

ACRONYMS USED

BMP – Bureau of Mining Programs
 CalDMO – California District Mining Office
 BUMIS – Bituminous Underground Mining Information System
 University – U. of Pittsburgh

NUMBER	COMMENT/RECOMMENDATION	PAGE	RESPONSE
WETLANDS			
1	Include wetlands in database.	4	The mining program is actively working on incorporating wetlands data into a more useable format than just on paper. Digitizing the backlog of wetlands data during the report period has been completed. The next step will be to finalize what attributes will be tracked. The wetland tracking would be similar to the way the Department tracks stream effects, possibly in BUMIS. Using an online version of ArcMap, it is anticipated the Department can eventually allow public access to this wetland data.
2	The University recommends that the PADEP enforce its policies regarding wetland mitigation report submission in order to better monitor the progress of these mitigation projects and increase transparency.	12-10	<p>To address timeliness of the reporting, the proposed “wetland” section in BUMIS noted in the response to Comment #1 will have an alert system that will trigger for specific report due dates. This same alert system is currently used in the BUMIS “stream impact” section and works well. This alert system will also provide CalDMO personnel time to inform the operator of their responsibilities. Progress of projects will eventually be reflected in the online tool as well.</p> <p>Due to personnel changes that occurred during the time period of the 5th report, several wetland progress reports were not logged and supplied to the University. CalDMO has since resolved this issue.</p>
3	The University recommends that PADEP initiate a quality control process to ensure that wetland delineations are performed in a consistent manner across mines and over time.	12-11	The Department will consider creating a standard procedure or checklist for the submittal and review of wetland data.
4	The University recommends that wetland data be submitted by all longwall mine operators in a georeferenced vector-based format (e.g. shapefile, .dwg) compatible with GIS software. The professional standard is to identify different types of delineated wetlands separately and defined in a “type” field. Metadata for all wetland delineations are needed for this layer (e.g., date delineated, wetland delineator, species observed).	12-11	The Department will revise the permit application documents to request all wetland data be submitted in a georeferenced vector-based format (e.g. Shapefile, .dwg) compatible with GIS software. Also, please see the response to Comment #1 on the digital formatting of wetland data.

DATA COLLECTION AND ANALYSIS			
5	<p>The University strongly recommends that the PADEP modernize the BUMIS data system and infrastructure. This underlying structure has to be compatible (i.e., simple for a common user to open, manipulate, and evaluate data) with the everyday tools their staff uses, from analysis packages to GIS packages. The database software has to be versatile and adaptable to future challenges and changes in analysis needs. It needs to allow interaction among employees across PADEP. This is potentially the most important recommendation and a consistent theme through three assessments.</p>	4, 2-7, 12-2, 13-4	<p>To clarify, BUMIS is an internal database used solely by Department staff to securely record and monitor the progress of mining impacts on water supplies, structures, streams and more. Due to the amount of personal data stored within BUMIS, it cannot be made available to other state employees or the general public. The Department does not use BUMIS to analyze the data. This comment from the University reflects the difficulty in exporting the database contents outside of the Department systems, which is admittedly cumbersome. However, for its intended purpose of securely recording and monitoring progress of mining impacts, BUMIS functions adequately.</p> <p>The addition of GIS capabilities in BUMIS would be beneficial, but doing so would be a large undertaking and require additional funding. However, in an effort to allow for visualization of location data in BUMIS, the Department is in the process of trying to extract the data and use it in other existing GIS tools. Also, in late 2019, BMP began integrating the BUMIS database with Microsoft's Power BI software in order to organize and analyze the data contained in BUMIS and make it much easier to provide more frequent, regular reporting to the public. (Please also see the response to Comment #30.)</p>
6	<p>The University recommends creation of infrastructure to allow for electronic submission of data or expand requirements for electronic submission to improve efficiency and accuracy. Barriers to electronic submission need to be eliminated. Transcription and organization necessary to answer questions slows progress and wastes effort.</p>	2-7, 12-3, 12-5, 13-4	<p>The Department agrees that digital submission is preferable and has previously requested that operators submit permit application information in an electronic format for specific modules. Presently, some operators are complying while others are not, but there has been progress.</p> <p>The Department will examine requirements for applicants and permittees to submit electronic content instead of paper but may not be able to mandate this requirement. As allocation of resources allows, BMP is moving towards implementing systems for the electronic submission of data with the current focus on submission of discharge monitoring reports for NPDES permits. Eventually, all monitoring reports will be via electronic submission.</p>
7	<p>Groundwater impacts are not tracked in BUMIS, and groundwater hydrologic monitoring and water supply loss data are not formally included in examination of stream recovery. Integration of subsidence impacts with broader hydrological management frameworks would make the subsidence impacts and repairs more apparent to all citizens of the Commonwealth.</p>	7-3, 11-6	<p>In May, a new Standard Operating Procedure (SOP) for completion reports was finalized to address review of all monitoring data, complaints and stream recovery data (Hydrologic Assessment and Completion Reports for Underground Coal Mines SOP (No. BMP-010)).</p> <p>The Department will also begin requiring operators to submit the pre- and post-mining piezometer data in the water loss and Stream Recovery Evaluation reports. Evaluation of database options in ARCGIS or BUMIS will occur at a later date.</p>

8	The University recommends that gate cuts be tracked in BUMIS: each mitigation event be entered separately (only one type of mitigation per entry) and that all active mitigation projects be entered, regardless of when the stream was undermined; important corresponding information (metadata) be included for each mitigation event, such as panel information and release date.	12-10	Currently, the “Stream Impact” section of BUMIS has a tab for “Mitigation” that includes a check box for gate cuts, latitude/longitude input boxes, and a comment area for all other pertinent information. No additional updates are needed to meet the University’s recommendation.
9	Apparent data entry errors included in the HMR are not clarified and corrected.	7-4	The errors cited here were from several years ago. The Department has since made a more concerted effort to review the monitoring data at renewal, and, if appropriate, at the time of a stream recovery report evaluation, and, finally, for bond release. As data submission moves further towards electronic reporting, such errors will be easier to flag and correct.
10	The University recommends that PADEP require at least five decimal degrees of precision when coordinates are submitted as latitude and longitude.	12-7	The Department’s Oracle-based programs (BUMIS, Samples Information System (SIS) and eFacts) currently require four-decimal degrees when recording all Latitude / Longitude readings. To keep with these established requirements, the Department will continue using four-decimals degrees when recording the Latitude / Longitude readings in BUMIS.
11	The University recommends PADEP consider whether additional accuracy in the determination of undermined stream mileage is warranted. If so, the University recommends that PADEP consider defining a DEM resolution and flow accumulation threshold to identify streams that are not included in “Networked Streams of PA” layer.	12-8	The Department is currently reevaluating the way “total stream mileage undermined” is determined and reported. The goal is to use the most accurate method that is feasible.

SAMPLING/MONITORING			
12	The University recommends inclusion of face position mapping for longwall mining panels as part of the base data for future assessments. Weekly to the Univ to supplement mine maps.	12-2, 12-3	The Department has implemented a longwall tracking spreadsheet with weekly face locations. Mapping these face locations is continuing.
13	Protection of the hydrologic balance is fundamental to the Act 54 legislation. To increase the use and therefore effectiveness of HMR data, the University recommends PADEP 1) examine the water quality parameters required as part of hydrologic monitoring, and 2) add parameters to evaluate potential emerging threats to water quality. Monitoring effectiveness can be enhanced by clarifying water chemistry data use and need. Water quality HMRs are underutilized in assessment of subsidence impacts. Minor adjustments to the required chemical parameters to be measured can provide insight into the impacts of changing landscapes and mitigation practice. Add calcium to detect effect of cement. Add nitrate.	7-3, 7-4, 7-16, 12-4, 13-4	The Department is considering including calcium and nitrate to the sampling parameters and, if justified, will include these parameters in a revised version of the submittal forms.
14	The University recommends that groundwater elevations in piezometers and wells being undermined be monitored at least at frequencies comparable to measurements of surface water flow, and ideally much more frequently. Future HMR groundwater monitoring points be sampled for groundwater elevation at a frequency that is at least consistent with sampling dictated for surface water protection during the pre- and post-mining period (TGD 563-2000-655), if not more frequent.	8-10, 12-6	The sampling frequencies will be reassessed as part of the revisions to the <i>Surface Water Protection – Underground Bituminous Coal Mining Operations</i> technical guidance document (stream protection guidance).
15	Groundwater monitoring is conducted quarterly. This schedule does not capture changes in groundwater occurring during undermining that can be reliably compared with related changes in surface water conditions. To clarify groundwater impacts, there may need to be additional piezometers and/or more frequent sampling of these sites.	13-3, 8-18	The sampling frequencies for groundwater monitoring will be reassessed as part of the revisions to the stream protection guidance.
16	Regarding causes of far field effects: 1) determine the cause of these far field effects; and 2) assess if current policies are sufficiently protective; and 3) decide if policies need to be altered to ensure protection from far field effects. Clarification of the causes of far field effects are necessary to improve predictions of subsidence impacts and advance policies designed to protect citizens' rights and environmental systems.	11-4	<p>The Department investigates all claims of mining-induced damages to determine cause and responsibility, even when damages are located beyond areas predicted to be impacted by traditional subsidence models. When it is determined the operators are at fault for the damages, they are held to the requirements according to Act 54.</p> <p>The Department is unable to predict where and/or when far-field movements may occur as the mechanisms are not fully understood. Additionally, the Department is not able to conduct research into these specific events other than the initial impact investigation report as doing so would require more resources than the Department currently has.</p>

17	The University recommends PADEP limit the practice of stream augmentation with nearby surface waters. Stream water only to those cases where this practice will allow mine operators to avoid other measures harmful to the hydrological systems. In these cases, the University recommends formal justification of tradeoffs.	11-11, 12-7	The current stream protection guidance does not take into account where the stream augmentation water is obtained. The Department will review this recommendation during the upcoming revision to that document.
18	To encourage data completeness, the University recommends compilation of pre-monitoring data as mining progresses to ensure complete pre-mining baseline data are available.	12-5 7-9	This recommendation by the University is specific to their task of compiling the data. The Department already receives pre-mining data with an application and with hydrologic monitoring reports quarterly. This data is stored in the permit files and can be accessed at any time by the reviewers.
19	The University recommends that a temporal requirement be added to ascertain the quality of water over the course of augmentation. If levels of contaminants are tested as augmentation continues, the likelihood of fish kills and loss of resource use will be reduced.	12-8	The augmented water must be of sufficient quality and quantity to maintain an affected stream's existing and designated stream uses. The Department requires augmentation water supplies to be sampled prior to release into the stream. The field inspectors can ask for additional sampling at their discretion if a problem is suspected. The Department notes only one incident where augmented water caused a fish kill as described. The larger threat to the stream biota is the lack of water entirely.
20	The University recommends that the duration of pre-mining daily monitoring specified in TGD 563-2000-655 be re-evaluated. The observation of stream impacts (heaving and fracturing) up to six weeks prior to undermining indicate the two-week time period may not be adequate to capture the occurrence of pre-mining impacts.	12-9, 9-13	The sampling schedule will be reassessed as part of the revisions to the stream protection guidance.
21	Available data are not comprehensively used. For example, groundwater HMR data are not used to evaluate stream recovery. This has the potential to lead to remedies that do not ultimately preserve the hydrologic balance.	13-4	The Department agrees on the benefits of using Hydrologic Monitoring Report (HMR) data as part of the stream evaluation. This review requirement was included in the recently finalized SOP - Hydrologic Assessment and Completion Reports for Underground Coal Mines SOP (No. BMP-010.)
22	Piezometers that are damaged by subsidence but not replaced create incomplete records that do not provide a contrast between pre- and post-mining conditions. The University recommends that PADEP require replacement of groundwater monitoring equipment if this equipment is destroyed during undermining and enforce this requirement.	8-18, 12-7	In the Department's experience, this situation rarely occurs, but any instances will continue to be reviewed on a case-by-case basis to ensure groundwater monitoring equipment is working as expected.

PROCESS			
23	Evaluation of the completeness of stream monitoring, as specified in technical guidance documents, reveals substantial deviations from the schedule. Current stream monitoring is not gathering flow data that are consistent with TGD recommended monitoring.	7-6 7-9	Holidays, bad weather, and hunting season are examples of situations that result in deviations from the sampling schedule. If there are any deviations, operators are required to explain the missing data in stream recovery evaluations.
24	<p>The University recommends that PADEP require that access to all streams be negotiated and settled prior to undermining. Failure to attain access to streams for collection of premining data or post-mining augmentation results in an unacceptable impact to Waters of the Commonwealth of Pennsylvania. If access for augmentation cannot be obtained prior to mining, then mine operators are not meeting the regulatory requirement to take measures “to ensure the protection of the hydrologic balance and to prevent adverse hydrologic consequences” (25 PA Code § 89.36(a)).</p> <p>The Commonwealth of Pennsylvania has not determined if failure to augment flow loss in streams due to access issues is an unacceptable impact to waters of the Commonwealth. Regardless, the University recommends that PADEP develop policy to minimize this situation.</p>	8-9 12-6	<p>The Department’s regulations (25 Pa. Code 89.52, 89.65, 89.82, 89,142a(h), 93.4a, and 96.3) require operators to conduct underground mining operations in a manner that protects the hydrologic balance, maintains the existing and reasonably foreseeable uses of streams, and minimizes adverse impacts on fish, wildlife and environmental values. The CalDMO requires all operators to include detailed mitigation plans and access agreements prior to the approval of applications. Where subsidence is predicted to increase pool depths by one foot or more, applications that do not include the appropriate access agreements are returned as incomplete.</p> <p>This same criterion cannot, obviously, apply to unanticipated impacts. In those cases, the CalDMO attempts to bring the parties together to resolve the issue. If that cannot be accomplished, then legal advice is sought.</p> <p>Failure to meet the stream use criteria would be an unacceptable impact.</p>
25	The University recommends that field staff (shadows) participate more equally in the release process decisions. The shadows have experience monitoring each stream before, during, and after undermining. The University also recommends more formal documentation of discussions about stream release and improved documentation of the final decision about release.	12-5	CalDMO has created a form for field inspectors (surface subsidence agents) to complete prior to the Stream Recovery Evaluation report review that requires their input regarding the status of stream recovery. Personnel who review the reports are also encouraged to actively involve the field inspectors during their review. Hydrologic Assessment and Completion Reports for Underground Coal Mines SOP (No. BMP-010) was recently finalized to also help address the issues in this comment.
26	The University recommends the PADEP define how to determine if a groundwater aquifer is impacted and the time frame for implementation of the repairs. If this is not possible, then another option is to define methods to identify the influence of groundwater impacts on other impacted hydrologic components (streams, wetlands, etc.) to clarify mitigation efforts in the other components.	12-6	<p>Aquifers in southwestern Pennsylvania can be affected by factors other than mining. In that sense, consideration of an entire aquifer goes beyond the scope of the Department’s mining program whose focus is the effects of mining.</p> <p>However, the Department’s mining program currently assesses the hydrology of the mine site area through the permit information and completes the Cumulative Hydrologic Impact Assessment for Underground Coal Mines and Preparation Plants (5600-FM-BMP0017) (CHIA) to determine the potential for cumulative hydrologic impacts of all anticipated coal mining in the general area of a proposed mining operation. The proposed operation is designed to prevent damage to the hydrologic balance as potential effects to streams, wetlands, and water supplies are assessed prior to permit issuance and are then monitored. Assessment of diminution or pollution of</p>

			groundwater are also addressed through monitoring and response to complaints. Action is taken when damage is discovered primarily because the use of the groundwater is affected. The Department already has processes in place to address these anticipated or unanticipated impacts.
27	The University recommends that the restoration time period of five years be evaluated. This evaluation might focus on streams that have not recovered after five years. If analyses indicate that the recovery period can sometimes exceed five years, the University further recommends re-evaluation of the determination of permanent nonattainment schedule.	12-7	The five-year stream restoration period has been discussed and debated since the conception of the stream protection guidance. Revisions to the stream protection guidance will include further clarification of this issue.
28	The University recommends that stream impact mitigation policies be enforced, and all gate cuts be evaluated for recovery after repair of pooling.	12-10	Emergency gate cuts are rare and must be completed as defined in the Department's stream protection guidance (DEP ID: 653-2000-655) when unplanned flooding hazards pose a significant risk to the public or environment. Subsidence-related pooling predictions for streams are reliable and based on empirical and established models. On occasion, stream pooling results from accumulations of substrates and not ground displacement. All proposed "gate cuts" are evaluated post-mining by DEP biologists and/or engineers.
29	The widespread practice of company purchase of undermined properties has the potential to change the tax base and social fabric of undermined areas. These changes should be evaluated. The University recommends examination of this emerging trend in property transactions, particularly given the broader importance for the Act 54 amendments (e.g., does this subsidence impact management practice "erode the tax base of the affected municipalities"?)	12-4 13-4	The Department understands the University's concerns about this practice, but oversight of buying and selling private parcels, even by a coal company, is not within the authority of the PA DEP Mining Program and is also beyond the scope of Act 54. Many other factors, outside of regulation, are at play. An option to address this issue may be to discuss it with legislators or municipalities affected.
30	The University recommends integration of subsidence impact tracking with broader hydrological management frameworks to make the subsidence impacts and repair more apparent to all citizens of the Commonwealth.	12-4	To bring the impact data from BUMIS to the public in a more timely and transparent manner, BMP is currently developing a process to export, compile, and organize this information for delivery through a public website on an annual basis. At a minimum, an annual release of the data can be made instead of only the 5-year data release as the reports are now. Through GIS tools, that also means providing visual representation of the mining progress. The DEP is partnering with the Citizen's Advisory Council in a workgroup to exchange ideas about these information releases in order to better serve the public.

31	Current hydrological evaluations lack unambiguous means to measure pre- and post-mining flow ranges. Better frameworks for how to use the data result in better data submissions and clarity in the decision-making process.	13-4	The Hydrologic Assessment and Completion Reports for Underground Coal Mines SOP (No. BMP-010) has been developed to detail a comprehensive process of hydrologic review that must occur as part of completion report for all underground mines. The Department is encouraging the submission of the data in an electronic format that allows personnel to review, compare, and graph the pre- and post-mining data expediently with fewer errors.
32	One of the gate cuts performed during the 5th assessment was an emergency gate cut (Mudlick Creek over Bailey Mine in September 2013) and monitoring was not required for release. It is not clear why this emergency gate cut was exempted from monitoring, and the University recommends that all gate cuts be monitored beginning before the project starts and continue to periods following completion.	9-19	<p>During the 4th Act 54 reporting period (2008-2013), an emergency gate cut was performed on the 16l panel (Bailey), near the confluence of Mudlick Fork and Hewitt Run, due to the potential flooding of several houses and a church. Pooling was not predicted, and because of the potential damage to several structure, the gate was cut. Although all gate cuts are monitored post-mitigation, unfortunately, the review for this was missed by staff at the time.</p> <p>Although this has been the only incident since the stream protection guidance has been put in place and incidents like this are not expected to be a regular occurrence, the Department will examine the procedure for emergency gate cuts to ensure they are monitored.</p>
33	There is no documentation of formal evaluation of water quality monitoring during renewals of longwall permits included in the permit files.	7-4	Data sets should be regularly reviewed by the inspectors who will flag a problem to discuss with technical staff. The Department is in the process of updating the permit renewal procedure and checklist, which will include evaluation of the monitoring data.

STREAM RECOVERY EVALUATIONS			
34	<p>Comparison of ranges is problematic for statistical reasons. New comparison of flow range methods require[s] more attention to data distributions to ensure statistical assumptions are met. Plotting log transformed flows in conjunction with the normal flow plots clarifies low flow ranges and distributions. A paired flow and log transformed flow time series pair improves and clarifies flow range evaluation. Two distribution comparisons can allow visual screening for potential biases: 1) the distribution of flows; and 2) the distribution of flow measurements across the year. The other potential bias is an oversampling of a characteristically wet or dry season. If late summer/early fall is over sampled, then the range of flows will be artificially low. If late winter/early spring is over sampled, then the range of flows will be artificially high. Further, as base flow evaluation continues to evolve (Hittle and Risser, 2019; Silvis et al, 2019), identification of these biases will remain important to accurate comparisons of flow. The University recommends visualization of log transformed flows in conjunction with the normal flow plots to clarify low flow ranges and distributions. The University recommends two distribution comparisons to assess potential biases: 1) the distribution of flows; and 2) the distribution of flow measurements across the year.</p>	7-9, 7-10, 7-12, 7-13, 7-14, 7-16, 12-5	<p>The Department agrees that potential biasing of the flow ranges as a result of data collection can be a problem. However, it is not clear if the issue is significant enough to warrant implementation of statistical processes if a simpler screening can be employed. A discussion of sampling will be addressed in the revisions to the stream protection guidance document.</p>
35	<p>Development of simple QA checks that can be specified as part of SRE reporting will facilitate more efficient evaluation of stream flow. At present, determination of recovery based on incomplete data sets occurs too often, and when it occurs the circumstances are often not documented.</p>	7-16	<p>The Department is reviewing the current information submitted with the Stream Recovery Evaluation reports in an effort to develop a SOP for completing and reviewing Stream Recovery Evaluation reports. As recommended, quality checks will be implemented through this process.</p>
36	<p>The University recommends that a different source of data be used to compare the TBS of streams before and after mining. This would require that the professionals or institutions conducting the assessment be given access to pre- and post-mining data for all monitored streams or that the professionals or institutions conducting the assessment be contracted to conduct post-mining surveys themselves, as in prior assessment periods. In addition, with each SRE report, PADEP could require operators to submit TBS data as well as the raw data used to calculate the TBS.</p>	12-9	<p>As part of the stream protection guidance revision, the current biological sampling methods will be replaced with the Department’s Bureau of Clean Water’s Index of Biotic Integrity for Benthic Macroinvertebrate Communities in Pennsylvania’s Wadeable, Freestone, Riffle-Run Streams (2015). This will give operators more flexibility in their sampling procedures and allow them to use more appropriate collection that will be more useful in evaluating stream recoveries through fair comparisons of pre- and post-mining biological data.</p> <p>The recommendation of including the impacted stream’s Total Biological Scores as well as the raw biological data will aid the Department’s biologist review of the Stream Recovery Evaluation report in determining the biological recovery of the stream and will be included the proposed Stream Recovery Evaluation report SOP.</p>

37	The University recommends that SRE reports be tracked in BUMIS, including status from submission to final resolution. This will build upon the progress made in the addition of stream impacts that occurred during this assessment.	12-9	BUMIS is designed to track impacts. The Stream Recovery Evaluation report is submitted to the Department when the operator believes the stream is recovered to pre-mining conditions and requests release from further stream mitigation. The operator may sample the stream several times over several years but will only submit a Final Stream Recovery Evaluation report for review when they believe the stream has recovered. The Department will explore adding a "completed review" date in BUMIS.
38	The University recommends requiring that mine operators survey headwater streams for fish before undermining occurs and that PADEP and mine operators coordinate with Pennsylvania Fish and Boat Commission to inventory stream fish, fauna and water quality as part of the Unassessed Waters Initiative, or other quantitative surveys, before and after such streams are undermined.	12-8	Operators follow the stream protection guidance document (DEP ID: 569-2000-655) and the current regulations regarding stream surveys prior to undermining. As the Department's mining program does not have the authority or resources to assist another agency in their initiatives, this comment is beyond the scope of the Act 54 report.
39	Subsidence agent input appeared to be less valued relative to hydrological and biological criteria.	7-16	Please see the response to Comment #25.

OTHER			
40	The mechanics of why so many unexpected reported effects occurred in Maple Creek is not known. Further investigations are recommended. Trend in subsidence impacts over inactive mines, if not examined, has the potential to impact property owners long after operator liability is expected to end. Further investigations of the mechanisms and factors driving subsidence impacts in inactive mines are recommended. The subsidence impacts in inactive mines during this assessment period creates the potential for extended responsibilities for mine operators that are not expected, both through time and across space. Processes driving these impacts can be clarified.	4-19, 11-4, 12-3, 13-4	<p>The Department investigates all claims of mining-induced damages in the context of either active mining-related subsidence or historic mining activity. However, the Maple Creek Mine is sealed and inaccessible. Therefore, direct examination of the mine workings is not possible. A systematic evaluation to determine the cause of subsidence occurring at Maple Creek would involve an invasive and expensive geotechnical study that would have to be coordinated outside of the normal scope of the CalDMO sphere of work.</p> <p>For mining conducted on/after August 21, 1994 (the implementation of Act 54 provisions), mine operators remain liable for mining-induced damages regardless of when the damages occur, unless the operator has executed a liability release for the structure. Homeowners have the option to apply for low-cost Mine Subsidence Insurance through the Commonwealth as a secondary coverage.</p>