The Mountain State Clean Water Trust Fund

a report to the West Virginia Department of Environmental Protection

Draft, May 2001

Michael J. Hicks, Ph.D.
Director of Research
Center for Business and Economic Research
Assistant Professor of Finance and Economics

Marc W. Simpson, Ph.D.
Research Fellow
Center for Business and Economic Research
Assistant Professor of Finance and Economics

Kristy Wilburn, MBA
Director of Business Analysis
Center for Business and Economic Research

Lewis College of Business
Marshall University
400 Hal Greer Boulevard
Huntington, West Virginia 25755
(304) 696-2313

Mountain State Clean Water Trust Fund

Issue: The *Special Reclamation Fund* is currently not adequate to both treat acid mine drainage and reclaim defaulted mine sites. In order to finance both tasks the Fund must be bifurcated into a land and water component.

Task: To create a water treatment fund that can treat the current and estimated acid mine drainage in perpetuity. This must be accomplished without leading to more coal firm defaults. The fund should also self-insure against the potential failure of coal mining firms, pay for administrative costs, and sunset itself as early as possible.

Solution: *The Mountain State Clean Water Trust Fund* is composed of the following parts:

The Trust Fund

A Trust Fund which firms currently treating water pay the actual engineering costs (roughly $25 million). This component is used to pay the current annual treatment costs. Firms paying into this Fund may elect to recoup the costs by treating their own water. This preserves the incentive to mitigate environmental damage and minimize costs.

A sunset annuity which amounts to roughly 24% of the current treatment costs for each firm that is presently treating their own acid mine drainage. This amounts to roughly 5.9% annually, and will sunset the Fund no later than 2025.

A risk insurance annuity of roughly 20 percent paid by those firms currently treating water in the State. This self-insures these firms against the possibility that a percentage of them will fail over the financing life of the Fund. This is roughly $5 million per year.

A 0.5% administrative fee to pay for fund analysis, short and long run coal forecasts, litigation and engineering costs studies.

Water Treatment Fee

A 3.6 cent per ton fee on coal production to account for currently defaulted mine sites. This would pay for all the current and expected treatment costs through 2025, pay for full reclamation and sunset this component merging treatment duties with the Fund no later than 2025.

Contents

Tables and Figures

I. Purpose and Concept

The *West Virginia Department of Environmental Protection*, in assessing the need for additional protection for current and future West Virginia taxpayers, charged the *Center for Business and Economic Research* at *Marshall University* to design a financing mechanism for the *Mountain State Clean Water Trust Fund*. This *Fund* is intended to bifurcate the financing of land reclamation and water treatment. Under current practice, the sole treatment financing administered by the State is the *Special Reclamation Fund* (Sect. 22-3-11, 22-3-12, *West Virginia Coal Mining and Reclamation Act*). This act has been approved, as administered, by the *Office of Surface Mining* pursuant to *Section* 509(c) of the *Surface Mining Control and Reclamation Act of 1977.*

The proposed financing mechanism will create a *Fund* solely for treatment of water effluence from mine sites. It will consist of payments to a *Fund* by firms engaged in cleaning waterways damaged by mine effluence and a *Fee* on all coal mining operations. The *Fund* and *Fee* must be legislatively enacted and will, if implemented as designed, fully cover the costs of water treatment from current and potential mining related effluence in perpetuity. The funding mechanism for the *Clean Water Trust Fund* should perform the following critical tasks:

A) Remove the liability for treating mine related environmental damage to the State's natural waterways from the *Special Reclamation Fund*.

B) Preserve incentives for firms to avoid environmental damage and invest in better abatement/treatment technologies.

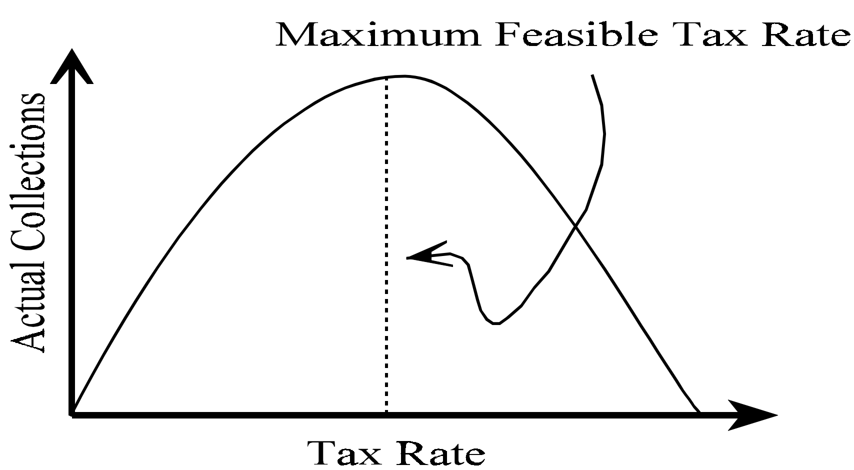
C) Sunset itself with a target date of 2025, with a fully capitalized fund that generates interest payments to cover projected clean up costs.

(D) Conform to the basic financing outline in initial DEP guidance, and maintain realistic but conservative assumptions for all forecasting.

II. Revenue Collection Considerations

Any mechanism for funding the *Clean Water Trust Fund* should collect sufficient revenues to conduct annual treatment of water damage while not leading to the failure of the firms paying into the *Fund*. This well known principle is embodied in a standard tool of taxation theory, shown graphically in Figure 1. In this graph, increasing rates of revenue collections will initially increase the total collection. However, as these rates increase beyond a point, actual collections will decrease. This could be due to non-compliance, defaults (through firm failure) or other causes. This dictates, in part, the appropriate rate of revenue collection for the *Clean Water Trust Fund*. (Note: Since the failure of a firm that is currently treating water potentially transfers treatment costs to the taxpayers of the State, it is an undesired consequence.)

Figure 1: Optimal Revenue Collections



A preferred method for determining actual treatment cost is an engineering study. In this process all costs are assessed directly to the per ton treatment cost of effluence. The *West Virginia Department of Environmental Protection* provided draft estimates of both actual abatement costs borne by companies and costs borne by the *Special Reclamation Fund* due to company default on abatement activities (primarily failed companies). The estimates we will employ (rounded in the text for ease of exposition) are of current annual operating liabilities of roughly $3.4 million. An additional $8.7 million is estimated to provide initial capital costs for mines for which treatment has not yet begun. A further $600 thousand is required for an additional four year to treat a single site. The private costs, borne by coal producers, is roughly $25 million annually. Due to changes in permitting regulations, no additional costs are expected to occur, with the total annual costs of abatement to be no more than $28.5 million per year. Over time, this cost is expected to remain stable or decrease (in constant dollars) as effluent levels are reduced to *Environmental Protection Agency* standards and technological improvements reduce the costs of abatement.

Given current data, the rate of change in actual abatement costs cannot be effectively estimated. We can however estimate the rate at which mine sites in the State fail to comply with water emissions standards. That rate has declined to a ten year average of roughly 0.0055 of total mines sites. This suggests that costs for treatment are unlikely to rise. To preserve the conservative estimates in this study, we will assume constant water treatment costs continue at the current rate for at least 25 years.

III. Some Potential Funding Options

The financing of trust funds is an established process. However, the evaluation of a program specific to the needs of West Virginia requires individualized analysis. In the early phases of this study, a variety of options for the *Trust Fund* were considered. All but one of these were ultimately rejected for reasons we will later explain.

Consideration for a full equity funding of a trust fund was almost immediately rejected. A one time payment to a trust fund sufficient to cover annual payments would represent over fifteen percent of the coal industry's annual revenues. This would lead to exorbitant default rates by firms currently treating water. Similarly, taxes levied against the entire industry is sub-optimal for two reasons. First, this method makes no effort to match actual costs with taxes. Second, the rate of taxation would be over 35 percent of the current severance taxes. This would endanger several firms with bankruptcy. A preferred method would be to address fees directly to firms currently treating water (where possible). Where responsibility cannot be adequately affixed, some other form of industry wide payment would better attach payments to cost. A full cash funding is clearly sub-optimal in that is would set aside funding of nearly $1/10^{th}$ of the State's annual tax receipts to ameliorate a $28.5 million water treatment problem. A third option is the purchase of a performance type bond. Under this method, a bonding agency essentially charges operators to insure the treatment of water. This is typically a private market mechanism which responds rapidly to changes in market conditions such as uncertainty and risk. The current market conditions for coal in the State, even with the recent price increase, are markedly uncertain. This suggests a bonding approach may not be appropriate for the State.

As current market conditions dictate, a near 100 percent financial capitalization is required to secure water treatment bonds, in addition to an annual fee. This effectively places performance bonding outside the feasible range for the bulk of firms currently treating water. While it is always desirable to permit market mechanisms to determine the scope and level of economic activity, there are conditions when markets fail. Indeed, this bonding process is designed to ameliorate the impact of market failure in the internalization of the costs of water pollution. The price of bonds is likely affected by distortions in the market process that are unrelated to the treatment costs and probability of firm default. A full treatment of this issue is outside the scope of this study.

More importantly for water treatment, bonding insures only a finite period of time. In West Virginia water treatment will likely continue for generations. A comprehensive treatment should, in our view, offer funding availability through the treatment period.

Other funding options, specifically applied to water treatment as a result of mining have been undertaken in Kentucky, Tennessee and Pennsylvania. Kentucky currently employs a treatment bonding formula in which a 20 year bond of actual value is required. In practice, a firm currently treating $50,000 in water, would have to bond $1,000,000 for treatment, covering only the ensuing twenty years. This process essentially traps one million dollars for the duration of the operation of the bond. The holding of financial capital for unproductive bonding would be especially damaging in West Virginia, where undercapitalization of firms is a continuing problem.

Tennessee similarly proposes bonds treatment, for 75 years. Under the this method, overseen by the *Office of Surface Mining*, operators are required to bond the present value of both annual treatment costs and the full value of projected equipment replace for the lifetime of the bond. This results in the purchase of a 75 year bond valued at just over 270 percent of the current annual operating expenses. This process has not yet been implemented, and is subject to litigation. Pennsylvania employs a site specific trust fund method estimating treatment over a 50 year period. This very complex mechanism is likely too cumbersome to implement in West Virginia (with many more mine sites) and may not receive approval from the *Office of Surface Mining*.

These explanations of each of these potential funding options, while very simple, reveal potential problems that make them unattractive for West Virginia. Chief among the problems are the scale of the initial payments and the temporary nature of the bond. As previously mentioned, a financing process which levies taxes or fees at a level which leads to firm failure is not optimal since it would potentially and unnecessarily burden the State's taxpayers with water treatment costs (or stress the adequacy of the *Special Reclamation Fund*). Also, the bond mechanisms outlined above fail on two counts. First, they typically burden firms with very high payments (an expected result in West Virginia). Second, they do not offer a permanent financing mechanism for water treatment. A review of alternative financing mechanisms for water treatment, both in practice and theory, suggests a new method will be necessary for West Virginia.

IV. Pressures Facing the State's Coal Industry

Coal mining in West Virginia continues to face challenges from a variety of economic and regulatory areas. These issues are covered in detail in a recent report *Coal Production Forecasts and Economic Impact Simulations in Southern West Virginia: A Special Report to the West Virginia Senate Finance Committee*. Here we briefly discuss supply and demand issues and how they are affected by regulation.

On the supply side, recent court decisions regarding the *Clean Water Act* limiting valley fill activities may substantially reduce coal production in the State. This is commonly known as the Haden Decision. {Note: Since the last draft of this report, the 4th Circuit Court of Appeals has overturned the Haden Decision based upon jurisdictional grounds.} At issue is the potential loss of a substantial amount of economically feasible surface mining due to limits on valley fills. This may also reduce underground mine production due both to economies of scope between deep and surface mines, as well as extension of the ruling to underground mines and preparation plants in the State.

On the demand side the *1990 Amendments to the Clean Air Act* require reductions in nitrogen oxide emissions. This will likely require coal fired generating plants in the Ohio Valley to reduce use of higher sulphur coal from West Virginia's mines. The growing use of low sulphur coal also makes West Virginia coal less attractive than coal from the Powder River Basin in Wyoming, a major competitor. Internationally, competition from Columbian and Australian coal is reducing demand for West Virginia coal by displacing its markets in the deep south. This further shifts North American exports towards domestic markets, reducing price and West Virginia's market share of world coal.

The recent increases in the price of petroleum and natural gas benefit coal production by making coal a more viable energy substitute. Together these impacts make future production levels uncertain, as they have always been. In this study we employ the *U.S. Energy Information Administration's* forecast of Appalachian coal production, while keeping West Virginia's 1999 share of that production constant. In addition, a Regional Economic Model estimate, by the CBER as well as an independent forecast by CBER which was virtually identical to the REMI result. was performed. The average of the two is employed for the estimates of production in this analysis. {Note: in late December, 2000 the EIA generated a new coal production forecast with a much more optimistic appraisal of short term coal production. We elected to maintain the earlier, lower forecast in this analysis in order to present a more conservative estimate of the *Fund* requirements.}

V. Firm Risk of Failure

As previously noted, this *Fund* is designed to provide a method of bifurcating payments for water treatment and eliminating unintended outflows from the *Special Reclamation Fund*. In order to accomplish this without transferring costs from the private to public sector, the *Fund* should not cause firms to default. However, it is possible that over the next 25 years some firms in the *Fund* may fail. Failure of a firm engaged in payment into the *Fund* complicates the financing mechanism. The details of the financing options under a firm default scenario are detailed in the appendices. Here, we describe the risk of default.

Two types of risk are associated with the *Fund*. The first risk is that the assessed fees or annuity payments might become sufficiently high to cause firms to shut down. Thus, any assessment of fees and annuities should include an analysis of the economic condition of the individual firms in the coal industry.

The second type of risk is the possibility that a single firm currently engaged in water treatment will exit the market for unrelated reasons. This occurrence directly transfers the cost of water treatment from the private to the public sector. To preclude this possibility a qualitative assessment of individual firm risk should generate a default risk annuity for firms currently engaged in treatment of water.

The fee and annuity payment levels outlined in this study dramatically reduce the first type of risk. The second type of risk is more substantial, meaning that one of the roughly 135 firms engaged in water treatment might shut down.

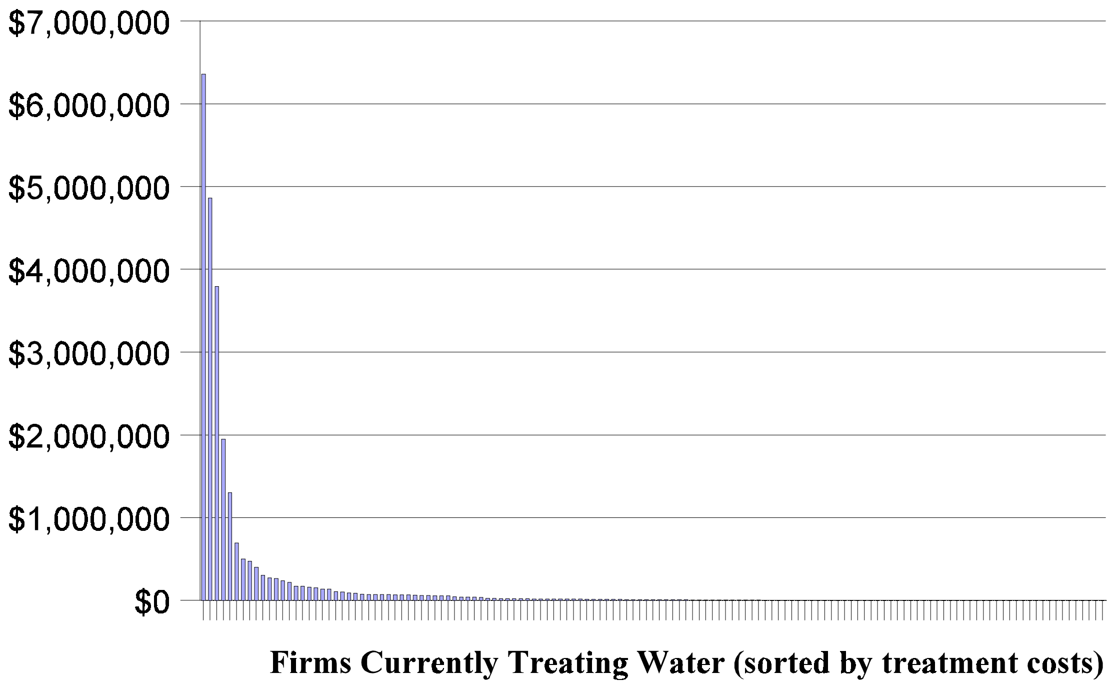
The risk here is that a firm that shuts down may end payments into the *Fund*, and require the State to engage in litigation to recover the revenues.

Individual analysis of the ten largest firms (in terms of treatment costs) reveals that they collectively engage in roughly $21 million of the roughly $25 million of private treatment costs. These are from multiple mine sites, and since many of these firms have a single corporate owner the "bunching" of liability within a few corporations is likely higher than that illustrated. However, identifying risk of default or failure of these firms is problematic. While the coal industry faces enormous risks, as outlined earlier, methods of analyzing firm level failure risk are scarce in general and entirely absent for this industry. In part, that is in part why this *Fund* is needed as a protection for the State's taxpayers. The appendices present the data employed in this analysis, but we note here that the ratio of treatment costs to firm revenues are small. [Note: while "small" is a value judgement, as we explain in the appendices, it should be noted that high treatment costs are mostly a function of the size of production, not necessarily lax environmental protection. The firm with the highest total treatment costs may have the lowest, per ton treatment costs and hence the best environmental record.] While the courts will ultimately address firm failure, we anticipate that except for very small, privately held firms, the potential for default is minimal. Indeed, for many of the firms with low treatment costs, any litigation costs to the State for recovering payment from a failed company would may exceed the firms actual liability.

VI. Engineering and Cost Considerations

In this model, we employ draft engineering estimates of treatment costs on

Figure 2, Preliminary Cost Estimates



Acidity, Alkaline Manganese and Alkaline Iron effluence into West Virginia's waterways. The actual engineering estimates will, of course, vary from year to year, but are expected to decline over time (in inflation adjusted dollars). In practical terms, a small variation in costs from estimated levels, will not be problematic for the condition of the States waterways. Since firms must meet *Environmental Protection Agency* guidelines on water quality, all private costs vary with actual abatement needs. The original estimates are primarily a guide to construct liability funding for the industry and firms.

These cost estimates include treatment sites of just under $2.7 million that are currently being treated by the State on an ongoing basis. An additional $600 thousand in treatment will be required for an additional four years. A small number of mine sites are currently undergoing the survey process used to determine actual treatment needs and estimated costs for that treatment. *West Virginia's Division of Environmental Protection* estimates the costs of treating these sites will not exceed $700 thousand per year in operating expenses and an initial $8.7 million in capital costs. This should prove to be the ceiling for treatment costs, as it is a high estimate of actual costs. These costs are illustrated in Table 1.

Table 1, Engineering Costs (Actual and Estimated)

Item	Estimated Cost	Termination Date
Current Known Treatment	$2,700,000	unknown
Single Site Treatment	$700,000	4 years
Annual Estimated Treatment	$700,000	unknown
Estimated Capital Costs	$8,700,000	to be paid over five years

VII. Incentives for Improving Treatment Technology

Current methods for treating effluence from mine sites varies with the size and type of effluence, individual site characteristics and technology employed. The established effluence levels set the effective goal of treatment. Essentially, firms will minimize their costs subject to the need to treat water to the standards set by the *Environmental Protection Agency*.

This process preserves the firms' economic incentives to engage in *low cost, but effective* treatment techniques. It also provides a motive for firms to avoid environmental damage. The choice of financing instrument selected by the State may seriously effect the incentives for firms to minimize their treatment costs and avoid environmental damage. Preservation of these incentives are important for two major reasons. First, new treatment technology are most likely to emerge from the incentive to implement low cost, effective treatment techniques. Simply, research and development are not performed in a vacuum but instead are motivated by real treatment cost reduction needs. The treatment of these types of effluents are likely to persist throughout much of this century and investment in better technology to treat water today is welcomed. Second, reduction or elimination of new environmental damage is clearly in the best interest of all.

An important consideration for this *Fund* is that it preserves the incentive mechanism. In order to facilitate this, the *Fund* participants must be permitted to engage in treatment themselves or allow the State to contract for treatment costs. If firms elect for the State to contract for treatment costs, then the actual costs for treatment will be the engineering estimate or the awarded bid for the contract, whichever is higher. A more likely scenario is that individual firms will elect to engage in treatment themselves. Under this scenario the payment to the firm treating its own effluence will be equal to the treatment's engineering cost estimate. Though the firm must treat water to meet effluence levels established by the *Environmental Protection Agency,* this preserves the incentive mechanism for firms to invest in better treatment technology. The self treatment element of this *Fund* is essential if the State desires firms to invest in better treatment technology.

VIII. Financing Considerations

We employ estimates of the present value of funds a weighted average interest rate of Series A, B and C, bonds issued by the State for a variety of activities and underwritten by *Morgan Stanley Dean Witter*; *Salomon, Smith, Barney*; and *Griffen, Kubik, Stephens & Thompson*. The weighted average interest rate is 5.4970%. The rates of return on investment are estimated as 30 year averages of the *Standard and Poor's 500 Index* and one year *Treasury Bills*. These are 10.37% and 6.84% respectively. The choice of different interest rates reflect the time value the State places on future assets (the bond rates) and a range of likely returns to the invested assets (S&P and T-Bill rates). These are appropriate and realistic figures.

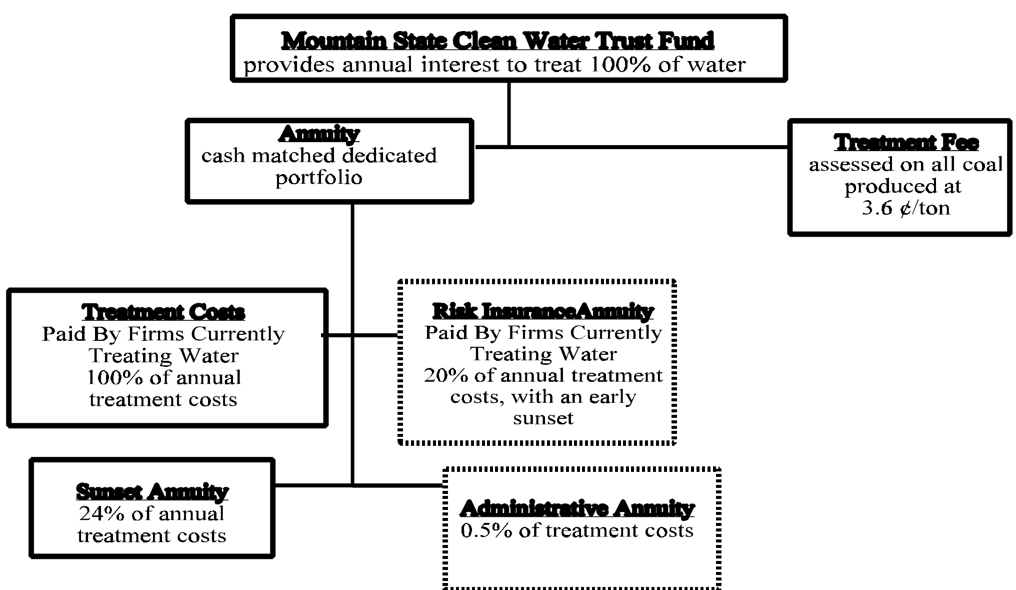
The termination of any fee or financing mechanism when no longer needed was a key planning consideration for the *Trust Fund*. In order to achieve this, we "sunset" the payment program no later than 25 years, and retire the entire *Fund* as the actual costs of cleaning the State's waterways drops to zero. Since we have no data with which to estimate this date, the *Fund* provides for continued operations indefinitely, but only so long as the *Environmental Protection Agency* adjudges clean up needs for the State's waterways that are associated with the pollutants mentioned above. We will recommend that firms paying into the *Fund* receive the principal and interest (the latter until the sunset date) back when their obligations are met. This could be as soon as a few years, several decades or longer.

IX. Funding Options

Several options for funding the *Clean Water Trust Fund* were considered, and rejected. Two reasons dominated the rejection decisions. First, payments into the *Fund* under several scenarios were sufficiently high to dramatically increase the risk of default by operators. Second, the goals of a fully funded, sunsetted program could not be obtained. The proposed *Fund* has two time components, the initial funding phase and the perpetuity phase. Outlined below are the two financing mechanisms designed to fully capitalize the *Fund*. They are described graphically in Figure 3.

A Cash Matched Dedicated Portfolio: A *cash matched dedicated portfolio* is a financing mechanism designed to fund cash flows through the *Clean Water Trust Fund*. This is also known as liability funding. This process matches actual engineering estimates of abatement costs, by effluent type, to payments into the Fund.

Figure 3, The Mountain State Clean Water Trust Fund



In this funding process, estimated current costs of treatment (roughly $25 million) are charged to each liable operator on an annual basis. The liabilities for treatment are then payed by the fund to firms engaged in treatment of the effluence. This *cash matched dedicated portfolio* fully covers the cost of abatement, <u>in the first year following inception</u>, for operators still conducting treatment activities. Treatment from defaulted mines will be addressed in the following section. Additionally, a *Sunset Annuity* will be charged to each firm engaged in water treatment. The annual costs of the *Sunset Annuity* are roughly 24 percent of the annual treatment costs for each firm treating water (roughly $5.9 million annually). This fund sunsets itself with a target date of 2025 under our most conservative interest rate estimates. This component immediately creates a $440 million *Trust Fund* for insuring the clean up of the Mountain State's water resources (in present value terms). See Table 2.

Table 2: Interest Rate and Sunset Projections

Interest Rate Received on Fund	Period Until Fund Sunsets
Average One Year Treasury Bill Rate 6.84%	25.00 years
Intermediate Rate 8%	23.16 years
Average S&P 500 Return 10.37%	20.30 years

An additional concern was the potential for default by a firm obligated to continue payments through the funding phase. While the *Fund* legislation would create a formal debt obligation, concern remains that some proportion of firms that potentially fail will be unable to meet these obligations even following litigation. In order to strengthen the *Fund*, providing it solvency even under the unlikely loss of several firms, we include a *Risk Insurance Annuity*. The *Risk Insurance Annuity* is an annual payment, spread proportionately across each of the firms currently treating water in the amount of $5,000,000. This amount was selected as the total amount of medium risk the State should reasonably insure. This is treated in more detail in the *Risk of Default* section of this study and in its appendices. The *Risk Insurance Annuity* will be the most rapidly terminating payment, and will end in under 11 years if not used to support defaulted obligations. This component of the

Fund is best viewed by the State as 'self insurance' for the potential failure of a firm that is currently treating water. Table 3 illustrates the termination date of the *Risk Annuity*. Figure 3 illustrates the *Fund* and *Fee*.

Table 3: Risk Annuity Termination Estimates

Interest Rate Received on Fund	Risk Annuity Termination Period
Average One Year Treasury Bill Rate 6.84%	10.48 years from inception
Intermediate Rate 8%	10.06 years from inception
Average S&P 500 Return 10.37%	9.35 years from inception

These processes will create a fully capitalized *Fund* to treat water in perpetuity. The size of the Fund will be determined by the manager's of the Fund at the appropriate time. Though it is hazardous to provide advice to these managers 20 or more years hence, it would seem prudent that the *Fund* be large enough to provide annual treatment costs under more costly than normal conditions.

Not presented in this analysis is the potential for a much more rapid sunset of the *Fund* that will occur if the *Risk Annuity* component is not used for defaulted treatment costs. We discuss termination criterion and procedures in more detail in the section dealing with *Fund* administration. An additional administrative fee of 0.5 percent on the basic Fund will generate $125,000 annually for a variety of administrative needs.

The Clean Water Treatment Fee: A supplemental fee on coal production to cover the unmet costs of abatement by operators who have already defaulted would currently require annual revenues of roughly $34 million in operating costs, $8.7 million in up front capital expenditures and another $2.4 million paid in four annual installments under a specific treatment agreement. This would require a roughly $0.036 per ton fee on coal (at the lowest *Energy Information Administration* production forecast). Under this rate the *Fund* pays all annual operating costs, pay down the capital expenditures over five years, and pay the additional $2.4 million over four years. This Fee rate permits the DEP to sunset the Fee and potentially engage in water reclamation with the residual revenues through 2025. We address the coal forecast in the appendices.

X. Inflation and Cost Assessment Variation

There are two types of cost changes that are of interest in planning for this fund: nominal and real. Nominal changes are caused by inflation, while real changes are due to specific price changes in the cost of inputs that are employed to treat water. Inflation is a monetary phenomenon, it is caused solely by changes in the supply of money in the economy. This naturally affects different parts of the economy at different levels and rates. While there are problems with inflation measures, they exist for a wide variety of production processes. We know of several hundred but are unaware of any that specifically target water treatment. In the case of inflation impacting water treatment, it is best to account for it as a spread between the interest rate employed and the rate of inflation. That estimate is straightforward, but not revealing for our purposes. It is perhaps better to use a systematic method of analyzing costs that incorporate real and nominal changes in the input prices for water treatment.

The *Fund* has been structured to change with engineering estimates of clean up costs. These cost changes may adjust payments into the *Fund* through the financing period. This very straightforward method should account for both real or nominal price level changes during the financing portion of this process. Simply, re-evaluating actual costs every few years will undoubtably account for changes, both nominal and real, than would the best of economic forecasts.

XI. Fund Summary

The *West Virginia Department of Environmental Protection* should recommend to the Governor and the Legislature that legislation creating the *Mountain State Clean Water Trust Fund* be enacted. This *Trust Fund* should consist of a *cash matched dedicated portfolio* which covers the current industry borne abatement costs of roughly $25 million. In addition, a *Clean Water Treatment Fee* in the amount of $.036 per ton extracted should be charged to all coal producers in the State.

We further recommend a *Risk Insurance Annuity* of $5 million be collected with payments distributed in proportion to the treatment costs for all firms engaged in water treatment. In less than 11 years, this would generate revenues sufficient to provide treatment costs for 20 percent of the total private cost of treatment. This form of self insurance by the State would also, if not tapped for treatment costs, permit the *Fund* to sunset much earlier than estimated.

We also recommend a *Sunset Annuity* be collected on private treatment costs. For the private treatment costs of roughly $25 million this *Annuity* would consist of an additional $5.9 million collected from firms in proportion to their current treatment costs, or 24 percent of their treatment costs. This *Fund* would sustain, through interest collections, the annual treatment costs of $25 million in perpetuity.

Finally, we recommend that a 0.5 percent administration payment be collected (from the base $25 million Fund) each year. This would generate roughly $125,000 per year dedicated to financing annual *Fund* and *Fee* analysis, short run coal production forecasts, and intermittent engineering studies and litigation.

Together, the various components of the *Fund* would require firms currently treating water to pay roughly $35.9 million annually. The *Fee* payment, assessed on all coal production in the State, would total roughly $0.0360 per ton of coal produced, generating an annual $5.14 million.

XII. Administration

The *Clean Water Trust Fund* should require annual payments to the *cash matched dedicated portfolio* in a *Fund* administered by the *State Treasury*. We recommend the *Treasury's* use of the *Investment Board*. We recommend that collections be performed using the standard procedures, and that any changes in cost or additional sites be accommodated in the *Fund*. We recommend that all costs be assessed by an engineering study which links actual effluence types to treatment costs.

We further recommend that an annual coal production forecast and analysis of the *Fund* be contracted by the *Department of Environmental Protection*. Both of these activities should be accomplished at an annual cost of less than $75,000. The remainder of the administration payment (another $75,000) should be accrued to pay for intermittent legal fees and engineering studies.

The *Fund* analysis and coal production studies are important in providing an updated estimate on when the *Fund* will sunset. Though we have targeted 2025 as the latest sunset date, it is likely that the *Fund* will terminate the financing phase much earlier. In particular, if no firms currently treating water default, then the *Risk Insurance Fund*, which will be fully able to generate $5 million within 11 years, will cut several years off the sunset date. Also, rates of return even modestly above the S&P 30 year average would cut more than five years off the projected 2025 sunset date. Foreknowledge of this is critical to management of the *Fund*. We also recommend that principle and interest (through the sunset date) be returned to firms whose mine sites meet *Environmental Protection Agency* standards without further treatment.

XIII. Impact on the Adequacy of the Special Reclamation Fund

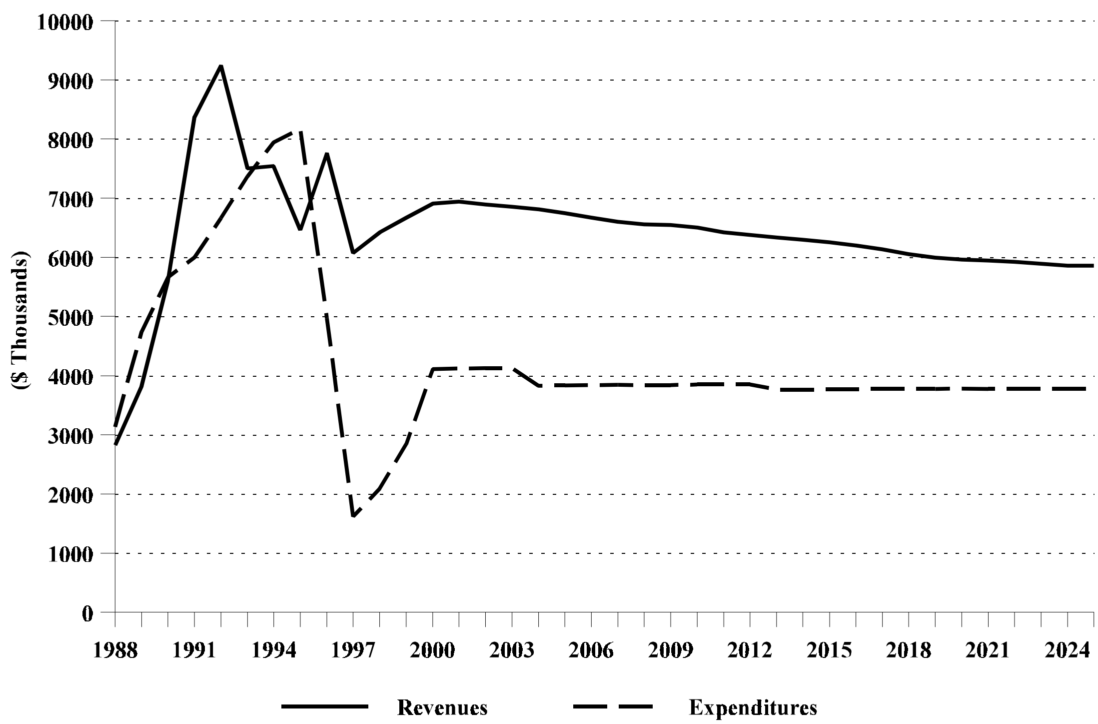
The *Special Revenue Fund* (SRF), mentioned at the outset of this study, collects revenues from a variety of sources. Chief among these sources are Bond Forfeitures, Civil Penalties and Taxes on the production of coal. Additionally, the SRF receives revenues from investment interest, excess reclamation, performance bonds, and a half dozen other sources that vary dramatically from year to year. In general, these latter revenue sources are dedicated to specific and occasional treatment needs.

Expenditures from the funds since 1988 have focused on land and water treatment and administrative expenses associated with both. At issue are two concerns. The first is whether the current level of revenue collections are adequate to treat both land and water without a bifurcation of the programs. The second is whether the SRF is adequate to treat land following the creation of a water fund that eliminates the need for water treatment from the SRF.

The current practice of treating water from SRF funds was necessitated by the more urgent nature of water effluence from mines. This decision was made by DEP in an effort to minimize overall environmental damages associated with coal mining in the State. The treatment of water in the State has incurred expenses of roughly $20.3 million since 1988.

The treatment of the State's water from the SRF has resulted in a slowdown of land treatment. It is the treatment expenditures that have not been accomplished which raise the suggestion of inadequacy of the SRF. It seems clear however, that without the diversion of funds to the treatment of water that the backlog of land

Figure 4, History and Forecast of Land Only Expenditures
(Revenues include only Taxes, Bond Forfeitures and Civil Penalties)



treatment would not have occurred. From this brief analysis it appears that pending continued treatment of water from the SRF fund and without changes in the tax rate there will continue to be the need to defer treatment of land.

Following a bifurcation of the SRF with a water specific fund, the treatment of water from the SRF will discontinue. This allows DEP to dedicate the unused revenues to land treatment. Figure 1 illustrates the history and forecast of the land only expenses against three major revenue sources for the SRF.

This illustration clearly outlines the solvency of the SRF when it is applied directly to the treatment of land, even under the most conservative of assumptions. The bifurcation of the SRF from water treatment would free up considerable revenues for treatment of land already identified as requiring treatment. Figure 4 illustrates this estimate.

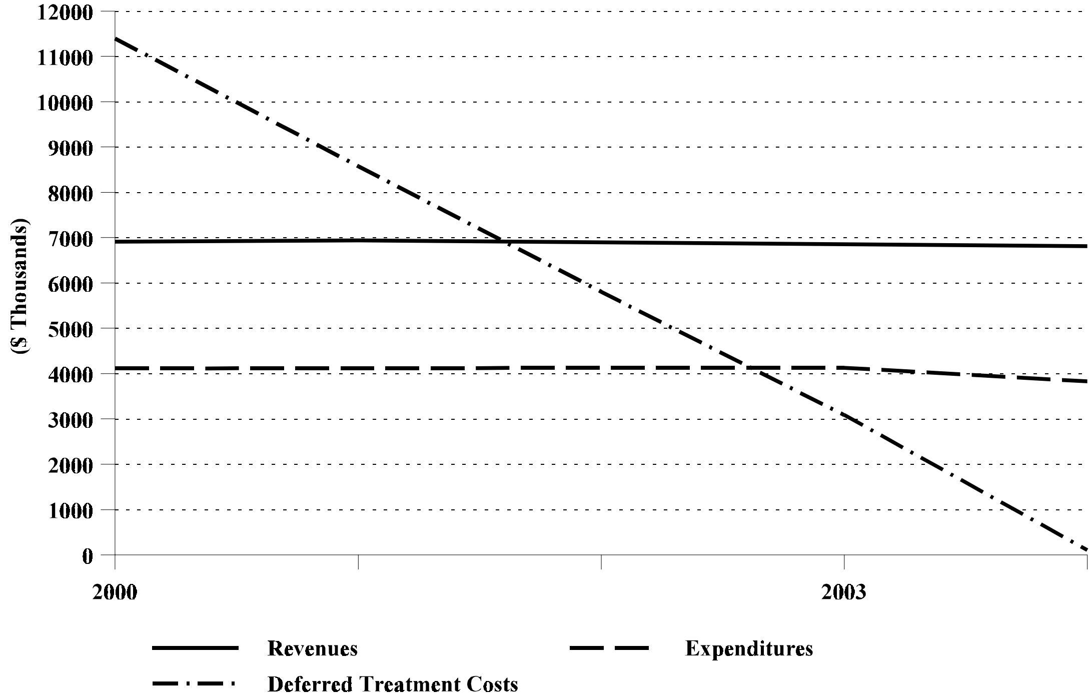
XIV. Treatment Specifications and Cost Forecasting of the SRF

Treatment of land following mining operations is a financial consideration. The employment of forecasts should recognize the aggregate fiscal demands of these treatment operations**.** *More clearly, it is the total cost of treatment, not the average per acre treatment costs that provide useful planning guidance*. The average unit cost of treating land is both arbitrary and not a readily forecastable and is therefore inappropriate for planning purposes. On the other hand the annual total costs are much more easy to forecast, are more stable, and are the appropriate decision making variable.

XV. Implications and Findings

The Special Reclamation Fund has recently provided treatment funds for water effluence related to mining operations in West Virginia. This process has been undertaken as an environmental priority. The appropriateness of environmental treatment priorities is not within the scope of this study. However, it is clear that this decision has, at most, modestly slowed reclamation of land in the State.

Figure 5, Total Land Fund Forecast, Most Likely Scenario

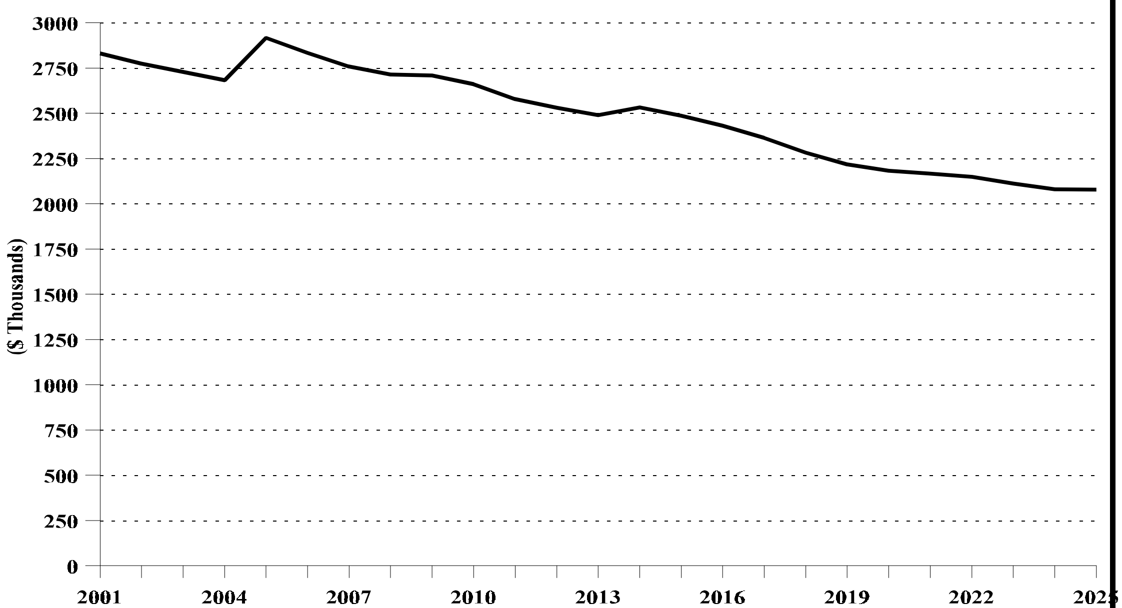


The ensuing backlog of treatment will require some time to complete under current fiscal conditions. The bifurcation of the SRF with the proposed *Mountain State Clean Water Trust Fund* will dramatically shorten the period necessary to complete the deferred treatment. Under the analysis presented above, the SRF will be adequate to fully complete deferred treatment of land. Under the most probable conditions, this will be completed in just under 5 years following bifurcation of the Funds. In our judgement, this *Special Reclamation Fund* is, without question, adequate to treat all deferred and forecasted land if water treatment demands are placed upon another funding source. Figure 5 illustrates the short run forecast of revenues and expenditures, as well as the reduction of backlog from inception through 2005. Figure 6 illustrates the projected revenues of the SRF freed by bifurcating the SRF with the *Clean Water Fund*.

XVI. Conclusions

The creation of the *Clean Water Trust Fund* with *Clean Water Treatment Fee* component provides the taxpayers and future generations of West Virginia with guaranteed clean up of mine effluence into the State's water resources. The *Fund* incentivizes firms to engage in clean mining practices and to invest in better abatement technology. The *Fund* insures that the actual costs of abatement are borne by firms still in operation. The *Fee* portion of the fund, though imposing a mild burden on current operators, is unlikely to result in an increased default rate. At the same time, the *Fee* insures the current and future West Virginian taxpayers against the possibility of increased defaults by coal operators, while isolating the

Figure 6, Revenues Freed From Water Treatment Following Bifurcation of Funding (forecast, 2001-2025)



actual cost of water damage incurred by past coal mining activities. This makes the SRF more than adequate for land reclamation through the foreseeable future. And, importantly, this *Fund* and *Fee* both terminate when no longer needed.

References

"Bituminous coal and Lignite Surface Mining." *1997 Economic Census*. US Census Bureau, Oct 1999.

"Bituminous Coal Underground Mining." *1997 Economic Census*. US Census Bureau, Oct 1999.

Boyd, Gale A. "Factor Intensity and Site Geology as Determinants of Returns to Scalein Coal Mining." *Review of Economics and Statistics*. v69 n1 Feb 1987, pp.18-23.

Burton, Mark L., Michael J. Hicks, Calvin Kent "Coal Production Forecasts and Economic Impact Simulations in Southern West Virginia" *A Special Report to the Senate Finance Committee*, 2000.

———— "The Fiscal Implications of Judicially Imposed Surface Mining Restrictions in West Virginia" A report to the West Virginia Legislature. 2001.

Darmstadter, Joel and Brian Kropp. "Productivity Change in U.S. Coal Mining." *Resources for the Future Discussion Paper*. V97 n 40 Jul 97.

Divison of Environmental Protection "A Quantitative Inventory and Interpretive Review of Water Quality on Active Mining Operations in West Virginia: West Virginia Acid Mine Drainage Study, 2000" March 2001.

Enders, Walter. *Applied Econometric Time Series*. John Wiley & Sons, Inc. New York, 1995.

Granger, C.W.J. (1989) Forecasting in Business and Economics, 2nd Editio, Academic Press, San Diego.

Greene, William. *Econometric Analysis 3rd Edition*, Simon & Schuster, Inc. 1997, Upper Saddle River, New Jersey, 1997.

Final Report on the Feasibility of Using Various Mechanisms to Demonstrate Financial Assurance for the Long-Term Treatment of Acid Mine Drainage. Office of Surface Mining, Pittsburgh, PA, Prepared under Contract No. 143868-CT99-12063, by Tetra Tech EM, Inc.

Findings of Recent IEA Work. International Energy Agency, 1997-99.

IEA, Monthly Energy Updates, Various Issues.

Historical Data 1931-1977: All Coal Mines in the United States. Department of Labor, Mine Safety and Health Administration Statistics. http://www.msha.gov/STATS/PART50/ WQ/1931/wq31c112.htm, 3/15/00.

Historical Data 1978-1998: All Coal Mines in the United States. Department of Labor, Mine Safety and Health Administration Statistics. http://www.msha.gov/STATS/PART50/ WQ/1931/wq31c112.htm, 3/15/00.

Kennedy, Peter (1994) A Guide to Econometrics, 2nd Edition. The MIT Press, Cambridge.

Krautkraemer, Jeffrey A. "Nonrenewable Resource Scarcity." *Journal of Economic Literature*. Vol. XXXVI Dec 1998, pp. 2065-2107.

Kruvant, William J. and Carlisle E. Moody, Jr. "Sources of Productivity Decline in U.S. Coal Mining, 1972-1977." *The Energy Journal*. v3 n3, pp.53-70.

Magda, Roman. "Mathematical model for estimating the economic effectiveness of production process in coal panels and an example of its practical application." *International Journal of Production Economics*. v34 1994, pp. 47-55.

Naples, Michele I. "Technical and Social Determinants of Productivity Growth in Bituminous Coal Mining, 1955-1980." *Eastern Economic Journal*. v24 n3 Summer 1998, pp. 325-342.

NMA Publications. http://www.nma.org/Pubs%20Map.html, 3/10/00.

Pindyck, Robert S. "The long-run evolution of energy prices." *The Energy Journal*. Cambridge, 1999.

Rohlf, F. James and Robert R. Sokal. *Statistical Tables, 3rd Edition*. W.H. Freeman and Company, New York, 1995.

Sengupta, Jati K. "A dynamic efficiency model using data envelopment analysis." *International Journal of Production Economics*. v62 1999, pp. 209-218.

Shih, Li-Hsing. “Planning of fuel coal imports using a mixed integer programming method.” *International Journal of Production Economics*. v51 1997, pp. 243-249.

Sensitivity Analysis of the Methodology for Estimating The Costs of Long-term Treatment of Mine Drainage. Office of Surface Mining, Pittsburgh, PA Prepared under contract number 143868-CT99-12063 by Tetra Tech EM, Inc.

Sims, Christopher. “Bayesian Skepticism on Unit Root Econometrics” *Journal of Economic Dynamics and Control* 12 (1988) pp 463-74.

Treyz, George I. Regional Economic Modeling: A Systematic Approach to Economic Forecasting and Policy Analysis, Kluwer, Boston, 1993.

Appendix A: Interest Rate Calculations

I. Methodology for Calculating Average Interest Rates.

InIn our In our calcIn our calculations the geometric mean is used rather than the arithmetic m (simple(simple average) because of the distortions caused by the calculation of the ar(simple average) meanmean that are not present in the geometric mean. For exampmean that are not present in wherewhere to grow to $110 in one year then decline to $100 in a third year,where to grow to $110 i meanmean of the rmean of the ratemean of the rate of return on this investment would indicat investmentinvestment earnedinvestment earned a (10% - 9%)/2 = .5% return over theinvestment ear leadlead one tolead one to concludlead one to conclude that the ending balance should be appro though it was previously stated that the ending balance would be $100.

TheThe geometric mean avoids this problem. The formula for the The geometric mean mean is as follows:

$$\text{Geometric mean} = [\prod_{i=1}^{n}(1+r_i)]^{1/n}\ 1$$

where ÿÿis the product sign, r_i is the return in period i, and n is the total number of periods. Using this example the geometric mean would be:$(1.1*.91)^{1/2}\ \ 1 = 0.$

II. The Average One-year Treasury Bill Rate.

The geometric mean of monthly,The geometric mean of monthly, one-year, Treasury billT 19701970 to1970 to December 1999, as reported by the Federal Reserve1970 to December 1999, as FederalFederal Reserve Economic Database is 6.84%. One-year treasury bill rates generally representrepresent the minimum expected return on a furepresent the minimum expected retur relationshiprelationship between risk and ratesrelationship between risk and rates of return.relation riskrisk on Treasury isrisk on Treasury issuerisk on Treasury issued securities, T-bills are often assets.

III. Average Return on the Standard and Poor s 500 Stock Index.

TheThe geometric meanThe geometric mean of monthly, one-year returns toThe geometric r fromfrom January 1970 to December 1999, as reported by the Federal Rfrom January 1970 to De St. Louis in the Federal Reserve Economic Database is 10.37%.

TheThe return to the The return to the stock index The return to the stock index can be th riskrisk risk investment for the period in question. The S&P 500 index representsrisk investmen weweightedweighted average price of the 500 largest, by market capitalization, firms wweighte stockstock are traded in the secondary market forstock are traded in the secondary market for corpo 500500 comprises approximately 75%500 comprises approximately 75% of the secondary market market capitalization.

IV. Present Value of an Annuity.

The formula for the present value of a stream of equal periodic payments made over a fixed period of time is:

$$PV = \quad C/(1+r)^n = c[(1/r)-(1/(r(1+r)^n))]$$

where PV is the present value, C is the payment (or cashflow), r is the discount (interest) rate, and n is the number of periods.

V. Present Value of a Perpetuity.

The formula for the present value of an infinite stream of equal periodic payments is:

$$PV = C/r$$

where PV is the present value, C is the payment (or cashflow), and r is the discount (interest) rate.

Appendix B: Risk Estimates

I. Background

Estimation of risk in economics and finance is primarily focused on empirically evaluating data in which events are observed. For example, the most widely employed risk measures are of the relative variability in the price of a security. Estimating risk involves calculating the values of the relative magnitude of fluctuations around the mean of an individual asset *relative* to other similar assets.

Other measures of risk involve qualitative analysis which focus on potential conditions that result in an undesired outcome. Applications of risk to business conditions usually involve changes in demand for a product or service. Models for estimating firm failure are noticeably absent in existing research. For our purposes, this means that estimates of the risk of an individual firm failing will rest on qualitative not quantitative analysis.

II. Data for Risk Analysis

Data on individual firms is available from a variety of sources, including federal and state tax records, *County Business Patterns*, the *Longitudinal Research Database, Office of Miner Health Safety and Training* and *Dun & Bradstreet's* databases. For more information regarding the difficulty in modeling mine life see the appendices in Burton, Hicks and Kent [2000, 2001]. Unfortunately none of these provide longitudinal, nearly complete and accessible records for coal mining firms. The result is that the best method for projecting default by firms is to examine directly the rate of default as recorded by DEP to treat mine sites.

II. A Risk Measure

The method we employed for analyzing the risk of default or firm failure is the ratio of estimated clean up costs to total revenues. This measure provides an estimate of the size of treatment costs relative to the size of the firm. While an imperfect measure of risk of default this should provide some evidence as to the problem of treatment. Only twelve firms in the sample that were still producing coal had treatment costs that exceeded 1 percent of their annual revenues, and of these only four firms had costs greater than 5 percent of their revenues. The total treatment costs of these 12 firms is just over $216,000 or under 1 percent of the total.

Two implications of these findings are critical. First, for firms in the *Fund* that are still producing coal (and are subject to market variations) only a small part of total revenues are dedicated to water treatment. Second, most firms continue to treat water even after coal production has terminated. This means that the failure of firms does not appear likely to cause them to default.

Another consideration is the ability of the State to recoup some costs associated with water reclamation following a firm failure. While the State has had a poor record of this over the past twenty years its record appears to be improving. (Note: The problem with recouping payments was primarily due to the collapse of mine mouth price of coal in the early 1980's, and the subsequent failure of hundreds of firms in a short period). Today, of the firms currently treating water over 85 percent of the costs are borne by large, multi-state heavily capitalized firms. The impact of the loss of all the remaining firms is less than $5 million per year.

III. The Size of the Risk Annuity

In order to protect taxpayers, this *Fund* required a default estimate, and in keeping with our effort to maintain estimates that erred on the side of protecting the State we selected $5 million as an appropriate figure. This number was not arbitrary but was tied to two existing figures. First, the State is currently paying just over $4.9 million to treat water. This represents the total known costs for treating water from defaulted mine companies statewide. Second, of the $25 million private costs of treatment roughly $5 million is from private firms. Private firms, because of their legal liability limitations, are more likely to default on obligations than are corporations.

Perhaps the most important risk component used in this analysis is the historical default rate. The current pool of defaulted firms has accrued since the passage of legislation outlined in the first section of this report, or 20-25 years. The current estimated default is roughly $4.9 million (though some mines have not been surveyed, and this includes a one year extraordinary cost). This period has seen dramatic declines in the number of coal operators in the State. A cautious risk assessment could extrapolate this high rate of default through the future, yielding a default rate, at the termination of this Fund of roughly $5 million in treatment costs. The recurring figure of $5 million appears to us to represent the high end of treatment default by several potential measures. For that reason we feel that prudence dictate this level of 'self insurance' by the State.

IV. Conclusions

No risk estimate is without shortcomings. Estimates of the potential for a firm failing are not present in the economic or finance literature. This suggests that qualitative estimates of risk be employed. In analysis for this fund we have employed what we feel are the best risk estimates, but which are designed to provide more than adequate resources for the State.

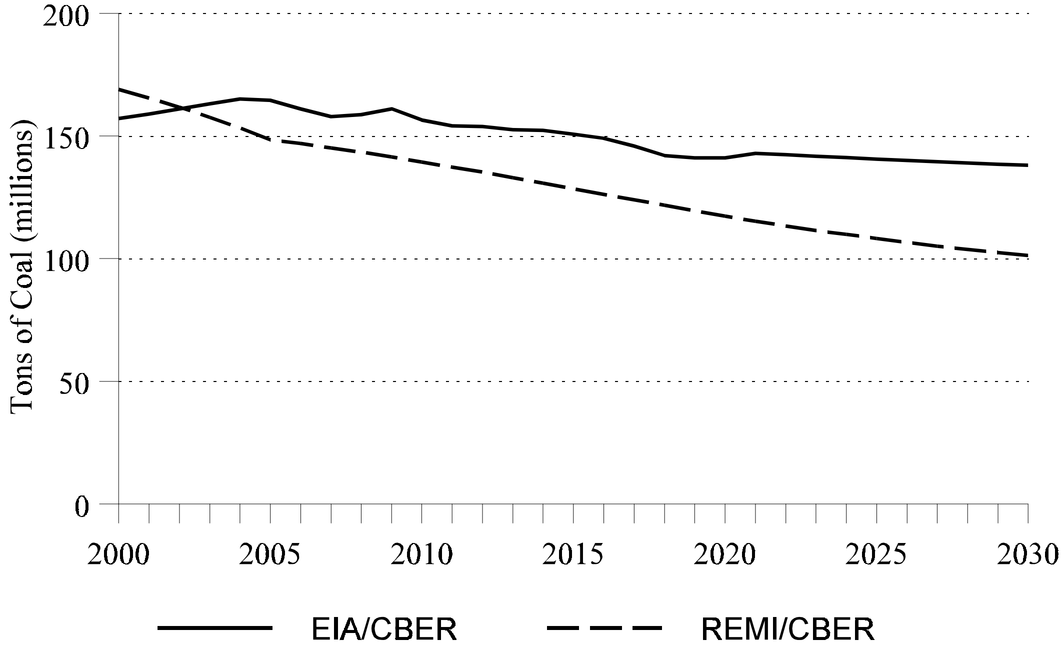
Appendix C: Coal Production Forecast

The absence of credible long term coal forecasts is of some concern to the stability of the *Fund* outlined in this study. Of particular concern is an early rapid decline in production of the type suggested by the simulations contained in *Coal Production Forecasts and Economic Impact Simulations in Southern West Virginia: A Special Report to the West Virginia Senate Finance Committee*. However, the models in that study did not evaluate long term coal production. Concurrent with this draft study, the *Bureau of Business and Economic Research* at *West Virginia University* is conducting a long run coal production forecast under the auspices of the *Environmental Protection Administration*. This study may provide some additional forecasts of coal production.

This study offers two forecasts of coal production. One is based on the *Energy Information Administration's* 20 year projection of Appalachian coal production (pre-December 2000). The other is a baseline regional forecast using the *Regional Economic Model* from REMI, Inc. The EIA/CBER forecast extrapolates the EIA 20 year forecast through 2025 using a basic time series model. The base The REMI/CBER forecast employs a well known regional forecasting model.

The projections in these two models indicate mean production levels of roughly 152 million and 134 million tons respectively through 2025. We employed a figure of 140 tons per year average production through 2025. The consequence of doing this is to understate both the expected levels of production and to understate the speed that the *Fund* will be able to sunset. Since the early years enjoy much higher levels of production we expect the *Fund* to enjoy greater early growth when it is more beneficial. A more detailed description of the forecast models and their empirical performance is available from the authors.

Figure C-1, Alternative Coal Production Forecasts: CBER/REMI and EIA/CBER



Appendix D: Firm Scenarios

I. Background

ThisThis appendix providesThis appendix provides several key scenariosThis appendix pro annuitiesannuities and fees in this pool. Each of these examples involves an actual firm, however the identity of the firm has been masked.

II. Scenario 1: The Corporation:

A corporation A corporation with multiple mine permits, both surface and A corporation w currentlycurrently treating water on 11currently treating water on 11 permitted sites in West Virgin eacheach of the threeeach of the three main types of effluence are treated foreach of the three main year.year. This firm producedyear. This firm produced roughly 1.2 million tons ofyear. This firm justjust under $30 million. Underjust under $30 million. Under this scenario the firm will pay into ofof clean-up, an additional $94,511 per yof clean-up, an additional $94,511 per yeof clean $111,39$111,392$111,392 i$111,392 into the *Sunset Annuity*. This firm continues to treat i receiving payments of $472,556 per year for providing that service.

TheThe firm produces roughly 1.2 million tons of coal, so will owe, unThe firm produce *TreatmentTreatment Fee* an an additional $43,200 per. an additional $43,200 per. This firm continu thethe *Sunset* of the *Fund*, receiving $472,556 per year to treat , receiving $472,556 per year to againagain again in 2042 again in 2042 the WVDEP conducts engineering estimates of trea reducingreducing them to $53,225 per year areducing them to $53,225 per year as reducin compliance.compliance. At this poincompliance. At this point the compliance. At this po WVDEPWVDEP selects the low cost bidWVDEP selects the low cost bid for treatment, of $48,77 treatmenttreatment services to an environmental etreatment services to an environmental engi differencedifference betweendifference between the engineering estimate and low cost bid ($4,448) State.State. State. In 2092,State. In 2092, all of this firm s mine sites become compliant with E rules.rules. The principal and interrules. The principal and interest througrules. The principal been acquired by another corporation).

III.III. ScenarioIII. Scenario 2: The Corporation 2: A Corporation with multiple A Corpora bothboth surface and undergroundboth surface and underground is currently treating waterboth surf Virginia.Virginia. From these 4Virginia. From these 4 sites only two off the three main Virginia. Fr forfor a total cost of $237,257 per year. This firm produced roughly 900,000 tons of coalcoal in 1999 with revenues of just over $22.5 million. coal in 1999 with revenues of just over willwill pay into the *Fund* the the cost of the cost of clean-up, an additional $47,451 per year into riskrisk annuity portion and $77,172 intorisk annuity portion and $77,172 into the *Sunset Annuity*. T its own water.

TheThe firm produces roughly 0.9 million tons of coal, so wiThe firm produces roughly *TreatmentTreatment Fee* an additional $32,400 per year. In 2007 this an additional $32,400 per year VirginiaVirginia as its two remaining permits are exhausVirginia as its two remaining perm paymenpaymentspayments for the firm, but does not end the *Fund* portion. The *Risk InsRisk Annuity* terminates in 2011, leaving terminates in 2011, leaving the terminates in 2011, leaving the f $314,429$314,429 an$314,429 ann$314,429 annually. This firm chooses to continue to trea $237,257$237,257 from the *Fund* each year. In 2022 the firm each year. In 2022 the firm *Sunsets* (t projected)projected) and payments into the *Fund* term terminate. terminate. This firm continu water,water, however anwater, however an engineeriwater, however an engineering study cond administradministraadministrativeadministrative fee) finds that the costs of treating water for $115,000$115,000 per$115,000 per year, as two sites come$115,000 per year, as two sites come into fifirmfirm receives a payment in this amount annually to treat water from the remafirm receives sites.sites. In 2054,sites. In 2054, followingsites. In 2054, following two additional cost reductions comecome into full compliance with EPA emissions rules. come into full compliance with EPA en principal from the *Fund*, and terminates its participation.

IV. Scenario 3: The Private Firm:

AA privately held mining firm is engaged in A privately held mining firm is engag permitted sites, one ofpermitted sites, one of which is emitting one type of effluence. permitted sit roughlyroughly 247,000 tons of coal per yearoughly 247,000 tons of coal per year, wroughly 247 TheThe firm is treating water at an annual cost of $The firm is treating water at an annual cost o into the *Fund* $7,025, with Risk Annuity payments of $1,405 $7,025, with Risk Annuity payment ofof $1,657.90. In addition this firm paysof $1,657.90. In addition this firm pays *Treatment Fees* a per year which is roughly 0.26 percent of its revenues.

ThisThis firm continues toThis firm continues to pay into the *Fund* and *Fee* through through duedue to bankruptcy. The State chooses not to litigate for padue to bankruptcy. The State choo fullfull $7,025 per year in treatment liability. Fortunately, the *RiskRisk Annuity* covers covers this cost, andcost, and the *Fund* Sunsets in 2023. The failure of this firm delayed the Sunsets in 2023. of the *Fund* by less than one month.

V. Conclusion

TheThe range ofThe range of potential scenariosThe range of potential scenarios are endless scenarios are clear:

The Fund is robust to firm failure, protecting the State

The Fund is a modest additional liability to coal mining firms

The Fund terminates no later th The Fund terminates no later than 2025 ev The Fu estimates.