Economic Analysis of Proposed Stream Protection Rule Stage I Report

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Date:
March 5, 2012

Project Number:
20-28301A

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List of Acronyms

AOC	Approximate Original Contour
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
CHIA	Cumulative Hydrologic Impact Assessment
CWA	Clean Water Act
DOE	Department of Energy
EIA	Energy Information Administration
EIS	Environmental Impact Statement
ENVIRON	ENVIRON International Corporation
EPA	Environmental Protection Agency
GDP	gross domestic product
IMPLAN®	IMpact analysis for PLANning
MMBtu	Million Metric British Thermal Units
MSHA	U.S. Department of Labor, Mine Safety and Health Administration
NEPA	National Environmental Policy Act
NMA	National Mining Association
O&M	Operations and Maintenance
OSM	Office of Surface Mining Reclamation and Enforcement
PWC	PricewaterhouseCoopers
QCR	Quarterly Coal Report
SEC	Securities and Exchange Commission
SMCRA	Surface Mining Control and Reclamation Act of 1977
SPR	proposed Stream Protection Rules
The proposed rules	proposed Stream Protection Rules
U.S	United States

Executive Summary

The purpose of this draft report is to present the results of ENVIRON International Corporation's (hereinafter, "ENVIRON") analysis of the anticipated economic impacts associated with the proposed Stream Protection Rules (hereinafter, "SPR" or "the proposed rules") that are expected to be promulgated in the near future by the Office of Surface Mining, Reclamation and Enforcement (hereinafter, "OSM"). This report was prepared at the request of the National Mining Association (hereinafter, "NMA"). The analysis contains the following key findings:

- Total number of jobs at risk of loss, including mining and linked sector employment is between 133,441 and 273,227 (29% to 59% of current employment levels), with the Appalachian region alone losing as many as 220,003 jobs.
- Direct mining jobs at risk of loss are predicted to be between 55,120 and 79,870, with the majority of these job losses being in the Appalachian region.
- The overall decrease in recovery of demonstrated coal reserves is between 30.4% and 41.5%; both surface and underground mines will be significantly impacted.
- The annual value of coal lost to production restrictions is $14 billion to $20 billion.
- Total annual federal and state tax revenue potentially foregone because of lost production is estimated at $4 billion to $5 billion.

In order to estimate the economic impacts of the proposed SPR, ENVIRON evaluated the language of the October 2010 draft rule and assessed the impact of implementation against current industry statistics and trends. Compliance with the proposed rules was evaluated for 75 current surface and underground mining operations in all regions of the country to determine the impact on access to demonstrated coal reserves. High and low ranges were calculated to account for various reasonable interpretations of certain key aspects of the rule.

The results presented in this report are based on data from the participating member sample of firms, and the sample of mines that were analyzed by the firms. The survey included data from 75 individual coal mines, from firms representing over 52% of the national coal production in the United States (U.S.).

The percent decrease in access to recoverable reserves was determined for both surface and underground mining, and for each of the three regions in the country. The largest decrease in recoverable reserves is expected in the Appalachian region, where 45% to 79% of the recoverable reserves will be lost if the proposed rules are implemented. Overall in the U.S., the decrease in recoverable reserves is anticipated to range between 30% and 42% (see **Table ES-1**).

Table ES-1: Anticipated Percent Decrease in Recoverable Reserves with Proposed SPR in Place			
Region	**Anticipated Percent Decrease in Recoverable Reserves with Proposed SPR**		
	Underground	**Surface**	**Total**
Appalachia	38.1% - 68.0%	55.7% - 78.3%	44.5% - 78.6%
Interior	64.0% - 64.0%	22.7% - 23.4%	36.7% - 37.3%
Western	36.2% - 37.9%	16.1% - 16.3%	20.7% - 20.9%
Total U.S.	**43.1% - 62.3%**	**23.8% - 28.1%**	**30.4% - 41.5%**

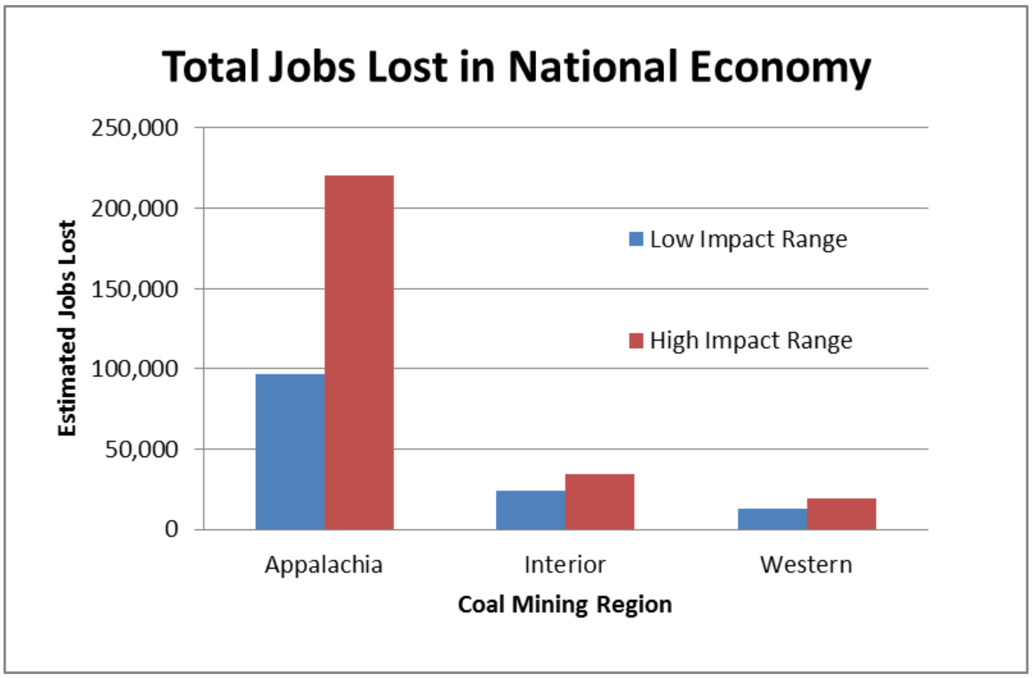
The impact of sterilized coal reserves on annual production will occur over several years, as the rules are implemented and operators adjust to meet operational considerations and contractual obligations. Once the decrease in access to demonstrated reserves is fully realized, the lost value of produced coal is estimated to be between $14 billion and $20 billion annually (see **Table ES-2**).

Table ES-2: Annual Coal Production Value at Risk with Proposed SPR in Place (in Millions of 2010 Dollars)			
Region	**Annual Coal Production Value at Risk with Proposed SPR in Place**		
	Underground	**Surface**	**Total**
Appalachia	$5,207 - $9,295	$4,547 - $6,419	$9,754 - $15,714
Interior	$2,001 - $2,001	$487 - $503	$2,488 - $2,504
Western	$787 - $825	$1,089 - $1,102	$1,877 - $1,926
U.S. Total	**$7,996 - $12,121**	**$6,124 - $8,023**	**$14,119 - $20,145**

The decline in annual coal production will have a direct impact on employment. At the national level, the implementation of the SPR is predicted to eliminate between 133,441 and 273,227 direct and indirect jobs, with the Appalachia region alone losing as many as 220,003 jobs (see **Table ES-3**) and **Figure ES-1**). Nationally, direct mining job losses are predicted to be between 55,120 and 79,870. Changes in the coal mining sector also indirectly impact industries that provide products and services to the coal mining industry, and the change in employment means fewer workers will be earning an income, leading to additional impacts occurring in industries that support household consumption. Although the range of production changes is 30% to 42%, the potential impact on jobs ranges from 29% to 59% because the sectors of coal production anticipated to be most affected by the SPR are those that are more labor-intensive or have higher employment requirements per ton of coal produced.

Table ES-3: Anticipated Decrease in Employment by Region with Proposed SPR in Place				
Region/Type of Mine	**Direct Employment**	**Direct Jobs at Risk**	**Total Direct and Indirect Jobs**	**Direct and Indirect Jobs at Risk**
Appalachia	89,712	39,788 - 64,311	306,897	96,323 - 220,003
Interior	21,642	9,965 - 10,035	74,037	24,125 - 34,328
Western	24,178	5,367 - 5,524	82,712	12,992 - 18,896
Underground	77,521	32,574 - 50,035	265,192	78,859 - 171,165
Surface	58,012	22,546 - 29,835	198,454	54,582 - 102,062
U.S. Total	**135,533**	**55,120 - 79,870**	**463,646**	**133,441 - 273,227**

Figure ES-1: Total Jobs at Risk from Proposed SPR



1 Introduction and Background

The purpose of this report is to present the results of ENVIRON International Corporation's (hereinafter, "ENVIRON") analysis of the anticipated economic impacts associated with the proposed Stream Protection Rules (hereinafter, "SPR" or "the proposed rules") that are expected to be promulgated in the near future by the Office of Surface Mining, Reclamation and Enforcement (hereinafter, "OSM"). Although the rules have not yet been released by OSM, this economic analysis is based on estimates of how coal production, and the coal industry as a whole, might change under the proposed rules, assuming these will contain the following key elements:

- Additional permitting, reporting and monitoring requirements;
- Restrictions on mining through, near, and beneath streams;
- New specification of approximate original contour (AOC), and variances and exceptions to AOC;
- Additional requirements for mining and reclamation regarding excess spoil fill placement, protection of fish and wildlife resources, stream restoration and reforestation; and
- Long-term financial assurance and bonding requirements.

The goals of the study are to identify the economic impacts to the coal mining industry in terms of: a) reductions in recoverable reserves; b) changes in production and output; c) impacts to the regional economy; d) employment in the coal and related industries; e) impacts on state, local, and tribal governments; f) additional permitting costs; and g) impacts to electricity consumers. Details of the derivation of these estimates by ENVIRON is also provided in the chapters that follow. This report was prepared at the request of the National Mining Association (hereinafter, "NMA").

1.1 Context and History

The OSM published a Notice of Intent to prepare an Environmental Impact Statement ("EIS") for the SPR in the Federal Register (75 Federal Register (FR) 22723) in April of 2010, which would replace the 2008 Stream Buffer Zone ("SBZ") Rule (73 FR 75815). The notice included a list of concepts ("Principle Elements") that are under consideration for the proposed SPR. Included in the Principle Elements were provisions for coal mining companies to gather more specific baseline data on a proposed mine site's hydrology, geology, and aquatic biology; establishing a definition of the term "material damage to the hydrologic balance" of watersheds outside the permit area; and developing additional requirements for mine operators to achieve approximate original contour (AOC) or seek a variance from AOC - the requirement that mined areas be reclaimed to their approximate original contour. In July 2010 OSM provided an open house forum to gather public comment on the SPR EIS. Since July, public comments provided by industry representatives have been strongly against the proposed SPR primarily arguing the rule change would significantly undermine the coal mining industry resulting in lost jobs and increased costs to meet the proposed permitting, compliance and financial assurance requirements.

1.2 Objectives of this Study

The key objectives of this study include:

- review the major provisions of OSM's SPR;
- design a complete concept of compliance with the proposed rules;
- establish the current and future regulatory environment in the absence of the proposed rules;
- conduct economic analysis of the impact of the proposed rules on employment, compliance cost, value of reserves, regional and local governments, and electricity consumers; and
- compile and explain analytic assumptions.

1.3 Structure of the Report

In order to clearly and accurately present the findings of the study, the report has the following structure. Chapter 1 introduces a brief history of the proposed rules in addition to outlining the goals and objectives of this study. Chapter 2 provides an overview of the methodology and economic approach employed to meet the objectives and analyze the economic impacts. The 3rd chapter presents the results of the economic analysis and provides details of the potential impacts of the proposed rules on coal reserves; on production and output; to the regional economy; on employment; to state, local, and tribal governments; additional permitting costs; and on consumers of electricity. The final chapter provides a conclusion and discussion of the analysis.

The report also has two appendices. Appendix A delves into an overview of the coal mining industry in the U.S., and outlines the trends and key issues impacting this sector. Case studies related to loss of access to reserves are presented in Appendix B.

2 Overview of Methodology

This chapter provides an overview of the methodology used to estimate the potential impacts of the proposed rules. First, the overall economic approach is presented. Next, the proposed changes to the SPR are outlined. Then, a discussion on entities potentially affected by the proposed rules is provided. This is followed by two sections on primary data collection and analysis and sources of secondary data. The final two sections outline the key assumptions underlying the analysis and the timeline for the analysis.

2.1 Economic Approach

This analysis examines the state of the world with and without the proposed SPR. The "without proposed SPR" scenario represents the baseline for the analysis, considering the existing regulation under the Surface Mining Control and Reclamation Act of 1977 ("SMCRA"). The "with proposed SPR" scenario attempts to describe the incremental effects associated specifically with and unique to the proposed SPR. The focus of the analysis, however, is determining the increment of effects that can be uniquely attributed to the proposed rules, to the fullest extent practicable.

The first step in the economic analysis is to identify the baseline level of coal production without the proposed SPR. The baseline for this analysis is the existing state of regulation that provides protection to the streams under the SMCRA and the Clean Water Act (CWA), as well as under other Federal, state, and local laws and guidelines, without the proposed SPR.

Incremental effects of the rule will include the direct compliance costs associated with additional effort for the renewal of permits forecast for renewal (including time delays) and new permits that would not otherwise have been required under the existing regulations. Additionally, incremental effects may accrue as a result of actions initiated in response to the proposed rules. These may include decreased availability of recoverable reserves (including those which are rendered economically infeasible due to the increased cost of mining associated with the new regulations), loss of employment in the coal industry and other related industries (such as transportation), and loss of income for state, local, and tribal governments, among others. The nature of these costs is described in greater detail in Chapter 3.

2.2 Proposed Changes to OSM Stream Protection Rules

The proposed rule changes were compiled by OSM in a detailed Draft proposed rules for surface and underground mining ("proposed rules") in October 2010. The primary changes and revisions to the SPR were listed in 30 Code of Federal Regulations (CFR) Parts 701, 780, 784, 816, and 817. The following discussion references the eleven Principle Elements as provided in FR 22723 and citations as listed in the proposed rules.

2.2.1 Baseline Data Collection and Analysis

Under the proposed rules in Parts 780.19 and 780.21 for surface mining activities and 784.19 and 784.21 for underground mining activities, the requirements for permit applications regarding baseline data on hydrology, geology, and aquatic biology are more extensive and specific. These added baseline monitoring requirements would include parameters (i.e., chemical, physical, biological), frequency of sampling, location, and duration of sampling to assess the cumulative hydrologic impacts (CHIA) from mining.

Specifically in Part 780.19 (b, c, d, e, g, h, i), proposed changes would establish additional sampling requirements from each location at equally spaced monthly intervals for a minimum of 12 consecutive months in order to document the seasonal variation in water quality. Sampling of perennial, intermittent and ephemeral streams within the permit area and adjacent areas would be required under the proposed rules. In addition, the collection of continuous flow measurement would be required where feasible. The rules also propose to expand upon the chemicals for analysis by including aluminum, calcium, potassium, iron, magnesium, manganese, sodium, silicon, sulfate, alkalinity (HCO_3 - expressed as bicarbonate), chloride (for major anions) and selenium (perhaps other trace elements on the Environmental Protection Agency's [EPA's] national priority metal list). In addition, this section would obligate baseline sediment load and identification of stressors associated with Total Maximum Daily Loads for those stream segments.

The rules would also impose the collection of data pertaining to temperature, precipitation amounts, and duration of individual storm and storm water in order to develop appropriate models for surface water runoff, quantity and management. The documentation of riparian and stream biological conditions as well as forest and other native plant communities located upland would be required under the proposed rules. Other requirements include documentation of stream form and function such as the location of the channel head on terminal reaches, fish, wildlife, soil, and geologic characteristics. At a minimum, the data must include a list of the presence and abundance of aquatic organisms identified to the lowest practicable taxonomic level for each stream segment within the permit and adjacent areas.

2.2.2 Definition of Material Damage to the Hydrologic Balance

A national definition of "material damage to the hydrologic balance" is proposed under the rules. As defined in Part 701.5 Definitions - material damage to the hydrologic balance is defined in the proposed rules as any quantifiable adverse impact from surface coal mining and reclamation operations or from underground mining activities, including any adverse impacts from subsidence that may occur as a result of underground mining activities, on the quality or quantity of surface water or groundwater, or on the biological condition of a stream, that would preclude any designated use or any existing or reasonably foreseeable use of surface water or groundwater.

Additional language proposed to define preventing material damage is provided in Part 773.17(i). It requires the permittee to review at least quarterly monitoring data to determine if values or trends in values have reached the corrective action level specified in the cumulative hydrologic impact assessment prepared under Part 780.21or Part 784.21 for any surface water or groundwater parameters. The permittee must either demonstrate that the values or trends for the parameters of concern are not the result of the mining operation or develop revised operation and reclamation plans demonstrating how, subject to the approval of the regulatory authority, modifications to the operation to avoid creating material damage to the hydrologic balance outside the permit area.

2.2.3 Mining Activities In or Near Streams

As discussed in Parts 780.28 and 784.28 and Parts 816.57 and 817.57, surface and underground mining activities would be prohibited through or underneath perennial or intermittent streams or on the surface of lands within 100 feet or those streams unless the restoration of the stream form and function can be demonstrated. The proposed rules would require an applicant to demonstrate that mining activities in or near streams would not hinder any pre-mining use, or any designated use of the affected stream segment. Furthermore, mining activities must not have more than a minimal adverse impact on the pre-mining ecological function of those segments following the completion of mining and reclamation. Specifically, mining activities must not impact the baseline flow of any stream segments and such segments must continue to have the necessary volume of baseline flow to retain its designation as intermittent or perennial. Furthermore, mining activities must not cause material damage to the hydrologic balance outside of the permit area.

The proposed rules also address requirements to obtain approval to construct an excess spoil fill or waste rock disposal facility in or near an intermittent or perennial stream. The applicant must demonstrate that there is no reasonable alternative that would avoid placement of excess spoil or waste rock in a perennial or intermittent stream and that the location and configuration of the proposed placement represents the alternative with the least adverse impact on fish, wildlife, and related environmental values after evaluating all reasonable possibilities. In addition, the fill must at the most have a minimal adverse impact on aquatic ecology and would not cause material damage to the hydrologic balance outside the permit area. If these requirements are properly demonstrated, then a surface runoff management plan must be developed and the applicant must propose in the reclamation plan to establish or reestablish a 300-foot forested buffer using native species, particularly ones with riparian characteristics, that is consistent with post-mining land use.

2.2.4 Mining through or Underneath Streams

As discussed in Part 816.57, mining through intermittent and perennial streams would be prohibited unless the restoration of stream form and function could be properly demonstrated. If a permit is approved based on this demonstration, an applicant must comply with the designs, construction, and maintenance in the approved permit. Restoration under the proposed rules means the affected stream segment must have a channel morphology comparable to the pre-mining form in terms of channel slope, sinuosity, water depth, bankfull depth, bankfull width, width of the flood-prone area, and dominant in-stream substrate. Restoration of stream function means the stream must have a biological condition comparable to the pre-mining condition, including benthic and other aquatic communities that fulfill a similar role in stream ecology. This would require expanding fish and wildlife protection.

2.2.5 Monitoring during Mining and Reclamation

A discussion of additional monitoring during mining and reclamation is provided in Parts 779.17, 780.23, 780.24, 780.28, 780.29, 784.23, and 816.57. Within these parts new proposed rules would establish monitoring requirements designed to identify conditions that could lead to material damage to the hydrologic balance. The sampling protocols improve on existing methods in order to develop a systematic data collection process that minimizes potential gaps.

The requirements include increased water quality monitoring that must continue through mining and reclamation until the final bond is released. Monitoring data for streams must be submitted to the regulatory authority every three months for review. Biological monitoring would be required and submitted on an annual basis (or more frequently) to the regulatory authority for review. Biological monitoring, as well, would continue until the final bond release. The applicant must examine the hydraulic structures following every significant precipitation event, as specified by the regulatory authority. Within 48 hours of the precipitation event, a report must be prepared and certified by a registered professional engineer before being submitted to the regulatory authority. The report must address the performance of the hydraulic structures, identify and describe any material damage that occurred to the hydrologic balance outside the permit area, and identify and describe the remedial measures taken in response to that damage. The regulatory authority may request that applicants revise permits to include additional monitoring whenever information available to the regulatory authority indicates that additional monitoring is necessary to protect the hydrologic balance, detect hydrologic changes, or meet other requirements of the regulatory program. The regulatory authority may not release any portion of the bond if an evaluation of monitoring data indicates that adverse trends exist that could result in material damage to the hydrologic balance outside the permit area.

2.2.6 Corrective Action Thresholds

As discussed in Part 780.21, 780.23, and 784.21 and 784.23, the regulatory authority would set Corrective Action Thresholds which would establish, based on monitoring, the degree of degradation in the environment that would trigger certain actions necessary to mitigate and prevent further damage. At least quarterly, the permittee would be required to review monitoring data that had been collected. If the data indicates that values or trends in water quality parameters are reaching the corrective action threshold, the established corrective action plan that is specified in the CHIA must be put into place. This includes notifying the regulatory authority, demonstrating that the values or trends are not the result of mining, or demonstrate how the applicant would modify operation to avoid creating material damage, to the hydrologic balance. If unable to demonstrate this, mining activities would cease and the site would be permanently reclaimed.

2.2.7 Surface Configurations and Fills

As discussed in 780.12, 784.28 and 816.102, more weight would be placed on minimizing the amount of excess spoil disposed of in valley fills and additional requirements regulating the placement of excess spoil would be imposed when restoring pre-mining topography. The proposed rule would achieve this by requiring permit applications to demonstrate that the operation has been designed to minimize the amount of excess spoil or waste rock to be placed in a perennial or intermittent stream to the fullest extent possible and that the maximum amount of overburden would be returned to the mined-out area. The proposed rules would prohibit uncontrolled placement of excess spoil in order to reduce unnecessary additional disturbance and sediment load. Surface configurations and fills must be conducted using current engineering practices. Landforming methods would be required and must be consistent with the pre-mining topography and the approved post-mining land use. Landforming methods must create topographic diversity by including elements such as swales, ridgelines, and valleys with varied hillslope configurations, even on sites to which the approximate original contour restoration requirements do not apply. Finally, a digital terrain model of pre-mining landforms is required in permit applications.

2.2.8 AOC Exceptions

As discussed in Parts 779.16, 785.16, 816.102, the rules would severely limit the ability of the regulatory authority to issue a variance from the approximate original contour requirements for non-mountaintop removal, steep-slope, and surface coal mining operations. In order to obtain a variance for steep-slope mining, the applicant would need to demonstrate that the variance would not result in the construction of a fill in a perennial or intermittent stream. In addition, the applicant must demonstrate that the proposed variance would result in a lesser adverse impact on stream characteristics compared to what would occur if the area were to be restored to its approximate original contour.

In order to obtain a variance for mountaintop removal mining, the applicant must demonstrate that the proposed operation would not increase the amount or concentration of total suspended solids and other parameters of concern. Furthermore, the applicant must demonstrate that the proposed operation would not result in changes in peak flows. Moreover, the total volume of flow must not vary in a way that would adversely affect any existing or approved use of surface or groundwater under the CWA. Applications must include a reclamation plan with final elevations and configurations and if necessary an explanation of why deviations from pre-mining configuration is appropriate.

2.2.9 Revegetation and Topsoil Management

Parts 780.12 and 780.16 would establish new requirements for revegetation, forestation and topsoil restoration and management. The new requirements include revegetation of all reclaimed lands to be consistent with the post-mining land use and the plant communities. Revegetation must be at least equal in extent of cover of the natural vegetation of the area. All vegetation and other organic materials that are to be removed must be stored and redistributed for restoration purposes. In cases where the applicant elects to use a top soil substitute, the regulatory authority must approve the use of the substitute selected and the applicant must demonstrate its appropriateness.

Applicants must reforest areas based on regulatory authority specifications. At a minimum, areas to be reforested include ranges with forest cover during part or all of the 5 years preceding the date of the application, unless otherwise specified. As proposed in Parts 816.116 and 817.116, the revegetation standard for success as approved by the permit authority, the permit must include information on the plant community and vegetation, soil type and productivity, land use, approved post-mining land use, species diversity, distribution of species, ground cover, agricultural production, and stocking for areas re-vegetated with woody plants. Finally, all excess spoils are required to be reclaimed with appropriate vegetation.

2.2.10 Fish and Wildlife Protection and Enhancement

Parts 780.12 and 780.16 establish new measures for the protection and enhancement of fish and wildlife. In general, applicants must include a fish and wildlife protection and enhancement plan. The applicant must comply with species-specific protective measures that are required by the regulatory authority and are consistent with the U.S. Fish and Wildlife Services and must be described in the permit. Enhancement measures must be located within the same watershed as the proposed operation unless opportunities for enhancement are not available within that watershed, in which case, enhancement measures must occur on the closest adjacent watershed.

2.2.11 Performance Bonds and Release

Part 800.42, The proposed rules establish bonding and bond release measures that are designed to attach financial responsibility directly to the mine operator instead of on the regulatory authority or tax payers. The two obligations that are not eligible for an alternative bonding system are restoration of the ecological function of a stream and treatment of long-term post-mining discharges. The permittee must post a surety bond, a collateral bond, or a combination of the two to cover the restoration of ecological functions and the permittee must post a financial assurance, a collateral bond, or a combination of the two for the guarantee long-term treatment of post-mining discharges. The calculations used to determine the amount of the bond must specifically identify the amount of the bond needed to guarantee restoration of stream's ecological function. Finally, the proposed rules would prohibit the regulatory authority from releasing any bond for restoration of stream form and function or long-term treatment of post-mining discharges if it is determined that adverse trends exist that may result in material damage to the hydrologic balance outside the permit area.

2.2.12 Financial Assurance for Long-Term Discharges of Concern

The proposed rules would establish a financial guarantee mechanism in the form of a financial assurance to be used instead of a conventional bond in the case of long-term discharges. In addition to prohibiting the use of alternative bonding systems and self-bonding as bonding systems, the proposed rules would establish that only trust funds and annuities are eligible as financial assurance which can be used in a manner that guarantees that sufficient monies would be available when needed to pay for treatment of discharges in perpetuity. The permittee would be held accountable for this unless the permittee properly demonstrates, and regulatory authority finds, that treatment would be needed for a lesser time, either because the discharge would attenuate or its quality would improve. Finally, the trust funds must meet administrative requirements.

2.2.13 Permit Coordination

The proposed rules mandate coordination efforts with other existing laws such as the CWA and the National Environmental Policy Act (NEPA). Coordination required through EPA CWA permits have resulted in significant delays in permitting as documented by the EPA inspector general's report titled: "Congressionally Requested Information on the Status and Length of Review for Appalachian Surface Mining Permit Applications."[1]

[1] U.S. Environmental Protection Agency. November 21, 2011. "Congressionally Requested Information on the Status and Length of Review for Appalachian Surface Mining Permit Applications." Report No. 12-P-0083.

2.2.14 Stream Definition

The proposed rules plan to update and develop upon the present definitions of perennial, intermittent, and ephemeral streams. While the current definitions are only based on the hydrological characteristics of streams, the proposed definitions would also include biological and physical characteristics that are associated with the continuous, seasonal, or episodic conveyance of water. In addition, the proposed rules modify the definition of an intermittent stream by removing the one square mile criterion which states that an intermittent stream is “a stream or reach of a stream that drains a watershed of at least one square mile.”

The current definition of streams is provided in 30 CFR Part 701 – Permit Regulatory Program, §5 Definitions. Based on the Proposed Draft Stream Protection Rule (October 2010), changes will be made to the standard definition of ephemeral, intermittent, and perennial streams. The following table outlines the differences in definitions:

Term	30 CFR Part 701.5 - Definitions	Proposed Changes (October 2010)
Ephemeral Stream	a stream which flows only in direct response to precipitation in the immediate watershed or in response to the melting of a cover of snow and ice, and which has a channel bottom that is always above the local water table	a stream which or segment of a stream with the following characteristics: A defined channel and an identifiable streambed are present. The channel contains an ordinary high-water mark and the channel bottom is always above the local water table. Water flows in the channel only in direct response to discrete precipitation events in the immediate watershed or in response to the melting of a cover of snow and ice, and which has a channel bottom that is always above the local water table. Groundwater is not a source of stream flow.
Intermittent Stream	(a) A stream or reach of a stream that drains a watershed of at least one square mile, or (b) A stream or reach of a stream that is below the local water table for at least some part of the year, and obtains its flow from both surface runoff and ground water discharge	a stream or segment of a stream with the following characteristics: (a) A defined channel and an identifiable streambed are present. The channel contains an ordinary high-water mark and the channel bottom is below the local water table for at least part of the year. (b) Water flows in the channel for only part of the year, with those flows originating from both surface runoff and groundwater discharge. (c) The biological, hydrological, and physical characteristics commonly associated with the seasonal conveyance of water are present, while the biological, hydrological, and physical characteristics commonly associated with the continuous conveyance of water typically are absent. (d) The biological community includes species that are aquatic during a part of their life cycle, are capable of diapause or other dormancy periods, or move to perennial water sources in dry conditions. More than 25 percent of the organisms present, as determined in accordance with § 780.19(e) of this chapter, are representative of taxa with the morphological, physiological, or behavioral adaptations for living in flowing water in the region.

Term	30 CFR Part 701.5 - Definitions	Proposed Changes (October 2010)
Perennial Stream	A stream or part of a stream that flows continuously during all of the calendar year as a result of ground-water discharge or surface runoff. The term does not include *intermittent stream* or *ephemeral stream*	a stream or part segment of a stream with the following characteristics: (a) A defined channel and an identifiable streambed are present. The channel includes an ordinary high-water mark. (b) that In a typical year, water flows continuously in the channel during all of the entire calendar year as a result of ground-water discharge or both surface runoff and groundwater discharge. The term does not include any stream or segment of a stream that meets the definition of an intermittent stream or an ephemeral stream, but it does include stream segments in which continuous flow ceases because of a protracted period of deficient precipitation or meltwater relative to historical norms, as determined under §780.19(c) of this chapter. (c) The biological, hydrological, and physical characteristics commonly associated with the continuous conveyance of water are present. (d) The stream supports aquatic organisms year-round. More than 25 percent of the organisms present, as determined in accordance with § 780.19(e) of this chapter, are representative of taxa with the morphological, physiological, or behavioral adaptations for living in flowing water in the region.

The definition of an intermittent stream no longer considers a stream which drains a watershed of at least one square mile. Furthermore the proposed definition for an intermittent and perennial stream includes the terms biological, hydrological, and physical characteristics of the stream.

2.3 Potentially Affected Entities

It is anticipated that the proposed rules, if implemented, would affect a wide array of public and private entities. The most direct effect of the proposed regulations is expected to be on coal companies and their employees. For the coal companies, this effect would manifest in lost income due to decreased or lost accessibility to reserves, changes in mining methods and technology, higher permitting costs, and delays in permitting process, among others. Because of the possibility of decreased production and lost income for coal companies, these companies are anticipated to cut jobs.

The direct effects on the coal industry are also anticipated to ripple through and impact other related industries. The most important among these is the transportation sector, including rail and barge, which are big in coal transportation. These industries are anticipated to suffer decrease or loss of business. The power generation sector, which consumes almost 94% of all coal produced in the U.S., is anticipated to be faced with higher priced coal, thus increasing the cost of power generation. Some of these effects would eventually be passed onto electricity customers in the form of more expensive power. Similar impacts can be expected for all sectors of the economy, including energy intensive manufacturing sector which likely will also suffer loss of business and jobs as they become less competitive globally. Venders who supply the coal industry with parts, services, and consulting services will also experience indirect impacts.

Public entities, such as state, local, and tribal governments, are expected to lose income from taxes on the coal industry if the proposed rules are implemented. For some tribal governments, these monies make up a large portion of their incomes. In addition to impacts on taxes, there is a possibility that some entities, such as the government and some tribes, might lose income from mining leases if the coal companies give up those leases as a consequence of the proposed rules.

The state permitting agencies would also be faced with the cost of hiring additional staff, or increasing the hours for existing staff, in order to carry out the additional permitting requirements and monitoring needs under the proposed rules.

2.4 Area of Analysis

The Energy Information Administration (EIA) classifies the coal-producing areas in the U.S. into three major geographic regions; Appalachia, Interior, and Western. These regions are further divided into sub-regions. Given the unique characteristics of coal and the coal mining industry in each region, the key results are presented separately for each of the three major coal-producing regions. However most of the analysis was carried out at the state level, and aggregated up to the sub-region and region levels in part to protect confidentiality of sample results. Table 2-1 shows the areas included in each region and sub-region, while Figure 2-1 presents these areas on a map.

2.5 Primary Data Collection

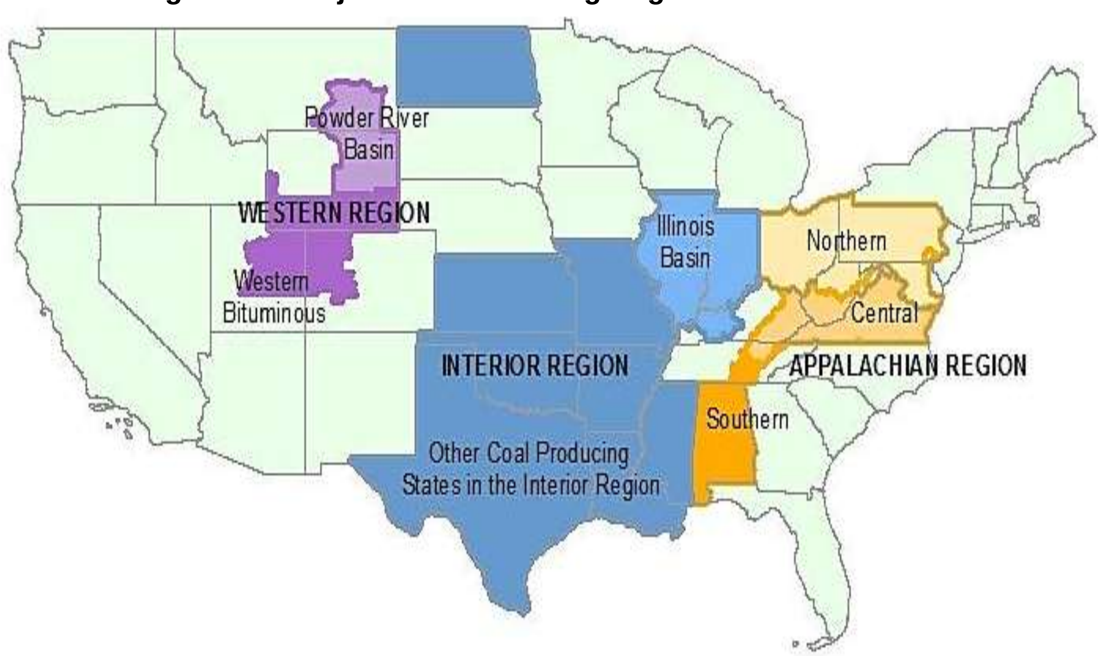
In order to estimate the economic impact to the many types of coal producing firms that would be affected by the regulation, ENVIRON first conducted a review of current coal production and recent trends in the industry. Key information from that process is presented in the appendix to this report. Information related to the conceptual framework of the proposed rules was also reviewed. Based on the understanding of the rules and their potential impact on the industry, a list of questions was developed and used to conduct interviews with coal companies that would be impacted by the proposal. In addition, and as a result of the interviews, firms estimated a range of potential impacts on a representative sample of mines and reported this information to ENVIRON. Impacts reported on a mine-by-mine basis were used to develop estimates of the percent decrease in access to recoverable reserves in each of six categories identified by ENVIRON based on the coal production regions and type of mining.

The results presented in this report are based on data from the participating sample of firms, and the sample of mines that were analyzed by the firms. The survey included data from 75 individual coal mines, from firms representing over 52% of the national coal production in the U.S.

Table 2-1: Coal-Producing Areas in the U.S.

Coal Producing Region	Sub-Region	States Included
Appalachia	Northern Appalachia	1. Maryland; 2. Ohio; 3. Pennsylvania; 4. Northern West Virginia.
	Central Appalachia	1. Virginia; 2. Eastern Kentucky; 3. Part of Tennessee; 4. Southern West Virginia.
	Southern Appalachia	1. Alabama; 2. Part of Tennessee.
Interior	Illinois Basin	1. Illinois; 2. Indiana; 3. Western Kentucky.
	Other Coal Producing States in the Region	1. Arkansas; 5. Missouri 2. Kansas; 6. North Dakota 3. Louisiana; 7. Oklahoma 4. Mississippi; 8. Texas
Western	Powder River Basin	1. Northeastern Wyoming; 2. Southeastern Montana.
	Western Bituminous	1. Southern Wyoming; 2. Part of Colorado; 3. Part of Utah.

Figure 2-1: Major Coal-Producing Regions in the U.S.



This report includes a range of impacts depending on how the regulations are implemented. The responses gathered through the data collection process were in the form of notes by the interviewer, as well as detailed spreadsheets provided by the companies with information such as potentially lost reserves, increased costs of compliance, increased permitting costs, and reduced employment, among others. The following steps were involved in analyzing these data:

1. Data on a mine-by-mine basis were compiled into a master spreadsheet for synthesis and analysis.
2. In case there was any missing information or clarification needed, the company representatives were contacted again to minimize gaps in the analysis. In addition, some information for publicly traded companies was also derived or clarified from the Security and Exchange Commission's (SEC) Form 10-K filings.
3. The region and state for each mine was identified, along with the mining method and type of mining associated with the mine.
4. Data were analyzed on a mine-by-mine basis in order to achieve maximum accuracy. The key variable analyzed was the anticipated loss of coal reserves. Companies provided the accessible reserves under the present situation (baseline), as well as the reduction in these reserves under one or more interpretations of the proposed rules.
5. The results were aggregated by state and by type of mining. Each observation (mine) was weighted by the share of state production in the sample represented by the observation, and then and by the share of regional production represented by each state to produce results by region and type of mining.
6. The resulting percentage decrease in coal reserves was derived for each of the three coal producing regions and the U.S., and for underground and surface mining in each geographic unit.
7. The decrease in reserves was applied to the actual production data in each region and type of mining in order to derive the anticipated loss in annual production due to the proposed rules.
8. Based on the average prices for each region and the U.S., and for the two types of mining, the lost value of coal production was estimated for the three regions, the U.S., and for underground and surface mining in each.
9. Reserve losses were used to estimate declines in production and projected job losses.

2.6 Other Sources of Data

The main sources of information for this report are actual communications with, and data provided by, personnel from the coal companies. In addition to using primary data collected directly from coal companies, the analysis relied on data from reliable secondary sources. These data were used for understanding the current status of the coal industry, developing the baseline scenario for the analysis of potential impacts, and confirming or adding to the information collected through the primary data collection process. Following is a list of the major sources of secondary data:

- Department of Energy/Energy Information Administration (DOE/EIA)
- National Mining Association (NMA)
- Bureau of Labor Statistics (BLS)
- Mining Safety and Health Association (MSHA)
- Security and Exchange Commission – Form 10-K Filings by publicly traded coal companies (SEC)

2.7 Assumptions

The analytic framework for the study is based on the following key assumptions:

1. Production within the U.S. in the absence of the proposed rules will continue as per the current trends.
2. The regulatory environment will continue as it presently operates, which involves state-run mine permitting interpreted by local authorities.
3. Impacts evaluated are to include only those impacts that are attributable to the proposed SPR. For example, if a firm currently faces declining production or profitability, this is anticipated to continue both with, and without the rule in place.
4. Production numbers from the most recent publicly available U.S. data[2] are assumed to be representative of current production. These data are aggregated across mines found in the state and region; although prices, markets served, and coal quality vary significantly from mine to mine.
5. In order to estimate impacts on the entire country, it is assumed that the sample of mines analyzed is representative of other mines within the state and region, and within the country.
6. Estimates of reductions in reserves from the firms were developed using company-specific decision making processes which include estimates of risk and uncertainty associated with expected returns and include a measure of uncertainty surrounding the interpretation of the regulation.
7. This study does not involve estimates of the potential benefits of the proposed regulation, and neither does it address the question of whether or not the proposed regulation represents a least cost approach to achieving the desired outcome of the rules.

[2] Energy Information Administration. 2011. Quarterly Coal Report (QCR) October-December 2010. May.

2.8 Timeline for the Analysis

The analysis estimates effects based on activities that are "reasonably foreseeable," including, but not limited to, activities that are currently authorized, permitted, or funded, or for which proposed plans are currently available. This analysis considers economic effects from 2013 (anticipated year of the implementation of the proposed SPR).

3 Potential Economic Impacts of the Proposed Rules

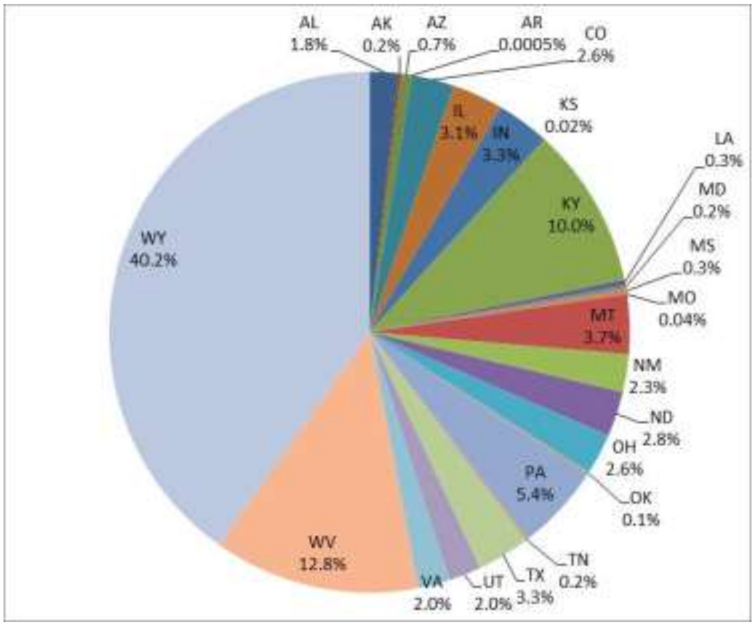
This chapter presents the anticipated economic impacts of the proposed rules. The first section outlines the context regarding production and value of coal in the country. The next section explains why and how certain key provisions in the proposed rules cause cost increases and/or loss of reserves based on information received from the coal companies. Then, the potential impacts on coal reserves are presented. This is followed by potential impacts on the value of production. Fifth, a discussion on impacts on the regional economy is presented followed by sections on potential impacts on employment; potential impacts to governments; potential impacts on consumers of electricity; and delays in the permitting process. Finally, a summary of all the impacts is presented.

3.1 Context – Production and Value of Coal

Critical to understanding the dynamics of the coal industry in the U.S. is to recognize the relationship, or lack thereof, between the production and value of coal. Figures 3-1 and 3-2 present the proportion of coal produced by state and the percentage of the value of coal attributable to each coal producing state, respectively. Almost 44% of coal in the U.S. is produced in northeastern Wyoming and southeastern Montana in the Powder River Basin (part of the Western region). However, in terms of value, the two states' share is only about 17%. The nine states within the Western region combined make up 55% of U.S. production, but account for only about 25% of value. On the other hand, 32% of U.S. coal produced in the Appalachian region, including, among others, the states of West Virginia, Pennsylvania, and Kentucky, makes up almost 61% of the value of this resource. The Interior region's 14% share of production accounts for about 15% of coal value in the U.S.

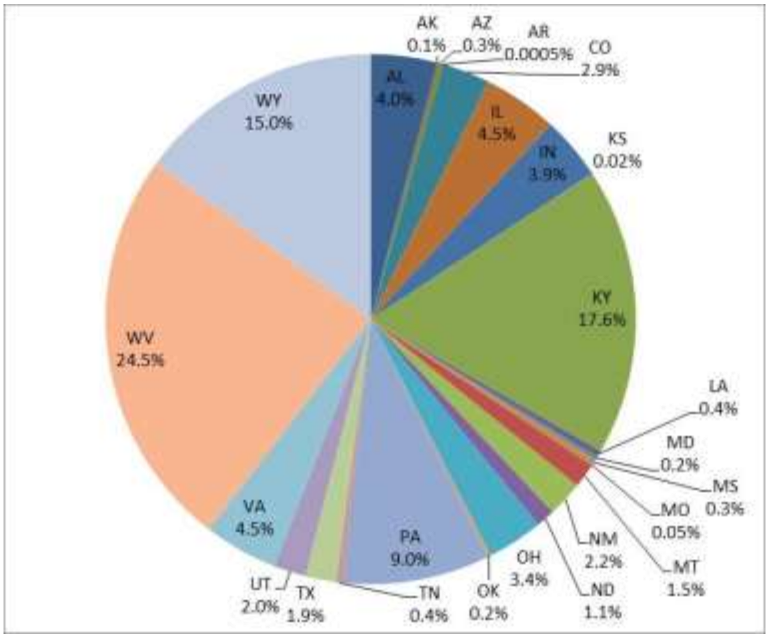
As is discussed in more detail in Appendix A, the reason behind this discrepancy is the difference in the price of coal. Several factors affect the price of this resource, the key ones being quality and rank (based on characteristics such as sulfur content and heat value), end use, mining method, size of mine, transportation costs, and accessibility to reserves see (Table 3-1). While on the one hand, reserves in the Appalachian region are becoming increasingly harder and more expensive to access due to mining over the years, those in the Western region are abundant, easier to mine and, thus, have lower production costs. Further, permitting costs are relatively higher in the Appalachia. Western coal also has lower sulfur content, which makes it more attractive and cost-effective for power plants that are faced with regulations limiting sulfur-dioxide emissions. Coal in the Powder River Basin within the Western region generally has lower heat value, and power plants have to blend it with coal with higher heat value in order to use it. These factors make the price of Western coal lower in the market. Therefore, given that value is a factor of both price and quantity produced, while the Appalachian region produces relatively less coal than the Western region, the higher price of that coal gives the former a much larger share of value overall.

Figure 3-1: Coal Production by State, 2009



Sources:
U.S. DOE/EIA. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.
U.S. Department of Labor, MSHA Form 7000-2, "Quarterly Mine Employment and Coal Production Report."

Figure 3-2: Distribution of Value of Coal by Production State, 2009



Sources:
U.S. DOE/EIA. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.
U.S. Department of Labor, MSHA. Form 7000-2. Quarterly Mine Employment and Coal Production Report.
U.S. EIA. Form EIA-7A. Coal Production and Preparation Report.

Table 3-1: Characteristics of Coal and their Effects on Relative Prices by Region

Coal Producing Region	Sub-Region	States Included	Rank of Coal Primarily Produced	Heat Value	Sulfur Content	Relative Prices
Appalachia	Northern Appalachia	Maryland; Ohio; Pennsylvania; Northern West Virginia	Anthracite; Bituminous	High 10,300 Btu – 13,500 Btu	High 0.8% – 4.0%	Higher than other regions
	Central Appalachia	Eastern Kentucky; Tennessee (part); Virginia; Southern West Virginia	Bituminous	High 11,400 Btu – 13,200 Btu	Low 0.2% – 2.0%	Higher than other regions
	Southern Appalachia	Alabama; Tennessee (part)	Bituminous	High 11,300 Btu – 12,300 Btu	High 0.7% – 3.0%	Higher than other regions
Interior	Illinois Basin	Illinois; Indiana; Western Kentucky	Bituminous	Higher 10,100 Btu – 12,600 Btu	High 1.0% – 4.3%	Lower than Appalachia; Higher than Western
	Other Coal Producing States in the Region	Arkansas; Kansas; Louisiana; Mississippi; Missouri; North Dakota; Oklahoma; Texas	Sub-bituminous; Lignite			Lower than Appalachia; Higher than Western
Western	Powder River Basin	Northeastern Wyoming; Southeastern Montana	Sub-bituminous	Low 8,000 Btu – 9,500 Btu	Low 0.2% – 0.9%	Generally lower than other regions
	Western Bituminous Region	Southern Wyoming; Colorado; Utah	Bituminous	Higher 10,000 Btu – 12,200 Btu	Low 0.4% – 0.8%	Generally lower than other regions

3.2 Potential Impacts on Coal Reserves

The key to understanding the larger impacts of the proposed rules is looking into how, and to what extent, the regulations might affect access to recoverable reserves. The primary data collection process involved asking the coal companies specific questions regarding this particular impact, given its significance for the analysis.

Aggregation to the sectors shown here – each sector being a combination of one of three geographic regions, and either surface or underground mining for a total of six sectors – was completed by assuming that the sample mines were representative of the sector and state where the mine is located. The potential losses at all mines within a particular state were averaged based on the magnitude of reserves represented in each mine. Then, the losses for all states within a sector were used to develop an average sector loss by taking a weighted average of the state losses based on the share of regional production seen in each state.

Tables 3-2(a) and 3-2(b) present the lower and upper ranges of the percentage decrease in recoverable reserves anticipated as a result of the implementation of the proposed SPR.

Table 3-2(a): Anticipated Percent Decrease in Recoverable Reserves with Proposed Steam Protection Rules - LOW RANGE

Region	Anticipated Percent Decrease in Recoverable Reserves with Proposed Stream Protection Rules		
	Underground	Surface	Total
Appalachia	38.1%	55.7%	44.5%
Interior	64.0%	22.7%	36.7%
Western	36.2%	16.1%	20.7%
Total U.S.	43.1%	23.8%	**30.4%**

Table 3-2(b): Anticipated Percent Decrease in Recoverable Reserves with Proposed Stream Protection Rules - HIGH RANGE

Region	Anticipated Percent Decrease in Recoverable Reserves with Proposed Stream Protection Rules		
	Underground	Surface	Total
Appalachia	68.0%	78.3%	78.6%
Interior	64.0%	23.4%	37.3%
Western	37.9%	16.3%	20.9%
Total U.S.	62.3%	28.1%	**41.5%**

The declines in recoverable reserves are anticipated for varying reasons; complete loss of reserves including loss of access to reserves, increased cost of production due to avoiding stream contours and possible damage to ground water (rendering fewer recoverable reserves economically available to mine), and in some cases, mine closures resulting from high costs due to variable operating costs. The largest decline is expected in the Appalachia region, where it is anticipated that between approximately 45% and 79% of the recoverable reserves would be lost if the proposed rules are implemented. Overall in the U.S., the decrease is anticipated to range between 30% and 42% in total coal production, with different sectors affected in different ways.

The significance of the loss of recoverable reserves is expected to result in different responses depending on the coal sector, the specific site characteristics of a mine, ability to change mining equipment types and continued mining productivity, firm-level business strategies, ability to pass additional costs onto the customers, and overall markets and prices. Some mines will continue producing but at reduced levels of output and employment; other mines will continue producing at current levels, but will simply exhaust reserves at an earlier time; others may have reduced annual production while maintaining current levels of labor and increasing costs. Some mines with contractual obligations will continue to mine but will incur higher costs per ton mined. Still others may be forced to shut down.

In terms of the loss in access to coal, the sectoral losses estimated above translate into an overall loss of coal production totaling 326 million tons nationwide under the low range, and over 445 million tons in the high range case. Tables 3-3(a) and 3-3(b) show how this varies from area to area. The Appalachian region shows the greatest volume of potential losses, with between 153 and 246 million metric tons of lost production. It should be noted that losses are based on estimates of known and defined reserves and might be expected to increase as more reserves or claims are made.

Table 3-3(a): Anticipated Change in Production of Coal with Proposed Stream Protection Rules (in Million Short Tons) - LOW RANGE

Region	Anticipated Decrease in Production under Proposed Rules		
	Underground	Surface	Total
Appalachia	80.0	73.3	153.3
Interior	43.2	17.7	61.0
Western	19.8	85.3	105.1
U.S. Total	143.0	176.2	**326.3**

Table 3-3(b): Anticipated Change in Production of with Proposed Stream Protection Rules (in Million Short Tons) - HIGH RANGE

Region	Anticipated Decrease in Production under Proposed Rules		
	Underground	Surface	Total
Appalachia	142.8	103.1	245.9
Interior	43.2	18.3	61.6
Western	20.7	86.2	106.9
U.S. Total	206.7	207.6	**445.0**

The implications of reduced recoverable reserves and subsequent production losses resulting from the proposed SPR will impact the total employment and output. The degree to which contractions in production occur in the near future will have an immediate impact on employment and output, while other impacts will occur through time. For the high impact range, 21 of the 75 mines are forecast to shut down. Assumptions for the shutdowns involved shifts away from coal use for electricity production in favor of lower-priced natural gas, infeasible extraction technology, and loss of access to reserves in order to avoid streams. The majority of shut downs (16 out of 21) were forecast to occur in Appalachia in the underground mines, which currently represent the largest sector contribution to direct output and direct employment in the U.S. coal mining industry.

3.3 Direct Economic Effect

The losses in recoverable reserves are further used to estimate losses in the value of coal output in each of the six sectors analyzed. In 2009, the total sale of coal produced was reported at $36.1 billion.[3] For the purpose of this analysis, average price data for each sector were developed based on data from the EIA and through primary data collected from coal companies. Coal prices vary widely according to the quality of coal, and the average prices in general represent a weighted average across all quality types in each sector. For example, coal mined in Western surface mines is typically of lower quality, selling at $12.80 per ton. The price of coal from Appalachia, while varying significantly within the region, averages around $64.00 per ton due to the significantly higher quality. The average prices for each sector are shown in Table 3-4 in 2010 dollars.

[3] U.S. Department of Energy/Energy Information Administration. 2011. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011; and primary data collected from coal companies.

Table 3-4: Average Price of Coal by Region and Type of Mining (in 2010 Dollars)

Region	Average Price		
	Underground	Surface	Total
Appalachia	$65.1	$62.0	$63.9
Interior	$46.3	$27.5	$36.8
Western	$39.8	$12.8	$15.5

Sources:
U.S. Department of Energy/Energy Information Administration. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.
Primary data collected from coal companies.

Using the average prices, the total value of coal production by sector is estimated based on 2009 production levels reported by the EIA. The total estimated current value of annual production is tallied at $36.1 billion using this method. Although the contraction in production is likely to occur across time in a varying degree, once the full impact of the contraction is reached the anticipated decrease in coal mining output is estimated to be between $14 billion under the low impact range and $20 billion annually under the high. The largest decrease in output is projected to occur in Appalachia which represents the largest direct contributor in economic output. In the low impact range, Appalachia is anticipated to decrease output by $9.7 billion and in the high impact range the decrease is estimated at $15.7 billion annually. Results are shown in Tables 3-5(a) and 3-5(b).

Because the prices are higher in sectors that are more affected by the regulation, the total potential effect of the proposed regulation on the value of coal production represents a higher percent of total coal value than total production. While the national impact of the rule shown in Tables 3-2(a) and 3-2(b) shows a contraction in recoverable reserves totaling 30.4% in the low range and 41.5% in the high range, the parallel contraction in annual production value represents a 39.2% loss under the low range and 55.8% in lost value with the high range (see Table 3-6). These data show again that the Appalachia region is expected to lose a greater share of production than the other regions with between 44.7% and 71.9% losses under the low and high ranges respectively. Also, the underground mining is anticipated to lose more than surface mining at the national level, with between 42 % and 64% in potential lost value forecast. This compares with estimated losses of 36% to 47% in the surface mining sector.

Table 3-5(a): Coal Value at Risk under Proposed Stream Protection Rules (in Millions of 2010 Dollars) - LOW RANGE

	Current Value	Secure Value under Proposed Rules	Value at Risk under Proposed Rules
Appalachia Underground	$13,660	$8,453	$5,207
Appalachia Surface	$8,163	$3,616	$4,547
Appalachia Total	$21,823	$12,069	**$9,754**
Interior Underground	$3,128	$1,127	$2,001
Interior Surface	$2,148	$1,661	$487
Interior Total	$5,277	$2,788	**$2,488**
Western Underground	$2,176	$1,389	$787
Western Surface	$6,775	$5,686	$1,089
Western Total	$8,951	$7,075	**$1,877**
U.S. Underground	$18,964	$10,969	$7,996
U.S. Surface	$17,087	$10,963	$6,124
U.S. Total	**$36,051**	**$21,932**	**$14,119**

Table 3-5(b): Coal Value at Risk under Proposed Stream Protection Rules (in Millions of 2010 Dollars) - HIGH RANGE

	Current Value	Secure Value under Proposed Rules	Value at Risk under Proposed Rules
Appalachia Underground	$13,660	$4,364	$9,295
Appalachia Surface	$8,196	$1,778	$6,419
Appalachia Total	$21,856	$6,142	**$15,714**
Interior Underground	$3,128	$1,127	$2,001
Interior Surface	$2,148	$1,645	$503
Interior Total	$5,277	$2,772	**$2,504**
Western Underground	$2,176	$1,352	$825
Western Surface	$6,775	$5,673	$1,102
Western Total	$8,951	$7,025	**$1,926**
U.S. Underground	$18,964	$6,843	$12,121
U.S. Surface	$17,120	$9,097	$8,023
U.S. Total	**$36,084**	**$15,939**	**$20,145**

Table 3-6: Percent of Coal Value at Risk under Proposed Stream Protection Rules

	Percent Value at Risk - LOW RANGE	Percent Value at Risk - HIGH RANGE
Appalachia Total	44.7%	71.9%
Interior Total	47.2%	47.5%
Western Total	21.0%	21.5%
U.S. Underground	42.2%	63.9%
U.S. Surface	35.8%	46.9%
U.S. Total	**39.2%**	**55.8%**

Under the high impact range, 21 of the 75 mines are forecast to shut down. The reasons for shutdowns are directly related to loss of mineable reserves in order to avoid streams, low productivity resulting in high cost of mining, inability to provide a consistent supply to consumers, infeasibility of current extraction technology/productivity (both in technical as well as economic terms), and assumptions that electric utilities will shift toward currently low-priced natural gas in hopes of reducing the uncertainty of coal production and prices. The majority of shut downs (16 out of 21) were forecast to occur in Appalachia in the underground mines which represent the largest contributor to direct output and direct employment in the coal mining industry (see Tables 3-5(a) and 3-5(b)). More about how and why the SPR will have the anticipated effect can be found in Appendix B.

3.4 Impacts to the Regional Economy

Changes in the coal mining sector will also indirectly impact industries that provide inputs to coal mining. In addition, the change in output and employment means fewer workers will be earning an income, leading to additional impacts occurring in industries that support household consumption. Together, these impacts are known as the direct, indirect, and induced impacts to a regional economy.

The estimated total change in output was derived using multipliers from the PricewaterhouseCoopers (PWC) study (see Section A.2.4 in Appendix A of this study for a description of the research). The PWC study reported estimates of multipliers for the contribution to gross domestic product (GDP), or the value-added metric. These multipliers capture the same ripple effect of indirect and induced contributions to GDP associated with coal mining activity, and therefore will be applied to the impact assessment in this report to provide an estimate of the total impact of the proposed rule. PWC estimated a national multiplier of 2.23.[4] This multiplier means that for every $1 contributed (or subtracted) to GDP from coal mining production directly, the total impact is $2.23. The contribution to GDP multipliers for each region was derived from the PWC study by estimating the weighted average for each

[4] PricewaterhouseCoopers. 2010. *The Economic Contributions of U.S. Mining in 2008*. A report prepared for the National Mining Association

region using the reported multipliers for each state. Multipliers vary at the regional level due to the different economic linkages (see Table A-5 in Appendix A).

The results indicate that if the full 30.4% reduction in coal production were to fully occur in the immediate future and result in the estimated $14,119 million reduction in coal production, the total loss in contribution to GDP could be $26,084 million (see Table 3-7(a)). If the full 41.5% reduction in production were to fully occur in the immediate future, the associated loss of $20,142 million in coal production could result in $36,306 million reduction in the total contribution to GDP (Table 3-7(b)).

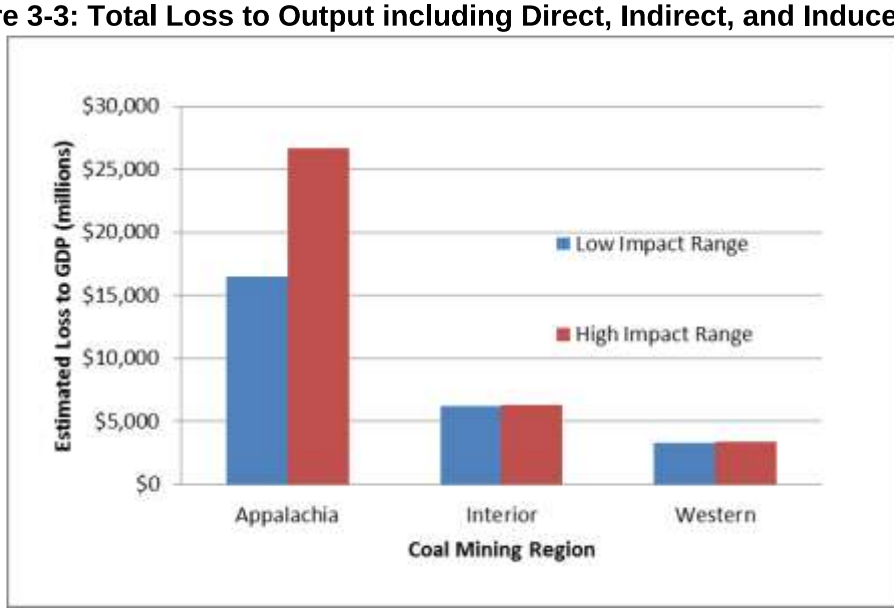
Table 3-7(a): Total Impact on Output - LOW IMPACT RANGE (Millions of 2010 Dollars)

Type of Mine	Effective Multiplier	Direct Impact on Output	Indirect and Induced Impact	Total Impact on Output
Underground	1.90	$7,996	$7,236	$15,232
Surface	1.77	$6,124	$4,728	$10,852
U.S. Total	1.85	$14,120	$11,964	$26,084

Table 3-7(b): Total Impact on Output - HIGH IMPACT RANGE (Millions of 2010 Dollars)

Type of Mine	Effective Multiplier	Direct Impact on Output	Indirect and Induced Impact	Total Impact on Output
Underground	1.83	$12,121	$10,100	$22,221
Surface	1.76	$8,023	$6,062	$14,085
U.S. Total	1.80	$20,144	$16,162	$36,306

Figure 3-3: Total Loss to Output including Direct, Indirect, and Induced Effects



3.5 Employment

In 2010, employment in the coal industry was reported at 135,533, with 89,209 operator employees and 46,324 contractors.[5] At the national level, the employment impact due to the estimated full decrease in access to reserves is predicted to range from 55,120 jobs for the low impact range (30.4% reduction in production) to 79,870 jobs for the high impact range (41.5% reduction in production). Since the average annual income for coal mining in 2010 was reported at $77,475 which was 67% higher than the average annual income in the U.S.[6] job losses in this sector represent significant lost wages.

In addition to the employment directly related to the coal mining sector, employment multipliers have again been developed to demonstrate the total economic impact showing the linked industries that could also be affected. The PWC study estimated a national employment multiplier of 3.61 for the coal mining industry.[7] This implies that for every worker directly employed in the coal mining industry, 2.61 additional jobs are created in the national economy, with the total impact representing 3.61 jobs. Just as with the value added multipliers, the multiplier impacts vary across regions due to the different degree of inter-connection within regional economies (see Table A.2.3 in Appendix A).

The employment multipliers for each region were developed based on IMPLAN modeling results, a review of similar studies, and MSHA mining employment numbers.[8] The total direct employment in the MSHA data captures both mining employees and contract workers. The multiplier used in the Low Impact Range is 2.42 and the multiplier for the High Impact Range is 3.42. These multipliers bracket the range of values found in similar studies of employment impacts (see Table A-5 in Appendix A). The results indicated that if the full 30.4% reduction in coal production were to occur in the immediate future and result in 55,120 jobs lost, then the total national impact could be 133,441 jobs (Table 3-8(a)). If the full 41.5% decrease were to occur, the associated 79,870 direct jobs lost would expand to 273,227 jobs in the national economy (Table 3-8(b)). Figure 3-4 illustrates the total impact expected to occur in the different coal mining regions.

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[5] U.S. Department of Labor, Mine Safety and Health Administration. MSHA Accident, Illness, and Injury and Employment Self Extracting Files (Part 50 Data).

[6] National Mining Association. 2011. "Annual Coal Mining Wages vs. All Industries, 2010." Updated September, 2011.

[7] PricewaterhouseCoopers. 2010. *The Economic Contributions of U.S. Mining in 2008*. A report prepared for the National Mining Association.

[8] Mine Safety and Health Administration. www.msha.gov

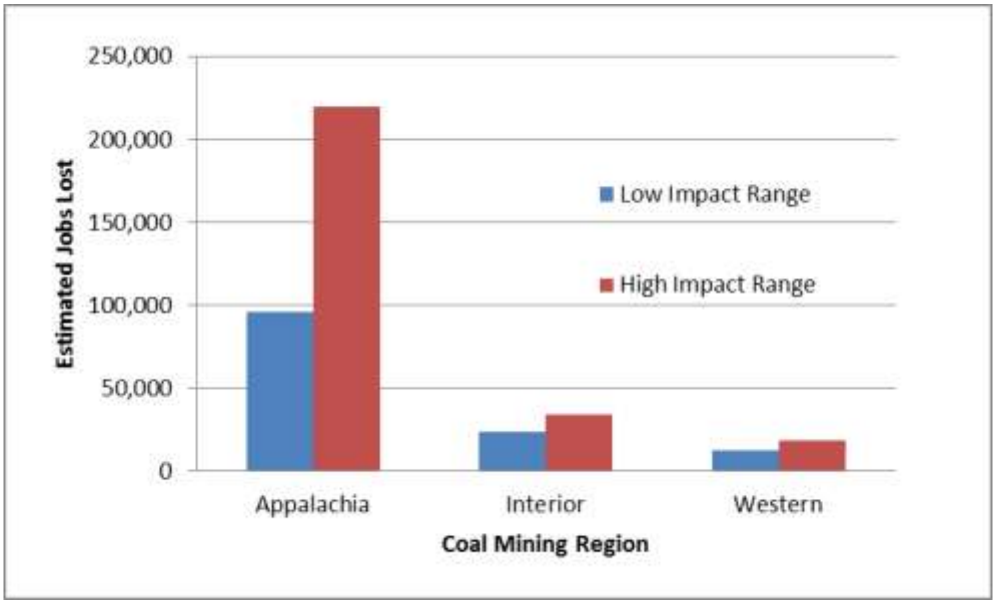
Table 3-8(a): Anticipated Decrease in Employment by Region with Proposed SPR in Place – LOW IMPACT RANGE				
Region/Type of Mine	**Direct Employment**	**Direct Jobs at Risk**	**Total Direct and Indirect Jobs**	**Direct and Indirect Jobs at Risk**
Appalachia	89,712	39,788	306,897	96,323
Interior	21,642	9,965	74,037	24,125
Western	24,178	5,367	82,712	12,992
Underground	77,521	32,574	265,192	78,859
Surface	58,012	22,546	198,454	54,582
U.S. Total	**135,533**	**55,120**	**463,646**	**133,441**

Table 3-8(b): Anticipated Decrease in Employment by Region with Proposed SPR in Place – HIGH IMPACT RANGE				
Region/Type of Mine	**Direct Employment**	**Direct Jobs at Risk**	**Total Direct and Indirect Jobs**	**Direct and Indirect Jobs at Risk**
Appalachia	89,712	64,311	306,897	220,003
Interior	21,642	10,035	74,037	34,328
Western	24,178	5,524	82,712	18,896
Underground	77,521	50,035	265,192	171,165
Surface	58,012	29,835	198,454	102,062
U.S. Total	**135,533**	**79,870**	**463,646**	**273,227**

In the low impact range, the decrease in reserves is estimated to be 30%, which is expected to lead to a 29% reduction in employment. For the high impact range, the 42% reduction in recoverable reserves is anticipated to reduce direct employment by 59%, with job loss potential reaching as high as 72% in the Appalachia region. This is because the sectors of coal production anticipated to be most affected are those that are more labor-intensive, or have higher employment requirements per ton of coal produced. For example, in underground mining, the average national number of employees needed to produce 1,000,000 short tons of coal is 151, compared to 51 for surface mining. In Appalachia, the average number of employees needed to produce 1,000,000 short tons is 170, compared to 27 in the Western region (see Figure A-14 in Appendix A).[9]

[9] Numbers derived from data obtained at Department of Energy. Report Number DOE/EIA-0584 (2009) and U.S. Department of Labor, Mine Safety and Health Administration Form 7000-2, "Quarterly Mine Employment and Coal Production Report."

Figure 3-4: Total Jobs at Risk from Proposed SPR



3.6 Potential Impacts on State, Local, and Tribal Governments

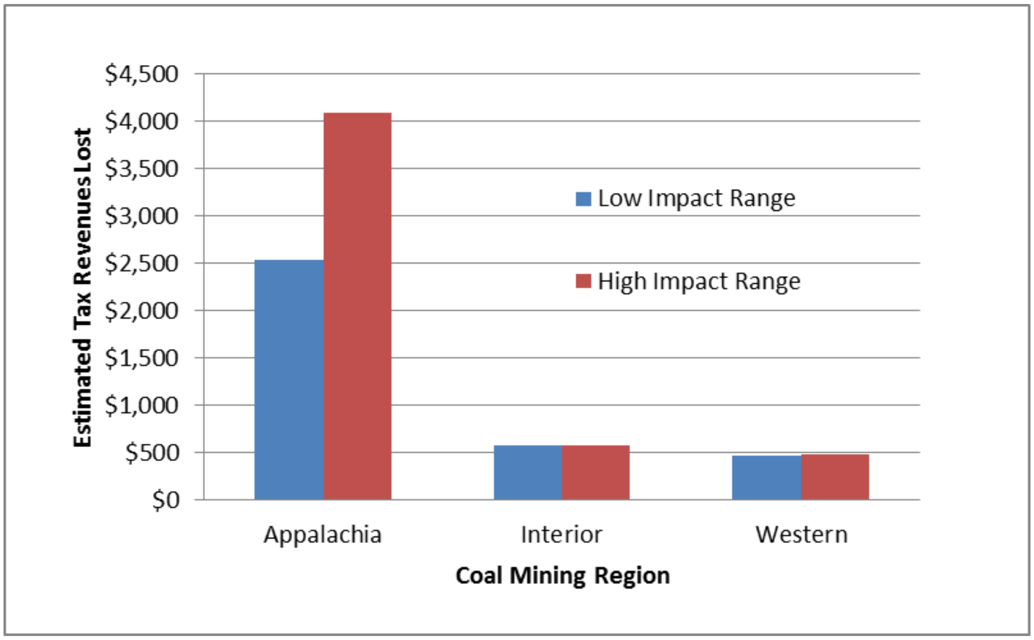
The PWC study reported a national total impact to taxes from coal of $16,456 million.[10] The estimated decrease in coal production will result in a direct loss to state and federal income due to a decrease in taxable coal mining revenue. In addition, the decrease in economic activity will generate indirect and induced impacts that will further affect the flow of tax payments to government. For the purpose of this analysis, the estimated impact to taxes was derived using the reported total impact to taxes by state and the total contribution to GDP by state reported in the PWC study. This information provided an estimated tax rate for each coal mining region. The derived tax rate was applied to the anticipated loss in coal production resulting in an estimated total loss in tax revenue. Potential impacts to taxes are reported below in Tables 3-9(a) and 3-9(b). The results indicate if the full 30.4% reduction in coal mining production were to occur, the estimated loss in total tax revenue is $3,587 million annually. If the full 41.5% reduction in coal mining production were to occur than the estimated loss total tax revenue could be $5,156 million. The largest loss in tax revenue for the high impact range is expected to occur in Appalachia. The impact can potentially be as high as $4,094 million which is 79% of the anticipated total loss in tax revenue. Figure 3-5 illustrates the expected impact to taxes for the three different coal mining regions.

[10] PricewaterhouseCoopers. 2010. *The Economic Contributions of U.S. Mining in 2008*. A report prepared for the National Mining Association.

Table 3-9(a): Tax Low Impact Range – 30.4% Reduction in Production			
Region	**State**	**Federal**	**Total**
Appalachia	$1,287 million	$1,254 million	**$2,541 million**
Interior	$325 million	$254 million	**$578 million**
Western	$251 million	$217 million	**$468 million**
U.S. Total	**$1,863 million**	**$1,725 million**	**$3,587 million**

Table 3-9(b): Tax High Impact Range – 41.5% Reduction in Production			
Region	**State**	**Federal**	**Total**
Appalachia	$2,074 million	$2,020 million	**$4,094 million**
Interior	$327 million	$255 million	**$582 million**
Western	$257 million	$223 million	**$480 million**
U.S. Total	**$2,658 million**	**$2,498 million**	**$5,156 million**

Figure 3-5: Estimated Total Impact to Federal, State, and Local Governments



Ultimately, if the coal industry were to contract production under the proposed SPR, it is likely that other energy producing industries, such as natural gas, would see increases in demand and would experience expansions so that the nation's energy needs would be met and the taxes might be provided from other industries. With these expansions, there would be an increase in employment and tax revenues in those alternative sectors. However, the expansion in the substitute sectors would lag behind a contraction in the coal sector, thus creating the potential for aggravation of current budgetary challenges facing governments at all levels as well as unemployment nationwide.

Finally, lease payments, rents, and royalties paid to the federal government and tribal governments (as well as to private landholders) will decline with any contraction of the industry. Lease rights may be defaulted, and the recipients of these income streams will lose the income streams. This can be particularly difficult for the tribal governments who depend on the income to support services for populations that do not have as strong a tax base as is seen on non-tribal lands.

3.7 Potential Impacts on Consumers of Electricity

As outlined previously, one of the drivers of electricity prices is the cost and type of fuel used. Although the price of natural gas tends to be the fuel with the greatest impact on electricity prices, the scarcity of any fuel can cause the price of electricity to rise. If the availability of coal begins to decline, with load demand the same, first the immediate demand for coal would remain the same, as substitution to another fuel at any particular plant is not a viable option, and this would increase the price of coal as fuel. Because the vast majority of coal is sold on contract to utilities, price increases might be slow to move into the electricity sector. However, many contract coal sales have clauses allowing the coal producer to pass on costs that stem from regulatory changes. Whether or not coal producers will be able to enforce these clauses remains a source of uncertainty in the minds of many producers, and so the degree to which cost increases will translate into contract coal sales (and utility price increases) remains to be seen.

If long-term supply of coal for fuel remained at the reduced level, it would most likely force the substitution of another fuel (most likely natural gas) through the construction of a new plant, retiring the coal-fired plant or plants. This would then most likely drive the price of the substituted fuel (natural gas) higher, thereby increasing the cost to produce electricity. As most electric service providers pass the cost along to the customers, this would increase the cost of electricity at the end-user level for all sectors of the economy including the energy-intensive manufacturing sector which likely will also suffer loss of business and jobs as they become less competitive globally.

3.8 Delays in Permitting Process

Participating coal producing firms were asked about the potential for permitting delays, additional permitting costs, and the costs associated with additional delays. Currently, some states allow continuation of mining while permitting data is still in process. One respondent said that additional baseline collection will certainly delay the permitting process and will be proportional to the additional monitoring time required. This spells a different story for smaller firms. If a firm cannot expect to have a permit approved in a reasonable time frame due to an increased monitoring period then operations may not progress from one reserve to the next. This could result in an opportunity cost, or even loss of jobs.

3.9 Summary of Potential Economic Impacts

This chapter has estimated the economic impacts of the proposed stream protection rule from OSM. Impacts quantified include:

- Total number of jobs at risk of loss, including mining and linked sector employment is between 133,441 and 273,227 (29% to 59% of current employment levels), with the Appalachian region alone losing as many as 220,003 jobs.
- Direct mining jobs at risk of loss are predicted to be between 55,120 and 79,870, with the majority of these job losses being in the Appalachian region.
- The overall decrease in recovery of demonstrated coal reserves is between 30.4% and 41.5%; both surface and underground mines will be significantly impacted.
- The annual value of coal lost to production restrictions is $14 billion to $20 billion.
- Total annual federal and state tax revenue potentially foregone because of lost production is estimated at $4 billion to $5 billion.

4 Conclusions and Discussion

This study involved interviews with coal producers representing over 52% of U.S. annual production. Small, medium, and large producers were interviewed regarding the potential impacts to their businesses as a result of a proposed SPR currently under consideration by the OSM. The results of the interviews demonstrate that impacts would be different for different operators depending on the state and region of the country, quality of coal produced, the number of streams in the area, the type of mining, local hydrology, proximity to customer base, operating margins, and many other factors. Detailed estimates of how mining plans would be altered at 75 different mines were developed. Assuming those analyses are representative of other mines in the same region and for the same type of mine, the result would be a nationwide loss in access to recoverable reserves ranging from 30.4% to 41.5%, with greater impacts concentrated in the more valuable coal resource areas in the Appalachia.

An impact on employment is anticipated to occur as a result of implementation of the proposed SPR due to a likely contraction of the coal industry; the degree of impacts can be estimated from the survey information and is expected to be immediate or in the short term, though details of the timing of the impact remain uncertain. If the low impact range (30.4% contraction in production) were to occur immediately, the associated employment would be a 41% loss of employment due to the labor intensity of the mines that would be affected. Under the high impact range, the employment decline would be 59%, or 79,870 direct jobs at risk. A more likely range is that the magnitude of the initial impact on the industry will be somewhat smaller than the estimated 30% to 42% decline, with the additional impact occurring over time. Further, the combined increases in cost and decreases in mineable reserves will result in upward pressure on energy prices, thus indirectly influencing a much wider share of the overall economy.

4.1 Understanding the Industry Response

As described above in section 2.4 (Primary Data Collection), the response to the proposed rules was based on confidential discussions with firms regarding the contents of the proposed SPR; the changes from the previous rule; and how this might affect each firm. Responses varied widely from mine to mine, and participants solicited detailed data from individual mine operators. Some respondents prepared internal analyses of the anticipated impacts of these proposed rules on their own mines prior to the decision to conduct this study, indicating that such numbers are what operators are actually using in their own long-term mine planning.

Under the high impact range, the number of mines anticipating shut down is 21, or 28% of the 75 mines in the sample. For the remaining mines, there was an anticipated loss of access to reserves resulting from the proposed rules, and firm strategies for responding to this fall loosely into three responses to this impact:

- Continue producing at the same level, and close mine earlier than would have happened otherwise, thus decreasing employment over time;
- Produce less on an annual basis (in effect raising costs/ton) which will decrease employment immediately and over time; or

- Increase production at other mines in order to meet annual output targets (in effect raising costs/ton) which may decrease employment over time.

The decision regarding which of these alternatives to select will also vary from firm to firm and from mine to mine. For this reason, the timing of anticipated contractions/cost increases/shut downs is not clear. However the impacts have been assessed for recoverable reserves and have been measured at active mines. Consequently, it is likely that the adjustments will begin immediately upon acceptance of the proposed regulations, and can be expected to occur throughout the life of the existing mines.

Differential impacts are anticipated across different geographies and types of mining. Responses between small and large firms are also expected to differ. In general, increased costs of permitting, and financial assurances and security bonds are up-front costs that are more easily assumed by larger firms that can spread the cost across a large volume of existing output. Smaller firms operate on smaller profit margins and will have greater difficulty responding to the upfront costs. Further, small firms are more susceptible to the risk of being shut down even temporarily because it will dramatically influence their income. Therefore, uncertainties described above are more pronounced in terms of feasibility decision-making. Additional explanations of the specific determinations that lead to estimates of lost access to reserves are provided in Appendix B - Loss of Reserve Access Examples.

4.2 Associated Impacts

The potential associated impacts estimated in this report suggest that significant effects in industries linked to the coal industry are possible with the acceptance of the proposed regulation. The pace and magnitude of the associated impacts will also depend entirely on the pace and magnitude of the impacts within the industry. These associated impacts measured include economic contractions in:

- Industries with backward linkages (indirect impacts) to the industry, and industries that benefit from incomes provided through coal production (indirect impacts);
- Industries linked through transportation and other businesses that support coal production;
- Industries with forward linkages, such as steel production and electricity generation;
- Tax impacts on federal, state, and local governments;
- Foregone lease payments, rents, and royalties to private landowners, the federal governments, and tribal governments.

As these associated impacts occur, the affected industries will contract, causing declines in output and employment in the associated economic sectors. Additional risks should be considered as any contraction in one sector implies contraction in others, and each affected sector is linked to many other sectors, just as the coal industry is linked to many others. Further, there is the possibility that simultaneous risks can compound upon each other and result in more system slowdowns. While some compensating increase in employment and output may be anticipated in the environmental science and consulting sector, and presumably in state agencies responsible for enforcing the new regulation, such increases are not anticipated to significantly compensate for job losses in the coal industry and related sectors.

4.3 Uncertainty

Many economic analyses assume the economy is at or near full employment conditions. Therefore job losses associated with a rule's impacts are assumed to be quickly subsumed within the economy. Currently the US economy is not at full employment. Potential job losses from the rule are not likely to be readily absorbed in the short term and for some regions of country these jobs losses may be permanent.

4.4 Conclusion

The results of this study suggest that the SPR as proposed would result in loss of 30.4% to 41.5% of the recoverable reserves at active mines. Associated employment impacts are expected to range between 133,000 and 273,000 lost jobs, including impacts to industries linked to the coal industry. Industries supplying inputs to the coal industry will experience an associated loss of revenue. Additional impacts can be expected in the steel and electricity industries as coal supplies are constrained and more costly reserves are accessed, both activities putting upward pressure on prices. Municipal, tribal, state, and federal governments will experience decreased tax, royalty, and fee revenues.

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Appendix A

Overview of Coal Mining Industry in the United States

A. Overview of Coal Mining Industry in the United States

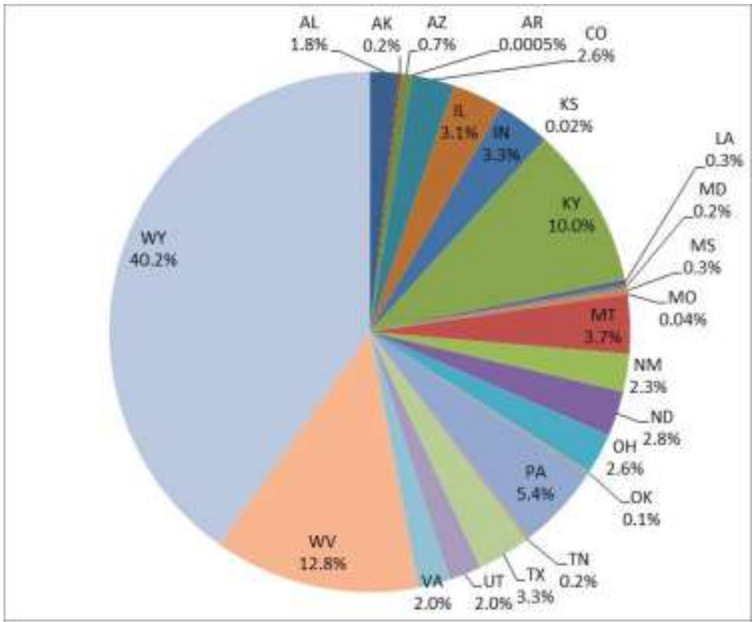
Coal is an important energy source in the U.S., and has been used for that purpose for hundreds of years. In addition to providing energy for domestic heating and cooking, it has historically played a critical role in transportation, energy for industrial applications, and generation of electricity. The use of coal has grown over time due to the abundance of coal reserves in the U.S. and the availability of this resource at relatively low prices. At present, almost 94% of coal produced in the U.S. is used for power production. This appendix provides an overview of the coal mining industry in the U.S., and looks at the trends, future outlook, and key factors impacting coal. The data presented here also provides a baseline for analyzing the potential effects of the proposed rules on the coal mining industry.

A.1 Trends in Coal Mining, Future Outlook, and Key Factors Impacting Coal

Critical to understanding the dynamics of the coal industry in the U.S. is to recognize the relationship, or lack thereof, between the production and value of coal. Figures A-1 and A-2 present the proportion of coal produced by state and the percentage of the value of coal attributable to each coal producing state, respectively. Almost 44% of coal in the U.S. is produced in northeastern Wyoming and southeastern Montana in the Powder River Basin (part of the Western region). However, in terms of value, the two states' share is only about 17%. The nine states within the Western region combined make up 55% of U.S. production, but account for only about 25% of value. On the other hand, 32% of U.S. coal produced in the Appalachian region, including, among others, the states of West Virginia, Pennsylvania, and Eastern Kentucky, makes up almost 61% of the value of this resource. The Interior region's 14% share of production accounts for about 15% of coal value in the U.S.

As is discussed in more detail later in this chapter, the reason behind this discrepancy is the difference in the price of coal. Several factors affect the price of this resource, the key ones being quality and rank (based on characteristics such as sulfur content and heat value), end use, mining method, size of mine, transportation costs, and accessibility to reserves. While on the one hand, reserves in the Appalachian region are becoming increasingly harder and more expensive to access due to mining over the years, those in the Western region are abundant, easier to mine and, thus, have lower production costs. These, in turn, render coal produced in the Appalachian region more expensive. Further, permitting costs are relatively higher in the Appalachia. Western coal also has lower sulfur content, which makes it more attractive and cost-effective for power plants that are faced with regulations limiting sulfur-dioxide emissions. Coal in the Powder River Basin within the Western region generally has lower heat value, and power plants have to blend it with coal with higher heat value in order to use it. These factors make the price of Western coal lower in the market. Therefore, given that value is a factor of both price and quantity produced, while the Appalachian region produces relatively less coal than the Western region, the higher price of that coal gives the former a much larger share of value overall.

Figure A-1: Coal Production by State, 2009



Sources:
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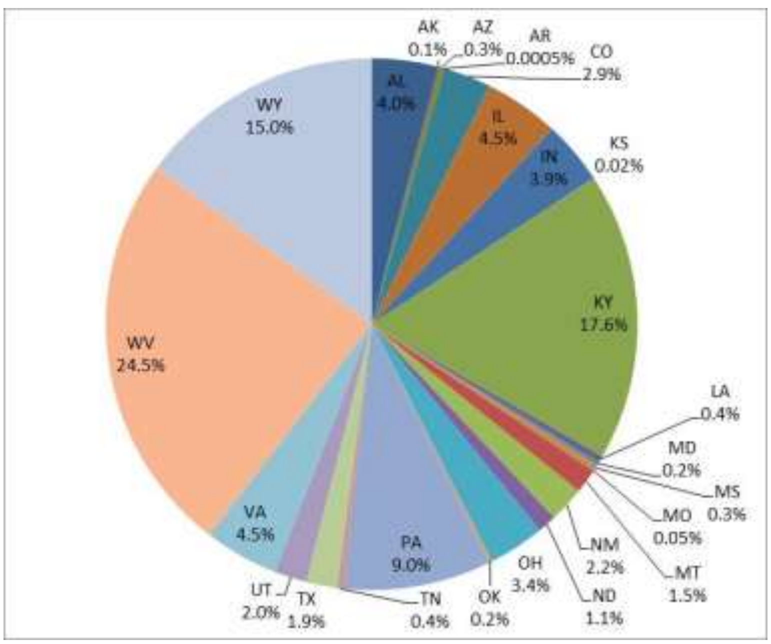
Figure A-2: Distribution of Value of Coal by Production State, 2009



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A.1.1 Trends in Coal Production

Coal production in the U.S. has been steadily increasing, in general, for many decades. From approximately 560 million short tons in 1950, it has grown to almost 1.08 billion short tons in 2010. The main reasons behind this rapid increase include, among others, abundant domestic coal reserves, increasing mine productivity due to better technology and larger mines, high demand, the 1973 Oil Embargo, and the 1978 Power Plant and Industrial Fuel Use Act (which mandated conversion of most existing oil-burning power plants to coal or natural gas). As presented in Figure A-3, the production of coal has been somewhat fluctuating over the past few years, primarily due to the recent economic recession. However, more recent analyses suggest that following the economic downturn, production is beginning to rebound.

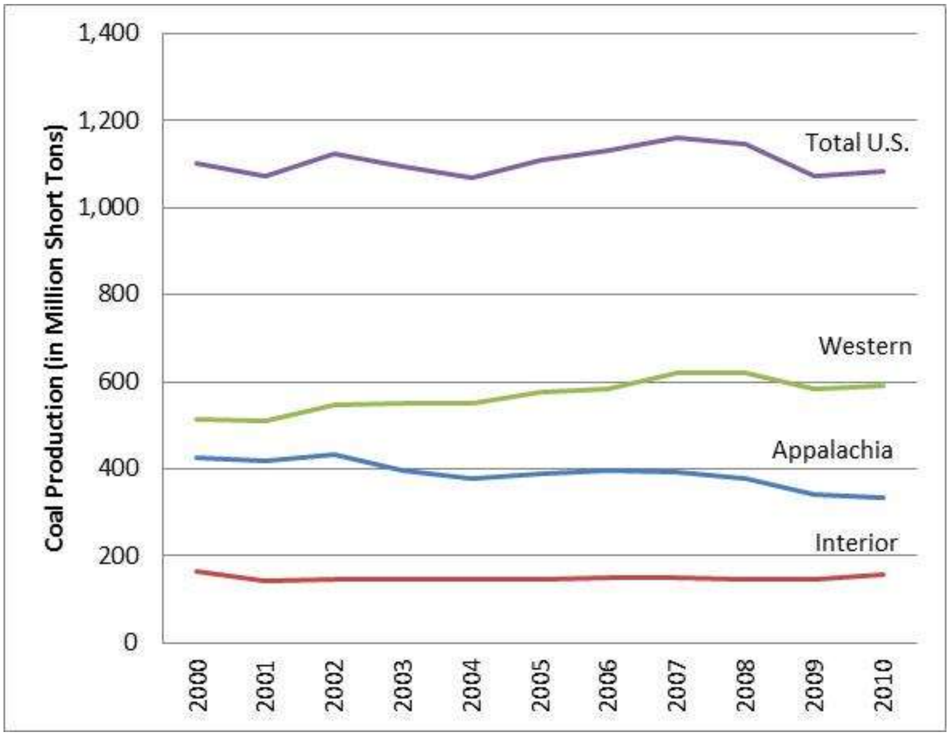
One of the most noteworthy trends in coal production in the U.S. over the past three decades is the increasing shift of production from the eastern states to the west. This is primarily occurring due to the presence of extensive beds of low sulfur coal with low mining costs in the states of Wyoming, Montana, and North Dakota. Strict regulations on sulfur emissions over the past decades have rendered purchasing this cheap coal from the west more feasible for power plants than to install costly equipment for meeting sulfur dioxide limits. Further, cheap transportation of the resource through unit trains and the development of huge surface mines in the west have further enhanced the cost-effectiveness of Western coal.

Between 1970 and 2010, coal production in the Western region increased over 16-fold, and is dominated by surface mining. In 1970, Western production was 31.8 million short tons. It rose to 187.8 million short tons by 1980, to 296.6 million short tons by 1990, to 454.9 million short tons by 2000, and to 522.3 million short tons by 2010.

Unlike the growth in the Western region, production in the Appalachian region has not changed much during the past 40 years. In 1970, Appalachian production was 529.6 million short tons. Production was 608.2 million short tons in 1980, 409.7 million short tons in 1990, 528.9 million short tons by 2000, and only 444.4 million short tons by 2010.

Similar to Appalachia, coal production in the Interior region also has changed little over the course of the last 40 years. Interior production was 158.3 million short tons in 1970; 202.9 million short tons in 1980; 167.2 million short tons in 1990; 136.2 million short tons in 2000; and 146.3 million short tons in 2010.

Figure A-3: Coal Production by Region, 2000-2010



Note: 2010 data are preliminary estimates.
Sources:
U.S. Department of Energy/Energy Information Administration. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.
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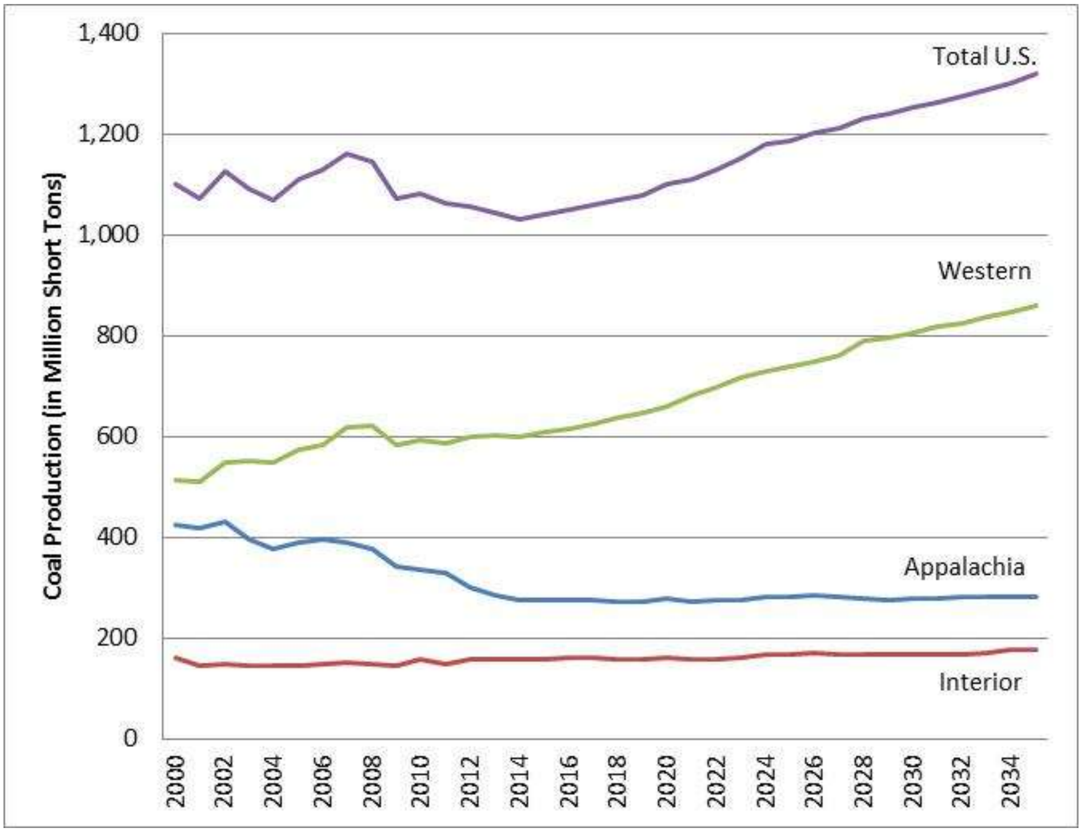
It is projected that the Western coal production would further increase in the coming decades, making up 65 percent of all production by 2035 (compared to 55 percent in 2010), while the proportion of production from the Appalachia region would decrease to 21 percent in 2035 (from 31 percent in 2010) (see Figure A-4).

Figure A-4: Past, Current, and Projected Future Coal Production by Region, 2000-2035



Note: 2010 data are preliminary estimates.
Sources:
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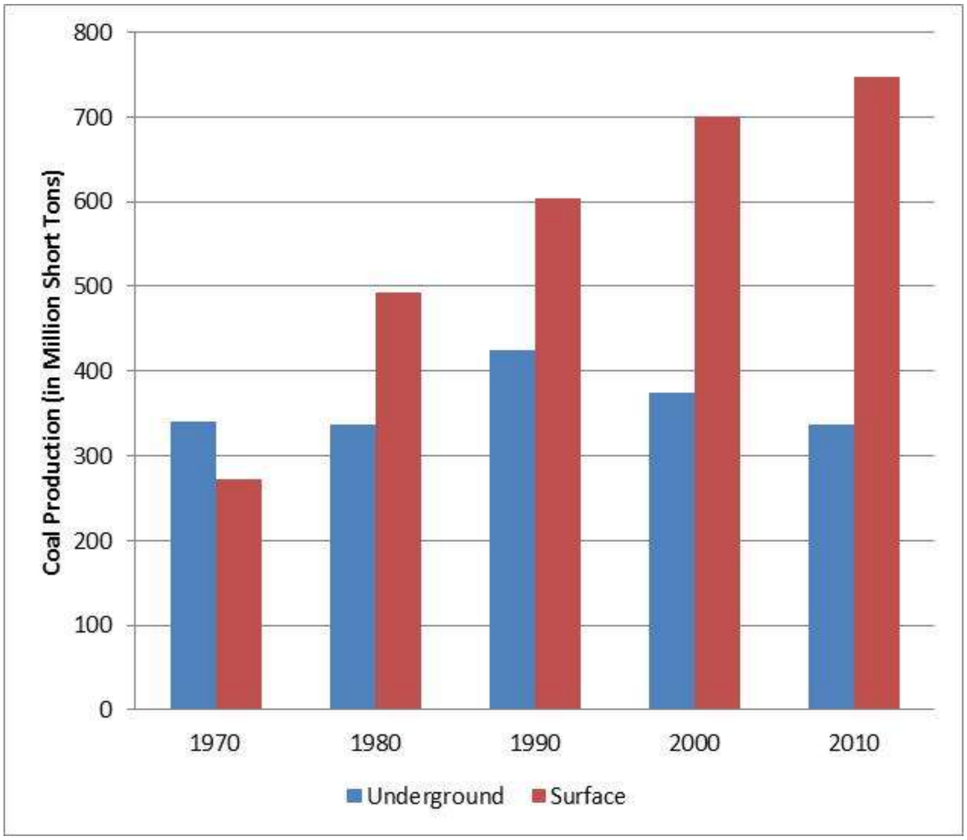
Another important trend in coal mining over the past few decades is the increasing shift from underground to surface mining. As presented in Figure A-5, underground mining still dominated surface mining in 1970. The two types of mining shared 50% of production each in 1973. However, between 1970 and 2010, the share of production from underground mines declined by almost a third, from 56% to 31%.

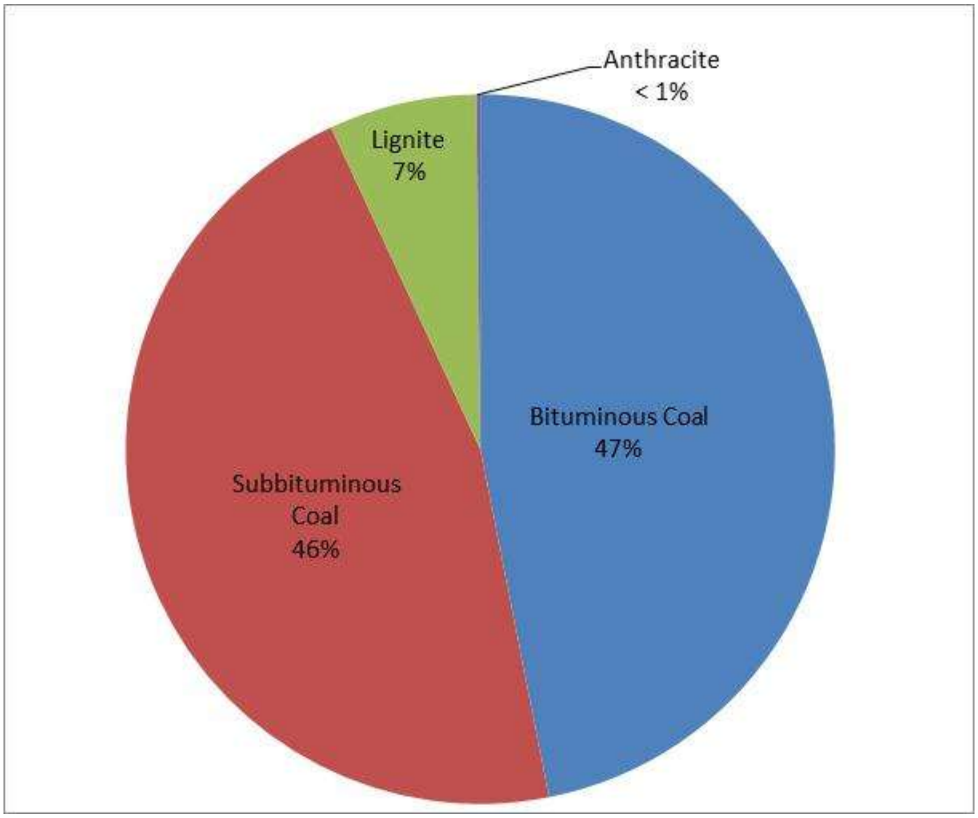
Figure A-5: Change in Distribution of Coal Production by Mining Method over Time, 1970-2010



Note: 2010 data are estimates.
Sources:
U.S. Department of Energy/Energy Information Administration. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.
U.S. Department of Energy/Energy Information Administration. Report Number DOE/EIA-0584. Annual Coal Report. 2001-2009 - various issues.
U.S. Energy Information Administration. Quarterly Coal Report. October-December 2010. DOE/EIA-0121(2010/Q4) (Washington, DC, March 2010).

Coal is ranked into four main categories based on heat value supplied by the carbon content; lignite, sub-bituminous, bituminous, and anthracite (in ascending order of heat value). The heat value, commonly measured in Btus, determines the amount of energy it contains per unit of weight and also its end use. Lignite has the lowest heat value, while anthracite has the highest. Both sub-bituminous and bituminous coal is used for power generation, while bituminous coal is also used for making coke for the steel industry. In terms of coal rank, approximately 47 percent of all coal produced in the U.S. in 2010 was Bituminous Coal, closely followed by Sub-bituminous Coal at 46 percent (see Figure A-6). Most of the remaining seven percent was Lignite, while Anthracite made up less than one percent of coal production.

Figure A-6: Coal Production by Rank of Coal, 2010



Sources:
U.S. Department of Energy/Energy Information Administration. Report Number DOE/EIA-0584. Annual Coal Report. 2001-2009 - various issues.
U.S. Energy Information Administration. Quarterly Coal Report. October-December 2010. DOE/EIA-0121(2010/Q4) (Washington, DC, March 2010).

A.1.2 Coal Producing Companies

In 2009, there were 48 major coal producing companies in the U.S., of which 29 companies produced more than 5 million short tons each.[11] The combined share of production of the top five coal producers is over 53%. The top ten producers account for over 67% of production, while the top 15 for more than 77%.[12]

A.1.3 Coal Reserves

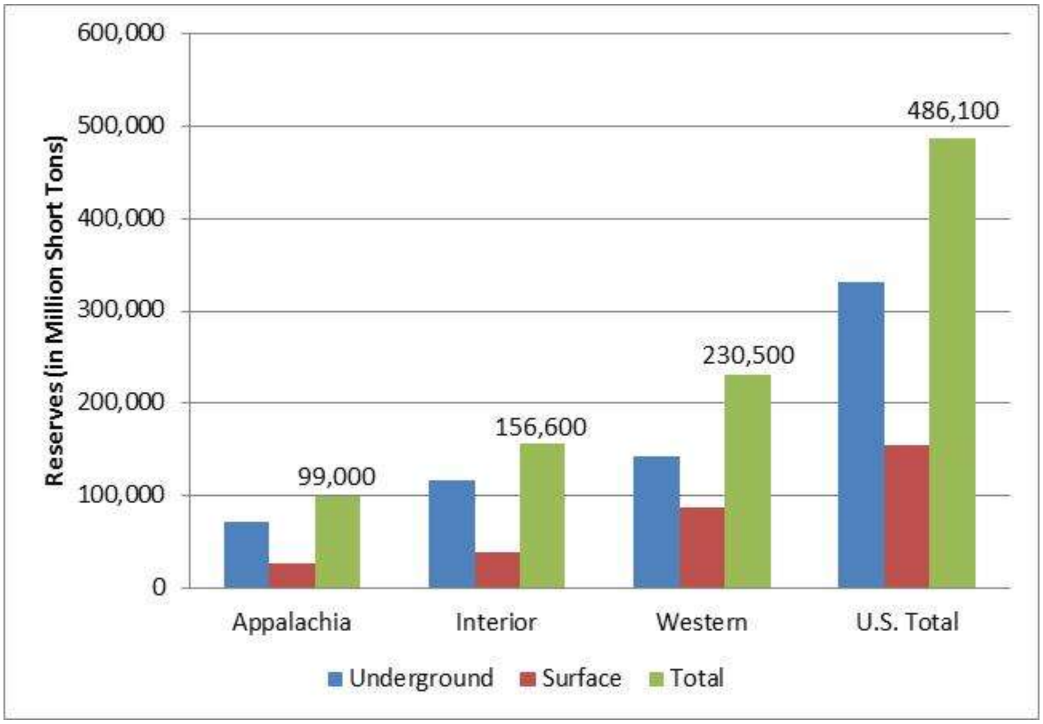
Coal reserves are categorized in the Energy Information Administration (EIA) data as demonstrated reserve base, estimated recoverable reserves, and recoverable reserves at producing mines. The demonstrated reserve base is defined as "a collective term for the sum of coal in both measured and indicated resource categories of reliability, representing 100% of the in-place coal in those categories as of a certain date." The U.S. coal demonstrated reserve

[11] U.S. Department of Energy/Energy Information Administration. 2011. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.

[12] U.S. Department of Energy/Energy Information Administration. 2011. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.

base is 486,100 million short tons as of January 2010 (see Figure A-7). Of these, about half (47 percent) are in the Western Region.

Figure A-7: U.S. Coal Demonstrated Reserve Base, January 2010

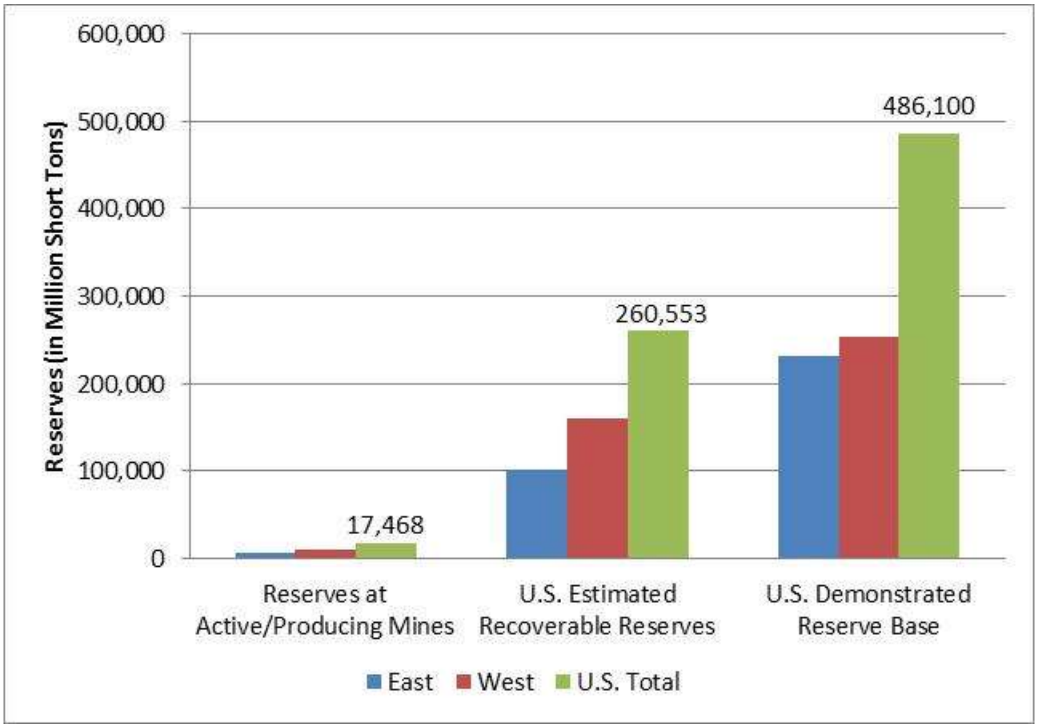


Sources:
U.S. Department of Energy/Energy Information Administration. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.
U.S. Energy Information Administration. Coal Reserves Database.

The estimated recoverable reserves, based on a demonstrated reserve base adjusted for assumed accessibility factors and recovery factors, are derived by the EIA "without specific economic feasibility criteria by factoring (downward) from a demonstrated reserve base for one or more study areas or regions." The estimated recoverable reserves in the U.S. are 260,553 million short tons, approximately 61% of which are in the west (see Figure A-8).

Finally, EIA defines recoverable reserves at producing mines as "The amount of coal that can be recovered (mined) from the coal deposits at active producing mines as of the end of the year." These are derived by EIA by aggregating "(upward) from reserve estimates reported by currently active, economically viable mines on Form EIA-7A." The recoverable reserves at producing mines are estimated at about 17,468 million short tons. Of these, almost 62% are located in the west.

Figure A-8: U.S. Coal Reserves by Type, 2009



Sources:
U.S. Department of Energy/Energy Information Administration. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.
U.S. Energy Information Administration. Coal Reserves Database.

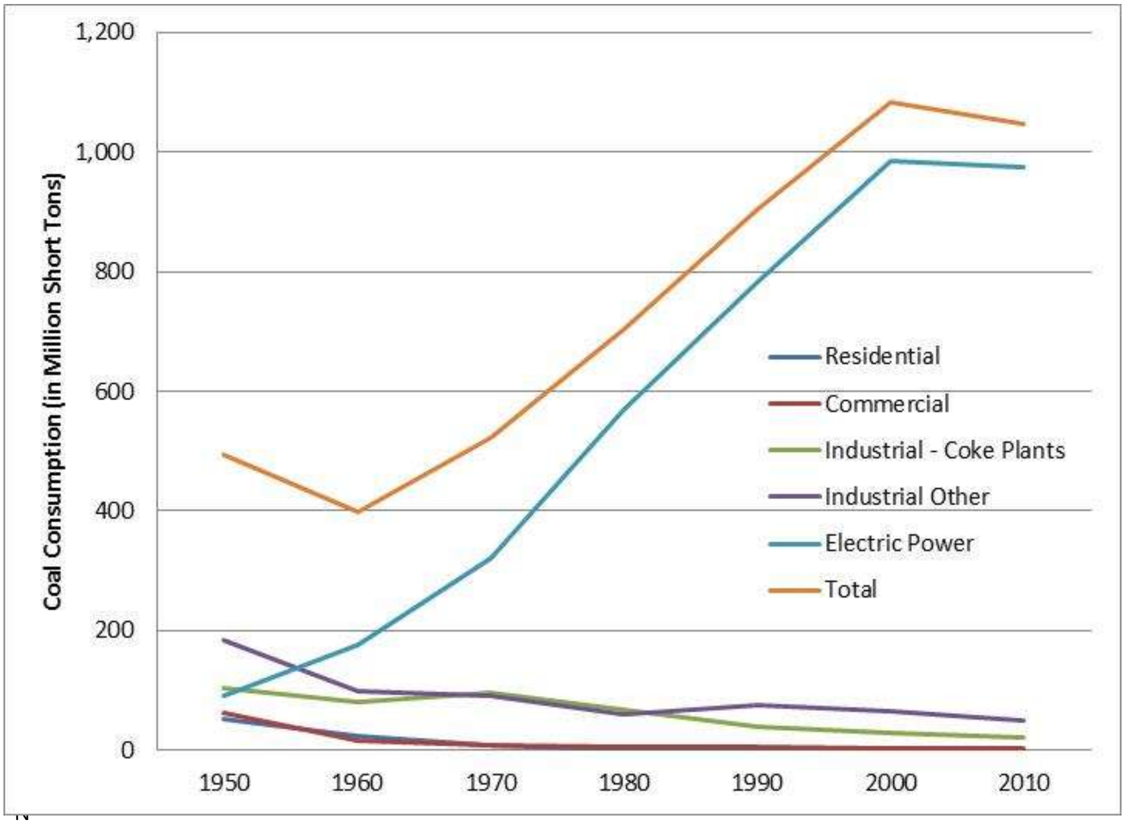
The U.S. government is the largest holder of reserves. With approximately 87 billion tons of estimated recoverable coal reserves, it owns one-third of the nation's coal resources.[13] This is followed by Great Northern Properties Limited Partnership, which reported 20 billion tons of reserve holdings.

A.1.4 Demand and Consumption

The major consumers of coal in the U.S. are electric power plants, the steel industry, and other industry. Demand is led by power plants, which consumed almost 94% (975.6 million short tons) of all coal produced in the U.S. in 2010, a substantial increase from about 19% (91.9 million short tons) in 1950 (see Figure A-9). Residential and commercial users, who made up over 23% of coal consumption in 1950, now account for only 0.3%. The steel industry consumed 2% and other industrial use made up about 5% of coal consumption in 2010. As presented in Figure A-10, production in the U.S. is outpacing consumption overall.

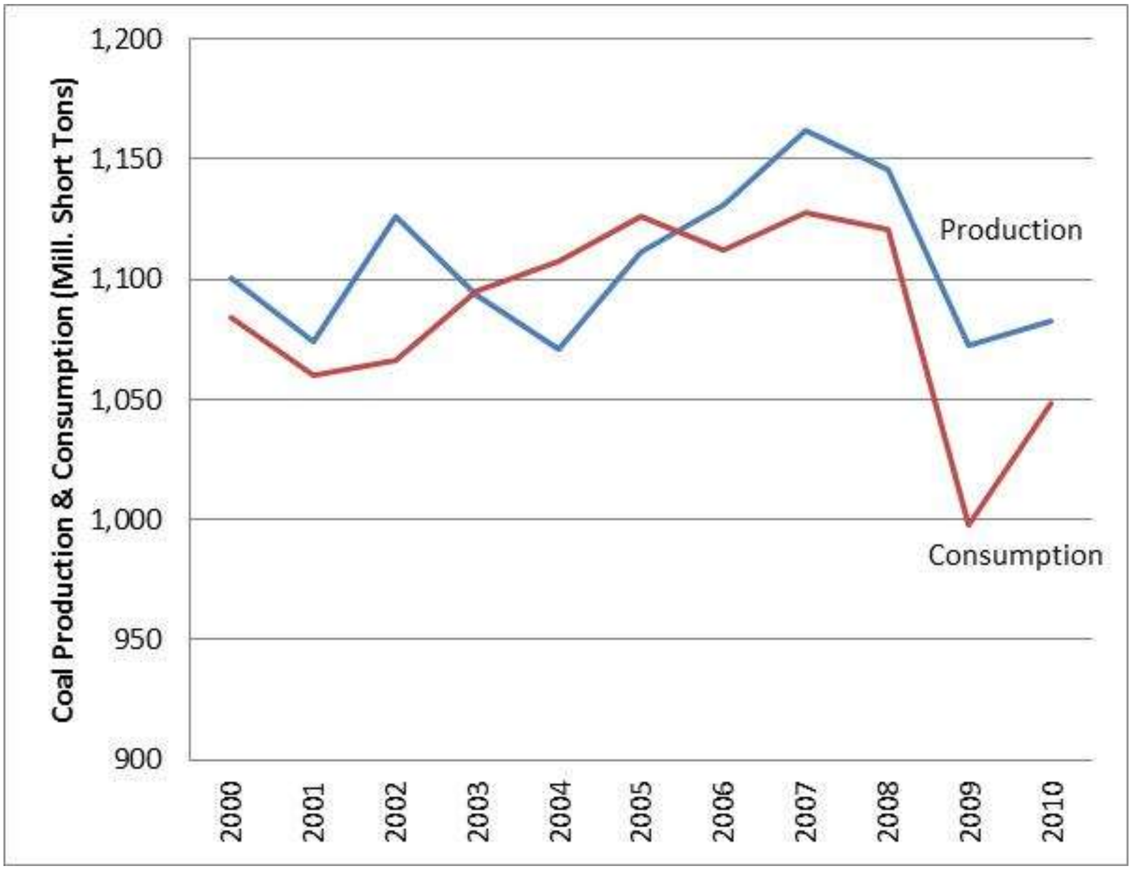
[13] National Mining Association. 2010 Coal Producer Survey. May 2011.

Figure A-9: Coal Consumption by End-Use Sector over Time, 1950-2010



Note: 2010 data are estimates.
Sources:
U.S. Department of Energy/Energy Information Administration. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.
U.S. Energy Information Administration Form EIA-906, "Power Plant Report," Form EIA-920, "Combined Heat and Power Plant Report," Form EIA-923, "Power Plant Operations Report," Form EIA-3, "Quarterly Coal Consumption and Quality Report, Manufacturing Plants," Form EIA-5, "Quarterly Coal Consumption and Quality Report, Coke Plants," Form EIA-6A, "Coal Distribution Report," and Form EIA-7A, "Coal Production and Preparation Report."

Figure A-10: Coal Production and Consumption, 2000-2010

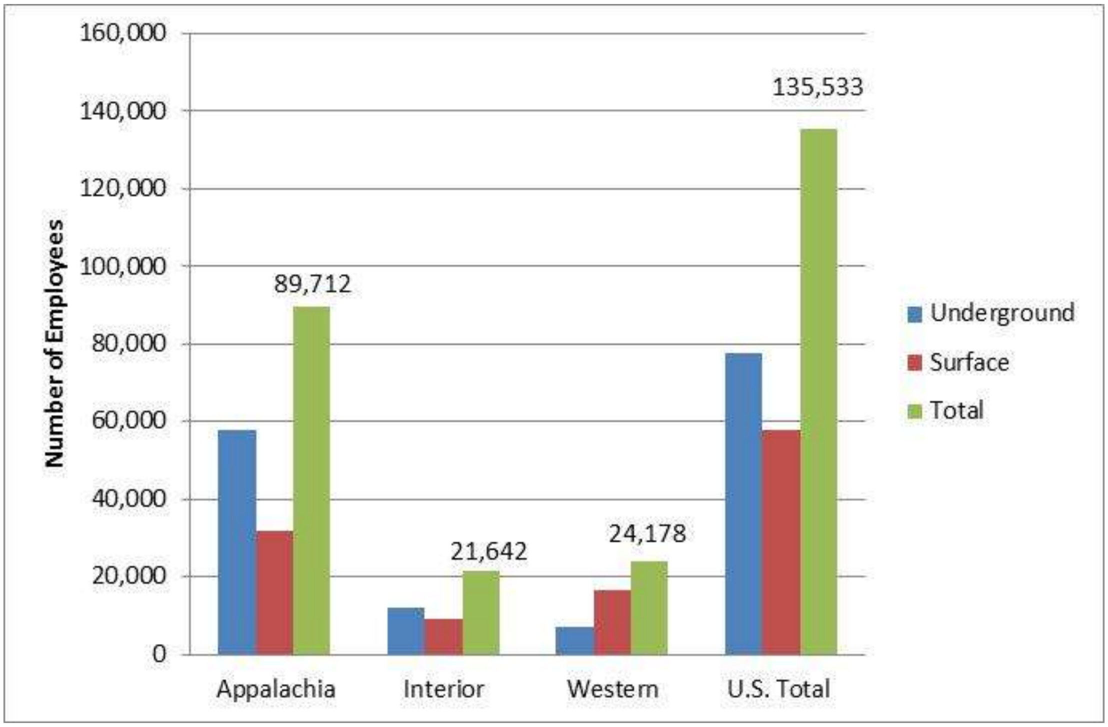


Note: 2010 data are estimates.
Sources:
U.S. Department of Energy/Energy Information Administration. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.
U.S. Energy Information Administration Form EIA-906, "Power Plant Report," Form EIA-920, "Combined Heat and Power Plant Report," Form EIA-923, "Power Plant Operations Report," Form EIA-3, "Quarterly Coal Consumption and Quality Report, Manufacturing Plants," Form EIA-5, "Quarterly Coal Consumption and Quality Report, Coke Plants," Form EIA-6A, "Coal Distribution Report," and Form EIA-7A, "Coal Production and Preparation Report."

A.1.5 Employment and Wages in the Coal Industry

In 2010, the coal mining industry employed 135,533 people in the U.S. (see Figure A-11). The Appalachian region employs 89,712 workers, making up over 66% of total employment in the industry.[14] This is followed by the Western region with almost 18% of employment and the Interior region with the remaining about 16%. Factors such as type of mining, mining methods, technology, and regional production levels are some of the key factors that affect employment. About 57 percent of mining employment is in underground mining (see Figure A-12). This is primarily because of the lower productivity per worker in underground mining methods.

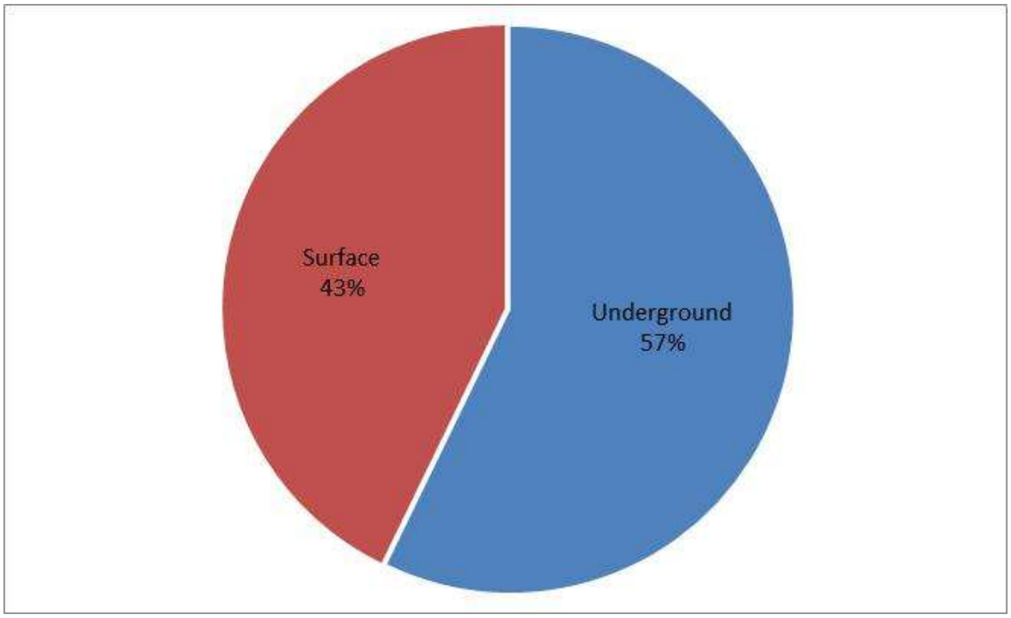
Figure A-11: Average Number of Employees by Region and Mine Type, 2010



Sources:
U.S. Department of Labor, Mine Safety and Health Administration. MSHA Accident, Illness, and Injury and Employment Self Extracting Files (Part 50 Data).
U.S. Department of Energy/Energy Information Administration. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.
U.S. Department of Labor. Mine Safety and Health Administration Form 7000-2. Quarterly Mine Employment and Coal Production Report.

[14] The distribution of employment by coal-producing region is estimated through applying the proportions of workers in each region provided by the Energy Information Administration (Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011) to the employment numbers for 2010 available from the U.S. Department of Labor, Mine Safety and Health Administration (MSHA Accident, Illness, and Injury and Employment Self Extracting Files (Part 50 Data)).

Figure A-12: Percentage of Employees by Type of Mining, 2010



Sources:
U.S. Department of Labor, Mine Safety and Health Administration. MSHA Accident, Illness, and Injury and Employment Self Extracting Files (Part 50 Data).
U.S. Department of Energy/Energy Information Administration. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.
U.S. Department of Labor. Mine Safety and Health Administration Form 7000-2. Quarterly Mine Employment and Coal Production Report.

Coal mining is one of the higher paid industries in the U.S. The average wage for coal mining in 2010 was $77,475, which is 40% higher than that for all industries combined (see Table A-1). This difference is highest in North Dakota (over 57%), followed by Montana (56%) and Alabama (54%).

Table A-1: Annual Coal Mining Wages vs. All Industries, 2010

State	Avg. Wages for Coal Mining	Avg. Wages for All Industries	% Difference b/w Coal Mining and All Industries Wages
Alabama	$85,607	$39,267	54.1%
Alaska	$70,000	$47,137	32.7%
Colorado	$78,153	$47,917	38.7%
Illinois	$76,371	$49,524	35.2%
Indiana	$76,099	$39,229	48.5%
Kansas	$76,892	$39,427	48.7%
Kentucky	$72,545	$38,368	47.1%
Maryland	$55,092	$49,495	10.2%

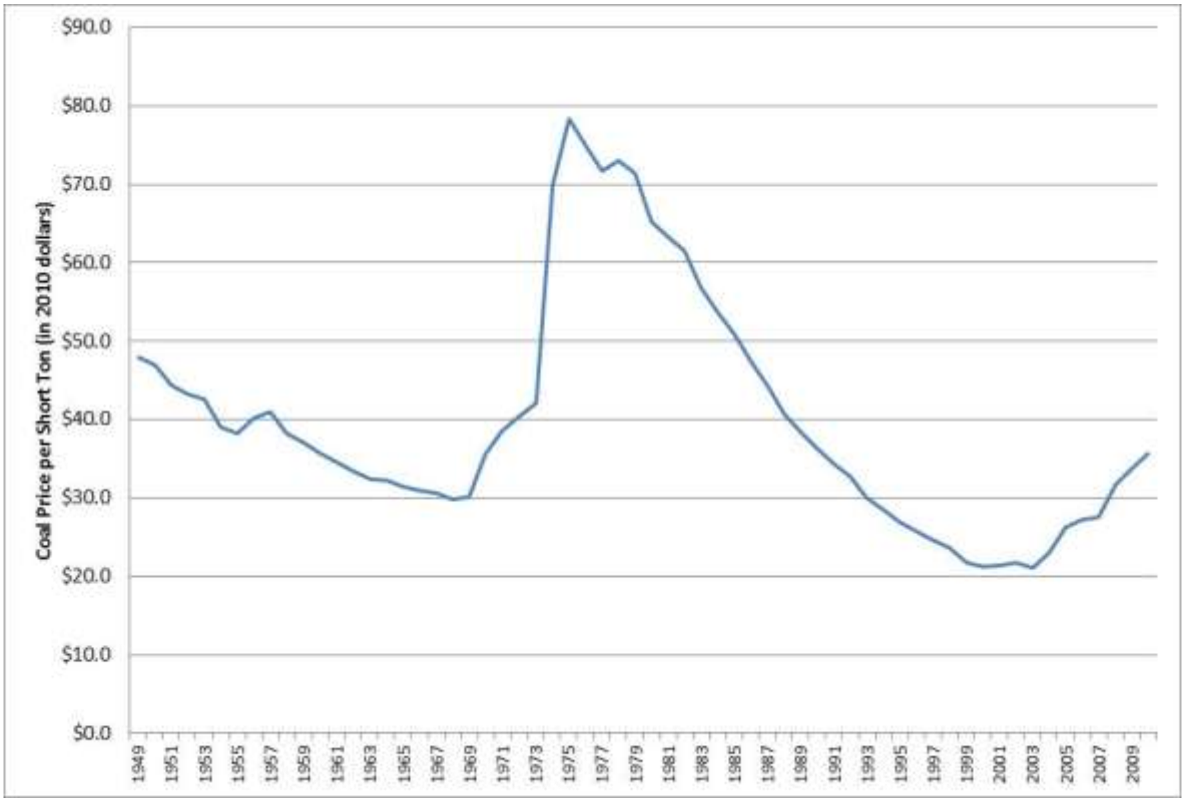
Table A-1: Annual Coal Mining Wages vs. All Industries, 2010			
State	**Avg. Wages for Coal Mining**	**Avg. Wages for All Industries**	**% Difference b/w Coal Mining and All Industries Wages**
Montana	$75,526	$33,236	56.0%
New Mexico	$80,000	$37,921	52.6%
North Dakota	$88,567	$38,028	57.1%
Ohio	$68,694	$41,036	40.3%
Pennsylvania	$75,379	$45,323	39.9%
Tennessee	$46,439	$41,759	10.1%
Texas	$81,202	$47,615	41.4%
Utah	$75,121	$38,932	48.2%
Virginia	$76,793	$49,137	36.0%
West Virginia	$79,409	$36,990	53.4%
Wyoming	$78,806	$41,261	47.6%
United States	**$77,475**	**$46,451**	**40.0%**

Notes:
Data for all industries are for private industry only and also exclude oil and gas extraction.
Wages for Alaska and New Mexico are estimated and based on preliminary data.
Source:
U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages.

A.1.6 Prices

Coal prices in the U.S. have remained relatively stable during the past 40 years. The two noteworthy instances of increasing coal prices were the 1973 oil embargo and the 2003-2004 growing coal demand in China, both external factors (see Figure A-13). The decline in coal prices between 1975 and 2000 largely reflect the improved labor productivity due to shift of coal mining to areas with higher productivity, such as the Western region. Improved technology and better management have also played roles in improving the cost-effectiveness of mining and, consequently, lowering the price.

Figure A-13: Price of Coal over Time, 1949-2010



Sources:
U.S. Department of Energy/Energy Information Administration. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.

Several factors affect the price of coal, the key ones being quality and rank (based on characteristics such as sulfur content and heat value), end use, mining method, size of mine, transportation costs, and accessibility to reserves (see Table A-2). While on the one hand, reserves in the Appalachian region are becoming increasingly harder and more expensive to access due to mining over the years, those in the Western region are abundant, easier to mine and, thus, have lower production costs. These, in turn, render coal produced in the Appalachian region more expensive. Western coal also has lower sulfur content, which makes it more attractive and cost-effective for power plants that are faced with regulations limiting sulfur-dioxide emissions. Coal in the Powder River Basin within the Western region generally has lower heat value, and power plants have to blend it with coal with higher heat value in order to use it. These factors make the price of Western coal lower in the market.

In 2010, the average sales price per short ton of coal in the U.S. was $33.79 (in 2010 dollars). Coal produced through underground mining was priced at $56.69 per short ton (in 2010 dollars) on average, while that produced from surface mines fetched $23.62 per short ton (in 2010 dollars).[15] In terms of end use, coal sold to power plants was priced, on average, at $45.20 per short ton (in 2010 dollars), while that for other industrial plants at $65.94 per short ton (in 2010

[15] U.S. Department of Energy/Energy Information Administration. 2011. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.

dollars). Metallurgical coal used for the production of steel fetched the highest average price at $145.36 per short ton (in 2010 dollars), followed by commercial and institutional uses at $98.88 per short ton (in 2010 dollars).[16]

Table A-2: Characteristics of Coal and their Effects on Relative Prices by Region

Coal Producing Region	Sub-Region	States Included	Rank of Coal Primarily Produced	Heat Value	Sulfur Content	Relative Prices
Appalachia	Northern Appalachia	Maryland; Ohio; Pennsylvania; Northern West Virginia	Anthracite; Bituminous	High 10,300 Btu – 13,500 Btu	High 0.8% – 4.0%	Higher than other regions
	Central Appalachia	Eastern Kentucky; Tennessee (part); Virginia; Southern West Virginia	Bituminous	High 11,400 Btu – 13,200 Btu	Low 0.2% – 2.0%	Higher than other regions
	Southern Appalachia	Alabama; Tennessee (part)	Bituminous	High 11,300 Btu – 12,300 Btu	High 0.7% – 3.0%	Higher than other regions
Interior	Illinois Basin	Illinois; Indiana; Western Kentucky	Bituminous	Higher 10,100 Btu – 12,600 Btu	High 1.0% – 4.3%	Lower than Appalachia; Higher than Western
	Other Coal Producing States in the Region	Arkansas; Kansas; Louisiana; Mississippi; Missouri; North Dakota; Oklahoma; Texas	Sub-bituminous; Lignite			Lower than Appalachia; Higher than Western
Western	Powder River Basin	Northeastern Wyoming; Southeastern Montana	Sub-bituminous	Low 8,000 Btu – 9,500 Btu	Low 0.2% – 0.9%	Generally lower than other regions
	Western Bituminous Region	Southern Wyoming; Colorado; Utah	Bituminous	Higher 10,000 Btu – 12,200 Btu	Low 0.4% – 0.8%	Generally lower than other regions

[16] U.S. Department of Energy/Energy Information Administration. 2011. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.

A.2 Economic Contribution of Coal Mining

In addition to the improved output and employment generated by coal production, the sector also contributes to the national economy through:

- Indirect linkages to input suppliers that in turn improve output and employment in those sectors;
- Improved household spending income generation that in turn stimulates retail industries;
- State and local tax revenue and royalties;
- Links to transportation and other support sectors; and
- Forward linkages to utilities and industries that use coal such as steel production.

This section provides a discussion of the ways that such linkages have been measured, and reports estimates of the overall economic impact of the coal sector where possible.

A.2.1 Direct, Indirect, and Induced Impacts

Economic contribution of coal mining production is captured through the direct impact coal mining creates through the hiring of labor and expenditures on equipment and the subsequent indirect and induced impacts stemming from the circulation of money through the economy. For many counties in the United States, coal mining represents a base sector. This means the employment and expenditures generated from coal mining stimulate economic activity in sectors that support the industry. These different impacts are categorized into direct impacts, indirect impacts, and induced impacts. Together, they sum up to the total economic impact from coal mining.

- **Direct impacts** capture the employment and spending resulting from coal mining activities that is injected into the local economy. This impact is created from the firms that operate coal mines.
- **Indirect impacts** measure the response of local supplies to the demand for equipment and materials from inter-industry transactions. The indirect impacts trace the ripple effect through the local economy. As coal firms demand materials and equipment for mining, the industries that support coal increase their demand from upstream supplies as well.
- **Induced impacts** measure the response of local industries to the expenditures resulting from household spending. Income generated and attributable to coal mining and the industries along the supply chain is spent throughout the local economy on household consumption.

Economic impact studies employ input-output modeling which provides estimated multipliers that can be used to determine the total impact resulting from a new project, policy or economic activity. Input-output modeling traces the inter-connected industries through a local economy and produces multipliers which measure, for example, the resulting total impact in a region given a $1 direct contribution from a coal firm. Multipliers are a function of the structure of the local economy and to what degree coal mining is interconnected with industries inside the region.[17] Therefore, the more diverse a local economy is, the greater the region will be able to retain and circulate the funds generated from coal mining.

A survey of five recent coal mining studies provide a baseline for understanding the total economic impacts and multiplier effect resulting from direct spending and hiring from coal firms. The various studies examined the impact for coal mining in different regions of the country including regions such as Appalachia, Illinois Basin, and New Mexico. Table A-3 summarizes the economic impacts found in these studies. The study by Thompson (2001) that examines the Appalachia region estimated the smallest multiplier although the volume of output was the largest. The total multiplier is 1.49, meaning that one dollar of direct output generates $0.49 in the related area. In other words, the direct output represents 67% of the total impact. This study, however, only included counties that were located in Appalachia and did not include impacts occurring at the state level. In general, the larger the study area, the larger the expected multiplier because a larger portion of the economic 'ripple effect' is included. This may be seen in the multiplier estimates for Pennsylvania and West Virginia which show much larger multipliers – 2.3 and 2.65 respectively - than the multiplier estimated for Appalachian counties. The estimated multipliers for the Illinois Basin and New Mexico are slightly larger than the estimated multiplier for the total Appalachia region indicating a relatively more economically diverse areas.

Table A-3: Output Impact by Study and Region (2011 Dollars)

Study	Study Region	Direct	Indirect & Induced	Total	Multiplier
Thompson et al (2001)	Appalachia	$17.48 billion	$8.60 billion	$26.08 billion	**1.49**
Sparrow (2009)	Illinois Basin	$1,534.2 million	$966.5 million	$2,500.7 million	**1.63**
Peach (2009)	New Mexico	$735.3 million	$399.3 million	$1,134.6 million	**1.54**
Penn Economy League (2010)	Pennsylvania	$3.25 billion	$4.23 billion	$7.48 billion	**2.30**
Bureau of Business and Econ (2010)	West Virginia	$7.83 billion	$12.92 billion	$20.78 billion	**2.65**

A.2.2 Value Added Approach

Value added is a slightly different way to measure the contribution of one industry to an economic system. 'Value added' is the portion of the estimated economic output that enters GDP directly. It is equal to output less the cost of inputs used in the production of coal. This measures the amount of new value that is added which is entirely generated by the production process. The estimated multipliers here also reflect the total value added in the economy given $1 of value added through production. Only two of the five studies reviewed reported estimates for value added from coal production. Both studies covered state- level impacts, and by comparing the direct output estimates (see Table A-3) with the value added portion (see Table A-4) it becomes clear that the value added portion is approximately 55% of the total direct

[17] Watson, Philip, Joshua Wilson, Dawn Thilmany, Susan Winter (2007), "Determining Economic Contribution and Impacts: What is the difference and why do we care?" *Pedagogy in Regional Studies* 37(2), pg. 1 – 15

impact. The total multiplier, based on the value added portion of production was estimated to be 1.59 and 1.46 for New Mexico and West Virginia respectively. Although the result for West Virginia had a slightly smaller multiplier, the state generated a much larger volume of production leading to nearly 10 times the estimated value added when compared to New Mexico.

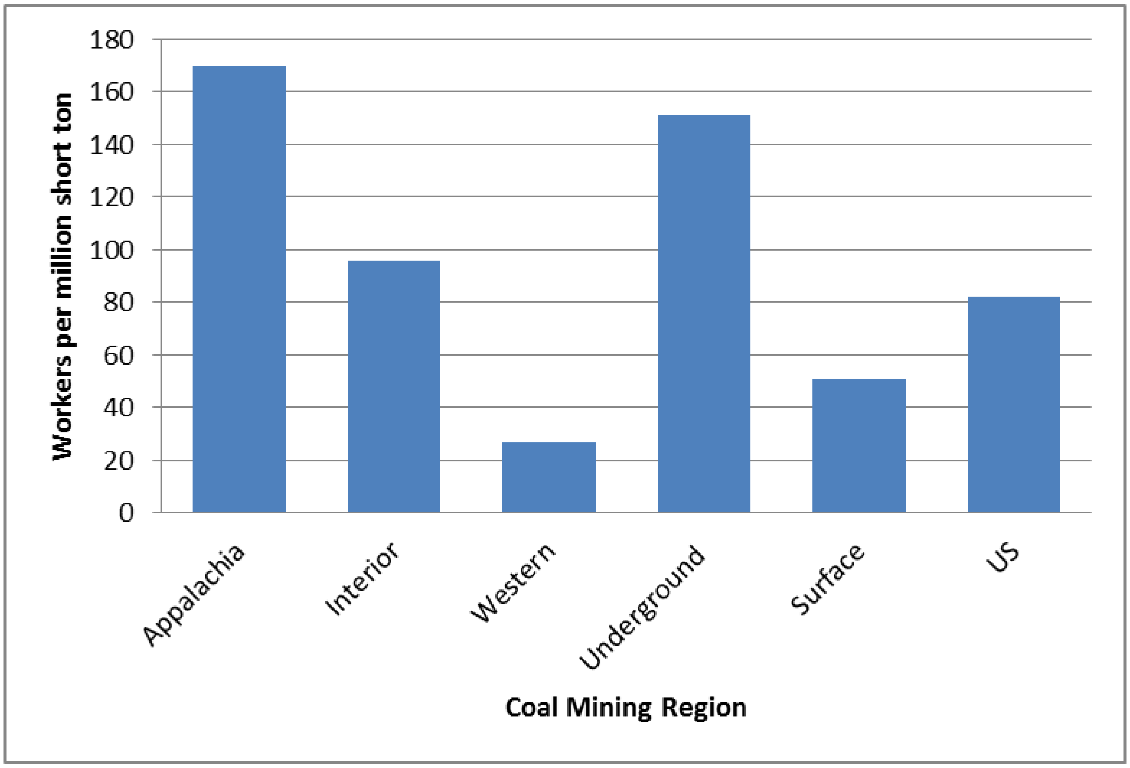
Table A-4: Value Added Impact by Study and Region (2011 Dollars)

Study	Study Region	Direct	Indirect & Induced	Total	Multiplier
Thompson et al (2001)	Appalachia	-	-	-	**-**
Sparrow (2009)	Illinois Basin	-	-	-	**-**
Peach (2009)	New Mexico	$404.03 million	$205.45 million	$642.22 million	**1.59**
Penn Economy League (2010)	Pennsylvania	-	-	-	**-**
Bureau of Business and Econ (2010)	West Virginia	$4.27 billion	$1.96 billion	$6.23 billion	**1.46**

A.2.3 Employment Impact Review

Employment impacts are the numbers of jobs that are within, and are attributable to the coal mining industry. Although the estimates in the studies focus on coal production in general within a region, employment and labor requirements vary between underground and surface coal production due to different production methods. For example, underground coal mining requires more labor than surface coal mining (Thompson 2001). Another significant factor is coal seam thickness. Coal seams out west in the Powder River basin are very thick, and therefore allow for a much higher productivity rate. A quick demonstration of this is seen in the following chart showing the number of workers used to produce 1 million tons of coal in different areas of the country (see Figure A-14). In Appalachia, more than 160 workers are needed, while in Western region, the same figure is just over 20.

Figure A-14: Jobs per Million Tons of Coal by Region



Source: Estimates based on data from U.S. Department of Energy/Energy Information Administration. Report Number DOE/EIA-0584 (2009). Released October 1, 2010 and updated February 3, 2011.

Returning to the employment multiplier, the results from different studies naturally vary, with the estimates ranging from 2.24 to 4.77 (see Table A-5). The difference in the estimates has to do with the composition of the regional economy, and the way direct, indirect, and induced results are measured. The study from Pennsylvania shows a much higher impact from employment, with a multiplier of 4.77. This could be the result of a highly diversified economy. Furthermore, the large multiplier can be attributed to only including employees directly in coal and not counting direct support or contractors. These jobs are then captured in indirect and induced effects resulting in a much larger multiplier.[18] Pennsylvania and West Virginia (which are located in the Appalachia region) contributed over 40,000 total jobs. Finally, New Mexico although having the second largest multiplier contributed the smallest portion of jobs total.

[18] Pennsylvania Economy League of Southwestern Pennsylvania, LLC. 2010. The Economic Impact of the Coal Industry in Pennsylvania. Prepared for Families Organized to Represent the Coal Economy, Inc.

Table A-5: Employment Impact by Study and Region (2011 $)					
Study	**Study Region**	**Direct**	**Indirect & Induced**	**Total**	**Multiplier**
Thompson et al (2001)	Appalachia	60,000 jobs	73,000 jobs	143,000 jobs	**2.38**
Sparrow (2009)	Illinois Basin	-	-	-	**-**
Peach (2009)	New Mexico	1,390 jobs	1,903 jobs	3,293 jobs	**2.37**
Penn Economy League (2010)	Pennsylvania	8,724 jobs	32,853 jobs	41,577 jobs	**4.77**
Bureau of Business and Econ (2010)	West Virginia	20,500 jobs	25,600 jobs	46,000 jobs	**2.24**

A.2.4 Current National Economic Impact

National estimates of impacts are provided by a sixth study by PricewaterhouseCoopers (PWC), which addressed several types of mining impacts for the entire U.S., including the specifics of coal mining.[19] The study approached impacts using IMPLAN® (IMpact analysis for PLANning), an economic input-output impact modeling system. The IMPLAN system allows researchers to estimate impacts based on data from the local economy. The estimated multipliers in the PWC study allow for impacts to cross state boundaries and therefore capture the full economic impact occurring inside the United States. The estimated multipliers from the PWC report are used later in this analysis of the impacts associated with the Stream Protection Rule.

The PWC study reported results using the value added, or contribution to GDP approach. Table A-6 summarizes the estimated contribution to GDP by region and also presents the total of the three regions analyzed in this study as well as the total impact to the national economy. The Appalachia region contributes an estimated $31.4 billion annually to GDP which is nearly 50% of the total contribution to the national GDP. The Interior region has the largest estimated multipliers. The multiplier estimates suggest that for every dollar in direct contribution to GDP, the total contribution to GDP is estimated to be $2.51. This multiplier is capturing impacts across all states from the Interior region, and all of the impact will not necessarily occur within the Interior region. The Western region has the least total economic impact out of the three coal mining regions. This can be attributable to a relatively lower direct impact, but also a smaller multiplier than the national average and the average of the three coal mining regions signifying a relatively less diverse regional economy. The estimated multiplier for all three coal mining regions is 1.86 which is just under the estimated multiplier for the full country. This means there are substantial impacts occurring in other parts of the country that are not being captured inside the coal mining regions.

[19] PricewaterhouseCoopers. 2010. *The Economic Contributions of U.S. Mining in 2008*. A report prepared for the National Mining Association.

Table A-6: Contribution to GDP by Region (in 2011 Dollars)				
Region	**Direct**	**Indirect & Induced**	**Total**	**Multiplier**
Appalachia	$18,551 million	$12,858 million	$31,409 million	**1.69**
Interior	$5,359 million	$8,085 million	$13,444 million	**2.51**
Western	$5,695 million	$4,409 million	$10,104 million	**1.77**
Total of Regions	$29,605 million	$25,352 million	$54,957 million	**1.86**
US Total	$30,775 million	$37,905 million	$68,680 million	**2.23**
Data Source: PricewaterhouseCoopers (2010). The Economic Contributions of U.S. Mining in 2008. A report prepared for the National Mining Association.				

A.2.5 Current Employment Impacts

Employment measures the number of jobs that exist and are attributable to the coal mining industry. Table A-7 reports the estimated multipliers and employment for each region developed by the report by PWC. The national multiplier suggests a total of 3.61 jobs in the national economy for every 1 job directly in the coal mining industry. Again, there is variation in the degree of impact across regions and associated mining methods. Appalachia captures the largest direct impact to employment making up nearly 70% of the total employment contributed between the three coal mining regions. In addition, the Appalachia region also captures the majority of the total employment even though it has the lowest multiplier. The largest multiplier was seen for the Interior coal mining region. This could be related to a more diverse regional economy. The multiplier estimates for every direct coal mining job, an additional 3.5 jobs are created through indirect and induced effects. This means that although the Interior region only captures 16% of the direct employment between the three regions, it generates nearly 25% of the total employment impact. Western region contributes the least total employment impact amongst the three regions making up only 18% of the total employment. However, the Western region does carry a slightly larger multiplier than the average of the three regions signifying a relatively more diverse economy than average. Similar to contribution to GDP, the estimated multiplier for the three coal mining regions is 2.88 which is less than the estimated multiplier for the nation. This means, there are impacts occurring to employment that are not captured within the three coal mining regions and imply additional impacts to employment.

In this study by PWC, the ‘direct’ job category includes jobs in the related industries of transportation and other contractors and support industries (see Section A.2.6). For this reason, the number of direct jobs reported in the nation – 149,150 – is larger than the number of employees within the coal sector according to MSHA data reported in Section A.1.5. The number of jobs directly generated by the mining industry in that estimate was 135,533 in 2010.

Table A-7: Contribution to Employment by Region				
Region	**Direct**	**Indirect & Induced**	**Total**	**Multiplier**
Appalachia	99,400	148,690	248,090	**2.50**
Interior	23,170	81,080	10,4250	**4.50**
Western	26,580	51,290	77,870	**2.93**
Total of Regions	149,150	281,060	430,210	**2.88**
US Total	154,020	401,250	555,270	**3.61**
Data Source: PricewaterhouseCoopers (2010). The Economic Contributions of U.S. Mining in 2008. A report prepared for the National Mining Association.				

A.2.6 Transportation and Supporting Service Employment

The three transportation modes primarily used for domestic coal shipments in the U.S. include rail, truck and river. Most of the coal delivered to U.S. consumers is transported by railroads, which accounted for 50% of total domestic coal shipments in 2010 (see Table A-8).[20] Rail transportation is used primarily for transportation due to the long distances coal needs to travel.[21] Trucks are used for short distances and make up 28% of the transported coal consumed.[22] Finally, river transportation made up 18% of coal transported on inland waterways. In addition, tramways, conveyors, and slurry pipelines (where the coal is mixed with water, pumped, and then separated at the destination)[23] are used over smaller distances and represents only 2% of transportation. Finally, transportation across the Great Lakes and tidewater piers represent the least used for of transportation and account roughly around 1% each.

The average rate for transporting the three primary modes range from roughly $18 to $5 per ton.[24] Specifically, the estimated rate for transporting coal by rail is $17.82. This results in an average transportation cost of coal by rail of $7,894,263 each fiscal quarter. The estimated rate for transportation by barge is $4.99 per ton which is $1,552,753 per fiscal quarter. Finally, the estimated rate for transporting coal by truck is $8.24 per ton which results in $408,494 per fiscal quarter.

[20] Data Source: U.S. Energy Information Administration. *Annual Coal Distribution Report.* *http://www.eia.gov/coal/distribution/annual/*

[21] Data Source: U.S. Energy Information Administration. *Annual Coal Distribution Report.* *http://www.eia.gov/coal/distribution/annual/*

[22] U.S. Energy Information Administration. *Coal Transportation Issues.* Released: Issues in Focus, AEO2007. http://www.eia.gov/oiaf/aeo/otheranalysis/cti.html

[23] Pennsylvania Economy League of Southwestern Pennsylvania, LLC. 2010. *The Economic Impact of the Coal Industry in Pennsylvania*. Prepared for Families Organized to Represent the Coal Economy, Inc.

[24] U.S. Energy Information Administration. Coal Transportation: Rates and Trends http://www.eia.gov/cneaf/coal/page/trans/ratesntrends.html

Table A-8: Mode of Transportation and Millions of Short Tons per Shipment per Fiscal Quarter (2010)

Mode of Transported	% of Total Transportation	Average Tons per Shipment per Fiscal Quarter
Rail Road	50%	443,000
River	18%	311,173
Truck	28%	49,575
Tidewater Piers	1%	51,861
Great Lakes	1%	365
Tramway, Conveyor, and Slurry Pipeline	2%	732

Data Source: U.S. Energy Information Administration. Annual Coal Distribution Report. http://www.eia.gov/coal/distribution/annual/

Furthermore, transportation generates its own economic contributions and impacts. PWC found that transportation comprises over 61,000 direct employees annually.[25] In addition, the Bureau of Business and Economic Research in West Virginia found rail transportation for coal contribute directly to 2,700 jobs leading to 6,200 jobs total in the local economy. Water transportation directly contributed 600 jobs generating a total of 1,700 jobs. The total output impact resulting from transporting coal by rail in West Virginia was estimated at $2,609.6 million with value added capturing 31% of total output.[26] Finally, water transportation of coal generated $768.8 million in total output impacts in West Virginia with value added capturing 20% of the total output. [27]

A.2.7 Taxes to Federal, State, and Local Governments

Economic activity provides an opportunity for federal, state, and tribal governments to collect funds for publically provided benefits such as health care and national parks. Coal mining has been a source of income for governments for many years, and governments may now depend on these funds. The PWC study reported direct taxes paid by the coal mining industry that total over $3.8 billion, but did not report indirect and induced funds for tax impacts resulting from coal mining. For the purpose of this analysis, multipliers were derived using the total contribution to GDP by state and the total taxes paid by state resulting from coal mining provided in the PWC study. Multipliers vary between region due to economic linkages and the indirect and induced activity that generates taxable funds. Results for federal tax impacts are reported in Table A-9 and results for state tax impacts are reported in Table A-10.

[25] PricewaterhouseCoopers. 2010. *The Economic Contributions of U.S. Mining in 2008*. A report prepared for the National Mining Association.

[26] Bureau of Business and Economic Research. 2010. West Virginia University and Center for Business and Economic Research, Marshall University. *The West Virginia Coal Economy, 2008*.

[27] Bureau of Business and Economic Research. 2010. West Virginia University and Center for Business and Economic Research, Marshall University. *The West Virginia Coal Economy, 2008*.

The results indicate that although Appalachia has the smallest federal tax multiplier, the region represents the estimated largest contributor to federal taxes out of the three regions providing more than half of the total taxes combined ($6,938 million). This is followed by the Interior region which contributed a slight larger portion of total federal taxes than the Western region. The Interior region has the largest multiplier which is expected given that the region also has the largest multiplier for value added and employment. The total estimated federal taxes attributable to coal mining that is paid between the three coal mining regions is nearly $7 billion dollars annually.

Similar with federal taxes, Appalachia has the smaller multiplier although it contributes more than half of the total estimated state taxes. This is again followed by the Interior region which contributed slightly more state taxes than the Western region. The Interior region has the largest multiplier which is expected given that the region also has the largest multiplier for value added and employment. The total estimated federal taxes attributable to coal mining that is paid between the three coal mining regions is nearly $6.5 billion dollars annually. The total state and federal taxes paid between the three coal mining regions sums up to $13 billion annually. PWC estimated a national contribution to state and federal taxes of $16 billion annually. This indicates that additional tax impacts will occur outside of the three coal mining regions.

Table A-9: Federal Taxes by Region (in 2011 Dollars)

Region	Direct	Indirect & Induced	Total	Multiplier
Appalachia	$2,337 million	$1,631 million	$3,968 million	**1.70**
Interior	$669 million	$1,010 million	$1,679 million	**2.51**
Western	$4,672 million	$3,161 million	$7,833 million	**1.68**
Total of Regions	$3,729 million	$3,209 million	$6,938 million	**1.86**
US Total	$3,885 million	$4,963 million	$8,848 million	**2.28**

Data Source: PricewaterhouseCoopers (2010). The Economic Contributions of U.S. Mining in 2008. A report prepared for the National Mining Association.

Table A-10: State Taxes by Region (in 2011 Dollars)

Region	Direct	Indirect & Induced	Total	Multiplier
Appalachia	$2,335 million	$1,530 million	$3,865 million	**1.66**
Interior	$648 million	$470 million	$1,118 million	**1.72**
Western	$536 million	$777 million	$1,313 million	**2.45**
Total of Regions	$3,519 million	$2,777 million	$6,296 million	**1.79**
US Total	$3,623 million	$3,983 million	$7,606 million	**2.10**

Data Source: PricewaterhouseCoopers (2010). The Economic Contributions of U.S. Mining in 2008. A report prepared for the National Mining Association.

A.2.8 Royalties and Lease Payments to Federal and Tribal Governments

Coal mining operations that occur on Federal Government land or on Native American land must be leased. Furthermore, these lands receive royalties that are a proportion of total coal sales. A lease can be acquired after an evaluation and planning process has been reviewed in order to determine if the land is suitable for coal mining development. The Bureau of Land Management (BLM) is responsible for leasing lands where the coal mineral is owned by the Federal Government. The BLM collects revenues on coal leasing from (1) a bonus that is paid at the time the BLM issues the lease through a competitive leasing process, (2) royalties paid on the value of the coal after it has been mined and, (3) an annual rental payment of $3.00 per acre.[28] The size of the bonus is determined through a competitive bidding process. Once land that is suitable for coal development is identified by the BLM, the BLM begins a leasing process and formulates an estimated "fair market value" of the coal which is kept confidential. Sealed bids are accepted and the winning bid will be the highest bid that meets or exceeds the coal's presale estimated fair market value. The bid value is known as the bonus.[29] The royalty paid for federal coal is established by law to be 12.5% of the gross value of surface coal produced and 8% of the gross value of underground coal produced.[30] Finally, the $3 per acre is required annually.

The payments to Native American lands follow the same process as Federal Government lands. All coal produced on Native American lands are subject to royalties determined by the BLM.[31] This means, the rate of 12.5% of the gross value of surface coal produced and 8% of the gross value of underground coal produced apply. Furthermore, a bonus and rent is paid to Native American lands.

Table A-11 details the number of leases Federal and Native American lands and the total coal producing acres. Federal lands represent a much larger portion of all leases. Together, there is over 683,000 acres of land. Just looking at Federal lands alone, the total rent collected at $3 per acre was $1,548,240. Table A-12 details the royalty revenue collected for Federal and Native American lands. The tons produced on Federal lands were about 20 times the tons produced on Native American lands. In addition, the royalty collected on Federal lands was just under 10 times the royalty collected on Native American coal producing lands. This can be related to a higher price for coal collected on Native American lands and also whether the coal was surface coal which collects a larger rate. The total royalty paid by coal firms is $848 million. Finally, Table A-13 presents the total payments made to Federal lands and Native American lands. The total includes the bonus and rental rates which adds an approximately $7.5 million to the total payments from coal firms on top of royalties.

28 Bureau of Land Management. "Coal Operations." Accessed February 11, 2011. http://www.blm.gov/wo/st/en/prog/energy/coal_and_non-energy.html

29 Bureau of Land Management. "Coal Operations." Accessed February 11, 2011. http://www.blm.gov/wo/st/en/prog/energy/coal_and_non-energy.html

30 Bureau of Land Management. "Coal Operations." Accessed February 11, 2011. http://www.blm.gov/wo/st/en/prog/energy/coal_and_non-energy.html

31 Title 30-Mineral Resources. Chapter XII – Office of Natural Resources Revenue, Department of the Interior. Subchapter A-Natural Resource Revenue. Part 1206-Production Value. Subpart J-Indian Coal. http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title30/30cfr1206_main_02.tpl

Table A-11: Coal Leases and Associated Acres (Fiscal year 2011)		
Land Owner	**Number of Leases**	**Acres**
Native American	8	167,398
Federal Government	332	516,080
Total	**340**	**683,479**
Data Source: Office of Natural Resources Revenues. http://www.onrr.gov/ONRRWebStats/Home.aspx		

Table A-12: Production and Royalties (Fiscal Year 2011)			
Land Owner	**Tons Produced**	**Sales Volume**	**Royalty Revenue**
Native American	21,469,008	$625,320,761	$74,451,220
Federal Government	451,352,837	$6,968,480,607	$774,117,051
Total	**472,821,845**	**$7,593,801,368**	**$848,568,271**
Data Source: Office of Natural Resources Revenues. http://www.onrr.gov/ONRRWebStats/Home.aspx			

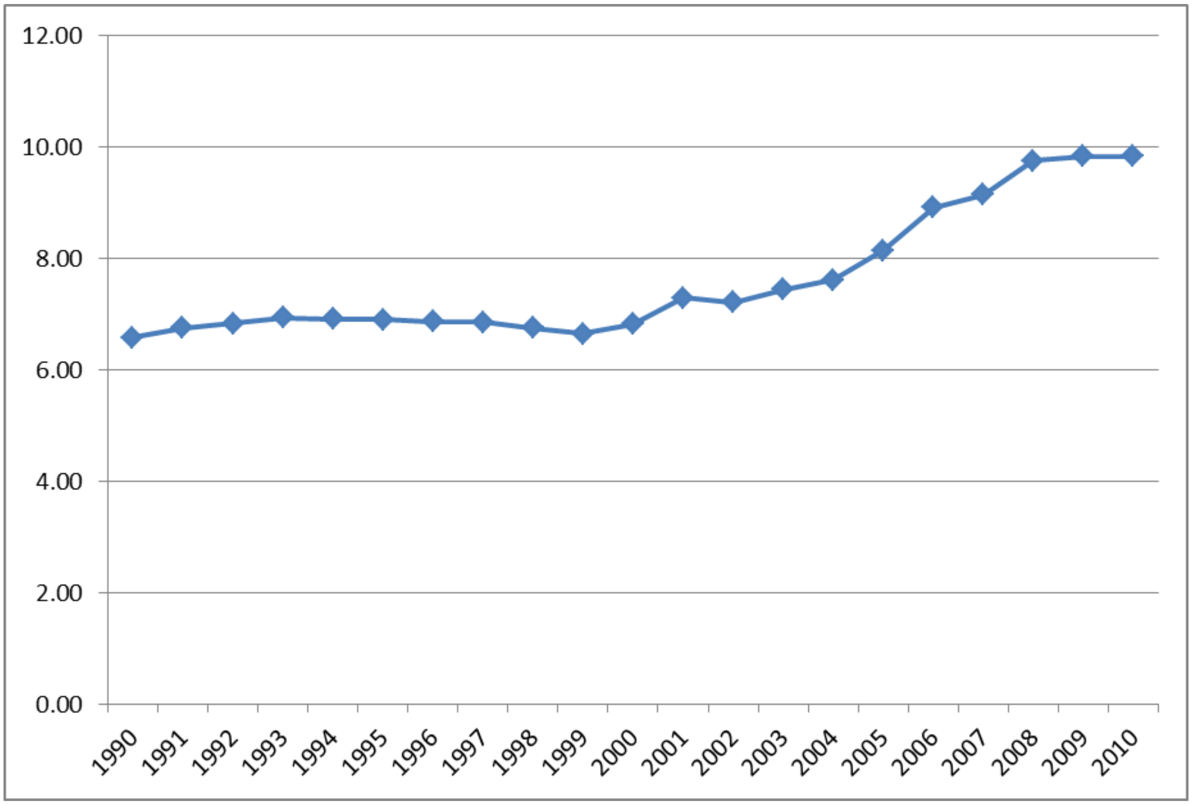
Table A-13: Total Payments (Fiscal 2011)			
Land Owner	**Native American**	**Federal Government**	**Total Payments**
Total Funds	$77,317,889	$778,618,250	$855,936,139
Data Source: Office of Natural Resources Revenues. http://www.onrr.gov/ONRRWebStats/Home.aspx			

A.2.9 Forward Linkages: Coal and Electricity Consumers

Coal production and costs are factors that influence the price of coal, which in turn has the potential to influence the buyers of coal – many of which are electric utilities. Hence just as there are backward economic linkages from coal production to the suppliers of inputs to the industry, coal customers are among the forward linkages to coal production, and these sectors too are potentially affected by changes in the supply structure. This section covers the background and explanation for understanding the relationship between coal production and electricity prices.

U.S. average end-user electricity prices were relatively stable in the 1990's, ranging between a low of 6.51 cents per kilowatt-hour (cents/kWh) in 1990 and a high of 6.93 cents/kWh in 1993, followed by a rapid increase between 2001 (7.29 cents/kWh) and 2008 (9.74 cents/kWh), as shown in Figure A-15. Since 2008 prices have stabilized again, with an average price of 9.83 cents/kWh in 2010.

Figure A-15: Total US Electric Historical Price in cents/KWH



Source: Energy Information Administration (EIA), State Historical Tables for 2010, released November 15, 2011.

A.2.9.1 Regional Differences in Electricity Prices

The EIA divides the U.S. into nine regions: New England, Middle Atlantic, E.N. Central, W.N. Central, S. Atlantic, E.S. Central, W.S. Central, Mountain, and Pacific. Prices between these regions can vary widely. In 2011, New England had the highest average total electricity price of 14.57 cents/kWh. The W.N. Central region had the lowest average price of 8.28 cents/kWh. The W.N. Central region includes Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota. Table A-14 shows the 2011 average price for each region, as well as the projected 2012 and 2013 prices for each region.

Table A-14: Average Regional Electricity Price for All Sectors (cents/kWh)			
Region	**2011**	**2012**	**2013**
New England	14.57	14.87	14.93
Middle Atlantic	13.43	13.57	13.77
E.N. Central	9.23	8.28	9.81
W.N. Central	8.28	8.23	8.24
S. Atlantic	9.81	9.98	9.97
E.S. Central	8.52	8.39	8.33
W.S. Central	8.68	8.63	8.77
Mountain	8.64	8.54	8.59
Pacific	11.44	11.25	11.26
U.S. Average	9.99	10.01	10.04
Source: Energy Information Administration (EIA), Short-Term Energy Outlook - February 2012, Table 7c. U.S. Regional Electricity Prices (Cents per Kilowatthour), available at: http://www.eia.gov/forecasts/steo/tables/pdf/7ctab.pdf, accessed February 9, 2012			

A.2.9.2 Drivers of Electricity Prices

Electricity prices are driven by several factors. These include generation (type and quantity produced), fuel (type and cost), emissions (costs and quantity), load (quantity demanded by sector), and transmission and distribution (cost to deliver power). The price of natural gas is one of the strongest drivers of electricity prices and has historically been the most volatile.

A.2.9.3 Deregulation of Electricity

Deregulation of the electricity market is defined as the act or process of removing rules or regulations, and is a decision made by individual states. There are currently 24 electricity deregulated states in the United States. These states are concentrated in the New England, South Atlantic, and Mountain regions, with Pacific, Middle Atlantic, W.S. Central, and E.N. Central also represented. Deregulation generally occurs at the generation level, as compared to transmission or distribution level. Very simply stated, deregulated states have open market competition for the generation portion of electricity service, while transmission and distribution of the electricity remains regulated and local utilities remain distributors of electricity to consumers.

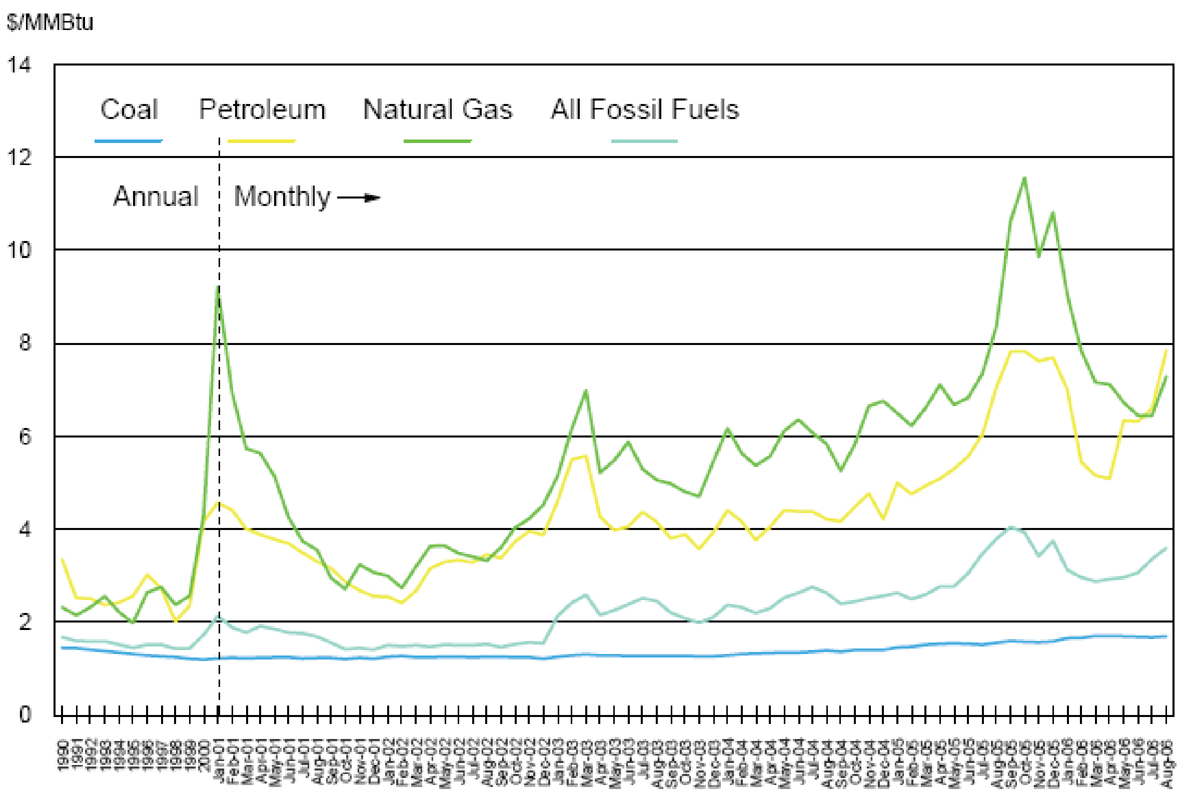
A.2.9.4 The Role of Coal in Electricity Production

Nearly half of all electricity produced in the U.S. in 2010 was fueled by coal in over 1,400 coal-fired electricity generating units. Approximately 93 percent of all U.S. coal consumption is used to produce electricity. The share of coal-fueled electricity is expected to decline by the year 2035, but with the increase in electricity demand, the actual coal expected to be used for fuel will increase.

A.2.9.5 Impact of Coal on the Electricity Market

According to the EIA, the fuel cost of generating one kWh of electricity from coal is much lower than that of natural gas, despite the greater efficiency of some natural gas generating plants compared to coal plants. Further, the historical stability of coal prices through time provides greater certainty than the volatility of natural gas prices. Much of that is due to long-term coal supply contracts in the electricity industry. Coal fuel prices have historically been fairly stable and have much less impact on electricity prices than natural gas. The recent historical increases in electricity costs can be primarily attributed to increased fuel and purchased power costs. They account for virtually the entire rise in operating expenses for electric utilities. In 2005 these costs comprised approximately 71 percent of utility Operations and Maintenance (O&M) costs. Figure 1A below is Figure 1 from "The Impact of Fuel Costs on Electric Power Prices" by Kenneth Rose. It clearly shows how coal fuel prices (in $/MMBtu) have been increasing at a much slower rate than natural gas through 2006, and the overall cost of fossil fuel used in electric generation generally follows the price changes in natural gas and petroleum. EIA's projected delivered coal fuel costs indicate expected continued increases in the near-term, with longer-term price impacts to the electricity sector more uncertain.

Figure A-16: Cost of Fossil Fuels for Electric Generation



Data Source: DOE/EIA

Source: Rose, Kenneth, 2007, The Impact of Fuel Costs on Electric Power Prices, June, available at: http://www.kenrose.us/sitebuildercontent/sitebuilderfiles/impactoffuelcostsonelectricpowerprices_final.pdf, accessed February 9, 2012.

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Appendix B

Loss of Reserve Access Examples

Mine A Plan – Longwall Plan

Slide 1 – Streams in mine area

Slide 2 – Original longwall mine plan

Slide 3 – Angle of draw

Slide 4 – Buffer zone and color coding

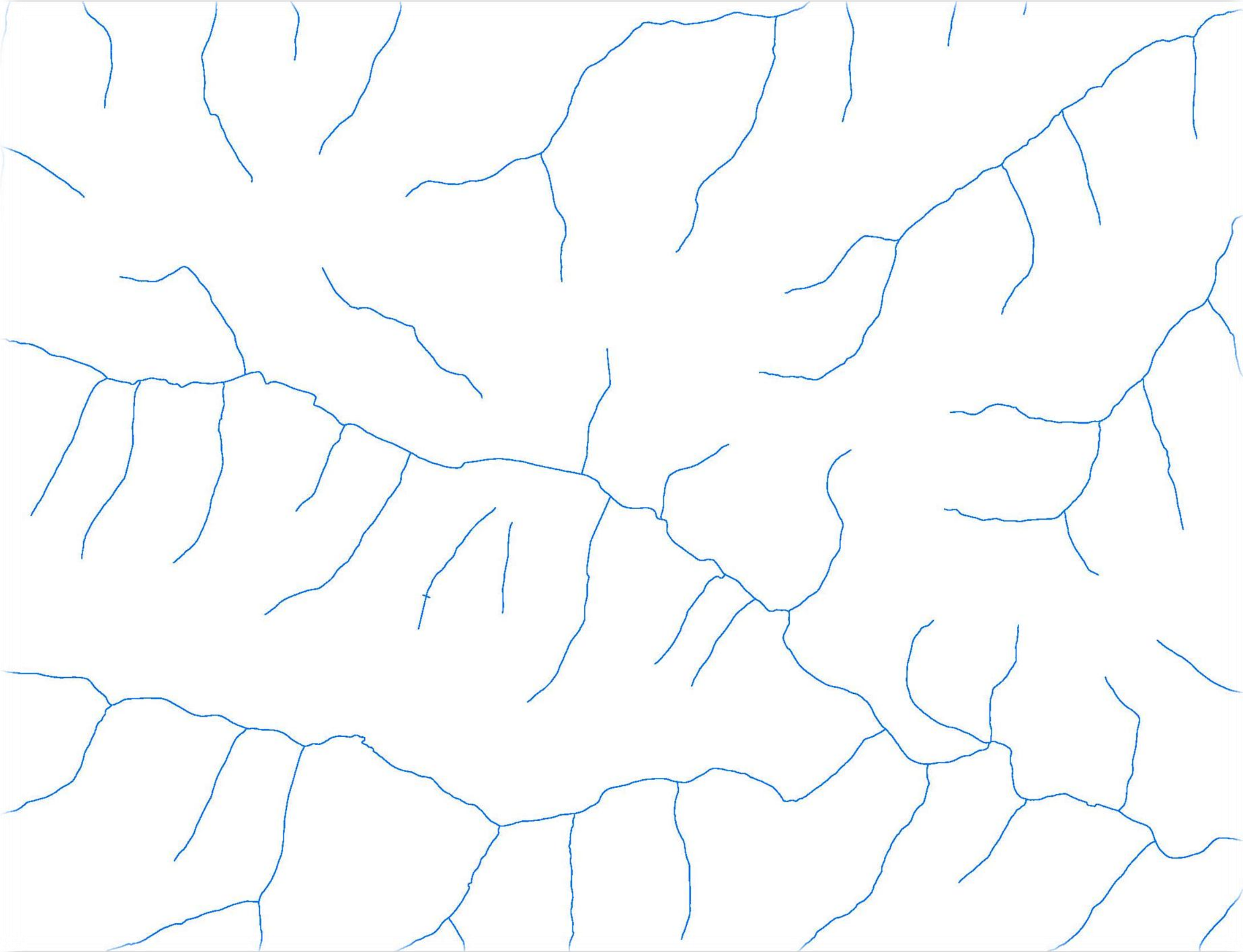
Slide 5 – Streams with color coded buffer zone

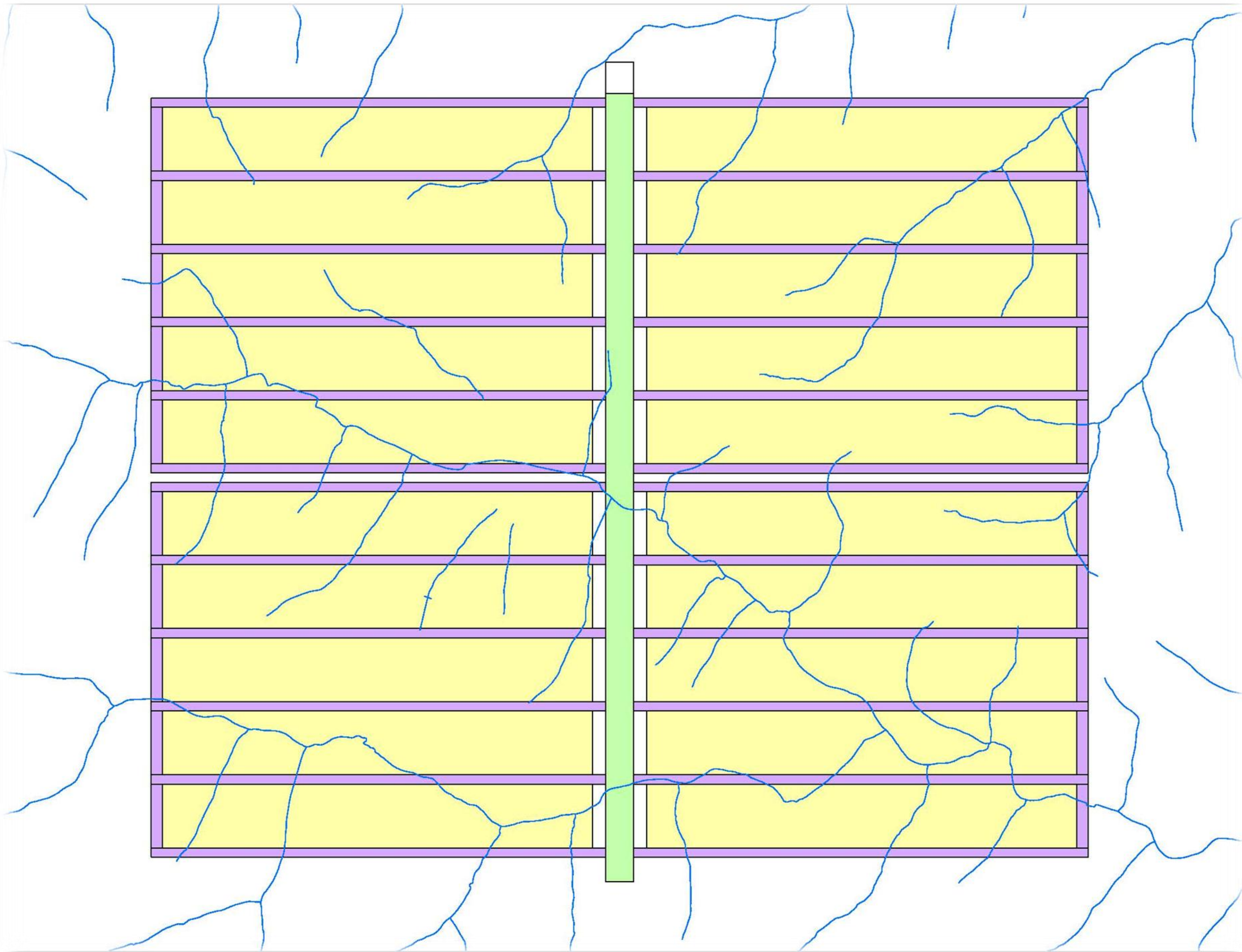
Slide 6 – 100’ buffer with buffer zone

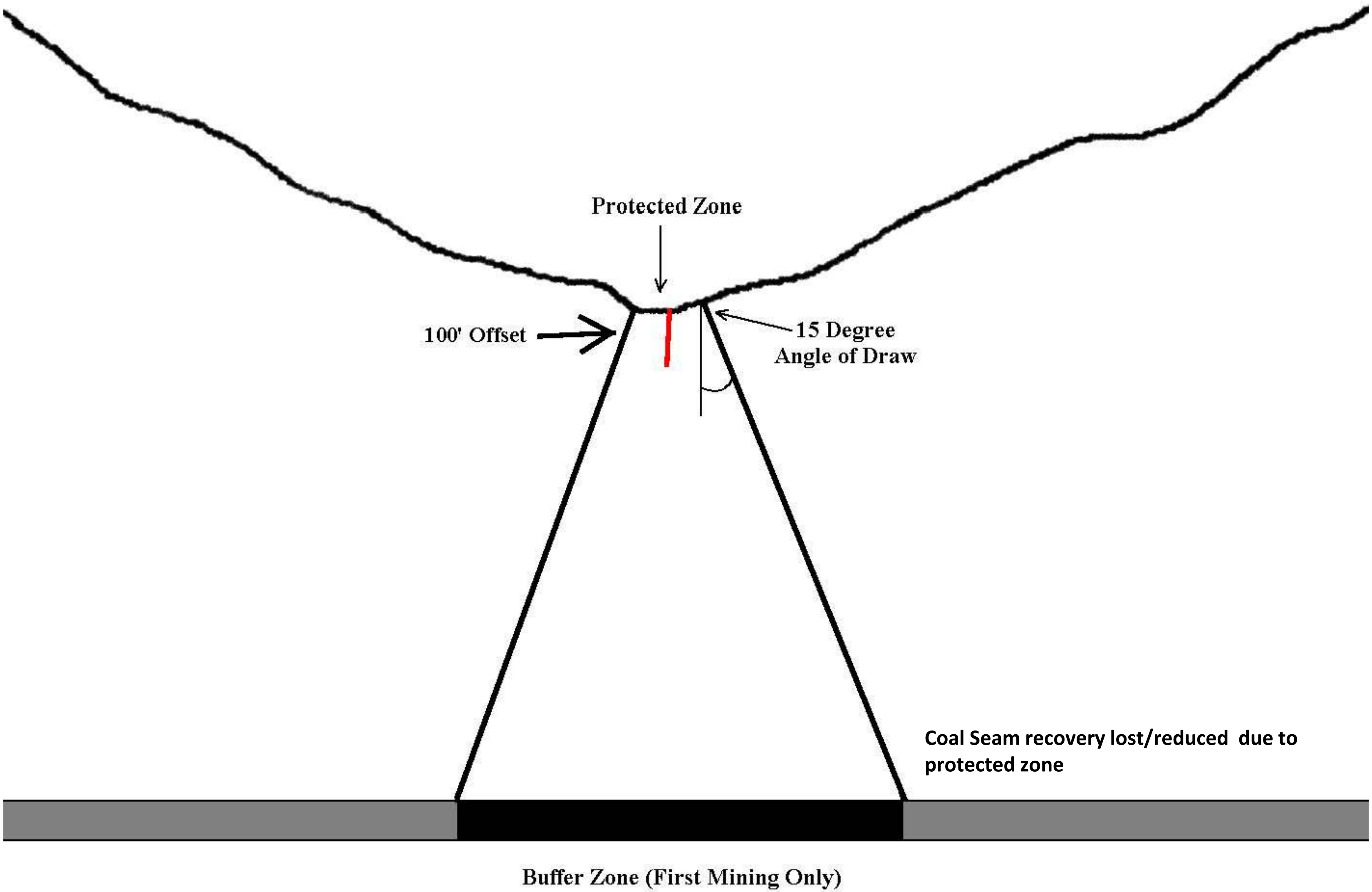
Slide 7 – Just 100’ buffer

Slide 8 – Original mine plan

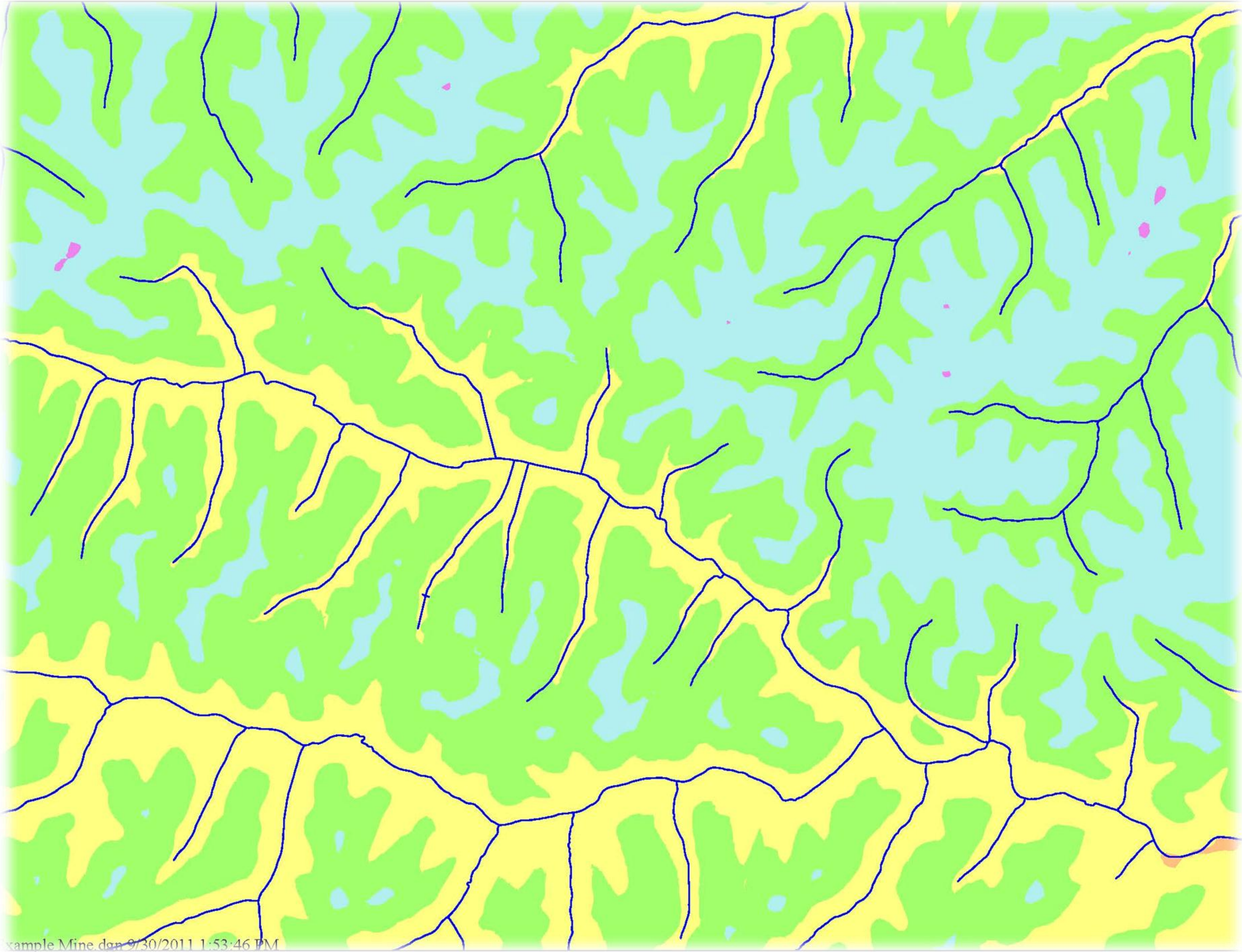
Slide 9 – Restricted mine plan due to stream protection






Protected Zone
100' Offset
15 Degree
Angle of Draw
Coal Seam recovery lost/reduced due to
protected zone
Buffer Zone (First Mining Only)

Overburden	Buffer	Offset	Color
0	100	100.0	
50	100	113.4	
100	100	126.8	
150	100	140.2	
200	100	153.6	
250	100	167.0	
300	100	180.4	Red
350	100	193.8	
400	100	207.2	
450	100	220.6	
500	100	234.0	Orange
550	100	247.4	
600	100	260.8	
650	100	274.2	
700	100	287.6	Yellow
750	100	301.0	
800	100	314.4	
850	100	327.8	
900	100	341.2	Green
950	100	354.6	
1000	100	367.9	
1050	100	381.3	
1100	100	394.7	Blue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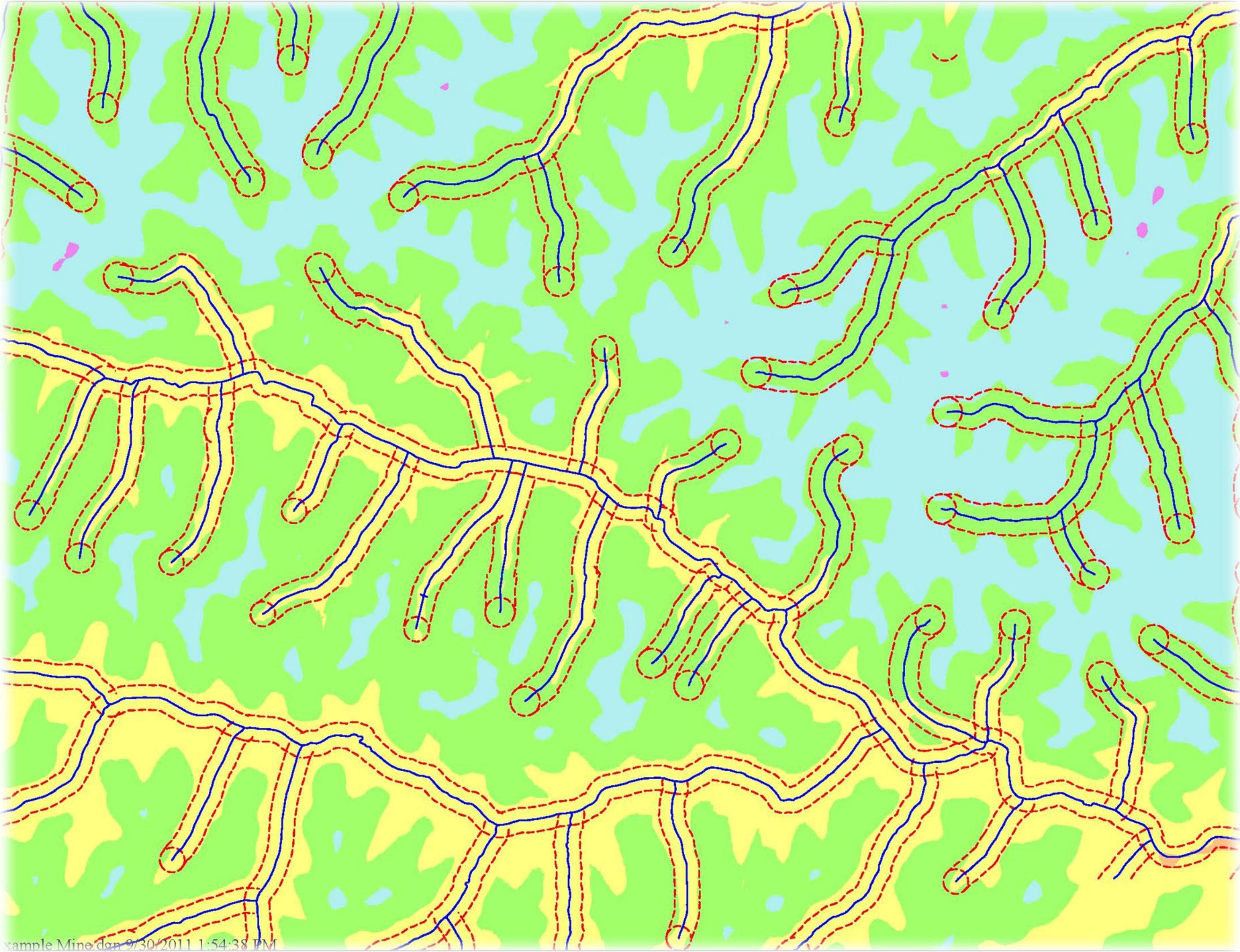
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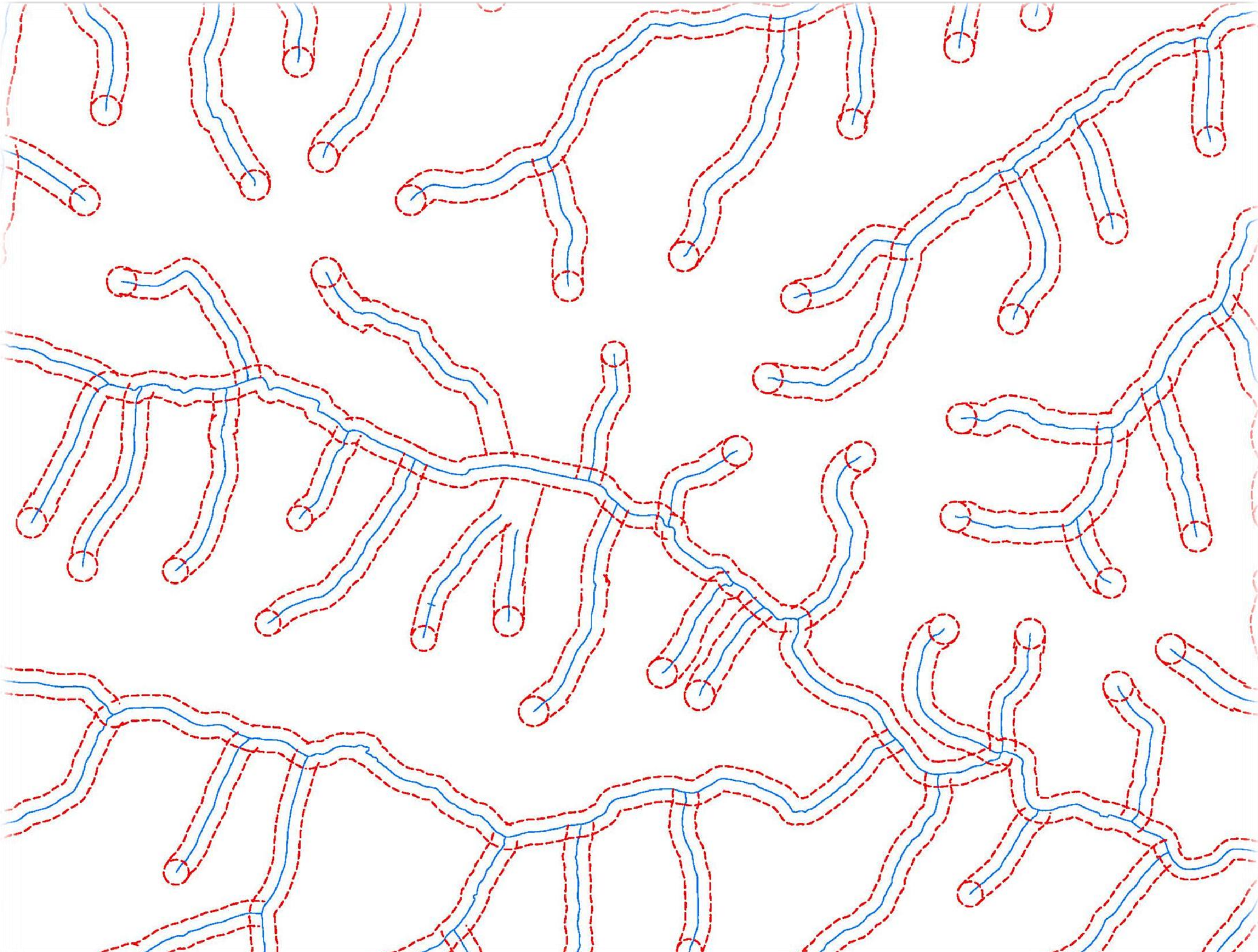
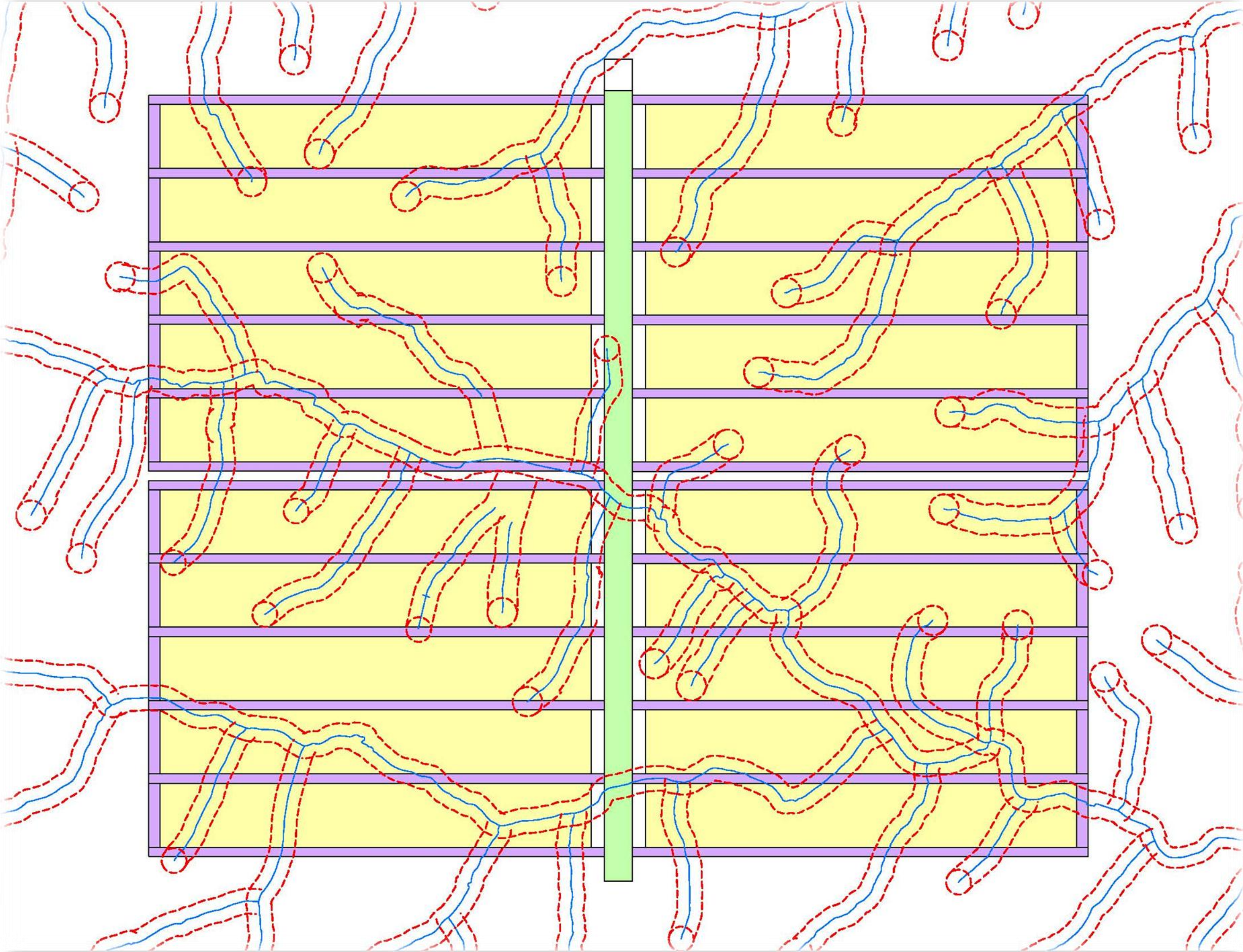
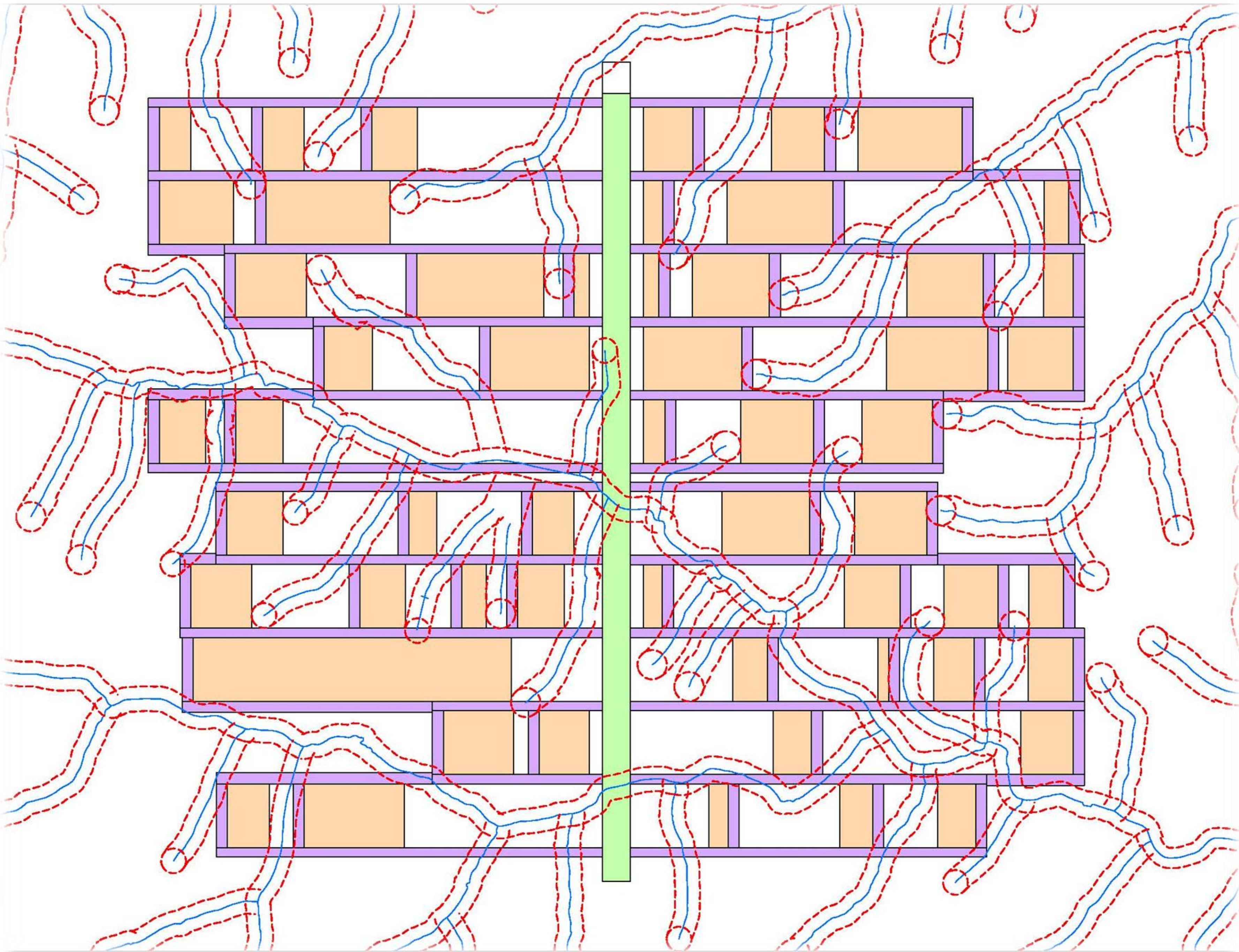
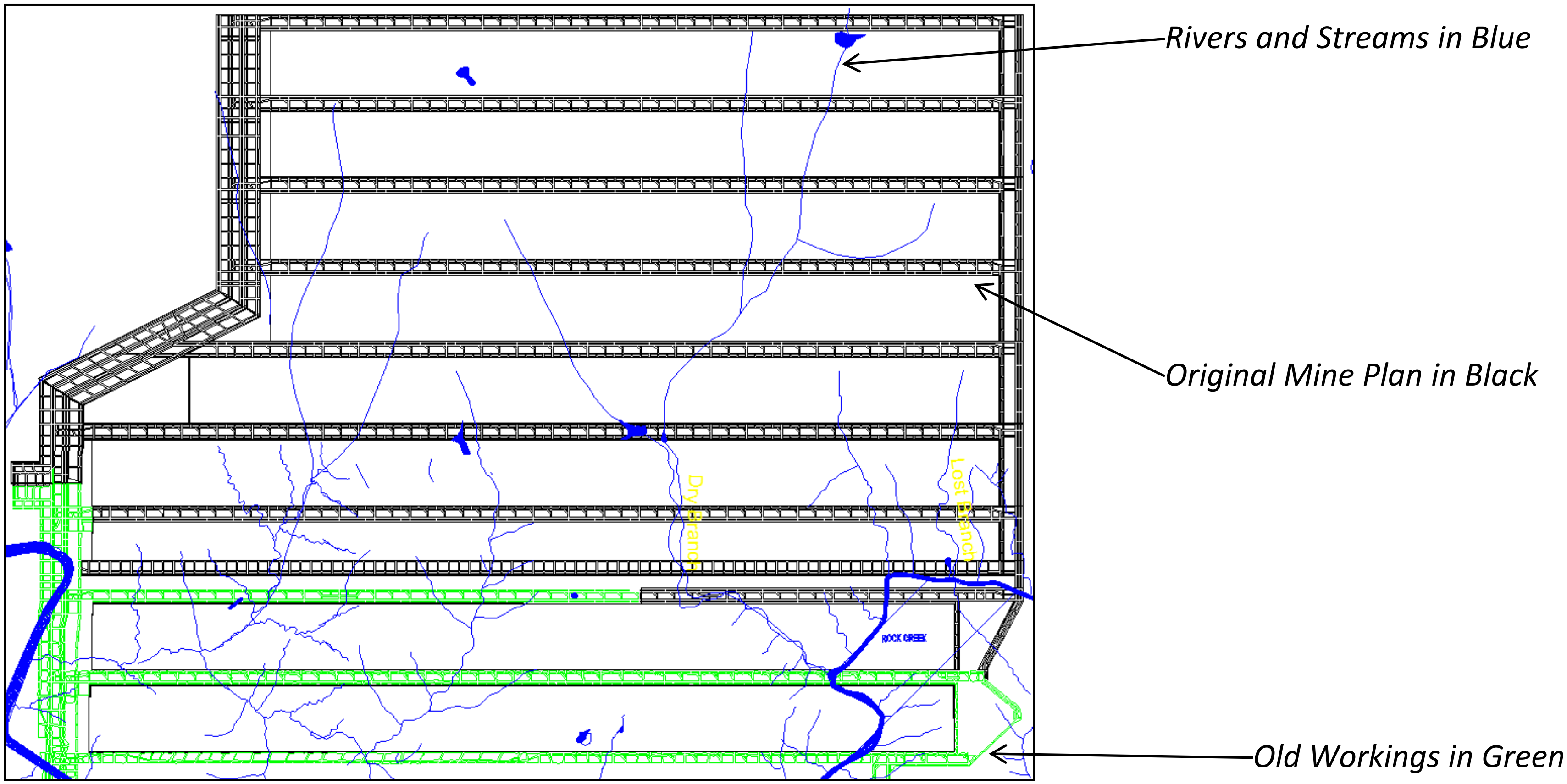






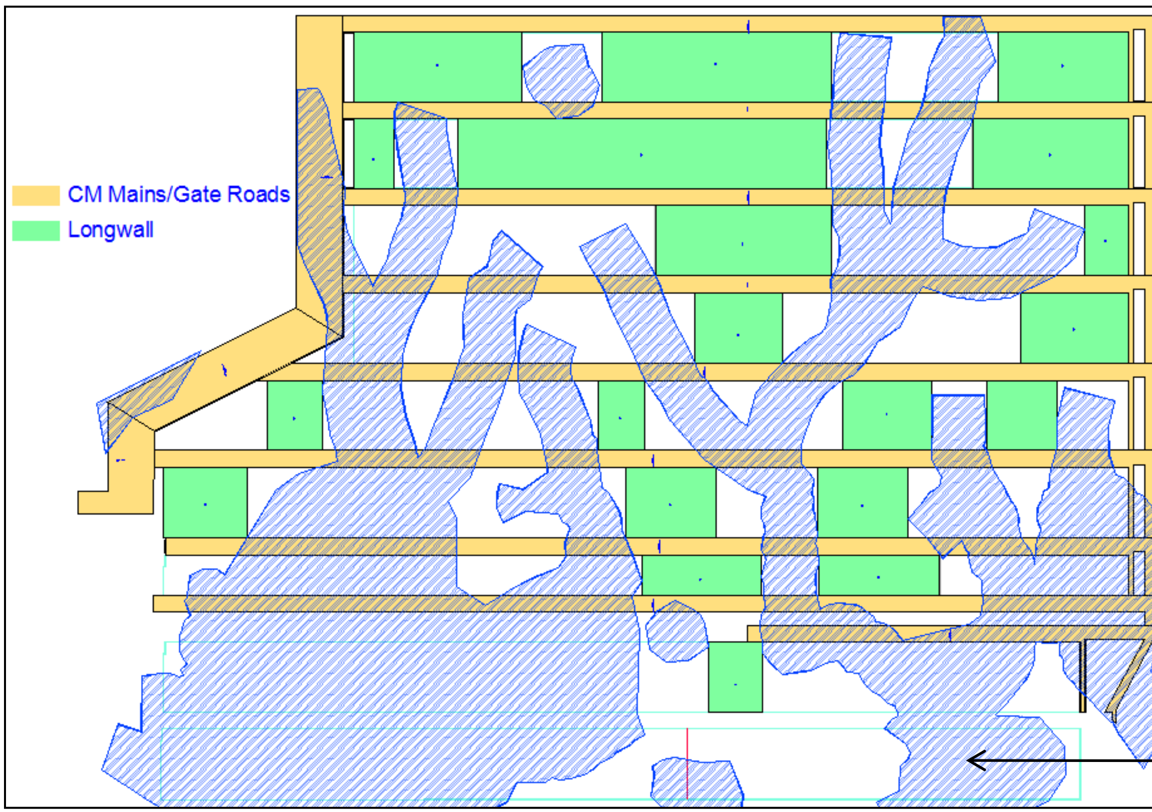
Mine B Plan – ORIGINAL

Mine B Plan	Longwall Moves	Continuous Miner (CM) Panels	Clean Coal Tons
Original	8	0	16,380,000



Mine B Plan – Scenario 1

Mine B Plan	Longwall Moves	Continuous Miner (CM) Panels	Clean Coal Tons
Scenario 1	20	0	6,348,000



Mine B: Scenario 1

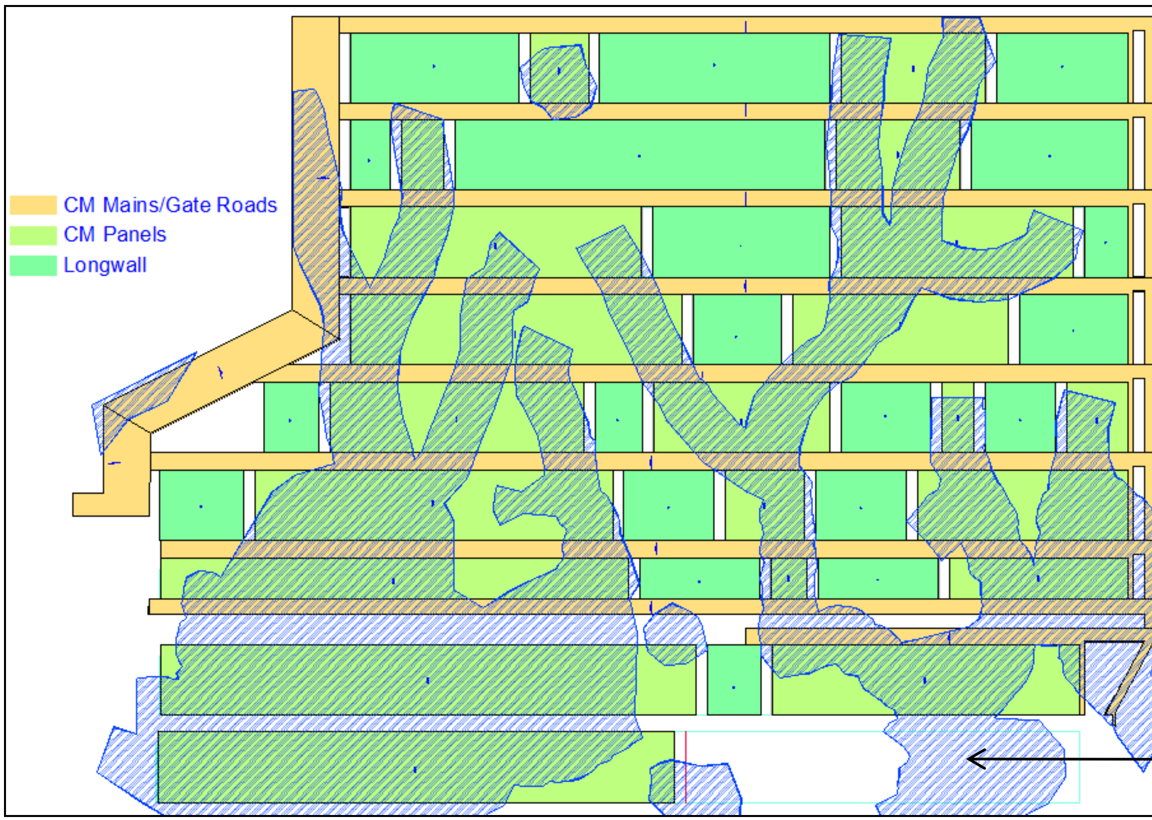
-CM mines the mains and gate roads with NO retreat mining

-LW mines in-between the rivers and streams Influence Area

Rivers and Streams Influence Area

Mine B Plan – Scenario 2

Mine B Plan	Longwall Moves	Continuous Miner (CM) Panels	Clean Coal Tons
Scenario 2	20	21	11,001,000



Mine B: Scenario 2

-CM mines the mains and gate roads with NO retreat mining

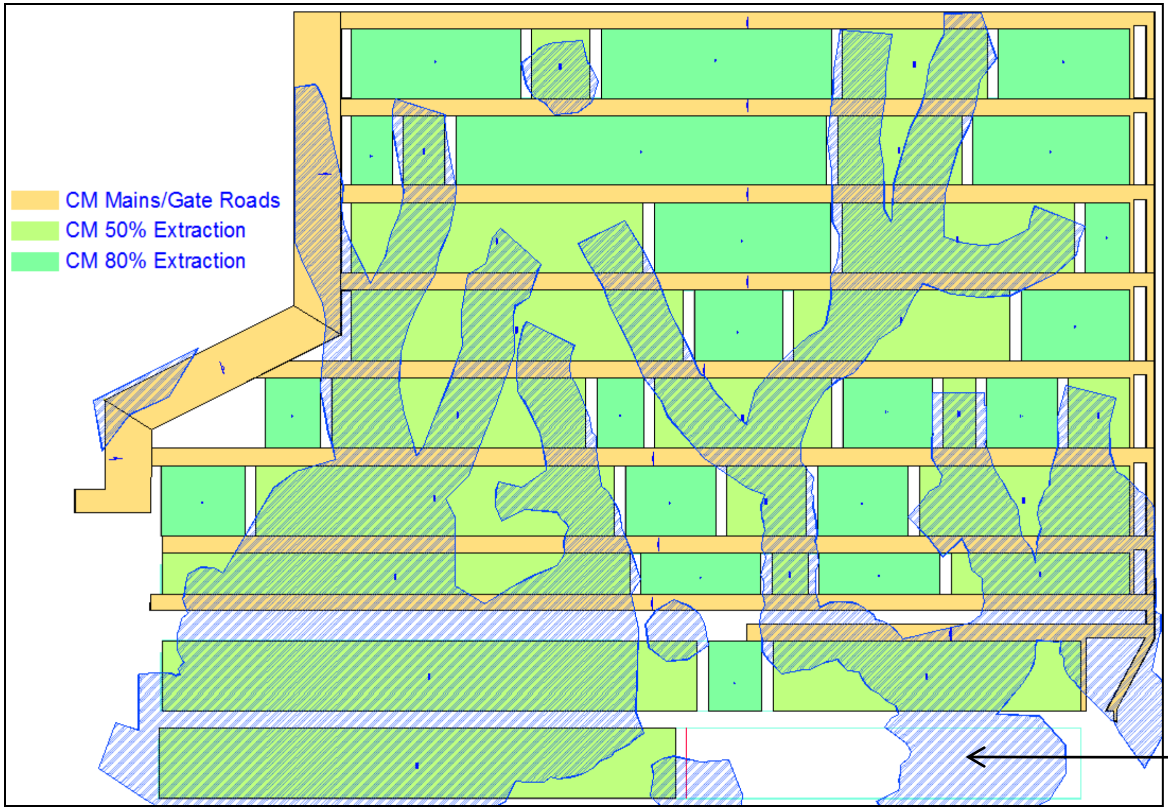
-CM mines under rivers and streams using 50% extraction ratio and NO retreat mining in the CM Panels between the LW panels

-LW mines in-between the rivers and streams Influence Area

Rivers and Streams Influence Area

Mine B Plan – Scenario 3

Mine B Plan	Longwall Moves	Continuous Miner (CM) Panels	Clean Coal Tons
Scenario 3	0	41	10,134,000



Mine B: Scenario 3

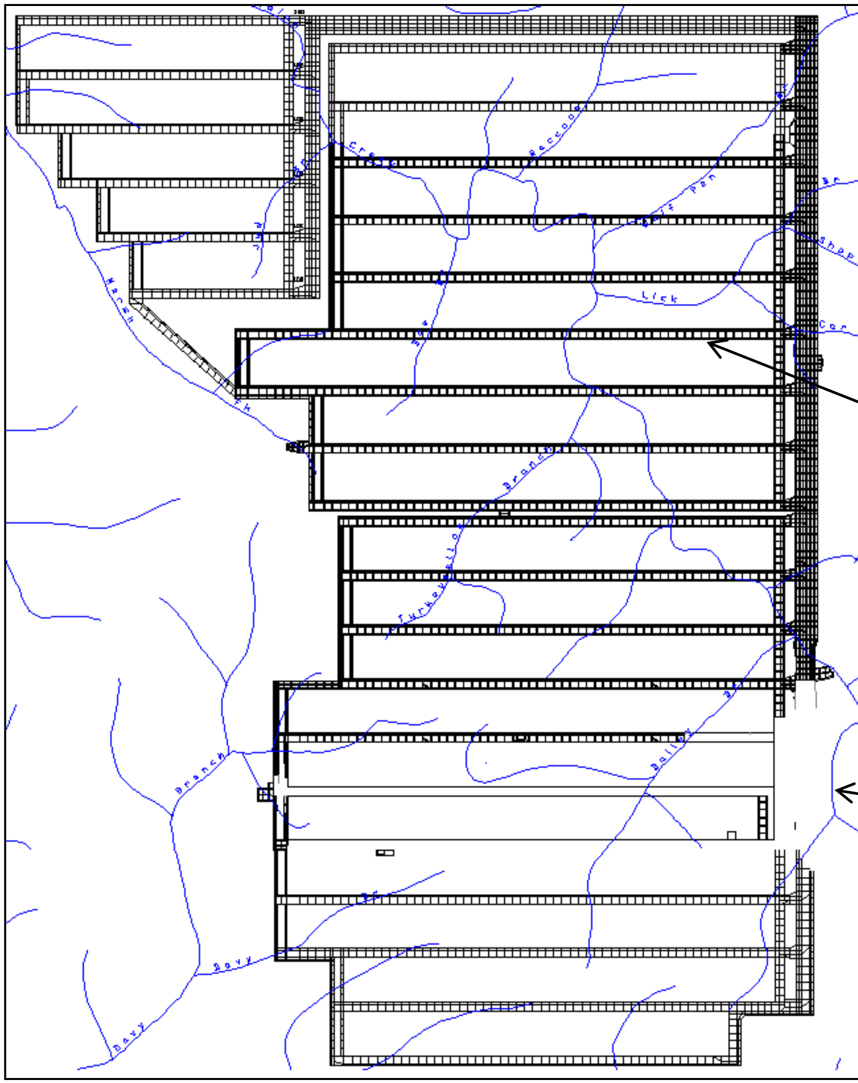
-CM mines the mains and gate roads with NO retreat mining

-CM mines under rivers and streams using 50%extraction ratio and NO retreat mining

-CM mines in-between the rivers and streams Influence Area using ~80% extraction ratio

Rivers and Streams Influence Area

Mine C Plan – ORIGINAL

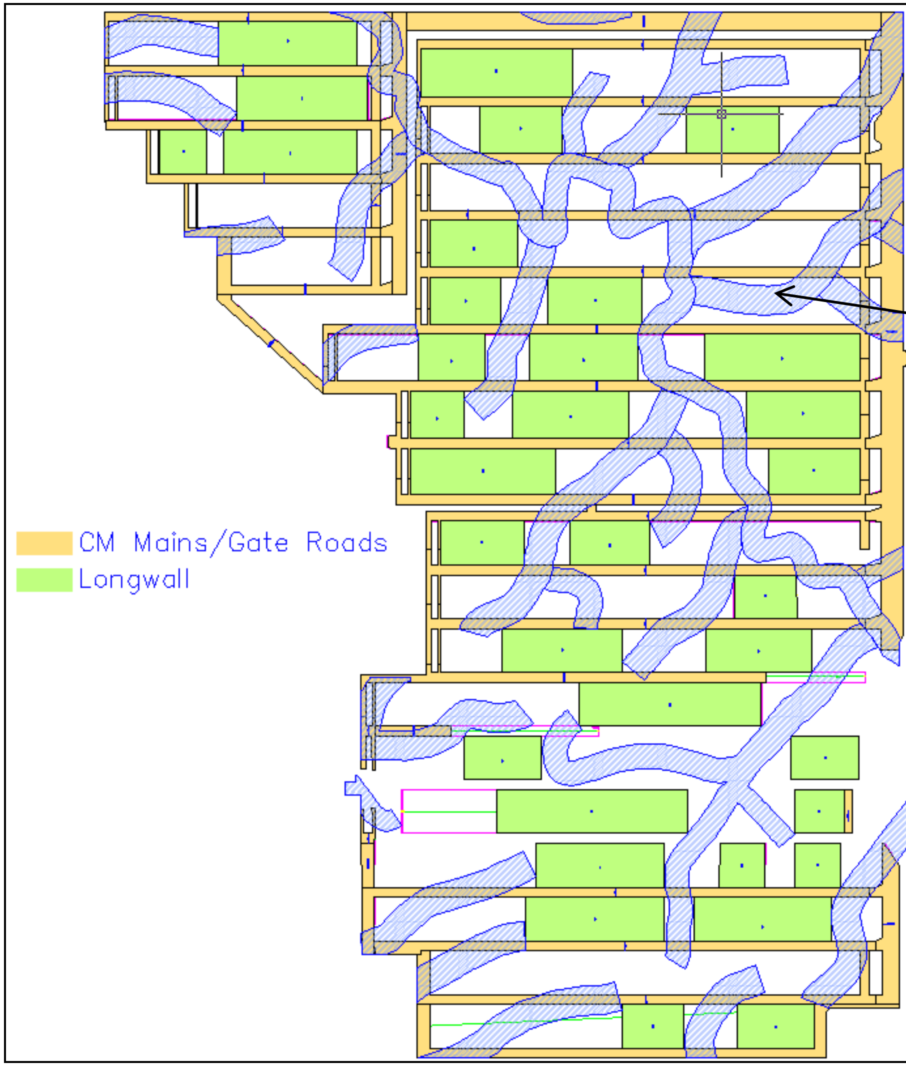


Mine C Plan	Longwall Moves	CM Panels	Clean Coal Tons
Original	22	0	45,400,000

Original Mine Plan in Black

Rivers and Streams in Blue

Mine C Plan – Scenario 1



Mine C Plan	Longwall Moves	CM Panels	Clean Coal Tons
Scenario 1	35	0	17,674,000

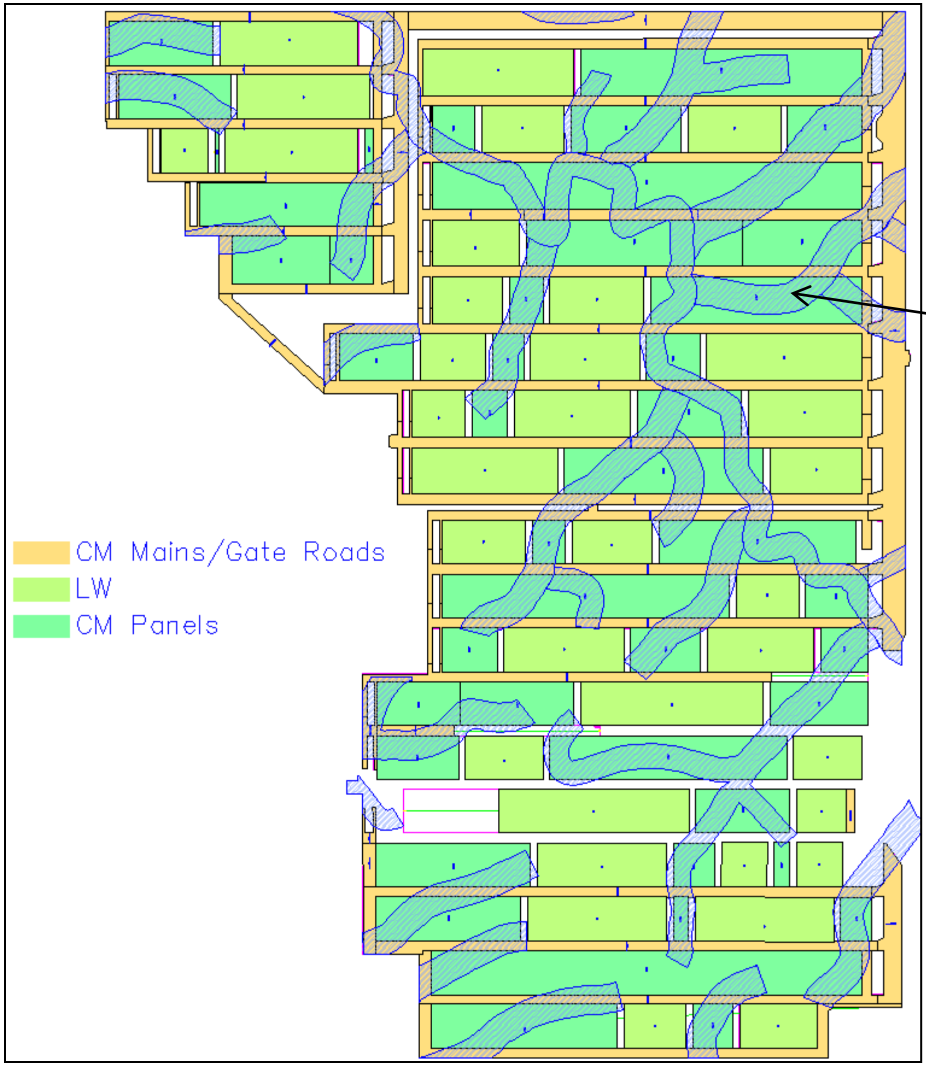
Rivers and Streams Influence Area

Mine C: Scenario 1

-CM mines the mains and gate roads with NO retreat mining

-LW mines in-between the rivers and streams Influence Area

Mine C Plan – Scenario 2



Mine C Plan	Longwall Moves	CM Panels	Clean Coal Tons
Scenario 2	35	41	27,138,000

Rivers and Streams Influence Area

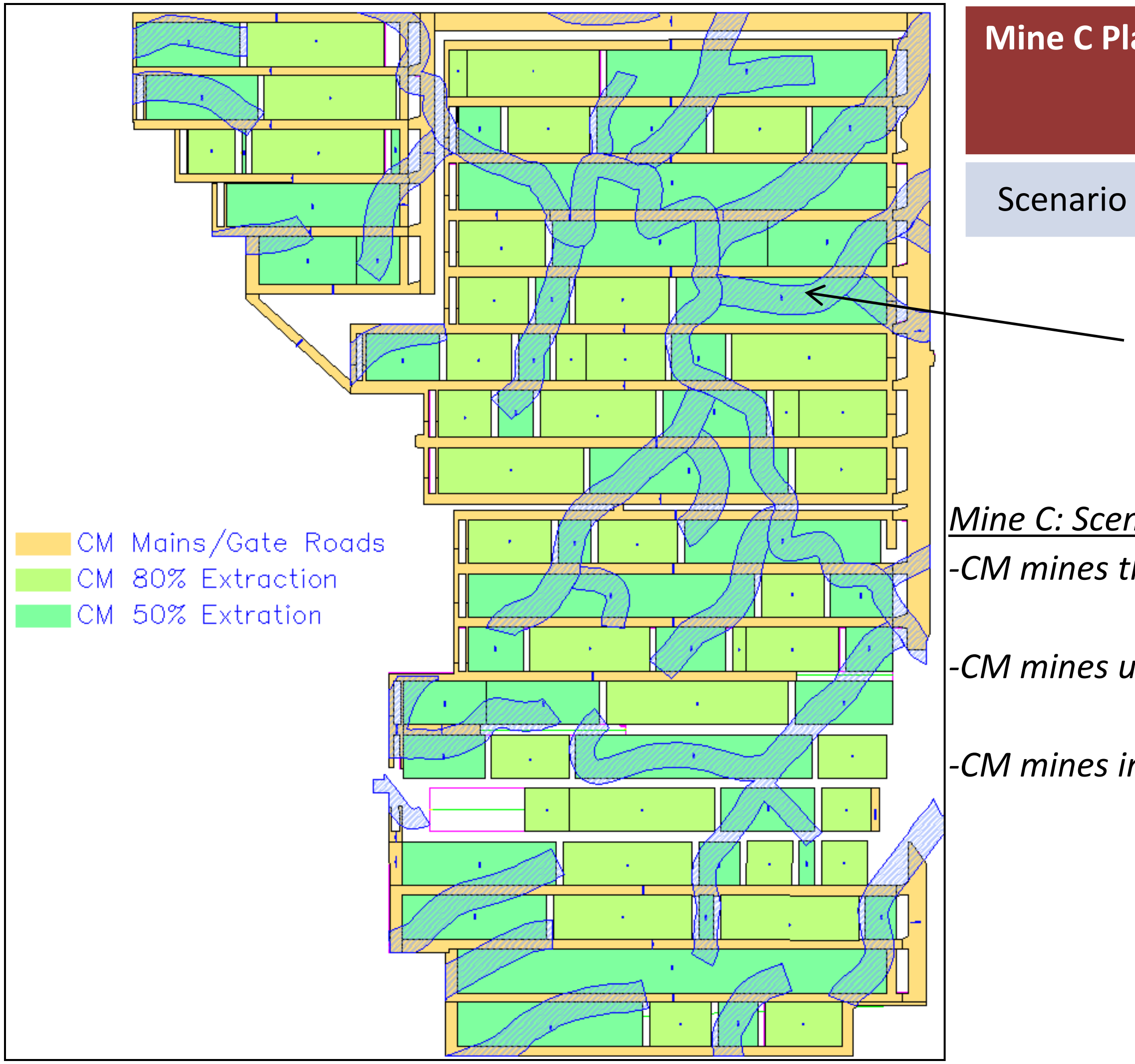
Mine C: Scenario 2

-CM mines the mains and gate roads with NO retreat mining

-CM mines under rivers and streams using 50% extraction ratio and NO retreat mining in the CM Panels between the LW panels

-LW mines in-between the rivers and streams Influence Area

Mine C Plan – Scenario 3



Mine C Plan	Longwall Moves	CM Panels	Clean Coal Tons
Scenario 3	0	76	24,488,000

Mine C: Scenario 3

-CM mines the mains and gate roads with NO retreat mining

-CM mines under rivers and streams using 50% extraction ratio and NO retreat mining

-CM mines in-between the rivers and streams Influence Area using ~80% extraction ratio