ASSESSMENT OF THE EFFECTS OF SUBSIDENCE (ACT 54) REPORT 2008-2013

An internal review of the report "The Effects of Subsidence Resulting from Underground Bituminous Coal Mining 2008-2013" by Tonsor, et al., University of Pittsburgh, August 30, 2014, and related public comments

Office of Active and Abandoned Mine Operations
Bureau of Mining Programs
Bureau of District Mining Operations

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Contents

Executive Summary

A multi-Bureau workgroup consisting of Department of Environmental Protection (DEP) staff was assembled to assess the fourth Act 54 Report (Report). The Report was prepared to satisfy statutory requirements of the Surface Mining Act and serves as an audit of Pennsylvania's underground mining program. The workgroup extracted recommendations and comments from the Report, responded to and clarified the issues that arose, and made recommendations to improve the program based on the Report's recommendations.

Included in this assessment are comments made by the public and interested organizations collected through the Citizen's Advisory Council's public hearings on the Report. Responses to the themes of the testimony are addressed and were used by the workgroup to help focus their recommendations for program actions. The public expressed concern about the following: quantity and quality of data, access to the data, a perceived lack of data organization and management, dissatisfaction with the current Act and processes allowed under the law, and transparency.

Key recommendations for DEP to implement include the following:

- Develop a written protocol for assessing streams that have been undermined. The DEP already has initiatives and studies in process that will inform and improve the stream assessments in order to evaluate and determine if they have been affected by mining and have or have not recovered in the allotted term.
- Proceed with enhancements to the Bituminous Underground Mining Information System (BUMIS) database system that tracks surface problems relating to mine subsidence.
- Develop written data and processing protocols to standardize BUMIS data submissions for easier analysis and public access.
- Improve receipt, review, storage and retrieval of permit data.
- Develop methods to improve quality control processes for the incoming data.
- Develop ways for the public to more easily obtain information.

Recommendations also include an emphasis on obtaining necessary locational data for permit monitoring points, a closer review of wetland mitigation plans, a change in the biological data collection protocol, and a review of monitoring point sampling frequency to balance usefulness with costs to mine operators. Several other recommendations are included for making the underground mining program more efficient, the data more useful, and improve the process for the completion of future Act 54 Reports.

Improvements to the next Act 54 are planned. The timing of the next report is important. There needs to be adequate time allotted for investigation without the drawback of missing data added at a later date while the analysis is ongoing. The communication process between DEP and the

contracted researchers needs to ensure all questions are being answered and progress is occurring. The DEP must be clear with contracted researchers what data is or isn't available through BUMIS permit files or other sources.

This report will be reviewed by DEP executive management to consider and provide guidance on development and implementation of a work plan. The next report cycle will also include an assessment on the extent to which DEP followed through on the work plan.

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Background

Bituminous underground mining activities in Pennsylvania are regulated by DEP under the Bituminous Mine Subsidence and Land Conservation Act (BMSLCA) of 1966 which calls for protection of structures, including buildings, homes and cemeteries. BMSLCA was amended in 1980 and again in 1994. The 1994 amendment, known as Act 54, included provisions for protection and restoration of water supplies affected by mining and additional remedies for structural damage. It also required regular assessment of the underground mining regulatory program.

Pennsylvania's bituminous underground mining program is primarily administered by the California District Mining Office (CDMO). The CDMO is responsible for reviewing and issuing all bituminous underground mining permits, collecting and tracking monitoring data, inspection/compliance, and investigation and follow-through for hydrologic, land subsidence, and structural problems related to the permitted areas. CDMO uses the Bituminous Underground Mining Information System (BUMIS) database to log and track these problems to resolution.

Policy, regulation and support services for the program are delivered by the Bureau of Mining Programs (BMP). The CDMO and the BMP staff work together to run, maintain, and enhance the program. The specific regulations pertaining to this program are codified in 25 Pa. Code Chapters 86 and 89.

Protection of streams and their uses is regulated under 25 Pa Code Chapter 89 as well as the Clean Streams Law, and informed by Chapters 93, 94, 96 and 105. An underground mine operator must demonstrate that activities are designed in such a way as to prevent damage to aquifers and perennial streams (§§ 89.35 and 89.36).

Under the Act 54 amendments to BMSLCA, DEP is required to compile data and report findings regarding the effects of underground mining on land, structures and water resources. This review is done with assistance from professionals with appropriate expertise as stipulated by Act 54. A Report is prepared and presented to the Governor, General Assembly and the Citizens Advisory Council (CAC) every five years.

The 2008-2013 interval constituted the fourth Act 54 reporting period. In September 2012, DEP contracted with the University of Pittsburgh for this task. Twenty-four researchers from the University of Pittsburgh's biology, geology and civil and environmental engineering departments collected and analyzed the data and provided conclusions and recommendations. The final report was submitted to DEP on August 30, 2014. DEP sent the Report to the Governor, General Assembly, and the CAC on December 22, 2014.

The Act 54 Report is deemed to be an important audit of Pennsylvania's underground mining program providing the public, organizations, and the mining industry with an opportunity to review and comment on the program and allowing DEP and overseeing parties to consider

program edits and improvements. The contract to complete the fourth 5-year Report (Report) was awarded to the University of Pittsburgh at a cost of $561,000.

In March 2015, a multi-Bureau workgroup was assembled to review the recommendations of the Report. This document represents the workgroup's findings and recommendations for improvement.

The Report focused specifically on the effects of subsidence on the hydrology of undermined areas and potential damage to streams. Thus, the Report emphasizes pre- and post-mining stream flow data and biological information in undermined areas, recovery periods for streams affected by subsidence, and impacts on wetland areas as well as on undermined surface land and structures.

Approach and Objectives

Assembled in March 2015, the workgroup consisted of members of BMP, CDMO, and Bureau of Point and Nonpoint Source Management (BPNSM). CDMO personnel provided expertise on the regulations, policy, permitting processes, hydrological regime, engineering details, reporting, and compliance issues of bituminous underground mining activities. BMP coordinated the effort to produce this assessment, compiled the information from all workgroup participants, and collected and reviewed testimony from the public hearings. BPNSM provided comments for the biological portion of the Report. The objective of the workgroup:

> *Identify any and all issues and recommendations within the Report as well as public comments regarding the Report; then, develop recommendations for program enhancements and/or changes that could be enacted immediately or planned as long-term action items.*

The workgroup extracted comments and recommendations from the Report which were then compiled and organized into the following themes from the structure of this report.

- Biology
- Wetlands
- BUMIS (database)
- Data Issues
- DEP Process
- Policy
- Future Report

Workgroup participants, focusing on their areas of knowledge and expertise, considered each issue and provided insight regarding the existing underground mine regulatory program and potential enhancements.

Several workgroup participants attended the CAC public hearings. The testimony from these hearings was also made available for review as part of this assessment. Responses to the important themes in the citizens' comments are also included.

Review of Report

Report Issues, Recommendations to the DEP, and Public Comments

The fourth Report was the most detailed and comprehensive to date, containing general and specific findings and recommendations for Pennsylvania's underground mining program. There was open review and comment by an engaged public and the CAC.

The workgroup identified 95 issues in the Report. These issues were organized by the above-referenced subject areas. *Appendix A: Issues and Responses* is a detailed listing of all recommendations mentioned in the "Recommendations" section of the Report and sub-issues mentioned throughout individual sections of the Report. The workgroup has responded to each of the 95 issues. If a recommendation correlates with the issue, the corresponding number from the Recommendations section is referenced.

There is some duplication across the subject areas since some comments address slightly different aspects of the same issue. For example, aspects of assessing stream impacts appear under BUMIS, Data Issues, DEP Process and Policy.

A numbered list of specific recommendations is provided in the Recommendations section of this assessment.

The following is a discussion and summaries of the issues identified within each theme and actions the workgroup has recommended.

Biology

Overall biological health of the stream before and after mining is measured via Total Biological Scores (TBS). The current method of collecting, reporting and using data to make the conclusion that an undermined stream is recovered was critiqued in the Report. The DEP relied on aquatic biologists outside the mining program to provide expert input on the best practices for obtaining biological data. Part of the recommendations in the Report included re-consideration of the existing technical guidance document. Immediate changes can be made including form revisions and data storage processes that will improve data quality and access. A revised policy for

obtaining TBS is feasible but will require a transitional period. The DEP will develop a reminder letter to be sent to operators to describe their obligations to provide post-mining biological data.

Wetlands

The Report included some straightforward comments about the quality of wetland delineation data, trouble locating the data, and oversight of the 1:1 replacement process. The DEP allows use of a grouping method for small wetlands with the understanding that, during different seasons, the individual wetlands may coalesce into a large one. But when grouping should apply is not clear and must be determined on a case-by-case basis. Workgroup recommendations include changes to storage of permit data, emphasis on 1:1 replacement of wetlands, move to multiple delineations during the initial assessment, and clarification on when it is appropriate to group wetlands.

Bituminous Underground Mining Information System (BUMIS)

BUMIS is the primary database used by the DEP to log and track reported problems related to permitted underground bituminous mining. Issues with the data (quality and quantity) and the database were a primary focus of the findings and recommendations by the researchers. The Report noted specific problems relating to missing data – locational and classification issues, status categories and dates, problems with unique identifiers for data points, and a lack of functionality for tracking stream impacts.

The DEP concedes that the database is not user-friendly. It is not easy to extract the data in compatible formats for use in analysis and was not originally intended to be used for stream impact tracking. The Report findings and recommendations sparked an in-depth group discussion about BUMIS and the various ways it can be improved to provide more useful data. A replacement of BUMIS would be a major undertaking involving years of planning and considerable cost. In the interim, enhancing or revising parts of BUMIS would produce an immediate effect. BUMIS can be modified to track stream impacts. Other modifications are also suggested that would allow for more efficient extraction of the data. Several improvements regarding data collection protocols are recommended that would address the quality control problems and missing data. This will involve outreach to staff and operators.

Data Issues

University of Pittsburgh researchers preparing the Report encountered various problems with availability and accessibility of data

For a bituminous underground permit, data sets include those collected for background/pre-mining, during mining, and post-mining. Specific types of data of interest include groundwater monitoring points, discharge monitoring points (NPDES), stream flow, biological surveys, wetland delineations, and characteristics of private water supplies and structures. The status of an

area being mined is updated through submission of six-month mine maps provided by the operator as mining progresses through the permitted area.

Three main themes regarding data emerged from the findings of the Report:

1. *Number, location and description of sample points*. The number and location of sampling points must be balanced with the data needs and usefulness. All points, including biological stations and stream segments, must be properly identified and have some form of locational measurements (lat/long). Careful consideration of all aspects of the monitoring plan ahead of mining, and attention to it during mining, is a process that takes extra time for the DEP reviewers and extra expense for the operators. However, this is worth the effort to ascertain whether the current plan is working properly or needs revision. Sound, early preparation can save a later dispute. There are regular permit review points (midterm review, permit revisions, permit renewals) that can be used to assess how the monitoring plan is working.

2. *Frequency of monitoring to capture data variability*. The Report notes the great variability in data from monitoring stations over the course of even a few hours. Some critical points may require continuous monitoring with transducers or gages in order to appropriately document the range of data and ensure costs of data collection is not wasted.

3. *Receiving and storing data*. The Report expressed serious problems with the data not being uniform in submission, difficult to access for analysis, containing many obvious errors, and not submitted in a timely manner. Fixes for these issues will be partially addressed automatically by implementation of the DEP's pending eDMR enhancement, which will include electronic submittal of data and automatic reporting of exceedances. The DEP has accepted operator-generated formats that are inconsistent in units and naming conventions as well as using undefined acronyms that hinder understanding. Some data is not necessarily well-tracked and may be stored on desk computers and not on shared folders. The volume of paper in permit files containing useful data is a hurdle to undertaking investigations. Management and analysis of data is a huge draw on staff time. The DEP also lacks some modern hardware and technical capabilities as well as not having access to various tools that the non-government entities can more readily purchase. Thus, data handling is a multifaceted issue. However, there are improvements that can be immediately made to DEP processes that will result in consistent and better quality data. Further consideration of data issues will reveal additional improvements that can be implemented.

Recommendations of the workgroup include standardization of the Hydrologic Monitoring Report (HMR) form and a move to provide this form in electronic spreadsheet format. Files should be stored electronically as well. The eDMR process, as noted, will be critical to improvements in data collection, storage and retrieval. A general shift to electronic submission and storage of data is necessary.

Written standards for six-month mine maps, monitoring data collection and submission, and for addressing missing or incorrect data are needed immediately.

Finally, the DEP is engaged in assessing what data is best needed for assessing streams potentially affected by mining via a contracted study with the US Geological Survey (USGS). This assessment would include frequency and location of monitoring, providing up to date progress reports, and requirement for operators under some conditions to use automatic recording equipment. Results of this USGS study will ultimately provide the basis for additional improvements to the program.

DEP Process

Several comments referenced DEP's process of permit review and the protocol for assessing impacts from mining. The University of Pittsburgh suggested upgrades to the process including technology purchases. The DEP is reviewing processes to determine ways to improve work flow and results.

The Report notes the use of control streams in several sections and several specific instances. The DEP has contracted with the USGS which will also include a study of natural streamflow in small watersheds. The objectives of this study occurring in southwestern PA is to document spatial and temporal variations in streamflow and to evaluate methods to estimate the natural streamflow characteristics. The DEP expects the results of this study, which is already underway, will provide information on evaluating the effects of undermining streams and in maintaining and protecting the existing uses.

The Report stresses a need for a sound, valid protocol for assessing streams and a system to tracking affected streams. As mentioned in the previous subsection on BUMIS, the database can be modified to improve the tracking.

Development of a protocol for stream impact assessment is a high priority task. BMP staff had already begun an internal evaluation of stream assessments involving cases from the CDMO. Findings from that will be used in the development of a standard operating procedure.

Other recommendations include focus on augmentation wells, real-time review of monitoring data to flag potential problems, and regular assessment of successful and unsuccessfully stream mitigation projects.

As with data handling, permit information and reports must move towards electronic submission and storage. Permit information integration with GIS applications is of great value to the DEP and the public.

Policy

The current DEP policy or technical guidance document (TGD) on streams, *Surface Water Protection – Underground Bituminous Coal Mining Operations 563-2000-655* is dated October 8, 2005. There were several issues identified with the policy and how it has been implemented. Many suggestions for improvements to the program made in the Report may require major revisions to this policy, including those regarding data collection that is a primary concern of the researchers and public.

The streams policy outlines the time schedules to be followed for stream mitigation. It states one year or "within a specific time period" to assess recovery of the stream after undermining. A footnote (page 7 of TGD 563-2000-655) in the streams policy refers to research that suggests recovery can take up to 2.3 years. The DEP had interpreted this as a three year span. The three year mark is a trigger to judge whether or not the stream has recovered and if mining plans must be revised. The next trigger is 5 years where, if the stream has not recovered, the operator may be required to compensate for this stream loss (page 9 of TGD 563-2000-655).

The Report made several other recommendations regarding overarching "policies" of the DEP such as how we interpret data, categorize cases, and assess problems. Those ideas were helpful in guiding the workgroup to point out what concepts need more thought and research. One recommendation, regarding use of control streams, had previously been identified internally and resulted in the project contracted to the USGS.

The streams policy should be reviewed to assure it is up-to-date regarding the best science available and that it reflects the findings of the Report and subsequent comments.

Recommendations also include attention to the collection of biological data to ensure reliability. The public was emphatic that all data collected by operators be available for undermined stream assessments. The DEP should pursue remedies to collect this data that may be retained by the operators.

Future Report

During review of the Report, the workgroup noted some items that might be addressed in the next Act 54 report. In addition, the findings of this Report and changes that will be implemented can be included as a follow-up task for the next report. The workgroup identified a problem with communication between the DEP and the researchers that resulted in misunderstandings and misinterpretation. One major action item for the next Report will be to establish with the contracted researchers a regular communications schedule to make sure all questions are being answered and progress is occurring. The DEP must be clear with contracted researchers what data is or isn't available through BUMIS or the permit files.

The DEP must consider the best timing of the next Report as well. There needs to be adequate time allotted for investigation without the drawback of missing data added at a later date while the analysis is ongoing.

The Report identified additional follow-up areas that the DEP will examine.

Clarification of items in report

The workgroup noted three sections in the Report that deserve clarification due to their potential to be misleading to the reader.

1. Purpose of BUMIS.

Section IV, page 2, contains the following statement:

> *"Subsidence related impacts are tracked within the BUMIS database (see Section II). The University periodically received output from BUMIS and used this information to assist in its analysis. The BUMIS database is meant to track all features, i.e. surface structures (dwellings, barns, etc.), water supplies (wells, springs, etc.), and water resources (streams, wetlands, etc.) undermined by bituminous coal mining operations."*

Other sections of the report suggest that the researchers are looking at the BUMIS database as containing ALL features in order to extract a percentage of unaffected as opposed to affected. BUMIS only contains information about impacted features. The DEP does not have a comprehensive database of all features undermined. This would be impractical. Therefore, the workgroup felt that the researchers may not have fully understood that the BUMIS data is limited. See Recommendation #43.

2. Number of cases unresolved.

Section V, page 6, contains the following statement:

> *"A total of 201 water supply reported effects were unresolved at the end of the 4th assessment period. Unresolved effects are given an interim status to indicate the processes occurring in assessing the liability of the effect. However, only three of the unresolved reported effects were given an interim status in BUMIS. The status of the remaining unresolved reported effects could not be determined from the BUMIS database."*

This statement is correct. However, it was interpreted in a misleading way by some readers of the Report. *No interim status given* means that the case is ongoing in investigation and resolution. It does not mean that the CDMO is not taking action on the claim and it does not mean that owner does not have water. There are many reasons that could account for the delay including simply a lack of input of the status or an unsuitable choice of status available. Several citizen comments included a demand

to address these unresolved cases (without interim status, therefore 198 cases). The DEP typically has a dynamic number of such cases (around 150-200) that are being resolved at any time. Since replacement or repaired supplies are eventually resolved and new ones entered, this number does not reflect a static number of problems or lack of effort by the CDMO, as alleged. A temporary supply is installed until a final supply is in place. There are inevitable delays with the resolution of a final supply as the DEP investigates the claim and potentially delays while another mining panel goes through. There also may be legal action being taken against the DEP's determination, or negotiations may continue for long periods, especially in cases of public water hookups. The CDMO holds quarterly meetings with the operators who have outstanding damage claims to insure that progress is occurring. See Recommendations #13 and 16.

3. Undermined stream lengths affected.

Section VII, page 20, contains the following statement:

> *"Streams experiencing flow loss, pooling or both comprised 39.2 miles (Table VII-7) – or roughly 77% – of the total miles of streams undermined by longwall techniques (50.59 miles, Tables VII-5). Thus, only 23% of the total miles undermined by longwall techniques belonged to streams that did not experience mining-induced flow-loss or pooling. In contrast, streams experiencing flow loss, pooling, or both comprised just 44% (6.55 miles; Table VII-7) of the total miles of stream undermined by room-and-pillar techniques (14.95 miles from the five longwall mines, Table VII-5)."*

Table VII-7 depicts the values related to this statement. However, in the text and in the table, the researchers noted that this percentage is derived from the ENTIRE stream length, not just the affected portion – it does not represent the length of impact. Even with the disclaimer, which may not be noticed or understood by readers, this workgroup feels the presentation is misleading. Evidence that it is prone to misinterpretation is the public comment submitted by the Center for Coal Field Justice that quoted the 77% value as "total miles of stream undermined" that experienced affects. Therefore, this 77% value can be interpreted erroneously as "77% of the *total* stream lengths were affected by undermining". The CAC also repeated that sentiment in their June 15, 2015 draft comments on the Report. That interpretation is not accurate. We do not have the true value of affected stream length as a proportion of the total stream length. Therefore, it is inappropriate to base an action upon that statement. Several Recommendations address documenting areas of stream loss and assessment of impacts. The DEP can provide a more specific answer to the impact of underground mining on streams in the future.

Public Comments

Public hearings chaired by the CAC were held on March 17, 2015 in Harrisburg and on March 27, 2015 at the California District Mining Office. All written testimony was posted on the CAC website. The commentators included environmental organizations, individuals living in mining areas, those who registered mining-related complaints and one representative from the mining industry. While many commentators echoed the Report's Recommendations section, comments ranged from requests to provide written policies and procedures all the way to banning the longwall method of underground mining. With regards to Act 54, opinions ranged from "the law is working" through "the law must be followed more stringently" to "the law is not working" – the Commonwealth should return to a "no damage" policy.

A petition with 153 signatories was submitted in support of the comments from the Center for Coalfield Justice.

Some commentators suggested comprehensive changes to mining policy, laws, and regulations as well as to DEP procedures. The citizens expressed dissatisfaction toward actions of the mining companies and DEP regarding investigation and resolution of complaints to their satisfaction. Those who testified did not express disapproval of the quality of the Act 54 Report or its findings.

The following Citizens' Comments and Response section is a summary of the major comments and concerns brought forth from those that testified at the two hearings and/or supplied written testimony. The workgroup has taken these issues into consideration in their Recommendations which are cross-references in the table on pages 19-21. Comments not addressed in the Recommendations table are addressed with a narrative response.

<u>Comments and Proposed Actions</u>

1. *There is a failure to uphold and enforce the laws in place. The documentation of irreparably damaged streams means the Act is not working. The stream policy was not being followed by DEP or operators. The longwall process, which caused the majority of damage claims, should be reexamined. Full extraction via this process should be prohibited underneath streams.*

   Considering the huge extent of underground mining in Pennsylvania at this time, irreparably damaged streams are the exception, with just five cases demonstrated in this Report. The workgroup agrees that the Streams Policy could be improved with protocols set into place to insure that it is understood and followed.

The citizens have asserted that the process of longwall mining causes material damage. The existing laws and regulations allow for full extraction (including longwall mining). The DEP has no legal means to prohibit it, but certain conditions and requirements exist throughout the statute and regulations which the DEP upholds that allow for mining activities that result in limited and/or temporary stream effects or activities supported by a demonstration by the operator that the streams will be protected. Longwall mining must be planned in such a way so as to prevent subsidence damage to aquifers and perennial streams (2006, UMCO Energy, Inc. v. Commonwealth of Pennsylvania, Department of Environmental Protection and Citizens For Pennsylvania's Future and 25 Pa. Code Sections 89.35 and 89.36). The primary condition to deny a permit would be if the DEP determines that the activity will cause severe, irreparable damage to the stream. Longwall mining is occurring throughout southwestern Pennsylvania and, in most cases, has NOT resulted in unanticipated, irreparable damage to streams. Thus, the statute and regulations are serving their purpose. Until the statutes and regulations are altered, full extraction will continue to be permitted with the required protections.

See Recommendations #30, 34, 38, and 40.

2. *Stream mitigation techniques do not appear to be successful. The DEP should undertake an examination of these techniques, and attempt to model stream loss before approval of activity. The operators should report the length of stream grouted and the DEP should assess chemical damage to the biota from grouting.*

   Post-mining biological scores show that the use and the biota recover in the majority of cases. Prediction is generally reliable with the results improving over the years. The DEP continues to evaluate prediction and stream mitigation techniques and incorporates information that can improve the process (such as limiting the length of panels to less than 1500 feet). As noted in the Report, extraneous effects from grouting needs additional study to substantiate the claim that it causes water quality degradation.

   See Recommendations #1, 9, 30, 34 and 35.

3. *Institute a 2-year time frame on repair/replacement of damaged structures and water supplies. DEP must address the remaining 198 cases of water supply effects and issue enforceable orders for repair/replacement. Greater penalties for mining companies should be imposed for noncompliance. Bonding for full damage restoration should be considered.*

   The citizens have asserted that the DEP should address the 198 outstanding cases of water supply effects that do not have an interim status. The DEP typically has a dynamic number of such cases (around 150-200) that are in various stages of resolution at any time. The workgroup understands that the numbers appear alarming, but they are due to complex circumstances. The cases are tracked and expediently addressed in order to maintain progress

towards resolution. The Report notes that 50% of the complaints are resolved within two months.

See Recommendation #33.

4. *The DEP should have a written procedure for tracking stream impacts and a policy for monitoring recovery and requiring compensatory damages. DEP should require deadlines for investigation of stream damage; the operators should be notified of their responsibility in a timely manner. The stream policy should be extended beyond a 5-year range.*

   The workgroup recommends that DEP follow through on improvements to the stream impacts tracking and protocol for investigation pursuant to the fourth Report recommendations. As noted in a previous comment, if the stream effects are temporary and limited, with a plan for mitigation, the DEP would not have grounds to prevent further mining. The DEP does not feel there is adequate justification to change the bonding or 5-year window.

   See Recommendations #9, 21, 30, 32, 34 and 35.

5. *Property buyouts are not a good solution. Private agreements do not exempt the mine operator of liability for damages. Prices of properties and compensation should be reported and be available to the public. Damage on mine-owned property should be reported as well. Such buyouts and company-purchased properties are negatively affecting the communities.*

   The current law allows for the property to be purchased and many people willingly take advantage of that opportunity. The DEP does receive notification of damage on mine property. The company's stance on liability does not affect the determination of effects by the DEP. If damage is anticipated, the DEP does require a replacement or mitigation plan.

6. *Better baseline hydrologic data should be required for permit review. This is especially important for permit revisions. The DEP should require more frequent collection of data (greater than quarterly). Additional HMR points should be located near at-risk water sources.*

   The workgroup has responded to the recommendation for better premining data, more frequent data and the location of monitoring points pursuant to the issues raised in the 4th Report.

   See Recommendations # 17, 18, 19, 21, 22, 29 and 30.

7. *DEP permit review should emphasize consideration of the ecosystem and the cumulative impacts on the hydrologic balance. The value of water resources for all uses should trump the value of mining. Mining should not "get a pass" or be allowed to cause damage that can't be adequately repaired.*

The workgroup recommends DEP focus on the Cumulative Hydrologic Impact Assessments (CHIA) to ensure that they are comprehensive and complete and reflect a true assessment of all the competing interests in the area proposed for mining.

See Recommendation #44.

8. *Reassess the rebuttable zone of presumption (RZP). Include liability for water supplies when the mine is not active or when outside the zone. Recalculate the angle of influence regarding subsidence damage.*

   While there are anomalies that can occur outside these boundaries, the workgroup considers the current guidelines as reasonable and scientifically valid. If further information is accumulated to justify a change to the current process, the workgroup recommends DEP consider revising the policy on the RZP and the angle of influence.

9. *Citizens do not know when revisions are proposed to permits. Name changes of the companies and operation designation makes it difficult to follow what is proposed. The permit information is incomprehensible. There should be a greater opportunity for citizens to participate in the process.*

   The DEP has launched a new e-comment process in May 2015 that will make it easier for the public to access and respond to changes in technical guidance documents and other published documents. The E-notice program can be used to provide citizens with email notices of permits under review in their areas of interest.

   See Recommendations # 28 and 29.

10. *Update the BUMIS system, improve reporting. Implement a new system as well as data standards to allow for meaningful evaluation, accessibility and transparency. Require electronic submission.*

    The workgroup recommends that DEP move forward with enhancements to BUMIS as well as undertake efforts to improve data submission and standards, to arrange the data in a more readily accessible format. A new system for electronic monitoring data submission is currently in development (eDMR).

    See the BUMIS section in Recommendations #9-16, and also #18 and 20.

11. *Companies should report all their collected data to DEP. The public should have access to this.*

    The workgroup discussed many ways to improve the data issues; these are included in the Recommendations. The workgroup also recommends various improvements to data organization and access by the public.

See Recommendations #29 and 36.

12. *Citizens call for comprehensive premining inventories and reporting of structures. The industry claims this is huge burden to log every structure including small ones.*

    The workgroup concludes that more data is not necessarily better if it is not utilized efficiently. With regards to better information on structures, see Recommendations #10, 11, 12 and 13.

13. *There is a lack of trust in DEP's complaint investigation. A complete analysis of oversight of the underground mining program and permit regulatory system is needed. The DEP should acknowledge and commit to address problems.*

    There are several aspects of the mining program that aid in transparency. The PA DEP program is overseen by the federal Office of Surface Mining (OSM). The DEP regularly responds to notices by OSM to answer questions or correct any noted problems. The 5-year Reports also serve as an important independent review of the program. DEP executive staff has committed to review this assessment of the 4th Report, consider the public comments and comments from the CAC, and follow through with an action plan to address concerns raised.

The DEP received comments and questions from the CAC. If those comments and questions are not addressed satisfactorily within this document, the DEP will meet with the CAC for further discussion.

Recommendations

The workgroup recommends the following actions to be considered by executive staff.

Biology
1. CDMO and BMP will work together to revise Module 8.8 forms and supply this to operators in .xls format (spreadsheet) to aid in higher quality data as well as standardization. Include a means to identify grouted stream segments. This will also encourage electronic submission of data.
2. Store biological data for each TBS in a place that is easily accessible, either on paper or CDs in the permit filed, labeled “Biological Data”.
3. Transition to December-May as index period as requested. This requires a change to the stream policy document and a transition plan for compliance.
4. Generate a 3-yr letter to operators reminding them of their obligations to collect biological data and include a schedule to be met unless the operator can demonstrate there will be justifiable delays.
Wetlands
5. Segregate wetlands data in the permit file to make retrieval easier.
6. Evaluate multiple delineations of wetlands during initial assessment. Have discussion with operators to examine the issue.
7. Add to Module 8.12 a comment regarding when grouping of wetlands in the delineation phase is or is not appropriate.
8. Address the issue regarding 1:1 wetland replacement with staff. Encourage operators to design restorations to replace wetlands as they were previously.
BUMIS (database)
9. CDMO and BMP will work together to enhance BUMIS for affected streams by adding a specific "streams" input screen to collect the appropriate information and store it in a central location. Included in the modification will be a field representing length of stream grouted and use of the 5 digit WRDS stream codes.
10. Unique identifiers are now required on six-month mine maps. Follow through with this practice.
11. Design a standard operating procedure (SOP) for input of BUMIS data. Examine staff ability to do this, emphasize quality control. Consider a mining specialist for this task.
12. Revise data collection forms (including biological data) for operators to insure that the needed information is collected upfront (lat/long, land effects). Conduct an information meeting with operators and inspection staff to emphasize importance of location data.

13. Assess BUMIS to identify what enhancements (in addition to the stream screen as given in #9) can be made and plan to coordinate action on changes. (Examples: land effects, feature types, unresolved structure effects, interim resolution/current status)
14. Replace BUMIS (long-term).
15. Revise Module 22 of the permit application to clarify identification of feature types.
16. Fix multiple BUMIS designations for recovered stream resolution final status, or clarify the various terms used if definitions are different.
Data Issues
17. Standardize HMR. DEP should not continue to accept individually designed forms from operators. Naming conventions and abbreviations used are to be explained. Points are to be uniquely labeled with accurate lat/long. The CDMO will encourage operators to submit in electronic spreadsheet format to a dedicated email account. Files should be stored on a server for easy access.
18. Develop written standards for monitoring data collection and submission.
19. Consider more frequent sampling of streams during key times to allow for a better assessment of flow loss. Discuss this with the operators including use of automatic recording equipment.
20. Pursue eDMR process to collect HMR data. Implement as soon as possible.
21. Determine what data is needed to best assess streams potentially affected by mining. Produce a public explanation of the determination. Does frequency and reporting of stream flow data need to be revised?
22. Assess if additional info is needed in hillslope areas.
23. Add checkbox for pre/post mining to biological data form.
24. Address missing and mistaken data submitted. Develop SOP for reviewing and promptly flagging bad data from operators and addressing it for correction. Train staff on this issue.
25. Encourage use of spreadsheets from operators to track stream flow to keep up to date on potential problems and recovery progress.
26. Develop written standards for six-month mine maps.
DEP Process
27. Examine the information provided on augmentation wells to assess if this is currently adequate. Consider augmentation wells in the impacts to aquifers. Operators should be informed about reporting all water withdrawals to DEP. (Refer to Chapter 110 regulations and http://www.pawaterplan.dep.state.pa.us/StateWaterPlan/WaterUse/WaterUse.aspx)

28. Consider better handling of application module information updates in the permit file so that changes from previous versions are evident.
29. Consider improvements in how permit information and reports are stored and accessed. Encourage electronic submittal from operators. Scan paper data and store electronically. Files should be labeled appropriately and include sub-files that are labeled with the particular data type. If the data is stored electronically, it should be in a central location (server) and a note should be placed in the permit file indicating which data is stored electronically.
30. Develop SOP for tracking and investigating stream impacts, augmentation rates, dates, stream section locations. CDMO and BMP should develop a plan for review of problem cases of stream effects. Consider findings of stream assessment review project between CDMO and BMP. Determine if further research on assessing stream impacts should be considered and, if so, identify the research questions and how the questions will be investigated.
31. Examine how to improve integration of permit document information with GIS.
32. Use the USGS stream study when completed to make procedural changes to the program. Make the conclusions of this study public.
33. Track data submissions to ensure they are submitted in a timely manner possibly through use of eFACTs self-monitoring screen as a tracking tool. Follow through with notices of violation, if delinquent.
34. Regularly assess successful and unsuccessful stream mitigation projects. Share information via articles or presentations to staff and public that evaluate existing and new techniques.
35. Compile stream loss info in real time to save effort for 5 year trigger and formal documentation of process. This can be part of the SOP regarding undermined stream assessment to be developed (Recommendation #30).
Policy
36. Pursue remedies to have operators supply ALL data they are recording, not just the minimum requirements.
37. Examine if a checklist or training for consulting biologists is necessary to ensure quality collecting techniques and that recommended procedures are followed.
38. Review the streams policy TGD 563-2000-655) to assess changes that need to be made.

Future Report
39. Follow up on Brush Run (after the study period).
40. Consider research into evaluating the effects of longwall mining on stream water quality. This can also be a separate contract with USGS.
41. Consider the timing for the next report to allow for the submission and preparation of all data (six-month mine maps) for that 5 year period.
42. Plan for regular quarterly meetings with the researchers to answer any questions and address problems as they come up.
43. Provide researchers with a clear explanation of what BUMIS is, what data is collected, and what is not included in the database.
General
44. Require increased cooperation between CDMO and BMP to make changes to forms, modules, policies and procedures. Specifically, examine the CHIA procedure.
45. Review Module 8 for general improvements.

APPENDIX A

Issues and Responses

	Issue	Response
BIOLOGY		
1	PADEP did not require selection of a control stream for comparison (Wharton Run). The University could not determine the reason for the inconsistencies. (Section 8, Page 17)	The operator had pre-mining biological scores for the affected panels of Wharton Run, thus no control stream was required. Post-restoration median scores were all within 12% of the pre-mining score; so the biological component of recovery was deemed achieved.
2	PADEP should redo Forms 8.8C and 8.8D for biological data submission. (Section 10, Page 7)	Agreed. See Recommendation #1.
3	PADEP biologists should request and store all macroinvertebrate taxon-level data associated with a particular biological score. (Section 10, Page 7)	Printed pages and/or CDs of the files will be stored in a specific folder labeled "Biological Scores" within the permit information file for ease of retrieval and public access. See Recommendation #2.
4	PADEP's index period should be shortened to December-May and that PADEP encourage operators to concentrate TBS sampling efforts in December-March. (Section 10, Page 7)	Agreed. See Recommendation #3.
5	PADEP should establish strict schedules for the submission of biology data following flow loss mitigation and flow recovery. (Section 10, Page 8)	"Strict" schedules are difficult to set and enforce due to real-world delays caused by weather conditions and other issues. A reminder to the operator of the 3-yr span would be helpful. See Recommendation #4
6	Biological samples collected after grout mitigation at sites experiencing flow loss impacts should be explicitly labelled as "post-grouting" to facilitate determination of the effectiveness of this technique. (Section 10, Page 8)	The DEP goes by the dates of these submissions to judge the evaluations as pre- or post-grouting. Forms 8.8 B and C have a comment space to include a mention that the stream has been grouted. See Recommendation #1.

	Issue	Response
WETLANDS		
7	Wetland inventories were difficult to find in files. The data were in permit renewal files. (Section 9, Page 1)	The CDMO will label a separate section of the file that contains wetland data. See Recommendations #5, 29.
8	PADEP should consider climate variation when evaluating the impact of subsidence on wetlands. (Section 9, Page 9)	Acknowledged, but it's unclear how this consideration can be implemented. The evaluation should at least include assessments from both dry and wet seasons. As the researchers note: "Additional data is clearly needed to fully assess the link between climate and change in wetland size." See Recommendation #6.
9	Multiple pre-mining delineations of wetlands would be needed to better assess the degree of natural variation in wetland size. Multiple delineations of a focal group of wetland may provide a natural standard deviation in wetland size that can be applied to evaluate post mining delineations. (Section 9, Page 9)	Agreed. Better premining evaluation is recommended. However, this would be an increase in cost to the operators. The DEP should consider multiple delineations. The DEP is willing to consider input that would improve the delineation and evaluation process. See Recommendation #6.
10	Individual wetland patches identified on the maps were grouped together as a single wetland for evaluation of gains and losses in the mine operator's data tables even though they were identified separately. No method for grouping was available. PADEP should identify the mechanism underlying wetland grouping. If the grouping reflects data collection methods or other factors unrelated to wetland ecology, then PADEP should request that mine operators discontinue the practice. (Section 10, Page 11)	Wetlands that are very small or coalesce during certain times of the year can be justifiably grouped. A protocol using a maximum distance between adjacent wetlands that explains grouping would be beneficial. Grouped wetlands should still be labeled with unique numbers (W1 - W1a, W1b, etc.). The decision to group or not can be informed by additional assessments instead of just one premining delineation. See Recommendation #7.
11	PADEP needs to provide greater oversight of the 1:1 replacement ratio for both wetland acreage and wetland function/type. (Section 10, Page 11)	In most cases, there should be 1:1 replacement to restore what was affected. The DEP considers the use of the wetlands and aim to restore the benefits as they were previously. See Recommendation #8.

	Issue	Response
BUMIS		
12	BUMIS-features lack unique identifiers. 30% of the features lacked a feature ID number. (Section 0)	The CDMO is in the process of working on actions to fix this. Unique identifiers are now required on six-month mine maps. BUMIS data will eventually reflect this change. A standard operating procedure (SOP) for BUMIS data input will be developed. See Recommendations #10, 11.
13	BUMIS is not designed to track stream impacts (Section 0)	Agreed. CDMO and BMP will work together to enhance BUMIS to address streams by adding a specific "streams" screen to collect the appropriate information and have it in a central location. See Recommendations #9, 43.
14	Spatial coordinates (i.e. longitude and latitude) often missing. Exact surface position of features missing. ALL information that can be georeferenced and is pertinent to permitting, regulation and reporting should be included in BUMIS to create a true information system where all relevant information can be accessed. (Section 2, Page 6)	Forms can be changed to add fields for lat/long identification and entered into BUMIS. A focus on including spatial coordinates should be emphasized to operators and inspection staff. Outreach and training is recommended. See Recommendation #11.
15	BUMIS did not contain enough information to match structures projected on maps with a BUMIS record. Therefore information on the number and kind of structures undermined during the 4th assessment period is not presented. (Section 4, Page 2)	This information was previously available through a personal database that is no longer maintained. BUMIS does not compile the number of structures undermined; it tracks only those that are affected. It is not feasible to use BUMIS to inventory all structures and the DEP does not agree that the value of this is worth the effort of collection. See Recommendation #43.
16	Feature types are commonly not adequately classified. Feature use is not always entered in BUMIS and is listed as "unknown" (46%). (Section 4, Page 2)	Multiple out-buildings are identified, but requiring a description of their uses is not required or deemed pertinent by the DEP in most cases. The CDMO staff contends that to require identification as such would be a level of detail that would not be justifiable.

	Issue	Response
17	Land reported effects, referred to as land damage problems in BUMIS, could not be accurately located and are therefore only reported in the aggregate. (Section 4, Page 2)	Spatial coordinates are difficult to assign to "land effects" but see response to comment #14 above. The DEP should consider a protocol for describing the location of such features. See Recommendation #12.
18	The majority of unresolved structure effects are considered to be “Currently Monitoring” by PADEP. This interim resolution status implies that most reported effects require a period of observation before a final resolution can be assigned. (Section 4, Page 7)	An unresolved case can have several explanations most often of which being that the owner is in negotiation with the mining company for resolution, or the situation could be in litigation. Additional enhancements could be added to BUMIS to clarify the current status. See Recommendation #13.
19	Water supply feature types are not always adequately classified. (Section 5, Page 2)	The primary water supplies are identified, but requiring a description of the uses of all other water supplies is not required or deemed pertinent by the DEP in most cases. The CDMO staff contends that to require identification of them as such would be a level of detail that would not be justifiable.
20	Unresolved water supply effects were not given interim dates. The status of the unresolved reported effects could not be determined from the BUMIS database. (Section 5, Page 6)	The "interim" condition is a function of the BUMIS layout for which there is only one field. The CDMO includes details of each activity in the related comments section of this field and the interim date is updated when any action occurs. An unresolved case can have several explanations most often of which being that the owner is in negotiation with the mining company for resolution, or the situation could be in litigation. Additional enhancements could be added to BUMIS to clarify the current status. See Recommendation #13.
21	Not all stream investigations from this period were tracked in BUMIS – only in paper files at CDMO. 25% of the stream impacts from this period are not identified in the BUMIS database. (Section 7, Page 26)	BUMIS was not designed to track stream impacts. See response to comment #13 above. See Recommendations #9, 43.

	Issue	Response
22	Thirty-eight cases state a final resolution status of "repaired", "resolved", and "stream recovered". University and PADEP could not determine the distinction between these three final resolution statuses. (Section 8, Page 3)	Agreed. Since these terms are interchangeable, the codes in BUMIS should be revised to use a standard term. See Recommendation #16.
23	Data entry errors were frequent. Written protocols for data entry should be developed and implemented. Standardized formats for submission should be followed by mining operators and DEP field staff. Quality control and quality checking protocols should be developed and implemented. (Section 10, Page 2)	The DEP should review data collection and input processes to address quality control issues. See Recommendations #11, 12.
24	All features should be input in BUMIS with geographic coordinates from either field GPS devices or computer geographic information system software. The coordinates should be given to the tenth of a second or to the ten-thousandths of a degree. (Section 10, Page 3)	See response to comment #14.
25	The University was unable to locate all features on six-month mining maps with a corresponding BUMIS report. The feature 'types' and 'uses' were not consistent with designations from the previous Act 54 assessment, making comparisons difficult. Feature identification should match that of the six-month mine maps. Features should be able to be identified by feature number alone. Features should be identified by type, use, or property parcel. (Section 10, Page 3)	BUMIS is not used by the DEP to record the location of all structures, just those that have been impacted. See responses to comments #12, 15.

	Issue	Response
26	BUMIS commonly misclassified structural features. The BUMIS database contains significant occurrences in which structures were classified as land features and vice versa. The 'land' feature type seems to be a 'catch-all' classification and contains some effects that should be classified as land reported effects, not water supply reported effects. The University believes that structures classified as land reported effects in BUMIS may be mislabeled. The University noted that often the reported feature type in BUMIS did not accurately describe the feature that sustained structural damage. (Section 10, Page 4)	Operators are not required to provide specific uses for out buildings and secondary water supplies (see responses to comments #16 and #19); this does result in catch-all classifications being used. Module 22 of the permit application can be revised to request this information. BUMIS can also be enhanced to include an updated list of features. See Recommendation #15.
DATA ISSUES		
27	PADEP bio-monitoring coordinates provided to the University were incomplete. This is an area where the PADEP could do better at collecting the coordinates and adding them to a database or GIS. (Section 2, Page 14)	DEP should ensure that the forms for collecting biologic data include a field for lat/long of each station. See Recommendations # 1, 12.
28	PADEP's staggered schedule for submission of six month mining maps resulted in some data being unavailable to the University for analysis. (Section 2, Page 17)	The schedule is such that it spreads out the workload for DEP staff. The 5-year span of the reporting period is an arbitrary boundary. The missing data will be picked up in the next report.
29	Pump test data is not directly connected to other geologic/hydrologic data. (Section 6, Page 9)	Pump test data is for baseline and background and kept with the permit file. The data is used when a problem arises.
30	HMR database naming conventions are not always clear. An over-count of stations due to duplicative station names may result. (Section 6, Page 12)	The DEP should ensure that the naming conventions and abbreviations regarding the data for monitoring points are unique and clear. The forms should be modified to include instructions for uniquely labeled points with all abbreviations defined by the operator. See Recommendations #17, 18.

	Issue	Response
31	Some HMR points lack spatial coordinates and are not usable. (Section 6, Page 12)	The DEP will focus on ensuring each point has correct coordinates. See response to comment #59 See Recommendations #17, 24.
32	Datums are not consistent for wells (elevation vs. depth) or streams (cfs vs. gpm) (Section 6, Page 12)	Data standards for these input parameters are appropriate. The resulting standards will be incorporated into the eDMR process. See response to comment #59 See Recommendations #17, 18, 24.
33	There are non-trivial issues with mass balance in the reported data. Confirmation of a problem and identification of the source of the problem should be addressed in the long term. If a problem was addressed, it was not documented in the HMR file. (Section 6, Page 13)	The HMR file is for flow measurements and not the proper location to address noted problems. Stream problems will be addressed by modifying the BUMIS database to better track these issues. See response to comment #13 See Recommendations #9, 24.
34	There is great variability in hydrologic conditions for some monitoring stations even over a few hours. This results in levels of uncertainty in the impacts making it difficult to detect changes in stream flow or water table due to mining impacts. HMR are insufficient to detect and characterize certain changes from mining impacts. (Section 6, Page 14)	Conditions may change dramatically in a short time. More frequent data collection as well as correlation to precipitation events, etc. will be considered. There is currently no method to do this except through analysis of the comprehensive stream data set. The DEP can request data loggers for more frequent measurements where needed to provide a more detailed assessment. A procedure (SOP) for reports assessing streams potentially affected by mining is necessary. Use of a qualified control stream can also be helpful to determine effects. DEP will consider the findings of the in process USGS study to ensure optimal monitoring frequencies are being deployed. See Recommendations #19, 21, 30, 32, 35.
35	Measurements do not clearly allow assessment of other no-flow impacts. (Section 6, Page 21)	
36	Current data is not adequate to determine mining-induced effects. Data collection frequency and the spatial density of sampling both need to increase. (Section 6, Pages 22 & 44)	

	Issue	Response
37	All data submitted under a permit should be in electronic form. Problem with paper files and results on desks instead of files. Or, as computer files on personal machines unavailable to the public. Use standardized electronic data forms, submit data electronically. Six-month mine maps should be submitted electronically. (Section 10, Page 2)	Written standards for six-month mine maps are appropriate. The DEP does not currently have an adequate structure in place to accept mine maps electronically. The paper copies of six-month mine maps are georeferenced and digitized by the CDMO staff and placed on the PASDA website. Therefore, the DEP has a process in place to share this information with the public. See Recommendation #26.
38	The existing data is limited in spatial and temporal density. There are few HMR points within each of the focal watersheds. (Section 6, Page 28)	These sites were developed before the streams guidance applied. The DEP will ensure that a monitoring plan is adequate to address data needs for assessment. See Recommendations #18, 19, 21.
39	A clear understanding of the role of groundwater in reported effects requires changes in the data collection regime. (Section 6, Page 41)	The DEP often uses piezometer data to assess groundwater flow to streams. It's not clear if the researchers considered these data.
40	Additional data collection is needed to understand impacts to hillslope hydrology (springs) (Section 6, Page 43)	The researchers emphasized the special conditions on slopes relating to spring impacts. The DEP will consider requesting additional monitoring on hillslopes if there appears to be a potential for water supplies to be affected. See Recommendation #22.
41	The groundwater data, as reported, is insufficient to allow clear assessment of hydrologic impacts. Improve documentation of what should be reported and how it should be reported. (Section 6, Page 44)	Researchers acknowledged that the data set collected is substantial in quantity (30,000 samples from 750+ points) but is still inadequate. The recommendation of creating standard procedures and a better data collection system are acknowledged and such plans will be pursued. See Recommendations #17, 18, 19, 25.

	Issue	Response
42	Paper files did not include maps for most pooling impacts. (Section 7, Page 22)	The DEP disagrees with this statement. The maps do show this. The DEP is unclear why this issue was not addressed directly to them. Regular communication with the researchers should be planned during the next study term. See Recommendation #42.
43	PADEP relies on the mine operator to submit flow and biology data. The University suggests that PADEP specifically request these data after mitigation to ensure a timely assessment of recovery. (Section 7, Page 26)	Agreed. A letter to alert the operator to the 3-year trigger will best inform the company of their obligation. Then, a biologist will receive the data for review in a timely manner. See Recommendations #4, 30.
44	TBS data was missing for several sites. (Section 7, Page 29)	See response to comment #3 regarding filing improvements.
45	The operator should be responsible for generating scores rather than DEP. (Section 7, Page 29)	The DEP does not generate biological scores but does check them for accuracy.
46	For mines operated by Alpha Natural Resources, the University used the “straight-line” maps to identify streams receiving augmentation. The “straight-line” maps do not provide information on the number of augmentation discharges that are installed or active on a stream and the University could not locate this information in any of the files at CDMO. (Section 7, Page 46)	Straight line maps are not required. Operators do show flow/nonflow sections of the stream. The DEP can recommend a configuration that will provide the most useful data set during pre-application discussions. The DEP will consider how to track augmentation rates, dates, stream section locations, etc. to better review stream assessments and recovery. See Recommendations #21, 25, 30, 35.
47	PADEP should require mine operators to report the length of stream grouted, but the University suggests that these data would be useful in assessing the actual extent of stream mitigation following mining. (Section 7, Page 52)	The DEP agrees in part. The information is not immediately useful to the DEP during assessment. DEP should consider if this should be required, how to report it, and how to store it. Consider modification to the BUMIS system to include this (in "streams" screen). See response to comment #13. See Recommendation #9.

	Issue	Response
48	Operators should label post-mining TBS. (Section 7, Page 59)	The DEP uses the dates of the biological assessments. A checkbox indicated pre or post-mining can be added. See Recommendation #23.
49	All data should be usable in spatially-explicit formats and/or readable by standard analytic software. (Section 10, Page 2)	See response to comment #14. The DEP will update the BUMIS database to make it easier to extract data in a standard format. See Recommendation #13, 14, 31.
50	Lack of uniformity in data submitted by the mine operators strongly hampers both enforcement of regulations and required Act 54 reporting. A protocol for submission of each type of data should be developed and disseminated. (Section 10, Page 2)	Standard procedures, better data collection processes and tracking improvements would address this issue. See Recommendations #17, 18, 20, 26, 33.
51	There were many errors and misreporting evident in the data submitted by operators. Water level elevation/flow data were reported in date format. Data was listed in the wrong row or columns. Adopt simple quality assurance evaluation. HMR data quality should be more carefully evaluated. A protocol for checking incoming data, and returning it if non-compliant, should be developed and implemented. (Section 10, Page 2)	The DEP acknowledges data quality problems. The new Electronic DMR (eDMR) process currently in development (probably a year away) will go far in forcing higher data standards and will allow for more expedient checking of the submitted data. Therefore, an action to correct this is already in process. CDMO can develop and undertake training to emphasize attention to the data quality for staff that handles the input and assessment. See Recommendations #17, 18, 20, 24.
52	For both spatial and non-spatial information, link all pertinent information in a single electronic system. Develop standards for data and record submission and tracking that can be used by mining operators. (Section 10, Page 3)	See response to comment #14. The DEP plans to update the BUMIS database to make it easier to extract data needed for assessments. Data standards will be automatically improved with the eDMR. See response to comment #51. See Recommendations #14, 18.

	Issue	Response
53	Six-month mine maps: Many structures on the maps were not adequately labelled. Structures and surface features should be labelled with a unique numerical identifier whereby that feature can be identified solely by its numerical identification for a given mine. All structures and surface features required to be identified should be identified within at least 200-ft of previous and active mining. (Section 10, Page 3)	If the DEP reviewer is not satisfied with the required detail on these maps, this is addressed with the operator. Too much labeling and detail may inhibit the usefulness of these maps. See responses to comments #12 and #17. The DEP expects to see improvement regarding unique labels for features for the next 5-yr assessment. See Recommendations #10, 26.
54	PADEP should adopt a numerical ID preceding the W1 or S1 identifier to allow more efficient tracking of undermined water supplies. (Section 10, Page 5)	The reported water loss/structure impacts in the files are identified by "WL" or "SA" with the current year and number of impacts reported for that year (Example: WL1501). This method was recently adopted. Improvement in this area should be noticeable during the next 5-yr assessment.
55	Many features are inaccurately labeled in initial input. Information for a particular feature should be checked for accuracy before the case is closed. (Section 10, Page 4)	This quality control issue relates to gathering and inputting the data into BUMIS. See responses to comments #12, 14, 16, 17, 19, 23, 26.
56	PADEP should enforce proper labelling of features on six-month mining maps with identifying numbers to facilitate the tracking of undermined structures and mining-related impacts. Adopt quality checking protocols to ensure BUMIS accuracy. (Section 10, Page 4)	This issue relates to gathering and inputting the data into BUMIS and general quality control. See responses to comments #12, 23, 53.
57	The University recommends that the frequency of sampling be increased to sub-daily time increments (e.g., hourly or at 15 min intervals), particularly during periods just before, during, and just after undermining. (Section 10, Page 5)	The current TGD does not require these increased frequencies and such frequent measurements would be practical only with automatic recorders. See response to comments #34/35/36. The DEP agrees that quarterly is not enough for monitoring and compliance purposes. See Recommendations #19, 21, 35.

	Issue	Response
58	The format of HMRs is inconsistent. HMR data collection was time and labor intensive. Electronic submission of HMRs should continue and be expanded. (Section 10, Page 5)	The DEP agrees. The DEP staff will provide an electronic spreadsheet template to operators to complete and require a standardized format for submission. The BMP will assist CDMO in producing the standard HMR electronic form. Also, see response to comment #59. See Recommendations #17, 20.
59	The University recommends that HMR data be stored as part of a larger information system, either incorporated into existing systems (e.g. BUMIS) or preferably, the next generation data systems with spatial querying capabilities. (Section 10, Page 6)	The DEP is in the process of implementing an electronic submission portal for HMR and other data called eDMR. This technology is expected to improve data quality, timeliness of submission, ease of retrieval, querying ability and storage issues. The schedule for the eDMR rollout is about a year away. See Recommendation #20.
60	Submission of monthly stream flow maps and data should continue through use of spreadsheets to explicitly quantify the lengths of flow loss. (Section 10, Page 7)	The DEP agrees and will encourage this to continue. See Recommendation #25.
61	The University encourages the display of active and inactive augmentation wells on maps to aid in identifying streams experiencing flow loss and the severity of the impact. (Section 10, Page 7)	This is not specifically required by the stream policy. It may be difficult to report and track since some wells in one watershed provide augmentation to another. The DEP should consider if this is a useful addition to operator requirements. See Recommendation #27.
62	PADEP should request and store all flow and biology data collected by the mine operator following mitigation to avoid the perception of selective data submission. (Section 10, Page 8)	The DEP does not understand this statement regarding “selective data submission”. All data is stored in the permit files.

	Issue	Response
63	PADEP must establish a standard measure of stream flow. Volumetric flow rates should be selected as the standard. Different operators provide different format of data for stream impacts. There is no standardized format for SSA stream logs. (Section 10, Page 8)	The DEP forms indicate that "gallons per minute" (GPM) is the standard for reporting. Some operators use cubic feet per second (CFS). The DEP should decide which to require (or both) and ensure that the operator reports (or converts) the measurement. See response to comment #58 regarding a standardized form for submittal. Also, the eDMR process will include standard units to use. The SSA logs are estimates, not measured with equipment. See Recommendations #17, 18, 24.
64	PADEP did not provide access to PADEP geographic information system. Does a GIS system exist containing mining regulatory information? If yes, the University was not given access. (Section 11, Page 1)	The CDMO maintains and is constantly enhancing its geographic information system. CDMO staff responded to all requests for data. This appears to be a communication problem. See Recommendation #42.
DEP PROCESS		
65	Repeating the same content in module revisions is questionable, as the variability in things like hydrogeologic conditions are likely large (e.g. Figure VI-9). However, even if this additional site-specific information is not useful/feasible, by surrounding the relevant, incremental changes in the much larger, unchanged documents, the ability to comprehensively evaluate water resource changes is diminished. (Section 6, Page 24)	The process of permit revision includes a page-by-page replacement of modules in the application to reflect the new information so that the entire module remains complete. The DEP will assess if a better way of providing revised modules is more useful (such as keeping the original info but providing revisions or updates on the same document). A move to electronic permitting (e-permitting) is being considered and a pilot program is being developed. See Recommendations #28, 29.
66	Adoption of a content management tool could simplify reports/evaluations. (Section 6, Page 25)	The DEP is limited in the purchase and use of such content management tools which would involve extensive software and hardware upgrades, training, staff hours, and licensing fees. See Recommendation #29.

	Issue	Response
67	Linkage of permit documents to GIS would facilitate planning. (Section 6, Page 25)	Some permit information is already GIS accessible. Adding all of the permit information would be useful but would require extensive manpower, modifications to the current data structure and additional funding for hardware upgrades and training. Improvements to current practices can be made so that the data can be extracted as needed for GIS applications. See Recommendation #31.
68	PADEP should develop a centralized/standardized system for tracking stream impacts. (Section 7, Page 26)	Agreed. This can be addressed with a new input screen for streams into the BUMIS databases. See response to comment #13. The 5 digit WRDS stream codes could be used as identification to link all stream information as well as permit numbers. See Recommendation #9.
69	There is a time lag in protecting streams. (Section 7, Page 26)	The time lag is inevitable and the Report had no definite suggestions to implement as the law allows for a recovery time period. Therefore, the DEP focuses on prediction and prevention of problems, as is currently done. According to CDMO, almost all of the problem stream cases were unanticipated effects. 100% accuracy of prediction is not a reasonable expectation. Consequently, during permit review, the operator is required to prepare mitigation plans. The CDMO, in cooperation with the BMP, should develop a plan for reviewing problem cases and various prediction and mitigation techniques in order to assess if improvements can be made. See Recommendation #34.
70	[Regarding Cessna Run] PADEP did not request that the mine operator select a control stream and post-mining flow data was not available in the stream investigation file. (Section 7, Page 27)	This was ST0903, Cessna Run (stream 46501). The CDMO hydrogeologist noted a dry section occurred during a statewide drought. Once normal precipitation resumed, flow returned. A control stream was deemed not needed for this situation.

	Issue	Response
71	In multiple cases, close inspection of the data that PADEP based its conclusion on relating to stream recovery indicates that the PADEP's decision was based on inadequate baseline and flow data and observations. Despite extreme inadequacies in the flow data, these were used to decide flow had recovered. (Section 7, Page 27)	The DEP had to assess the cases based on information that was available and made the best use of the data that existed. See related issues in the Data Issues section. The current USGS stream study will provide the DEP with additional information on the most useful types of data and how to use it efficiently. See response to comment # 79. See Recommendation #32.
72	PADEP agents should continue to monitor sampling efforts by operators and perform their own spot-checking. (Section 7, Page 63)	This is already occurring.
73	The five-year time period may prevent the PADEP from taking action to prevent permanent stream flow loss on additional streams when mining conditions, overburden depth and composition and other factors are similar to those leading to unrecoverable stream loss in the first instance. (Section 7, Page 75)	The policy is to allow 3 years of mitigation/stream recovery before preliminary action is taken, not 5. Mining does continue during evaluations. The DEP does not see a plausible alternative to that scenario. Information compiled in real time will improve the promptness of evaluation and may result in better decisions regarding protection of other nearby streams. See Recommendation #35.
74	PADEP and mine operators should use data from the case studies to create more detailed predictions regarding mining-induced flow loss impacts, not general rules. (Section 8, Page 11)	The DEP uses a detailed weighted analysis and data matrix. In general, the DEP uses case studies to inform their decisions but do not cite those for every prediction. See response to Comment #69. See Recommendation #34.

	Issue	Response
75	The significant recovery of the biological community over the past several years calls into question the appropriateness of the control stream TBS as an accurate benchmark for measuring recovery of this stream. (Section 8, Page 15)	The researchers allege that there was an error in the method of comparing TBS between the undermined and control streams. The selected control stream may not have been comparable to the undermined stream. However, in general with a well-matched control stream, this method is scientifically sound. No better proposal currently exists to replace TBS comparisons. The operators are encouraged to provide adequate background data and not rely on control stream comparison. If control streams are to be used, the DEP ensures that the protocol for selecting these control streams is followed. See Recommendations #21, 32.
76	The University recommends that stratigraphic logs of all wells or piezometers completed as part of the underground mining permitting process be submitted to existing state data bases such as the Pennsylvania Ground Water Information System (PAGWIS). (Section 10, Page 6)	This is not required by the regulations. The DEP would have no means to enforce this.
77	PADEP needs to establish a more rigorous protocol for assessing impacts on stream flow. (Section 10, Page 8)	Agreed. A protocol will be developed. A review of assessments of stream impacts has already begun with BMP and CDMO. See #43 regarding measuring stream flow. See Recommendations #21, 30, 32, 35.
78	PADEP must ensure that mine operators comply with TGD 563-2000-655 and submit at least two years of pre-mining stream flow data. (Section 10, Page 8)	Agreed. The CDMO reports that it is rare to not have two years of premining stream flow data submitted with a permit application. See Recommendation #21.

	Issue	Response
79	Control sites are not selected in the rigorous manner required by TGD 563-2000-655. (Section 10, Page 9)	The DEP has contracted with the USGS for a study assessing the process of selecting and monitoring control streams. The results of this study are expected to provide valuable insight into use of control streams. The DEP will make the conclusions of this study available to operators and to the public. The results will be used to make necessary procedural changes to the program. See Recommendation #32.
80	PADEP should require mine operators to formally quantify the length of grouting and access road construction. (Section 10, Page 10)	See responses to comments #47 and #93.
POLICY		
81	The collection and reporting of more frequent data is necessary to evaluate the impacts of mining. Stream flow data is generally inadequate. (Section 6, Page 21)	There is no ideal amount of sampling. Additional premining data would be beneficial. Changing the frequency to two times a month or weekly would capture the variability of the flow better than once a month. Such a change would require a revision of the streams policy. ALL the data that the company is recording should be shared. See Recommendation #36.
82	TBS is based on an unpublished draft document. (Section 7, Page 2)	The existing protocol for TBS was based on what was acceptable use at the time. The researchers found the TBS index to be comparable to other states. According to DEP aquatic biologists, if done correctly, the method is effective. The DEP is evaluating a way to transition to the current method used by DEP aquatic biologists. This will also require a transition phase. See Recommendations #3, 38.
83	The three year recovery period outlined by TGD 563-2000-655 does not apply to unexpected pooling impacts. (Section 7, Page 25)	Pooling is an easy-to-correct situation in most cases and is not a major issue. Unexpected pooling occurs only a few times a year. Such cases are handled as they are documented.

	Issue	Response
84	DEP should require certification of consultant's ability at sample competence. (Section 7, Page 31)	DEP biologists can conduct training to consulting biologists to promote proper techniques. There is no "certification" system available or required for biologists. The DEP will consider instituting a checklist to follow to ensure that all recommended protocols are followed for sampling. See Recommendation #37.
85	Water quality does not recover over time and pH and conductivity at flow loss sites remain elevated following mitigation. (Section 7, Page 76)	The researchers found that TBS increases over time at sites experiencing mining-induced flow losses but allege that water quality does not recover. They suspect it may be due to weathering of the grout. The DEP does not have a basis to conclude this, however. More evidence to support this claim is needed. See Recommendation #40.
86	Review of hydrologic monitoring plans should be designed so that hydrologic monitoring points are arranged along at least one continuous transect from hilltop to valley bottom. (Section 10, Page 5)	This suggestion has merit and would be the ideal condition but it isn't always feasible or necessary. Additional points can be requested as needed. This can be recommended to operators but should not be required.
87	Additional monitoring of changes to hillslope moisture status should be added to the technical guidance allowing the assessment of changes in hillslope soil moisture patterns. (Section 10, Page 6)	Assessment of soil moisture patterns is beyond the scope of the DEP's mining program expertise. Further clarification would be needed for the DEP to address this concern.
88	PADEP should develop a written policy for tracking stream impacts along with a centralized and standardized database system that incorporates all relevant data, including maps, photos, narratives, and raw data. (Section 10, Page 8)	A standard operating procedure for investigating and tracking stream impacts is an excellent recommendation. Also, see response to Comment #13 regarding a "streams" screen addition to BUMIS. See Recommendation #30.

	Issue	Response
89	PADEP should establish quantitative guidelines for determining what degree of variation indicates an adverse effect of mining on stream flow. (Section 10, Page 8)	Such values would be difficult to pin down. The DEP relies on the restoration of designated stream *use* over *flow* since that is what is required in the regulations. If the stream can attain its intended use, the operator has met the legal obligations.
90	Control streams should only be utilized in extreme circumstances to evaluate recovery of undermined streams. Two years of pre-mining flow data and TGD compliant pre-mining Total Biological Scores should be required of all mining operators. (Section 10, Page 10)	The DEP strongly agrees that premining data is preferred over use of control streams. Post 2008, the DEP has required premining data except in extenuating circumstances (as allowed in the TGD) and will require collection of adequate premining data. The current USGS stream study underway will provide additional insight into the best practices for using control streams. See response to comment #79.
FUTURE REPORT		
91	The University could not identify any clear cases of "self-healing" of the stream, suggesting that for many streams, additional mitigation work is required to repair the flow loss impacts. (Section 7, Page 44)	Streams that have no reported problems are assumed to be self-healed. CDMO concentrates on affected streams.
92	The effectiveness of this liner installation could not be evaluated by the University because the mitigation work occurred so close to the end of the current assessment period. The University suggests that future studies follow up on this stream restoration project. (Section 7, Page 56)	This refers to Brush Run. The DEP biologists and engineers will follow up on the work. See Recommendation #39.
93	Mine operators specifically quantify and report the length of access road construction as this would provide valuable information regarding the degree of disturbance to terrestrial and aquatic ecosystems during mitigation. (Section 7, Page 57)	Based on field observations, this does not appear to be a significant impact factor with other factors playing a larger role. Minimization of disturbance is a best practice, but, ultimately, this is the land owner's decision.

	Issue	Response
94	Future reports should avoid significant overlap between the assessment period and the report preparation time period. The PADEP should aim for six months of overlap between the two periods to facilitate a timely report yet avoid unnecessary data updates. (Section 10, Page 4)	Due to the six-month mine maps submitted 4-6 weeks after the completion date, and the time needed to scan the maps and complete the geo-referencing, the researchers suggested moving the data collection end date to 6 month later (than August 21 as was given) which would have allowed for the researchers to have had access to all the data within the five-year period. See Recommendation #41.
95	PADEP and future Act 54 Reports should investigate the effects of longwall mining on stream water quality. Future reports should follow up on the finding of changes in water quality detected by the University to assess if they are a general trend associated with mining-induced flow loss and assess the nature of the relationship between water quality and macroinvertebrate community composition at mined sites. (Section 10, Page 10)	The DEP should consider if this is a useful subject for further research. If so, the DEP can pursue the most efficient means of study which may include contracting with other entities instead of placing this in the Act 54 5th report context. See Recommendation #40.