



Repairing the Damage:

The costs of delaying reclamation
at modern-era mines

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Appalachian Voices
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About Appalachian Voices

Founded in 1997, Appalachian Voices brings people together to protect the land, air, and water of Central and Southern Appalachia and advance a just transition to a generative and equitable clean energy economy. AppVoices.org

About the Cover:

Aerial photo of a surface mine in West Virginia, 2014. Photo by Lynn Willis, flight courtesy of Southwings.

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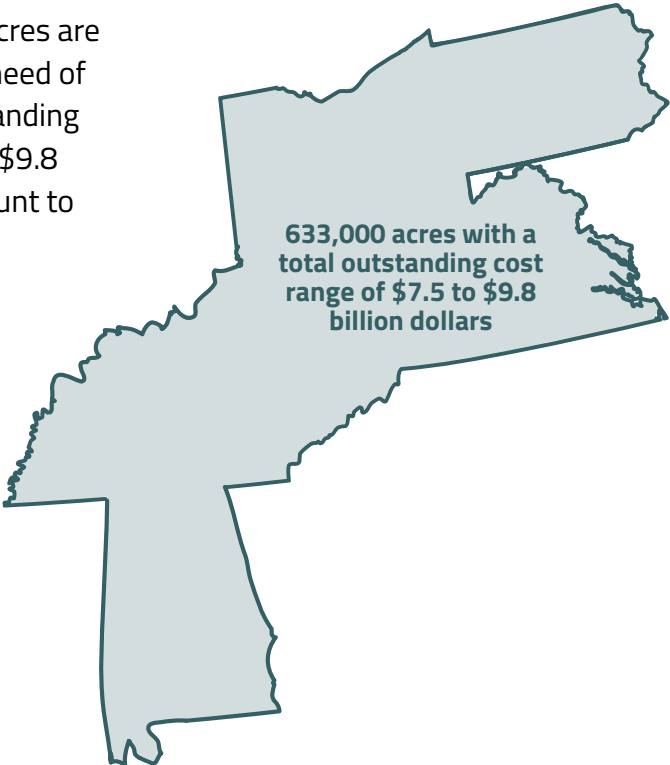
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Executive Summary

As the coal industry declines, companies are delaying reclamation for long periods of time, putting mine cleanup at risk. The Surface Mining Control and Reclamation Act (SMCRA), passed in 1977, requires coal companies to obtain bonds to help ensure proper reclamation of the mine occurs. When financial or other circumstances prevent a coal company from having the resources to fully reclaim a mine, those bonds are used by the regulatory agency to complete reclamation, a process known as bond forfeiture. As more coal companies declare bankruptcy, fewer companies remain to take over mines, so the number of companies forfeiting their reclamation bonds and abandoning their cleanup responsibilities will only increase. Current reclamation bond structures may not cover eventual outstanding reclamation needs. SMCRA was intended to prevent any more abandoned mines being left unreclaimed, but now we may be facing a new wave of modern unreclaimed abandoned mines.

The main purpose of this report is to estimate the cost to clean up mine sites and to compare that with available funding sources for the cleanup, based on publicly available data, for seven Eastern coal mining states: Alabama, Tennessee, Virginia, Kentucky, West Virginia, Ohio, and Pennsylvania. State mining agencies and the Office of Surface Mining Reclamation and Enforcement collect some data on mine reclamation, but no region-wide analysis has been done to estimate total outstanding reclamation. Using state and federal reclamation data and an average dollar-per-acre cost for mine reclamation for several mine types, we have determined that 426,000 acres of mined land have been partially reclaimed and 207,000 acres are unreclaimed, for a total of 633,000 acres in need of some degree of reclamation. The total outstanding cost of this reclamation ranges from \$7.5 to \$9.8 billion dollars. The total available bonds amount to approximately \$3.8 billion dollars.



At this point, it is not possible to estimate how much of this outstanding cost will be covered by the responsible coal companies, and how much will need to be covered by available reclamation bonds or alternative bonding. Total available bonds across the seven Eastern states amount to about \$3.8 billion dollars. But bonds are not equally available across states, or even across mine permits. We know that not all reclamation will be completed by coal companies, as we are already seeing large-scale mine abandonment by several companies in Kentucky and West Virginia. Bonding systems in those states are already at risk of failure.

While demand for coal will remain far below former levels, and many companies are likely to default on reclamation obligations, there are still many steps state and federal agencies can take to mitigate this situation. OSMRE should work with states to complete a nationwide inventory of outstanding reclamation needs and costs. State agencies and OSMRE must enforce bonding and reclamation requirements more strictly. OSMRE should require full cost bonding and disallow alternative bonding structures. Alternative bonds include self-bonding, where a company guarantees reclamation funding without putting up any actual money, and pool bonding, where multiple companies pool money to cover reclamation at many permits. OSMRE should ensure timely reclamation is taking place and that coal companies are not idling mines to delay reclamation obligations, potentially putting off reclamation until they can get rid of it altogether in bankruptcy court.

To address mines where permits have already been forfeited but where bonding will not cover the full cost of reclamation, the federal government should fund a program to make up for bonding shortfalls, and ensure high-quality, timely reclamation. Such a program should incentivize local and union labor, and fund reclamation projects that are responsive to local communities' needs. This program could be run through existing regulatory structures, which would simplify and expedite launching this new program. Regulatory agencies already administer programs to reclaim Abandoned Mine Land (mined land abandoned prior to the passage of SMCRA) and bond forfeited mines. Ideally, this program would also address the inadequacies in SMCRA that have led to the development of this situation, for example, inadequate bonding standards, lax reclamation standards and timelines, and loopholes regarding coal company accountability. Such a program should not act as a coal company bailout — it should not further incentivize companies to offload reclamation obligations by transferring mines to subsidiary companies or by declaring bankruptcy.

The above measures could increase the total amount of reclamation completed by coal companies, and improve the quality of reclamation. We found that if the remaining 633,000 acres in need of reclamation were reclaimed, this would create between 23,000 and 45,000 job-years across the Eastern states. Proper mine reclamation could have significant positive economic impacts, and contribute to carbon sequestration and climate change resilience.

Introduction

The coal industry has declined precipitously in the last decade, raising the question of whether adequate regulations are in place to ensure that mined land is properly reclaimed. While state and federal agencies often collect data on the amount of land disturbed by mining and the progress made in reclamation, there is no nationwide analysis of reclamation liability for current mines. Because this data is unavailable, it is extremely difficult to determine whether adequate funding exists for reclamation through reclamation bonds.

This report is an attempt at quantifying the outstanding reclamation liability across seven Eastern states: Alabama, Tennessee, Virginia, Kentucky, West Virginia, Ohio, and Pennsylvania.¹ It is an imperfect analysis, based on variable state and federal data, and limited by an inability to predict future bankruptcies and mine abandonments. Our hope is that this analysis will provide a starting point for a discussion on reclamation liability and bonding, and what the country might do to ensure that coal mining regions that have provided so much for the nation are provided the mine reclamation they deserve. We strongly encourage state and federal agencies to work together to improve these estimates and make this information available to the general public.

The Surface Mining Control and Reclamation Act

Coal mining has occurred in the United States for well over a century. It has provided the electricity and the raw materials for steel that have been integral to building the country. But coal mining has also imposed costs on miners, communities, and the environment, in the form of black lung disease, water and air pollution, and environmental degradation. In 1977 Congress passed the Surface Mining Control and Reclamation Act (SMCRA) to regulate the impacts of mining across the country, including the problem of mine operators abandoning mines without cleaning them up. Passage of the law was a massive achievement, and successful in addressing many of the impacts of coal mining. But as the industry has declined in recent years, flaws in the law have limited the law's effectiveness.

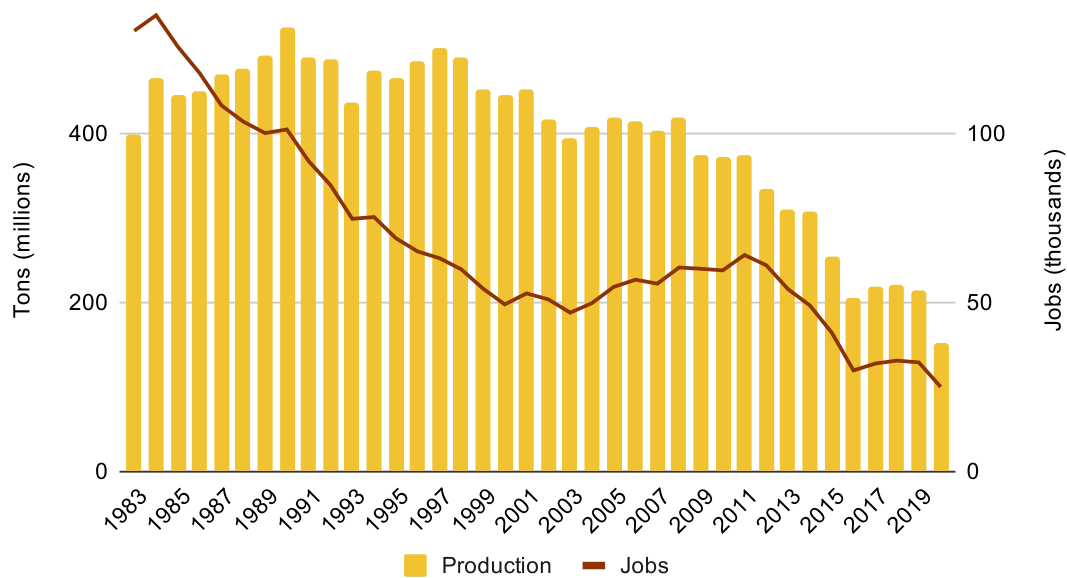
One of the most important aspects of the law is the requirement for coal companies to provide reclamation bonds for all mining permits. Bonds are required for all SMCRA mining permits, including permits for surface mines, surface features of underground mines, and coal processing facilities. The bonds help to ensure reclamation can be completed even if a company abandons a permit. The requirement was supposed to prevent any further mine abandonment. Mine abandonments prior to passage of the Act had left the country with billions of dollars in cleanup costs for these Abandoned Mine Lands (AML). SMCRA created the AML Fund, which receives money through fees on current coal production, to address AML cleanup. The program has been operating for nearly 50 years, but has not yet come

close to cleaning up all historic AML sites. Currently, there is not enough money in the AML fund to finish cleaning up all known AML sites.

Now, we may be facing a new wave of modern abandoned mines. The Office of Surface Mining Reclamation and Enforcement (OSMRE) has given states significant leeway in designing bonding programs. As a result, states have implemented bonding mechanisms that are not sufficiently secure and have estimated bond amounts that may not cover actual reclamation liability. Largely due to federal oversight and pressure from local communities, some states have attempted to strengthen bonding programs in recent years. But it may be too little, too late. As coal companies continue to declare bankruptcy, these insufficient bonding programs mean that mines may once again be at risk of abandonment.

The Wind-down of the Coal Industry

Figure 1: Coal Production & Employment Across Eastern States



Source: Mine Safety and Health Administration. Accident, Illness and Injury and Employment Self-Extracting Files (Part 50 Data). <https://arlweb.msha.gov/stats/part50/p50y2k/p50y2k.htm>

Coal production nationwide has been declining since 2008, and has taken a particularly steep dive in Eastern states in recent years.² Many factors have contributed to the decline, including competition from natural gas, declining mine productivity as coal reserves dwindle, improvements in renewable energy technology, and regulations to internalize the external costs of coal mining. The decline has been predictable and is not likely to reverse. Some predictions indicate that coal will no longer be used to generate electricity in the United States as soon as 2033, though some coal may still be mined and exported for energy generation or steel manufacturing.³

Though coal companies are supposed to reclaim mines as mining progresses, reclamation often depends on mining continuing perpetually. In many cases, additional mining provides the necessary money and/or fill material to reclaim previously mined areas. This creates an obvious problem as coal mining declines — the last remaining mines may be left with insufficient funding, material, equipment and/or workers to complete reclamation. This situation will lead to increased bond forfeiture.

Over the past several decades, companies have occasionally turned mining permits over to regulatory agencies, and when they have, they have forfeited their reclamation bond so that the money may be used for reclamation. In most large bankruptcy cases, companies have either maintained ownership of mine permits when emerging from bankruptcy, or have successfully sold permits to other coal companies. Bond forfeitures have occurred, but the total number of permits and total acreage has been low, so the forfeitures have not placed excessive stress on state bonding programs. In the past several years, the trend of companies either successfully emerging from bankruptcy or selling permits has changed.

Nearly 50 coal companies declared bankruptcy between 2012 and 2015.⁴ At least 18 more declared bankruptcy between 2016 and 2020.⁵ Companies are using bankruptcy to shed reclamation and other liability. From 2012 to 2017, four large coal companies — Patriot Coal, Alpha Natural Resources, Arch Coal, and Peabody Energy — shed almost \$5.2 billion of environmental and retiree liabilities.⁶ In most of these earlier bankruptcies, companies shed their environmental liability by selling mines to smaller, less well-capitalized companies. Mines were often sold for little to no money.⁷ Now fewer companies are available to take on mines, so as the companies that assumed those liabilities also declare bankruptcies, they have begun forfeiting permits to the regulatory agencies for cleanup. The Blackjewel bankruptcy is one example of this scenario — after acquiring permits through other bankruptcies, the company declared bankruptcy, which has led to the forfeiture of dozens of mines, and may still lead to many more (see the Case Studies section of this report for additional information on this bankruptcy). Many state bonding programs were not designed to withstand widespread forfeiture resulting from multiple bankruptcies or even the bankruptcy of a single large company.

SMCRA was not designed to function as the industry winds down. Enforcement of the law primarily relies on punitive measures such as preventing coal companies from obtaining new permits or mining more coal. But now that few companies are mining coal or applying for new permits, there is little incentive for companies to complete reclamation. As a result, we have already seen years-long delays in mine reclamation. Compounding the problem, as more companies declare bankruptcy or otherwise exit the coal industry, fewer companies remain to take over existing mining permits in need of reclamation. We do not yet know how many permits will be bond-forfeited, so we cannot determine the total bond shortfall likely to occur. But what is clear is that without significant intervention, the bonding system may be unable to prevent a new wave of abandoned coal mines.

Outstanding Mine Reclamation

Our first step in estimating outstanding reclamation liability was to determine how many permits there are across the region, and identify other information about them to help determine reclamation needs. Ideally, reclamation needs would be identified at the permit level, and would include detailed information like the amount of highwall to be backfilled, amount of regrading, amount and type of vegetation needed, outstanding water treatment needs, number of ponds and roads to be removed, etc. Unfortunately, collecting such detailed information for thousands of permits across seven states is beyond the scope of this paper. Instead, we collected data on the number of permits, mine type, acreage, and any information that would indicate reclamation progress.

Most states collect some data on activity at each mine. This may include the amount of acreage disturbed, amount of acreage reclaimed, and/or what phase of mining the permit is in. As reclamation milestones are met, portions of the bond are released by the regulatory agency. Because of this, most states track whether mines have reached certain phases of reclamation. Reclamation milestones are fairly standardized between states, consisting of:

- **Phase 1** - major regrading complete, 60% of bond released;
- **Phase 2** - vegetation planted, additional percentage of bond released at discretion of regulatory agency;
- **Phase 3** - vegetation established, water treatment no longer necessary, permit and bond fully released.^{8,9}

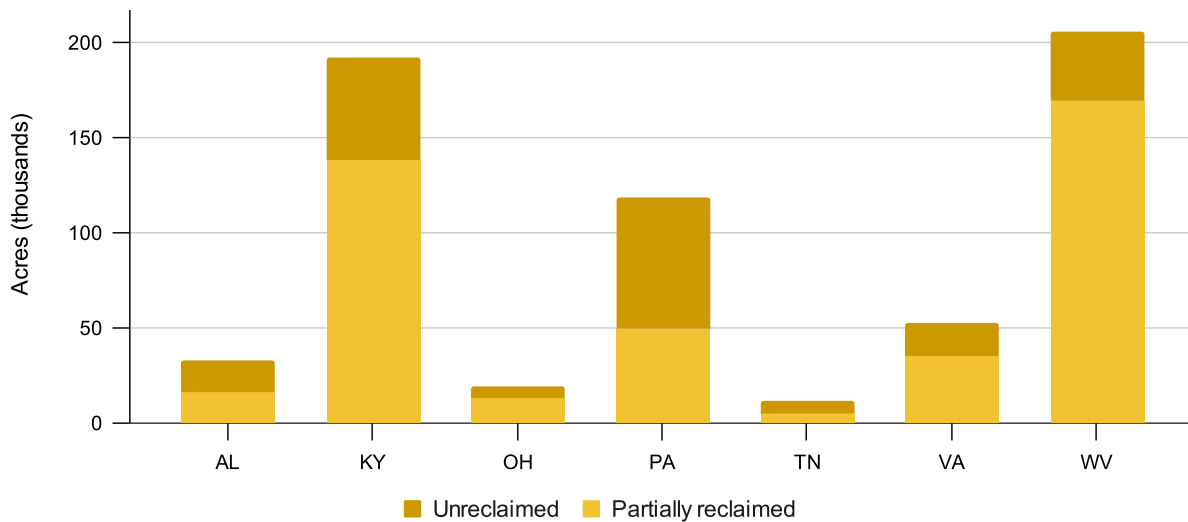
While each state tracks which mines are active or in various phases of reclamation, this information does not provide a completely accurate assessment of outstanding reclamation needs. Inspectors from either the state mining agency or OSMRE inspect every mine regularly. These inspections are primarily used to identify permit violations: off-site impacts, erosion issues, water pollution, etc. Sometimes these inspections are also used to quantify the amount of disturbance and/or the amount of reclamation on a mine, but this information is not uniformly collected nor made publicly available.

Among the Eastern states, Virginia and Ohio collect the most detailed acreage information. Virginia provides estimates of “disturbed” acreage, “regraded” acreage, and “reseeded” acreage for every mine through publicly available GIS files.¹⁰ Ohio tracks disturbed, phase 1, phase 2, and phase 3 acreage for all mines.¹¹ Kentucky and West Virginia provide a slightly more coarse breakdown, listing “disturbed” and “reclaimed” acreage, where “reclaimed” acreage generally includes acreage that has been regraded, and possibly reseeded.^{12,13} Tennessee, Alabama, and Pennsylvania provided comparatively little information regarding the amount of disturbance and reclamation on active mines.^{14,15,16}

To allow comparison between states, we created two categories for mines across all states: “unreclaimed” acreage is acreage that has been disturbed by mining and has not been categorized as “regraded” or “reclaimed” and does not have a mine status indicating achievement of any of the stages of reclamation. “Partially reclaimed” acreage is acreage that has been regraded or has achieved some phase of reclamation. To ensure reclamation is completed in a timely manner and excessive amounts of reclamation do not fall to states in the event of bond forfeiture, SMCRA requires contemporaneous reclamation, where portions of the mine are reclaimed as other portions continue to have coal removed.¹⁷ Because of this requirement, it is possible that some “unreclaimed” acreage does have reclamation activities taking place, though it has not been categorized as such.

426,000 acres of mined land have been partially reclaimed and **207,000 acres** are unreclaimed, for a total of **633,000 acres** (just under 1,000 square miles)

Figure 2: Outstanding Mined Land Reclamation Across Eastern States

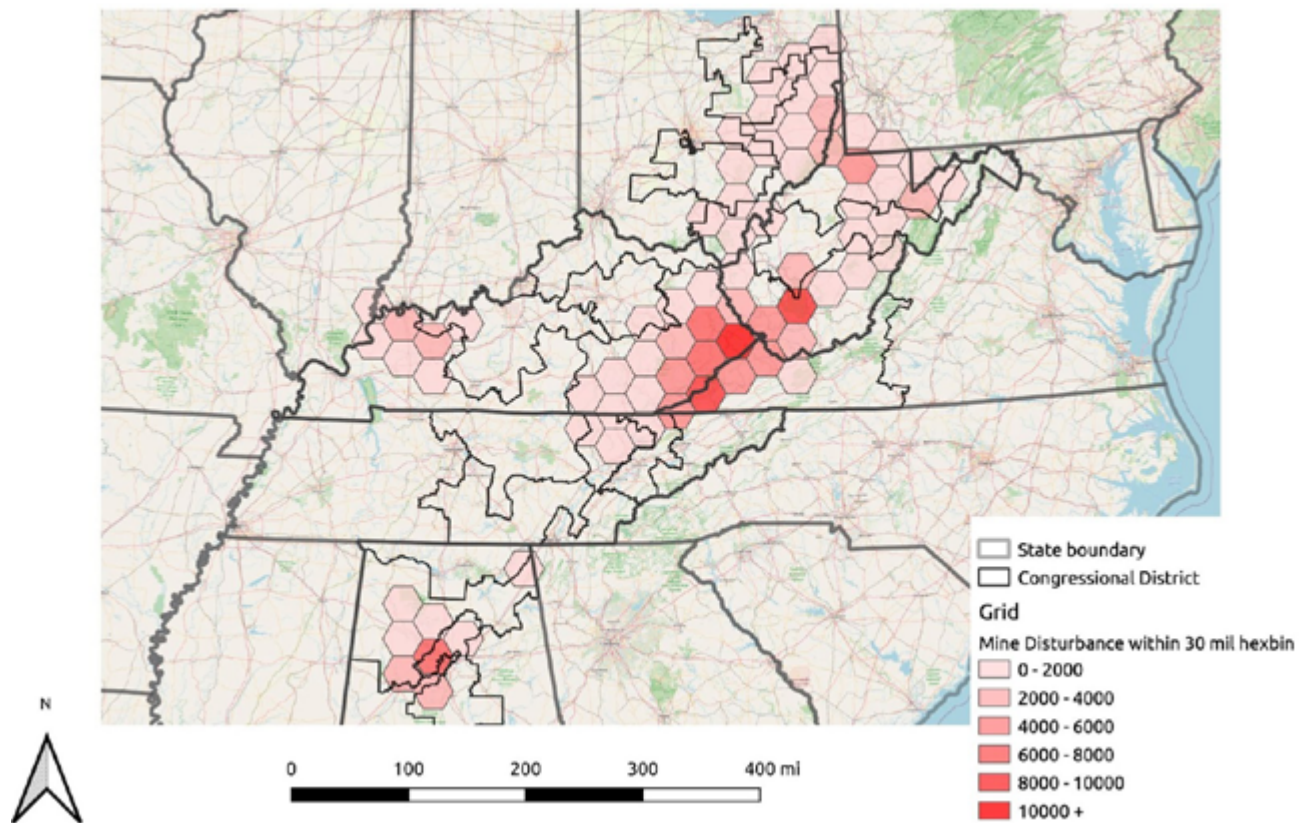


This graph represents the total outstanding reclamation needed at current mines that are held by coal companies and under an active SMCRA permit. We have categorized the acreage as unreclaimed and partially reclaimed, where unreclaimed land has had mining activity and no record of significant reclamation, and partially reclaimed land has some record of reclamation progress.

Using the above data and categorizations, we determined that across the seven Eastern coal mining states, 426,000 acres of mined land have been partially reclaimed and 207,000 acres are unreclaimed, for a total of 633,000 acres (just under 1,000 square miles) under active SMCRA permits that require some degree of reclamation. In comparison, a similar analysis was completed by the Western Organization of Resource Councils in 2018, which determined that 150,000 acres had active disturbance and 105,000 acres had partial reclamation, for a total of 255,000 acres across Wyoming, Montana, North Dakota, Colorado, New Mexico and Arizona.¹⁸

Ideally, much of this outstanding reclamation will be completed by the responsible coal company. However, given the decline in the industry, it is clear that some reclamation obligation will fall to the states to address through state bonding programs. How much reclamation obligation will be abandoned remains to be seen.

Figure 3: Current Mine Disturbance Across States and Congressional Districts



This map includes both unreclaimed and partial reclaimed (total disturbed) acreage for all current mine permits across Alabama, Tennessee, Kentucky, Virginia, West Virginia, and Ohio. Pennsylvania is excluded because insufficient GIS data is available.

Reclamation Bonds

All coal companies are required to provide reclamation bonds for mining permits. If a company does not fulfill its reclamation obligations, the regulatory agency can pursue bond forfeiture. Through the bond forfeiture process, a state takes responsibility for the mine and acquires the money provided by the reclamation bond. The state can then choose to complete reclamation using the available bond money or attempt to find another coal company to take over the permit.

Surety bonds: bond amounts are guaranteed by a third party company

Collateral bonds: bond amounts provided through financial or property assets

Self-bond: bond amounts promised by coal company itself, but no cash or collateral exists

SMCRA allows states to create bonding programs based on a variety of options. There are three major types of allowable bonds. Surety bonds are bond amounts guaranteed by a third party company. Collateral bonds are financial instruments or property assets, including cash, certificates of deposit, and first-lien interests in real estate.¹⁹ Self-bonds are a bond amount promised by the coal company, but no cash or collateral is actually held by the regulatory agency or by an independent third party. States are also allowed to employ alternative bonding systems, including bond pools.

Of these three types of bonds, surety bonds have traditionally been considered the most secure. This is largely still true, although several large surety companies have taken on millions of dollars in liability by providing bonds for multiple mining companies across multiple states. This has raised some concern that the bankruptcy of even one large coal company could put the financial health of certain sureties at risk. Self-bonds have always been considered the least secure. Self-bonding relies on a “too big to fail” model. But now, even the largest coal companies are at risk of bond forfeiture. Many states replaced self-bonds with more secure bonding over the last five years, as a wave of bankruptcies hit in 2015. Some self-bonds have remained in place, with states unwilling or unable to force coal companies to replace these bonds, due to the risk of pushing the companies into bankruptcy.

Many states also ease the burden of bonding on coal companies by allowing or even requiring companies to take part in a “pool” bond. Under this system, each mining permit holds a permit-specific bond, but also pays fees into a state pool. In exchange, the permit-specific bond is a lower amount than would be required by full-cost bonding. Under this scenario, when a permit is forfeited, the permit-specific bond is first used to fund reclamation, then any remaining cost is covered by the pool. The major problem with pools is that, by definition, they are not set up to cover the full cost of reclamation at every permit included in the pool. The

amount of funds maintained in the pool is based on a backward-looking actuarial analysis that does not account for predicted future changes to the industry. As the industry shuts down and more permits are forfeited, the state pools are put under more strain.

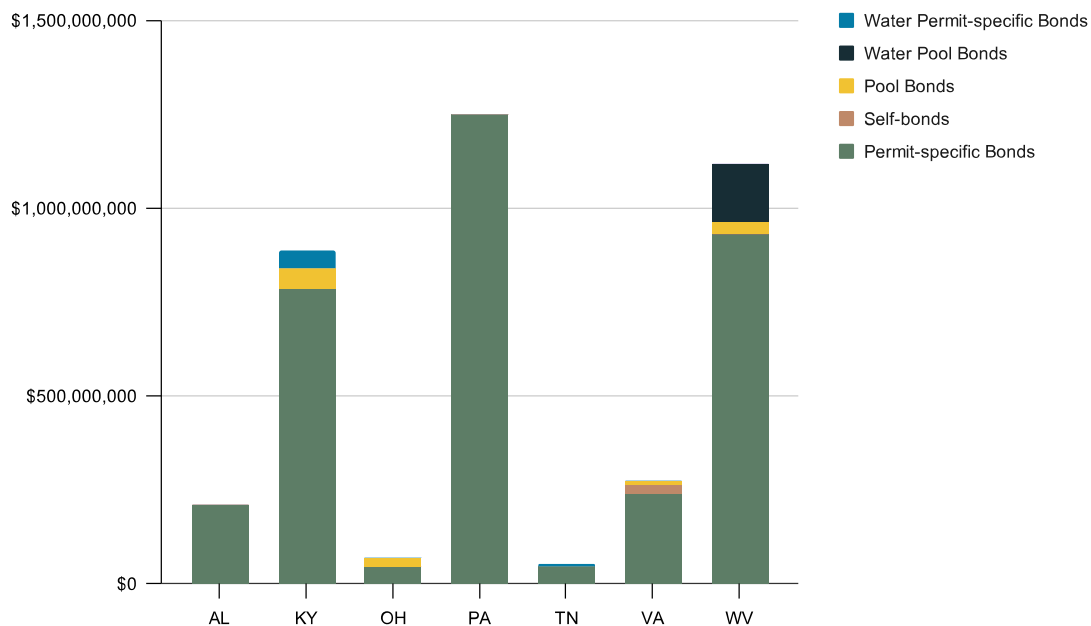
The Eastern states have considerable variability in bonding types and systems. In the East, most permits are covered either by surety bonds or financial asset collateral bonds. Virginia still has some legacy self-bonds in place, though new self-bonds are no longer allowed.²⁰ In Ohio, West Virginia, Virginia, and Kentucky, many companies take part in state pool bonds. Only Alabama, Pennsylvania and Tennessee require full-cost bonding.

Several states also have bonding systems specific to long-term water treatment. Most mines require some form of water pollution control while active mining and reclamation are taking place. In many cases, this treatment consists of sediment ponds that control runoff from the mine, allowing sediment to settle out of the water, before the water enters public streams and rivers. Once mining and reclamation have been completed, the runoff from normal rainfall no longer accumulates sediment from mining waste, and no longer needs to pass through a sediment pond. These ponds are removed at the completion of phase 3 reclamation.

In other cases, more serious water pollution issues arise that are not as easy to address. Traditionally, the most common long-term pollutant has been acid mine drainage — a mixture of polluted water that accumulates iron and has a decreased pH level. Selenium is another long-term pollutant, which is harmful to aquatic life, and can be difficult and costly to treat. Although mining is not supposed to occur where long-term water treatment may become necessary, in practice, long-term water pollution does occur and must be dealt with.²¹

Traditional bonding structures have not been set up to handle long-term water treatment, which can cost thousands of dollars annually and require treatment for decades. Both coal companies and bond providers expect to reclaim mines and have bonds released upon successful completion of reclamation. Typically, bond amounts are not calculated to include the cost of long-term water treatment. As with other bonds, different states have handled bonds for long-term treatment in various ways. Alabama, Ohio, and Virginia have no specific requirements for long-term treatment bonds. West Virginia has a pool bond specific to long-term water treatment, funded through fees paid by coal companies. Kentucky, Pennsylvania, and Tennessee require long-term treatment bonds when a permit causes long-term water pollution. Typically, these bonds are in the form of an annuity or trust fund, so that funding is available over many decades. OSMRE administers the bonding program in Tennessee, and requires annuities or trust funds that provide funding over a 75-year time period for permits requiring long-term water treatment. Pennsylvania also utilizes a 75-year timeframe.

Figure 4: State Reclamation Bonds



Bond amounts and type by state. See Appendix B for more information on state bonds and how that information was collected.

In total, there are about \$3.8 billion dollars in bonds available for current mining permits across the region. However, this money is not equally available across all states or even across permits within states. Full-cost bonds are generally only available to the specific mine permit they cover. Pool bonds are available to any permit taking part in the pool, but pools are generally only sufficient to cover a subset of permits within them. Like full-cost bonds, long-water treatment funds are generally only available to the specific permit for which they have been put in place.

As more companies go bankrupt and more bonds are forfeited or permits are transferred to a dwindling number of remaining coal companies, the state bonding systems are being tested. In some cases, companies are unable to complete permit transfers because they have been unable to secure bonds from sureties wary of overextending themselves. In West Virginia and Kentucky, the failure of a single large company has threatened to push the state pool to its breaking point. A more robust bonding system that required full-cost, third-party bonding at all permits might have prevented the reclamation debacle we are now facing. Some states may still have time to strengthen existing bonds. But in many states, it is too late to reform the bonding system.

Reclamation Liability Estimates

State agencies and OSMRE collect data from each mine permit on the amount of land disturbed from mining, reclamation progress, and bond types and amounts. While useful, this data provides an incomplete understanding of the true amount and cost of outstanding reclamation needs. Estimating the actual cost of outstanding reclamation is much more difficult. Ideally, reclamation costs should be estimated on a site-specific basis. Total outstanding reclamation costs depend on a variety of factors, including the amount of highwall requiring backfilling, the amount of regrading needed, the number roads and ponds to remove, the amount and type of revegetation needed, and any long-term water treatment needs.

To our knowledge, of the Eastern states, only Ohio routinely estimates outstanding reclamation costs at each permit within the state.²² Other states have collected this data for subsets of permits, often when there is a problem with a particular coal company. For states with thousands of permits, this in-depth review may be cost- and labor-prohibitive. But this information is critical to determining whether bonding programs will adequately cover reclamation in the face of widespread mine abandonment.

Shortly before publication of this report, the West Virginia Legislative Auditor released an assessment of West Virginia's bonding program.²³ The report utilized a similar methodology to the methodology we ultimately chose: estimating liability based on cost data from reclamation projects and forfeited permits. That report found that the bond system in West Virginia covers only 10% of the actual reclamation liability in the state. Our report found the percentage to be slightly higher (see next section), likely due to the use of a different subset of forfeiture data for our calculations. The West Virginia audit should be viewed as the more definitive estimate for that state, as the report's authors had better access to state data. We encourage all state governments to conduct this kind of assessment of their mining programs.

Despite limited data, we have attempted to estimate a rough cost of outstanding liability across the region. Understanding reclamation liability from state to state is a necessary part of ensuring a positive transition for the region as coal mining declines. Given the likelihood of continued bankruptcies and widespread bond forfeitures, states should be doing everything possible to quantify the problem and devise solutions. Because it is not possible for us to determine or compile reclamation estimates at the individual permit level for thousands of permits across seven states, we determined a dollar-per-acre estimate for unreclaimed acreage and partially reclaimed acreage for surface mines, surface components of underground mines, and processing and refuse facilities.

In considering our methodology, we reviewed state data, state reports, bond amounts, actuarial analyses, OSMRE annual reports, and Securities Exchange Commission filings.

We chose our final reclamation price points based on a report prepared by Marshall University for the West Virginia Department of Environmental Protection, which reported a dollar-per-acre estimate for surface mines, underground mines, and other coal facilities based on a selection of projects completed through West Virginia’s pool bond fund, the Special Reclamation Fund.²⁴ We used the average total cost of both land and water reclamation, and corrected those dollar amounts for inflation over the last 15 years.

We chose to use the Marshall estimates for all seven states based on knowledge of mine characteristics, comparisons with state liability estimates, and state bonding amounts (For more discussion, see Appendix C). To determine a dollar-per-acre estimate for partially reclaimed mines, we used 40% of the cost for unreclaimed acreage. This reflects the fact that 60% of the reclamation bond is released upon completion of phase 1 reclamation.

Table 1: Estimated reclamation liability by mine type and reclamation status

Reclamation Status	Surface Mines	Underground Mines	Other Mines
Unreclaimed	\$12,143/acre	\$29,485/acre	\$26,350/acre
Partially reclaimed	\$4,857/acre	\$11,794/acre	\$10,540/acre

These reclamation amounts are based on a 2006 analysis done by the Marshall University Center for Business and Economic Research. We adjusted the amounts for inflation.

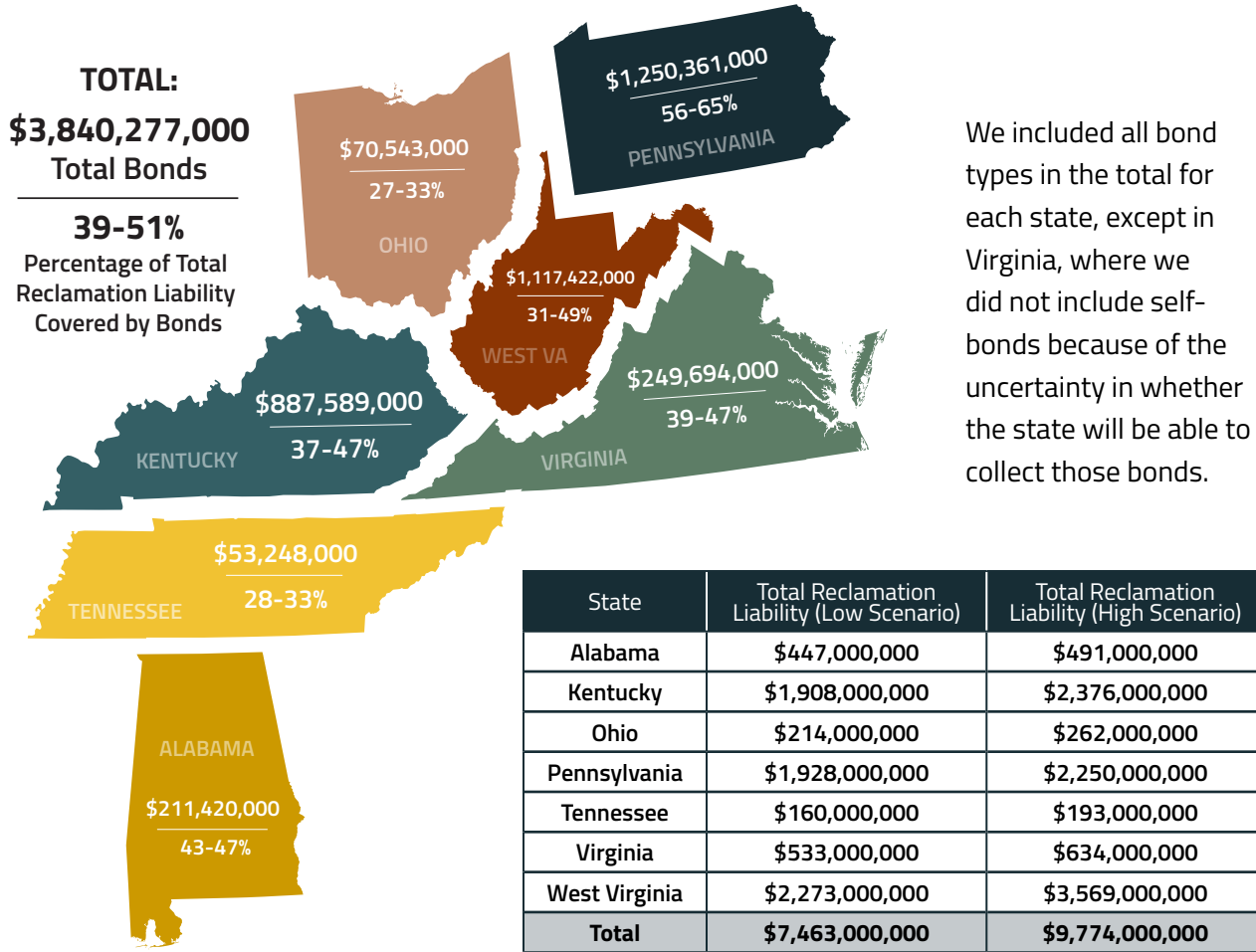
Finally, we estimated a range of liability for long-term water treatment. To determine the cost of treatment of long-term water pollution and the prevalence of such sites, we reviewed data from the states that maintain data on the cost of treatment at individual sites — Kentucky, West Virginia, Pennsylvania, and Tennessee. The estimated percent of sites requiring long-term treatment ranged from 4.4% to 8.8%. Average cost across states ranged from \$21,000 to \$55,000 annually. We used a 75-year treatment timeline, based on OSMRE’s use of a 75-year treatment period when calculating total long-term treatment liability in Tennessee.²⁵ We then calculated a low estimate based on 5% of permits requiring treatment at \$21,000/year, and a high estimate based on 10% of permits requiring treatment at \$55,000/year.

Comparison of Bonds and Liability

Based on the above methodology, **we determined the total outstanding cost of reclamation across the seven Eastern states to range from \$7.5 to \$9.8 billion.** Of that, \$6.9 billion dollars is for land and water reclamation, with an additional cost of long-term water treatment liability between \$545 million and \$2.9 billion dollars.

The total outstanding cost of reclamation could be as high as \$9.8 billion dollars. However, coal companies are continuing to cover most of this cost as they complete reclamation. It is very difficult to determine how much of this outstanding liability will fall to available bonds. Total available bonds across the region amount to approximately \$3.8 billion — this represents 51% of the total reclamation cost under the low scenario and 39% of the total reclamation cost under the high scenario. But bonds are not equally available across states, or even within states. Site-specific bonds are available only for the mine for which they were originally taken out. Pool bonds are available to any mine taking part in the pool, but only within a given state.

Figure 5: Comparison of Available Bonds and Total Reclamation Liability



Case Studies

While it is uncommon for state regulators to determine total reclamation liability, several states have recently determined reclamation liability for particular companies. The cases summarized demonstrate the risk bankruptcies can pose to site-specific reclamation bonds, state pool bonds, and even to surety company solvency. How states choose to deal with these scenarios can have serious implications for reclamation and enforcement of environmental laws. In each of these cases, states are attempting to shield their bonding programs from the impact of widespread bond forfeiture, either by allowing almost unlimited time to complete reclamation, or by removing access to the pool bonds. Both of these strategies put nearby residents at risk, prolong environmental damage, and create a drag on the local economy.

A&G Self-bonds in Virginia

Though Virginia stopped approving self-bonds in 2014, A&G Coal Corporation still has self-bonds in place for 20 mining permits that were issued prior to 2014. Nineteen of these permits also participate in Virginia's pool bond.²⁶ The Virginia Department of Mines, Minerals and Energy (DMME) has been unable to compel the company to replace its self-bonds with a more secure form of bonding. The company is a subsidiary of Southern Coal Corporation, which is owned by the family of West Virginia Governor Jim Justice.



The Looney Ridge Mine in Wise County, Virginia.

Many of A&G's mines have sat idle for many years. The mines have produced no coal in six of the last 10 years.²⁷ In 2016, the DMME estimated the reclamation liability at A&G's mines to be \$134 million dollars. Some reclamation progress has been made in the last four years, but a review of the three largest mines, responsible for \$95 million of the total liability, shows little reclamation progress from 2016 through 2020. Reclamation has recently begun again at one of the three largest permits, the Looney Ridge permit, but only after considerable pressure from the Virginia Department of Mines, Minerals, and Energy, and community groups, including Appalachian Voices.

A&G holds about \$5.5 million in surety and cash bonds, and over \$24 million in self-bonds. The state pool bond currently holds just over \$10 million and covers a portion of 151 permits held by 33 companies.²⁸ If A&G were to forfeit its permits, the cost of reclamation may

exceed the total pool bond and the available permit-specific bonds by as much as \$94 million. If the state were unable to collect the self-bonds from the company, reclamation costs as high as \$118 million could fall to taxpayers.

[Blackjewel Bankruptcy in Kentucky](#)

Blackjewel, Revelation Energy, and their affiliates declared bankruptcy in July 2019, marking the beginning of a complex, drawn-out bankruptcy that has left many mines in limbo. Blackjewel operated over 300 permits covering 365,000 acres across Kentucky, West Virginia, Virginia and Wyoming. Blackjewel acquired many of these permits through previous bankruptcy sales. Over the course of the bankruptcy, the company has repeatedly tried to sell permits to other coal companies. While some permits have sold and successfully transferred ownership, the vast majority have either failed to successfully transfer, or have no interested buyer.



[A Revelation Energy surface mine in West Virginia. Since the bankruptcy began, the permit has been revoked by the West Virginia Department of Environmental Protection. Photo Credit: Kanawha Forest Coalition](#)

Kentucky has felt the largest impact from this bankruptcy, as it is home to about two-thirds of Blackjewel's permits. Early in the bankruptcy, the Kentucky Energy and Environment Cabinet reviewed 20% of the Blackjewel mines in Kentucky to determine reclamation liability. The analysis revealed that the reclamation liability at those permits exceeded the available bonds by \$38 million.²⁹ The Kentucky Reclamation Guaranty Fund, the state pool meant to make up the shortfall, has approximately \$53 million.³⁰ The pool bond includes roughly 96% of permits in Kentucky.³¹

Blackjewel finalized a bankruptcy plan in March 2021, but the fate of roughly 200 permits remains in question.³² Kentucky is home to 170 of these permits, and of those, 33 have no buyer and will either be reclaimed by the surety company providing the bonds, or the bond will be forfeited to the state. Virginia has 27 Blackjewel permits. Of those, four are already going through bond forfeiture proceedings. The bankruptcy plan allows for an additional 180 days to finalize the sale of the remaining permits. The 180 day period ends in September, and could be extended to December at the discretion of the court. But many of these permits have already been caught in limbo for well over a year, as companies struggle to secure new reclamation bonds or pay necessary transfer fees. It seems likely that many more permits will eventually end up in bond forfeiture.

ERP Environmental Fund Receivership in West Virginia

In early 2020, the West Virginia Department of Environmental Protection (DEP) filed a lawsuit seeking to place the coal company ERP Environmental Fund into a receivership, where a third party is appointed to manage the company's mines.^{33,34} The DEP had previously issued a number of enforcement actions to compel the company to comply with environmental and safety regulations through monetary penalties and the prospect of permit revocation. But, according to court documents, ERP conveyed that the company had no cash, and already owed \$15 million to various vendors and suppliers.³⁵

ERP originally obtained over 100 permits in West Virginia through the bankruptcy of Patriot Coal Company in 2015. At that time, the DEP determined those remaining permits would cost \$230 million to reclaim. Unfortunately, the company made little progress in reclamation over the next four years.

At the time the lawsuit was filed, ERP's permits were backed by \$115 million in reclamation bonds, provided by Indemnity National Insurance Company. However, according to the motion filed by DEP, neither Indemnity nor the DEP want the permits forfeited, as the true cost of reclamation, estimated at \$230 million, could bankrupt Indemnity National Insurance Company and overwhelm the Special Reclamation Fund, West Virginia's pool bond fund.³⁵ In the past year, community groups and advocates have sued both the West Virginia DEP and the Biden Administration over the inadequacies of West Virginia's reclamation bonding program.^{36,37}

A recent report on West Virginia DEP's Special Reclamation Fund, completed by the West Virginia Office of the Legislative Auditor, raised alarm about the potential reclamation liability that may fall to the fund.²³ The report indicated that ERP still holds 91 permits, after forfeiting or transferring some permits. Those permits are back by \$83 million in bonds. However, the same report found that bonds in West Virginia typically only cover 10% of the actual reclamation liability. This indicates the true outstanding cost of reclamation at the remaining ERP mines could be as high as \$830 million. In comparison, our report found slightly more positive ratios in West Virginia — that available bonds likely cover between 31% and 49% of the estimated total reclamation liability across the state.

Job Creation

The coal industry across the seven Eastern states has lost about 27,000 jobs over the last 10 years — a decline of about 46%.³⁸ Addressing the reclamation backlog could put a substantial number of people back to work. Based on the estimated reclamation liability for land reclamation (excluding long-term treatment costs), between **23,000 and 45,000 job-years could be created by completing reclamation** across the seven states.

To estimate job creation, we used our estimated outstanding liabilities, an average dollar per hour wage for reclamation jobs, a 2,000 hour work year, and a range of percentages of total project cost spent on payroll. We based the wage calculation on a regional average wage for mining machine operators, which is likely the most common reclamation occupation reported by the Bureau of Labor Statistics. That rate is \$23 per hour for the seven state region.³⁹ We estimated a range of 15% to 30% of total reclamation costs would be spent on payroll, based on similar reports completed by the Western Organization of Resource Councils and the Ohio River Valley Institute.^{40,41} This estimate is based solely on estimated project costs and associated labor. It does not account for associated economic impacts, like agency administrative jobs or benefits to associated industries related to machinery, fuel, and materials suppliers.

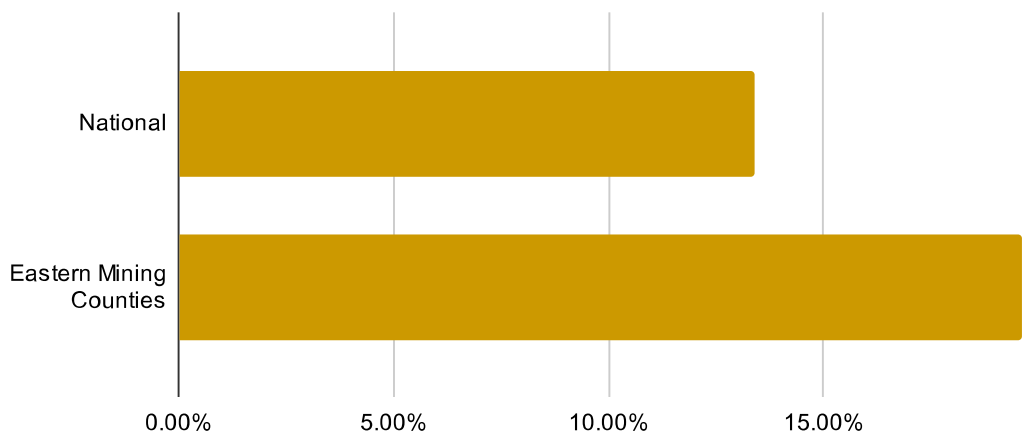
Figure 6: Job Estimates by State

State	Job-years (15% on payroll)	Job-years (30% on payroll)
Alabama	1,425	2,850
Kentucky	5,862	11,724
Ohio	660	1,321
Pennsylvania	6,037	12,075
Tennessee	498	996
Virginia	1,660	3,320
West Virginia	6,415	12,831

Community Context

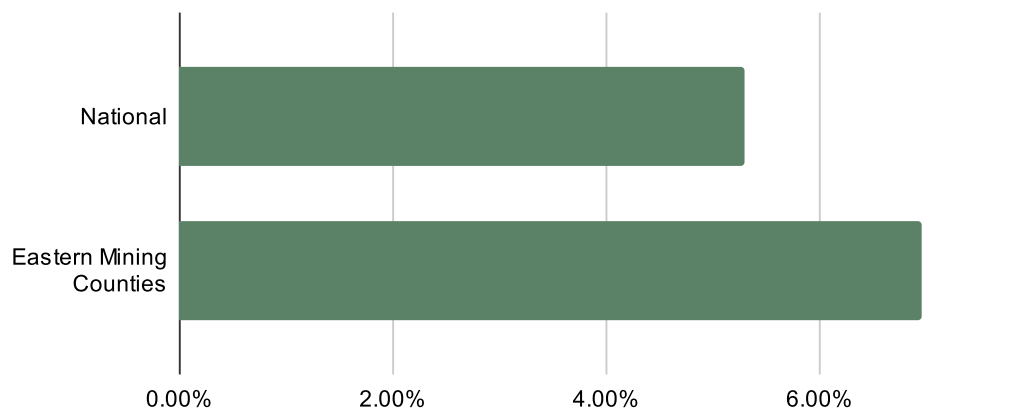
Persistent poverty and unemployment have plagued Eastern coal mining counties for well over a century. Many factors have contributed to this, including reliance on a coal mono-economy and the boom and bust cycle of coal mining. As mines have shut down, high rates of poverty and unemployment have continued in the region. As of 2019, the poverty rate of Eastern mining counties was over 6 percentage points higher than the national average and the unemployment rate was 1.65 percentage points higher.⁴²

Figure 7: Poverty Rate



U.S. Census Bureau. American Community Survey (5-year estimates). 2019. US Census Bureau. Downloaded from Social Explorer, April 2021

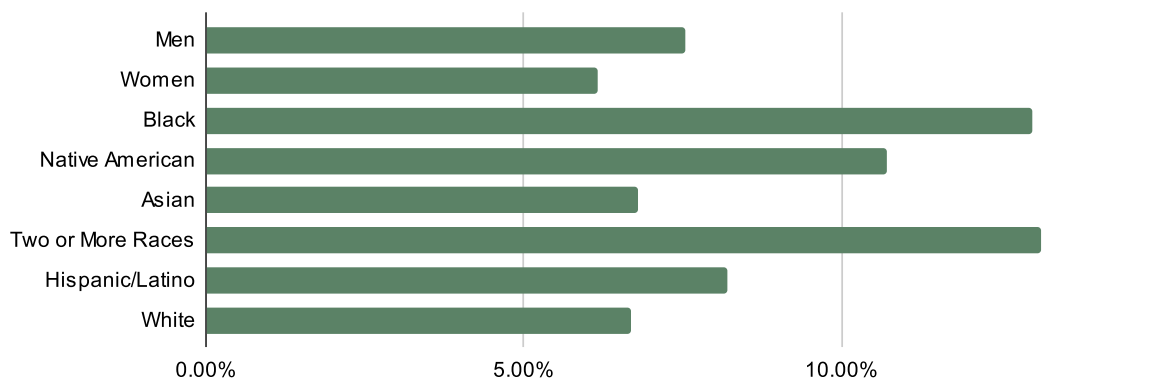
Figure 8: Unemployment Rate



U.S. Census Bureau. American Community Survey (5-year estimates). 2019. US Census Bureau. Downloaded from Social Explorer, April 2021

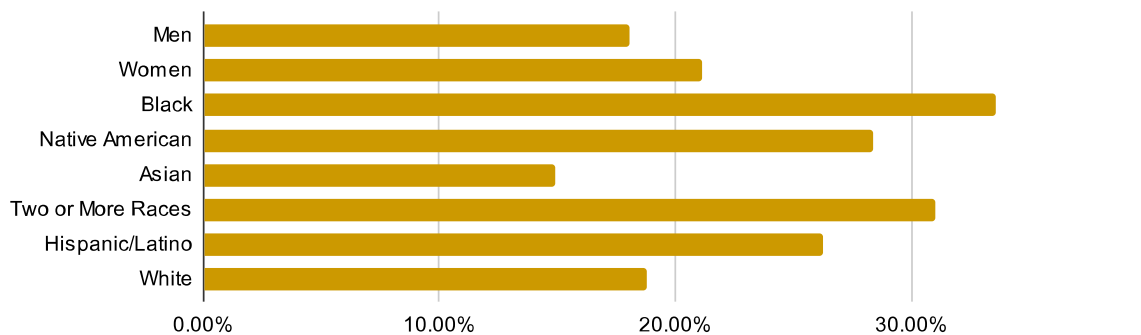
Poverty and employment have been particularly burdensome for women and people of color living in Eastern mining counties. Black people in the region, once drawn to mining counties for employment in the mines, now have an unemployment rate over twice the national average. Likewise, they have the highest poverty rate in the region at 33.5%. Similarly, Native Americans and Latinos living in Eastern coal mining regions suffer higher rates of poverty and employment than their white neighbors. Women have a slightly lower rate of unemployment compared to the region as a whole, but nevertheless have a higher rate of poverty than their male counterparts.

Figure 9: Unemployment by Race and Gender, Eastern Mining Counties



U.S. Census Bureau. American Community Survey (5-year estimates). 2019. US Census Bureau. Downloaded from Social Explorer, April 2021

Figure 10: Poverty by Race and Gender, Eastern Mining Counties



U.S. Census Bureau. American Community Survey (5-year estimates). 2019. US Census Bureau. Downloaded from Social Explorer, April 2021

Environmental Justice Case Study in McDowell County, WV

Across the region, the adverse impacts of mining are disproportionately exacted upon low-income people. In McDowell County a third of residents live below the poverty line. While these impacts upon the economically disadvantaged are the most consistent manifestation of environmental injustice in Appalachia's mining region, there are a small number of communities where environmental racism is also evident.

For instance, in Keystone, West Virginia, a coal waste dump looms above the community, which was 70% African American as of the 2010 census. The nearby Clark Branch Refuse Dump (permit 0008382) has been cited repeatedly in the recent years for a variety of regulatory infractions, many of which remained unaddressed for months after being noted by state regulators.⁴³ This pattern of noncompliance is unsurprising, as the operation is part of the coal empire owned by West Virginia Governor Jim Justice's immediate family, who are infamous for delaying and evading reclamation and other environmental standards.⁴⁴

Implications for Climate Change

Forest reclamation of mine sites across the Appalachian region has significant implications for carbon storage and positive impacts on climate change. Traditionally, much of the Southeastern United States has served as a carbon sink. But extensive land use change, including surface mining, has been shifting the carbon balance of the region. Research indicated that the Southern Appalachian region could switch from a carbon sink to a carbon source by 2025 if mining continued at historic rates and grassland reclamation was the primary reclamation type.⁴⁵

Reforestation of current mines could have significant impacts on carbon sequestration. Currently, many mine sites in Appalachia are reclaimed as grassland. According to a recent study, grassland reclamation achieves only 14% of the original carbon storage potential of pre-mined forested lands.⁴⁶ The same study examined reforested mine sites in southeast Kentucky and determined that forest reclamation could result in carbon sequestration at a rate of 5.6 metric tons of carbon dioxide per acre per year. If all 633,000 acres of mined land in need of reclamation across Appalachia were reforested as native forests, 3.6 million metric tons of carbon dioxide could be sequestered each year. This would be equivalent to removing 770,000 passenger vehicles from the road.⁴⁷ In addition, reforestation would mitigate climate change impacts in the region by reducing flooding and the risk of landslides.

Climate change would be further mitigated through mine reclamation if reclamation projects included methane capture or destruction technology. The Environmental Protection Agency estimates that surface, underground, and abandoned mines contributed 122 billion cubic feet of methane emissions between 1990 and 2018.⁴⁸ Methane can have up to 84 times the global warming potential of carbon dioxide.⁴⁹

Policy recommendations

Though the problems with bonding sufficiency and reclamation standards have been many years in the making, it is not too late to address many of these issues through better enforcement of existing regulation and policy changes. Where it is too late to reinforce existing bonds, additional money should be made available to ensure reclamation is completed.

Nationwide Inventory of Reclamation Liabilities

This report is an initial attempt at quantifying outstanding reclamation liability across the Eastern states. Its accuracy is limited by a lack of adequate data on mine disturbance, reclamation progress, and outstanding costs. Without an accurate assessment of liability by regulatory agencies, it will be difficult for the agencies to evaluate the adequacy of current bonds. To our knowledge, Ohio is the only Eastern state that currently evaluates all permits for outstanding reclamation liability. Other states perform monthly mine inspections and maintain databases of disturbance and reclamation metrics. It would not be unreasonable for states to take the extra steps necessary to calculate reclamation liability on an annual or semi-annual basis.

OSMRE should require all state regulatory agencies to evaluate all mines for outstanding reclamation needs and costs. OSMRE should develop a standardized set of metrics for this data, so that comparisons between states can be made easily. Metrics should include: total current disturbance, length and height estimates of highwalls, long-term water pollution sites and pollution types, reclamation progress (backfilling, regrading, and revegetation progress), and estimates of the total outstanding cost of needed reclamation.

Bonding

In 2016, OSMRE issued a policy advisory regarding self-bonding.⁵⁰ In this advisory, the agency suggested states review the eligibility of all companies currently utilizing self-bonds, discontinue issuing new self-bonds until the coal market stabilizes, and ensure that companies meet all requirements for self-bonding before issuing any new self-bonds. This guidance was rescinded in 2017. At a minimum, this policy should be reinstated under the current administration.

Given the findings of this report, and the continued decline of the coal industry, self-bonding should be permanently disallowed by OSMRE. Further, any company that still has self-bonds in place should make every effort to replace those bonds with full-cost third-party bonds. If companies are unable to do so, those companies and their related entities should not be issued new SMCRA permits in any state.

Our analysis indicates that many, if not all, of the Eastern state pool bonds are insufficient to cover reclamation in the likely event of widespread coal company bankruptcy and bond forfeiture. In addition, the bankruptcy of Blackjewel and the failure of ERP Environmental have called into question the ability of sureties to cover their bond obligations in the event of widespread bankruptcy as well.

All other bonds should also be reviewed for adequacy and security. States utilizing alternative bonding systems, such as pool bonds, should review the solvency of the pool. Regulatory authorities can and should review bonds at midterm permit reviews, permit renewals, and permit transfers. Each of those opportunities should be used to replace alternative bonds with full-cost bonds provided by sureties or other financial institutions capable of covering their likely total liability. All bonds, including full-cost bonds, should also be evaluated to determine whether they cover the cost of actual reclamation liability, including the cost of any long-term water treatment. States and OSMRE should also institute bonding specific to the treatment of long-term water pollution. Ideally, these bonds should be in the form of trust funds or annuities, and target values should be set to provide treatment costs for at least 75 years. States should diligently identify and inventory sites in need of long-term treatment, ideally as early as possible and before reclamation is declared complete or bonds are forfeited.



Acid mine drainage in Kentucky.

Reclamation Progress

While SMCRA requires that coal mine reclamation occurs as contemporaneously as possible, regulations allow considerable leeway in interpretation of contemporaneous reclamation.⁵¹ Companies are allowed to place permits into “temporary cessation” status for many reasons, including “economic conditions.” Some permits move in and out of temporary cessation repeatedly over a number of years, making little to no coal removal or reclamation progress in that time period. Currently, many mines across the Eastern states and in other coal mining regions are functionally abandoned — though the permit has not gone through bond forfeiture nor has the coal company gone through bankruptcy, the mines have made little progress in reclamation over a number of years. Sometimes, these mines can be identified by a mine status listing of “temporary cessation,” but generally, states do not maintain comprehensive data that can be easily used to identify these mines.

To address the lag in contemporaneous reclamation, OSMRE should require updated mine reclamation and closure plans. These plans should evaluate the original mining plan and determine whether the current economic climate warrants revising the mining plan. OSMRE should also disallow the use of temporary cessation status beyond a three-year period. Mines should be evaluated to determine if any appreciable coal removal or reclamation has occurred during the time between periods of temporary cessation status. If no progress has been made, the mine should be considered to have been in temporary cessation for the entire time period and should not be allowed to extend the status beyond three years. OSMRE should also reinstate the time and distance standard, which specifies reclamation of highwalls within 60 days or 1,500 linear feet following coal removal, and reclamation of area mines within 180 days following coal removal.⁵²

Funding for Bonding Shortfalls

Congress should consider providing additional funding from the general treasury to supplement shortfalls in state bonding programs. Unfortunately, in some cases it may be too late for states to address bonding shortfalls at mines where companies have already gone bankrupt or are otherwise in poor financial health. Because most state bond pools rely on funding from applicant fees and fees on current coal production, at this point, it is difficult to increase the amount in state pools by any considerable amount. If these shortfalls are not addressed by the federal government, the repercussions of another round of abandoned mines will fall to local communities. Already, we are seeing state agencies struggle with bond forfeited mining permits, delaying reclamation or attempting to lower reclamation standards.

If the federal government funded bonding shortfalls, this influx of money could act as an economic stimulus in coal-impacted communities, putting miners back to work completing long-overdue mine reclamation. It would be critical that such a program not act as a coal company bailout. To avoid this pitfall, we suggest only funding reclamation at mines that have already been forfeited, where the available bond is not adequate for reclamation, and where the regulatory authority has made every effort to recover additional money from all liable parties. If state regulatory authorities had such a backstop available, they may be more willing to aggressively pursue bond forfeiture at mines that are failing to comply with reclamation standards under SMCRA.

Currently, the enforcement of SMCRA requirements regarding coal company accountability rely on OSMRE's Applicant/Violator System (AVS). The system is intended to provide information across states regarding coal companies that have outstanding violations and should no longer be eligible for additional mining permits under SMCRA.⁵³ While this system works in many ways, it also provides ample loopholes for coal companies to avoid

repercussions from their outstanding violations. In many cases, subsidiary companies may be blocked from acquiring new permits by the AVS, but their parent company, the owners and officers of the parent, and other subsidiaries owned by the parent are not blocked. Such a system creates an incentive for coal companies to form many subsidiaries and shed liability through transferring failing mines to sacrificial subsidiaries.

For this program to provide maximum benefit to communities, it is critical it go hand-in-hand with effective oversight by OSMRE. Projects proposed for funding should have high reclamation standards that can be completed in a timely manner, and that take the needs and desires of the surrounding communities into consideration. In some cases, mines may be suitable for economic development, such as renewable energy development. But in many cases in Eastern states, mines should be restored to native hardwood forests. States and the OSMRE should also consider landownership when selecting sites for additional funding. Many mine sites are owned by large land holding companies that have made considerable money off resource extraction, and in some cases may be directly related to coal companies. These companies should also be held accountable for outstanding environmental violations related to resource extraction.

Reclamation Workforce

The above recommendations will not only help to ensure timely mine reclamation, but also help to put miners back to work completing the reclamation they were always intended to do. Ideally, better oversight by state agencies and the OSMRE will lead to more coal companies hiring for reclamation work. In cases where the coal company is unable to complete reclamation, the bond should be forfeited, so that the regulatory agency can complete the reclamation. Once an agency is in charge of reclamation, that agency could implement specific requirements to improve job quality. Agencies should require hiring from the local workforce, prioritizing displaced coal industry workers. Agencies should ensure jobs provide prevailing wages and fair benefits. Where possible, agencies should aggregate projects in order to attract union contracts.

Conclusion

The coal industry has changed tremendously in recent years, and the string of bankruptcies now underway shows no signs of stopping. The systems designed to provide a backstop against mine abandonment no longer appear capable of meeting that challenge, both because bond requirements have been too lax and because enforcement mechanisms, such as fines and permit revocations, mean little to failing companies that can no longer sell coal.

Across the Eastern states, current mining permits cover about 633,000 acres of land in need of some degree of reclamation. Our estimate for the total outstanding cost of that reclamation ranges from \$7.5 to \$9.8 billion dollars. In contrast, all available reclamation bonds only total \$3.8 billion.

Determining whether bonding programs are sufficient to cover potential reclamation liabilities is difficult because the answer depends on a number of variables: the true cost of reclamation, the number of permits relinquished to regulatory agencies, and available bonds. Ideally, all mines would be fully reclaimed by the responsible coal company, but we have already seen that this will not be the case for at least some mines.

The Blackjewel and ERP Environmental cases demonstrate that worst-case scenarios are already unfolding in several states. Each of these situations has the potential to devastate the state pool bond, making it less likely that the state can cover the cost of mine cleanup when the next coal company goes bankrupt, leaving reclamation at these mines underfunded. The findings of this report indicate that permit-specific bonds may be insufficient. These would put landowners and nearby residents at risk as well as prolong the environmental damage and the local economic drag of unreclaimed mines.

In light of the current instability of the industry, it is imperative that state mining agencies and OSMRE work together to determine reclamation need and liability, the health of state bonding programs, and how to incentivize timely reclamation that leaves former mine sites in safe and clean condition, ready to support a wide range of ecological and economic post-mining land uses.

Appendix A

Methodology for Reclamation Acreage Estimates

To estimate the amount of reclamation needed across the Eastern states, we needed to create a data set where acreage could be compared between each state. States track disturbance on mines differently, and the OSMRE Appalachian Region does not require states to report standardized sets of data on disturbance and reclamation. In contrast, the OSMRE Western Region collects standardized state data that tracks acreage that has been regraded, acreage that has been revegetated for less than 10 years, and acreage that has been revegetated for more than 10 years.

We created a data set for comparison across the Eastern states by categorizing acreage as either “unreclaimed” or “partially reclaimed.” Any acreage with known mining disturbance, but no recorded reclamation activity was classified as unreclaimed acreage. Any acreage that was disturbed and had any degree of recorded reclamation (regrading or reseeding) was classified as partially reclaimed. Many states lump this acreage together into a category simply labeled “reclaimed,” though the acreage is still part of an active SMCRA permit and is still covered under a reclamation bond. This acreage could be under phase 1 reclamation (regraded), phase 2 reclamation (reseeded), or phase 3 reclamation (essentially complete). Without additional data with better

specific information on what reclamation milestones acreage has achieved, we were not able to break down acreage into any finer categories. We are aware that some partially reclaimed acreage may actually be fully reclaimed and need little to no additional reclamation expenditures. We are also aware that some disturbed acreage likely has contemporaneous reclamation taking place, but without any record of that activity, we were unable to include it in the “partially reclaimed” classification. The other side of this argument is that some partially reclaimed acreage may still have large outstanding costs, such as long-term water treatment needs or large highwalls to reclaim. Therefore, our general liability assessment is likely too high for certain acreage and too low for other acreage. Without a permit-by-permit analysis, it is not possible to identify these variations.

We also compared our resulting acreage estimates to the most recent annual reports for each state produced by OSMRE, found in table 6 “Surface Coal Mining and Reclamation Activity” in each report.⁵⁴ Most state data matched the OSMRE annual reports fairly closely, especially considering each was from slightly different points in time. The West Virginia Department of Environmental Protection data showed about 30% higher acreage disturbance than the OSMRE annual report for that state. We did not determine a reason for

this discrepancy. We chose to use the data provided by the state of West Virginia. In contrast, the OSMRE annual report for Pennsylvania listed considerably more disturbed acreage for that state than the Pennsylvania Department of Environmental Protection (PA DEP) reported. After speaking with both the PA DEP and OSMRE, we were still unable to identify any reasons for the discrepancy. In this case, we also chose to use the data provided by the state agency. The Alabama report does not include sufficient data for comparison. No report is available for Tennessee, as OSMRE oversees mining in that state directly.

Below are details of how state data was collected and compiled:

[Alabama](#)

Through a records request to the Alabama Surface Mining Commission, we were provided a list of all active permits (listed by permit number), bond amounts for those permits, and bonded acreage. Alabama does not maintain a database of disturbed or reclaimed acreage. We considered the bonded acreage to be the maximum disturbed acreage for any given permit. We then visited the Surface Mining Commission office to review recent inspection reports to determine mine status (active or in some phase of reclamation), and to read narrative descriptions of mine disturbance. This was a reasonable endeavor because Alabama only has 130 active permits. We relied first on any narrative description of the amount of acreage disturbed and/or reclaimed. Second, if permits did not have that narrative description, we categorized

the entire acreage based on the permit status. For example “active coal being removed” was categorized as unreclaimed, while “active regrading and reseeding” was categorized as partially reclaimed. If we could not determine rough categorization in either of these ways, we reviewed satellite imagery of the permit using Google Earth. Mines that were seen to have significant regrading and revegetation as determined via the imagery were given a status of partially reclaimed.

[Kentucky](#)

The Kentucky Energy & Environment Cabinet makes permit inspection reports available to the public through the online Surface Mine Information System (SMIS). We first compiled a master list of permit numbers based on the bonding list provided by the Cabinet through an open records request for active bonds. Then we automated a program to open and record the acreage data from the most recent inspection for each permit in SMIS. Total reclaimed acreage was subtracted from total disturbed acreage, as the former is a subset of the latter.

A majority of coal mining occurs in Eastern Kentucky, within the Appalachian region; however, additional mining also occurs in Western Kentucky, which is within the Illinois Coal Basin. We chose to include all mining in Kentucky, because the state mining program applies to the whole state and does not differentiate between coal basins. There is little to no difference in bonding or reclamation requirements between the two basins within Kentucky.

Additionally, we felt it was important to convey the total amount of reclamation and the total cost of reclamation across the whole state.

[Ohio](#)

The Ohio Department of Natural Resources tracks mining activity in a fairly detailed manner. The state provided information on mine types, including surface mines, underground mines, and processing facilities. The state also provided data on “affected acres” — acres that either have, or will have, mining activity within the year, but have not had reclamation activity. The state also tracks acreage that is in reclamation, broken down by phase 1, 2, and 3 reclamation status.

We used the “affected acres” as our unreclaimed acres. The “to be reclaimed” category included over 10,000 acres designated as “phase III completed,” which we subtracted from the total amount, and used the resulting number as our partially reclaimed acres. The partially reclaimed acres includes acreage that has achieved phase 1 or phase 2 reclamation, as well as acreage where phase 1 reclamation is due.

[Pennsylvania](#)

The Pennsylvania Department of Environmental Protection does not track disturbance or reclamation progress, other than through a general mine status. The state was able to provide us with a list of permits that included mine status, total permitted acreage, and authorized acreage, where authorized acreage is the portion

of the mine allowed to be active. Not all permits had data for authorized acreage. Mine status included “active,” “phase 1,” and “phase 2,” among others. We grouped the various mine statuses into either “unreclaimed,” “partially reclaimed,” or “no disturbance.”

We then compiled total acreage for unreclaimed and partially reclaimed acres based on the authorized acres where available, or by permitted acres when authorized acres were not available. This likely made our estimates of total unreclaimed and partially reclaimed acreage high for Pennsylvania, as not all permitted acres are likely to be authorized for disturbance. About 30,000 acres of “partially reclaimed” land was from permits with no data for authorized acres. This is 60% of the total partially reclaimed acreage calculated. About 32,000 acres for “unreclaimed” land was from permits with no data for authorized acres. This is about 42% of the total unreclaimed acreage. Clearly, there is a substantial amount of uncertainty, given the way in which the Pennsylvania DEP reports acreage data and the missing data for authorized acreage. But we also believe it is highly unlikely that the mines for which we used permitted acreage actually represent some disturbance close to zero, given that we also used mine status to exclude non-started and reclaimed mines.

[Tennessee](#)

We requested an inspectable units list from the Office of Surface Mining Reclamation and Enforcement. The list includes permit

numbers, permit status, and disturbed acreage. We utilized the site status to determine whether disturbed acreage for any given permit should be categorized as “unreclaimed” or “partially reclaimed.” Any mine with a site status of “P1” or “P2” (phase 1 or phase 2 reclamation) was considered “partially reclaimed.”

Virginia

The Virginia Department of Mines, Minerals and Energy provided acreage data through their GIS department, through a records request. The department maintains detailed records of disturbed acreage, regraded acreage, and reseeded acreage. This state’s data was the most detailed of all 7 states. We included both regraded and reseeded acreage as “partially reclaimed.” Like Ohio, we realize that much of the reseeded acreage may be almost fully reclaimed. However, in order to compare across states, it was necessary to categorize acreage into similar categories. Because other states did not provide information as detailed as either Ohio or Virginia, we were unable to properly account for varying degrees of reclamation progress.

West Virginia

The West Virginia Department of Environmental Protection provides acreage information directly through the agency’s online GIS system. The GIS files include disturbed and reclaimed acreage for active coal mining permits. As with other states, we included all “reclaimed” acreage on active permits as “partially reclaimed” since more detailed information on reclamation

progress was not readily available and this acreage had not yet been released from bond or permit. We removed the acreage from permits that covered rock quarries (all permits beginning with “Q”) from our totals. According to the WV DEP, the reclaimed acreage is a subset of the reported disturbed acreage, so we subtracted reclaimed acreage from reported disturbed acreage to find the total “unreclaimed” acreage for our report (i.e. completely disturbed with no reported reclamation).

Appendix B

Methodology for Bond Compilation

Bonding systems vary widely from state to state, so we collected detailed information about each state's bonding program in order to determine the total amount of money available for reclamation in each state. There are a few important things to consider when interpreting the significance of total bonds available in each state: First, the default plan for all mines is for the responsible coal company to complete reclamation. In this case, the coal company does not use bond money for reclamation. Second, most states utilize some form of permit-specific bonding to provide at least a portion of the bond needed for reclamation at each permit. In the case of full-cost bonding, the permit-specific bond should be sufficient to cover the full cost of reclamation at that permit. However, in the past, some states have not calculated the cost of reclamation accurately, and full-cost bonds have not covered the full cost of reclamation. Third, many Eastern states use pool bonding in addition to permit-specific bonds. In this case, permit-specific bonds do not cover the full cost of reclamation. The bond pool is intended to make up for any shortfall in bonding in the case of permit abandonment. Bond pools are not intended to cover reclamation at every permit that takes part in the pool. Fourth, the need for long-term water treatment arises at some permitted areas and may not be accounted for in bond calculations. Some agencies have instituted the use of long-term treatment trusts or annuities for these cases, but others have not.

The main takeaway is that state bond totals are composed of multiple bond types, and not all bonds that make up the total are available for all permits. Permit-specific bonds and long-term water treatment bonds are only available to the permit to which they apply. Bond pools are only available to participating permits. Nevertheless, we have reported totals to provide a comparison to outstanding reclamation liabilities.

Alabama

The Alabama Surface Mining Commission provided data on available bonds upon a records request. The state of Alabama utilizes full-cost bonding. The state does not have a pool bond, or long-term water treatment bonds.

Kentucky

The Kentucky Energy & Environment Cabinet provided bonding data upon a records request. Additional data was obtained through the 2020 annual report of the Kentucky Reclamation Guaranty Fund — Kentucky's pool bond. The vast majority of permits in Kentucky take part in the pool bond, while a very small portion have full-cost bonds. The pool bond was created to make up for bonding shortfalls identified by the state and OSMRE in 2013.⁵⁵

Kentucky also requires long-term water treatment bonds for permits determined

to require this treatment. The long-term treatment bonds were included in the list provided for all permit-specific bonds, though they were not readily identifiable as such. We also requested a list of long-term treatment bonds, and subtracted these from the other permit-specific bonds so that we could report each bond type separately. The long-term treatment bonds are calculated to cover treatment for 20 years. Though Kentucky has implemented these water-specific bonds, the OSMRE has not approved this system because “Kentucky has not demonstrated that a 20-year multiplier will result in an adequate bond.”⁵⁶

Ohio

The Ohio Department of Natural Resources provided bonding information in response to a records request. Ohio utilizes a pool bond called the Reclamation Forfeiture Fund, and requires permits to also obtain a permit-specific bond. The balance of the pool bond was obtained from meeting minutes of the fund advisory board.⁵⁷ Not all permits participate in the pool bond fund. Companies that participate in the pool must have operated a mine in Ohio for at least 5 years, must pay a permit-specific bond of \$2,500/acre, and must pay severance taxes to the fund.⁵⁸ Ohio does not utilize any long-term water treatment bonds.

Pennsylvania

Bonding information was obtained through a records request to the Pennsylvania Department of Environmental Protection. Pennsylvania currently utilizes full-cost bonding. The state also requires long-

term water treatment trust funds for permits requiring such treatment, generally based on a 75 year treatment period. Pennsylvania has a pool bond, but use of the pool was discontinued in the 2000s.⁵⁹ It now only funds ongoing reclamation at permits that have already been forfeited.

Tennessee

Bond information for Tennessee was obtained through correspondence with the Office of Surface Mining Reclamation and Enforcement’s Appalachian Region office. The OSMRE administers the mining program in Tennessee, including the bonding program. While pool bonding is allowed in Tennessee, it is not currently utilized. Coal companies provide full-cost bonds. Coal companies with permits requiring long-term water treatment must provide a long-term treatment trust to cover a 75-year treatment period.

Virginia

Bonding information was obtained through a records request to the Virginia Department of Mines, Minerals and Energy. Virginia currently utilizes both pool bonding and full-cost bonding. Coal companies must qualify for participation in the pool, provide a portion of the bond through a site-specific bond, and pay fees into the pool. While self-bonds are no longer allowed in Virginia, one company, A&G coal, still has legacy self-bonds in place. These bonds were not included in the calculations for total bond amounts for Virginia or for all states (table 5) because these bonds are only a promise of payment in the event of forfeiture, and are

not backed up by any collateral. Most of the A&G permits also take part in the state pool.

West Virginia

Bonding information for West Virginia was obtained through a records request submitted to the West Virginia Department of Environmental Protection. West Virginia requires all companies to participate in the state pool bond, the Special Reclamation Fund. In addition to this, each permit has a permit-specific bond. West Virginia also has a water-specific pool bond called the Special Reclamation Water Trust Fund. The balance of the Special Reclamation Trust Fund and the Special Reclamation Water Trust Fund were obtained from the state legislative audit report.²³

Appendix C

Methodology for Liability Estimates

Estimating the cost of outstanding reclamation is the primary goal of this paper. Since most Eastern states do not routinely estimate outstanding reclamation liability, there is no region-wide estimate of the cost of remaining reclamation. We believe it is necessary to estimate the costs for each state, in order to have more informed discussions about how this reclamation will be completed in the face of widespread bankruptcy. However, since the critical costs estimates per mine are not available, our estimate is understandably limited by data availability. To compare liability between states, across thousands of permits, we needed to assign a dollar per acre value to mines within broad categories. We spent the majority of time preparing this report on considering different methodologies for determining liability.

Methodologies ultimately not chosen:

We reviewed actuarial analyses contracted by state mining agencies. Many of these reports are gathered to assess the health of a state's pool bond. They are most commonly completed by a company called Pinnacle Actuarial Resources, Inc. These reports provided a lot of information about individual state bonding programs, but they are flawed in estimating liability because they are predominately backward-looking. The reports consider previous rates of bond forfeiture and bonding shortfall, but

do not typically consider forward-looking increases in bankruptcies, which could involve multiple large companies forfeiting permits. For this reason, we did not use these reports for our estimated cost.

The main need for this paper arises out of bankruptcies that are already unfolding — bankrupt companies are threatening to abandon permits for which there is not adequate bonding. This problem was created by insufficient bond calculations and inadequate alternative bonding systems. In states that utilize pool bonding, permit-specific bonds are only a fraction of the total cost of reclamation, since coal companies also participate in the state pool. Pennsylvania, Tennessee, and Alabama are the only states that utilize full-cost bonding. In theory, bonds in these states should cover the total reclamation liability at each permit. However, assuming that the agencies overseeing the mining programs in these states adequately estimated bond amounts would defeat the purpose of the analysis by immediately assuming these bonding programs are adequate.

We reviewed 10-K report to the Securities Exchange Commission. This methodology did not work for several reasons. First, only a small number of coal companies are publicly traded and therefore required to submit 10-K reports. These companies also often had many mine permits across several regions, so it was impossible

to determine what percentage of their reported liability corresponded to specific subsets of permits.

Chosen methodology:

We ultimately chose a 2006 report from Marshall University, which was prepared for the West Virginia Department of Environmental Protection.²⁴ This report reviewed existing actuarial analyses completed for West Virginia, and also estimated liability with a more forward-looking approach. In particular, the authors gathered cost data for permits that had already been forfeited and reclaimed through West Virginia's pool bond fund. Using this data, they reported dollar per acre estimates for surface mines, underground mines, and coal processing facilities.

We then compared these estimates to other cost data from estimates of reclamation costs at several sets of permits in other states. One group consisted of 29 permits held by A&G Coal Company in Virginia.⁶⁰ The estimates were completed by the Virginia Department of Mines, Minerals, and Energy. The set predominantly consisted of surface mines, but also included one underground mine and nine processing facilities. We discarded data from the most expensive surface mine, as its dollar per acre reclamation cost was more than double the next most expensive mine. We then averaged the dollar per acre estimate across all surface mines, which amounted to \$13,600/acre. This estimate was very close to the Marshall estimate of \$12,100/per acre (corrected for inflation).

The estimates for underground mines and processing facilities were considerably lower than the Marshall estimates, but these averages were based on small sample sizes and mines that were a mix of preparation plants, underground mines and surface mines. We also examined the estimated liability at Blackjewel mines in Kentucky, which were calculated by the Kentucky Energy and Environmental Cabinet.⁶¹ We similarly discarded mines that were outliers within the set. This set resulted in an average dollar per acre cost of \$7,600/acre for surface mines, \$76,000/acre for underground mines, and \$20,500/acre for processing facilities. The estimates for surface mines and processing facilities matched the Marshall estimates relatively closely. The estimate for underground mines did not, but unlike in Virginia, the Kentucky set was substantially higher than the Marshall estimate. These data sets indicate that reclamation liability at underground mines may be highly variable.

We utilized the same categories of mine type for our analysis. Each state provided data on mine type, which could generally be matched to the same categories used in the Marshall report. In cases where mines were classified as more than one mine type by the state agency, we used additional permit information and satellite imagery to choose the predominant mine type.

We used the cost estimates from the Marshall report for all seven states. Initially, we planned to further refine the dollar per acre estimates for each state outside of the Central Appalachian states of Tennessee,

Kentucky, Virginia, and West Virginia. Each of these states have similar topography and use similar mining techniques, so reclamation costs should be comparable. After reviewing available data from the remaining three states, we chose to use the Marshall estimates for all seven states.

We were unable to find additional information in Alabama that provided any indication that reclamation costs would be either higher or lower. We also reviewed extensive permit details on total acreage, size of highwalls, and amount of regrading, and felt that mine characteristics in Alabama were sufficiently similar to the Central Appalachian states.

The Ohio Department of Natural resources is the only state that routinely estimates outstanding liability at every mine permit in the state. These estimates are referred to as performance security estimates (PSEs). The PSEs report the cost of reclamation at the point the estimate is completed, and also account for contingencies that may increase the cost of reclamation. A 2019 actuarial analysis reported the total amount of all PSEs in Ohio at that time to be \$587 million.⁶² This is considerably higher than Ohio's total available bonds. When using the Marshall cost estimates for Ohio, we determined a low end liability that fell neatly between the bond amount and the total PSE amount. The high end estimate was only 11% higher than the PSE total. These comparisons indicated that the Marshall estimates were reasonable estimates to use for Ohio mines as well.

We also faced a lack of additional information in Pennsylvania. Like Alabama, Pennsylvania utilizes full-cost bonds, so this state's bond amounts should reflect the true cost of reclamation. However, assuming the state has adequately estimated bond amounts without sufficient evidence would defeat the purpose of this report. We did look at bond amounts broken down by mine type, and determined that the rough dollar per acre amount for surface mines in Pennsylvania was about half of the Marshall estimate, while the dollar per acre amount for underground mines was nearly twice the Marshall estimate. The rates for processing facilities were relatively close. It is likely that surface reclamation costs in Pennsylvania are significantly lower, given the smaller size of surface mines, the difference in topography, and the resulting differences in mining techniques (no mountaintop removal, valley filling, etc.). It is possible that the true liability in Pennsylvania is closer to the current state bond amount of \$1.25 billion.

Long-term water treatment methodology:

While the Marshall report did consider long-term water treatment of acid mine drainage, the reported dollar per acre figures we used from that report only covered land and water capital costs, not long-term treatment (see table 1 in the Marshall report). To determine both the cost and rate of long-term water pollution treatment, we reviewed data from the states that maintain data on the cost of treatment at individual sites. Because

these states typically calculate long-term treatment bonds after water pollution problems have arisen, we felt more confident in utilizing these bond amounts to represent actual cost of treatment.

The Kentucky Energy & Environment Cabinet provided a list of permits requiring long-term water treatment, and the associated bond amounts. The Pennsylvania Department of Environmental Protection similarly provided a list of permits and associated trust funds. The OSMRE provided a list of permits in Tennessee requiring long-term water treatment, and the associated trust fund amounts. We collected data on long-term treatment prevalence and cost for West Virginia from the 2018 Special Reclamation Fund Advisory Council Annual Report.⁶³

Using the above data sets, we calculated a per-year average treatment cost per site for each state (some states set fund totals based on 20 year timelines, others on 75 year timelines). Annual costs ranged from \$21,000 to \$55,000 per site. The prevalence of treatment was estimated by calculating the percentage of permits requiring treatment, using lists of permits requiring such treatment, and the total number of permits in each state. Rates of treatment ranged from 4% to 9%.

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