioned in this Act 54 Report. The CCC review, which included a multitude of records overlapping the third Act 54 assessment period, found that, although detailed pre-mining bioassessment data on streams and wetlands now are being compiled, these data still are largely being ignored by PADEP during the permit review process. As a result, the mandated Act 54 assessment process is being deprived of crucial information that could and should be available to evaluate potential and actual impacts to water resources from underground coal mining.

Perhaps because the University researchers did not carefully review the data actually being collected pursuant to the TGD during this review period, they tended to make some great leaps of faith. For example, the TGD specifies that weekly and even daily measurements of stream flow are supposed to be collected as undermining approaches a stream. Thus, the University reviewers assumed that those data are actually being used and will be used to monitor, avoid, or mitigate potential impacts:

> *Detailed flow data was crucial in the determination of impacts on streams and will be an important component of data collection for mining companies in the future.* (page VIII-12)

In fact, as the recent CCC report revealed, many of those flow measurements, even if collected, are not *required* to be *reported* to PADEP or to anyone else. Thus incidents of flow loss may go unnoticed for many weeks or months (Schmid & Company 2010b).

Possible Under-Reporting of Problems

The Act 54 Report mentions that, beginning in 2007, if a mining company did not dispute a report of stream flow problems, no stream investigation report was initiated by PADEP, which reduced the amount of information that otherwise (and previously) would have been available for the Act 54 Report analysis. This is an important development, the consequences of which are not fully explained in the Report. Were the undisputed reports of problems counted *anywhere* as problems? If not, this may be another way that the actual impacts of mining are being hidden from public view and from Act 54-required assessment. Other practices that prevent full disclosure of the extent of damage are when mining companies either A) buy up properties where structures or water supplies are likely to be damaged, thus removing those damages from the reporting column, and B) enter into confidentiality agreements with landowners so that none of their damages are reported publicly. Confidentiality

typically is a condition if a landowner is to receive timely compensation. The Act 54 Report does not acknowledge or seek to quantify the effect of such events on its overall evaluation of impacts.

Of 269 water supply effects where liability was attributed to underground mining and a final resolution was reached, nearly half (131, or 49%) were "resolved" by an agreement between the landowner and the mining company or by the mining company buying the property. Only 7% of the water supplies recovered, and only 2% were repaired *in situ*. An alternative permanent water supply was provided in 32% of the cases. Even if surface owners are getting some relief, there is significant, permanent destruction of natural resources, which are no longer available for use and enjoyment of future generations of Pennsylvanians.

Similarly, of 300 reported structure impacts where mining was determined to be liable and a final resolution was reached, actual repair or compensation occurred in only 87 instances (29%). By contrast, in 211 cases (70%) the mine company either bought the property or relied upon a pre-mining or post-mining agreement (page V-14).

Planned and Controlled Subsidence

The third Act 54 Report often refers to subsidence associated with longwall mining as being "planned" and/or "controlled", euphemisms widely employed by the coal mining industry and by PADEP. It is certainly true that surface subsidence at present is intentionally planned to occur at every longwall mine in Pennsylvania. Yet data from this Report, as with past Act 54 reports, demonstrate that the extent to which longwall mine subsidence can be forecast or controlled to prevent or avoid impacts actually is quite limited.

The Report states (page VIII-3) that simulations and modeling are used by mining companies to predict stream impacts, but it fails to note that those primitive models apply only to pooling, and that flow loss rarely is predicted but often occurs. Coal companies lack the ability to predict where streams, springs, and wetlands will dry up. Even expected pooling in streams, which can be predicted to some extent by available models,[3] does not forecast how extensive the resulting damage will be or how long and expensive the work necessary to "fix" the damage will be, if it can be fixed at all. For example, the damage to the Duke Lake Dam in Ryerson Station State Park clearly was not planned or controlled, and the impact continues unabated to this day.

The Report also fails to discuss why, if models can be used to predict specific stream damage, more is not done voluntarily (or required by PADEP to be done) to avoid those predicted impacts or to mitigate in advance, rather than after the fact. At least part of the reason, unfortunately, is that Act 54 removed any incentive for mine operators to do so.

[3] Comprehensive and integrated subsidence prediction modeling (CISPM) was developed in the 1980s and 1990s (Peng & Chiang 1984, Peng 1992, Peng & Luo 1994).

One of the shortcomings of this third Act 54 Report with regard to the "planned and controlled" nature of longwall subsidence is that it does not compile any statistics on how *many* pooling and flow loss (or structure, or land) impacts were *predicted* in the permit applications, so it cannot compare either the number or location of predicted impacts with the impacts that actually occurred. The Report thereby effectively conceals the inability of existing models to forecast the location and extent of subsidence damage accurately. Tabulating the incidence of impacts is enlightening to some extent, but evaluating the effectiveness of the predictive models would have been much more informative in the context of the Act 54 assessment requirements and the potential for alleviating future damages.

VII WETLANDS

The second Act 54 Assessment Report prepared by California University of Pennsylvania (CUP 2005) concluded its discussion of "Wetlands" with several recommendations, including:

- *Mining companies should survey properties to be undermined to identify all NWI wetlands that lie within the permit boundaries plus wetlands not listed in the NWI.*
- *All six-month mining maps should show the locations and dimensions of wetlands.*
- *All information on wetlands should be electronically stored and mapped through GIS software.*
- *Wetlands should receive more attention than they have been previously given because they provide habitats for a number of organisms, including migratory birds.*

The CUP researchers clearly determined that more detailed and precise baseline information on wetlands, and a more thorough evaluation of wetland impacts, were needed. These recommendations echoed earlier recommendations by others (including CAC 2000 and Schmid & Company, Inc. 2000). Consequently, this third Act 54 Report section on "Wetlands" begins by saying that the University of Pittsburgh researchers intended:

> *to analyze the number, types, and sizes of wetlands that were impacted by mining operations using information from permit applications, operator reports, stream loss investigation files, wetland loss investigation files, and wetland impact reports submitted by the CDMO* [California District Mining Office staff].

What the University researchers *intended* to do was precisely what the CUP researchers had recommended to be done. Unfortunately, it was not done. The third Act 54 Report discussion went on to explain why:

> *However .... this was not, in general, possible.....*[because] *....very little documentation from these sources was provided during the seven months of document gathering by the University*.

It is a poor reflection on PADEP, and the attention it gives to its Act 54 mandate that, after serious concerns had been raised regarding the lack of pre-mining data available for review in both of the two previous Act 54 five-year reports, this third assessment declares that it could not do a proper evaluation of wetlands because of the same lack of pre-mining data as that which affected its predecessors.

This Act 54 Report laments the fact that the TGD (PADEP 2005) did not become fully implemented until the final year of the five-year review period. This ignores the reality that PADEP in fact had been requiring mine applicants to submit comprehensive data on streams and wetlands as early as 2005 when the TGD first went into effect. Even so, there was nearly a full year during the assessment period when mining was occurring beneath areas that should have had completed pre-mining (and even post-mining) wetland assessments, but those data were not evaluated in the Report. Perhaps there were no data to investigate, but that seems unlikely because some such pre-mining data have been examined by others (Schmid & Company, Inc. 2010b).

The third Act 54 Report concedes (page IX-4) that the wetland data it obtained for its assessment primarily were derived from the National Wetland Inventory (NWI). That non-regulatory NWI maps significantly understate the actual extent of wetlands on virtually every project site is widely known and was even acknowledged in the second Act 54 report. Thus any impact analysis based primarily on NWI data would be expected to be virtually meaningless when addressing wetlands at specific mine sites.

This Act 54 Report discusses only two incidents that could be reviewed and documented regarding wetland effects: one which involved a wetland loss, the other, a wetland "gain". The wetland loss incident actually occurred in 2009, *after* the five-year assessment period had ended. The wetland "gain" incident was documented in July 2003, just prior to the start of the five-year assessment period. In reality, then, the third Report was unable to document any wetland effects at all during the specific five-year period under review. (It should be made clear that the inability to *document* any wetland impacts is not the same as there not having *been* any wetland impacts; rather, it reflects PADEP's continuing lack of records.)

There are several procedural problems with the University team's evaluation of the alleged wetland "gain" incident. First, there is no indication in the Report that the area where the "newly-created" wetland was found in July 2003 had been field-examined prior to mining to determine definitively that it was not, in fact, already a wetland at that time. Given the widespread absence of pre-mining data, of course, the "new" wetland might have simply been ignored when the permit application was prepared, even though it had existed for many years. From the information provided it is unclear how much time was needed after undermining for the area in question to develop into a wetland --- presumably it was a considerable period of time, because reportedly it not only had formed hydric soils but it also supported wetland vegetation, and neither of those processes is likely to happen instantly. Finally, the alleged wetland "gain" reportedly was "mitigated" by being filled and regraded so that water would not collect in it in the future. (The Report apparently fails to appreciate the irony of referring to this as "mitigation" of a wetland effect.) The Report does not mention whether the filling and regrading of the wetland were done in accordance with a permit, as typically would be "required"

statewide for any such work to destroy wetlands, new or old, pursuant to 25 *Pa. Code* Chapter 105. For longwall mines PADEP typically requires Chapter 105 permits only for wetland or stream channel disturbances related to work attempting to restore flow in damaged streams, not for the unregulated destruction of the watercourses or wetlands by subsidence, but the third Act 54 Report does not point this out.

This Act 54 Report offers unsupported, credulous, and subjective statements regarding the state of affairs vis-à-vis wetland assessments following the full implementation of the TGD in 2007. It suggests that "*all wetlands*" now are being identified, and that the current delineations are "*extraordinarily precise and thorough*". While that *might* be the case, neither experienced University reviewers nor anyone else qualified to recognize or delineate wetlands performed any first-hand field evaluations of the thoroughness or accuracy of the industry-delineated wetlands to warrant this characterization in the third Report. The University team's rosy observations are based merely on a comparison with the very few wetlands typically identified by the NWI maps, if they have any basis at all.

The third Act 54 Report opines that the information about wetland effects should improve "*in the future*" because "*the PADEP has implemented appropriate protocols to assure that*" it does improve (page X-15). This appears to be both a great leap of faith and a convenient excuse for kicking the problem (the continuing inability to evaluate mining-related wetland impacts) down the road another 5 years or more. In fact, there long has been in place a procedure for obtaining formal Jurisdictional Determinations (JDs) from the Army Corps of Engineers to establish the location and extent of regulated wetlands prior to mining or any other activity that damages surface waters. That JD process provides a minimum level of screening of proposed wetland delineations for PADEP, which lacks staff to identify wetlands. It could easily be required as part of the underground mine permit review process, just as is done routinely for other industrial development in the Commonwealth. But JDs are rarely encountered in PADEP underground mine files, and it is not surprising that the University team encountered none.

VIII STREAMS

The longwall mining method of coal extraction was found to cause a disproportionate amount of the damage from underground coal mining reported to streams during the review period, even more than to structures and land. With respect to structures, the third Act 54 Report notes (page V-31) that approximately equal numbers of structures were undermined by longwall mines as by room-and-pillar mines (1,856 vs 1,879), yet 23% of the structures above longwall mines reported damage versus only 1.5% of the structures above room-and-pillar mines. With regard to land impacts, of 108 reported impacts, 103 (95%) were associated with longwall mines (page VII-3). The correlation between stream impacts and longwall mining was even more pronounced.

The Report notes that "*All stream impacts have occurred over longwall mines*." (page X-14). It reports that subsidence is an "expected" and intentional outcome of longwall mining, as if that somehow makes the impacts less egregious. The Report notes that the few examples of subsidence associated with room-and-pillar mining were found

rarely to lead to stream problems (such as pooling or flow loss). This important distinction between stream impacts due to longwall mining and the lack of such impacts due to room-and-pillar mining is not elaborated in the Act 54 Report, as it should have been in light of the significant difference.

The methodology used by the University's team to evaluate longwall mining's effects on streams (page VIII-5) has several fundamental problems. First, it defines a "stream" as only those waterways with a WRDS (Water Resources Data System) 5-digit code per the Pennsylvania Gazetteer of Streams. Defining streams in this manner significantly undercounts the extent of both permanent and intermittent headwater streams. Indeed, the mine companies have been routinely identifying regulated streams farther upstream from the end of WRDS mapping in recent longwall mine applications. The real problem, of course, is that PADEP (and, in turn, the Act 54 assessments) do not recognize the full extent of streams at risk and streams actually being affected by underground mining.

Second, the University's evaluation relies exclusively on 25 *Pa. Code* Chapter 93 "designated uses" of streams, with no regard for their "existing uses". All streams in Pennsylvania have been assigned one or more *designated* uses, but many streams have *existing* uses which are better than their designated uses, and thus by law are "required" to receive a higher level of protection. Per 25 *Pa. Code* §93.4c(a)(1), PADEP has the obligation to make an existing use determination every time it reviews and approves any permit (but virtually never does for mining permits). Applications for underground mine permits and NPDES (National Pollutant Discharge Elimination System) permits are supposed to require an identification and evaluation of *both* the designated and existing uses of affected streams. Indeed, pre-mining bioassessment data being compiled and submitted to PADEP by the mine applicants could be used to identify streams that may be attaining in-stream uses better than their Chapter 93 designated uses (Schmid & Company, Inc. 2010a), but rarely, if ever, is this happening.

By ignoring the *existing uses* of undermined streams, as the PADEP and the Act 54 analyses consistently do, any evaluation of impacts pre- or post-mining begins with an ignorance of the streams' actual water quality. This is especially important when trying to determine whether an "adverse impact" has occurred, because if a stream has an EV (Exceptional Value) existing use (as several Greene County streams now do, following formal acknowledgment by PADEP), no degradation is allowable in accordance with the antidegradation policies of Chapter 93. As this Act 54 Report notes, the PADEP considers a stream impact "resolved" if its post-mining TBS (total biological score) is 88% or higher, when compared to its pre-mining TBS. The Report fails to acknowledge, however, that even a 12% change in the TBS might reflect real degradation, which especially in an EV stream (Tier 3 water) is contrary to the antidegradation policies of the Pennsylvania Clean Streams Law and the federal Clean Water Act. The Act 54 Report also fails to acknowledge the growing literature on the inability of Appalachian streams to recover from the damage caused by longwall mining (*e. g.*, Alexander *et al*. 2007, Freeman *et al*. 2007, Kaplan *et al*. 2008, Lowe and Likens 2005, Meyer *et al*. 2007, Stout 2004).

Third, stream impacts are not accurately quantified. Although the mileage of streams undermined is partially tabulated (totals by assessment period, by mining method, and by mine), the analysis is based entirely on PADEP's reported incidents (or investigations) of stream damage. All incidents are not equally significant, however. A flow loss in 200 feet of a stream for a year is quite different from a flow loss of 1.5 miles for several years. This Act 54 Report identifies how many incidents of stream damage were reported, calculates the number of incidents per mile undermined, and tabulates the resolution status of incidents, but it offers no evaluation of how many miles of streams were impacted, what the nature of those impacts were (miles of pooling, flow loss, contamination), the miles of streams where restoration was attempted, the miles of streams where restoration was successful, or the miles of streams that remain impacted. University researchers obtained no such statistics from PADEP, because PADEP does not compile them. Consequently, a crucial element of the Act 54 analysis -- the actual extent and nature of stream damage -- remains unknown.

Despite the "requirements" of the TGD, to date there apparently has been no direct comparison of pre-mining and post-mining conditions based on biological and chemical data collected in any undermined stream. In an admirable but unsuccessful attempt to do so, the University researchers performed bioassessments of a small subset of stream reaches where impacts had been reported during the review period. Lacking pre-mining bioassessments for comparative evaluation of those streams, however, the University team's data are at best only a rough approximation. The Act 54 Report does not cite even one instance where a mining company performed both pre- and post-mining bioassessments on a stream. A study prepared for the Citizens Coal Council (Schmid & Company, Inc. 2010b) similarly reported that no post-mining stream assessment could be found in its examination of more than 75,000 pages of PADEP underground mine permit files addressing three longwall mines during the 2007-2009 period.

As noted in this Act 54 Report, about 34% of stream impact incidents attributed to underground coal mining were determined by PADEP to have been resolved by the end of the five-year assessment period (conversely, two-thirds of the impacts were unresolved). The Act 54 Report presents those findings without question or comment. In many cases, however, it is not at all clear *why* a "resolved" determination was made by PADEP. For example, streambed heaving and flow loss issues were detailed in Appendix D (pages D-3 to D-5) above six longwall panels on Stream 32511, an unnamed tributary to Dunkard Fork associated with Bailey Mine. The issues above Panels 14C and 15C were determined by PADEP to have been resolved on 17 May 2006. Yet three months later (in August 2006) PADEP observed no water flowing in the stream. Furthermore, when the University team did its own independent assessment of this stream in May 2009, they found nearly 500 feet of the 1,800-foot segment of stream dry, and that was after a significant amount of rainfall (3.0 inches) during the prior week. Apparent discrepancies such as this were not explained or elaborated in the Report, but they cast serious question on the credibility of PADEP's assignment of "resolved" status to damaged stream segments.

The Act 54 Report (page VIII-4) offers the following rosy generalization with no support

or documentation:

> *restoring flow to pre-mining conditions is often sufficient to regain the biological health of a stream*.

An abundance of scientific literature (Alexander *et al*. 2007, Freeman *et al*. 2007, Kaplan *et al*. 2008, Lowe and Likens 2005, Meyer *et al*. 2007, Stout 2004) and the University team's own stream sampling for this Report contradict that statement. The Act 54 Report notes that Coal Lick Run (Stream 40407) had experienced flow loss above three longwall panels during June 2005 (page D-39 to D-41). During September and October 2003, prior to mining, PADEP had noted "good" flow, three species of fish, and various macroinvertebrates in the stream. After undermining, gate cutting was performed by the mining company, and PADEP declared the stream problem "*resolved (repaired) as of January 13, 2007*". University reviewers observed the entire segment to be flowing during March 2010, but at the same time they calculated an extremely low TBS of 18.1. Although no pre-mining TBS had been recorded, it is hard to imagine that it could have been lower, and most likely it was substantially higher, than 18.1 prior to being undermined. Simply restoring flow to this stream does not appear to have improved its biological condition. The fact that a mine-impacted stream found to have such an abysmal TBS would have been deemed "resolved" was not mentioned as unusual or discussed at all in the Act 54 Report. The unstated implication, of course, is that PADEP is not protecting the waters of the Commonwealth from longwall coal mining.

In another example, this one associated with the Blacksville No. 2 Mine (pages D-23 to D-26), Stream 41728 reportedly had flow loss issues above longwall Panels 3N, 4N, and 5N during 2004. PADEP reportedly determined the sections above Panels 3N and 4N were "resolved" as of May 2005, but 5N remained unresolved as of August 2008. Yet the stream above all three panels reportedly was dry during October 2005, and major sections of this stream were dry during June 2005, December 2006, and June 2007. Flow was observed by PADEP during August 2008, but when the University researchers did their own stream survey in April 2010, 377 feet (30% of the1,235 feet observed) were found to be dry. Again, these discrepancies are not discussed in the Act 54 Report, despite their major implications as to the credibility of PADEP in pronouncing any instance of stream damage "resolved".

The CCC review of files for three longwall mines discussed several additional instances of stream damage (Schmid & Company, Inc. 2010b). One involved a fish kill beneath the I-79 Bridge at Waynesburg resulting from discharge of drilling mud pollutants in excess of permit limits late in the third Act 54 Report period. The above-standards discharge was documented by PADEP by photographs and by laboratory analyses. No other nearby potential source of pollution associated with the fish kill could be identified by the PADEP inspector. Yet no enforcement action was taken and no fine was imposed. This Act 54 Report apparently did not catalog and certainly neglected to mention instances such as this of non-enforcement of ostensible protections from pollution that Pennsylvania streams in fact do not receive.

Special Protection Waters

The very best streams in the Commonwealth, those recognized as either EV (Exceptional Value) or HQ (High Quality), are considered to be "Special Protection" waters. As noted above, some Pennsylvania streams (including some in the coalfields) have been documented to be achieving better quality than their Chapter 93 "designated uses". Greater protection (at least in theory) is to be afforded to those streams once their higher "existing use" has been formally recognized.

Early in 2008 (during the subject five-year assessment period), and also in 2009, a total of seven sections of streams within Greene County were formally documented by PADEP as having attained EV existing uses. Previously those streams had been "designated" as having either "WWF" (Warm Water Fishery), "TSF" (Trout Stocking Fishery), or "HQ" (High Quality) uses. It is most likely that additional streams in southwestern Pennsylvania with lesser designations, if they were to be formally evaluated prior to mine permit approval, also would be found to qualify as EV or HQ. The pre-mining bioassessment data on streams, which currently are being collected in permit applications pursuant to TGD-655, can easily be used to identify preliminarily which streams may have existing uses that are better than their designated uses (Schmid & Company 2010a). Yet there is no discussion at all in this Act 54 Report about the existence of, or impacts to, any Special Protection waters in the context of underground coal extraction. The strong implication, unstated in the Act 54 Report, is that PADEP affords no Special Protection from underground mining to qualifying streams.

Water Quality Impacts

According to this Act 54 Report (page VIII-2), damage to streams from underground coal mining can come either from contamination by pollutants or from subsidence. It goes on to state that almost all of the damage during this third review period was due to subsidence, apparently reflecting the authors' total failure to examine the existing data from the period on ongoing stream pollution by wastewater from longwall mines and ancillary facilities such as coal refuse disposal areas. While subsidence often damages streams directly, water quality degradation also is occurring as a result of underground mining. Subsidence-induced changes in the quantity of water in a stream (by pooling or by flow loss) can significantly affect its water quality and habitat value. The Pennsylvania Environmental Hearing Board[4] has determined that diminution of streamflow constitutes "pollution" under the Clean Streams Law. Water quality impacts likewise can occur when the surface facilities of underground mines have direct discharges of either stormwater or mine water to a stream. Hydrogeological disruptions caused by subsidence can allow the migration of methane, radon, or other gases trapped belowground into surface and subsurface waters. Yet the effects on water quality by underground mining in general, and by longwall mining in particular, have been largely ignored in this, as in previous Act 54 reports.

[4] *Oley Township v. DEP*, 1996 EHB 1098

A recent report prepared for the Citizens Coal Council found that the DMRs (discharge monitoring reports) for wastewater from longwall mines often document exceedances of pollutant limitations or other permit conditions -- some acknowledged by permittees, many not -- and there are many inconsistencies between "required" monitoring and the data actually being reported to PADEP (Schmid & Company 2010b). The University team apparently did not review any of the numerous underground mine DMR records for this five-year assessment period, and thus this Act 54 Report does not evaluate the effects on water quality related to the frequent exceedances of so-called discharge "limits" or the characteristic lack of enforcement action by PADEP. The absence of this information is significant: not only were there thousands of discharge violations during the review period, but neither the authors of this Act 54 Report nor anyone else has ever seen any longwall mine's completed Non-Compliance Reporting Form, which PADEP purportedly requests for all discharge violations. No DMR data have been reviewed by anyone for room-and-pillar mines, so it is not possible to determine whether they did or did not have a record of frequent wastewater discharge violations similar to that of longwall mines during the reporting period.

Flow loss effects are not so predictable as pooling impacts, but both impacts are common with longwall mining. The Act 54 Report highlights one example of a major flow loss incident that was not predicted and which ultimately could not be "resolved." The Report discusses the UMCO High Quality Mine (page VIII-10), which caused unanticipated loss of water in Maple Creek when it was undermined by longwall panels during 2004. Repeated efforts to restore the streamflow were unsuccessful. The mine operator vigorously fought PADEP's ensuing prohibition on further use of longwall mining here. As a result of litigation before the Environmental Hearing Board, PADEP was supported in its requirement to limit further Maple Creek mining to the room-and-pillar method when undermining streams with shallow overburden. For its efforts here PADEP deserves major credit.

This Act 54 Report notes that there were 55 stream investigation reports initiated during the five-year period under review. Of the 18 that were "resolved", only 5 were resolved in less than 300 days, and the average time to resolution was 688 days (1.9 years). As noted below, the few stream surveys conducted by University reviewers raise serious questions as to whether any stream impacts ever were actually resolved to the extent that stream quality equaled or exceeded pre-mining conditions.

The Act 54 Report occasionally makes reference to requirements in permit application Modules or in sections of PADEP mining regulations, but provides no evaluation of whether or how well those requirements are being adhered to by applicants or applied by PADEP. For example, in a discussion of hydrogeology, the Report mentions Module 8 (Hydrology) and says:

> *The mine operator is required to provide information regarding natural hydrology, water supply and stream inventories, background sampling, prediction of hydrologic consequences/protection of hydrologic balance, and a hydrologic monitoring plan.*

No further discussion is provided, so the reader is left with the impression that all of those "requirements" are being strictly met and applied, when in fact, that is not the case. Obviously, University representatives did not review actual permit applications.

A recent investigation for the CCC that did review longwall mine permit applications found that no comprehensive hydrologic descriptions are being provided. No assessment of, much less protection of, the local or regional hydrologic balance is being accomplished in the context of longwall mining (Schmid & Company 2010b).

Appendix D in the Act 54 Report provides considerable information, some of which is a compilation of data and observations from PADEP files, and some of which is the result of original stream assessments done by the University of Pittsburgh review team. Twenty streams associated with five different longwall mines were independently surveyed by University researchers between April 2009 and April 2010. Although considerable good information is presented, the University stream survey data are not so useful as they might seem. The Act 54 Report fails to draw important and obvious conclusions, especially when the University team's independent results contradict the PADEP file data or regulatory conclusions. In other ways the two datasets are simply not comparable. For example, the Act 54 Report typically identifies multiple observation points along a given stream, yet does not indicate where the University's actual biological survey was conducted. In the discussion, impacts to some stream segments were reported to have been "resolved" by PADEP while some remained unresolved. Also, rainfall totals for the day and week prior to University sampling are noted, which is helpful; but rainfall totals for the year are not particularly informative (*e.g.*, total annual rainfall for all of 2009 is irrelevant when the University sampling was done on 24 April 2009, see page D-13).

Appendix C in the Report provides a series of maps showing each underground mine and highlighting areas mined by method (longwall, room-and-pillar, or room-and-pillar with pillar recovery), 200-foot buffer areas, structure effects (Y/N), and watersource effects (Y/N). These maps provide an excellent visual characterization of the mines. The maps highlight the contrast between longwall mines (Figure 2) which always had some (and often had many) structure and watersource damage effects, versus room-and-pillar mines (Figure 3) which often had none of either. As shown in Figure 4, impacts at mines using both methods generally are concentrated above the longwall panels.

University reviewers compiled their data in several ways, not all of which appear to be relevant or appropriate. For 15 streams undermined during the third Act 54 assessment period, the University team conducted new stream surveys and compiled data to provide a TBS (total biological score). Their TBS scores, however, are of limited practical use because there were no baseline, pre-mining TBS scores against which to compare their new data. Nevertheless, the University team tried their best to make use of the data they collected. They note that a TBS greater than 50 generally suggests that a stream is attaining its designated uses (and less than 50, that it is impaired). But without knowing the TBS prior to undermining, a score of 56.1, for example, is almost useless -- first, because the unknown pre-mining TBS may have been much higher (or lower), and second, because the existing use of the stream prior to mining may have been much better than its designated use (so even if it currently is just barely attaining its designated use, that still may represent a significant degradation).

Despite those concerns with the assessment methodology, the actual data collected by the University team were not encouraging regarding the health of longwall-undermined

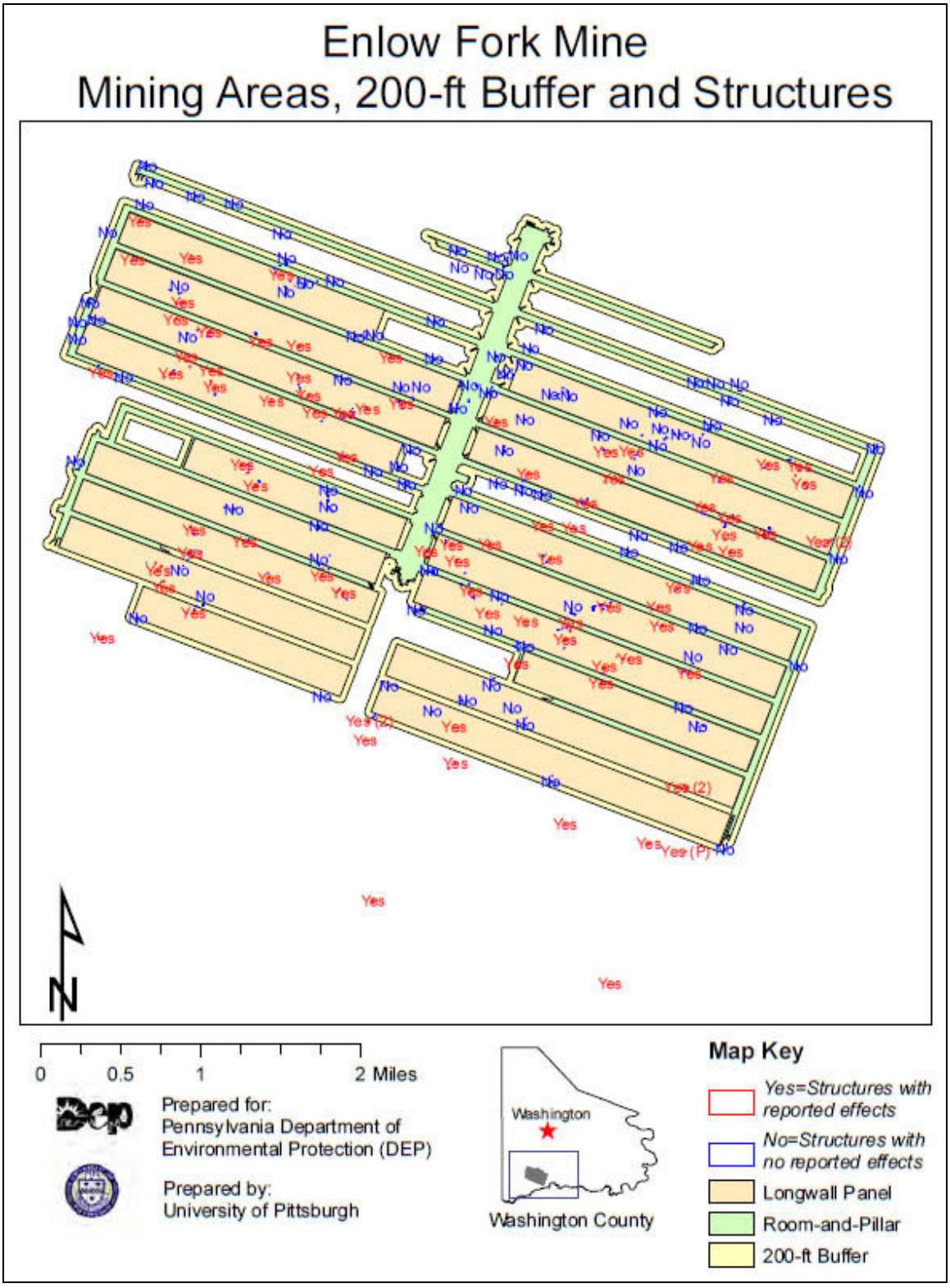

FIGURE 2. Example of a map in Appendix C of the Act 54 Report showing reported structure effects associated with the Enlow Fork Mine during the third review period. Compare the numerous structure impacts (red) above this longwall mine with the lack of any such structure impacts at the Cherry Tree room-and-pillar mine (Figure 3). Blue denotes structures with no reported effects.

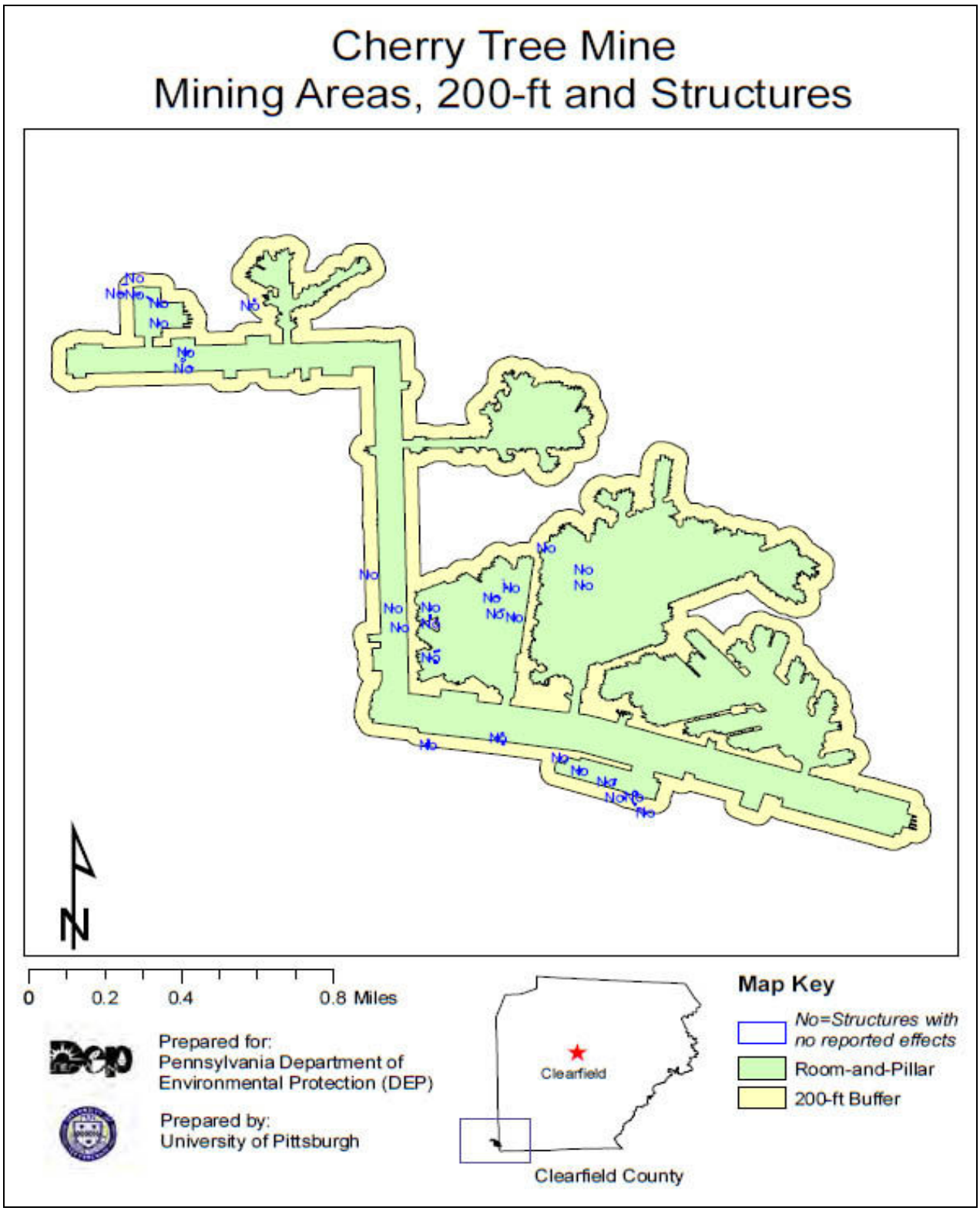

FIGURE 3. Example of a map in Appendix C of the Act 54 Report showing lack of reported structure effects associated with the Cherry Tree room-and-pillar mine during the third review period. Compare this with the numerous structure impacts (red) above the Enlow Fork longwall mine (Figure 2). Blue denotes structures with no reported effects. (Most of Cherry Tree Mine is in adjacent Indiana County; the section active during this review period is in Clearfield County.)

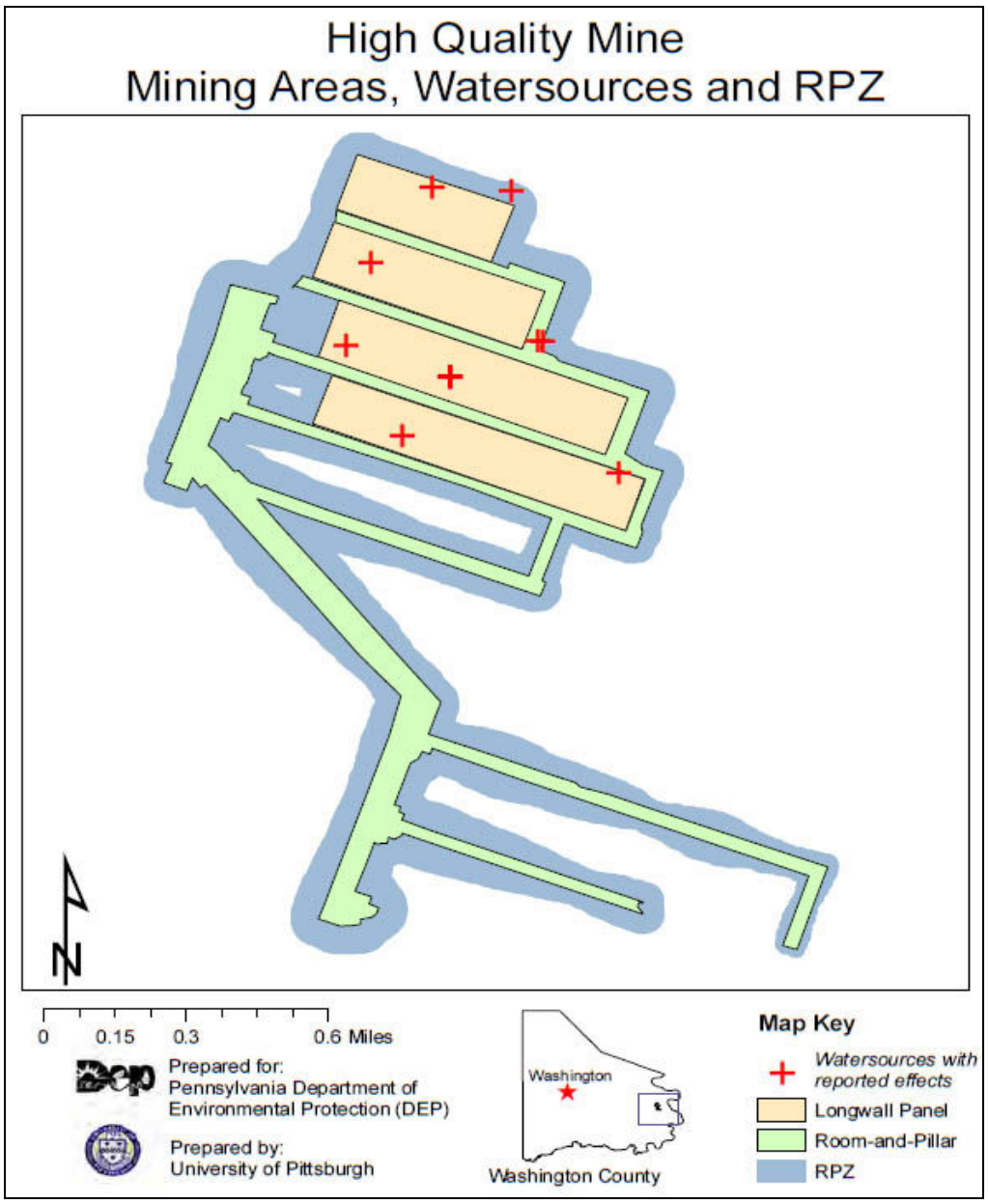

FIGURE 4. High Quality Mine, which used both room-and-pillar (green) and longwall (tan) methods of underground coal mining during the third Act 54 review period. All of its water supply impacts occurred in the longwall areas or their Rebuttable Presumption Zone (RPZ).

streams: the average TBS of 15 streams surveyed was 46.1 (below the 50.0 cut-off for attainment), and the stream scores ranged from a deplorable low of 13.3, to a high of 73.1. Even that highest TBS score was marginally lower than the 76.3 recorded for an unsubsided nearby "control" stream deemed after-the-fact to have had comparable pre-mining conditions.

On pages VIII-14 to -15 of the Act 54 Report, the University team attempts to compare

its new stream survey data with some macroinvertebrate data it was able to locate for six streams that had been impacted during the second assessment period and which PADEP wanted to be reevaluated this time around. Unfortunately, this evaluation is virtually meaningless, because the single stream with any pre-mining data was dry when examined by University researchers. For the 5 streams with post-mining macroinvertebrate data for "taxa richness" and "Percent EPT," University data were not directly comparable, inasmuch as the University team used "*observed values only and [which] are not adjusted*".

The University team incorrectly transcribed the TBS score for Headley Hollow (Stream 32530), listing it as 68.8 instead of the 65.9 which it reports in the detailed write-up in Appendix D (page D-7). This error would change to "yes" its conclusion for this stream as being "adversely affected" in Table VIII-8, meaning 5 of the 7 streams (71%) in this evaluation clearly were adversely affected, and the other 2 streams were borderline, scoring TBSs slightly lower than their "control" streams.

Above Bailey Mine Panels 1I through 4I, Polly Hollow (pages D-14 through D-17) was reported to have experienced flow loss and compression ridges beginning in February 2004. Significant dry stretches and iron staining were observed during 2004, 2005, and 2006. Flow augmentation by the mine operator began in 2006 and continued throughout 2007 and into 2008. Three of the 4 panels were deemed "unresolved" as of the end of the assessment period. The fourth panel (1I) was deemed "resolved" in August 2007 "*after approval of an appropriate mitigation plan*". There is no documented evidence provided that there was any followup monitoring to ensure that the "plan" actually had been implemented or that it had improved the stream in any way. Some undermined streams could not be successfully restored even after years of revised plans and many attempts by the longwall operator (Schmid & Company 2010b).

The Act 54 Report presents in Appendix D two categories of observations by PADEP's Subsidence Agents/Biologists ("Stream Observations" and "Flow Observations"). There is no explanation what either category is supposed to mean or how or why they may overlap or differ from one another. In at least one case (page D-24 to D-25) the "Stream" and "Flow" observations were made by PADEP subsidence agents on the exact same date (14 December 2006), but different conditions are reported.

IX WATER SUPPLIES AND OTHER HYDROLOGIC EFFECTS

Of the 397 water supplies that reported effects after being undermined by longwall mines, diminution (water loss) was the leading cause of impact (78%), with contamination reported in approximately 12% of cases. Of the water supplies with reported effects, 60% involved wells, 37% involved springs, and 3% involved ponds. Wetlands that dried up were not recorded or considered in this Act 54 Report.

"Resolution" of such impacts is not as straightforward or objective as that word might imply. According to the Report:

> *A final resolution status indicates that there is no longer an impact to the* [individual's] *water supply, or simply that the water supply case is closed.* (page VI-3)

Yet the hydrologic assessment of the Report says:

> *... to assess the overall impact of mining on the post-mining aquifer system, the University further analyzed the resolution statuses for the* [mine operator-]*liable impacts to see how the impacted water supplies were being replaced.* (page VI-15)

It may be appropriate to examine actual impacts to *water supplies* as a proxy for evaluating the effects on local or regional aquifers. It is not at all appropriate, however, to try to evaluate aquifer impacts based on the *resolution statuses* as reported in PADEP files. First, even if 100% of the reported effects were resolved in some way according to the PADEP tracking system, most of those resolutions would have done nothing to repair the damaged aquifer. In the 163 cases where a longwall mine company was determined to be responsible for a water supply impact, the final resolution in 110 cases (67%) was either a confidential agreement or monetary compensation (page VI-6). In most, and perhaps all, of those cases, there likely was no attempt to actually repair or restore the affected local or regional aquifer system.

We all know that fruits and vegetables do not "come" from a store -- they usually come from a farm and we *get* them at the store. In the same way, wells are not water supplies; the aquifer is the water source, and the wells are just receptacles that tap it. Thus, when the water source (aquifer) is impacted by longwall mining, it is not "fixed" when a well is replaced with a deeper well; and the aquifer certainly is not fixed when the mine company simply buys the property or pays the landowner for his loss. At best, those may count with PADEP as "resolution" for an individual's loss or inconvenience, but they do nothing to address damage to the aquifer, damage which may persist indefinitely.

The proposed Scope of Work for this Act 54 Report (University of Pittsburgh 2008) stated that information contained in the Module 8 sections of mine permit applications, as well as DMRs (discharge monitoring reports) and HMRs (hydrologic monitoring reports), may be examined. There is no mention anywhere in this Report of DMRs or HMRs, both of which were available for every mine throughout the period under review. It is not possible to tell from the Report whether these data sets were even made available to the University team by PADEP.

The second Act 54 Report included a thoughtful discussion of the "presumptive zone of influence" that extends outward from longwall panels. Act 54 establishes a zone of presumptive liability for underground mine operations that is equal to the area of the mine operation plus an additional area bounded by the intersection of the surface and a line drawn from the base of the coal seam at an angle of 35 degrees from vertical. Within this zone, mine operators are presumed to be responsible for water supply damage, unless they can convincingly demonstrate that the water loss was due to another cause. The reviewers of the second Act 54 report determined that many longwall water supply impacts were occurring outside the area covered by the 35^{o}

angle of influence, and they proposed a distance of 328 feet (100 m) as a better predictor of where impacts were likely to occur 80% of the time.

The second Act 54 Report concluded:

> *The effect of distance from longwall mining to the water source is so significant that a presumption of liability based on an angle of hydrologic influence must be seriously questioned.*

This third Act 54 Report discusses the issue of a "rebuttable presumption zone" (RPZ) created by the 35° angle of influence. It found that more than 22% of the water supply impacts where the mining company was determined to be liable were located beyond the RPZ. This would appear to corroborate, at least in principle, the important findings of the second Act 54 report, yet the previous report is not even acknowledged in this discussion, and no conclusions or recommendations regarding the adequacy of the 35° angle (or some fixed distance) of influence are provided in this Report.

The 35° angle of influence, or RPZ as it is referred to in this third Report, only applies to water supply impacts per the directives of Act 54. There has been no discussion in this Report, or previous Act 54 reports, about the possible relevance of the 35° (or larger) angle of influence for impacts to structures or other features. This would appear to be a worthwhile topic for future Act 54 reviews to address in detail.

The Scope of Work for this Report (University of Pittsburgh 2008) included the following task regarding hydrologic assessment:

> *The ability of shallow aquifers to support rural, domestic, and agricultural water supplies in areas undermined during the 3rd assessment period will be explained with a hydrologic model. .... The assessment will include a comparison of the effects of different mining methods (i.e., longwall mining, room-and-pillar mining and room-and-pillar retreat mining).*

The only mining method examined, however, in the hydrologic assessment described in Section VI of this Act 54 Report is longwall mining. Thus the statement in the Report that *Longwall mine subsidence tends to alter the hydrogeology of the overburden* (page VI-15) is well supported, but it is less enlightening than if different mining methods had been examined and compared. The second Act 54 assessment had examined different mining methods, and it reported a lack of water loss impacts associated with room-and-pillar mines during the previous review period. That *may* have been the reason for the University team's departure from their proposed task in this third Act 54 review, but no such explanation was provided.

Since only one mining method (longwall) was examined with regard to hydrogeologic effects during this latest Act 54 review period, however, it is inappropriate to attribute any conclusion to "underground mining" in general. Yet that is exactly what is done in the final sentence of Section VI:

> *This shows that the process of underground bituminous coal mining affects the natural hydrogeologic characteristics of overburden strata.*

That sentence is clearly misleading because it fails to acknowledge that the preceding discussion of a hydrogeologic model focused only on longwall mining. This Act 54 Report does not examine hydrogeologic damage (or the lack of such damage) due to room-and-pillar mining.

X UNDERMINING INTERSTATE HIGHWAYS

Section IV in this Act 54 Report is entitled "Effects of Undermining Interstate 79 during the 3rd Assessment Period". This section does not focus exclusively on the 2003-2008 period under review, however, nor does it discuss only I-79. It devotes considerable discussion to the undermining of I-79 by the Gateway Mine in the 1980s and to the undermining of I-70 by Eighty-Four Mine during 1987-1988 and 1999-2000.

Three impacts to I-79 were characterized as "significant" in this Act 54 Report:

1) highway traffic flow was adversely affected for 5 years,
2) the vertical curvature and sight distances of the highway were altered, and
3) Commonwealth taxpayers spent nearly $20 million to monitor, repair, and maintain the highway during undermining.

Yet, in the final paragraph of this section, the Act 54 Report makes these amazing statements:

> *One fact is certain...it has been more cost effective to allow longwall mining to proceed than to condemn the coal needed to provide support for the highway. The cost to condemn the coal was estimated by O'Connor (2001) at approximately one order of magnitude higher than the current repair cost sighted* [sic] *earlier.*

In fact, the cost-effectiveness of making repairs versus purchasing support is not at all clear or certain from the information provided. The cost analysis prepared by O'Connor in 2001 looked at I-70, not I-79. There has been no comparable examination for I-79. It is debatable whether the 2001 study conclusions were valid even for I-70, much less whether they are transferable to I-79. Some of the assumptions it made are questionable, including the volume of coal needed simply to provide support versus the volume of coal actually longwall mined from beneath the highway in 1999. Also, the cost of coal in 1999 was used ($7.20/ton) rather than the cost in 1962 ($0.49/ton) when the State could have purchased it. It is hard to imagine that the cost to purchase the coal needed to support I-79 would have been nearly $200 million (an order of magnitude greater than the $20 million actually spent by PennDOT). The quote above is but one of many unsubstantiated statements made throughout this Report.

It is of interest that this Act 54 Report focused on certain impacts and not on others. This entire 26-page Section was devoted to the effects of undermining Interstate 79 (and other interstate highways, both during and prior to the 2003-2008 assessment period). By contrast, in the entire Act 54 Report there are only two brief mentions (on pages V-8 and X-13) of the even more significant damage and public inconvenience caused by longwall mining during 2005 to the Ryerson Station Dam and the associated

need to drain Duke Lake, which -- unlike the damage to the interstate highways -- remain unresolved. The Dam and Lake today are still unable to serve the public.

There is an excellent discussion in this Section of the Act 54 Report regarding subsidence properties and the critical width of longwall panels. Unfortunately, it is somewhat hidden within a discussion of interstate highways, when in fact its findings are relevant to all potential surface impacts. The discussion points out that the width of longwall mine panels in Pennsylvania has increased significantly over time. It notes that as panel width increases, maximum subsidence potential is reached more quickly (which potentially results in more surface damage). The Report points out that panel widths for the Gateway Mine during the 1980s ranged from 470 to 567 feet in width. By 2009, the average longwall panel in the US was 1,075 feet wide. The Emerald Mine and Cumberland Mine panels mined beneath I-79 during the third review period averaged 1,295 feet in width. (An application submitted by Foundation Mining LLC in late 2010 proposes longwall panels up to 1,600 feet in width.) Thus, longwall panel widths have increased more than 300% in the last few decades. Damages have increased, too, but none of the Act 54 reports has evaluated the correlation.

This Act 54 Report notes that maximum subsidence potential is realized when the panel width-to-overburden height ratio exceeds 1.0. At ratios greater than 1.0, a panel is considered "supercritical"; below 1.0, it is "subcritical". The Report points out that the ratio of longwall panels that undermined I-79 during this third review period *averaged* 1.7, ranging from 1.5 to 1.9. The important point, although not well explained, is that, as longwall panels increase in width, damages to surface features increase proportionately.

XI LACK OF OBJECTIVITY

Subjective, unsupported statements are sprinkled throughout this Act 54 Report and appear to betray an industry bias. A few examples already have been mentioned. A few more are discussed below.

> ***The extraction of bituminous coal from Pennsylvania's rock formations plays a significant role in the state's economic development as it has for over 125 years. This role is still prominent today. In 2008, The Federal Energy Information Administration reported Pennsylvania's bituminous underground coal mines employed 5,331 miners and produced 53,318 million tons (short tons) of coal ... This data demonstrates the prominent role coal plays in the lives of Commonwealth citizens.*** (page I-2)

The above rosy assessment is in sharp contrast to the fact that employment in coal mining in Pennsylvania actually has declined dramatically over the past century. According to the mining reports on the PADEP website[5], at the height of coal mine employment in 1923 there were 359,302 people employed in coal mining in

[5] http://www.dep.state.pa.us/dep/deputate/minres/bmr/annualreport/2009/index.html

Pennsylvania; in 2009, only 7,324 were employed in coal mining in Pennsylvania. In fact, coal mining employment today represents a minuscule percentage of total employment in the Commonwealth (less than one-tenth of one percent of total employment statewide). If the authors had truly wanted to delve into the issue of coal mining employment, it would have been more interesting and relevant to an Act 54 assessment to have compared employment in longwall mines with employment in room-and-pillar mines during the review period. Furthermore, if the intent of the above quote was to provide a larger perspective of the economics (and externalities) of coal, there are many good references in the literature (Clean Air Task Force 2010, Epstein *et al*. 2011, Konty & Bailey 2009).

> ***Very little of the monitoring data presented by mining companies or the PA DEP allows definitive objective conclusions to be drawn. The PA DEP based its conclusions about the extent of the flow problems … on the best available evidence …***[**and on their**] ***familiarity with the streams in the area…. It was the opinion of the University that the conclusions drawn by the PA DEP about the effects of subsidence on stream flow were in general sound and well-reasoned.*** (page VIII-10)

As the first statement above notes, there were few objective data upon which to base any conclusions about stream impacts or attempted restoration. The last statement -- the "opinion of the University" -- is likewise unsupported by objective facts or the data presented in the stream section of the Report. Indeed, just the opposite appears to be the case when one examines the Act 54 Report data themselves. The University team conducted its own, independent evaluations of 20 streams that had been impacted by longwall mining, 16 during the five-year period and 4 from the previous period. The University team's findings regarding the quality or quantity of water in the streams they sampled often appear to contradict the favorable resolution status reported by PADEP, yet these discrepancies are not highlighted or discussed.

> ***Recently submitted permit revisions have shown a more significant effort is currently underway by the companies to report accurate wetlands data.*** (page EX-4) ***These new applications were extraordinarily precise and thorough in their wetland delineations.*** (page IX-7)

To be sure, a greater *number* of wetlands than merely those shown on National Wetlands Inventory (NWI) maps now are being identified in permit applications. There was no attempt, however, by the University team to verify the accuracy of any wetland map or delineation in a mine permit application, so there is no basis for any conclusion regarding their precision or accuracy.

> ***The University further believes that the PA DEP has implemented appropriate protocols to assure that mining companies mitigate impacts to streams and wetlands undermined in the future.***

It is a great leap of faith to believe, as suggested in the quote above, that protocols that are 'on the books' will effectively "assure" anything in the future, especially when

there is no evidence at present that they are being applied or enforced by PADEP. Indeed, this Act 54 Report does not evaluate the current effectiveness of those protocols, even though outside reports which the University team failed to acknowledge or review suggest that their effectiveness in practice is highly questionable (*e.g.,* Lombardi 2009a, 2009b; Schmid and Company 2010a, 2010b).

> ***The efforts to remediate these impacts by mining companies are in many cases significant and will hopefully have the intended outcome.***

Unfortunately, this assessment that remediation efforts have proven to be successful is not borne out by the data presented in the previous sections of the Act 54 Report. It is mere wishful thinking.

> ***Is ACT 54 working and is there Compliance?***

The above question is the heading of the final section of the Act 54 Report. Presumably it is answered in the affirmative. If that is the case, the writers' conclusion must be based on an unusually cynical view that it is acceptable public policy to allow a minority (and the environment) to suffer so that the price of coal remains relatively cheap.

> ***These processes take time. The system in-place that achieves a successful resolution in 80-pct of the cases in the first 600 days seems adequate.***

"Seems adequate"? Adequate to whom? Perhaps to PADEP and to the coal industry. It certainly must *not* seem adequate to the families whose only transgression was that they owned land above a coal seam and thus were suddenly inconvenienced, or much worse, for 600 days. And they are among the "fortunate" 80%, half of whom had their case "resolved" by some agreement which they are forbidden to disclose, so they cannot even be asked about how adequately *they* believe they have been treated or compensated. Fully 20% are not even that lucky, because they have had their lives disrupted for much longer. The viewpoints expressed in Act 54 reports should not be confined to those of the PADEP and the mining industry to the exclusion of coalfield residents and the public at large.

How can the adequacy of this system be judged by lumping all of the impacts together, computing an average, and concluding that the majority of those impacted are well served if they have been wronged for "only" 1.5+ years? It should be evaluated on the basis of the worst cases -- the 1 in 5 who have suffered longer than 600 days without final resolution of the damages.

Rather than lumping impacts from all underground mining methods together, the data presented throughout this Act 54 Report should have been used to highlight consistently the major differences between effects on structures, land, streams, and water supplies above room-and-pillar mines and those above longwall mines. Resolution times for the impacts attributed to room-and-pillar mines are achieved much more quickly than for damages above longwall mines. How is it that these important distinctions seem to have been overlooked in this Act 54 assessment?

XII ACT 54 AND THE PENNSYLVANIA CONSTITUTION

The concept of the "public trust doctrine", codified some 1,500 years ago during the Roman Empire, holds that certain of Earth's riches should never be claimed exclusively for private use, but must be left for the public's enjoyment and must be stewarded by those in power (Takacs 2008). This concept is embedded in Article 1, Section 27 (Declaration of Rights) of the Pennsylvania Constitution:

> ***The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people.***

Thus, clean water, clean air, and other natural amenities are among the basic Constitutional rights afforded to all Pennsylvania residents. Article 1, Section 27 should preclude the State from allowing or encouraging predictable and intentional environmental degradation, especially to resources not owned by any single individual.

Act 54, and the PADEP regulations and policies that enable longwall mining as currently practiced, would appear to be contrary to the Article 1, Section 27 tenet of responsible government stewardship. Indeed, the Pennsylvania Supreme Court [*Commonwealth v. Harmar Coal Co.*, 306 A.2d 308 (Pa. 1973)], concluded that

> *[t]he public interest is not served if the public, rather than the mine operator, has to bear the expense of abating pollution caused as a direct result of the profit-making, resource depleting business of mining coal.*

While Act 54 ostensibly was well-intentioned in seeking to have mine operators repair or replace individual structures and wells that might be damaged by underground mining, or to provide monetary compensation to individuals if repairs could not successfully be made, it failed to acknowledge that the protection directly afforded to structures under the 1966 law indirectly benefited the streams, springs, wetlands, aquifers, parkland, and farmland in the vicinity of those structures. With the protection of structures removed, without provisions to address the effects to those other resources, the result is that impacts are occurring on much broader regional and watershed scales, affecting public as well as private resources.

As one coalfield resident eloquently explained it:

> *... if there were 10 springs on the property, but only 4 were developed, the coal company is only required to replace 4, not 10. ... [T]here are two problems with this: (1) when farmers lose their water and are only compensated to the extent of "current use," the mining industry is not compensating either the farmer or the Commonwealth for the future <u>potential</u> of that land; and (2) the combination of confidentiality agreements the landowners must sign to get compensation and the loophole that*

allows coal companies to settle with landowners on water loss issues independently of DEP seriously compromises state oversight of its own water resources. (CAC 2007)

In many cases, arriving at a resolution of damages to houses and wells can be time-consuming, stressful, and less than satisfactory to the individual affected -- all for a problem he or she did not create. And that is for situations specifically *covered* by Act 54. No attention, and thus no reparation, is being afforded to the broader public and environmental resources owned and enjoyed collectively by all Commonwealth citizens, such as groundwater and surface waters, that are being damaged throughout the coalfields but that currently are *outside* the scope of Act 54.

The Act 54 Amendments must be realigned to work as they were intended in conjunction with the Pennsylvania Constitution's Environmental Rights Amendment -- to allow extraction of valuable coal resources without damaging our citizens, our land, or our water resources.

XIII ACT 54 POLICY CONSIDERATIONS

The five-year review process mandated by the Pennsylvania Legislature under Act 54 presumably was meant to be purposeful. If there is any purpose for an Act 54 review, it should be to inform a periodic reevaluation of the adequacy of the law to provide the necessary balance between the rights of those who own coal and the rights of others who are harmed by its extraction.

To accomplish the Section 18.1 mandate of Act 54, it is important to document what actually occurred as a result of underground coal mining during each five-year period. That is an appropriate, even primary, aspect of the Act 54 assessment. But it is only one aspect of the required analysis. Counting the number of impacts to structures, water supplies, etc., does not provide a complete picture of the effects of deep mining.

This third Act 54 Report, like the two before it, fails to consider whether the impacts that were identified *should* have occurred; that is, whether the laws and regulations that are in place suggest that those impacts were to be allowed or were to be prevented or at least minimized. Simply tabulating impacts fails to consider whether the PADEP's permit review and approval process acknowledged those impacts (anticipated them and made provisions to avoid, mitigate, or compensate for them) and if not, whether the permit would have been issued had those impacts been acknowledged in advance. These are important policy considerations that have been completely ignored in the current (and previous) Act 54 Review Reports.

Many coal rights were sold a century or more ago when the only underground mining method in Pennsylvania was room-and-pillar, and coal was being extracted in a manner meant to provide support and protection to the surface landowners. No one can deny the right of a mine company to the coal it rightfully owns. But is that right absolute, at any cost? Does the right to the coal have any limits on the time or manner of its extraction, or must the coal be removed upon demand of the coal owner using

any method it chooses? Should the extraction of coal now be allowed at *any* time and in *any* manner, even if doing so intentionally harms another property owner or destroys public resources? Or should coal extraction be allowed only to the extent that it can be done safely?

> **Shylock:**
> Most learnèd judge, a sentence! Come prepare!
>
> **Portia:**
> Tarry a little, there is something else.
> This bond doth give thee here no jot of blood;
> The words expressly are "a pound of flesh."
>
> (*The Merchant of Venice Act 4, scene 1, 304–307*)

Mining technology is constantly evolving. Is it unreasonable to expect coal to be extracted only where, when, and to the extent it can be done without harm? During the past several decades, longwall mining technology has steadily improved to make the extraction of coal more efficient (and in turn, more profitable). One such efficiency, as pointed out in this Act 54 Report, is that longwall panels have gotten progressively wider, from about 400 to 500 feet in width two decades ago, to 1,500 and 1,600 feet in width today. This "efficiency" in large part is due to the fact that powerful machines are doing more of the work, so there is less manpower needed. This greater “efficiency" also typically means there is much more widespread destruction of surface resources.

Over the years there have not been similar, comparable improvements in the technology for environmental protection or for damage mitigation. It is conceivable that improvements in the technology of underground mining methods might have taken a different route, had Act 54 never been passed. Advancements in room-and-pillar mining technology could have been made in the design of new types of roof supports so that less of the valuable coal might need to be left in place. That not only would have increased the percentage of coal extracted by traditional room-and-pillar mining, but it would have reduced the immense subsidence problem. It likely would have kept mine employment levels higher, too. If, at the same time, improved backstowing technology had been developed and implemented, that might have further reduced the likelihood of subsidence and reduced the amount of surface waste as a bonus.

<u>This Act 54 Report demonstrates that there exists a clear alternative to the longwall mining method as currently practiced, an alternative with only a small fraction of the impacts: the room-and-pillar method</u>. If the use of the room-and-pillar mining method were required often enough as an alternative in sensitive areas (such as streams, highways, churches, cemeteries, or historic houses), then mine engineers would have a strong incentive to improve its technology and make it more productive. Act 54, however, as applied by PADEP, effectively removed and precludes any incentive to seek improvements in underground mining technology that could minimize impacts while maximizing coal extraction.

Just because something *can* be done does not mean it *should* be done. Longwall mining is a method, not a right. Clearly, room-and-pillar mining can still be used profitably to extract coal, as evidenced by the large number of active room-and-pillar

mines documented in this latest Act 54 Report. Longwall mining, however, provides significantly greater profits to large mining companies. Logically, some, if not all, of the higher profit is related to the fact that the damages caused by longwall mine subsidence are not being charged to the mine operator, but instead are being passed along to landowners, to the public, and to the environment (Epstein *et al.* 2011).

The policy question going forward should not be: Is it fair for PADEP to compel the coal companies to invest in technologies that will prevent environmental impacts? Rather, the question should be: Why should PADEP allow the coal companies to continue to damage the environment *without* trying to prevent impacts, when they have proven during the last 16 years to be unable or unwilling to faithfully and completely restore the systems they damage?

There has been no attempt in these Act 54 assessments to think outside the Act 54 box. It seems to have been taken as a "given" that impacts from underground mining are inevitable, and that if at least *some* minimal effort is made to repair or compensate for *some* of those impacts, then everything is okay. But is that really the case? Is that what Act 54 intended? Is that just, or even constitutional in Pennsylvania?

This Act 54 Report strikingly documents that Act 54 is fundamentally flawed. Just because it promises a legal remedy for certain impacts does not mean that it meets the broader guarantee of environmental protection granted by right to all citizens by the Pennsylvania Constitution. Indeed, Act 54 does just the opposite: it *allows* damage to be knowingly and intentionally inflicted on certain lands and landowners. It is especially abhorrent that the damage today is being inflicted largely within designated "Environmental Justice" areas, an issue that is not mentioned in this Act 54 Report.

Act 54 is fundamentally flawed because it starts with the premise that impacts from underground mining *will* occur, that they *must* occur, that it is acceptable for those impacts to occur, and that no effort need be made to avoid or minimize those impacts. Yet this Act 54 Report demonstrates that impacts are *not* inevitable during underground coal mining; impacts are *only* inevitable with one specific method of underground coal mining -- longwall mining -- *as currently practiced* in Pennsylvania under the current PADEP regulatory system.

Act 54 is fundamentally flawed because, *when* those impacts which it allows actually occur, it mandates what measures must be taken to fix, or to attempt to fix, *some* of those impacts. But not all of the impacts are *covered* by the mandated remedies. This might be more palatable if all of the remedies that *are* covered by Act 54 (in the form of mitigation, restoration, compensation) were being fully implemented, but unfortunately, they are not, given inadequate enforcement by PADEP. So we are realizing partial remedies of some impacts, and no remedy of others. Clearly, this avoidable and unnecessary devastation of private property, public property, and the environment is not what Act 54 intended.

The crucial implications of this Act 54 Report must not be swept under the rug like each of the last two. The CAC, the newly-elected Governor, and the General Assembly need to understand that Act 54 is not working and that there must be a

serious effort undertaken to correct its deficiencies. It is unacceptable to continue to rely on the false hopes repeated in each of these Act 54 Reports -- that things might be better in the next five-year period. The Report's own statistics show that impacts are getting worse, not better, as time passes.

XIV SUMMARY AND CONCLUSIONS

This third Act 54 Review Report compiles and presents an enormous amount of information about underground coal mines and mining during the five-year period from August 2003 to August 2008. A lot of data essential to an analysis of the impacts of underground coal mining, however, either were not available or were not reviewed. As a result, this Act 54 Report fails to adequately address wetland impacts, water quality impacts, Special Protection waters, and the actual extent of impacts to streams, among other issues. Nevertheless, this Act 54 Report once again highlights the destructive nature of underground coal mining on land, structures, and water supplies. It illustrates that impacts are being mitigated in only a partial and piecemeal fashion.

More so than previous Act 54 reports, this third Report documents clear differences of impacts between the longwall mining method and the room-and-pillar method. Longwall mining was shown to cause many more, and more significant, impacts to surface features, and their times to final resolution are significantly longer, than room-and-pillar mining. Despite accounting for less than 50% of the area undermined during the five-year review period, longwall mining was responsible for 100% of the reported impacts to streams, 95% of the land impacts, and 94% of the impacts to structures.

The unspoken conclusion of this Act 54 Report is that longwall mining as currently practiced in the Commonwealth of Pennsylvania is a highly destructive technology that is not compatible with environmental protection, landowner protection, or taxpayer protection. The good news coming out of this third Act 54 Report is that underground coal mining can be and is being done with minimal impact to surface structures, streams, and landscapes in Pennsylvania, but only using room-and-pillar, not longwall, methods.

This Act 54 Report raises, for the third time in a row, important issues about the regulation of underground coal mining that must be addressed by the CAC, the General Assembly, and the Governor. These issues include the inadequacy of pre-mining baseline data in coal mine permit applications; unacceptably long times to final resolution of impacts caused by underground mining, but particularly by longwall mining; a failure to address regional or cumulative hydrologic impacts; and a failure to address impacts to public and community resources as well as private resources.

XV RECOMMENDATIONS

Given the absence of recommendations from this third Act 54 Report, this section summarizes the obvious needs for improvement of PADEP efforts to regulate underground coal mining to protect the residents of the coalfields and the environment.

If these recommendations are implemented timely, they will enable a much different and more informative story to be told in the next Act 54 five-year assessment report. Most of these recommendations address the responsibilities of PADEP. Others will require action by the Governor and the General Assembly. A few address the authors of the next five-year Act 54 report and any PADEP staff responsible for overseeing their work product.

- This third Act 54 Report provides some limited discussion of the RPZ (rebuttable presumption zone) and the 35^{o} angle of influence. It fails, however, to draw any appropriate conclusions. The second Act 54 report addressed this issue in detail, and made the recommendation that a fixed distance from the edge of mining (it recommended 328 feet) rather than the Act 54-mandated 35^{o} angle would be more appropriate for determining potential liability for water supply impacts, and it recommended additional study and consideration of the issue. This remains a critical area for further study, not only for water supply impacts but for impacts to structures and other features. We recommend that this issue be seriously investigated for immediate strengthening of PADEP regulations, in time for results on the ground to be analyzed in the next Act 54 report.

- Information specific to the length of streams impacted during the review period (in addition to stream impact incidents) must be collected by PADEP and analyzed in future Act 54 reports. We recommend that mine-specific data be compiled on the length of streams impacted, the nature of those impacts (flow loss, pooling, pollution, etc.), and the resolution status of those impacts.

- Much greater attention needs to be paid to water quality impacts from underground mining. Section 18.1 mandates that the five-year review be used to determine the effects of deep mining on "water resources." Stream flow and potable water system impacts have received some attention, but direct and indirect water quality impacts from subsidence and from pollutant discharges largely have been ignored. We recommend that all water resource impacts be recorded routinely by PADEP and made available for analysis in the next report.

- Electronic collection and storage of data -- from permit applications, monitoring records (DMRs and HMRs), enforcement files, mine maps, and other sources -- need to be standardized and modernized using electronic data storage and GIS (geographic information system) technology. This would provide the basis for meaningful hydrogeologic modeling and assessment, would provide close to real-time identification of impacts, and would allow for quicker, more efficient, and more effective Act 54 analyses and reporting. We recommend that PADEP update its archaic record-keeping system immediately, so that data will be accessible electronically for the next five-year report and for public inspection. We recommend that particular attention be given by PADEP to collecting and compiling all data by mining method, so that impacts from longwall and from room-and-pillar operations can be clearly distinguished and so that the knowledge gained can be routinely used by PADEP to protect the public and its resources in its permit decisions.

- All pre-mining and post-mining monitoring data on streams, springs, wells, and wetlands should be used to prepare mine-specific databases or models of local surface water and groundwater flow patterns. These datasets can be used to compare pre- and post-mining conditions and to determine what specific changes (if any) occurred as a result of mining. As more and more data are developed from each mine experience, a regional model can be developed which will provide a powerful and accurate tool for analyzing and predicting changes to the hydrologic system. Every new application, as well as PADEP staff, would then benefit from the cumulative experiences of all prior mining. We recommend that data collection specifically targeted to hydrologic modeling be implemented immediately by PADEP, so that the results can be evaluated in the next five-year Act 54 report.

- The Act 54 Reports should always follow up unresolved impacts from previous periods. This was done to some extent in this third Report. We recommend that future reports focus in detail on any unresolved impacts left over from prior reporting periods.

- Data sources must not be restricted to BUMIS and other selected PADEP files and to mine operators' records. The relevant literature (including prior Act 54 Reports) and the affected public also must be consulted when preparing future Act 54 reports. We recommend that every future report include a review of the relevant literature and an investigation of public complaints recorded during the review period, along with their resolution.

- Every future five-year assessment should discuss findings regarding impacts in the context of Act 54 and the effectiveness of the underground mining regulatory program as administered by PADEP to protect the resources and the people of the Commonwealth. Attention also should be focused on impacts in relation to Environmental Justice areas.

- Data from permit applications and from monitoring and enforcement files available from PADEP have been largely ignored in this Report, despite the mandate of Act 54 itself. We recommend that all impacts specifically predicted in permit applications be identified and compared with all impacts actually experienced; that the results of required monitoring be scrutinized, along with PADEP followup enforcement for violations encountered; and that all kinds of violations be tabulated meticulously by mining method in the next Act 54 report.

- As it has done for decades, the PADEP Bureau of Mining and Reclamation (BMR) evaluates underground mine permit applications primarily from a mine engineering perspective. While that may have been appropriate for room-and-pillar mines, or when the prevention of subsidence was a major consideration, it is not appropriate post-Act 54 for longwall mines where subsidence and the associated widespread environmental impacts are a certainty. We recommend that BMR interact more directly with other PADEP offices (particularly, the Water Management bureaus) to more fully evaluate water resource issues.

- There continues to be no analysis of the economic costs of underground mining impacts. We recommend, at minimum, that future Act 54 reports include a comparison by mining method of costs to prevent or minimize impacts with costs to repair, restore, or otherwise compensate for impacts.

- At present Act 54 is being administered in direct conflict with the guarantees of the Pennsylvania Constitution. Act 54 itself should be revisited by the General Assembly to reestablish protections formerly extended to the environment and residents of Pennsylvania by the BMSLCA and the Constitution. The highly destructive longwall technology henceforth should be allowed only where surface resources will be protected and impacts will be avoided and minimized.

- The arrival of a new administration in Harrisburg offers an opportunity for redirection of PADEP personnel to undertake effective implementation of existing State regulations pertaining to underground coal mining. We recommend that the environmental protections prescribed in existing regulations be fully implemented. Future regulatory improvements might be helpful, but will be meaningless unless actually applied and enforced.

- Finally, we recommend that work on the next five-year Act 54 report should begin immediately (inasmuch as we presently are more than halfway through the fourth five-year period) and should be completed as soon as possible after the close of the current assessment period.

XVI AUTHORSHIP AND ACKNOWLEDGMENTS

This report was prepared by Stephen P. Kunz and James A. Schmid, senior ecologists with Schmid & Company, Inc. Mr. Kunz has been a consulting ecologist since receiving a degree in human ecology from Rutgers University in 1977. Dr. Schmid is a biogeographer with 40 years of experience in ecological consulting. Both Mr. Kunz and Dr. Schmid are certified as *Senior Ecologists* by the Ecological Society of America and as *Professional Wetland Scientists* by the Society of Wetland Scientists.

Mr. Kunz and Dr. Schmid offer outstanding credentials as experts in ecology, wetlands, environmental regulation, and impact assessment. They have analyzed the environmental impacts of many kinds of proposed development activities in many states, including coal mining facilities, industrial facilities, transportation facilities, commercial developments, and residential developments. They have written Environmental Impact Statements under contract to the US Environmental Protection Agency, Army Corps of Engineers, Interstate Commerce Commission, various agencies of state and local governments, and a diverse array of private sector entities. They have prepared comprehensive analyses of environmental regulations of nationwide scope.

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