# EPA MINING POLICIES: ASSAULT ON APPALACHIAN JOBS—PART I

(112–29)

## HEARING

BEFORE THE

SUBCOMMITTEE ON
WATER RESOURCES AND ENVIRONMENT

OF THE

COMMITTEE ON
TRANSPORTATION AND
INFRASTRUCTURE
HOUSE OF REPRESENTATIVES

ONE HUNDRED TWELFTH CONGRESS

FIRST SESSION

MAY 5, 2011

Printed for the use of the
Committee on Transportation and Infrastructure

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# CONTENTS

# U.S. House of Representatives
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Washington, DC 20515

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Ranking Member

April 29, 2011

James W. Coon II, Chief of Staff

James H. Zoia, Democrat Chief of Staff

**MEMORANDUM**

TO: Members of the Subcommittee on Water Resources and Environment

FR: Bob Gibbs
Subcommittee Chairman

RE: Hearing on "EPA Mining Policies: Assault on Appalachian Jobs Parts I and II"

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**PURPOSE OF HEARING**

The Water Resources and Environment Subcommittee is scheduled to meet on Thursday, May 5, 2011, at 10:00 a.m. and on May 11, 2011 at 10:30 a.m. in 2167 Rayburn House Office Building, to receive testimony from State regulators, the mining industry, impacted businesses, economists, and the Environmental Protection Agency on the Environmental Protection Agency's surface mining guidance and other related extra-regulatory activities.

**BACKGROUND**

**Surface Mining**

Mining in the United States takes place in all 50 States and is critical in providing the nation with the raw materials to maintain our quality of life. Like any industry, advances in technologies have increased efficiencies and safety at today's mining operations.

Coal is the nation's most abundant fossil fuel and the United States has more coal reserves than any other country. Commercial coal mining began in Virginia in the 1740's and by 1800 coal fueled the steam engines that propelled the Industrial Revolution and manufacturing into the 20th century.

Coal mining is an important aspect of the nation's mining industry and is woven into the fabric of Appalachian life. Today coal is mined in 26 States. While Wyoming is the leading coal producing State, it is closely followed by West Virginia and Kentucky. The United States consumes 1.1 billion tons of coal every year. 33% of this coal (approximately 390 million tons annually) comes from the Appalachian region of the United States. 50% of the power generated in the nation comes from coal as its fuel source.

Surface mining in Appalachia has created some environmental impacts on landscapes, streams, and communities. Many of these coal seams lie deep below the surface of the mountains in Appalachia. During initiation of a surface mining operation, the land is cleared of trees and other vegetation. Explosives or other techniques are then employed to break up the overlying solid rock, creating dislodged materials referred to as "spoil." Most of this spoil is placed back in the mined-out area. However, spoil that cannot be placed back in the mined-out area is sometimes placed as "fill" in adjacent valleys and in some rare cases, this fill buries nearby streams.

**Selected Federal Laws Pertaining to Surface Mining**

Under Section 404 of the Clean Water Act, the United States Army Corps of Engineers has authority to issue "dredge and fill" permits for the discharge of materials into navigable waterways at specified disposal sites. The Corps of Engineers develops these disposal site permits in conjunction with the Environmental Protection Agency. Congress intended for expeditious decisions on Section 404 permits. Specifically, it instructed that, to the maximum extent practicable, decisions on Section 404 permits will be made within ninety days.

The Corps' own procedures require the Corps to review permit applications for completeness and, within 15 days of receiving applications, issue a public notice for applications deemed complete. By regulation, the comment period shall last for a reasonable period of time within which interested parties may express their views, but generally should not be more than 30 days. The Corps generally must decide on all applications no later than 60 days after receipt of a complete application.

Section 404 assigns the EPA two tasks in regard to fill material. First, EPA must develop the guidelines in conjunction with the Corps for the Corps to follow in determining whether to permit a discharge of fill material. Second, the Act confers EPA authority, under specified procedures, to prevent the Corps from authorizing certain disposal sites. EPA guides the Corps' review of the environmental effects of the proposed disposal sites. For example, no permit shall be issued if it causes or contributes to any water quality standard violations.

EPA may comment on the Corps' application of the Section 404 guidelines to particular permit applications during the interagency review period required for each permit. In addition, EPA has limited authority under Section 404(c) to prevent the Corps from authorizing a particular disposal site. To exercise that authority, EPA must determine, after notice and an opportunity for public hearing that certain unacceptable environmental effects on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreation areas would result. EPA does not have authority to exercise unfettered enforcement of compliance with the Section 404 guidelines. EPA must also consult with the Corps and publicize written findings and reasons for any determinations it makes under Section 404(c).

Section 303 of the Clean Water Act reflects Congress' policy to recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce and eliminate pollution. Section 303 allocates primary authority for development of water quality standards to the States. A water quality standard defines the water quality goals of a water body by designating uses for a particular body of water and setting criteria necessary to protect those uses. Such standards can be expressed as specific numeric limitations or as general narrative statements. Permit limitations are developed to meet these water quality standards. Courts have consistently held that States have the primary role in establishing water quality standards, and that EPA's sole function is to review those standards for approval.

Congress gave EPA limited authority to promulgate water quality standards only if it determines that a state's proposed new or revised standard does not measure up to the requirements of the Clean Water Act and the State refuses to accept EPA-proposed revisions to the standard.

Section 402 of the Clean Water Act focuses on wastewater discharges to receiving waters and governs such discharges through the establishment of technology-based limits placed on the constituent make-up of a wastewater discharge. Section 402 permits are known as National Pollutant Discharge Elimination System ("NPDES") permits. When application of a technology-based limit to a particular discharge will not assure compliance with applicable water quality standards established for the particular receiving stream, the permitting authority must develop permit limitations that would work to maintain such water quality.

Conforming to the statute's goal of allocating the primary responsibilities for water pollution control to the States, the Act establishes a system of cooperative federalism, whereby States assume primary administration and enforcement of the NPDES permitting program. Once EPA approves a proposed State permitting program, States have exclusive authority to implement the NPDES program within their boundaries, and EPA has only limited authority to review State action. EPA retains authority in certain instances to object to a particular NPDES permit. If the State does not respond adequately to EPA's objection within specified timeframes, EPA may assume the authority to issue the permit. If EPA does not object to a permit within the specified procedures and timeframes, the State may proceed in accordance with its delegated authority and issue the permit.

In addition, the Surface Mining Control and Reclamation Act carried out by the Department of the Interior imposes requirements to minimize impacts on the land and natural channels, such as requiring that water discharged from mines will not degrade water quality on nearby streams.

**Arch Coal Permit Revocation**

In 2007, the Corps of Engineers issued a Sec. 404 permit in connection with the Arch Coal, Mingo Logan, Inc., Spruce No. 1 Surface Mine, located in Logan County, West Virginia.

Prior to the issuance of the permit, Arch Coal conducted an extensive 10-year environmental review, including a 1,600 page Environmental Impact Statement (EIS) in which EPA fully participated and agreed to all the terms and conditions included in the authorized permit. Subsequently, the mine operated pursuant to and in full compliance with the Section 404 authorization. This type of environmental review is unprecedented for activities on private lands.

Without alleging any violation of the permit, on April 2, 2010, EPA Region III published a Proposed Determination to prohibit, restrict or deny the authorized discharges to certain of the waters associated with the Spruce project site. The notice was followed by public comment and hearings. In addition, the notice prompted a legal challenge in the federal district court where Mingo Logan Coal Company, Inc. challenged the agency's unlawful attempt to revoke a CWA Section 404 permit more than three years after the permit's issuance.

On September 24, 2010, EPA Region III Regional Administrator signed a Recommended Determination recommending EPA withdraw the discharge authorization. In response, Mingo Logan Coal provided EPA with substantial technical comments to support its opposition to the Recommended Determination.

**Guidance vs. Regulation**

Much of the Clean Water Act is a delegated program. States that have received delegation have demonstrated to the Environmental Protection Agency that they have adopted laws, regulations, and policies at least as stringent as federal laws, regulations, and policies and these States have developed and demonstrated the capability to maintain existing and assume new delegations.

Congress in environmental statutes and the Administrative Procedure Act (APA) established a formal rulemaking process to provide a mechanism for public comment, offering amendments, or allowing States to object, and provided standards for judicial review of agency actions.

The APA prescribes procedures for agency actions such as rulemaking as well as judicial review of such actions. Rulemaking is the agency process for formulating, amending, or repealing a rule, where a rule is defined as an agency statement of general or particular applicability and future effect designed to implement, interpret, or prescribe law or policy or describing the organization, procedure, or practice requirements of an agency.

Guidance documents, which are not specifically defined by the APA, generally are considered to be a particular type of agency rule, known as a "general statement of policy. Under APA notice-and-comment rulemaking procedures, agencies must publish notice of a proposed rulemaking in the Federal Register, provide opportunity for the submission of comments by the public, and publish a final rule and a general statement of basis and purpose in the Federal Register at least thirty days before it becomes effective as a substantive rule.

Rules that have been promulgated through the notice-and-comment process have the force and effect of law and are known as substantive, or legislative, rules. A substantive rule has been described by courts as a rule through which an agency intends to create a new law, rights or duties, or rule that is issued by an agency pursuant to statutory authority and which implements the statute. A rule has also been defined as substantive if in the absence of the rule there would not be an adequate legislative basis for enforcement action or other agency action to confer benefits or ensure the performance of duties.

In contrast, agency documents that are merely general statements of policy, such as guidance documents, do not have to undergo APA notice-and-comment procedures. APA notice-and-comment requirements do not apply to interpretive rules, general statements of policy, or rules of agency organization, procedure, or practice. These types of agency action, while technically defined as rules, are generally referred to as nonlegislative rules, as they do not have the force and effect of law. General statements of policy have been described by courts as statements issued by an agency to advise the public prospectively of the manner in which the agency proposes to exercise a discretionary power.

General statements of policy do not impose any rights and obligations, nor do they establish a binding norm because they do not represent the final determination regarding the issues they address. Thus, while a guidance document indicates the agency's thoughts on a topic, the document is not legally binding on courts or persons outside the agency.

A guidance document can become binding on an agency in practice. If a general statement of policy is implemented in a manner that is binding on the agency and/or outside parties, a reviewing court would likely regard it as a legislative rule that should be deemed invalid for failing to comply with APA notice-and-comment procedures. The question of whether a general statement of policy or a nonlegislative rule is in fact a legislative rule required to be issued under APA notice-and-comment procedures is a fact-specific one that courts will examine on a case-by-case basis. A reviewing court may examine whether the document has a binding effect, whether the agency retains its ability to exercise discretion, whether the document uses voluntary or mandatory language, whether the agency characterizes the document as guidance, and whether the agency published the document in the Federal Register or the Code of Federal Regulations to determine if the guidance document is in fact a legislative rule.

Some States are required by their own laws to conduct their own rulemaking prior to implementing federal regulations and some States are prohibited by State law from implementing any requirement more stringent than the federal requirement. The States have limited options to challenge interim guidance or interim rules, draft policy or reinterpretation policy, and the Courts have been inconsistent in their findings for judicial review in these cases.

The processes used by EPA, rather than the environmental substance of the underlying rules, to impose interim guidance, interim rules, draft policy or reinterpretation policy, may result in a State agency being forced to choose whether it will comply with either EPA's policy or its own State laws. While interim guidance, interim rules, or policy may not be legally binding, States may have to use these as the basis for issuing permits or other actions and this may result in delays and potential job losses. EPA's continued imposition of interim guidance, interim rules, draft policy or reinterpretation policy has led to uncertainty regarding actions taken by State and federal regulatory bodies.

**Enhanced Coordination**

On June 11, 2009, EPA, the Corps, and the Department of Interior released a Memorandum of Understanding on Implementing the Interagency Action Plan on Appalachian Surface Coal Mining ("MOU"). Among other things, the MOU formalized an extraregulatory review process of CWA Section 404 permits that EPA had previously commenced in January 2009 and signaled a further change in the Section 404 permitting process, the launch of the Enhanced Coordination Process. Concurrent with the release of the MOU, EPA issued formal details on the Enhanced Coordination Process (EC), which were immediately effective and imposed substantive changes to the Section 404 permitting process by creating a new level of review by EPA and an alternate permitting pathway not contemplated by the current regulatory structure.

In the Enhanced Coordination Process, EPA first utilizes a Multi-Criteria Integrated Resource Assessment (the "MCIR Assessment") to screen all pending Section 404 permit applications for Appalachian coal mining operations. In the MCIR Assessment, EPA determines which permit applications will proceed to review by the Corps under the longstanding existing permit processing procedures and which permit applications will be subject to the EC Process. It effectively sets a threshold of acceptable effects from coal mining to create a "fork in the road" in the Section 404 permitting process, and it expands EPA's role from mere commenter to gate-keeper. The Corps was not involved in developing the components of the MCIR Assessment, and the MCIR Assessment was not subjected to public notice and comment.

Once a permit application is earmarked for the EC Process as a result of the MCIR Assessment, the applicant faces a burdensome review process that is wholly separate from the public hearing and comment process envisioned in Section 404. Specifically, the EC Process involves discussions among EPA, the Corps, the permit applicant, and other potentially relevant agencies during a 60-day coordination period that the Corps must initiate. There is no requirement for the Corps to do so in a timely fashion, which contrasts sharply with the permitting processing timelines set forth in Section 404 and its implementing regulations.

Thus, the EC Process adds a minimum of 60 days and potentially many months of review to the existing review process entirely outside of, and in addition to, the existing Section 404 procedures and timelines. At the end of the EC Process, only if issues identified by EPA are resolved in individual permit applications may those permits move forward to the Corps for processing and incorporation of new permit terms or conditions dictated by EPA during the EC Process. If EPA's concerns remain unresolved at the close of the EC Process period, EPA may then initiate Section 404(c) procedures. Neither EPA nor the Corps proposed to revise the existing codified review procedures and EPA did not propose to amend its existing Section 404 Guidelines when formalizing the EC Process.

In practice, EPA has utilized the MCIR Assessment to identify almost 250 coal-related Section 404 permits currently pending with the Corps that would be subject to the EC Process rather than the Section 404 process. Numerous permit applications remain indefinitely stalled. The timelines for those permit applications stray far from the deadlines that Congress envisioned in Section 404 and from the Corps' own regulatory deadlines.

EPA released the Guidance on April 1, 2010 to provide EPA Regions 3, 4, and 5 for the review of all coal mining operations under the CWA, National Environmental Policy Act ("NEPA"), and the Environmental Justice Executive Order. While EPA solicited public comment on the Guidance, it nevertheless made the Guidance effective immediately.

In the Guidance, EPA made sweeping pronouncements regarding the need for water quality-based limits in CWA Section 402 and 404 permits, as well as the adequacy of mitigation measures associated with Section 404 permits.

First, the Guidance effectively established a region-wide water quality standard by directing that Section 402 and 404 permits should contain conditions that ensure that conductivity levels do not exceed 500 Siemens (μS/cm). (For reference, Evian water contains conductivity levels of 552 μS/cm while Perrier contains conductivity levels of 712 μS/cm.) EPA's direction was based on a draft, not-yet-peer-reviewed EPA report entitled, "A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams," which purports to recognize stream-life impacts associated with conductivity. From that report, EPA established a presumption that it expects that in-stream conductivity levels above 500 μS/cm are likely to be associated with adverse impacts to water quality. Further, the Guidance seeks to provide EPA with a continuing review and approval role by sequencing the installation of valley fills such that fills must proceed one at a time and only after various permit conditions are met.

EPA is using the Guidance to cause indefinite delays and impose new and unattainable conditions in the Section 402 and 404 permit processes for coal mining operations. In addition, various permitting authorities, at EPA's insistence, have begun inserting the conductivity limit from the Guidance into pending Section 402 and 404 permits.

Yet, EPA has provided no basis to conclude that these conductivity levels will harm the uses protected by the various narrative water quality standards promulgated by the States, and, in some instances, natural background is higher than these levels. Furthermore, as contemplated in the Guidance's sequencing policy, EPA recently began invoking the Guidance to reopen *previously issued permits* in order to impose the conductivity limit, which works to effectively halt projects in their tracks. In short, the Guidance is threatening to cause significant financial losses and even drive some companies out of business.

Some estimates provided to Congress show that the EC Process and Guidance will place roughly 1 in every 4 coal mining jobs in the Appalachian region at risk of elimination and that 81 small businesses will lose significant income and will be at risk of bankruptcy.

The EPA has placed a time consuming, costly, and perhaps unlawful obstacle in the path of the exercise of property rights in the form of the EC Process and Guidance. The EPA is delaying and effectively preventing mining companies from developing their private property interests. Moreover, the strict conductivity limit that the Corps is imposing as a result of EPA's Guidance will render certain contemplated mining projects unfeasible. Last, EPA is even using the Guidance to revisit permitting decisions that pre-date the Guidance in order to impose the conductivity limit therein, completely disrupting the established regulatory certainty a permit provides in the exercise of property rights.

The Environmental Protection Agency assert that none of these actions—the MCIR Assessment, the EC Process, or the Guidance Memorandum—qualify as final agency action within the meaning of the Administrative Procedures Act. They maintain that the EPA used the MCIR Assessment to screen permit applications as only the first of several steps in the permitting process, and that the MCIR Assessment therefore did not cause a denial or issuance of any permits.

**Use of Conductivity as a Measure of Water Quality**

The U.S. Environmental Protection Agency has issued guidance on water quality requirements for coal mines in Appalachia. The guidance, which was issued on April 1, 2010 and became immediately effective, relies solely on electric conductivity (also known as specific conductance) as an indicator of water quality impairment.

Conductivity is a measure of a given quantity of water to conduct electricity at a specified temperature. It is predicated upon the presence of dissolved solids, which conduct an electrical charge.

Conductivity has generally been used in the field as a first screen for water quality. Elevated conductivity levels indicate that further analysis should be done to determine the specific water chemistry, i.e., the makeup of the specific dissolved particles in the water, and whether those particles occur in amounts that are demonstrated to impair aquatic life specific to that stream.

Conductivity is not a meaningful measure of contamination or the ability of a given body of water to meet its designated use. The EPA guidance eliminates this vital step, an approach that is scientifically and legally deficient. Further, the levels are unachievable. EPA has noted they expect few, if any fill permit applications in Appalachia to meet the levels of conductivity set in the guidance. This limit will apply immediately to all coal mining, including underground operations, in the six Appalachian states. EPA has not ruled out applying the standard similarly to other industries throughout the water program.

This conductivity guidance establishes a de facto water quality standard that interferes with the States' statutory authority to set water quality standards and issue permits. Implementation of the conductivity limit also will make EPA the final decision-maker on permits issued by the U.S. Army Corps of Engineers and the Office of Surface Mining (OSM).

**Witnesses**

(In no particular order)

Thursday, May 5, 2011, 10:00 a.m.

Michael Gardner, General Counsel, Oxford Resources
Harold Quinn, President, National Mining Association
Dr. Leonard Peters, Secretary, State of Kentucky Energy and Environment Cabinet
Teresa Marks, Director, State of Arkansas Department of Environmental Quality

Wednesday, May 11, 2011, 10:30 a.m.

Ms. Lisa Jackson, Administrator, Environmental Protection Agency
Dr. David Sunding, University of California-Berkeley
Reed Hopper, Pacific Legal Foundation
Michael Carey, President, Ohio Coal Association
Steve Roberts, President, West Virginia Chamber of Commerce

# EPA MINING POLICIES: ASSAULT ON APPALACHIAN JOBS—PART I

**THURSDAY, MAY 5, 2011**

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON WATER RESOURCES
AND THE ENVIRONMENT,
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE,
*Washington, DC.*

The subcommittee met, pursuant to notice, at 10:03 a.m., in Room 2167, Rayburn House Office Building, Hon. Bob Gibbs (Chairman of the subcommittee) presiding.

Mr. GIBBS. The committee will come to order, Water Resources and Environment Subcommittee of Transportation and Infrastructure. Welcome.

I am going to start. My Ranking Member, Mr. Bishop, has to leave, and he wants to do his quick opening statement. So proceed.

Mr. BISHOP. Thank you, Mr. Chairman. I thank you very much for indulging my schedule.

As a representative of Long Island, I am not faced with the day-to-day implications of surface coal mining. However, I have quickly learned that few issues have energized or engendered a more passionate response from industry, from mine workers, and from everyday citizens than recent actions by the current administration to provide oversight of surface coal mining operations.

Mr. Chairman, your decision to hold this series of hearings provides an opportunity for our Members to learn more about this important issue. It also highlights the complex balance that policymakers face in providing well-paying jobs for American families, and ensuring the continued growth and economic health of our communities, and in protecting our natural environment for current and future generations. In my view, this balance is often times most evident in relation to providing safe and reliable sources of energy for our Nation.

We recognize that energy generation is an essential element of modern society, and is critical to growing the U.S. economy and protecting American jobs. However, we are also coming to recognize that energy generation itself comes with a significant cost. As the experiences of the past few years have demonstrated, the goals of domestic energy generation and protection of the environment are not mutually exclusive.

However, the reality is that the pendulum cannot sway too far to either side. I am hopeful that these hearings start the debate on reaching that careful balance point, and I yield back the balance of my time with my gratitude for your indulgence of my schedule.

Mr. GIBBS. Thank you. I have an opening statement, but first of all I want to welcome everybody again to this hearing, "EPA Mining Policies," a discussion about assault on jobs. And we will have a part two of the hearing next week.

Coal mining is an important aspect of the Nation's mining industry and is woven into the fabric of Appalachian life. Today coal is mined in 26 States. While Wyoming is the leading coal-producing State, it is closely followed by West Virginia and Kentucky. The United States consumes 1.1 billion tons of coal every year. Thirty-three percent of the coal—approximately 390 million tons annually—comes from the Appalachian region of the United States, and 50 percent of the power in the Nation comes from coal as a fuel source.

Coal is an abundant and domestic source of energy. Its use does not subject us to the whims of a foreign cartel, nor does it tend to thrust us into international conflicts. In addition, using domestic coal creates American jobs.

While it is important to continue our research and development into new sources of energy, it is clear that coal will and must remain a major source of energy well into the future. And therefore, it is important that we keep coal as a safe and inexpensive alternative to other energy options.

For this reason, I am concerned about the Environmental Protection Agency's recent policy decisions regarding coal mining activities. It would appear that the objective of the Agency is to make coal mining so expensive that alternative sources of energy will become more attractive. The effect of such a policy is to significantly drive up the cost of energy. Since energy cost is a factor in all aspects of our economy, this policy will act like an anchor that drags down our short-term economic recovery and our long-term economic global competitiveness.

While Congress has passed no law amending the Clean Water Act, and the Environmental Protection Agency has promulgated new regulations changing the Clean Water Act, EPA has issued draft and interim guidance and—substantively changes how the Clean Water Act applies to surface mining, and is using it as de facto law to unlawfully delay or kill Clean Water Act permits for surface mining operations in Appalachia.

In doing this, I am extremely concerned how the administration is attempting to short-circuit the process for changing substantive Agency policy under the Clean Water Act without following the proper, transparent rulemaking process that is dictated by the Administrative Procedure Act. By ignoring the Administrative Procedure Act, EPA is changing the Clean Water Act and its implementing regulations. EPA is taking these actions with little regard to economic consequences, with little regard to national security, and most importantly, with little regard to the law.

Much of the Clean Water Act is a delegated program. States that have received approval to implement Clean Water Act programs have demonstrated to the Environmental Protection Agency that they have adopted laws, regulations, and policies at least as stringent as the Federal laws, regulations, and policies, and these States have developed and demonstrated the capability to maintain existing and assume new responsibilities under the Act.

Congress, in the Administrative Procedures Act and environment statutes, established a formal administrative rulemaking process that provides a mechanism for public comment, proposing amendments, or allowing States to object and provide its standards for judicial review of the agency actions.

Section 404 of the Clean Water Act assigns the EPA to two tasks in regard to fill material. First, EPA must develop the guidelines in conjunction with the Corps of Engineers in determining whether to permit a discharge of fill material. Second, the Act confers EPA the authority, under specified procedures, to prevent the Corps from authorizing certain disposal sites. EPA guides the Corps' review of the environmental effects of the proposed disposal sites. For example, no permit shall be issued if it causes or contributes to any water quality standard violations.

EPA may comment on the Corps' application of the Section 404 guidelines to particular permit applications during the interagency review period required for each permit. In addition, EPA has limited authority under Section 404 to prevent the Corps from authorizing a particular disposal site. To exercise that authority, EPA must determine, after notice and an opportunity for a public hearing, that certain unacceptable environmental effects on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreation areas would result. But, EPA does not have the authority to revoke an already issued Section 404 permit.

Even though the EPA is very much involved in the permit application process along with the State, the Corps of Engineers, and other Federal agencies, the EPA is now revoking permits that have already been issued. That is illegal. That is not legal.

EPA is clearly ignoring the Clean Water Act and other laws as it relates to surface mining activities in Appalachia. EPA's continued imposition of interim guidance, interim rules, draft policy or reinterpretation of policy has led to uncertainty regarding actions taken by the State and Federal regulatory bodies.

In addition, it is simply not a responsible way for government to act. This regulatory overreach should be considered a property rights issue. What does it really mean to get a permit? Shouldn't it come with some certainty that the activity can move forward unencumbered, but within the bounds of the permit, particularly those activities on private lands?

This no longer seems to be the case and it is going to have a stifling effect on not just mining operations in Appalachia, but on economic development projects nationwide. While the President and his administration talks a good game about job creation and removing unnecessary governmental burdens on business, in reality the Environmental Protection Agency is crippling economic growth with little or no benefit to the environment.

I welcome our witnesses to the hearing today, and I look forward to hearing from each of you in the next coming minutes.

But at this time I want to recognize the Ranking Member of the T&I Committee, Congressman Rahall.

Mr. RAHALL. Thank you, Chairman Gibbs. I appreciate very much your holding this hearing, and I welcome our witnesses today, and extend my appreciation for their participation.

You know, the subject of this hearing is one of great interest to the Appalachian region. But it is of acute concern to the people in the district that I am honored to represent. This hearing is intended to delve into a matter that we, in southern West Virginia, have been struggling with for decades, for decades: The delicate balance between producing domestic energy while preserving our national resources and the health and safety of our coal field residents.

In fact, I would wager to say that there is nowhere in this Nation—nowhere in this Nation—where our citizens know better the difficulty and the tensions entailed in trying to strike that balance than in the communities I represent.

The people in southern West Virginia love—love—the natural beauty of our land. We want clean water, clean air. We want our children and grandchildren to live and breathe and grow up in clean environments. But we want jobs, as well. We want jobs for our children and grandchildren, as well.

We do not condone coal companies' failure to ensure the safety of their miners and the well-being of the communities in which they operate. That is simply wrong. But it is also wrong for a Federal agency to circumvent the law and treat guidance as binding policy, particularly when that policy targets only one industry in only one region of the country. And I know you referred to that, Mr. Chairman, in your comments.

As I have said before, the EPA has a legitimate role to play in the Clean Water Act permitting process. And early on in this administration, many had high hopes that the EPA would provide the clarity and the certainty that coal mining constituencies throughout Appalachia have been asking for, pleading for, for many years. Unfortunately, we have been disappointed, as a result of the guidance that the EPA issued in April of last year, guidance with far-reaching consequences that was made effective immediately, without the opportunity for the public to comment.

Through that guidance, the EPA is not only dictating the Army Corps of Engineers 404 permitting process, but it is also intervening in State-issued 402 discharge permits, bypassing existing law and longstanding regulation in substituting a wholly new, barely studied, entirely confusing criterion for determining water quality, along with new timelines for review and approval of petitions. Instead of offering that clarity and certainty, the regime set forth in that guidance has thrown the entire permitting process throughout the region into utter turmoil.

Nobody can say with any certainty what will gain a mine an approved permit, and what will earn one a refusal. Or, still, nobody can now say what it will take to keep an existing permit because the Agency has used criteria in that guidance to veto a permit that was granted years before the guidance document was ever written.

As a result, coal miners in my district are consistently concerned about losing their jobs, and communities fear that they will not generate sufficient revenue to support schools, to keep the lights on, and to build basic infrastructure and provide basic services such as law enforcement.

As well, the work to shore up the long-struggling economy of Appalachia and ensure that our children and grandchildren can have a future there is further hindered because the entire region is being subjected to inequitable treatment under Federal law, in comparison to the rest of the country. It is, after all, the Federal Water Pollution Control Act.

Unfortunately, the effect of all this is that we are not finding common ground. Instead, the parties on all sides of the issue have dug their heels in even more deeply. So, I appreciate today's hearing, I appreciate the testimony that we are going to hear, and which I have already reviewed. And the next week I hope—it is my fervent hope that we may help to inform this government and guide this Nation in our long-running endeavor to reach that delicate balance between energy development and the protection of our natural resources.

Thank you, Mr. Chairman.

Mr. GIBBS. Thank you.

Mr. Duncan?

Mr. DUNCAN. Well, thank you very much, Mr. Chairman, and thank you for calling what I consider to be a very, very important hearing. And I appreciate the statement that you have made and that the Ranking Member just gave.

I am in my 23rd year in the Congress, and I have never heard as many complaints about any agency as I have heard about the Environmental Protection Agency over the past couple of years. It seems to me that that Agency has gone power-mad. And in any heavily regulated or over-regulated industry, what happens? First the small businesses are run out. Then the medium-sized businesses. And these industries end up in the hands of a few big giants.

And so, extremely big government, slowly, over the years, becomes the best thing that ever happened to extremely big business. But it sure hurts the little guys and the medium-sized guys.

And then I have noticed over the years that almost all environmental radicals come from very wealthy or very upper-income families. And perhaps they don't realize how much they hurt the poor and the lower income and the working people by destroying jobs and driving up prices. But that is what they do, and that is what they have done in so many instances, in so many industries over the years. And I have seen it. These groups, they don't want you to drill for any oil, they don't want you to dig for any coal, they don't want you to cut any trees. And they drive up these prices.

I mean, for instance, President Clinton vetoed the expansion of drilling for oil in Alaska in the mid-1990s, which would have meant a million barrels of oil more a day coming down to this country, and gas prices wouldn't be anywhere close to where they are today if that hadn't happened. And yet, we have a Secretary of Energy in this administration who says we need to be paying the same price for oil as they pay in Europe, $8 or $9 a gallon. And, obviously, the goal is to force people to drive less.

And the same thing, as you noted, Mr. Chairman, is happening in the coal industry. Apparently, environmental radicals want to destroy the coal industry so that people use less coal. But the United States has been referred to as the Saudi Arabia of coal. They oppose nuclear power, they oppose coal, they oppose oil, they oppose every kind of energy. And the only thing they really help, they help foreign energy producers. But they hurt our people, especially the lower and middle-income people.

I want to tell you what has happened in east Tennessee. I was told several years ago that there were 157 small coal companies in east Tennessee. Now there are none. We used to drill—we used to produce about 12 million tons a year in coal. Now about 2 million.

We opened up, at that time, in—around the late 1970s we opened up an office of surface mining in Knoxville. And very quickly, within just a few years, all the small coal companies and all the medium-sized companies were run out of business. Once again, big government had helped the big giants. But they had hurt all the little people.

And what does this do? It drives up the utility prices. Everybody's utility prices are higher today because of this. And, once again, going back to President Clinton, he locked up the largest low-sulfur coal deposit in the world after the Ryati brothers in Indonesia became his biggest contributors. But, once again, it hurt the—there are a lot of people out there who are having trouble paying their utility bills now because of that action, and because we put so many limitations on coal production.

I chaired this subcommittee for 6 years, and I want clean air and clean water as much as anybody. But you have to have a little balance and common sense in these areas, and you cannot always give in to the far left environmental radicals. And if we don't wake up and realize what is happening in this country, we are going to destroy this country, economically, and we are going to send even more jobs to other countries. We are going to help the foreign energy producers, like I said earlier.

And people, all these college students getting out now wonder why they can't find jobs and have to work as waiters or waitresses in restaurants. And the left-wing environmental movement is a large part of that cause.

Thank you, Mr. Chairman.

Mr. GIBBS. Thank you. Mr. Crawford, you have an opening statement?

Mr. CRAWFORD. Yes, I do. Thank you, Mr. Chairman. I want to welcome all the witnesses today. I appreciate your time and your testimony. One in particular I want to say welcome, as a fellow Arkansan, to Ms. Marks. And I have the pleasure of introducing Teresa Marks today, the director of Arkansas Department of Environmental Quality, and the secretary/treasurer of the Environmental Council of the States.

As Arkansas is the natural State, Ms. Marks is responsible for protecting Arkansas' air, water, and land from the threat of pollution. And so we welcome her leadership before the committee today. Thank you.

After graduating from the University of Arkansas at Monticello, Ms. Marks became a high school teacher where she taught secondary level students in geography, history, and civics. She returned to the classroom the following year, graduating from the Bowen School of Law at the University of Arkansas at Little Rock with a juris doctorate degree.

In 1995 Ms. Marks began serving the State in the office of attorney general, a job that lasted almost 12 years. Eventually Ms.

Marks was named Arkansas attorney general's public protection department deputy attorney general, where she supervised several lawyers and support staff in representing the interests of consumers and State agencies in consumer protection, antitrust, utilities, and environmental matters. These experiences make her well-suited to testify today regarding the EPA's practice of combining interim guidance with objection authority.

EPA actions have the practical effect of ensuring that no permits are issued and none are reviewable, because they only provide interim guidance. The EPA should finalize their guidance so that courts are able to review whether the final guidance complies with the Administrative Procedures Act.

Once again, Ms. Marks, I thank you for your leadership, and I look forward to your testimony today. I yield back.

Mr. GIBBS. Thank you. Mr. Cravaack?

Mr. CRAVAACK. Thank you, Chairman Gibbs and Ranking Member Rahall for holding these important hearings today on how they affect EPA as not only mining jobs in Appalachia, but also how it affects the mining operations in the mines of Minnesota's iron range.

I would also like to welcome our witnesses, and thank you very much for taking your time out of your busy schedules to be here today to help educate us on the best way to proceed. And I look forward to hearing your testimony regarding the new procedures the EPA has developed for permitting Appalachian coal mining operations.

As we all well know, about 50 percent of our Nation's power comes from coal. And 3 percent of that coal comes from the Appalachian region. Coal mining provides thousands of jobs and supports numerous communities throughout the region, and is the essential core of our energy production.

I am concerned at some of the steps taken recently by the EPA to expand its oversight and to impose increased burdensome regulations on the coal mining industry. These new rules seem to bypass the established protocols, making the permitting process more complicated and more time-consuming.

I find the EPA's new regulations and "guidelines" very troubling, and I worry about their unprecedented overreach and the effect that they are going to have on mining jobs and mining communities.

I look forward to hearing from your testimony today from the witnesses on this current situation of the coal mining industry, and their thoughts on what steps can be taken to protect thousands of jobs, harvest our own natural resources smartly, and keep energy costs low.

Thank you very much, and I look forward to hearing from your testimony. And I yield back, Mr. Chairman.

Mr. GIBBS. Thank you. Mrs. Capito?

Mrs. CAPITO. Thank you, Mr. Chairman. Thank you and the Ranking Member Rahall, who—I am a fellow citizen of the State of West Virginia, and we are—we have been blessed to be one of the largest producers of coal, and also natural gas.

We consider that a gift in West Virginia, and we want to be able to weave the delicate balance that Congressman Rahall talked about between the economy and the environment. Recently it has been difficult for us to watch as, we feel, the administration has targeted our cheapest and most abundant resource, and that is our coal. We just feel that this is putting us on a path of higher energy prices at a time we can ill afford this.

There is so much uncertainty and concern throughout the State of West Virginia—those who are involved directly in coal mining. But whether it is the local gas station or restaurant, any kind of retailer, we feel this. It just tremors all through every economic part of our State.

So, as we are attempting to get our economy moving in the right direction, I believe we shouldn't be placing undue burdens on our manufacturers who are depending now on our reasonably priced energy. Simply put, coal is and must be a part of our Nation's energy portfolio.

The title of the hearing that we are going to have today is "EPA Mining Policies: Assault on Appalachian Jobs." I have explained I live in Appalachia, and am a proud daughter of our State. But in several—in a meeting that I had with the EPA, point blank, that was the comment that was made to me, that the decisions that we make, we make regardless of the impact it has on jobs and the economy. And that was a pretty startling statement, especially in the economic times we are in now, but in any time, from an administration official.

And so, I think it is time for us, as Members of Congress, to take back the issue of how we are going to weave the balance between the economy and the environment, do it in a smart way, a smart way for our future, but a way that eases the anxieties that we see every day in our State, and that I know a lot of other States across the Nation are feeling.

Thank you. I yield back. Thank you, Chairman.

Mr. GIBBS. Thank you. Just for a point of information, I am told they are going to call votes, two votes here, in a little bit. And we are watching here, we will just have to break and have to come back. So I just want to give you—we are trying to move forward as much as we can, but we will have to recess for a short period of time.

At this time I want to introduce our panelists. We have a doctor, Leonard Peters, who is the secretary of the State of Kentucky energy and environment cabinet, and Congressman Crawford already introduced Ms. Marks. And we also have Mr. Harold Quinn, he is president of the National Mining Association, and Mr. Michael Gardner, who is the general counsel for Oxford Resources.

At this time, Dr. Peters, we look forward to your testimony. Welcome.

**TESTIMONY OF LEONARD K. PETERS, SECRETARY, STATE OF KENTUCKY ENERGY AND ENVIRONMENT CABINET; TERESA MARKS, DIRECTOR, STATE OF ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY, AND SECRETARY-TREASURER, ENVIRONMENTAL COUNCIL OF THE STATES (ECOS); HAL QUINN, PRESIDENT AND CEO, NATIONAL MINING ASSOCIATION; AND MICHAEL B. GARDNER, GENERAL COUNSEL, OXFORD RESOURCE PARTNERS, LP**

Mr. PETERS. Thank you, Mr. Chairman. members of the committee, thank you for the opportunity to testify today. I am secretary of Kentucky's Energy and Environment Cabinet, and we are the State's executive branch agency that has been delegated, by the Federal Government, primacy over environmental protection and coal mine permitting programs. The cabinet's mission also includes development of the State's energy resources in an environmentally responsible manner, including implementing programs for energy efficiency and renewable energy. I will provide a brief overview of my written comments.

In October of last year, the Commonwealth of Kentucky intervened in support of the Kentucky Coal Association in its lawsuit against the U.S. Environmental Protection Agency. We took this very unusual step because we strongly believe that EPA's actions since April 1, 2010, when it issued its interim final guidance, are arbitrary, requiring Kentucky's regulators to adhere to permitting conditions that have not been promulgated in line with the Federal Administrative Procedures Act.

Specifically, in our complaint the Commonwealth of Kentucky contends that, not withstanding the State's delegation under the Clean Water Act in developing water quality standards, and without promulgating a standard to require notice and comment procedures, EPA has, since April 1, 2010, unlawfully reviewed and objected to 402 permits proposed for coal mining operations in 6 Appalachian States, including Kentucky, for compliance with an unpromulgated water quality standard for conductivity.

In fact, since EPA issued its interim guidance last April it has objected to permits that staff in my cabinet drafted in accordance to standards that EPA had, prior to April 1, 2010, supported. The interim objection letters reference the April 1 guidance. From a regulatory viewpoint, we are concerned that interim guidance is not a legally defensible policy for the States or for EPA, yet it is still being used as a basis to object to State-delegated permitting actions.

Now, as someone responsible for overseeing the State's environmental protection programs, I support regulations necessary to protect our land, air, and water resources. However, regulators and the regulated community need certainty in the process. In Kentucky, coal mining employs 18,000 people, brings in more than $3.5 billion from out of State each year, and pays more than $1 billion in direct wages. Kentucky is the third largest coal producing State.

And our low electricity rates, based on our primary production of electricity from coal, allow us to produce a large share of the Nation's stainless steel, aluminum, automobiles, and other manufactured goods. It is for these reasons that Kentucky's governor, Steve Beshear, reminds us that coal is not a local issue, it is not a State issue, it is a national issue. And the importance of coal to our Nation's economy and security cannot be overstated.

There are many discussions regarding states' rights on this and other regulatory issues. Governor Beshear and I recognize and respect that EPA has a responsibility and obligation to revise and update regulations and program requirements, as necessary, to protect human health and the environment.

However, EPA should not create new regulatory requirements that have not undergone the appropriate congressional or rule-making processes. As it is, today EPA is preventing, through its objection process, the delegated States from issuing permits with no recourse for the States or the regulated community. There is no recourse because, currently, an EPA permit objection is not deemed to be a final Agency determination subject to potential judicial review by an affected or interested party.

Additionally, EPA is not bound by specific timeframes for making a final permit determination, and becomes the permitting authority for a permit action, instead of the delegated State. It is troubling that, absent a timeframe to make a final permit determination, whether that is permit issuance or permit denial, there is currently no obligation upon EPA to take any final action, leaving both the State and the regulated community in a prolonged state of uncertainty. This uncertainty costs jobs and affects the livelihoods of thousands of families in Appalachia.

I will conclude by saying that we have not been silent on the issue with EPA, nor have we been in a combative relationship. As I mentioned, we respect their mission and authority to establish Federal rules to ensure consistency and fairness. My staff and I have been in ongoing discussions with our regional EPA administrator—that is in region 4—attempting to resolve the issues to the satisfaction of all parties: the EPA, the State, the regulated community, and the citizens of Kentucky.

Unfortunately, I am not highly optimistic that such a resolution will occur, especially in light of a recent meeting with region 4 EPA. Indications are that these earnest discussions to arrive at resolution are not being accepted by EPA headquarters. I am disappointed that EPA Administrator Jackson can be so dismissive of such an important issue.

Thank you again for the opportunity to provide these comments.

Ms. MARKS. Thank you. Thank you, Mr. Chairman and Mr. Ranking Member, for inviting me here today. And thank you, Congressman Crawford, for the introduction. I am Teresa Marks. I am the director of the Arkansas Department of Environmental Quality and an officer of the Environmental Council of the States, or ECOS, for which I am testifying today. ECOS is the membership organization of all the State environmental agency leaders.

The reason I am testifying is to let this committee know that the States and ECOS are concerned about the manner in which the U.S. Environmental Protection Agency is combining interim guidance with its objection authority powers. This combination creates a situation in which EPA can require a State to insert virtually any provision EPA wants into a class of permits without the benefits of the due process procedures of the Administrative Procedures Act, such as public comment and judicial review. This practice is unwelcome and is potentially dangerous. It obviously thwarts the cooperative procedures that the APA was designed to foster. It is not a transparent way to create public policy.

States issue the vast majority of water discharge permits. These permits must comply with Federal and State law and rules. EPA then reviews these permits, and the Clean Water Act allows EPA to object to them for cause. We believe this power was rarely exercised until recently.

Last year, EPA issued an interim guidance to its regional administrators, instructing them to object to permits that did not follow the steps indicated within the guidance, although the guidance itself stated that it was not legally binding. EPA is not required to publish guidance, nor is it required to accept public comments on such guidance. EPA can issue interim guidance and expect full implementation in the permitting process, in spite of the fact that there is disclaimer language issued with the guidance, or that the guidance has not been finalized.

Guidance, by the way, is seldom reviewed by the Office of Management and Budget, and so is usually issued directly from the Agency without further executive oversight. ECOS has no general concern about the use of guidance, or objection authority in principle.

But there is a difference between issuing interpretive, as opposed to substantive guidance. EPA's use of interim guidance, coupled with objection authority to create substantive and binding changes in the permitting process amounts to final agency action, and warrants the due process protections of the Administrative Procedures Act. ECOS does not believe that EPA has ever attempted to require States to implement interim guidance by coupling it with objection authority until recently.

Finally, there is another matter of how courts treat any Federal action that is not final. Courts routinely decline to review cases when requested to rule on a matter which does not involve final agency action. When EPA issues an interim guidance it follows that a court would not be inclined to review it, since it would not, obviously, be a final agency action.

Similarly, courts refuse to rule on permits that have not been issued. This could create a situation in which EPA could object to a State-issued permit, then fail to make a permitting decision itself, or fail to make one in a timely manner, resulting in the permit applicant being stymied for months, or perhaps years, in obtaining a permit decision. Fortunately, in the case under discussion today, the court has indicated that EPA's actions could amount to final agency action, and therefore, reviewable by the court.

We hope that the committee can see why the issue of interim guidance, coupled with the use of objection authority, is an unfair and indefensible position in which to place the States and the regulated community, and must not be allowed to continue.

Thank you very much.

Mr. GIBBS. There is a call to vote, but we have got 13½ minutes, so we will—you testify, then we will recess, then we will come back for Mr. Gardner.

So go ahead, Mr. Quinn. Welcome.

Mr. QUINN. Thank you. Good morning, Mr. Chairman, Ranking Member, Congressman Rahall, members of the subcommittee. I want to thank the subcommittee for holding this hearing to exam policies that continue to choke off job-creating opportunities in the Appalachian coal fields.

Over 2 years ago, when the Nation was in the throws of a deep recession, and losing about 600,000 jobs a month, EPA embarked upon a series of actions that prevented coal companies from obtaining permits necessary to expand or start mining operations, projects that would preserve and create thousands of highway jobs in Appalachia.

At the beginning of 2009 a backlog approaching 150 Clean Water Act 404 permit applications had developed, while litigation over the Corps' permitting process was being resolved. On February 13, 2009, the fourth circuit court of appeals issued a decision upholding the Corps' processing for permitting coal mines, thereby removing the obstacles to clearing the backlog. Shortly thereafter, EPA announced that it wanted to revisit some of the applications. Many had been pending for over a year. These are permits EPA already had ample time to review and raise any concerns to the Corps.

In response to our reaction that it appeared EPA was instituting a permit moratorium, the Agency issued a statement that was "EPA is not halting, holding, or placing a moratorium on any of the mining permit applications," plain and simple. As it turns out, EPA had already requested the Corps to develop a list of over 100 permits that were ripe for a decision by the Corps. And then, EPA unleashed a series of new policies in the form of memoranda and guidelines, altering the process, rules, and standards for issuing coal mine permits.

EPA crafted a process that did not resemble anything in the law or the regulations. EPA commandeered the entire 404 process from the beginning to the end by displacing the Corps of Engineers. The new process allows the agencies to ignore all timeframes and the regulations for reaching decisions. New process allows EPA to run roughshod over the States that the Clean Water Act empowers to establish and apply water quality standards for waters within their borders.

The centerpiece of this policy was a so-called enhanced coordinating process, outlined in a memorandum issued on June 11, 2009. By the time the permit backlog—by this time, the permit backlog had grown to about 230 permit applications. How well did the so-called enhanced coordination process work? Well, well over a month later, the Army Corps of Engineers reported that EPA had yet to provide them with the criteria EPA was using to review the permits. In fact, detailed guidance was not issued until almost a year later, April 2010.

A report by the Government Accountability Office requested by the Ranking Member, Congressman Rahall, found the following: "EPA and the Corps did not begin meeting with permit applicants until January and February of 2010, more than 6 months after they created this new, enhanced process. EPA did not document the concerns it presented to the applicants. EPA and the Corps often met separately with the applicants, not together. EPA did not send to these meetings officials authorized to make any decisions."

And finally, “While the process imposes 60-day time period for reviewing the permits, the 60-day period did not begin until EPA said so. And even then, EPA was free to suspend or extend it.” This hardly resembles a coordinated process, let alone an enhanced one, or one that we were told would lead to expeditious review of these permits.

Companies have been worn down. Today, far more permits have been withdrawn by companies than permits issued. And most permits are still languishing in a regulatory limbo. Permits delayed are jobs denied. If the purpose of all this policy is to discourage new investments and job-creating opportunities, well, EPA can declare a mission accomplished.

Let me close by saying that when you talk to coal miners about mining coal, you hear in their voices the great pride they take in what they do and how well they do it. They often speak about their families, their country, and jobs. But the jobs they speak about first are not their own jobs. Rather, they typically talk about all the other jobs they know depend upon them doing their job well. Today I often get questions from them about why their government at times seems to put so much effort into working against them, rather than supporting them in what they do for their country. I wish I had a good answer; they certainly deserve one.

Thank you very much.

Mr. GIBBS. Yes, we are going to have to recess to go vote for two votes. There is still almost about 9 minutes in this first vote, and it will be a 5-minute vote after that. So we will try to reconvene before—between 11:00 and 11:15.

So, when we are back we will have Mr. Gardner’s testimony, and then I look forward to having questions and dialogue. So please excuse us. Thank you.

[Recess.]

Mr. GIBBS. Thank you. Committee will come back into order.

And at this time I welcome Mr. Gardner for your testimony. The floor is yours.

Mr. GARDNER. Good morning. My name is Michael Gardner, and I am general counsel of Oxford Resource Partners, a top-20 domestic producer of steam coal in the largest surface coal mining company in Ohio. In addition to operations in northern Appalachia in Ohio, West Virginia, and Pennsylvania, Oxford has operations in western Kentucky in the Illinois basin. I have been asked to share some of Oxford’s experiences in dealing with EPA’s mining policies. But first, on behalf of Oxford, let me thank you for conducting these oversight hearings, and for the opportunity to present my testimony.

It is imperative that this Congress carefully review EPA’s recent activities in the area of water resources policy. On June 11, 2009, EPA announced its enhanced coordination procedures, and published an initial list of 108 section 404 permits. I sometimes refer to this as EPA’s black list. On September 11, 2009, EPA published its final initial black list of permits subject to enhanced coordination. Only four of Oxford’s eight permits on the initial list made the final cut, the others having been previously issued.

And then, on September 18, 2009, Oxford’s CEO, Chuck Ungurean, sent an urgent letter to EPA Administrator Lisa Jackson. This was a plea, as a stakeholder, to meet with EPA to discuss the critical nature of three of our four permits on the black list. No response has ever been received.

The first project on EPA's final black list that I want to highlight for you is Oxford's Kaiser Mathias permit. It is the poster child for the absurdity of EPA enhanced coordination. On November 4, 2008, Oxford submitted an application for a Nationwide 49 Permit. Nationwide 49 is a general section 404 permit, pre-approved by EPA specifically for remining activities, because the benefits of remining so clearly outweigh any adverse environmental impacts.

In this instance, Oxford proposed to backfill 4½ miles of dangerous high wall, reclaim 450 acres of previously unreclaimed mine land, and restore all the land to meet current standards. It wasn't until March 5, 2010, that EPA finally authorized Kaiser Mathias. This was after 9 months of EPA enhanced coordination of a permit that should never have been on EPA's radar to begin with, and a permit decision that was, quite literally, a no-brainer.

But it doesn't stop there. Three days later, EPA published a press release, taking credit for an 80 percent reduction in impacts to streams, and a 70 percent reduction in impacts to wetland at Kaiser Mathias, all as a result of its enhanced coordination. The only problem with this self-serving press release was that the starting points for these claimed reductions were completely fabricated. Oxford could not have submitted a Nationwide 49, had it proposed the kind of impacts for which EPA claimed a reduction. And there was no mention of Nationwide 49.

Next I would like to share with you what happened at our Halls Knob permit. On October 2, 2008, Oxford submitted an individual section 404 permit application. Almost a year later, on September 11, 2009, Ohio EPA issued its section 401 certification that the project met stringent State water quality standards. One week later, in our September 18th plea to EPA Administrator Jackson, Oxford asked about EPA's environmental concerns, given that Ohio EPA had none. It was not until May 27, 2010, after nearly 1 year of EPA enhanced coordination, that we found out what EPA wanted to exact from Oxford for this permit.

On June 6, 2010, the court drafted the permit, as instructed by EPA, with a host of special conditions that Oxford had never seen before and could not accept. EPA recommended denial of the permit without these special conditions. Now faced with shutting down the mine and laying off 25 coal miners, Oxford went to its congressional delegation for help. On June 18, 2010, a meeting was held with the EPA in the office which I believe is now occupied by Chairman Gibbs. And on July 12, 2010, the Corps reproffered the permit with marginally acceptable conditions after 13 months of EPA enhanced coordination.

These two examples, and the others being submitted to the committee for the record represent five Oxford section 404 permit applications. Permit delays from EPA enhanced coordination have put at risk more than 200 direct coal mining jobs and thousands of secondary jobs, which translates into nearly 2 million tons of annual coal production.

At a time when our Nation still needs reliable, affordable energy to fuel economic growth and prosperity, EPA's water resources policies are crushing employment opportunities and thwarting capital investment in the coal industry that provides and can create high-wage, shovel-ready jobs still needed and valued in Appalachia. Thank you.

Mr. GIBBS. Thank you. I will start with some questions. We will have a round of questions, because there is a lot of, I think, information that needs to be brought to light.

I am going to start with Dr. Peters, since you are a chemist, by trade, I believe. I think I want to have a lot of discussion on the enhanced coordination, and also the conductivity test. Can you, first of all, explain the conductivity test, and then numerical versus narrative, and how it relates to what is going on?

Mr. PETERS. The conductivity is a measure of the actual electric conductance that water would carry, and it is affected by various species that are in water. So, you can have various species in that water that may give the same conductivity, but in fact, they could have different biological impacts, different chemical impacts.

So, conductivity is a measure that, by itself, does not give the complete picture of the contaminants in water. And what EPA has done is specified limits of 500 microsiemens per centimeter as the break-off point in that particular regard, as opposed to a narrative water quality standard, where you look at much broader issues, and not simply conductivity in assessing water quality.

Mr. GIBBS. So then, numerical standard and conductivity, it is narrowly focused, so it is maybe not giving a whole picture, but it could distort the picture?

Mr. PETERS. It is certainly not giving you the whole picture, because you could have the conductivity of—I mean, pick a number, 600 or 700 in one place. You could have the same conductivity in another place. And the chemicals making up that, or that are causing that conductivity, could be distinctly different, and they could have different impacts on health and welfare.

Mr. GIBBS. Now, in different areas, geographical areas, different streams, would you get different results?

Mr. PETERS. Very frequently. One of the dominant features of conductivity is the geology in the area, so that the geology that you have in the Appalachian area is going to be different than what you might have in Kentucky, at least, in our western coal fields, so that the same conductivity, because of differing geologies, would probably represent different chemical constituents in that water.

Mr. GIBBS. So you could get false assertions?

Mr. PETERS. You certainly don't get the entire picture, and you would not be able to make—I have argued, starting 2 years ago, that they shouldn't focus simply on conductivity in and of itself. It is an early indicator. It is not the conclusive indicator that you need to really evaluate the quality of the water.

Mr. GIBBS. And so my understanding is you're head of the Kentucky EPA?

Mr. PETERS. Yes.

Mr. GIBBS. OK. And that is pretty much the standard that the U.S. EPA is using?

Mr. PETERS. That is the standard that came out in the interim guidance on April 1, 2010.

Mr. GIBBS. And in regards to interim guidance, were you, as the State Agency, able to object or was there hearings on that new procedure?

Mr. PETERS. No, there were not hearings on that new procedure. We had to adapt that particular procedure.

And if I could amplify for—just very briefly—over the last 7 months—well, prior to April 1st, we had been putting in permits, 402 permits, the water permits, that were being accepted by EPA even as late as March 31st. Suddenly, on April 1st, those permits that we had been submitting were no longer acceptable.

We had been in discussion for 7 months with region 4, which is the cognizant region that we have, to try to develop a template permit. What would be an acceptable permit? My staff and region 4 staff developed a permit that was acceptable. We thought we had an agreement, and I just found out, actually yesterday, that that agreement was overruled in EPA headquarters.

Mr. GIBBS. So this practice was changed when the administration changed.

Mr. PETERS. That is correct.

Mr. GIBBS. OK. Let's where I want to go next. There is so many questions in my mind, here. I am almost out of my time. I am going to go to Representative Rahall for his—for a series of questions, and we will rotate.

Mr. RAHALL. Thank you, Mr. Chairman. I would like to ask the panel—you heard both myself and Chairman Gibbs reference during our opening comments concerns with EPA applying national standards and practices in order to target a particular industry—a single industry, if you will—and a single area of the country: coal mining in Appalachia, of course, which is part and parcel of the April 2010 guidance statement.

Are any of you aware of any other instance where EPA has ever done this? And are you aware of any other situations where EPA is seeking to enforce conductivity as a de facto water quality standard?

Mr. GARDNER. I am not——

Mr. QUINN. Congressman Rahall, no, I am not aware of, in my career, of ever seeing something like this: one industry, one region, and this type of approach.

Mr. RAHALL. That is a negative from all four of you, then?

Ms. MARKS. Yes, sir.

Mr. RAHALL. All right. The April 10th guidance document became effective immediately with a public comment, almost as an afterthought. To those of you on this panel, is this practice normal in your dealings with the Federal Government, to have such a guidance issued and then the public comment just kind of thrown in at the last minute?

Mr. QUINN. Not for something that changes the rules of the game so substantially. And what should have been done was, if it was some science they wanted to have reviewed, is peer reviewed it out in the open, as well as in terms of their policies, since they are all substantially changing the rules of the game in midstream.

Mr. RAHALL. Anybody else wish to comment?

Ms. MARKS. Yes, sir. I think the big problem that ECOS—from an ECOS point of view—is that there is a difference between interpretive and substantive guidance. Interpretive guidance, of course, is necessary, and it needs to be issued, and it serves a purpose and would probably block things or jam things up if it had to go through the procedural due process requirements of the EPA. But when you are dealing with substantive guidance, you are dealing with almost a rulemaking, basically, and you are not—you do not have those due process requirements that are necessary to make sure that everyone has a chance to be heard, and that there is a chance for judicial review. So, that is our concern.

Mr. RAHALL. So interpretative and minor clarifications are a standard——

Ms. MARKS. Yes, sir.

Mr. RAHALL [continuing]. But not such a major——

Ms. MARKS. They basically change the rules.

Mr. RAHALL [continuing]. Such a major ruling?

Ms. MARKS. Yes, sir.

Mr. RAHALL. To have it become the force of law, almost.

Ms. MARKS. Yes, sir.

Mr. GARDNER. I would agree with Ms. Marks. And our experience in Ohio is that when—and we are familiar with the Agency's publishing guidance and not necessarily of a substantive nature, though, but to interpret their existing rules and regulations. And when they do that, in Ohio, it has always been a collaborative effort, where you meet with all the stakeholders and you pound things out and you come up with, you know, a consensus, if you will, of how this is going to apply, how this is going to work to move things forward. That never happened in this instance, that I am aware of.

Mr. RAHALL. Yes. I know we are here, and this committee's jurisdiction is over the Clean Water Act and its application to coal mining. But I do not believe we could have this conversation without reference to the Federal office of surface mining and SMCRA. I, having been in the Congress when SMCRA was enacted, served on the committee when it was passing the law in 1977. And I am sure the witnesses know that SMCRA explicitly provides for a variance from the requirement that mine lands be reclaimed to their approximate original contour if certain conditions are met—in layman's terms, mountaintop removal mining and valley fills—provided that post-mining land use supports some type of economic development—industrial, commercial, agricultural, and the like.

Let me ask you, Mr. Quinn, are you aware of EPA challenging proposed post-mine land uses of this nature as part of its 404 permit reviews?

Mr. QUINN. Yes, I am. Two examples, I guess, for brevity purposes.

In your State, if I recall, there was two—three operations, and two operations involved King Coal Highway. And the post-mining land use was designed to allow the road bed, flat or rolling terrain, to accommodate the road bed for that highway. My understanding is there was an estimate that that work would save the taxpayers $100 million.

There was another case where EPA questioned the need for post-mining land use being proposed down in Logan County, in your district, for leaving land suitable for an emergency flood housing, and they questioned the need for such housing. And, of course, anybody who is familiar with that county down there knows that flooding is a situation that emergency housing is necessary. And this was to be operated by FEMA.

Mr. RAHALL. Thank you. I appreciate the Chairman's indulgence while I ask one more question of the whole panel. I think it is extremely important that the science used to support government environmental policies be peer-reviewed. Are any of you aware of, and can you comment on the science used to support the EPA's April 2010 guidance, and whether it was peer reviewed?

Mr. PETERS. There was a peer review that took place subsequent to the issuance of it. It had not taken place prior to it. And there are differing views on the science. At this point in time, probably the best terms to use for the science is that it is incomplete, at best. It is not totally conclusive, in that particular regard.

So, there is certainly not unanimous and uniform agreement. But it was only peer-reviewed after the interim final guidance was issued, and that was a number of months after the case.

Mr. GIBBS. Dr. Peters, would it be fair to say that they developed the policy and then kind of figured out what the science should be?

Mr. PETERS. Well, they did have some science ahead of time, but that was science that had not been peer-reviewed prior to that point in time. And I think we all recognize that the peer review is a very important step in evaluating the quality and the voracity of that science.

Mr. GIBBS. Representative Cravaack, do you have questions? Go ahead.

Mr. CRAVAACK. Thank you, Mr. Chairman. Mr. Gardner, if I could, sir, why do you think the EPA issues guidance? Why don't they just issue a rule? What is your opinion on that?

Mr. GARDNER. Well, I think the Administrative Procedures Act is, you know, difficult. It is a long process. And guidance documents are easy to generate. On every guidance document I have ever seen there is always a disclaimer that says, "This guidance document does not have the force of law," yet at the same time it is being foisted on the industry, and you are required to meet the standards that are established in that as binding conditions for getting a permit.

Mr. CRAVAACK. So, what you have found in your experience is that these guidances have, in de facto, become rules.

Mr. GARDNER. Absolutely, yes.

Mr. CRAVAACK. That is what I hear. Thank you, sir.

Also, Director Marks, in your opinion as a State legislator, do you feel the EPA has overreached its authority?

Ms. MARKS. In a situation where EPA—such as this, where EPA has combined their guidance authority with their objection powers to make it basically binding, to make sure that they guidance followed in permitting decisions made by the States, yes sir, we do think that they have gone too far. As far as that goes, there should be due process and a chance to comment from the States.

Mr. CRAVAACK. And what rule do they state that says that they can interfere with states' rights?

Ms. MARKS. I am not aware of any rule. The response, generally, we have received from EPA is that they use guidance, and they have used it for years, which is absolutely true.

And we see the need for guidance. We don't think that there is a problem with the use of guidance, as long as that guidance is not used to basically change the rules and make them binding on the regulated community and the States, without that ability to challenge.

Mr. CRAVAACK. OK. Thank you very much.

Mr. Quinn, sir, compared to previous permitting timelines and costs, how do you expect the future—the expected timelines and cost to change in this new process?

Mr. QUINN. Well, right now it is taking several years, where it used to take us maybe 4 to 6 months. So now are seeing an increase four or five-fold.

In terms of cost, it is—what is happening now is it is not only taking longer, but with the conditions they are trying to place on these permits, the productivity of these operations is dropping. And, in fact, the Energy Information Administration recently came out in its energy outlook and has lowered the productivity projections for surface coal mines in Appalachia by 20 percent. That is a very substantial regulatory penalty that is being assessed against the operations in this region.

Mr. CRAVAACK. Yes, we are experiencing the same kind of operations in Minnesota, as well, in our iron range region. We are trying to get some open pit mining done, as well, for precious metals. So we are finding the same kind of—the permitting process in the coal industry is also reflective of other mining operations, as well.

Mr. QUINN. Mine permitting in this country is the largest impediment to new domestic investment in the mining industry in this country, with taking up to 10 years to get permits.

Mr. CRAVAACK. And I totally agree with you on it being a national security issue, as well. So—and depending on our own natural resources. So I agree.

Dr. Peters—thank you, sir. Dr. Peters, why do—what do you think the driving force is behind the EPA's changing their process?

Mr. PETERS. I wish I could answer that. It is very difficult——

Mr. CRAVAACK. I really wish you could, too.

Mr. PETERS [continuing]. To do anything other than conjecture at this particular point in time. When you ask EPA what does a good mining permit—what does an acceptable mining permit look like, we cannot get a definitive answer today. So when you cannot get that definitive answer, you begin to ask yourself, "What is the motive?" And all you can do is conjecture and hypothesize. And being a scientist, I would rather not hypothesize on that.

But it is definitely stymying the industry. It is not—not only is it not valuable for the—hurting the industry and the regulatory community in the State, it is really, in a very significant way, breaking that Federal-State cooperative partnership to protect the environment that we had for so many years.

The only thing I could say is if that partnership is not entirely broken at this point in time, it certainly is severely fractured. And that is, I think, one of the fatalities of—or certainly one of the fatalities of what we are seeing at this point in time.

Mr. CRAVAACK. I am almost out of time. But America's Commitment to Clean Water Act was passed in the House last year, and did not go forward. But what I am seeing now is they are trying to implement the America's Commitment to Clean Water Act, not through legislation, but through mandatory rulemaking. And do you see that, as well?

Mr. PETERS. That is certainly one of the reasons that people are offering for it, yes.

Mr. CRAVAACK. Thank you very much, sir. And, Mr. Chairman, I yield back.

Mr. GIBBS. Thank you. I think we are hitting conductivity pretty good, but I have got one more follow-up on that of Dr. Peters. I have got a report here that talks about the guidance effectively established the regionwide—and we talked about the geographical problems and issues with that—but the conductivity levels should not exceed 500 siemens.

It is my understanding that this bottle of water exceeds that level. Would that be true?

Mr. PETERS. I cannot speak for that bottle of water, but there are many bottles of water that do exceed that value, yes.

Mr. GIBBS. So you are telling me that the standard that would be applied under the permit to pass the test would have to be cleaner than most bottled water?

Mr. PETERS. That is correct. And it varies from region to region to region. But, yes, absolutely.

Mr. GIBBS. That is absurd, but I mean I—that is hard to understand, but that makes it, gives me a red flag that there is a different agenda going on here.

I want to talk, Mr. Gardner, to the enhanced coordination. In your written testimony, it talked about, on the applications, filed—it was kind of like going in a black hole, you couldn't get any answers, you couldn't get back—can you expound a little bit on the enhanced coordination? I believe the enhanced coordination is dealing with the Corps, the EPA, and the Department of the Interior, is that correct?

Mr. GARDNER. In theory, yes. But, I mean, it is all being directed by U.S. EPA, you know. The example I gave you, Halls Knob, that was a permit that, you know, we received a copy of a letter from U.S. EPA to the Corps saying, "These are the special conditions to put in the permit," and the Corps obediently drafted the permit with those conditions in it.

So, as far as coordination goes, you know, we tried to coordinate with the Corps on it, and they said, you know, "You are not going to get your permit unless you have these conditions in it," and that is when we went to the congressional delegation.

Mr. GIBBS. Let me just——

Mr. GARDNER. You know——

Mr. GIBBS. It is my understanding, then, that the enhanced coordination is something that kind of supersedes that, maybe the whole permit application process too, that they can put road blocks up in front of you before you really get into the permit process with the Corps?

Mr. GARDNER. Yes, exactly. I mean initially it came out they published a list of permits that were subject to enhanced coordination.

And I call it the black list, not just because it was permits subject to enhanced coordination, but because, literally, the permits went into a black hole. You couldn't get any information out of EPA, you know, why your permit got on the list, how you get your permit off the list. It was just, you know, radio silence for months and months and months. And then they come out, you know, and start issuing the permits.

But that's been our experience with enhanced coordination. The procedures that they are deploying are more suitable for courtroom litigants than the regulatory process, where you first—you know, you ignore your opponent and then you stall and delay and—until they either run out of money or time or both, and they are forced to settle or go away.

Mr. GIBBS. I don't believe there is anything in the Clean Water Act or law anywhere that talks about enhanced coordination. So I don't know where they get the jurisdiction to do that. I don't know if you agree or not. When did this new policy and procedures come into effect?

Mr. GARDNER. I would say with the publication of their announcement June 11, 2009. Coordination is kind of a term of art. You know, we have been coordinating with the Corps years before that to get our permits. The initial step in that process is generally what is called a jurisdictional determination, where you submit a preliminary mine plan to the Corps, and they go out and review where the jurisdictional waters are that are proposed to be impacted, and that is coordination. Enhanced coordination is a, you know, figment of EPA's imagination.

Mr. GIBBS. Oxford, I believe, is surface operations, right?

Mr. GARDNER. Correct.

Mr. GIBBS. In your written testimony—I was reading it last night—you talked about filling in where high walls are, the dangerous high walls, which would be, I guess, hundreds of feet. Can you explain a little bit, you know, the reclamation process that Oxford uses, and what the end result is, and the regulatory process you have to go through?

Mr. GARDNER. Sure. I mean, ordinarily, most all of our operations are remining operations, to some extent. That means we are going back in to areas that were mined before SMCRA was passed in 1977, where there were, you know, miles of exposed high wall hundreds of feet high that are dangerous for people driving ATVs in the wilderness and falling off of high walls, or they were abandoned final-cut pits from the prior mining that had acid mine water in it.

And we are—in our permitting operations, we proposed to go back in there, remine the area, which means we go back in and we have to get rid of all the toxic water that was there, and we will go back in and remove additional coal reserves that were left, because it was easy coal that was taken, you know, 40, 50 years ago. We will go back in and remove additional coal and then backfill, from our operations, the hundreds of feet of abandoned high wall and restore the land to meet current mining standards.

Mr. GIBBS. Did you give this to us, the committee, these pictures?

Mr. GARDNER. I think that is from Mr. Quinn, but——

Mr. GIBBS. Oh, OK. Well, I guess, Mr. Quinn, I will just go to you here. I guess I am out of time, but I will yield myself a little bit more. I don't think the Ranking Member will mind.

I understand these are pictures of reclaimed land?

Mr. QUINN. Yes, that is reclaimed land. That is in eastern Kentucky, where we have an arrangement with the Rocky Mountain Elk Foundation. We have introduced the largest set of Rocky Mountain elk in the east.

Mr. GIBBS. Pretty nice looking pictures to me with the elk on there. And I was reading—I think it was your testimony—that there has been some issues on permitting on your—I mean you're doing a mining operation during the permit to get the reclamation plans, I guess. There was some issues with the EPA about the issue of wildlife being on the reclaimed land and the—I guess, lack of better term—manure from the wildlife coming into the streams. Is that an issue?

Mr. QUINN. Well, they are questioning, as Mr. Rahall is indicating, they are questioning the post-mining land uses that are being chosen by the companies. In some cases it is wildlife habitat, in other cases it is industrial development or housing development. So they are getting way outside their scope and sphere by getting into the areas that the office of surface mining and the State mining regulators are the ones who are qualified and empowered to make those decisions.

Mr. GIBBS. OK, thank you. Mr. Rahall?

Mr. RAHALL. Thank you, Mr. Chairman. I have just a general thought I would like to throw out to the panel, as I am sitting here listening to questions, especially those from the gentleman from Minnesota. And I have thrown this out before in the public arena.

But in looking at why all this is happening to this generic arena of applications that are out there, is it possible that during the previous administration, that perhaps EPA was told not to exercise their legal right under the CWA to review these permits? In other words they were told to stay out.

And with the advent of a new administration, could there be those within the EPA that felt they were wrongly shut aside during the previous administration, and now, with a vengeance, want to come back, and we see the pendulum swinging too far the other way, in which they are exercising a personal vendetta or agenda, whichever you want to use, because of not being allowed to do what they thought was proper during the previous administration?

In other words, pendulum went too far one way, now it is going too far the other way. Don't we need to get back to the middle?

And I don't reference permits that have been granted, such as a spruce permit in my district. That is totally beyond what I am talking about. I am not talking about previously approved permits being revoked. But I am just talking about the generic field of surface mine applications out there.

Mr. GARDNER. I will take a stab at that for you. I don't know that there was any administration that told EPA to stay out of coal mining permits. But the Clean Water Act itself delegates responsibility under section 404 to the Secretary of Army and the Corps of Engineers, and wisely so, because they are more familiar with it.

EPA has its hands full with, you know, an number of different regulatory programs.

And I think it is fair to say, though, when this administration came in, they stepped up the efforts, particularly after the fourth district court of appeals overturned or reauthorized or upheld the Corps' authority to issue 404 permits under the Clean Water Act. That is when they really ramped up their efforts to get involved with reviewing what was previously the Corps' exclusive jurisdiction.

Mr. QUINN. Let me say that I have heard that, and perhaps that might be some motivation, but I would say the following things.

One, I think it is more likely that coal mine permitting was not a priority. Nobody ever told them they couldn't comment. It was not a priority because it is already well regulated. You already had the Surface Mining Control Reclamation Act, which already evaluates much of what EPA now says it wants to look at, which is operation plans, water impacts, water management, post-mining land use, things along those lines.

If EPA felt it was shunted aside in the prior administration, then the answer would have been return to their normal authorized role, which is to file comments with the Corps of Engineers about pending permits. Instead, they have created a process that has displaced the Corps of Engineers from the front end of the process. The Corps—actually gets to screen which permits it will allow the Corps to actually review. And at the end of the process, whatever decision is made by the Corps has to align with what EPA wants.

So, if that was the sole concern, which was commenting, that is—they have gone well beyond that.

Ms. MARKS. Yes, sir. I would have to say that I have not heard anybody express that concern among the States. ECOS does not have an official position on that issue. But I have not personally been concerned that there has been some type of policy swing in that regard. And I have not heard other States express that.

The concern that we have, of course, is it is easier—it is certainly quicker, it is easier to go ahead and institute guidance. And if you can do that without the due process issues, then it is easier to get it in place and get it started. The problem is, when you are dealing with these substantive issues, you just cannot ignore the due process. It has to be in place, and—for the States to have a cooperative relationship with EPA. And that is certainly what we strive to have, is a cooperative relationship.

Mr. RAHALL. Mr. Peters?

Mr. PETERS. I was not present in—I was not in my current position during the prior administration, during President Bush's administration, so I have no firsthand knowledge of that. Some of my staff have said that is the case, but that is simply what they have indicated.

Mr. RAHALL. Some of your staff who were around during the previous administration?

Mr. PETERS. That is correct.

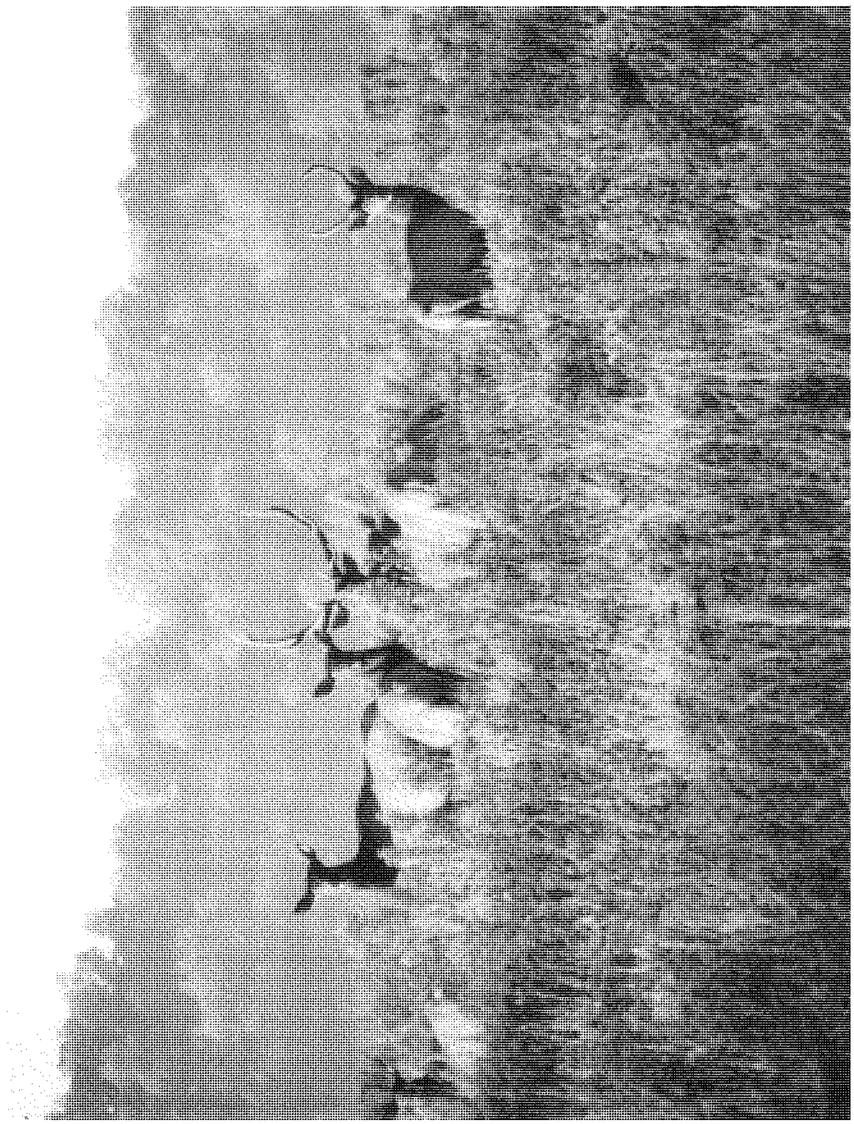
Mr. RAHALL. Thank you.

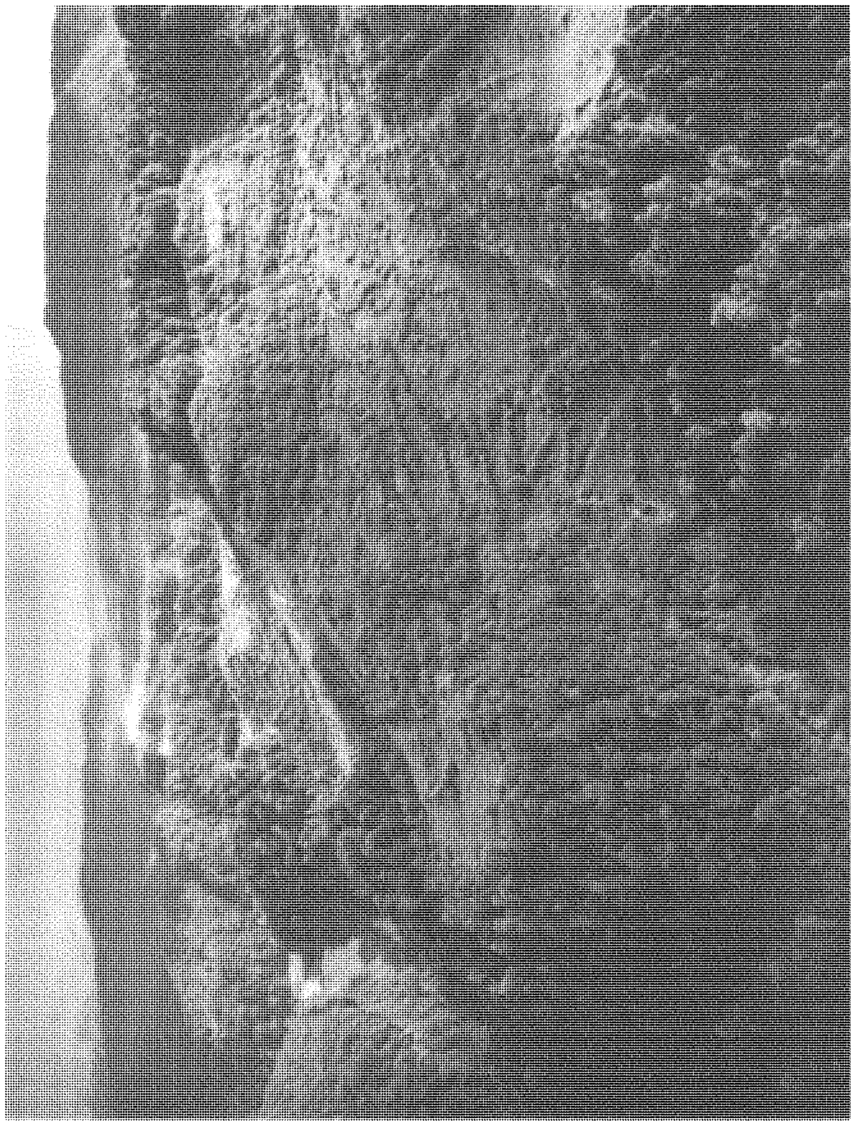
Mr. GIBBS. Before I go to you, I want to ask for unanimous consent to have these put in the record, Mr. Quinn, these pictures of the reclaimed land.

[No response.]

Mr. GIBBS. I heard no objection. Enter into the record.

[The information follows:]





Mrs. CAPITO. Thank you. Thank you. Pardon if you have answered this already, but as you have probably figured out, we like to have things answered several times, to make sure we clearly understand.

Part of the things that I am hearing in West Virginia, in terms of working with the EPA and trying to reach a sense of fairness is the prolonging, or the time spans are becoming so much lengthier, and—that you are really not getting a yes or a no answer, it is just a continuation of changing the process or redoing the process. And sometimes I think in life it is better to get a no than a maybe. Or, "That might work."

Do you find this to be the case, that it is more of a moving the goal post with the different provisions and working with the Corps and the DEPs, or do you find that it is more a sense of an absolute answer, one way or the other? I am curious to know about that. Dr. Peters?

Mr. PETERS. Certainly in our case it has greatly prolonged the process. And it has prolonged the process to the point where some companies are simply withdrawing permits because they do not see the end in sight. And that prolonging of the permits, of course, costs them money.

Mrs. CAPITO. Right.

Mr. PETERS. And they have to make a business judgment as to whether or not they can persist for that length of time.

But, you know, our data clearly show that it is much, much longer to get a permit today than it was 3 years ago or 5 years ago. We have, right now, 162 permits that we are about ready—we are trying to figure out what we need to do with them so that they will be acceptable to EPA. And they are OK and approved by the State standards. But by the same token, if we begin to move forward with submitting them to region 4 for their comment, they are just going to be delayed much longer.

So, that is why we have been in great discussions with region 4 as to how we can expedite the process. But it is definitely prolonging the process without a definite yes or no.

Mrs. CAPITO. Does anybody else want to comment on that?

Mr. QUINN. Well, I agree with Dr. Peters. That is the experience of our members. There is no end in sight. As I indicated in my testimony, the results of this process is more permits have actually been withdrawn by the operators than actually issued.

If I have a $50 million or $100 million or $150 million initial investment, if I am faced with the prospect of not getting a permit 2, 3, 4, 5 years, I can take that money and go to another State, get a return on my investment sooner. Or, even worse—or even perhaps take that investment to another country and get it a lot sooner. And that can make a big difference, in value proposition.

Mrs. CAPITO. Going along the lines of the topic, which is the jobs issue—and I think we all addressed this in our statements—I know that part of the permitting process is obviously public comment period, probably public hearings in the affected areas where individuals who are more deeply affected maybe have a chance to voice their opinion. And also, I would imagine in the—and I know this to be true in West Virginia, that when a project is on the table it is quantified many times in terms of how many jobs it might be.

Going along the lines of my opening statement, when the EPA looks at these particular issues in terms of permitting, they readily admit that the job data is irrelevant to their decision. How would you characterize that, in terms of how you think your individual States or your individual communities would feel about that, when they have obviously poured their heart out at a public meeting, talking about job and ability to stay in their own community and live and work in a place where they love? Have you heard this as a theme throughout the—this process? Dr. Peters?

Mr. PETERS. Certainly in Kentucky we have heard that expressed. And we take the position in our cabinet that it is not something that we can ignore. We cannot ignore the jobs involved in it. It is finding the right balance between what we need to do with getting a permit issued and the jobs in place. Because not only are you putting those—by delaying the permits, not only are you putting that business in the dark, you are leaving those miners in the dark, wondering when they are going to be able to get back to work.

So, we do look at that. We do try to make some assessments in that particular regard. And we do remind region 4 EPA that jobs are something that we must consider, and we do need to consider within our State, even though they tell us that jobs is not one of their considerations.

Mrs. CAPITO. Thank you. Thank you, Mr. Chairman.

Mr. GIBBS. Mr. Altmire, do you have any questions?

Mr. ALTMIRE. Thank you, Mr. Chairman. Mr. Quinn, I know that the NMA has commissioned some scientific studies that raise concerns with the EPA's studies, and specifically the methodologies that they use. And you referenced that in your testimony and in the Q&A today also.

And I was just wondering. Has the EPA responded to any of NMA's concerns or studies?

Mr. QUINN. Thank you, Mr. Altmire. No, they have not. And I have the studies here with me, if the Chairman will accept them for submission in the record. They have looked at—we retained an independent, well-known firm to look at EPA studies and the methodology. They came back and found that there was no causal relationship proven, in terms of EPA's work. EPA was actually imposing a standard that is higher than background levels, and also did not use its standard methodology for reaching its conclusions.

So, the short answer is no, we have yet to hear anything from EPA about——

Mr. GIBBS. Without objection, we will accept those into the record.

[No response.]

Mr. GIBBS. Hearing none——

Mr. ALTMIRE. Yes, it would seem to me, even if they may be skeptical of the source of the commission, this is something that—you are owed a response, at minimum, from the EPA.

Mr. QUINN. I would think so, even more—for more reasons than just a courtesy. Because I think if they want to have confidence in their own work, they would take a look at this and consider it. And if they find it persuasive, then look into it further. If not, then respond publicly about why it is not—lacks merit.

Mr. ALTMIRE. And I would just say that, being a member of the committee, I would appreciate the EPA giving a response to these concerns, too.

Mr. QUINN. Thank you, sir.

Mr. ALTMIRE. Dr. Peters, thank you for being here, as well. I was wondering if the EPA's conductivity benchmark was derived using West Virginia data, but has been applied to all streams within central Appalachia, including my home State of Pennsylvania. Do you agree that it is appropriate for the EPA to apply the conductivity limit in this way?

Mr. PETERS. Conductivity is a measurement that does not give the complete picture of what is in the water. And it is very, very dependent on the geology, the local geology, in many cases.

In fact, in Kentucky, I have asked our department of environmental protection, who has primary responsibility in this area, to look at our data that we have across the State. And we are not able to draw any firm conclusions across the State, at least at this particular point in time. It varies from region to region. It probably varies from microgeology to microgeology, as well.

Mr. ALTMIRE. Thank you. And on that point, Mr. Quinn—back to you—do you believe that the EPA's conductivity guidance represents a substantial change to prior regulations?

Mr. QUINN. Oh, absolutely. It is a substantial change in regulations. And, actually, they are asserting themselves in the State water quality process, which—they don't have that authority, certainly not in the way they have done it.

Mr. ALTMIRE. Right. Lastly, Mr. Chairman, I would ask Mr. Gardner.

You talk in your testimony about addressing past environmental problems through Oxford's remining operations. Can you tell the committee who would be responsible for addressing these environmental problems if the mining industry was unable to take on this remediation through its active mining projects?

Mr. GARDNER. Well, yes. You know, the mining industry itself pays a severance tax to the Federal Government, 35¢ a ton, that goes into an abandoned mineland fund. And those monies, in addition to whatever taxpayer monies, would be all that is available to reclaim abandoned mineland.

Mr. ALTMIRE. Great. Thank you. Thank you, Mr. Chairman.

Mr. GIBBS. Thank you. Mr. Cravaack, you have another question?

Mr. CRAVAACK. Yes. Thank you, Mr. Gibbs. Mr. Quinn, I have got a quick question for you in regards to—I don't know if you have the data, but because of these new processes that are being implemented, do you know what the average cost to the average American would be in regards, not only—but in electrical costs, heating costs, what we would also have to charge, you know, buying a gallon of milk off the shelf at the store?

Mr. QUINN. From this policy? I don't have any numbers along those lines, Congressman, but what I can tell you is this, that 21 of the 25 States with the lowest electricity costs depend on coal for 40 percent or more of their electricity. And it is no coincidence that those same States have the highest concentration of manufacturing in our country, because of low-cost, affordable coal.

So, I think it is clear, as you raise the cost of coal and raise the expense—electricity, not only are you affecting those businesses, but you are affecting households, which probably 50 percent of households in this country already spend 20 percent of their aftertax income on energy.

Mr. CRAVAACK. Yes. My electrical bill is high enough, thanks.

But, anyway, Director Marks, if I could ask you—we are all concerned about our environment. You know, I live in a beautiful State called Minnesota, land of 10,000 lakes. We are very concerned about water quality. And it has been my opinion that nobody takes care of Minnesota better than Minnesotans.

So, with that said, in your opinion, what does a perfect EPA look like to you, as a State representative?

Ms. MARKS. Well——

Mr. CRAVAACK. You have a blank slate, here.

Ms. MARKS. That is a pretty dangerous thing. But I think that one thing that the States are all concerned about—and you know we all come from different areas, we come from different backgrounds. There is very few times that we agree on anything, all 50 of us, wholeheartedly. And this was one, when we did the resolution about this issue, this was one we did agree to.

I think what the States desperately need EPA to understand is that we are actually implementing their rules and regulations. We are implementing those delegated programs, on a case by case basis, in our States. We need the resources and we need the background to be able to do that. We also need the science to support what we are doing. And, most importantly, we need to have a voice in that process.

And that is what I would envision for EPA, is to have—to let the States have more of a voice in the process of what is going on in their States. Because, truly, they do know more than anybody—locals know better than anybody—what is going on, as far as the environment goes.

Mr. CRAVAACK. Yes. You know, that is so true. Because Minnesota looks a lot different than New Mexico, you know, different—totally different issues, as well.

Mr. Quinn, if I can ask you one more question, what can Congress—you know, I am a military guy, so identify the problem, what is the solution—what can Congress do, in your opinion, to address the issue of permitting, not just in Appalachia, but also through all mining operations?

Mr. QUINN. Well, there is a couple things that come to mind, particularly based on the testimony today.

One, you could clarify what the existing law requires, is that the States are responsible for establishing the water quality standards, interpreting them, and applying them; that EPA's role is one of oversight, not one of taking command of the process, at either the State level or the Army Corps.

It could also clarify that point with respect to the 404 process, with the Army Corps, and also indicate that its role is limited to providing comments, but not commandeering the process, as well.

And it could also, given—in view of the recent activities where we probably have entered a—some unchartered territories, in terms of regulatory risk for business in this country, with the retroactive revocation of a permit to a coal mine in West Virginia, we could probably use some clarification there, that that is not what Congress had in mind at all, that if EPA has concerns they should get those to the Corps contemporaneously with the process about deciding over the permit, not after the fact.

Mr. CRAVAACK. Thank you very much, sir. And, Mr. Chairman, I yield back my time.

Mr. GIBBS. Thank you. Dr. Peters, just a quick follow-up from one of Representative Cravaack's questions with Ms. Marks: your experience in Kentucky running your EPA, and direction you have gotten from the U.S. EPA, have you had any instances where you have had a direction from EPA, U.S. EPA, and you have implemented them, and—how has it worked out?

Mr. PETERS. Well, certainly we have relied primarily—as it was intended—in our interactions with the regional, region 4. And those interactions—and I think that is true of all States. Your first point of contact and your most substantive interaction should be with the regional EPA. They are the ones that, while they don't know everything that is going on in Kentucky or Arkansas or Alabama, they have a better sense than what headquarters does at this point in time.

Our interactions with region 4 have been positive. The breakdown, as I see it, is the breakdown has been between headquarters and the regional offices in this regard. If we could re-establish that connection, and the primacy of that connection, it would be much, much better used. That is an important interaction.

We have—we had a set of permits prior to April 1 of 2010 that were acceptable to EPA. Then, when that interim final guidance came out—within 1 week, OK—that whole picture changed. And it is that inconsistency that really drives the regulator and the regulatory community mad, when you have that inconsistency. Because it is not easy to justify a decision that you made last week when it is a different decision than you made the week before.

Mr. GIBBS. OK. Mr. Quinn, one final question for you. Looking at the enhanced coordination process, and they have a—I have got a document here that says EPA first utilized what they call the multicriteria integrated resource assessment, MCIR, to determine that fact. Is that used across the country, or is that just used in Appalachia?

Mr. QUINN. To the best of your knowledge, Mr. Chairman, that is a concept for discussing issues, but not a decisionmaking process. But what they have done is they have taken this theoretical process, and have applied it in a decisionmaking mode.

No, to our knowledge it is not used anywhere else for any type of permitting decision. It may be used for evaluating policy options for a program, but not for permitting decisions.

And this is the process they use to screen which permits they want to work with on—with the Army Corps of Engineers on, which is completely different than things they have done in the past, which are permits are given to the Corps, the Corps makes the decision, EPA, like other agencies, is provided an opportunity to provide some comments.

Mr. GIBBS. And it is my understanding that this enhanced coordination, what you just referred to, is really specifically just used in the Appalachian area?

Mr. QUINN. Yes, their memorandum establishes the enhanced coordinating process as basically a side track for Appalachian coal permits in about six States, including Ohio.

Mr. GIBBS. OK. And it is also my understanding, under this process, the section 404 guidelines has never formalized that process. So there is nothing in the law or in the administrative code, I guess, that puts a time limit on when they have to have the process done, when they go through this—using this new procedure.

Mr. QUINN. Not the new procedure. There is limits in the Army Corps of Engineers regulations for decision points. But those, under this policy, are all ignored. They have said in their policy there is a nominal 60-day period to reach resolution. But as I indicated in my opening remarks, EPA is—makes—that 60-day period only starts when EPA says it starts, which can be months or years later. And they are free to suspend the 60 days, once it starts, if they decide they need more time.

Mr. GIBBS. OK. So obviously, it is going to be used as a delaying tactic.

Mr. QUINN. Yes.

Mr. GIBBS. OK. Ms. Marks, in your written testimony you talk about how you don't believe that EPA has ever attempted to require States to implement interim guidance until recently, and you have a concern that the interim guidance could put your State or any State in a position to actually break Federal law or break State law. So that is a Catch-22.

Ms. MARKS. Yes, sir.

Mr. GIBBS. Can you kind of expound on that a little bit?

Ms. MARKS. Yes, sir. The problem is that there are a lot of States—or there are some States—that cannot enact laws any more stringent than Federal law. That is pursuant to their State government, they cannot do that. When you have an interim guidance come down that is being used pursuant to the objection authority is binding in permits, you put the State in the position of either I have to go ahead and put these things in the permit that EPA wants so they won't object to the permit, and break State law, because this is an interim guidance, it is not final——

Mr. GIBBS. OK.

Ms. MARKS [continuing]. Or, I go ahead and don't put that in, and then EPA can use their objection authority and my facility might not get their permit, or their permit may be delayed for a long time if EPA takes that—uses that objection authority.

So, you put them in a real Catch-22. They are either going to violate one Federal law or State law, one or the other.

Mr. GIBBS. Well, I appreciate all you coming into Washington today. This has been very enlightening for us. We are having a hearing next week, and the EPA will be represented in one of the panels.

It is clear to me, from your testimony, that there has been some questions raised and concerns about the science used to make some of these determinations, the conductivity tests that we talked about. Obviously, enhanced coordination that might be specifically targeted to a region in the country and issues like that where I think, you know, under the law, due process and equal process under the law might be one issue. It seems like there is a whole host of issues here.

And I think we have a—and what also is amazing to me, too, is the—we have two State EPAs represented here today that have serious concerns about what is going on at the Federal level, and making your job tougher. You know, we had regulators here represented, and plus, the industry represented. So, I just want to make that clear, that I think this was balanced. And next week we will have the EPA here to have them respond to what we learned here today.

So, thank you very much for coming in, and that will conclude this hearing today.

[Whereupon, at 12:07 p.m., the subcommittee was adjourned.]

Oxford
Resource Partners
Reliability Matters

# STATEMENT OF
# MICHAEL B. GARDNER

## GENERAL COUNSEL
## OXFORD RESOURCE PARTNERS, LP

**Before the House Subcommittee on Water Resources and Environment**

**Hearing On**

## EPA Mining Policies:
## Assault on Appalachian Jobs – Part I

**May 5, 2011**

Good morning; my name is Michael Gardner, and I am General Counsel of Oxford Resource Partners, LP (NYSE: OXF). Oxford is a Top 20 Domestic Producer of steam coal and the largest surface coal mining company in Ohio. In addition to its Northern Appalachia operations in Ohio, West Virginia and Pennsylvania, Oxford has operations in Western Kentucky in the Illinois Basin.

We have a dedicated, non-union workforce of approximately 880 employees and expected coal production for 2011 of 9+ MM tons from 21 mines. Oxford has an enviable environmental, health and safety record, as evidenced by its recognition for outstanding achievements in reclamation and safety with more than 100 awards since 1985.

Oxford supports a carbon sequestration research project with Ohio State University and sponsors a field trial evaluation with a biotech company to demonstrate the viability of growing energy crops on our reclaimed mined land. And Oxford is fulfilling a substantial, three-year financial commitment as a corporate sponsor of the Foundation for Appalachian Ohio, to enhance the quality of life in our local communities.

We do surface mining only. Nearly all of our operations involve re-mining to some extent with the resulting beneficial backfilling of miles of dangerous highwall left from past mining practices, treatment of millions of gallons of toxic water accumulated in old strip pits, and elimination of acid mine drainage from abandoned deep mines, along with restoration of the land in accordance with current mining standards.

I have been asked to share Oxford's experiences in dealing with EPA's Mining Policies and its assault on the coal industry in the name of our nation's Clean Water Act.

The exhibits to my testimony contain a summary of facts and supporting documentation for 9 Oxford mining projects that illustrate our experience since June 2009, when EPA announced its Enhanced Coordination Procedures. I would need 5 hours, not 5 minutes, to do this justice; so I will share with you some of the highlights from my perspective.

But first, on behalf of Oxford, let me thank you for conducting these oversight hearings and for the opportunity to present my testimony. It is vital to our national interest in providing affordable energy that this Committee and others in Congress carefully review the EPA's recent activities.

**ENHANCED COORDINATION PROCEDURES**

On June 11, 2009, EPA announced its Enhanced Coordination Procedures and published an initial list of 108 §404 permits subject thereto (Ex. D). Eight Oxford sites appeared on EPA's Initial List of 108. It suffices to say that it's not a good thing to be on any list compiled by EPA. I sometimes refer to this as EPA's Blacklist. It's not a misstatement to say that, since June 11, 2009, every pending coal mining §404 permit application is on EPA's Blacklist, whether or not it appears on any published list. It's a Blacklist not only because these permits became subject to "Enhanced Coordination," but because these applications literally fell into a Black Hole, where no information was forthcoming—literally the opposite of transparency. You couldn't find out why a permit was on the list; and you couldn't find out how to get them issued off the list. This was a *de facto* moratorium on §404 permits – one sure way to reduce environmental impacts.

**OXFORD BLACKLISTED PERMITS**

On September 11, 2009, EPA published its "Final/Initial" List of 79 §404 permits subject to Enhanced Coordination (Ex. E). Only 4 of Oxford's 8 permits on the initial list made the final cut; the others having already been previously issued. The **first 4 numbers** of these permits are **highlighted** below to indicate the year when Oxford first began *coordinating* these permits with the Corps of Engineers – the delegated regulatory authority under §404 of the Clean Water Act. This Blacklist includes 4 Oxford sites: (1) Kaiser Mathias (200701021); (2) Halls Knob (200501385); (3) Peabody 3 (200500421); and (4) Ellis (200701180).

On September 18, 2009, Oxford's CEO, Chuck Ungurean, sent an urgent letter to EPA Administrator Lisa Jackson (Ex. F). This was a plea, as stakeholder, to meet with EPA to discuss the critical nature of 3 of our 4 permits on EPA's final/initial Blacklist of 79 (see EPA Letter to Sen. Inhofe, May 6, 2009, Q&A #4). We reminded EPA of its June 11, 2009 Press Release (Ex. F, p.11) entitled: Obama Administration Takes Unprecedented Steps to Reduce Environmental Impacts of **Mountaintop Coal Mining** [MTM], and reiterated that none of these permits involved MTM or for that matter Valley Fills. Despite numerous attempts to follow up by email, telephone messages left with Ms. Jackson's assistant, and voicemails to her Chief of Staff in the Division of Water, no response has ever been received.

**Kaiser-Mathias (Ex. G)**

The first one on the final/initial Blacklist of 79 that I want to discuss is Oxford's Kaiser-Mathias permit. It is the poster child for the absurdity of EPA's Enhanced Coordination.

Oxford began *coordinating* this permit with the Corps in 2005 to determine the extent of its jurisdiction (*aka* Jurisdictional Determination). Oxford submitted an application for a NWP 49 permit on November 4, 2008. This gives you an idea how far out ahead of the curve we try to be in our permitting efforts because of all the regulatory burdens and uncertainty.

NWP 49 is a nationwide general permit, specifically, pre-approved by EPA for surface coal **re-mining** activities because the benefits of **re-mining** so clearly outweigh any adverse environmental impacts. In this instance, Oxford proposed to backfill 4.55 miles of dangerous highwall, reclaim 455 acres (87% of the permit area) of previously unreclaimed mined land, and restore the land to meet current SMCRA standards.

This project was a new mine with 24 direct mining jobs. Studies have shown that up to 11 indirect jobs (*e.g.*, mechanics, welders, truck drivers, etc.) are created for every direct coal mining job. Thus, the cumulative potential employment impact was more than 200 jobs, and this in the Appalachian area that chronically suffers from high unemployment.

It wasn't until March 5, 2010 that EPA finally authorized the Kaiser-Mathias permit (see Ex. G, pp. 2-3). This was 6 months after our plea to EPA Administrator Jackson (see Ex. F, p. 2) and after nine months of EPA-Enhanced Coordination of a permit that should never have been on EPA's radar to begin with; and a permit decision, which was quite literally a no-brainer. Members of the Subcommittee, that's EPA's Enhanced Coordination.

But it doesn't stop there. Three days later, EPA published a Press Release (Ex. G, p. 4) taking credit for an 80% reduction in impacts to streams (12,930' > 2352') and a

70% reduction in impacts to wetland (3.39 acres >1), all ostensibly as a result of Enhanced Coordination. The only problem with this self-serving Press Release was that the starting points for these claimed reductions are completely fabricated. Oxford could not have submitted an NWP 49 had it proposed the kind of impacts for which EPA claimed a reduction.

And there was no mention in its Press Release that the application was for an NWP 49 permit, preauthorized for this type of mining. So much for transparency in EPA-Enhanced Coordination.

**Halls Knob (Ex. H) (a personal favorite)**

Oxford began *coordinating* this permit with the Corps, also in 2005, to determine the extent of its jurisdiction under Clean Water Act §404. On October 2, 2008, Oxford submitted an Individual Permit §404 application and proposed to backfill 1.62 miles of dangerous highwall, reclaim 38 acres of previously unreclaimed mine land, seal abandoned deep mine entries, and restore the land in accordance with current SMCRA standards. At the time, this project was a proposed new mine with 25 direct mining jobs (thus a cumulative potential impact of greater than 200 jobs).

On July 27, 2009, the SMCRA mining permit was conditionally issued, subject to issuance of Ohio EPA's Clean Water Act § 401 permit and the Corps' §404 permit. On September 11, 2009, Ohio EPA issued its §401 water quality certification that the project meets stringent state water quality standards.

In our September 18, 2009 plea to EPA Administrator Jackson (see Ex. F, p. 2), Oxford asked about the EPA's environmental concerns, given that Ohio EPA had none.

We were 3 months into Enhanced Coordination. There was no response from the black hole. On further, six months, and then nine months, into Enhanced Coordination, and still nothing. It was not until on May 27, 2010 – after nearly one year of Enhanced Coordination - under transmittal by EPA's Office of Water, Chief of Staff, Greg Peck, EPA – that we found out what EPA wanted to exact from Oxford for this permit in comments submitted to the Corps (Ex. H, pp. 2-9). The comments contained a host of unacceptable special conditions, that Oxford has never before seen and could not accept. EPA had recommended that Corps deny the §404 permit without these special conditions.

Halls Knob would be one of the first §404 permits issued after EPA's Guidance on Enhanced Coordination was published on April 1, 2010. On June 6, 2010, the Corps drafted the permit as instructed by EPA, without any material changes in the egregious special conditions, including phased sequencing of mining (which was ridiculous as mining had commenced almost one year prior); extensive specific conductivity monitoring; extensive biological monitoring; additional mitigation requirements for temporal losses; and mining operations stoppage if any sample result exceeded Ohio's water quality standard of 2400 microsiemens/cm for specific conductivity, whether or not it was caused by mining activities. The draft permit gave EPA ten additional days to seek any further changes and Oxford a window of opportunity to eliminate or reduce the regulatory burdens of these special conditions in the final permit.

Now faced with shutting down the mine and laying off 25 coal miners because we had run out of mineable SMCRA permitted reserves without the Corps §404, Oxford went to its Congressional delegation for help. On June 11, 2010, ironically after exactly one year of EPA-Enhanced Coordination, the Delegation sent a letter to EPA Administrator Jackson requesting a meeting to discuss Halls Knob (see Ex. H, pp. 10-11).

On June 18, 2010, the meeting was held in the office which I believe is now occupied by Chairman Gibbs. Attending for Oxford was our CEO, Chuck Ungurean, our §§401/404 Permitting Coordinator, Nate Leggett, and myself. Attending for EPA was Greg Peck, Office of Water, Chief of Staff, and others, along with representatives of our Ohio Delegation.

The most noteworthy comment from the meeting was the lay opinion expressed by Mr. Peck that streams were void of aquatic life with specific conductivity above 300. Mr. Leggett presented Mr. Peck with pre-mining, background sampling data for Halls Knob indicating specific conductivity ranging upwards of 1,500 in streams which we were being required to mitigate because of the aquatic life present. (See Ex. H, pp. 12-13.)

On July 12, 2010, after three more weeks of Enhanced Coordination, the Corps re-proffered the §404 permit with marginally acceptable special conditions. This was 10 months after our initial plea to EPA Administrator Jackson, nearly one year after mining had already commenced, 13 months after EPA-Enhanced Coordination was introduced and 21 months after the Individual Permit §404 application was submitted.

**Peabody 3 (Ex. I)**

Oxford began *coordinating* with the Corps on its Jurisdictional Determination in 2005. On February 27, 2009, an Individual Permit §404 application was submitted. On

May 15, 2009, USEPA objected to the Corps issuing the permit for a variety of reasons having nothing to do with making our nation's waters fishable or swimmable (Ex .I, pp. 2-3). To no one's surprise, Peabody 3 appeared on EPA's Initial Blacklist of June 11, 2009, and was still on the September 11, 2009 "final/initial" list of 79.

In our September 18, 2009 plea to EPA Administrator Jackson (Ex. F, p. 2), Oxford advised USEPA that 1.1 MM tons of permitted coal reserves would be lost without this §404 permit, resulting in the layoff of 57 coal miners employed at the mine (thus a cumulative potential impact of greater than 500 Appalachian jobs). On November 20, 2009, by mutual agreement with the Corps, Oxford withdrew the Individual Permit application in order to avoid the scrutiny facing permits on the Blacklist. This was viewed as the best possible remedy to deal with Enhanced Coordination in order to advance issuance of the permit.

On November 30, 2009, Oxford resubmitted the Individual Permit; nonetheless, on April 9, 2010 (Ex. I, pp. 4-6), EPA again commented to the Corps on the Individual Permit. Oxford agreed to avoid impacts to streams that aren't streams; to avoid wetland that was created by human activities; to build sediment ponds outside natural drainage channels where they belong; and to avoid springs emanating from the coal seam that will be mined--all of which result in dramatically increased mining costs--in order to obtain the permit, continue mining and avoid laying off a dedicated workforce.

On June 9, 2010, seven months after resubmittal and 21 months after the original submittal, the Corps Issued the Individual Permit.

As a direct result of Enhanced Coordination, EPA's mining policy has sterilized over 150,000 tons of coal in the ground, contrary to the express purposes of SMCRA and the energy needs of our country. This sterilized coal represents more than 10% of the coal reserves to be mined at Peabody 3. There are 15,000 more tons of coal at risk of sterilization by future mining due to EPA-Enhanced Coordination (see Ex. I, pp. 7-8).

**Ellis (Ex. J)**

Oxford began *coordinating* with Corps on its Jurisdictional Determination in 2007. On October 28, 2008 Oxford submitted the Individual Permit §404 application proposing to backfill 2.63 miles of dangerous highwall, reclaim 144 acres (31% of the permit area) of previously unreclaimed mined land and restore the land to in accordance with current SMCRA standards. Ellis will be a new mine with 32 direct mining jobs (thus a cumulative impact of greater than 300 jobs).

On April 22, 2010, Oxford withdrew the Ellis Individual Permit §404 application in order to remove it from EPA's Blacklist and advance issuance of the permit. On August 17, 2010, Oxford resubmitted an Individual Permit application for Ellis. On November 24, 2010, EPA provided comments to the Corps on the Individual Permit application (see Ex. J, pp. 2-5). In addition to raising earlier Enhanced Coordination concerns of avoidance, minimization of impacts and biological monitoring, EPA raised new concerns regarding the Financial Assurances that will be provided and lack of details on protecting mitigation areas from livestock impacts because the postmining land use is described as pastureland and the Ohio River is impaired for fecal coliform. After nearly two years of this kind of EPA-Enhanced Coordination, permit issuance is anything but certain.

**OTHER OXFORD CLEAN WATER ACT §404 PERMITS IMPACTED BY ENHANCED COORDINATION**

**Garrett (Ex. K)**

Garrett was not Blacklisted by EPA, although the Individual Permit §404 application was submitted on February 18, 2009. Nevertheless, Garrett still was being subjected to Enhanced Coordination. *Coordinating* with the Corps on its Jurisdictional Determination commenced in 2007. Oxford proposed to backfill 0.70 miles of dangerous highwall and reclaim 50 acres (9% of the permit area) of previously mined and unreclaimed mined land in accordance with current SMCRA standards.

Garrett is a new mine with 30 direct mining jobs (thus a cumulative impact of greater than 300 jobs). On September 2, 2010, the EPA provided comments to the Corps on the Individual Permit application (Ex. K, pp. 2-5).

In addition to raising earlier Enhanced Coordination concerns of avoidance, minimization of impacts and biological monitoring, the EPA raised new concerns regarding the Financial Assurances that will be provided, requirements for Adaptive Management Plans and the Cumulative Impacts of livestock impacts and impacts from other mining projects in the watershed. After nearly two years of this kind of EPA-Enhanced Coordination, permit issuance is anything but certain.

**EPA'S MINING POLICIES: CLEAN WATER ACT §402; OXFORD'S EXPERIENCE**

EPA-Enhanced Coordination is not limited to §404 of the Clean Water Act. Section 402 of the Clean Water Act grants exclusive jurisdiction to state-approved programs like Ohio to issue National Discharge Elimination System (NPDES) permits. EPA had previously approved Ohio's NPDES General Permit for surface coal mining operations effective February 28, 2009. (See Ex. L, p. 9.) This General Permit established effluent limitations for discharges of water from surface coal mines such that, if these limits are met, individual and cumulative discharges from surface coal mines to waters of the US will have de minimus adverse impacts.

EPA-Enhanced Coordination is following the same pattern here as with the NWP 21 permit under §404, namely to invalidate the utility of a General CWA permit. Except that EPA has not followed the law to suspend or revoke Ohio's valid, existing Coal General Permit, which does not expire until 2014 by its own terms (*id.*). EPA-Enhanced Coordination has unlawfully interfered with Ohio's EPA-approved §402 program causing Ohio EPA to deny coverage under Ohio's Coal General NPDES Permit.

**West (Ex. L)**

On December 22, 2009, Oxford submitted its Notice of Intent (NOI) for coverage under Ohio Coal General NPDES Permit to Ohio EPA (Ex. L, p. 6). On May 13, 2010, six weeks after EPA published its April 1, 2010 "Guidance" on Enhanced Coordination, Ohio EPA put Oxford's West NOI on "hold" (see Ex. L, p. 8).

On July 28, 2010, Ohio EPA denied Oxford's West coverage under Ohio's valid Coal General NPDES permit (see Ex. L, pp. 4-5). The purported basis for this denial was two External Review Draft studies, funded by EPA, authored by EPA researchers and conducted in West Virginia to establish aquatic life benchmark levels for specific connectivity (see Ex. L, pp. 10-11). Oxford was directed by Ohio EPA to submit an Individual NPDES permit for surface coal mining operations, which had never before been required in Ohio.

On August 26, 2010, Oxford appealed the denial of coverage under the NOI. On August 27, 2010, Oxford's CEO wrote to Governor Strickland asking for assistance in getting Ohio EPA to issue coverage under a valid, existing Ohio Coal General NPDES Permit (Ex. L, pp. 2-3).

On September 20, 2010, Oxford submitted an Individual NPDES application for surface coal mining operations, even without any chemical-specific monitoring limitations established by EPA-Enhanced Coordination.

On March 3, 2011, Ohio EPA backtracked and authorized coverage under the Coal General NPDES, 7 months after preparing and submitting an Individual NPDES permit application, 9 months after it was originally denied, after 10 months of EPA-Enhanced Coordination, and 14 months after the original NOI was submitted for what was previously a routine authorization.

**OTHER EPA-ENHANCED COORDINATION INTERFERENCE WITH STATE §402 PROGRAM**

The attached Ex. L contains an email thread from EPA Region 5 Chief of Watershed and Wetlands Branch, Kevin Pierard, and Krista McKim, Professional Engineer (January 24, 2011- February 8, 2011, Ex. L, pp. 12-17). EPA requested supplemental information on sediment pond design, construction, etc., so EPA can "have a better understanding of the project." These emails demonstrate that EPA Region 5 lacks the engineering/technical skills to review even General Coal Mining NPDES permits.

Issuing a valid General NPDES Permit is the exclusive province of EPA-approved State programs – like Ohio's. More Enhanced Coordination for your consideration.

**Elk Run and East Canton**

Elk Run and East Canton are two separate mining projects combined to demonstrate how EPA-Enhanced Coordination works by co-opting its state counterparts. The circumstances in these instances follow on the heels of Ohio EPA denying coverage under the Coal General NPDES Permit for Oxford's West mine.

On September 30, 2010, Brian Hall, Assistant Chief, Ohio EPA, emailed EPA asking permission of EPA Region 5 to see if Ohio can still issue Ohio's Coal General NPDES permits for these two projects (Ex. M, pp. 2-6). In response, EPA indicated its engagement in Enhanced Coordination with the Corps. On October 1, 2010, EPA Region 5 Watersheds & Wetlands Branch Chief, Kevin Pierard, responded to further inquiry that Region 5 needs to do more Enhanced Coordination with the Corps on its Jurisdictional Determinations (Ex. M, p. 3). On October 13, 2010, Ohio EPA received direction from Region 5 on issuance of Ohio's Coal General NPDES permit, but needed to first brief the Director of Ohio EPA (Ex. M, pp. 4-5).

On October 18, 2010, "Based on direction of [EPA] Region 5," Oxford is advised to submit Individual NPDES permit applications for East Canton and Elk Run (Ex. M, p. 6).

On October 25, 2010, Ohio EPA backtracked and issued General Coal NPDES permit because Region 5 ultimately conceded that there were no jurisdictional waters of the US impacted by these projects. EPA-Enhanced Coordination was thus even extended to matters for which it has no jurisdiction.

**EPA's Mining Policies: Secondary effects on Corps §404 Decision-making**

**Daron/Consol**

On August 21, 2006, the Corps issued an Individual Permit for this 1700-acre project. This is one of the first Individual Permits issued to Oxford after it became clear that NWP 21 permits would be of no further value. NWP 21s are issued for a 5-year term. The industry had been advised to use Individual Permits in lieu of NWP 21 because, among other reasons, Individual Permits are issued for the duration of the project--until activities are completed. No renewals were required.

Unknowingly at the time, the Corps erroneously issued a Daron/Consol Individual Permit with a 3-year term for construction activities. The construction period expired December 31, 2009, which was not a reasonable time for completion as required by 33 CFR 325.6(c).

This fact was not discovered until January 10, 2011 (Ex. N, p. 2). On February 4, 2011, Oxford requested an extension of the time period authorized for construction activities (Ex. N, pp. 2-3). Extensions will be granted unless contrary to public interest (accord, 33 CFR 325.6(d)). There were no additional impacts or expansion in the scope of the project that would require a new permit to be issued (accord, 33 CFR 325.7 (a)).

Nonetheless, on March 24, 2011, the Corps denied Oxford's request for an extension of time (Ex. N, p. 4). The Corps decided the work was no longer authorized, even though not completed and even though Oxford had been mining in the interim since December 2009. Oxford must resubmit a new Individual Permit application, specifically subject to Public Notice and Comment—again--and subject to more Enhanced Coordination for the same project permitted in 2006.

EPA-Enhanced Coordination and scrutiny has the Corps scared of its own shadow, which interferes with the exercise of sound regulatory decision-making.

**SUGGESTED GENERAL WATER RESOURCES POLICY CONSIDERATIONS**

Water Resources Policy should recognize coal's importance in providing an affordable source of America's energy needs.

Water Resources Policy should reconcile statutory conflicts between the CWA and SMCRA with regard to protection of water resources and performance standards.

Water Resources Policy should recognize that the coal mining industry does not need three environmental protection agencies at the federal level and counterparts at the state level to command and control coal mining impacts on water resources.

Water Resources Policy should acknowledge and reflect that impacts to water resources from coal mining are unavoidable.

Water Resources Policy should recognize OSM and its primacy state agencies as the regulatory authority on impacts to water resources from coal mining operations.

Water Resources Policy should provide that unavoidable impacts to water resources from coal mining operations should be managed to minimize the adverse impacts to water resources within the mine site and prevent material damage to water resources outside of the mine site to the extent technologically and economically feasible.

Water Resources Policy should acknowledge that, by minimizing the adverse impacts to water resources within the mine site and preventing material damage to water resources outside of the mine site to the extent technologically and economically feasible, aquatic biology will be adequately protected.

Water Resources Policy should afford as much protection to the lives of coal miners as is provided to the protection of macroinvertebrates.

Water Resources Policy should refocus EPA on the Clean Water Act goals of making waters of the US fishable/swimmable, while recognizing that no natural person swims or fishes in waters of the US within the boundaries of a coal mining permit.

Water Resources Policy should recognize that Clean Water Act jurisdiction does not extend to cover every drop of water in the hydrologic cycle.

Water Resources Policy should prescribe limits on jurisdictional determinations of waters of the US with respect to intermittent and perennial streams located below the local water table as determined by the scientific methods of hydrogeology and geomorphology.

**SUGGESTED CLEAN WATER ACT AMENDMENTS FOR CONSIDERATION**

The Clean Water Act should be amended to delegate from the Administrator and the Secretary of the Army to OSM all Clean Water Act authority with respect to coal mining projects, without any reservation of rights.

The Clean Water Act paradigm that there shall be no discharge of pollutants without a valid permit should be amended to designate a SMCRA permit as the valid permit for Clean Water Act § 404 (dredge & fill), § 402 (water discharges) and § 401 (state water quality certification), in lieu of any other permits required for impacts to water resources from coal mining operations.

Clean Water Act § 404(c) should be amended to prohibit use (and threatened use) of the Administrator's veto authority under § 404(c) after a § 404 permit has issued and restrict any use (or threatened use) of the Administrator's veto authority to 30 days after a § 404 permit is proffered.

Clean Water Act § 404(f) exemptions should be enlarged to expressly exempt SMCRA permitted activities.

The Clean Water Act should be amended to define intermittent and perennial streams as only those located below the local water table as determined by the scientific methods of hydrogeology and geomorphology, thereby eliminating any existing and conflicting definitions in federal jurisprudence.

## INDEX OF EXHIBITS

# Exhibit A

Oxford
Resource Partners

Reliability Matters

MICHAEL B. GARDNER
General Counsel

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Suite 3450
Columbus, OH 43215-6150
P 614.643.0337
F 614.754.7100
www.oxfordresources.com

# EXHIBIT A – CURRICULUM VITAE

**Michael B. Gardner** has been General Counsel of Oxford Resources GP, LLC, the general partner of Oxford Resource Partners, L.P. (NYSE: OXF)(OXFORD), since September 2007. Mr. Gardner also serves as General Counsel of OXFORD's operating companies, Oxford Mining Company, LLC and its wholly owned subsidiary, Oxford Mining Company – Kentucky, LLC. For three years prior to joining Oxford, Mr. Gardner was Associate General Counsel of the largest independently-owned coal mining company in the US.

Mr. Gardner has more than 30 years experience in the coal industry and environmental regulatory compliance management, beginning in 1979 as a state mine inspector with the Ohio Department of Natural Resources, jointly responsible for enforcing the federal Surface Mining Control and Reclamation Act of 1977 with the US Department of Interior, Office of Surface Mining. Mr. Gardner also worked for another surface coal mining company in Ohio, an international engineering and construction company and an environmental consulting firm before entering the private practice of environmental law in 1993.

Mr. Gardner is an alumnus of the Ohio University, where he received a Bachelor of Science degree in Environmental Biology (Botany emphasis). He also holds a Juris Doctorate from Case Western Reserve University and a Masters of Business Administration from Ashland University.

Mr. Gardner is a licensed Ohio attorney and is admitted to practice before the Ohio Supreme Court, the US District Court of Ohio (Northern and Southern Districts), the US Court of Appeals (6th Circuit) and US Tax Court.

Mr. Gardner serves on the Board of Directors of the Ohio Coal Association and Kentucky Coal Association and serves as a trustee on the Energy and Mineral Law Foundation Governing Member Organization for the Ohio Coal Association. He is also a member of the American Corporate Counsel Association, Northeast Ohio Chapter and the Cleveland Metropolitan Bar Association.

**COMMITTEE ON TRANSPORTATION AND INFRASTURCTURE**
*Truth in Testimony Disclosure*

---

Pursuant to clause 2(g)(5) of House Rule XI, in the case of a witness appearing in a nongovernmental capacity, a written statement of proposed testimony shall include: (1) a curriculum vitae; and (2) a disclosure of the amount and source (b agency and program) of each Federal grant (or subgrant thereof) or contract (or subcontract thereof) received during the current fiscal year or either of the two previous fiscal years by the witness or by an entity represented by the witness. Such statements, with appropriate redaction to protect the privacy of the witness, shall be made publicly available in electronic form not later than one day after the witness appears.

(1) Name:

**MICHAEL B. GARDNER**

(2) Other than yourself, name of entity you are representing:

**OXFORD RESOURCE PARTNERS, LP**

(3) Are you testifying on behalf of an entity other than a Government (federal, state, local) entity?

**YES** If yes, please provide the information requested below and attach your curriculum vitae.

NO

(4) Please list the amount and source (by agency and program) of each Federal grant (or subgrant thereof) or contract (or subcontract thereof) received during the current fiscal year or either of the two previous fiscal years by you or by the entity you are representing:

**NONE KNOWN**

Michael B. Gardner
Signature

May 2, 2011
Date

# Exhibit B

Oxford
Resource Partners

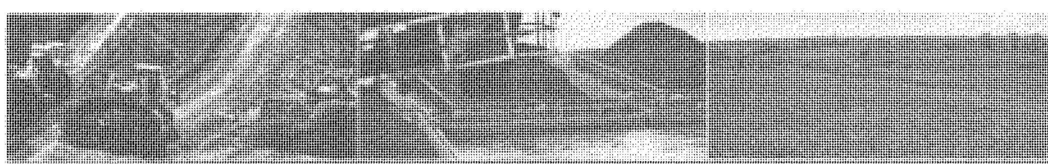
**EXHIBIT B – INTRODUCTION TO OXFORD**
**Excerpt from 12/7/2010 Presentation**

Reliability Matters

# 2010 Wells Fargo Securities 9th Annual Pipeline, MLP and E&P, Services & Utility Symposiums

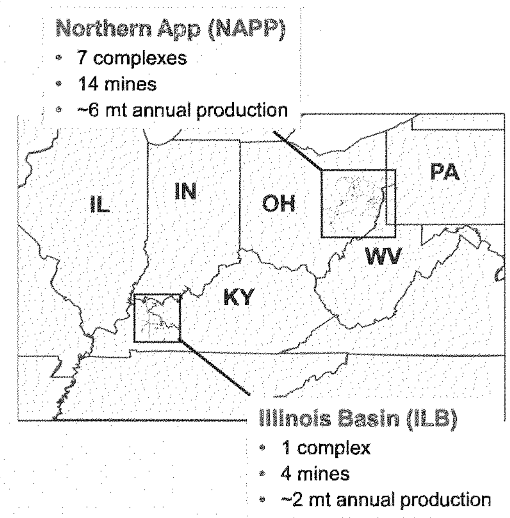
Jeff Gutman, SVP & CFO
Brian Meilton, Investor Relations

*December 7, 2010*



# We are a Leading Producer of Surface Mined Coal in NAPP and ILB

- Successful operating history since 1985
- Among lowest cost producers in region
- Diverse asset base with 8 mining complexes comprised of 18 individual mines
- 92 million tons of reserves located in eastern Ohio (NAPP) and western Kentucky (ILB)
- Annual production of ~8 mt of thermal coal
- Strategically located in close proximity to customers in 6-state region




Oxford Resource Partners



Reliability Matters

# Long-term Customer Relationships

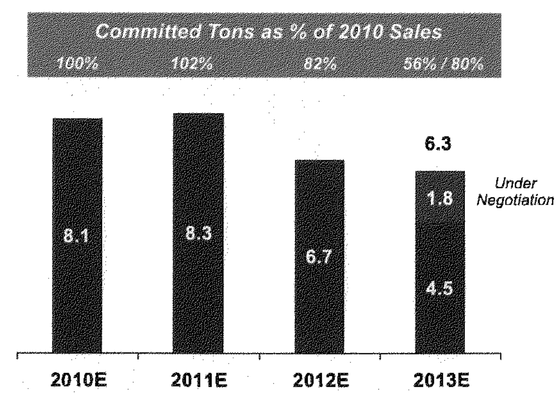
- Long-standing relationships with top electric utility customers
- Sales contracts with terms ranging from one to eight years
- Mainly serve base-load scrubbed power plants

## High Quality Customer Base

AEP American Electric Power
FirstEnergy
Duke Energy
Big Rivers Electric Corporation
LG&E
Martin Marietta Materials
East Kentucky Power Cooperative

## Highly Committed Sales Portfolio[1]

(Tons in millions)

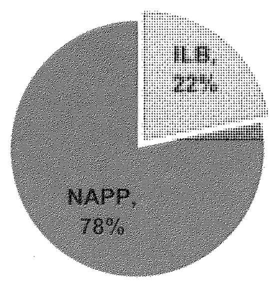



Oxford Resource Partners

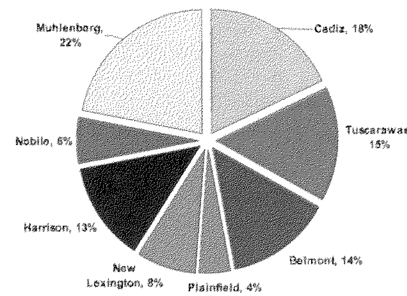
1. As of 9/30/10.

# Diverse Operations

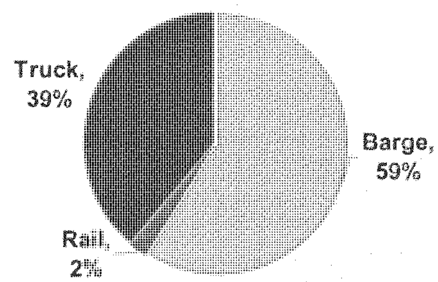
## Regional Production




## Production by Mining Complex



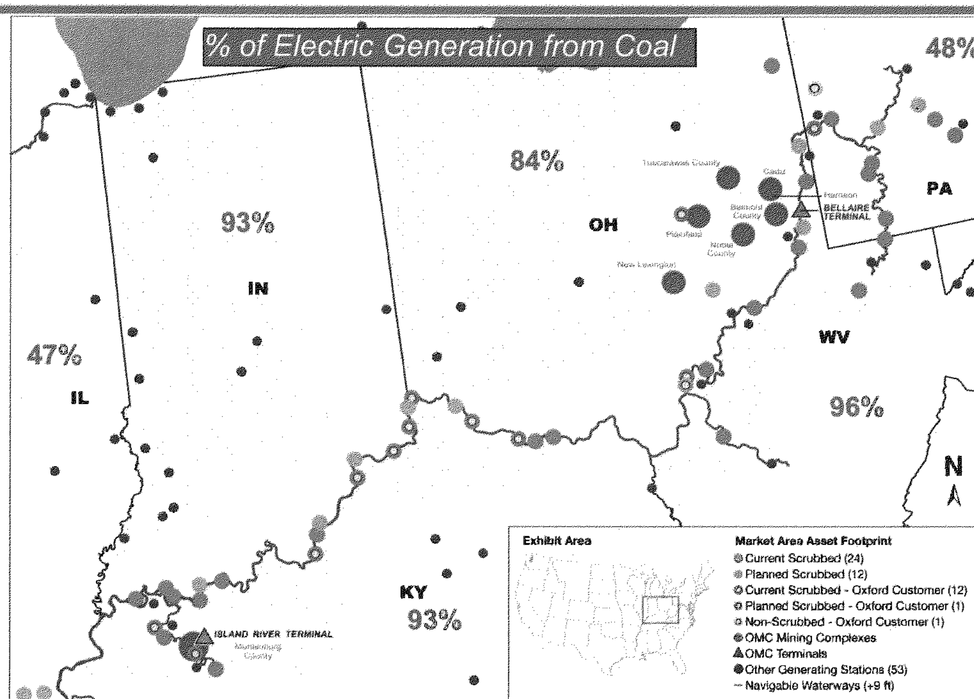

## Transportation




Oxford
Resource Partners

Data as of 9/30/10.

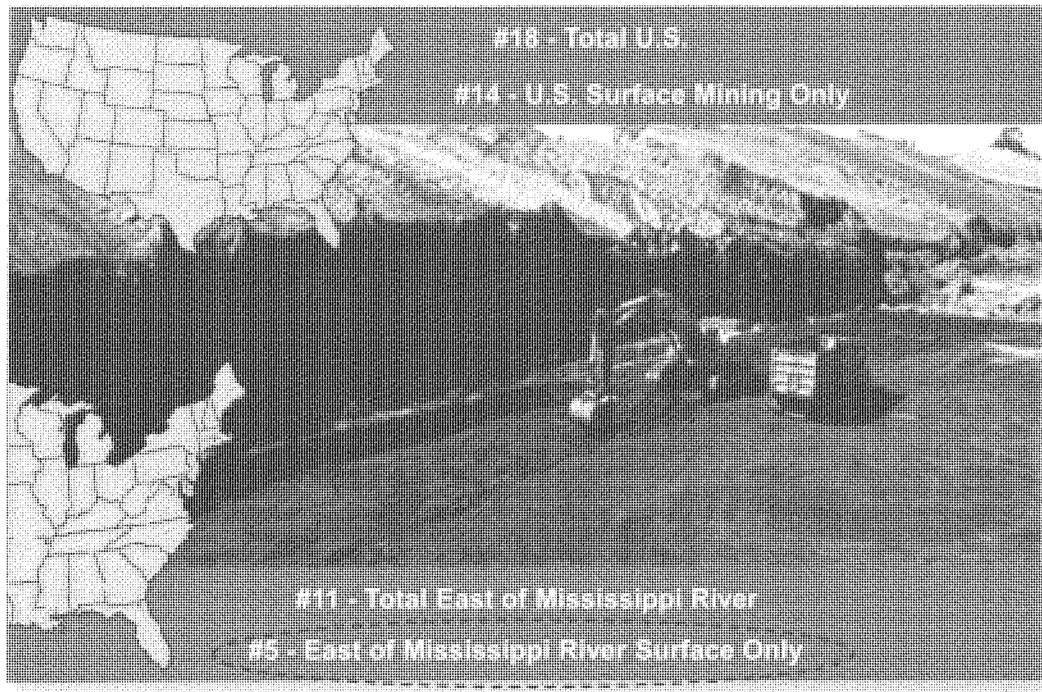
# Strategic Position in Key Growth Markets




Oxford Resource Partners

Red figures indicate percentage of electric generation from coal (data as of 12/31/09).
Source: EIA and J.T. Boyd.

# Oxford is a Top 20 Domestic Coal Producer




Oxford Resource Partners

*Source: Boyd and MSHA; 2009 production data, Oxford is pro forma Phoenix Coal acquisition.

# Exhibit C

## EXHIBIT C - EPA MINING POLICIES

**I. January 20, 2009 (Obama inauguration)**

A. *EPA Region III letter to Corps*

B. *Objects to/threatens to veto CWA §404 permits issued for surface coal mining based on draft, EPA-funded study in WV of impacts on benthic macroinvertebrate populations downstream of valley fills from mountain top mining operations.*

**II. February 13, 2009 (US Court of Appeals, 4th District)**

A. *Reverses OVEC et al. v. Aracoma, et al (S.D. WV)*

B. *Upholds Corps authority to issue CWA §404 permits*

C. *EPA launches into anti-mining agenda into overdrive*

**III. March 2009**

A. *EPA list of 48 permits w/i 60 days of issuance*

B. *6/48 with substantial environmental concerns*

**IV. June 11, 2009 -EPA MOU with Corps/OSM/CEQ**

A. *EPA Enhanced Coordination Procedure (ECP)*

1. Press Release "to reduce environmental impacts of Mountain Top Mining" (Ex. F, p.11)
2. Asserted control over all Corps §404 permits
3. Enhanced coordination = regulatory black hole
4. Transparency - only thing apparent -delayed issuance

B. *List of 108 (1 many lists, e.g., "Cong. Rahall List"; "NMA"; "final initial"); Ex. D (w/ 8 Oxford permits highlighted)*

C. *Corps seeks to suspend NWP 21 in 6 Appalachian states only*

1. General CWA §404 permit for surface coal mining ops
2. First issued 1982;
   a) reauthorized March 2007
   b) expires March 2012
   c) Streamlined permitting process pre-approved by EPA
   d) Minimal individual and cumulative impacts

D. *EPA to review CWA §401 & §402 programs*

1. §401- State certification that project meets state WQS
2. §402- federal NPDES permit for water discharges
   a) General Coal NPDES permit available for surface mining ops
   b) Pre-approved by EPA where discharges meet certain technologically-based effluent limitations

**V. September 30, 2009**

A. *"final" "initial" List of 79 (Ex. E )*

1. w/ 4 OXF permits highlighted

B. *Introduced MIRA tool used to coordinate process*

1. Multi-criteria Integrated Resource Assessment
2. Never before used in regulatory decision-making

C. *CWA§404 permit blackhole gets darker/deeper*

**VI. October 16, 2009- EPA threatens veto Arch Coal – Spruce No. 1**

A. *IP Issued 2007*

B. *Never before used authority CWA §404c*

C. *After 10 years of environmental studies*

1. Including EIS with EPA as coordinating agency

D. *Threat to ALL EXISTING §404 Permits*

**VII. April 1, 2010 – Detailed Guidance effective immediately**

A. *EPA invades states exclusive authority to:*

1. Issue CWA §402 NPDES permits
    a) imposing numeric/narrative WQS
        *(i) e.g, conductivity*
2. Issue state CWA§401 water quality certifications

B. *Ignores procedural safeguards for establishing new Water Quality Standards and technologically-based effluent limitations.*

C. *CWA §404 application – new requirements*

1. Biological monitoring
2. Adaptive Management Plans
    a) Surrogate for inspection & enforcement
    b) Additional compensatory mitigation required

D. *Challenged by NMA, WV and KY; now in DC District Court of Appeals*

**VIII. May 21, 2010 – Sen. Environment/Public Works Report**

A. *235 permits subject to EPA enhanced coordinated review*

B. *EPA had allowed only 45 to be issued*

1. At significant increased cost and lost reserves

**IX. June 18, 2010- Corp Suspends CWA§ 404 NWP 21**

A. *After public hearing and comment.*

**X. January 13, 2011- EPA vetoes Arch Spruce No. 1 CWA§404**

A. *Due to adverse effects on WILDLIFE*

1. Specific Conductance.>adv. Macroinvertebrates>adv. Fish>adv. Wildlife
2. Alternatives to veto: Adv. municipal water supplies, shellfish beds; fisheries, recreational [or wildlife] –
3. absurd causal nexus

B. *Eliminate all certainty in permitting process*

**XI. May 2011- Final EPA – Corps Guidance on ECP?**

A. *Due, Per April 1, 2010 Initial Guidance Memo*

B. *National Clean Water Act Framework – April 27, 2011?*

# Exhibit D

# LIST OF 108 PENDING 404 PERMIT APPLICATIONS

| District | Corps Number | SMCRA Number | Applicant name | Project Name |
|---|---|---|---|---|
| Huntington | 200300065 | S-5027-99 | Hobet Mining | Hewett |
| Huntington | 200400336 | 898-0715 | Bear Fork | Bear Fork |
| Huntington | 200400624 | S-5025-97 | Independence Coal Company | Constitution Surface Mine |
| Huntington | 200400867 | S-45014-04 | Central Appal Mining | Remining No. 3 |
| Huntington | 200401152 | 10296 | Buckingham Coal | Buckingham Wash Plant |
| Huntington | 200401155 | S-2001-05 | Brooks Run Mining | Brandy St & Cove Mtn |
| Huntington | 200401451 | S-5001-02 | Independence Coal Company | Glory Surface Mine |
| Huntington | 200500167 | U-3004-06 | Catenary Coal Co. | Tenmile Fork Deep Mine |
| Huntington | 200500217 | S-4014-01 | Bluestone | Contour Auger 1 |
| Huntington | 200500421 | D-2295 | Oxford | Peabody 3 |
| Huntington | 200500753 | D-2290-1 | Oxford Mining | Long Sears Adjacent |
| Huntington | 200500934 | 898-5694 Am5 | Premier Elkhorn | U/T Old Beefhide |
| Huntington | 200501115 | O-10-83IBR9 | Green Valley Coal Company | Blue Branch Refuse |
| Huntington | 200501198 | S-5008-02 S-5021-01 | Marrowbone Development | Taywood W & Marrowbone |
| Huntington | 200501211 | S-5020-99 AM3 | Premium Energy, Inc. | Premium Mills Surface Mine |
| Huntington | 200501275 | 10397 | Oxford | Mizer |
| Huntington | 200501385 | 10400 | Oxford | Halls Knob |

# LIST OF 108 PENDING 404 PERMIT APPLICATIONS

| District | Corps Number | SMCRA Number | Applicant name | Project Name |
|---|---|---|---|---|
| Huntington | 200600100 | S-5009-00 | ICG Eastern, LLC | Jenny Creek Surface Mine |
| Huntington | 200600126 | 860-0390 Am4 | Consol of KY | Area 80 |
| Huntington | 200600127 | 860-5260 Am1 | Consol of KY | Slone Br Mine |
| Huntington | 200600821 | U-3001-98 IBR5 | Catenary Coal Co. | Laurel Fork |
| Huntington | 200602033 | S-3016-06 | Wildcat | No. 2 Surface |
| Huntington | 200602256 | 10379 | Oxford Mining | Horn |
| Huntington | 200602290 | S-7-81 | Colony Bay Coal Co. | Colony Bay Surface Mine |
| Huntington | 200700182 | S-3011-07 | Alex Energy, Inc. | Federal Surface Mine |
| Huntington | 200700282 | U-4012-06 | Pioneer Fuel | Little Eagle |
| Huntington | 200700285 | S-3009-07 | Alex Energy, Inc. | Lonestar Surface Mine |
| Huntington | 200700286 | S-3010-06 | Pioneer Fuel | MT5B |
| Huntington | 200700499 | 10372 | Oxford Mining | Page |
| Huntington | 200700708 | 10391 | Surface Mining Inc | Young Property |
| Huntington | 200701021 | 10405 | Oxford Mining | Kaiser Mathias |
| Huntington | 200800114 | U-3016-95 | Performance Coal Company | Upper Big Branch Deep Mine |
| Huntington | 200800491 | S-5002-07 | CONSOL of Energy | Buffalo Mt. Surface Mine |
| Huntington | 200800562 | S-4004-07 | Eastern Associated Coals | Huff Creek Surface Mine |

# LIST OF 108 PENDING 404 PERMIT APPLICATIONS

| District | Corps Number | SMCRA Number | Applicant name | Project Name |
|---|---|---|---|---|
| Huntington | 200800791 | S-5002-07 | Hobet Mining | Surface Mine No. 45 |
| Huntington | 200800805 | S-3001-08 | Coyote Coal Company | Joes Creek Surface Mine |
| Huntington | 200800830 | S-5006-07 | CoalMac, Inc. | Pine Creek Surface Mine |
| Huntington | 200800935 | U-5010-08 | Hampden Coal | Harrys Br |
| Huntington | 200801098 | S-5018-08 | Frasure Creek Mining | Spring Fork Surface Mine No. 2 |
| Huntington | 200802160 | 10403 | B&N Coal | Whigville III |
| Huntington | 200900427 | U-5023-92 | Argus Energy WV, LLC | Devils Trace No. 2 Punchout |
| Huntington | 200900428 | U-5031-08 | Consol of Kentucky | Spring Branch No. 3 Deep Mine |
| Louisville | 200301276 | 897-0430 A1 | Candle Ridge Mining | Candle Ridge Mining |
| Louisville | 200500851 | 867-0440 | Cheyenne Resources | Cheyenne Resources |
| Louisville | 200501893 | 895-0171 | Sturgeon Mining | Sturgeon Mining |
| Louisville | 200600756 | 897-0457 A2 | ICG Hazard | ICG Hazard |
| Louisville | 200601124 | 836-5488, 836-0317 | Matt/Co | Matt/Co |
| Louisville | 200601290 | 877-0167, 877-0168 | Licking River Resources | Licking River Resources |
| Louisville | 200601296 | 898-4150 A1 | Clintwood Elkhorn | Clintwood Elkhorn |
| Louisville | 200700069 | 898-0803 | CAM Mining | Cane Branch |
| Louisville | 200700193 | 898-0400 | Premier Elkhorn Coal | Premier Elkhorn Coal |

# LIST OF 108 PENDING 404 PERMIT APPLICATIONS

| District | Corps Number | SMCRA Number | Applicant name | Project Name |
|---|---|---|---|---|
| Louisville | 200700217 | 897-0480 | Leeco, Inc. | Stacy Branch Surface Mine |
| Louisville | 200700335 | 898-0607 | Apex Energy | Apex Energy |
| Louisville | 200700393 | 867-0456 | Consol of KY | Razorblade Surface Mine |
| Louisville | 200700400 | 895-0177 | Candle Ridge Mining | Candle Ridge Mining |
| Louisville | 200700400 | 864-0195 | Argus Energy | Argus Engergy |
| Louisville | 200700594 | 898-0800 | Premier Elkhorn Coal | Premier Elkhorn Coal |
| Louisville | 200700595 | 860-0455 | Leeco, Inc. | Elk Lick |
| Louisville | 200700669 | 836-0338 | Miller Bros. Coal | Miller Bros. Coal |
| Louisville | 200700706 | 858-0206 | Johnson Floyd Coal | Johnson Floyd Coal |
| Louisville | 200700733 | 880-5071 | Martin County Coal | Martin County Coal |
| Louisville | 200700815 | 877-0176 | Licking River Resources | Licking River Resources |
| Louisville | 200700867 | 898-0779 | CAM Mining | CAM Mining |
| Louisville | 200701026 | 836-0341 A1 | Frasure Creek Mining | Frasure Creek Mining |
| Louisville | 200701044 | 898-0712 | Apex Energy | Apex Energy |
| Louisville | 200701104 | 836-0292 A1 | The Raven Co. | The Raven Co. |
| Louisville | 200701131 | 836-0335 A2 | Miller Bros. Coal | Miller Bros. Coal |
| Louisville | 200701132 | 836-0349 | Miller Bros. Coal | Frasure Branch Mine |

# LIST OF 108 PENDING 404 PERMIT APPLICATIONS

| District | Corps Number | SMCRA Number | Applicant name | Project Name |
|---|---|---|---|---|
| Louisville | 200701190 | 897-0355 A3 | Pine Branch Coal | Pine Branch Coal |
| Louisville | 200701205 | 836-0307 | Matt/Co | Matt/Co |
| Louisville | 200701206 | 877-0782 | Frasure Creek Mining | Frasure Creek Mining |
| Louisville | 200701224 | 860-5304 | Miller Bros. Coal | Miller Bros. Coal |
| Louisville | 200701230 | 860-8012 | ICG Knott Co. | ICG Knott Co. |
| Louisville | 200701301 | 836-0335 | CAM Mining | Tom's Branch Surface Mine |
| Louisville | 200701397 | 836-0350 | FCDC | FCDC |
| Louisville | 200701406 | 860-0462 | ICG Hazard | Bearville North |
| Louisville | 200701445 | 836-0339 | FCDC | FCDC |
| Louisville | 200701504 | 898-0783 A3 | CAM Mining | CAM Mining |
| Louisville | 200701515 | 897-0456 A10 | ICG Hazard | ICG Hazard |
| Louisville | 200701518 | 898-0799 | Clintwood Elkhorn | Clintwood Elkhorn |
| Louisville | 200701582 | 813-0319 | Miller Bros. Coal | Miller Bros. Coal |
| Louisville | 200701644 | 877-0166 | Consol of KY | Consol of KY |
| Louisville | 200701660 | 880-0066 | Martin County Coal | Findlay Branch Mine |
| Louisville | 200800095 | 898-0817 | Premier Elkhorn Coal | Premier Elkhorn Coal |
| Louisville | 200800114 | 897-0445 A1 | BDCC Holdings | Cherries Branch |

# LIST OF 108 PENDING 404 PERMIT APPLICATIONS

| District | Corps Number | SMCRA Number | Applicant name | Project Name |
|---|---|---|---|---|
| Louisville | 200800115 | 836-0356 | Wolverine Resources | Jake Fork and Stoney Branch Surface Mine |
| Louisville | 200800138 | 807-0352 | Chas Coal | Chas Coal |
| Louisville | 200800139 | 898-0646 A1 | Apex Energy | Apex Energy |
| Louisville | 200800226 | 880-8002 A4 | Czar Coal | Czar Coal |
| Louisville | 200800239 | 813-0328 | Frasure Creek Mining | Frasure Creek Mining |
| Louisville | 200800408 | 880-0156 | Czar Coal | Czar Coal |
| Louisville | 200800525 | 877-0191 | Middle Fork | Middle Fork |
| Louisville | 200800654 | 860-0464 | Enterprise Mining | Enterprise Mining |
| Louisville | 200800727 | 813-0310 A1 | Miller Bros. Coal | Miller Bros. Coal |
| Louisville | 200800777 | 897-0455 A3 | ICG Hazard | ICG Hazard |
| Louisville | 200800781 | 836-0348 | Wolverine Resources | Wolverine Resources |
| Louisville | 200801368 | 919-0067 | North Fork Collieries | Gilmore Surface Mine |
| Nashville | 200201435 | 3064 | Premium Coal | Refuse Area No.3 |
| Nashville | 200400062 | 3143 | Premium Coal | Area 19 |
| Nashville | 200400609 | 3112 | Appolo Fuels | Jellico Strip |
| Nashville | 200401108 | 918-0392 | Ikerd Coal | Ikerd Coal |
| Nashville | 200401391 | 861-0467 | CH Development | CH Development |

# LIST OF 108 PENDING 404 PERMIT APPLICATIONS

| District | Corps Number | SMCRA Number | Applicant name | Project Name |
|---|---|---|---|---|
| Nashville | 200501691 | 3191 | Appolo Fuels | Buckeye Springs Mine No. 2 |
| Nashville | 200601647 | 807-0342 | Nally & Hamilton | Nally & Hamilton |
| Nashville | 200700820 | 807-0355 | Nally & Hamilton | Nally & Hamilton |
| Nashville | 200900382 | 8502 | Tennessee Land Reclamation | Cherry Branch Reclamation Project |
| Pittsburgh | 200600660 | 10395 | Ohio American Energy | Red Bird South |
| Pittsburgh | 200701180 | 10399 | Oxford Mining Company LLC | Ellis Area |

# Exhibit E

| Permit Number Listed in ECP | Revised Permit Number | Applicant Name | Project Name | County | State |
|---|---|---|---|---|---|
| LRH-2004-00336 | | Bear Fork | Bear Fork S.M | Pike | KY |
| LRH-2005-00934 | | Premier Elkhorn | U/T Old Beefhide | Letcher | KY |
| LRH-2006-00126 | | Consol of KY | Area 80 | Knott | KY |
| LRH-2006-00127 | | Consol of KY | Slone Br Mine | Knott | KY |
| LRL-2005-00851 | | Cheyenne Resources | Cheyenne Resources | Letcher | KY |
| LRL-2006-01124 | | Matt/Co | Matt/Co | Floyd | KY |
| LRL-2006-01290 | | Licking River Resources | Licking River Resources | Magoffin | KY |
| LRL-2006-01296 | | Clintwood Elkhorn | Clintwood Elkhorn | Pike | KY |
| LRL-2007-00069 | | CAM Mining | Cane Branch | Pike | KY |
| LRL-2007-00193 | | Premier Elkhorn Coal | Premier Elkhorn Coal | Pike | KY |
| LRL-2007-00217 | | Leeco, Inc. | Stacy Branch Surface Mine | Perry | KY |
| LRL-2007-00335 | | Apex Energy | Apex Energy | Pike | KY |
| LRL-2007-00400 | | Argus Energy | Argus Energy | Lawrence | KY |
| LRL-2007-00400 | LRL-2007-00401 | Candle Ridge Mining | Candle Ridge Mining | Owsley | KY |
| LRL-2007-00594 | | Premier Elkhorn Coal | Premier Elkhorn Coal | Pike | KY |
| LRL-2007-00595 | | Leeco, Inc. | Elk Lick | Knott | KY |
| LRL-2007-00706 | | Johnson Floyd Coal | Johnson Floyd Coal | Johnson | KY |
| LRL-2007-00867 | | CAM Mining | CAM Mining | Pike | KY |
| LRL-2007-01026 | | Frasure Creek Mining | Frasure Creek Mining | Floyd | KY |
| LRL-2007-01044 | | Apex Energy | Apex Energy | Pike | KY |
| LRL-2007-01104 | | The Raven Co. | The Raven Co. | Floyd | KY |
| LRL-2007-01131 | | Miller Bros. Coal | Miller Bros. Coal | Floyd | KY |
| LRL-2007-01132 | | Miller Bros. Coal | Frasure Branch Mine | Floyd | KY |
| LRL-2007-01205 | | Matt/Co | Matt/Co | Floyd | KY |
| LRL-2007-01206 | | Frasure Creek Mining | Frasure Creek Mining | Magoffin | KY |
| LRL-2007-01224 | | Miller Bros. Coal | Miller Bros. Coal | Knott | KY |
| LRL-2007-01230 | | ICG Knott Co. | ICG Knott Co. | Knott | KY |
| LRL-2007-01301 | | CAM Mining | Tom's Branch Surface Mine | Floyd | KY |
| LRL-2007-01397 | | FCDC | FCDC | Floyd | KY |
| LRL-2007-01406 | | ICG Hazard | Bearville North | Knott | KY |
| LRL-2007-01445 | | FCDC | FCDC | Floyd | KY |
| LRL-2007-01504 | | CAM Mining | CAM Mining | Pike | KY |
| LRL-2007-01515 | | ICG Hazard | ICG Hazard | Perry | KY |

| Permit Number Listed in ECP | Revised Permit Number | Applicant Name | Project Name | County | State |
|---|---|---|---|---|---|
| LRL-2007-01518 | | Clintwood Elkhorn | Clintwood Elkhorn | Pike | KY |
| LRL-2007-01582 | | Miller Bros. Coal | Miller Bros. Coal | Breathitt | KY |
| LRL-2007-01660 | | Martin County Coal | Findlay Branch Mine | Martin | KY |
| LRL-2008-00095 | | Premier Elkhorn Coal | Premier Elkhorn Coal | Pike | KY |
| LRL-2008-00114 | | BDCC Holdings | Cherries Branch | Perry | KY |
| LRL-2008-00115 | | Wolverine Resources | Jake Fork and Stoney Branch Surface Mine | Floyd | KY |
| LRL-2008-00139 | | Apex Energy | Apex Energy | Pike | KY |
| LRL-2008-00226 | | Czar Coal | Czar Coal | Martin | KY |
| LRL-2008-00239 | LRL-2009-00239 | Frasure Creek Mining | Frasure Creek Mining | Breathitt | KY |
| LRL-2008-00408 | | Czar Coal | Czar Coal | Martin | KY |
| LRL-2008-00525 | | Middle Fork Dev. | Middle Fork Dev. | Magoffin | KY |
| LRL-2008-00654 | | Enterprise Mining | Enterprise Mining | Knott | KY |
| LRL-2008-00727 | | Miller Bros. Coal | Miller Bros. Coal | Breathitt | KY |
| LRL-2008-00781 | | Wolverine Resources | Wolverine Resources | Floyd | KY |
| LRN-2006-01647 | | Nally & Hamilton | Nally & Hamilton | Bell | KY |
| LRN-2007-00820 | | Nally & Hamilton | Nally & Hamilton | BELL | KY |
| LRH-2004-01152 | | Buckingham Coal | Buckingham Wash Plant | Perry | OH |
| LRH-2005-00421 | | Oxford | Peabody 3 | Coshocton / Muskingum / Guernsey | OH |
| LRH-2005-01385 | | Oxford | Halls Knob | Guernsey | OH |
| LRH-2007-01021 | | Oxford Mining | Kaiser Mathias | Tuscarawas | OH |
| LRP-2006-00660 | | Ohio American Energy | Red Bird South | Belmont | OH |
| LRP-2007-01180 | | Oxford Mining Company LLC | Ellis Area | Jefferson | OH |
| LRN-2004-00062 | | Premium Coal | Area 19 | ANDERSON | TN |
| LRH-2003-00065 | | Hobet Mining | Hewett | Boone | WV |
| LRH-2004-00624 | | Independence Coal Company | Consitution Surface Mine | Boone | WV |
| LRH-2004-01155 | | Brooks Run Mining | Brandy St & Cove Mtn | Webster | WV |
| LRH-2004-01451 | | Independence Coal Company | Glory Surface Mine | Boone | WV |
| LRH-2005-00217 | | Bluestone | ContourAuger1 | Wyoming | WV |
| LRH-2005-01115 | | Green Valley Coal Company | Blue Branch Refuse | Nicholas | WV |
| LRH-2005-01198 | | Marrowbone Development | Taywood W & Marrowbone | Mingo | WV |
| LRH-2005-01211 | | Premium Energy, Inc. | Premium Mills Surface Mine | McDowell | WV |
| LRH-2006-00756 | LRH-2006-00100 | ICG Eastern, LLC | Jenny Creek Surface Mine | Mingo | WV |
| LRH-2006-02033 | | Wildcat | #2 Surface | Kanawha | WV |

| Permit Number Listed in ECP | Revised Permit Number | Applicant Name | Project Name | County | State |
|---|---|---|---|---|---|
| LRH-2006-02290 | | Colony Bay Coal Co. | Colony Bay Surface Mine | Boone | WV |
| LRH-2007-00182 | | Alex Energy, Inc. | Federal Surface Mine | Nicholas | WV |
| LRH-2007-00285 | | Alex Energy, Inc. | Lonestar Surface Mine | Nicholas | WV |
| LRH-2007-00286 | | Pioneer Fuel | MT5B | Raleigh | WV |
| LRH-2008-00491 | | CONSOL of Energy | Buffalo Mt. Surface Mine | Mingo | WV |
| LRH-2008-00562 | | Eastern Associated Coals | Huff Creek Surface Mine | Wyoming/ Logan | WV |
| LRH-2008-00791 | | Hobet Mining | Surface Mine No. 45 | Lincoln | WV |
| LRH-2008-00805 | | Coyote Coal Company | Joes Creek Surface Mine | Boone/ Kanawha | WV |
| LRH-2008-00830 | | CoalMac, Inc. | Pine Creek Surface Min | Logan | WV |
| LRH-2008-01098 | | Frasure Creek Mining | Spring Fork Surface Mine NO. 2 | Mingo | WV |
| LRH-2009-00428 | | Consol of Kentucky | Spring Branch No. 3 Deep Mine | Mingo | WV |
| | LRH-2006-00760 | Paynter Branch Mining | Paynter Branch South Surface Mine | Wyoming | WV |
| | LRH-2007-00134 | Atlantic Leasco | Muddlety Surface Mine No. 1 | Nicholas | WV |

# Exhibit F

**OXFORD Mining Company, LLC**

544 Chestnut Street
P.O. Box 427
Coshocton, OH 43812-0427

• Mining
• Reclamation
• Earth Moving

Bus. (740) 622-6302

Fax (740) 623-0365

Via US and Electronic Mail

September 18, 2009

Lisa P. Jackson, Administrator
Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Re: Appalachian Surface Coal Mining Enhanced Coordination Procedures
Request for Meeting

Dear Ms. Jackson:

I am writing to you as President and Chief Executive Officer of Oxford Mining Company, LLC ("Oxford") to take you up on your offer "...to meet with stakeholders at any time" expressed in your May 6, 2009 letter to Senator James J. Inhofe in response to his inquiry of you regarding recent activities under your Enhanced Coordination Procedures to review Appalachian coal surface coal mining permits (see, attached Answers to Questions 4 & 8) As the coal mine applicant for four of the six Ohio permit applications that remain identified on your recently published preliminary list of 79 permits identified for further, detailed review, Oxford has a tremendous stake in the outcome of this unprecedented process (see, attached EPA press release/list, 9/11/09). So do the 570+ Oxford coal miners employed and producing over 6 million tons of Ohio coal as a low-cost energy source to fuel our economic recovery. The time to meet is now.

Our Company's mission is to fuel America's energy independence through coal, which we accomplish by supplying key markets and corporate citizens such as American Electric Power ("AEP"), Duke Energy Ohio ("Duke"), First Energy as well as the Ohio municipalities of Shelby, Orville and Dover. Oxford has also received numerous "Greening of the Lands" awards recognizing our outstanding achievements in reclamation over the past 20 years and just this year, Oxford received the Excellence in Reforestation Award sponsored by the US Department of the Interior's, Office of Surface Mining, Appalachian Region Reforestation Initiative. I also want you to know that, in addition to providing these high-paying, well-benefitted, private sector jobs in the most economically depressed part of Ohio, we are a under a three-year commitment as a corporate sponsor of the Foundation for Appalachian Ohio to enhance the quality of life here, where the latest reported unemployment rates in Ohio's coal-bearing counties is 12.9%.

It is my understanding that EPA has a short, 15-day window of opportunity that closes next Friday, September 28, 2009, at which time your preliminary list will become final. It is my sincere hope and objective that the outcome of our meeting will result in at least two, if not all of Oxford's permit applications being removed from your preliminary list.

I have attached a summary table of what I believe are the pertinent facts for the subject permits abstracted from your document entitled "Detailed information on all proposed surface mines" at the following URL http://www.epa.gov/owow/wetlands/pdf/Proposed_Project_Info_09-11-09.pdf. What the data on this table indicates is that none of our subject permit applications involves mountain top mining or valley fills, the premise for your enhanced coordinated review of Appalachian coal mining (See, attached Press Release, Obama Administration Takes Unprecedented Steps to Reduce Environmental Impacts of Mountaintop Coal Mining, Announces Interagency Action Plan to Implement Reforms, 6/11/09).

Moreover, none of our subject permit applications impact more than 1 acre of wetland and to the extent that any of the impacted watercourses have perennial flow, it is only because of base groundwater emanating from the very coal resource that will be interrupted for a short time during mining. All of these adverse impacts will be more than compensated for by our excellent mitigation and reclamation work.

One important criteria missing from your detailed permit information and apparently not considered by your Multi-criteria Integrated Resource Assessment decision-making tool ("MIRA") is the fact our Kaiser-Mathias application is pending under a Nationwide Permit (NWP-49) because 87% of the area impacted has been previously mined. The nationwide permit program authorizes only those activities with minimal individual and cumulative adverse environmental effects on the aquatic environment and state water quality certification is not even applicable. Oxford proposes to reclaim 4.55 miles of dangerous highwalls in its mining process, another criteria apparently omitted in your decision-making. One would think that the EPA would not stand in the way of eliminating such a significant public safety hazard to the 5,129 people in the surrounding community under a permit that by its own terms has only minimal adverse environmental impacts. Oxford stands ready to commence performing this public service as soon as you release the Corps of Engineers to issue the §404 permit.

Our Hall's Knob permit is another pending application where the State of Ohio has just issued its §401 water quality certification (September 11, 2009) under laws and regulations that are more stringent than federal law. Additionally, the figure for the sum of watercourses filled in linear feet under the approved §401 certification, was reduced from the 9306 feet shown on your detailed project information to 5920. Since Ohio EPA has indicated that Oxford's Hall's Knob permit will not violate its stringent state water quality standards, it is not clear what EPA's environmental concerns are in this instance.

Administrator Jackson, each and every one of our §404 applications is vital in succession to an active mining operation. What is clear to this coal mine applicant is that your review process is unfair to our miners, who wonder if they will be able to continue providing for their families and it is unfair to expect Oxford to make substantial investments and business plans to assure our long-term success under such regulatory uncertainty. Your Enhanced Coordination Procedures have a long way to go to achieve its laudable goals of transparency and timely review.

By way of example, we have been engaged with Ohio and US EPA since 2005 to obtain our §§401 & 404 permits at Peabody 3. Although we have more than 1.3 million tons of coal remaining under our SMCRA authorized mining permit, we simply have no place left to mine. I will have no choice but to layoff dozens of miners with high-paying, well-benefitted jobs, by the end of October, at a time when Ohio's latest reported unemployment rate in coal-bearing counties stands at 12.9% without an acceptable and timely resolution at Peabody 3.

I will be pleased to review with you our revised mine plans to further minimize and mitigate impacts to watercourses and wetlands at Peabody 3 and at all of our pending applications when we meet. I know that time is of the essence, and I will make myself available to meet with you on short notice. Oxford is steadfastly committed to working with EPA and every level of state and federal government to secure these critical water quality certifications in a fair and lawful process that protects our natural resources.

I look forward to meeting you. Please do not hesitate to contact me should you have any questions or require additional information. Thank you for your consideration.

Sincerely,
Oxford Mining Company, LLC

Charles C. "Chuck" Ungurean
President and Chief Executive Officer

Attachments
cc: President Barack H. Obama (via facsimile 202-456-2461)

VIA Electronic Mail
Governor Ted Strickland

The Honorable George V. Voinovich

The Honorable Sherrod Brown

The Honorable Charlie Wilson

Asst. Sec. Army Civil Works. Jo Ellen Darcy,

Greg Peck
Bob Sussman:

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
WASHINGTON, D.C. 20460

MAY - 6 2009

OFFICE OF
WATER

The Honorable James M. Inhofe
United States Senate
Washington, DC 20510

Dear Senator Inhofe:

Thank you for your April 20, 2009, letter to U.S. Environmental Protection Agency (EPA) Administrator Lisa P. Jackson, expressing concerns regarding review of pending mountaintop mining permits and the economic importance of mountaintop mining activities. Administrator Jackson asked that I respond to the important questions posed in your letter

EPA has raised detailed concerns with potential environmental risks associated with surface coal mining, particularly to water quality in streams and rivers below surface coal mines. Scientific studies have highlighted the water quality impacts associated with surface coal mining activities. EPA is prioritizing its evaluation to those mining proposals undergoing Clean Water Act evaluation which raise the greatest potential for environmental harm. Our goal is to work in a timely manner with the Army Corps of Engineers, the States and the mining community on those few permits with which we have the most serious environmental concerns, to effectively reduce the potential for adverse environmental effects.

EPA is not raising concern with the majority of pending permits, and the Corps is expected to continue to issue permits for surface coal mining operations that do not raise environmental problems. We also expect that mining companies will continue to submit new permit applications for evaluation under the Clean Water Act. For these new proposals, EPA will follow existing regulatory procedure and provide comments to the Army Corps of Engineers as a part of the public notice and comment process.

I want to assure you that EPA understands the importance of surface coal mining to the economic welfare of the communities and citizens of the Appalachian region and pledge to work with the Committee, our state and federal partners, and the mining industry to identify improvements to mining operations that reduce environmental impacts. In doing so, our goal will be to ensure consistency with the requirements of the Clean Water Act and the Surface Mining Coal and Reclamation Act, and allow environmentally responsible coal mining to proceed.

I hope you will find the enclosed detailed responses address your concerns. If you have any additional questions, please feel free to contact me or your staff may call Denis Borum of EPA's Office of Congressional and Intergovernmental Relations at

Sincerely,

Michael H. Shapiro
Acting Assistant Administrator

Enclosure

**Surface Coal Mining**

**Questions and Answers**
**Senator James M. Inhofe**

**1. Please list the entire scope of mountaintop mining permits that EPA is currently reviewing. Please also list the time that the permit has been pending or backlogged and the rationale for the review. Please also indicate on the list the permits that have previously been reviewed.**

Because of active litigation in the 4th Circuit challenging the issuance of these Corps permits for coal mining, the Corps has been issuing far fewer permits for surface coal operations since the litigation began in 2007. As a result, there is a significant backlog of permits under review by the Corps, some of which have been pending for years while others for only months, and are in differing stages of evaluation.

EPA has identified only a small subset, 6 of 54 actions pending authorization in the next several months, with which the Agency has concern. EPA is not raising concern with the majority of pending permits. These represent mines with significantly fewer environmental impacts. The Corps is expected to continue to issue permits for surface coal mining operations that do not raise environmental problems.

We also expect that mining companies will continue to submit new permit applications under the CWA. For these new proposals, EPA is following existing regulatory procedure to provide comments to the Corps of Engineers as a part of the public notice and comment process. As provided in greater detail below, EPA has identified a set of environmental criteria under which we have, and will continue to, review and evaluate, pending permit actions for surface coal mine operations

**2. It has taken EPA a month and a half to review and comment on 54 permits that were previously reviewed. How much time will it take EPA to reexamine the remaining backlog of permits?**

EPA is prioritizing its evaluation to those current mining proposals which raise the greatest potential for environmental harm. In doing so, EPA is working with the Corps to identify an efficient and effective process for working through the backlog of proposals. Our goal is to work in a timely manner with the Corps, the State and the mining community on those few permits with which we have concerns, to effectively reduce the potential for adverse environmental effects.

**3. Which of the permits are individual permits and which are NWP 21? Do you anticipate that your review of individual permits will take more time than reviewing NWP 21 permits? Can this be expedited?**

As you have identified, there is a significant backlog of permits resulting from the 4th Circuit litigation that are under review by the Corps. EPA expects to be actively involved in the review of these permits. As indicated above, EPA is prioritizing its evaluation to those current mining proposals which raise the greatest potential for environmental harm. Under section 404(e) of the Act, the issuance of a nationwide permit may not have more than individual minimal or cumulative impact. So long as EPA believes that threshold is met according to the information provided to us under the pre-construction notification, we will continue to focus our review on individual permits, those believed to raise the greatest potential for environmental harm. Our goal is to work in a timely manner with the Corps, the State and the mining community on those few permits with which we have concerns, to effectively reduce the potential for adverse environmental effects.

In addition, the district court for the Southern District of West Virginia issued an order on March 31 vacating and remanding the Corps' primary nationwide permit for authorizing discharges associated with surface coal mining (NWP21). The judge enjoined the Corps from issuing authorizations pursuant to NWP 21 (2007) in the Southern District of West Virginia until the Corps prepares a revised EA or an EIS and also determines that NWP 21 (2007) will not have adverse cumulative impacts as required by CWA §404(e). The judge also enjoined the Corps and the Intervenors (a number of mining associations and individual coal companies) from all activities authorized under NWP 21 (2007).

**4. In terms of full disclosure, please list all industry groups, mining companies, non profit groups, associations, advocacy groups, and local stakeholders that you or your staff have met with or are scheduled to meet with at EPA from January 23, 2009 through April 17, 2009 regarding mountaintop mining.**

EPA has met with a variety of stakeholders and government officials on all sides of this issue. Meetings have been held with the Governor of West Virginia, the West Virginia Department of Environmental Protection, representatives of the environmental community, including: Sierra Club, Natural Resources Defense Council, Public Justice, Southern Appalachian Mountain Stewards, Coal River Mountain Watch, Ohio Valley Environmental Coalition, Appalachian Voices, Save Our Cumberland Mountains, Kentuckians for the Commonwealth, and Heartwood, the National Mining Association, and representatives of the mining community including: Massey Energy, Patriot Coal, Colony Bay Coal, Central Appalachia Mining, International Coal Group, CONSOL, and Alpha National Resources. EPA believes these meetings are valuable and welcomes the opportunity to meet with stakeholders at any time.

**5. Please list the issues—scientific, legal, and technical—behind EPA's decision to reexamine these permits. Were these issues different from those covered in previous reviews?**

EPA has identified a set of environmental criteria under which we have, and will continue to, review and evaluate, pending permit actions for surface coal mine operations. Based on these criteria, EPA has, and will continue to, focus our comments to mine proposals in the following areas:

- Length of stream impacts, in particular impacts to perennial streams and critical headwater streams
- Number of valley fills
- Geographic location of the proposed action, and assessment of impacts based on watershed level information, considering factors such as percentage of area mined, percentage of forested area, interior forest, percentage of urban area, and stream density/quality, index of biotic integrity (IBI), threatened and endangered (T&E) species
- Cumulative effects, particularly in consideration of the number of proposed new mines proposed for given watershed
- Existing water quality and potential for water quality impacts downstream of fill, in particular selenium and conductivity as specific constituents of concern; and the potential impacts to biotic integrity and T&E species in high quality and state outstanding resources waters
- Adequacy of alternative analysis; and
- Adequacy of mitigation

Where EPA believes that an activity, as proposed and noticed by the Corps of Engineers, may result in an adverse impact to the aquatic environment, based upon the above criteria, EPA will exercise its responsibility to ensure compliance with the regulations under the Act.

**6. Did you discuss this review process at any time with Carol Browner and/or other White House officials? If so, what role has she and other White House officials had in this review process?**

As part of this action, EPA is following its long-standing practice of coordinating these reviews with the Army Corps of Engineers and is consulting the Council on Environmental Quality as necessary.

**7. The Buffalo Mountain Section 404 permit covers a project that is estimated to produce 50 direct jobs and 250 indirect jobs with about $94.3 million in tax revenue for the state of West Virginia and the United States Treasury. The Highland Permit covers a project with 203 existing jobs. The Republic No.1 Permit covers another project that would create 270 jobs. If EPA continues to delay issuance of these permits, these jobs will be lost. Is EPA taking these economic considerations into account in its review?**

EPA shares your concerns about the welfare of the people of the Appalachian region and its citizens. EPA has expressed concerns with the environmental risks associated with surface coal mines. These risks have raised issues regarding not only the health of the streams in this region, but the welfare of its people as well. EPA's objective is to ensure that activities which will discharge a pollutant into a water of the United States are fully evaluated in accordance with the regulations under sections 404 and 402 of the Clean Water Act to afford the citizens of these affected areas full protection of the streams used for swimming, fishing, and public drinking water, and can result in contamination of groundwater also used for drinking water. EPA also understands the importance of surface coal mining to the economic welfare of the communities and citizens of the Appalachian region. We can address both of our concerns by working closely with all of the involved agencies, interested officials and the mining community to effectively respond to the environmental problems while ensuring that coal extraction is allowed to proceed.

**8. Please provide me with the specific steps EPA plans to take in the coming months to process these permits.**

EPA believes that meetings directly with the individual mining companies are valuable and welcomes the opportunity to meet with our state partners and coal mine applicants at any time. As indicated above, we are working with the Corps to identify an efficient and effective process for working through the backlog of proposals. Our goal continues to be to work in a timely manner with the Corps, the State and the mining community on those few permits with which we have concerns, to effectively reduce the potential for adverse environmental effects. In addition, EPA has suggested identifying an opportunity to discuss EPA's concerns more broadly and consider measures our state partners and the coal industry could evaluate when drafting a mining plan in an effort to lend greater predictability to the process. To begin discussion with the WVDEP and the mining industry, EPA has proffered some suggested measures which we believe could yield significant improvements in environmental protection. These are not meant to be exhaustive and may not be appropriate in all circumstances, but have been offered as a means to initiate this dialogue. EPA welcomes discussion on these opportunities, many of which relate directly to authorities under the CWA, and how best to incorporate these considerations earlier in the mine development process under SMCRA in an effort to strengthen environmental protections and lend greater predictability and transparency into the process.

| Corps # | 200500421 | 200501385 | 200701021 | 200701180 |
|---|---|---|---|---|
| Mining Company Name | Oxford - Peabody 3 | Oxford - Halls Knob | Oxford - Kaiser-Mathias | Oxford- Ellis |
| 401* (Issued or Pending) | I | I | P | P |
| PEOPLE | 2275 | 2803 | 5,129 | 6,801 |
| Valley Fill DRAINAGE | 0 | 0 | 0 | 0 |
| WETLAND LOSS (acres) | 0.410 | 0.18 | 0.98 | 0.03 |
| STRM_RATIO (mitig/impact) | 1 | 0.61 | 1 | 0.92 |
| WETL_RATIO (mitig/impact) | 1 | 1 | 1 | 1 |
| Sum of Streams Filled (l.f.) | 6033 | 9306 | 2,352 | 11,816 |
| Coal Extraction (mm Tons) | 1.200 | 0.64 | 1.32 | 1.89 |
| Stream mitigation (l.f.) | 6,033 | 5,679 | 2,352 | 11,388 |
| Wetland mitigation (ac.) | 0.62 | 0.48 | 1.47 | 0.03 |
| New Mine (Y/N) | N | Y | Y | Y |

**FOR IMMEDIATE RELEASE:**
**June 11, 2009**

**Contact: Christine Glunz (CEQ): (202) 456-3469**
**Kendra Barkoff (DOI): (202) 208-6416**
**Adora Andy (EPA): (202) 564-2715**
**Gene Pawlik (USACE): (202) 761-4715**

**Obama Administration Takes Unprecedented Steps to Reduce Environmental Impacts of Mountaintop Coal Mining, Announces Interagency Action Plan to Implement Reforms**

***Federal agencies take coordinated action to strengthen oversight and regulation, minimize adverse environmental consequences of mountaintop coal mining***

WASHINGTON, DC – Obama Administration officials announced today that they are taking unprecedented steps to reduce the environmental impacts of mountaintop coal mining in the six Appalachian states of Kentucky, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia through a coordinated approach between the Environmental Protection Agency (EPA), Department of the Interior (DOI) and Army Corps of Engineers.

Through a Memorandum of Understanding signed by Lisa P. Jackson, Administrator of the Environmental Protection Agency; Ken Salazar, Secretary of the Interior; and Terrence "Rock" Salt, Acting Assistant Secretary of the Army for Civil Works, the Administration will implement an Interagency Action Plan on mountaintop coal mining that will:

- Minimize the adverse environmental consequences of mountaintop coal mining through short-term actions to be completed in 2009;
- Undertake longer-term actions to tighten the regulation of mountaintop coal mining;
- Ensure coordinated and stringent environmental reviews of permit applications under the Clean Water Act (CWA) and Surface Mining Control and Reclamation Act of 1997 (SMCRA);
- Engage the public through outreach events in the Appalachian region to help inform the development of Federal policy; and
- Federal Agencies will work in coordination with appropriate regional, state, and local entities to help diversify and strengthen the Appalachian regional economy and promote the health and welfare of Appalachian communities.

"Mountaintop coal mining cannot be predicated on the assumption of minimal oversight of its environmental impacts, and its permanent degradation of water quality. Stronger reviews and protections will safeguard the health of local waters, and thousands of acres of watersheds in Appalachia," said EPA Administrator Lisa P. Jackson. "Our announcement today reaffirms EPA's fundamental responsibility for protecting the water quality and environmental integrity of streams, rivers, and wetlands under the Clean Water Act. Getting this right is important to coalfield communities that count on a livable environment, both during mining and after coal companies move to other sites."

"The Army is pleased to support interagency efforts to increase environmental protection requirements and factual considerations for mountaintop coal mining activities in Appalachia," said Terrence "Rock" Salt, Acting Assistant Secretary of the Army for Civil Works. "The initiative being announced today will allow us to move forward on a number of important permit applications while providing improved certainty and transparency to permit applicants and the public."

"The steps we are taking today are a firm departure from the previous Administration's approach to mountaintop coal mining, which failed to protect our communities, water, and wildlife in Appalachia," said Secretary Salazar. "By toughening enforcement standards, by looking for common-sense improvements to our rules and regulations, and by coordinating our efforts with other agencies, we will immediately make progress toward reducing the environmental impacts of mountaintop coal mining."

"This agreement represents federal agencies working together to take the President's message on mountaintop coal mining into action," said Nancy Sutley, Chair of the White House Council on Environmental Quality. "We are committed to powering our country while protecting health and welfare in the Appalachian region, securing access to clean streams and safe drinking water, and honoring our clean water laws."

In close coordination, EPA, DOI, and the Corps will take several short-term actions to reform the regulation of mountaintop coal mining under the two primary environmental laws governing this mining practice.

The Army Corps of Engineers and the Environmental Protection Agency will take immediate steps under the CWA to minimize environmental harm by taking the following actions in 2009:

- Requiring more stringent environmental reviews for future permit applications for mountaintop coal mining;
- Within 30 days of the date of the MOU, the Corps will issue a public notice (pursuant to 33 C.F.R. § 330.5) proposing to modify Nationwide Permit (NWP) 21 to preclude its use to authorize the discharge of fill material into streams for surface coal mining activities in the Appalachian region, and will seek public comment on the proposed action;
- Strengthening permit reviews under CWA regulations (Section 404(b)(1)) to reduce the harmful direct and cumulative environmental impacts of mountaintop coal mining on streams and watersheds;
- Strengthening EPA coordination with states on water pollution permits for discharges from valley fills and state water quality certifications for mountaintop coal mining operations; and
- Improving stream mitigation projects to increase ecological performance and compensate for losses of these important waters of the United States.

The Department of Interior will also take the following steps:

- Reevaluate and determine how the Office of Surface Mining Reclamation and Enforcement (OSM) will more effectively conduct oversight of state permitting, state enforcement, and regulatory activities under SMCRA;

- Ensure the protection of wildlife resources and endangered species by coordinating the development of CWA guidance with the U.S. Fish and Wildlife Service (FWS); and
- If the U.S. District Court vacates the 2008 Stream Buffer Zone Rule, as requested by the Secretary of the Interior on April 27, 2009, Interior will issue guidance clarifying the application of stream buffer zone provisions in a preexisting 1983 SMCRA regulation to ensure mining activities will occur in a more environmentally protective way in or near Appalachian streams.

Concurrent with these short-term actions, the three agencies will embark on a comprehensive, coordinated review of their existing respective regulations and procedures governing mountaintop coal mining under existing law. The agencies will also create an interagency working group to promote ongoing Federal collaboration and ensure the Action Plan achieves results. As these reforms are implemented, the agencies will seek to involve the public and guide Federal actions through robust public comment and outreach.

EPA and the Army Corps of Engineers are today taking steps to enhance coordination in the environmental review of pending Clean Water Act permits for surface coal mining activities in Appalachian States. Administrator Jackson and Acting Assistant Secretary Salt have directed EPA and Corps field offices to coordinate under new procedures to ensure Clean Water Act permit decisions are fully consistent with sound science and the law, reduce adverse environmental impacts, provide greater public participation and transparency, and address pending permits in a more timely manner.

The Federal agencies will also work in coordination with appropriate regional, state, and local entities to help diversify and strengthen the Appalachian regional economy and promote the health and welfare of Appalachian communities. This interagency effort will have a special focus on stimulating clean enterprise and green jobs development, encouraging better coordination among existing federal efforts, and supporting innovative new ideas and initiatives.

###

# Exhibit G

## Exhibit G

## Oxford Kaiser-Mathias
## CWA §404 Nationwide Permit 49 (NWP 49)

| OXFORD MINING COMPANY, LLC (OHIO)<br>USEPA Blacklisted 404 Permit Application | |
|---|---|
| **Project Name** | **Kaiser Mathias** |
| **Permit Number** | LRH-2007-01021 |
| **SMCRA Number** | 10405 |
| **Applicant Name** | Oxford Mining |
| **NWP/IP** | NWP 49 |
| **Submittal Date** | 11/4/2008 |
| **Coordinate PN/PCN (Date)** | 1/26/2009 |
| **Days to Coordinate** | 82 |
| **Status Date (Issued)** | 3/5/2010 |
| **New or Expansion (N/E)** | N |
| **Direct Mining Job Potential** | 24 |
| **Remining (Y/N)** | Y |
| **Mine Acres** | 531 |
| **Remining Acres (% mining acres)** | 455 (86%) |
| **Pre-law Highwall to be reclaimed** | 24,042 feet |
| **Proposed Coal Extraction (tons)** | 1,320,000 |
| **Valley Fills (#)** | 0 |

### Abstract

USEPA in its press release takes credit for an 80% reduction in impacts due to its enhanced coordination procedures, when Oxford never intended to impact and only applied to permit impacts to 2300 feet of jurisdictional streams, not the 13,000 feet in the vicinity of the project over which the Corps had jurisdiction. Kaiser-Mathias was applied for and issued as a Nationwide Permit 49, a special permit authorized by USEPA for remining projects where it has already determined there to be minimal adverse impacts of mining clearly outweighed by the benefits of remining and reclaiming, as in this case, nearly 5 miles of abandoned, dangerous old highwalls not to mention acres of old pit impoundments.

NWP 49 nationwide general permit for remining projects previously approved by USEPA based on the conclusion that remining projects generally do not have significant adverse environmental impacts and thus the environmental benefits clearly outweigh any impacts.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

MAR 05 2010

REPLY TO THE ATTENTION OF: WW-16J

Ginger Mullins, Chief
Regulatory Branch
U.S. Army Corps of Engineers
Huntington District
Attn: CELRH-OR-F
502 Eighth Street
Huntington, WV 25701-2070

Subject: LRH-2007-1021-Kaiser Mathias

Dear Ms. Mullins:

U.S. Environmental Protection Agency, Region 5, has completed its review of Oxford Mining's proposed Kaiser Mathias mine in Tuscarawas County, Ohio. This review was conducted under the Enhanced Coordination Procedures (ECP) for surface coal mining applications, as detailed in the June 30, 2009, *Memorandum of Understanding among the U.S. Department of the Army, U.S. Department of the Interior, and U.S. Environmental Protection Agency Implementing the Interagency Action Plan on Appalachian Surface Coal Mining*. This project was placed on the final list of applications subject to the ECP on September 30, 2009, due to environmental concerns over the potential for further impact minimization and the inadequacy of proposed compensatory mitigation, specifically the lack of long-term site protection.

The ECP 60-day coordination period was begun by Huntington District on October 5, 2009, and would have originally concluded on December 3, 2009. During discussions on potential resolution of EPA's concerns, it was discovered that the Huntington Corps District had not been aware the State of Ohio was still processing Oxford's SMCRA application for the mine, and the SMCRA review was not anticipated to be complete for several months. As a result, Huntington District requested that the ECP coordination be placed on hold while the District waited for final SMCRA authorization. Following SMCRA authorization, and the finalization of Huntington District's application review, the District notified Region 5 on January 6, 2010, that they had reinitiated the 60-day coordination period for resolving environmental concerns through the ECP. Following discussion with the applicant and the Huntington District, EPA believes the previously identified environmental concerns have been addressed, and the application may be finalized by the Corps.

The applicant proposes to discharge 1,850 cubic yards of fill material into 0.98 acres of jurisdictional wetlands and 2,352 linear feet (lft) of jurisdictional streams. Impacts to these waters would occur in association with surface coal mining activities such as pond construction and coal removal. It is EPA's understanding that this project will be authorized under a Nationwide Permit #49, for coal remining activities. To demonstrate that water quality will improve as a result of this project, the applicant proposes to reclaim abandoned mine lands by removing 193 acres of pit impoundments, backfilling 24,042 lft of highwall to the approximately original contour and reducing sediment loading through reclamation and revegetation of exposed soils. The applicant also proposes to reconstruct 2,571 lft of both jurisdictional and non-jurisdictional streams using natural channel design and 1.47 acres of wetlands on site. The reconstructed streams will have a 50 foot wide riparian corridor and both streams and wetlands will be preserved with conservation easements.

Stream impacts have been reduced 80%, from 12,930 lft to 2,352 lft and wetland impacts have been reduced 70%, from 3.39 acres to 0.98 acres. Four hundred and fifty-five (455) acres of the 531 acre mining area has been previously stripped mined and left unreclaimed. Because of these pre-SMCRA, unreclaimed areas, the majority of streams on-site scored low using the Qualitative Habitat Evaluation Index (QHEI) and the Headwater Habitat Evaluation Index (HHEI). Low QHEI and HHEI scores often indicate a lack of species diversity present in the streams as well as poor fish habitat. As a result, the applicant will demonstrate appropriate biological communities are present in the reconstructed streams through direct biological sampling.

Pre-SMCRA, unreclaimed features on site include pits, 80 foot high highwalls and spoil piles, some of which are highly erodible and contribute significant quantities of soils and sediments downstream. Currently, there are an estimated 437.4 tons of soil lost through erosion on site yearly. Through the reclamation practices proposed within this project, total post mining soil loss would be reduced to an estimated 115.66 tons/year and will be monitored as a permit condition. The restoration of pre-SMCRA areas will improve resources in the impaired Stone and Oldtown Creek watersheds by restoring on-site streams using natural channel design and permanently protecting those areas under a conservation easement.

EPA believes the improved mitigation proposal compensates for unavoidable project impacts, which have been significantly reduced. Reclamation of the existing source of water quality problems will provide an overall environmental benefit and ecological lift to the watershed. We have reviewed the draft permit and are satisfied that our concerns have been addressed; therefore, EPA does not foresee any delay in the Corps' ability to issue the permit

I want to thank you and your staff for your cooperation and willingness to address our issues. If you have any question, please call me at

Sincerely,

Tinka G. Hyde
Director, Water Division

cc: OEPA

# EPA: United States Environmental Protection Agency

A-Z index

## News Releases By Date

## EPA Approves Ohio Surface Coal Mine

Release date: 03/08/2010

Contact Information: Enesta Jones, jones.enesta@epa.gov 202-564-7873 202-564-4355

FOR IMMEDIATE RELEASE
No. 10-OPA025

**EPA review and coordination with company results in less environmental impacts**

CHICAGO (March 8, 2010) - The U.S. Environmental Protection Agency (EPA) has concluded its review of a Clean Water Act permit application for Oxford Mining Company's proposed Kaiser Mathias mine in Tuscarawas County, Ohio and has approved the project. After extensive coordination with the coal operator, EPA is requiring significant improvements to the surface coal mining project to reduce anticipated environmental and water quality impacts and repair environmental damages caused by previous mining in the watershed. There are no valley fills associated with this mine.

The project changes identified by EPA will result in an overall ecological improvement to the Stone Creek and Oldtown Creek watersheds through the reduction of sediment loads to downstream waters, replacement of lost wetlands and stream functions, the restoration of areas previously mined and long-term site protection.

Improvements to the project will require the company to:
• Reduce stream impacts by more than 80 percent from 12,930 linear feet to 2,352 linear feet.
• Reduce wetland impacts from 3.39 acres to less than one acre.
• Restore the entire 531 acre mining site to repair environmental and water quality impacts from previous mining activities at the site.
• Conduct enhanced biological and water quality monitoring to protect streams and establish conservation easements to permanently protect undisturbed streams.
• Reduce erosion from previously mined areas into streams by an estimated 115.66 tons a year.
• Require stream and wetlands mitigation to replace lost ecological function.

The Kaiser-Mathias mine is a "remining" project that will recover coal at a location mined prior to the Clean Water Act and the Surface Mining Control and Reclamation Act. Clean Water Act approval for new mining at the site provides an opportunity to require that previous environmental and water quality damages within the watershed are repaired. The U.S. Army Corps of Engineers is expected to issue a final Clean Water Act permit for the Kaiser Mathias mine shortly.

The Kaiser Mathias mine was evaluated by EPA as part of the EPA/Army Corps Clean Water Act "Enhanced Coordination Procedures" for review of Appalachian surface coal mining projects.
The details of EPA's revisions to the permit are described here:
http://www.epa.gov/owow/wetlands/guidance/pdf/Kaiser_Mathias_030510.pdf

# Exhibit H

**EXHIBIT H**

**OXFORD HALLS KNOB**

| **OXFORD MINING COMPANY, LLC (OHIO)<br>USEPA Blacklisted 404 Permits** | |
|---|---|
| **Project Name** | Halls Knob |
| **Permit Number** | LRH-2005-01385 |
| **SMCRA Number** | App 10400 |
| **Applicant name** | Oxford Mining |
| **NWP/IP** | IP |
| **Submittal Date** | 10/2/2008 |
| **Coordinate PN/PCN (Date)** | 3/20/2009 |
| **Days to Coordinate** | 170 |
| **Status Date (Issue/Withdrawn/Pending)** | 7/12/2010 |
| **New or expansion (N/E)** | N |
| **Direct Mining Job Potential** | 25 |
| **Remining (Y/N)** | Y |
| **Mine acres** | 263 |
| **Remining acres (% mining acres)** | 38 (14.4%) |
| **Pre-law Highwall to be reclaimed** | 8,600 feet |
| **Proposed Coal Extraction (tons)** | 635,000 |
| **Valley fills (#)** | 0 |

**ABSTRACT**

Oxford began coordinating this permit with Corps in 2005. October 2, 2008, Individual §404 Permit (IP) submitted. No MTM or Valley Fills. Oxford proposed to reclaim 1.62 miles of dangerous highwall and 38 acres (14.5%) of this 263 acre project that was previously mined and unreclaimed to current SMCRA standards. This was a new mine with 25 direct mining jobs. On July 27, 2009 the SMCRA Permit conditionally issued subject to issuance of CWA§ 401 &§404 permits. On September 11, 2009, Ohio EPA issued its §401 permit. On May 27, 2010, after nearly 1 year of Enhanced Coordination, Greg Peck, Chief of Staff, Office of Water EPA transmits comments to Corps with unacceptable proposed terms and conditions, without which EPA recommend denial. Halls Knob was one of first 404 permits issued after EPA's April 1, 2010 Guidance was published. Faced with shutting down mine operations w/o §404 permit, Oxford went to its Congressional delegation, who helped arrange a meeting with EPA in Representative's D.C. office. On June 16, 2010 the Corps proffers permit without any material changes to EPA draft conditions (phased sequencing of mining; monthly Specific Conductivity upstream/downstream; extensive biological monitoring twice seasonally; additional mitigation for temporal losses; stop mining if SC > 2400 microsiemens/cm; TDS > 1500 mg/l). On July 12, 2010 §404 permit issued with marginally acceptable terms and conditions two weeks after our meeting in D.C. and after 13 months of Enhanced Coordination.

-----Original Message-----
From:
Sent: Tuesday, June 01, 2010 8:31 AM
To: Nate Leggett
Cc: Newman, Sheila M LRH
Subject: FW: EPA Region 5 Comments on Halls Knob Mine

Nate,

Here is the USEPA letter, sorry I could not get it to you sooner, my PC and Blackberry crashed on me while out west. After you read, I would suggest you, Sheila, and I have a call.

Mark

* * *

-----Original Message-----
From:
Sent: Friday, May 28, 2010 2:17 PM
To: Taylor, Mark A LRH; Mullins, Ginger LRH
Cc:

Subject: EPA Region 5 Comments on Halls Knob Mine

Ginger/Mark:

Since a number of EPA folks have started the long holiday weekend early (and hopefully you have too!), there aren't many of us around today to send you EPA comments on the DA permit application for the Halls Knob mine. But this note gives me the opportunity to say hi to both of you and wish you a happy weekend. Tinka and her folks are back in the office on Tuesday - so please give them a call if you have any questions.

Best,
Greg

(See attached file: Halls Knob Letter.pdf)

---

Gregory E. Peck
Chief of Staff
Office of Water
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

202-564-5778

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF
WW-16J

May 27, 2010

Ginger Mullins, Chief
Regulatory Branch
U.S. Army Corps of Engineers
Huntington District
Attn: CELRH-OR-F
502 Eighth Street
Huntington, West Virginia 25701-2070

Subject: LRH-2005-1385-TUS Halls Knob

Dear Ms. Mullins:

The U.S. Environmental Protection Agency, Region 5, has reviewed Oxford Mining's proposed Halls Knob mining project located in Millwood Township, Guernsey County, Ohio. The project proposes to impact 5,445 linear feet of stream (214 linear feet of perennial stream, 3,184 linear feet of intermittent stream, and 2,047 linear feet of ephemeral stream), 0.173 acre of jurisdictional wetland and 0.923 acre of jurisdictional open water through new mining activities, remining, and reclamation of historic abandoned mine areas. This permit application was selected as one of 79 permit applications for enhanced coordination announced pursuant to the June 11, 2009, interagency Memorandum of Understanding on Appalachian surface coal mining. In its September 30, 2009, announcement that this and other projects would be subject to enhanced coordination, EPA identified three areas of general concern: avoidance and minimization, water quality impacts, and mitigation. There are no valley fills associated with this mine.

**Avoidance and Minimization**

As originally proposed in the March 20, 2009, public notice, the project would have filled 9,306 linear feet of stream (214 linear feet of perennial stream, 6,269 linear feet of intermittent stream and 2,823 linear feet of ephemeral stream), 0.183 acres of wetland and 0.923 acres of open water. As currently proposed, stream impacts have been reduced by 3,861 linear feet (41%), from 9,306 linear feet to 5,445 linear feet. Wetland impacts have been reduced by 0.01 acre (5%) from 0.183 acre to 0.173 acre.

Oxford's original mine plan included 13 sediment ponds to reduce the amount of pollutants entering the surface water system from the mining operation. Streams 1, 2, and 7 would have been significantly impacted by construction of the ponds as originally proposed. Oxford has revised the application to construct 3 additional sediment ponds out of channel, so that the ponds associated with streams 1, 2, and 7 could be reduced in size, and to specify that the remaining instream ponds will be temporary and stream channels restored post mining.

In cases where springs are mined through, depending on the elevation of the coal seam, critical sources of hydrology are eliminated, thereby decreasing the chance for a the establishment of a diverse biological community in mitigated streams. Oxford's plan to stop the highwall at 100 feet in elevation and continue with auger mining does not adversely impact the springs, and will benefit both downstream water quality and the proposed stream reclamation.

**Water Quality**

This project is within the Wills Creek Watershed, which is listed on the State of Ohio's 303(d) list for aquatic life use impairment caused by sediment and siltation from surface mining sources. The directly impacted downstream water is an unnamed tributary (Stream 9) to Leatherwood Creek; neither of these has been assessed. The area has been partially impacted by previous pre-SMRCA mining. The applicant proposes to reclaim the entire site to current regulatory standards as set by ODNR-DMRM under SMCRA and return the land to its previous uses as requested by the landowner.

Ambient data collected by the company on April 12, 2010, showed conductivity levels ranging from 812µS/cm to 2,680µS/cm over 13 monitoring stations. The 39.5 acres of pre-SMCRA mining are suspected to be partly responsible for the high conductivity levels. The operation will eliminate an abandoned underground mine, that is a suspected source of acid mine drainage (AMD), and reclaim abandoned highwalls and old pit impoundments, which will improve water quality. During mining the use of Best Management Practices will help to prevent the degradation of water quality prior to reclamation of the site.

**Mitigation**

As mitigation for impacts to 214 linear feet of perennial stream, 3,184 linear feet of intermittent stream, and 2,552 linear feet of ephemeral stream, Oxford proposed to construct a minimum of 214 linear feet of perennial stream and 3,925 linear feet of intermittent stream using natural channel design, as well as 0.06 acre of wetland. As mitigation for impacts to 0.173 acres of non-forested/emergent wetlands, Oxford will construct a minimum of 0.32 acres of wetland.

EPA appreciates that Oxford identifies and restores pre-mined areas that are contributing to downstream water quality impairments. For this project, they will eliminate an abandoned underground mine that is a suspected source of AMD, and reclaim abandoned highwalls and old pit impoundments. They have a proven track record of conducting this type of reclamation that will result in environmental improvement.

To account for temporal loss and the uncertainty of stream reclamation, Oxford will provide additional mitigation, consisting of at least 750 linear feet of stream restoration and protection of the area with a conservation easement. They will also identify additional areas for mitigation focused on chemical and/or biological improvements in the watershed.

**Proposed Permitting Approach**

EPA appreciates the efforts of Oxford and the Corps to incorporate provisions in the design of the Halls Knob mine intended to avoid and minimize the potential for increased water quality problems within the Wills Creek Watershed. Remining and reclamation on 39.5 acres of the site are intended to correct existing sources of conductivity currently contributing to exceedances of the state's water quality criterion for conductivity. We are concerned, however, that new mining and associated disturbance of 224.2 acres of land at the site, including new mine through operations impacting almost 5,500 linear feet of stream, will likely cause or contribute to additional exceedances and associated significant degradation of aquatic life in the already impaired Wills Creek Watershed. Current information available does not provide quantifiable data regarding the efficacy of reclamation efforts to ensure that new mining will not further elevate conductivity levels in the watershed.

In order to address this concern, and in an effort to allow some mining to proceed at the site as soon as possible, EPA recommends that the Corps proceed with phased permitting of the proposed mining operation as follows:

Phase I mining would be authorized to permit remining and reclamation to proceed immediately on the 39.5 acres of the Halls Knob site. The permit would require downstream monitoring of conductivity levels to evaluate the effectiveness of reclamation efforts to reduce existing conductivity levels in the watershed and to protect stream biota. The Corps, EPA, and the State should coordinate to assess any observed reduction in conductivity in waters below the remining/reclamation area as a part of the decision to approve subsequent new mining at the site under Phase II.

Phase II mining would involve the remainder of proposed mining at the Halls Knob site, including the mine through of 5,500 linear feet of stream. A decision whether or not to approve Phase II mining would be based on coordination among the Corps, EPA, and State to compare anticipated increases in conductivity in waters downstream of Phase II mining with the results of any observed improvement in water quality below Phase I remining and reclamation efforts, based on data collected during conductivity and biological monitoring. Phase II mining could be approved if the agencies determined that a combination of anticipated new mining water quality impacts and reductions in conductivity associated with repair of existing conductivity sources resulted in no net increase in conductivity and related biological impairments in surface waters in the Wills Creek watershed.

Absent the adoption of a phased permitting approach described here, as well as the collection and utilization of this necessary information and analysis, EPA recommends that the permit application for the project, as currently proposed, be denied.

The combination of a phased mining approach, of reclaiming pre-SMCRA areas, reclamation of on site streams, additional on-site stream mitigation, extensive water quality and biological monitoring, use of best management practices, and an adaptive management plan for corrective action, will prevent this project from elevating pollutant levels in streams already impaired by previous mining and causing significant degradation to downstream waters. We believe the enclosed conditions are consistent with the agencies' Clean Water Act regulations, including the section 404(b)(1) Guidelines.

I want to thank you and your staff for your cooperation and willingness to address our issues. If you have any question, please call me, at

Sincerely,

for Tinka G. Hyde
Director, Water Division

Enclosure

cc: George Elmaraghy, Ohio EPA

**Special Conditions**
EPA appreciates the collaboration between the Region and the District on developing the special permit conditions. We believe this productive working relationship benefits both agencies in our effort to ensure that the chemical, physical and biological integrity of the nation's waters is maintained.

In addition to the conditions, the applicant is required, in the SCMRA permit, to implement Best Management Practices and reclamation methods for land disturbance, erosion and sediment control, revegetation and drainage. The proposed Section 404 special conditions, which EPA and the Corps have agreed upon, are listed below.

1. Conductivity shall be monitored on a monthly basis at upstream monitoring station U-9 and downstream monitoring station D-9. Other parameters to be monitored include flow, pH, temperature, dissolved oxygen, Iron, Aluminum, Selenium, TDS, TSS, Conductivity, Calcium, Potassium, Magnesium, Sulfate, Chloride, Sodium, and Total Alkalinity. The upstream monitoring point will be the reference point and the downstream station will be the compliance point.

Data shall be reported to the USACE and USEPA within 15 days of monitoring. After 6 months of data collection a time-series analysis of the data shall be performed to determine if conductivity readings are developing a trend. The analysis shall be reported to the USACE and USEPA within 30 days of the 6 month monitoring date. If the conductivity is trending upward a detailed reasoning for increased conductivity shall be conducted and included in the above analysis report.

The trend analysis shall begin upon site preparation for mining and take place every 6 months until reclamation is completed.

If an unexplained spike in conductivity reading takes place, the frequency of monitoring shall be increased to twice per month.

If corrective measures are necessary, the Adaptive Management Plan shall be implemented, which may require additional mitigation focused on chemical improvements in the watershed.

2. Habitat and aquatic biology shall be monitored twice between June 15 to September 30 at least 6 weeks apart at upstream monitoring station U-9 and downstream monitoring station D-9. During the sampling period, the company will determine if there is any change in QHEI, ICI, and IBI scores. Data shall be reported to the USACE and USEPA within 15 days of monitoring.

If the ICI or IBI scores show a negative change greater than 4 points an analysis with detailed reasoning for decreased biology will be required. The QHEI score shall be used to determine any change in the physical habitat. After a season (two complete monitoring reports) of data collection an analysis of the data shall be reported to the USACE and USEPA within 30 days.

If the QHEI score drops significantly or the ICI or IBI scores show a negative change greater than 4 points during to your mining operation, the Adaptive Management Plan shall be implemented, which may require additional mitigation focused on habitat or biological improvements in the watershed.

3. Yearly sampling shall be conducted on each of the thirteen sampling stations using the qualitative methodology described in the Primary Headwater Habitat Manual (HHEI) and the Headwater Macroinvertebrate Field Evaluation Index (HMFEI). HHEI and HMFEI scores shall be reported in the annual monitoring reports. The approved monitoring stations are documented on the Monitoring Station Map (Hall's Knob D-2334) dated 2/23/2010 which is attached (Attachment D). Baseline parameters shall be established prior to any site activity.

4. For temporal loss of stream functions on site, you shall submit an additional mitigation plan. The plan shall identify a minimum of 750 linear feet of stream channel on or off site as a mitigation site. The mitigation should include restoration/creation/enhancement and must include protection in perpetuity.

5. If water quality shows that the conductivity has exceeded Ohio's water quality standard for conductivity of 2400 μS/cm or 1500 mg/l Total Dissolved Solids at downstream monitoring station D-9, mining must stop and the adaptive management plan must be implemented.

6. An Adaptive Management Plan (AMP) shall be developed and approved with 90 days of this authorization. This plan shall include activities initiated when there is a degradation of water quality or biology. If trend analyses indicate a degradation of water quality or biology, then the applicant will submit a report within 30 days to the USACE, and the USEPA and any other appropriate agency with a detailed list of proposed actions to address the increased conductivity or loss of biodiversity. The proposed actions shall also identify a timeline for the implementation of the action plan which shall be implemented following written approval by the USACE after consultation with the USEPA and other resource agencies. The potential techniques that may be employed include, but are not limited to, revisions to material handling plans, revisions to the storm water storage; grading and vegetation of reclaimed areas, addition of pretreatment ponds, and internal storm water diversion.

7. Additional Compensatory Mitigation shall be required for degradation of water quality which results in action under the Adaptive Management Plan. If monitoring indicates any upward trend in conductivity or downward trend in biology due to the mining activity additional mitigation focused on chemical and/or biological improvements in the watershed shall be provided. The requirement will be reset after 24 consecutive sample reports indicate results in normal limits of the baseline. The projects to which the additional compensatory mitigation can be applied will be defined in advance by the applicant and approved by the USACE in consultation with the USEPA and other resource agencies.

An additional proposed Section 404 special condition, which EPA and the Corps have not yet agreed upon, is listed below.

1. The permit shall allow mining to occur in 2 phases. Phase I would include the 39.5 acres of pre-SMCRA mined and unreclaimed portion of the project. Based on monitoring results and the success of reclamation in reducing existing conductivity and pH at monitoring station D-9, the Corps and EPA would determine whether the second phase (new mining) could be approved.

**Congress of the United States**
**Washington, DC 20515**

June 11, 2010

The Honorable Lisa Jackson
Administrator
Environmental Protection Agency
Ariel Rios Federal Building
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Dear Administrator Jackson:

We write to ask that you please accommodate Oxford Mining's request to meet with Washington-based senior level officials at the Environmental Protection Agency (EPA) before June 16, 2010. The company wishes to discuss the draft final special conditions that were attached to its Halls Knob permit, and to do so before EPA's 10 day final review period terminates.

As you know, the Halls Knob permit application was one of the 79 permits selected for enhanced coordination pursuant to the June 11, 2009, interagency Memorandum of Understanding on Appalachian surface coal mining. Out of that effort, EPA identified three areas that it believed were of concern: avoidance and minimization, water quality impacts, and mitigation. It is our understanding that the special conditions were recommended by EPA to be incorporated into the draft permit issued by the Army Corp of Engineers. That permit is now under a 10 day review period by your agency that is due to end on June 16th.

Oxford Mining would like to discuss its concerns about the special conditions proposed by EPA. The company believes that the special conditions proposed by EPA are excessive and if followed, will not make it economically feasible for the company to pursue the project. Due to the uniqueness of this approval process and the fact that these new procedures could have a profound and direct economic impact on a region of our state that has been devastated by high unemployment, we would ask that you agree to Oxford Mining's request for a meeting in Washington, D.C. prior to your June 16th deadline.

Thank you for your personal attention to this matter. We hope that you can accommodate the company's request and ask that you keep us informed as to the status of this request in a timely manner.

Sincerely,

George V. Voinovich
United States Senator

Sherrod Brown
United States Senator

Zack Space
United States Representative

Charlie Wilson
United States Representative

CC: Ted Strickland, Governor, State of Ohio
Ginger Mullins, Chief, U.S. Army Corps of Engineers – Regulatory Branch
Tinka G. Hyde, Director, U.S. Environmental Protection Agency – Water Division
George Elmaraghy, Chief, Ohio EPA – Division of Surface Water

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | D-2334 | | D-1 | | | | | | |
| Date | Disc. | pH | Acid | Alk | Fe | Mn | AL | SS | Hard | So3 | SC | Net Alk |
| 01/09/06 | 5.0 | 7.63 | 5 | 66 | 0.220 | 0.424 | - | 3 | 258.54 | 126.00 | 472 | 61 |
| 02/20/06 | 5.0 | 7.70 | 3 | 44 | 0.061 | 0.146 | - | 1 | 281.57 | 189.00 | 526 | 41 |
| 10/09/06 | 4.0 | 7.77 | 6 | 74 | 0.380 | 0.394 | 0.353 | 5 | 218.56 | 119.00 | 453 | 68 |
| 08/18/09 | 0.1 | 7.33 | 12 | 128 | 0.110 | 0.011 | 0.096 | 1 | 351 | 210.00 | 778 | 116 |
| 11/04/09 | 0.1 | 7.32 | 18 | 164 | 2.300 | 0.080 | 1.860 | 162 | 299 | 88.20 | 528 | 146 |
| 03/16/10 | 7.0 | 7.13 | 4 | 36 | 0.900 | 0.070 | 0.700 | 12 | 469 | 321.00 | 687 | 32 |
| | | | | | | | | | | | | 0 |
| | | | | D-2334 | | D-4 | | | | | | |
| Date | Disc. | pH | Acid | Alk | Fe | Mn | AL | SS | Hard | So3 | SC | Net Alk |
| 01/09/06 | 28.0 | 7.67 | 4 | 52 | 0.066 | 0.020 | | 2 | 286.59 | 155.00 | 512 | 48 |
| 02/20/06 | 32.0 | 7.61 | 4 | 48 | 0.044 | 0.011 | | 1 | 265.23 | 175.00 | 499 | 44 |
| 10/20/06 | 30.0 | 7.95 | 2 | 76 | 0.141 | 0.017 | | 1 | 246.01 | 180.00 | 557 | 74 |
| 08/18/09 | 0.1 | 6.86 | 16 | 74 | 0.061 | 0.010 | 0.059 | 1 | 211 | 105.00 | 492 | 58 |
| 11/04/09 | 0.1 | 7.41 | 6 | 40 | 0.140 | 0.330 | 0.080 | 7 | 562 | 4.97 | 958 | 34 |
| 03/16/10 | 28.0 | 7.48 | 2 | 38 | 0.150 | 0.040 | 0.200 | 3 | 321 | 234.00 | 548 | 36 |
| | | | | | | | | | | | | |
| | | | | D-2334 | | D-7 | | | | | | |
| Date | Disc. | pH | Acid | Alk | Fe | Mn | AL | SS | Hard | So3 | SC | Net Alk |
| 01/09/06 | 20.0 | 7.70 | 7 | 76 | 0.040 | 0.364 | - | 11 | 677.1 | 439.00 | 1023 | 69 |
| 02/20/06 | 24.0 | 7.57 | 5 | 60 | 0.062 | 0.307 | - | 1 | 619.77 | 491.00 | 1008 | 55 |
| 10/09/06 | 25.0 | 7.82 | 7 | 66 | 0.538 | 0.538 | 0.575 | 30 | 371.23 | 245.00 | 682 | 59 |
| 08/18/09 | NF | | | | | | | | | | | 0 |
| 11/04/09 | 0.2 | 7.44 | 8 | 80 | 0.550 | 0.040 | 0.580 | 12 | 263 | 181.00 | 464 | 72 |
| 03/16/10 | 12.0 | 7.76 | 2 | 70 | 1.700 | 0.030 | 1.330 | 4 | 156 | 34.70 | 232 | 68 |
| | | | | | | | | | | | | |
| | | | | D-2334 | | D-8 | | | | | | |
| Date | Disc. | pH | Acid | Alk | Fe | Mn | AL | SS | Hard | So3 | SC | Net Alk |
| 01/09/06 | 12.0 | 7.96 | 6 | 90 | 0.111 | <0.01 | - | 17 | 170.69 | 63.60 | 320 | 84 |
| 02/20/06 | 14.0 | 7.67 | 4 | 86 | 0.340 | 0.012 | - | 7 | 109.28 | 30.40 | 227 | 82 |
| 10/09/06 | 12.0 | 7.92 | 4 | 116 | 0.333 | 0.024 | 0.388 | 3 | 182.9 | 77.40 | 380 | 112 |
| 08/18/09 | NF | | | | | | | | | | | 0 |
| 11/04/09 | NF | | | | | | | | | | | 0 |
| 03/16/10 | 9.0 | 7.81 | 2 | 84 | 0.980 | 0.020 | 0.820 | 8 | 183 | 53.30 | 283 | 82 |
| | | | | | | | | | | | | |
| | | | | D-2334 | | D-50 | | | | | | |
| Date | Disc. | pH | Acid | Alk | Fe | Mn | AL | SS | Hard | So3 | SC | Net Alk |
| 01/09/06 | 70.0 | 7.89 | 7 | 94 | 0.045 | 0.155 | - | 8 | 676.1 | 401.00 | 1038 | 87 |
| 02/20/06 | 75.0 | 7.93 | 5 | 103 | 0.051 | 0.187 | - | 13 | 657.18 | 498.00 | 1178 | 98 |
| 10/09/06 | 70.0 | 7.91 | 6 | 108 | 0.207 | 0.158 | 0.234 | 1 | 501.14 | 346.00 | 951 | 102 |
| 08/18/09 | 8.0 | 7.68 | 8 | 148 | 0.080 | 0.031 | 0.176 | 3 | 640 | 446.00 | 1311 | 140 |
| 11/04/09 | 10.0 | 8.01 | 6 | 154 | 0.110 | 0.200 | 0.160 | 1 | 842 | 64.30 | 1440 | 148 |
| 03/16/10 | 200.0 | 7.72 | 4 | 80 | 0.260 | 0.260 | 0.280 | 2 | 718 | 436.00 | 995 | 76 |
| | | | | | | | | | | | | |
| | | | | D-2334 | | U-4 | | | | | | |
| Date | Disc. | pH | Acid | Alk | Fe | Mn | AL | SS | Hard | So3 | SC | Net Alk |
| 01/09/06 | 4.0 | 3.75 | 99 | 0 | 0.230 | 9.250 | - | 9 | 528.89 | 513.00 | 1061 | -99 |
| 02/20/06 | 7.0 | 3.74 | 97 | 0 | 0.815 | 7.990 | - | 1 | 456.17 | 521.00 | 1005 | -97 |
| 10/20/06 | 2.0 | 3.62 | 129 | 0 | 1.410 | 9.910 | - | 1 | 504.61 | 743.00 | 1510 | -129 |
| 08/18/09 | NF | | | | | | | | | | | 0 |
| 11/04/09 | NF | | | | | | | | | | | 0 |
| 03/16/10 | 4.0 | 3.85 | 150 | 0 | 0.450 | 10.300 | 34.800 | 2 | 709 | 748.00 | 1241 | -150 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

111

| | | | | D-2334 | | U-50 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Disc. | pH | Acid | Alk | Fe | Mn | AL | SS | Hard | So3 | SC | Net Alk |
| 01/09/06 | 50.0 | 8.01 | 11 | 110 | 0.029 | 0.181 | - | 9 | 797.33 | 546.00 | 1272 | 99 |
| 02/20/06 | 50.0 | 7.92 | 7 | 106 | 0.028 | 0.229 | - | <1 | 770.97 | 618.00 | 1319 | 99 |
| 10/09/06 | 50.0 | 8.01 | 5 | 134 | 0.171 | 0.193 | 0.242 | 3 | 643.23 | 462.00 | 1169 | 129 |
| 08/18/09 | 6.0 | 7.76 | 8 | 150 | 0.065 | 0.048 | 0.184 | 2 | 658 | 509.00 | 1404 | 142 |
| 11/04/09 | 7.0 | 8.06 | 4 | 164 | 0.380 | 0.120 | 0.060 | 1 | 1030 | 87.80 | 1553 | 160 |
| 03/16/10 | 100.0 | 7.88 | 4 | 100 | 0.880 | 0.290 | 0.880 | 9 | 893 | 576.00 | 1218 | 96 |

# Exhibit I

## EXHIBIT I

## OXFORD PEABODY 3

| OXFORD MINING COMPANY, LLC (OHIO) USEPA Blacklisted 404 Permits Applications | |
|---|---|
| **Project Name** | Peabody 3 |
| **Permit Number** | LRH-2005-00421 |
| **SMCRA Number** | D-2295 |
| **Applicant name** | Oxford Mining |
| **NWP/IP** | IP |
| **Submittal Date:** | 2/27/2009; 11__/2009 |
| **Coordinate PN/PCN (Date)** | 3/20/2009; 12/30/2009 |
| **Days to Coordinate** | 22 |
| **Status Date (Issued)** | 6/9/2010 |
| **New or expansion (N/E)** | N |
| **Direct Mining Job Potential** | 57 |
| **Mine acres** | 888 |
| **Proposed Coal Extraction (tons)** | 1,168,978 |
| **Valley fills (#)** | 0 |


### ABSTRACT

Oxford originally submitted Individual Permit (IP) Application on February 27, 2009, after coordinating with the Corps on this project since 2005. On November 20, 2009 Oxford voluntarily withdrew the IP after it was agreed with the Corps that this was he best possible remedy, in order to advance this project as a result of EPA Enhanced Coordination. Oxford agreed to reduce impacts by relocating sediment ponds at increase mining cost out of natural drainage channels and to avoid springs emanating from the coal seam that contribute water to these natural drainage channels in order to obtain the permit. On June 9, 2010, the Corps issued the IP. In the final application (revised Min Deg II), Oxford agreed to avoid Stream PS-55 as EPA was not going to allow impacts as it was designated as a Class III perennial stream, although not located below the local water table. Oxford's plan called for recovering this coal by mining through streams 51 and 52 (only the upper 150 feet). As it turned out, the coal dipped into the avoidance area and made the mining impracticable. The total tonnage loss in these areas is 153,603 tons. This loss is directly attributed to the EPA.

The three remaining areas of coal loss are smaller in scale but represent the same issue. The coal crop was lower in elevation, making the lower extent untouchable as doing so would have affected jurisdictional waters. The total tonnage in these areas is 15,000 tons.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

WW-16J

May 15, 2009

U.S. Army Corps of Engineers
ATTN: CELRH-OR-FE
502 8th Street
Huntington, West Virginia 25701-2070

Re: Oxford Mining Company, LLC-Peabody III-UT to Two Mile Run / PN # LRH-2005-421-1

Dear Ms. Newman:

This letter responds to the subject public notice issued March 20, 2009 by the U.S. Army Corps of Engineers (Corps) in which Oxford Mining Company, LLC proposes modifications to permit # 200500421(Peabody III-UT to White Eyes Creek) authorized on August 1, 2008. The original permit allowed for impacts to 981 linear feet of perennial streams; 4,420 linear feet of intermittent streams; and 7,141 linear feet of ephemeral streams in association with mining activities on 424 acres of the 1400 acre Peabody III surface coal mine site (the site). The proposed permit modification includes impacts to an additional 6,033 linear feet of streams and .41 acres of wetland that are located within an 888.8 acre portion of the site. The total surface area that would be affected by the original and proposed mining activities is 1312.8 acres. The Peabody III surface coal mine site is located in Linton Township in Coshocton County, Monroe Township in Muskingum County and Knox Township in Guernsey County, Ohio.

As you know, the 404 (b) (1) Guidelines require the applicant to demonstrate there are no practicable alternatives available which would have a less adverse impact on the aquatic environment for non-water dependant activities. The guidelines presume that less damaging upland alternatives exist for these activities unless demonstrated otherwise by the applicant. The applicant must follow a sequence of steps to achieve compliance with the 404 (b) (1) Guidelines; which include avoidance, minimization, and compensation for unavoidable impacts. The United States Environmental Protection Agency is deeply concerned about the potential for serious impacts to the current hydrologic regime and ecological structure of Class III primary headwater habitat streams (PHWH) and Category III wetlands.

Streams 3, 18, 24, 27, 29, 32, 33, 40, 44, 49, 55, 64, 76, 81, 102, and 103 have been identified as perennial Class III PHWH streams by the Ohio Environmental Protection Agency (OEPA). Class III PWHW streams support aquatic communities specifically adapted to cold water systems. PWHW streams aid in nutrient control, sediment control, and flood control, transport of organic matter and aquatic organisms downstream, and regulation of base flow in larger streams within the watershed. Adverse impacts to high quality PHWH streams may compromise the ecological integrity of and hydrological connectivity to downstream waters. Approximately 2,790 linear feet of perennial Class III PHWH would be impacted for this project according to the information available to EPA.

Category III wetlands typically display unique, high-quality ecological values and functions. WL3, WL4, WL9, WL10, WL12 and WL18 have been designated by OEPA as Category III wetlands. EPA understands that all direct impacts to Category III wetlands have been avoided; however, secondary impacts such as fluctuations in hydrology and an increase in sediment and nutrient load could detrimentally affect these high quality resources.

Please be advised that Wills Creek (downstream Leatherwood Creek to mouth), OH05040005001, is listed on the 2008 303(d) list by the State of Ohio as an impaired water body. The cause of impairment to this segment of Wills Creek is siltation. A mining operation will likely increase the sediment load to Wills Creek-potentially causing further impairment. Just upstream of this segment of Wills Creek is segment OH05040005020 (headwaters to upstream Leatherwood Creek), which is impaired for metals (other than mercury), habitat alteration, pathogens, siltation and unionized ammonia. The information available indicates that the wetland/stream systems within and surrounding the downstream segment of Wills Creek are likely functioning to alleviate the loads of metal, pathogens, and ammonia to the downstream segment of Wills Creek. The proposed project would likely put the downstream segment of Wills Creek at risk for further impairment.

In conclusion, EPA is deeply concerned about further disturbance of the landscape and hydrology in an area where high quality wetlands and streams exist. We object to the issuance of a permit for the reasons mentioned above. Thank you for the opportunity to provide comments on this public notice. If you have any questions, please call Melissa Gebien of my office at

Sincerely,

Kevin Pierard, Chief
Watersheds & Wetlands Branch

cc: Ric Queen, OEPA

Opt-Out: [illegible]

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

APR 9 2010

REPLY TO THE ATTENTION OF:

**WW-16J**

U.S. Army Corps of Engineers, Huntington District
ATTN: CELRH-OR-FE
502 8th Street
Huntington, West Virginia 25701-2070

Subject: Oxford Mining Company, LLC / Peabody III –UT to Two Mile Run / PN # LRH-2005-421-1

Dear Ms. Mullins:

On March 20, 2009, the U.S. Army Corps of Engineers (Corps) issued a Public Notice in which Oxford Mining Company, LLC (Oxford) proposed modifications to permit # 200500421, Peabody III-UT to White Eyes Creek, authorized on August 1, 2008. The original permit authorized discharges to 981 linear feet of perennial stream, 4,420 linear feet of intermittent stream, and 7,141 linear feet of ephemeral stream in association with mining activities on 424 acres of the 1400 acre Peabody III surface coal mine site located in Linton Township in Coshocton County, Monroe Township in Muskingum County and Knox Township in Guernsey County, Ohio.

The proposed permit modification included an additional 6,033 linear feet of stream impacts and 0.41 acres of wetland impacts. The permit modification area encompassed approximately 888 acres of the 1400 acre Peabody III surface coal mine site. On May 15, 2009, the United States Environmental Protection Agency objected to the issuance of a permit for the project as proposed because of direct and indirect impacts to Class III Primary Headwater Habitat (PHWH), which support aquatic communities specifically adapted to cold water systems, and indirect impacts to Category III wetlands, which typically display unique, high-quality ecological values and functions. Ultimately, the applicant did not demonstrate avoidance and minimization of adverse aquatic impacts to the maximum extent practicable in the proposal, which is required by the 404 (b)(1) Guidelines.

On November 20, 2009, Oxford withdrew the pending Individual Section 404 application for the Peabody III modification area because of the concerns raised by state and federal agencies on impacts to Class III PHWH streams and Category 3 wetlands.

Oxford submitted a revised Individual Section 404 application to the Corps for the 888 acre Peabody III modification area, which was subsequently public noticed on December 30, 2009. EPA has reviewed this public notice, the revised 404 permit application dated November 2009, the Monitoring Plan dated January 29, 2010, and the revised Monitoring Plan dated February 4, 2010. The revised project as proposed would impact approximately 100 linear feet of perennial streams and 961 linear feet of intermittent streams for a total of 1,066 linear feet of stream impacts. Proposed stream impacts have been reduced by a total of 4,967 linear feet with the revised permit modification. Proposed impacts to Class III PHWH streams have been reduced from 2,790 linear feet to 100 linear feet. EPA appreciates the applicant's efforts to significantly reduce impacts to these valuable resources.

EPA offers the following comments based on our review of the revised documents:

To enhance avoidance and minimization efforts, EPA recommends the applicant avoid, where possible, mining through springs on site in order to maintain hydrology for both the reconstructed and avoided streams, as well as avoided wetlands. The avoidance of springs/hydrology sources, with certain exceptions, should be included as a special condition of the 404 permit. This is especially important for all Class III PHWH streams and Category III wetlands.

According to the monitoring plan, the applicant has agreed to perform biological monitoring and physical assessments prior to the initiation of mining activities to establish baseline conditions, during the mining activities to assist in determining potential impacts to aquatic habitat, and continuing at least five years after the completion of stream restoration and site reclamation activities at the mine site, where appropriate, to determine mitigation success. On February 4, 2010, EPA reviewed the January 29, 2010 Monitoring Plan and recommended that the applicant establish monitoring stations on stream IS-2 south of the confluence of IS-1 and IS-2 and Township Road 812, at the confluence of streams PS-53 and PS-55 and just upstream of the confluence of streams PS-33 and PS-41 on PS-33. On February 8, 2010, EPA received a copy of the revised monitoring plan which included the additional stations.

The applicant's revised mitigation proposal includes mitigation for 1,016 linear feet of stream impacts with the reconstruction and protection of all 1,061 linear feet of streams, and protection of an additional 532 linear feet of Class III PHWH streams in perpetuity with an environmental covenant. However, the proposal does not include many details on performance standards, success criteria or a conceptual mitigation schedule. It is critical that these be included in the final mitigation plan to ensure there is a means to measure and evaluate the success of the mitigation areas. Additionally, financial assurances and adaptive management should be addressed in the final mitigation plan. Ultimately, the mitigation plan must include more detailed information and meet the minimum requirements set forth in the 2008 Compensatory Mitigation Rule so that the Agencies may evaluate whether or not the mitigation will provide appropriate compensation for any unavoidable loss of functions and values before a 404 permit is issued.

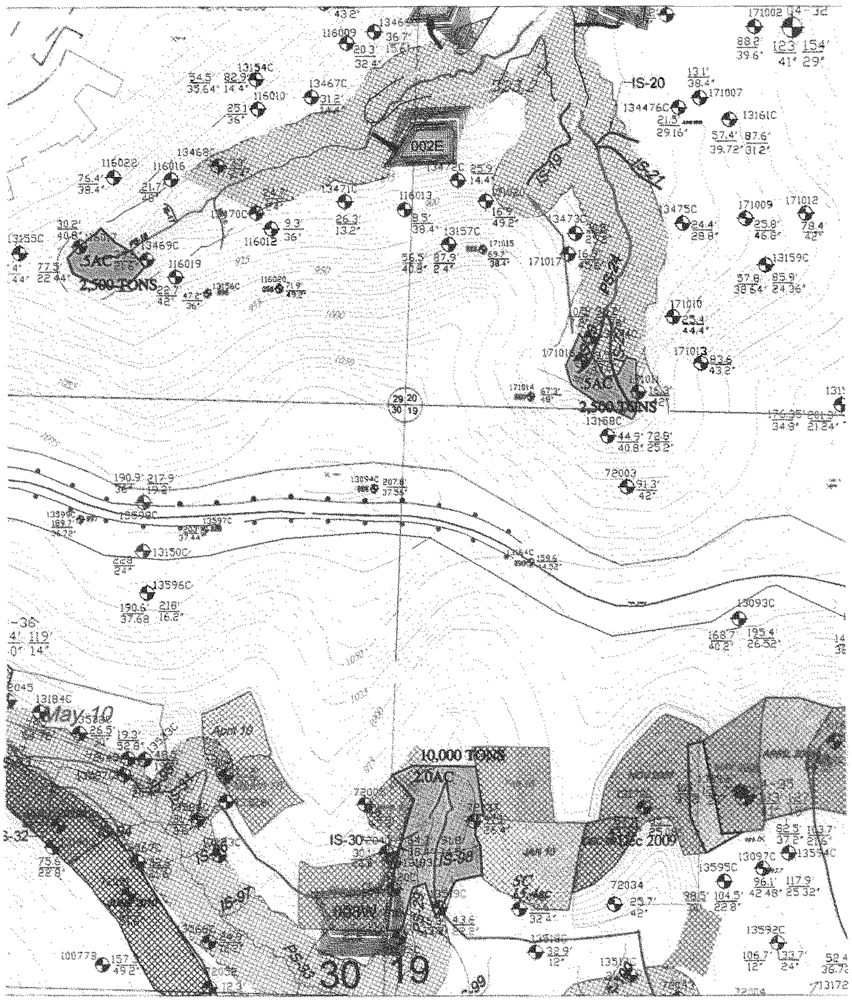
In conclusion, permit conditions should incorporate our comments on avoiding springs, biological monitoring, and mitigation details. Thank you for the opportunity to provide comments on this project. Please keep EPA apprised of the status of the permit and any major revisions. If you have any questions, or if we can be of further assistance, please contact I ' or Andrea Schaller Hilton at :

Sincerely,

For Tinka G. Hyde, Director
Water Division

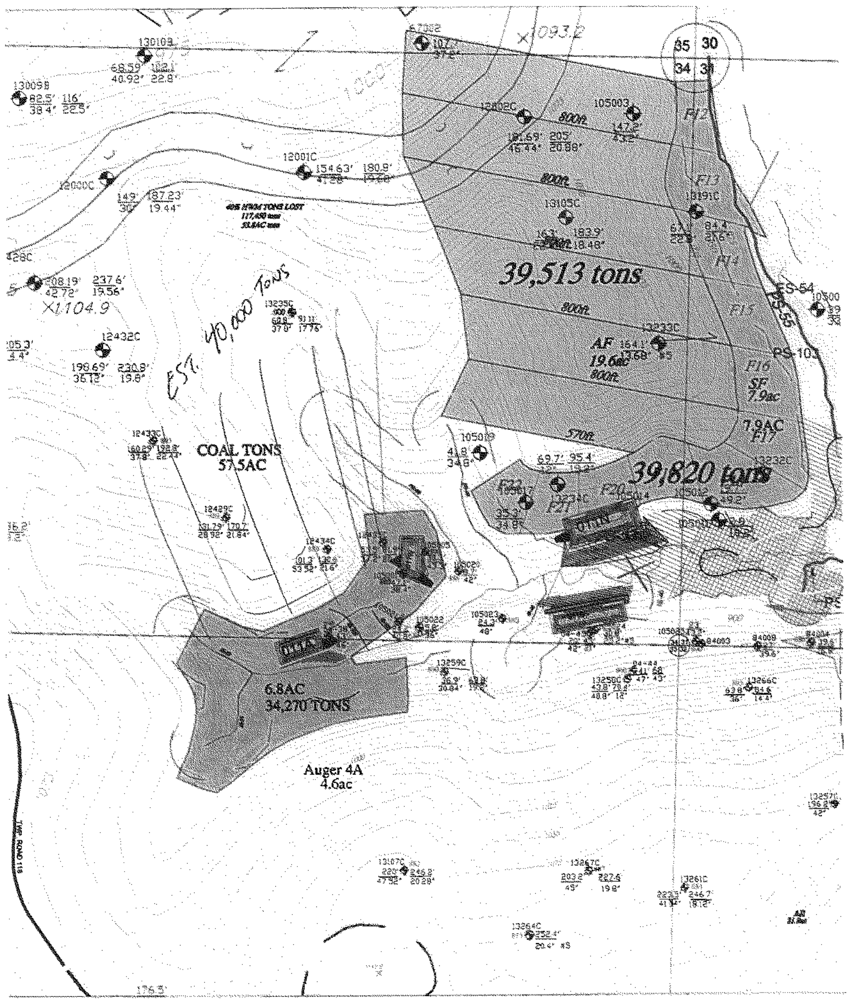
cc: Ric Queen, Manager
Ohio Environmental Protection Agency
Division of Surface Water
Lazarus Government Center
50 West Town Street, Suite 700
P.O. Box 1049
Columbus, Ohio 43216-1049

Mary Knapp, Field Supervisor
U.S. Fish and Wildlife Service
Reynoldsburg Ecological Services Field Office
6950-H Americana Parkway
Reynoldsburg, Ohio 43068


002E
IS-20
5AC
2,500 TONS
10,000 TONS
2.0AC
May 10
April 19
IS-30
IS-97
IS-98
Dec 2009
JAN 10
30
19



1" = 300'


39,513 tons
39,820 tons
EST. 40,000 TONS
COAL TONS
57.5AC
6.8AC
34,270 TONS
Auger 4A
4.6ac
AF
19.6ac
SF
7.9ac
7.9AC
800ft.
570ft.
×1093.2
×1104.9
35
30
34
31

I-8

1" = 300'

# Exhibit J

## EXHIBIT J

## ELLIS AREA

| OXFORD MINING COMPANY, LLC (OHIO) USEPA Blacklisted 404 Permits Applications | |
|---|---|
| **Project Name** | Ellis Area |
| **Permit Number** | LRP-2007-001180 |
| **SMCRA Number** | App 10399 |
| **Applicant name** | Oxford Mining |
| **NWP/IP** | IP |
| **Submittal Dates:** | 10/28/2008; 8/17/2010 |
| **Coordinate PN/PCN (Date)** | 2/10/2009; 4/22/2010 |
| **Days to Coordinate** | 106 |
| **Status Date (Issued)** | Uncertain |
| **New or expansion (N/E)** | N |
| **Direct Mining Job Potential** | 32 |
| **Remining (Y/N)** | Y |
| **Mine acres** | 470 |
| **Remining acres (% mining acres)** | 144 (30.6%) |
| **Pre-law Highwall to be reclaimed** | 13,890 feet |
| **Proposed Coal Extraction (tons)** | 848,000 |
| **Valley fills (#)** | 0 |

**ABSTRACT**

Individual Permit (IP) LRP 2007 001180. Coordinating with Corps commenced 2007. IP submitted October 28, 2008. There is no proposed Mountaintop Mining or Valley Fill. Oxford proposes to reclaim 2.63 Miles of dangerous highwall, and 144 acres previously mined and unreclaimed (31% of this 470 acre project) and restore the land to meet current SMCRA standards. This project is for a new mine with 32 direct mining jobs. On June 11, 2009, the project was Blacklisted by USEPA and subjected to Enhanced Coordination. On August 17, 2010, Oxford resubmits IP. On November 24, 2010, EPA further comments on IP to Corps raising original Enhanced Coordination concerns (avoidance; sediment ponds in streams), biological monitoring and new Enhanced Coordination concerns; Financial Assurance requirements and Protection of Mitigation Areas from Livestock. IP Issuance is uncertain due to continued Enhanced Coordination.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

NOV 24 2010

REPLY TO THE ATTENTION OF:

WW-16J

Scott A. Hans, Chief
Regulatory Branch
U.S. Army Corps of Engineers, Pittsburgh District
1000 Liberty Avenue
Pittsburgh, Pennsylvania 15222-4186

Re: Public Notice No. 10-57 / Ellis Area, Oxford Mining Company, LLC

Dear Mr. Hans:

The United States Environmental Protection Agency has reviewed the subject Public Notice (PN) and the associated Section 404 permit application for the Ellis Area project located approximately 2.5 miles southwest of Brilliant in Wells Township, Jefferson County, Ohio. According to the PN, the applicant proposes to strip and auger mine the No. 8, No. 8A and No. 9 coal seams within the 450.3 acre permit area which would result in impacts to 12,169 linear feet of perennial and intermittent tributaries to Blues Run and Rush Run and .03 acres of wetland. We offer the following comments based on our review of the documents provided and our November 10, 2010 site visit:

Background Information:

- The applicant refers to the reclamation of an abandoned mine land (AML) site that will improve water quality, however not much detail is provided regarding the reclamation. The applicant should provide details about all AML reclamation work that is proposed onsite and elaborate on anticipated water quality improvements onsite and directly downstream.

- The cumulative impacts analysis (CIA) includes Rush Run and other selected tributaries, however the CIA does not specify what other tributaries were evaluated. The CIA states that pre-SMCRA mining has impacted the watershed with high sediment loading, high metal loading, acid mine drainage (AMD) contamination, and reduced upland buffers. The applicant must detail how the proposed project will avoid causing or contributing to the impairment of the Rush Run and Blues Run watersheds. At a minimum, this assessment should discuss how the proposed operation, in conjunction with previous, current and reasonably foreseeable future operations, may affect the physical, chemical and biological integrity of the Blues and Rush Run watersheds.

Avoidance and Minimization:

- Where possible, the applicant must avoid mining through hydrology sources in order to maintain hydrology for both the reconstructed and avoided aquatic resources. Oxford does not discuss the avoidance of hydrology sources in detail in the application. The applicant should consider avoidance of Springs 2 and 6 which are major sources of hydrology for Stream 8 and 9. The applicant should also explore the feasibility of locating Pond 001 outside of Stream 8 and Pond 003 outside of Stream 1.
- The economic feasibility of transporting overburden/spoil to upland areas is discounted within the application, however no cost estimates are provided to support the statements made. Oxford should substantiate these statements to enhance the alternatives analysis.

Mitigation/Monitoring:

- The applicant proposes to reconstruct 12,169 linear feet of perennial and intermittent streams. A distinction must be made between the linear feet of perennial and intermittent channel that will be reconstructed.

- There are statements within the application that the surface mining will permanently impact several hydrology sources, i.e. springs and seeps, and that the original flow regime will return via manipulation of hydrology during reclamation. The applicant must detail how reconstructed mitigation reaches will achieve and maintain their intended flow regime.

- A construction schedule for completion of stream and wetland mitigation construction should be provided.

- Ecological performance standards must be provided for stream buffer and wetland vegetation.

- Wetland mitigation monitoring is only proposed in years 3 and 5 post construction. Wetland mitigation should be monitored biannually for a minimum of five years and monitoring data should be included in an annual report submitted to your office.

- As a part of the monitoring program for affected and reconstructed streams, biological monitoring is required to ensure there is no degradation to the communities that inhabit the streams. Biological monitoring, along with water chemistry and physical assessments, must occur prior to the initiation of mining activities to establish baseline conditions. During the mining activities, these assessments must continue and will assist in determining potential impacts to aquatic habitat and water quality downstream of the impacts. Finally, the assessments must continue for at least five years after the completion of stream reconstruction and site reclamation activities at the mine site where appropriate to determine mitigation success. The suite of monitoring requirements should be included in the conditions of the Section 404 permit.

- The adaptive management plan for mitigation needs to be more detailed. As stream reconstruction and AML reclamation are major components of the plan, it should be expanded to include a "strategy that anticipates likely challenges associated with compensatory mitigation projects and provides for the implementation of actions to address those challenges, as well as unforeseen changes to those projects (40 C.F.R. § 230.92)." Further, the applicant should also consider the risk associated with implementing the plan along with the complexity of the mitigation. Procedures should be established for identifying, reporting, and implementing remedial actions according to specific timelines, in the event they are necessary. The discussion about contingency actions in the permit application is vague as the applicant simply indicates that issues will be addressed as they arise. A greater level of pre-planning is needed to instill confidence that any remedial actions will be conducted appropriately and in a timely manner.

- The applicant must provide information regarding the Financial Assurances that will be provided and what form they will take. The mitigation rule provides that the "district engineer shall require sufficient financial assurances to ensure a high level of confidence that the compensatory mitigation project will be successfully completed." (40 C.F.R. § 230.93(n)(1))

- Long-term protection is not proposed for all mitigation areas. In order to receive mitigation credit for proposed stream and wetland mitigation, the mitigation areas must be protected in perpetuity. Long-term protection of the mitigation areas should be included as a condition of the Section 404 permit.

- The post mining land use will consist of prairie and grassland habitat. There are no details regarding how restored and preserved waters would be protected from potential livestock impacts. The Ohio River is impaired for dioxins and fecal coliform downstream of the project area. The applicant should take every precaution to avoid contributing further to said impairments.

If Oxford accepts our recommendations, we do not object to issuing the permit. As indicated by the preceding comments, a substantial amount of information must be provided to the Corps before an informed permit decision can be made. Please keep EPA apprised of any response to these comments. Feel free to contact Melissa Gebien at or Andrea Schaller at with any questions you may have.

Sincerely,

Peter Swenson, Chief
Watersheds and Wetlands Branch

cc: Rachel Taulbee, OEPA (via e-mail)
Jeromy Applegate, USFWS (via e-mail)
Tyler J. Bintrim, USACE-Pittsburgh District (via e-mail)
Scott Stiteler, ODNR-DMRM (via e-mail)

# Exhibit K

## EXHIBIT K

## GARRETT

## OTHER OXFORD CWA § 404 ENHANCED COORDINATION

| | |
|---|---|
| **Project Name** | Garrett |
| **Permit Number** | 2007-874 |
| **SMCRA Number** | App 10411 |
| **Applicant name** | Oxford Mining |
| **NWP/IP** | IP |
| **Submittal Date** | 2/18/2009 |
| **Coordinate PN/PCN (Date)** | 5/14/2009 |
| **Days to Coordinate** | 86 |
| **Status Date (Issue/Withdrawn/Pending)** | Pending |
| **New or expansion (N/E)** | N |
| **Direct Mining Job Potential** | 30 |
| **Remining (Y/N)** | Y |
| **Mine acres** | 583 |
| **Remining acres (% mining acres)** | 49.5 (8.5%) |
| **Pre-law Highwall to be reclaimed** | 3,741 feet |
| **Proposed Coal Extraction (tons)** | 880,000 |
| **Valley fills (#)** | 0 |

**ABSTRACT**

Garrett was overlooked from any list published by EPA, but did not escape Enhanced Coordination. The Individual Permit (IP) was submitted February 18, 2009, without any Mountatintop Mining or Valley Fill. Oxford proposes to reclaim 0.7 miles of dangerous highwall, 50 acres of previously unreclaimed mined land to current SMCRA standards. This is a new mine with 30 direct mining jobs. On September 2, 2010, after 15 months of Enhanced Coordination, in addition to previously raised environmental concerns of avoidance and biological monitoring, EPA raise new issue of financial assurance, ignoring SMCRA's performance bonding requirements, Adaptive Management Plans being used for additional mitigation requirement, and cumulative impacts. IP issuance uncertain due to Enhanced Coordination 4 years after first coordination with Corps and 2+ years after submittal of application.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

SEP - 2 2010

REPLY TO THE ATTENTION OF:
**WW-16J**

U.S. Army Corps of Engineers, Huntington District
502 Eighth Street
Huntington, West Virginia 25701-2070
ATTN: CELRH-OR-FE

Re: Public Notice No. LRH 2007-874 / Oxford Mining Company, Garrett Surface Mine

Dear Ms. Mullins:

The United States Environmental Protection Agency has reviewed the subject public notice issued on June 13, 2009, the 401 Water Quality Certification issued November 4, 2009, and other relevant documents associated with the proposed surface mining of an 583.7 acre site located in Clay Township, Tuscarawas County, Ohio. The project as proposed would impact approximately 9,820 linear feet intermittent streams, 2,715 linear feet of ephemeral streams and 0.49 acres of jurisdictional wetlands as a result of mining activities. The project involves the remining and reclaimation of 67.4 acres of pre-law mining on the site. EPA offers the following comments based on our review of the abovementioned documents:

**404(b)(1) Guidelines**

As you know, the Guidelines require that the applicant demonstrate there are no practicable alternatives available that would have a less adverse impact on the aquatic environment for non-water dependant activities. The Guidelines presume that less damaging upland alternatives are available for these activities unless demonstrated otherwise by the applicant. The applicant must follow a sequence of steps to be in compliance with the 404 (b)(1) Guidelines that include avoidance, minimization, and compensation for unavoidable impacts.

As proposed there are several detention basins within the stream channels. The application must relocate the new impoundments out of the stream channels where possible and remove all impoundments from the stream channels during reclaimation. As currently proposed the applicant has not adequately demonstrated avoidance and minimization efforts within the project boundary.

**Mitigation**

The applicant's revised mitigation includes mitigation for 12,535 linear feet of stream impacts with the reconstruction and long-term protection of 13,405 linear feet of streams. The 401 Water Quality Certification included many details on performance standards, success criteria and a conceptual mitigation schedule. Additionally, constructed or restored waters must meet the definition of waters of the United States under the Regulatory Program regulations applicable on the date of the nationwide permit authorization and are connected to a surface water tributary system of waters of the United States.

*Stream Monitoring*

Baseline biological stream data were not included in the public notice or other material reviewed. Baseline biological assessments must occur prior to the initiation of mining activities to establish baseline conditions, during the mining activities to assist in determining potential impacts to aquatic habitat immediately downstream of the operation, and must continue at least five years after the completion of stream reconstruction activities at the mine site where appropriate to determine mitigation success. In addition to biological monitoring, chemical and physical monitoring should be conducted at the same time and be included in the conditions of the Section 404 permit.

The parameters monitored must include conductivity, flow, pH, temperature, dissolved oxygen, iron, aluminum, selenium, TDS, TSS, Conductivity, Calcium, Potassium, Magnesium, Sulfate, Chloride, Sodium, and Total Alkalinity. It is recommended that this data minimally be taken with the appropriate level of physical and biological sampling on downstream compliance sites. The results should be analyzed every six months with a trend analysis. Any upward trend in conductivity or downward trend of biology would require a detailed rationale and possible implementation of a pre-approved adaptive management plan.

The biological monitoring plan should include multiple sampling stations using the qualitative methodology described in the Primary Headwater Habitat Manual (HHEI) and the Headwater Macroinvertebrate Field Evaluation Index (HMFEI). HHEI and HMFEI scores shall be reported in the annual monitoring reports. It is important that these standards be included in the mitigation plan to ensure there is a means to measure and evaluate the biological success of the mitigation areas.

*Financial Assurances and adaptive management*

Financial assurances and adaptive management should be addressed before the Section 404 permit is issued. Financial assurances for compensatory wetland and stream mitigation for 404 purposes are separate and distinct from those required by the Surface Mining Control and Reclamation Act (SMCRA). Oxford Mining should discuss details on the dollar amount, type(s) of assurance (ex. performance bond, letter of credit) and release conditions with the U.S. Army Corps of Engineers (Corps). Estimates of the planning, construction, monitoring, and maintenance costs of mitigation activities will be necessary. The Corps cannot evaluate whether the financial assurances are sufficient to cover potential mitigation inadequacies without this type of information. Ultimately, the mitigation plan must include more detailed information and meet the minimum requirements set forth in the 2008 Compensatory Mitigation Rule so that the Agencies may evaluate whether or not the mitigation will provide appropriate compensation for any unavoidable loss of functions and values.

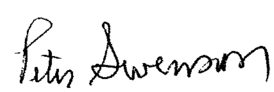
**Cumulative Impacts**

Post mining land use includes the conversion of 578.9 acres from undeveloped to grazing land. This sub watershed of the Tuscarawas River is listed on the State of Ohio's 303(d) list with impairments due to habitat alteration, metals (other than mercury), organic enrichment, pathogens, and sediment. Unrestricted access to creeks by livestock is listed as one of the sources of impairments in the watershed. This project would convert 578.9 acres of land to grazing land use; EPA requests the applicant provide measures to protect the water resources onsite site and the watershed from further degradation. As you know the Guidelines require the proposed project must not cause or contribute to further impairment of the water resource.

Currently, there are at least eight Surface Coal Mining Section 404 permits being reviewed or recently issued within the Tuscarawas Watershed. Due to the current volume and proximity of these projects to one another in an impaired watershed, EPA is concerned about the cumulative impacts to the chemical, physical and biological integrity of the watershed. Collectively, these projects would impact over 24,000 linear feet of stream and approximately 2.5 acre of wetland impacts, and convert 920 acres of forested lands into grazing lands.

Please consider these comments prior to issuance of a permit for the proposed project. Thank you for the opportunity to provide comments on this project. Please keep me apprised of the status of the permit and any major revisions. If you have any questions, or if we can be of further assistance, please contact Andrea Schaller at Melissa Gebien at .

Sincerely,



Peter Swenson, Chief
Watersheds and Wetlands Branch

cc: Ohio EPA, Division of Surface Water, Environmental Mitigation & Special
Permitting Section
Attn: Ric Queen, Manager
Lazarus Government Center
50 West Town Street
P.O. Box 1049
Columbus, Ohio 43216-1049

Mary Knapp, Field Supervisor
U.S. Fish and Wildlife Service
Reynoldsburg Ecological Services Field Office
6950-H Americana Parkway
Reynoldsburg, Ohio 43068

Scott Stiteler, Ohio Deparment of Natural Resources
Division of Mineral Resources Management
2045 Morse Road, Building H-3
Columbus, Ohio 43229

# Exhibit L

**EXHIBIT L**

**OXFORD WEST - RUSH TWP APPLICATION**
**USEPA CWA SECTION 402 INTERFERENCE**

**Abstract:** On July 26, 2010 Ohio EPA denies Oxford West CWA §402 General Coal NPDES Permit based on Draft USEPA funded studies, by USEPA researchers conducted not in Ohio, but West Virginia. Correspondence dated August 27, 2010 from Oxford to Governor Strickland seeking assistance in having Ohio EPA issue existing Coal General NPDES, previously approved by USEPA in February, 2009. Oxford submits Individual NPDES application never before used for surface coal mining operations on September 20, 2010.

Other USEPA Enhanced Coordination interferences with West Coal General NPDES continue from January 24, 2011 through February 8, 2011 and document in accompanying email highlight EPA's lack of understanding of basic engineering and design of surface coal mining and wastewater treatment and discharge facilities and inability to perform basic map reading and interpretation.

On March 3, 2011, Ohio EPA backtracked and issued the West Coal General NPDES permit after 10 months of Enhanced Coordination, 14 months after submittal of what was previously a routine authorization of a valid existing permit.

Oxford
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Reliability Matters

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August 27, 2010

Governor's Office
Riffe Center
77 South High Street
Columbus, OH 43215-6108

Re: Request for Intervention with Ohio EPA's denial of coverage under Ohio's NPDES general permit for surface coal mining operation (NPDES coal general permit #OHR000003)

Dear Governor Strickland:

I am once again writing with a personal plea for your leadership to help Oxford Mining Company, LLC keep our 600+ Ohio coal miners employed and producing over 6 million tons of Ohio coal as a low-cost energy source to fuel our economic recovery. Recently, your director of environmental protection denied our request for initial coverage under Ohio's NPDES coal general permit #OHR000003 for surface coal mining operations for a new mine we proposed to open in Tuscarawas County (see the accompanying OhioEPA denial letter dated July 26, 2010).

The purported bases for this unprecedented action are the following two studies cited only by reference to a USEPA website (see the accompanying copy of the USEPA website page where such studies can be accessed under "EPA Office of Research & Development Scientific Reports"):

- The Effects of Mountaintop Mines and Valley Fills on Aquatic Ecosystems of the Central Appalachian Coalfields (*External Review Draft*)
- A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams (*External Review Draft*)

Governor Strickland, these studies at face value are draft reports performed in the Central Appalachian Coalfields (not the Northern Appalachian Coalfields of Ohio), have not been subject to the level of rigorous scientific review required to alter decades of permitting practice in Ohio and cannot possibly form a rational basis for denying coverage under Ohio's NPDES coal general permit. There is no alleged imminent threat to Ohio water quality that can only be addressed by an individual NPDES permit as implied by the director's action.

The inappropriate action in this regard was the director's attempt to impose specific monitoring requirements under §402 of the federal Clean Water Act (the "CWA") as special conditions of the state's water quality certification under §401 of the CWA. By reason of Oxford exercising its lawful right to object to the director's inappropriate use of authority under §401 of the CWA, the director has wrongfully sought to exact retribution by denying coverage under Ohio's NPDES coal general permit.

In the interest of full disclosure, I must inform you that Oxford has appealed the director's misguided action to the Environmental Review Appeals Commission in order to protect its right to coverage under Ohio's NPDES coal general permit. We will also be pursuing an individual NPDES permit application. However, we have no idea how long either process will take.

Oxford simply cannot afford further delays in obtaining all of the required permits to open a new mine and bring more high-paying, well-benefitted, private sector jobs to the most economically depressed part of Ohio where, I dare say, unemployment is even higher that the statewide average of nearly 10%. In my past 37 years of industry experience we have always received the NPDES coal general permit upon issuance of the Ohio Department of Natural Resources mining permit, which we would expect to be issued early next year.

I implore you to work with us to restore the utility of Ohio's NPDES coal general permit. We need more certainty, not less certainty, in the processing of coal mining permit applications in order for us to be able to plan and invest in our business so that our miners can continue working to expand the economic recovery. To that end, we would welcome the opportunity to meet with you, your staff, Director Korleski and Department of Development Director Lisa Patt-McDaniel to discuss this critical issue as soon as practical.

Please do not hesitate to contact me should you have any questions or require additional information in advance of such meeting. I thank you in advance for your consideration.

Sincerely,

Oxford Mining Company, LLC

Charles C. "Chuck" Ungurean
President and Chief Executive Officer

Enclosures

cc (w/encl): Jen Lynch (via email:
Lisa Patt-McDaniel
Chris Korleski (via email:
Michael T.W. Carey
Michael B. Gardner

OhioEPA

State of Ohio Environmental Protection Agency

STREET ADDRESS:
Lazarus Government Center
50 W. Town St., Suite 700
Columbus, Ohio 43215

TELE: (614) 644-3020 FAX: (614) 644-3184
www.epa.state.oh.us

MAILING ADDRESS:
P.O. Box 1049
Columbus, OH 43216-1049

July 26, 2010

Richard Smith
Oxford Mining Company, LLC
P.O. Box 427
Coshocton, Ohio 43812

Dear Mr. Smith:

Re: Oxford West Mine, Rush Township, Tuscarawas County

As a result of Oxford Mining's decision **not** to accept chemical-specific monitoring conditions in its 401 certification for the proposed "West" mine, I am returning the enclosed Notice of Intent (NOI). You will need to apply for an individual NPDES permit.

Please refer to EPA's website www.epa.gov/owow/wetlands/guidance/mining.html. Once on the website please click on the link entitled: "EPA Office of Research & Development Scientific Reports" and then review the first two reports. These reports in conjunction with federal regulation 40 CFR 122.44 support the need for chemical-specific monitoring in addition to the requirements contained in Ohio's NPDES general permit for coal surface mining activities (NPDES permit # OHR000003). Therefore, coverage under the general permit is inappropriate.

Also enclosed are federal application Forms 1-General Information, 2C-Wastewater Discharge Information (intended for existing discharges), and 2D-New Sources and New Discharges. In order for an initial individual NPDES permit to be drafted and processed, you must first submit Form 1 and 2D. Form 2D requires you provide an estimated daily maximum and average for certain pollutants, listed in the form's instructions. It also requires that within 2 years of when the mine begins discharging that items V (Intake and Effluent Characteristics) and VI (Potential Discharges Not Covered by Analysis) of Form 2C be completed and submitted.

If you would prefer, we would accept your completing Form 2C for an existing mine where the discharge characteristics are expected to be representative of the proposed mine; thereby, negating the need to submit Form 2D. In addition to the parameters requiring sampling/estimates per Form 2C/2D's instructions, respectively, U.S. EPA is requiring the same information be provided for total dissolved solids, specific conductance, and chloride under the authority of 40 CFR 122.21.

Richard Smith
Re: Oxford West Mine, Rush Township, Tuscarawas County
July 26, 2010
Page Two

If you have any questions regarding this letter, please contact Paul Novak at
or via e-mail at

Sincerely,

George Elmaraghy, P.E., Chief
Division of Surface Water

cc: Kevin Pierard, U.S. EPA-Region 5
John Husted, Ohio Department of Natural Resources-MRM
Brian Hall, Division of Surface Water
Paul Novak, Division of Surface Water
Ric Queen, Division of Surface Water

OhioEPA

# Notice of Intent (NOI) For Coverage Under Ohio Environmental Protection Agency General Permit

(Read accompanying instructions carefully before completing this form)

Submission of this NOI constitutes notice that the party identified in Section I of this form intends to be authorized to discharge into state surface waters under Ohio EPA's NPDES general permit program. Becoming a permittee obligates a discharger to comply with the terms and conditions of the permit. Complete all required information as indicated by the instructions. Forms transmitted by fax will not be accepted. A check for the proper amount must accompany this form and be made payable to "Treasurer, State of Ohio." (See the fee table in Attachment D of the NOI instructions for the appropriate processing fee)

## I. Applicant Information/Mailing Address

Company (Applicant) Name: Oxford Mining Company, LLC

Mailing (Applicant) Address: P.O. Box 427

City: Coshocton State: OH Zip Code: 43812

Contact Person: Richard Smith Phone: Fax:

Contact E-Mail Address:

## II. Facility/Site Location Information

Facility Name: West

Facility Address/Location:

City: State: Zip Code:

County(ies): Tuscarawas Township(s): Rush

Facility Contact Person: Phone: Fax:

Facility Contact E-Mail Address:

Quarter: Section(s): 21 & 22 Range:

Receiving Stream or MS4: Tuscarawas River (via Crooked Creek and Stillwater Creek)

If aware of a state nature preserve within 1,000 feet of the facility/site, check here: ☐

Enter river code here, if discharge is to a river designated scenic, wild, or recreational, or to a tributary within 1,000 feet (see instructions):

General Permit Number: OHM000003 Coal Surface Mining Activities Initial Coverage: ☒ Renewal Coverage: ☐

Type of Activity: Coal Surface Mining Activities Fee = $200

SIC Code(s):

Existing NPDES Permit Number:

ODNR Coal Mining Application Number: 10420

| Outfall | Design Flow (MGD) | Latitude | Longitude |
|---|---|---|---|
| 001 | | 40° 17' 45.19" | 81° 21' 21.12" |
| 002 | | 40° 17' 56.73" | 81° 21' 15.73" |
| 003 | | 40° 18' 06.26" | 81° 21' 26.51" |
| 004 | | 40° 18' 05.43" | 81° 21' 40.13" |

**For Ohio EPA Use Only**

Check ID (OFA): 503402

Person:

Place:

DOC #: 377030

ORG #: 102786

Rev. ID #: 745908

Other DSW Permits Required:

Proposed Project Start Date (MO DY YR): 06/01/10 Estimated Completion Date: (MO DY YR): 06/01/15

Total Land Disturbance (Acres): 125.6 MS4 Drainage Area (Square Miles):

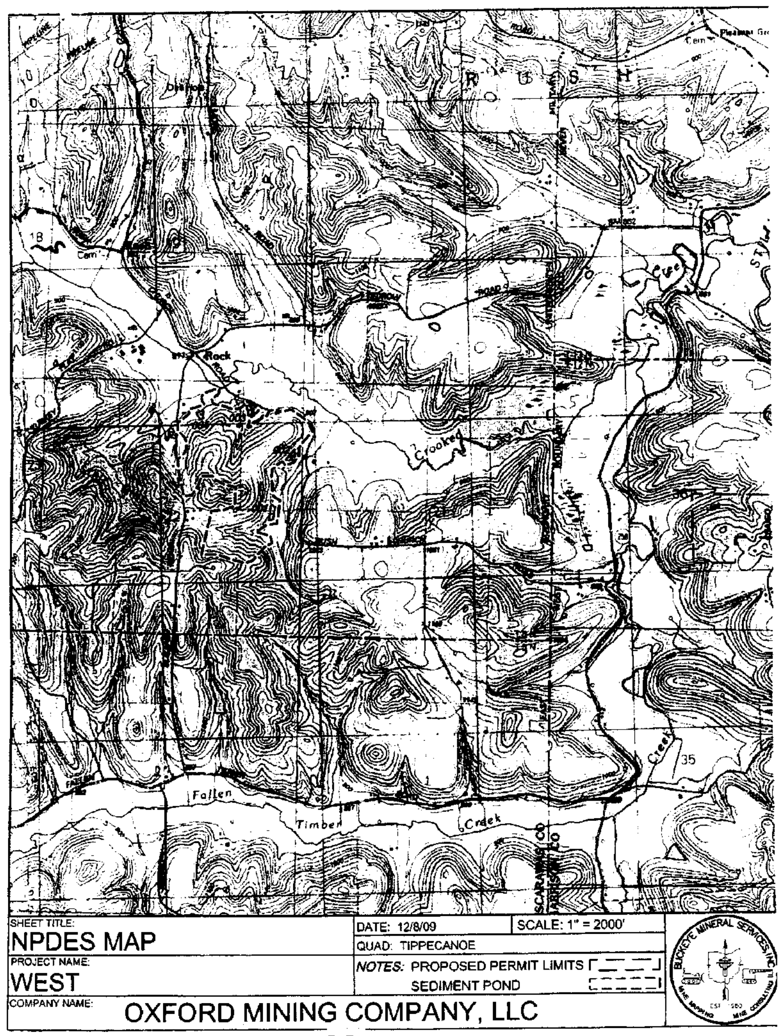
Payment Information: Check # 039293 Check Amount: $200 Date of Check: 12/18/09

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Applicant Name: R. Wayne Light Title: Permit Coordinator

Applicant Signature: R. Wayne Light Date: 12/22/09

EPA 4494 (Rev. 1/08) FOR CONSTRUCTION STORM WATER, ATTACH LOCATION MAP Click to clear all entered information CLEAR


Rock
Crooked
Fallen
Timber
Creek
35
SHEET TITLE:
NPDES MAP
PROJECT NAME:
WEST
COMPANY NAME:
OXFORD MINING COMPANY, LLC
DATE: 12/8/09
SCALE: 1" = 2000'
QUAD: TIPPECANOE
NOTES: PROPOSED PERMIT LIMITS
SEDIMENT POND

Rrc said keep on hold, 5/13/10

Page 1 of 24

NPDES Permit No.: OHM000003

Issuance Date: November 24, 2008

Effective Date: March 1, 2009

Expiration Date: 5 years after effective date

## OHIO ENVIRONMENTAL PROTECTION AGENCY

## GENERAL PERMIT AUTHORIZATION TO DISCHARGE WASTEWATER AND STORM WATER FROM COAL SURFACE MINING ACTIVITIES UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended (33 U.S.C. 1251 et. seq., hereafter referred to as "the Act"), and the Ohio Water Pollution Control Act (Ohio Revised Code Section 6111), discharges of waste water, as defined in Part I.B. of this permit, are authorized by the Ohio Environmental Protection Agency, hereafter referred to as "Ohio EPA", to discharge from the outfalls at the sites and to the receiving waters identified in the applicant's Notice of Intent (NOI) on file with Ohio EPA in accordance with the conditions specified in Parts I through VI of this permit.

It has been determined that a lowering of water quality of various waters of the state associated with granting coverage under this permit is necessary to accommodate important social and economic development in the State of Ohio. In accordance with OAC 3745-1-05, this decision was reached only after examining a series of technical alternatives, reviewing social and economic issues related to the degradation, and considering all public and intergovernmental comments received concerning the proposal.

Granting of permit coverage is conditioned upon payment of applicable fees and submittal of the Notice of Intent form. Permit coverage is effective only after the applicant receives written notice from the Director that coverage is granted.

This permit and the authorization to discharge shall expire at midnight on the expiration date shown above. In order to receive authorization to discharge beyond the above date of expiration, the permittee shall submit such information and forms as are required by the Ohio EPA.

Laura H. Powell
Assistant Director

I certify this to be a true and accurate copy of the official documents as filed in the records of the Ohio Environmental Protection Agency.

By: Date: 11/20/08

DRAFT
DO NOT CITE OR QUOTE

EPA/600/R-10/023A
March 2010
External Review Draft

# A Field-based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams

**NOTICE**

This information is distributed solely for the purpose of predissemination peer review under applicable information quality guidelines. It has not been formally disseminated by the U.S. EPA. It does not represent and should not be construed to represent any Agency determination or policy.

National Center for Environmental Assessment
Office of Research and Development
U.S. Environmental Protection Agency
Washington, DC 20460

J. N. Am. Benthol. Soc., 2008, 27(3):717–737

DOI: 10.1899/08-015.1
Published online: 8 July 2008

# Downstream effects of mountaintop coal mining: comparing biological conditions using family- and genus-level macroinvertebrate bioassessment tools

Gregory J. Pond[1], Margaret E. Passmore[2], Frank A. Borsuk[3], Lou Reynolds[4], AND Carole J. Rose[5]

*Region 3, US Environmental Protection Agency, 1060 Chapline Street, Wheeling, West Virginia 26003 USA*

**Abstract.** Surface coal mining with valley fills has impaired the aquatic life in numerous streams in the Central Appalachian Mountains. We characterized macroinvertebrate communities from riffles in 37 small West Virginia streams (10 unmined and 27 mined sites with valley fills) sampled in the spring index period (March–May) and compared the assessment results using family- and genus-level taxonomic data. Specific conductance was used to categorize levels of mining disturbance in mined watersheds as low (<500 μS/cm), medium (500–1000 μS/cm), or high (>1000 μS/cm). Four lines of evidence indicate that mining activities impair biological condition of streams: shift in species assemblages, loss of Ephemeroptera taxa, changes in individual metrics and indices, and differences in water chemistry. Results were consistent whether family- or genus-level data were used. In both family- and genus-level nonmetric multidimensional scaling (NMS) ordinations, mined sites were significantly separated from unmined sites, indicating that shifts in community structure were caused by mining. Several Ephemeroptera genera (e.g., *Ephemerella, Epeorus, Drunella*) and their families (Ephemerellidae, Heptageniidae) were correlated most strongly with the primary NMS axis ($r > 0.59$ for these genera; $r > 0.78$ for these families). These same Ephemeroptera were absent and, thus, eliminated from most of the mined sites. Total Ephemeroptera richness and relative abundance both declined with increasing mining disturbance. Several other metrics, such as richness, composition, tolerance, and diversity, clearly discriminated unmined vs mined sites. Most family-level metrics performed well and approximated the strength of genus-based metrics. A genus-based multimetric index (MMI) rated more mined sites as impaired than did the family-based MMI. Water-quality variables related to mining were more strongly correlated to NMS axis-1 scores, metrics, and MMIs than were sedimentation and riparian habitat scores. Generally, the correlations between the genus-level MMI and water-quality variables were stronger than the correlations between the family-level MMI and those variables. Our results show that mining activity has had subtle to severe impacts on benthic macroinvertebrate communities and that the biological condition most strongly correlates with a gradient of ionic strength.

**Key words:** bioassessment, coal mining, macroinvertebrates, specific conductance, Ephemeroptera, multimetric index, taxonomic resolution.

Many studies have shown that coal mining activities negatively affect stream biota in nearly all parts of the globe (e.g., Lewis 1973a, b, Scullion and Edwards 1980, Winterbourn and McDiffett 1996, Garcia-Criado et al. 1999, Kennedy et al. 2003). Acidic coal mine drainage (pH < 6) and associated water-quality degradation have been studied the most extensively of all effects (e.g., Herlihy et al. 1990, Maltby and Booth 1991, Winterbourn and McDiffett 1996, Verb and Vis 2000, Cherry et al. 2001, DeNicola and Stapleton 2002, Freund and Petty 2007). In the northern Appalachians and Allegheny Plateau, certain coal strata have higher S content than other strata and tend to cause acidic mine drainage. Some coal mining activities routinely produce acidic mine drainage, but mountaintop mining (MTM) in the steep terrain of the Central Appalachian coalfields of Kentucky, Virginia, and West Virginia generally results in alkaline mine drainage

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[5] rose.carole@epa.gov

* * *

-----Original Message-----
From: Pierard Kevin [mailto.
Sent: Monday, January 24, 2011 1:35 PM
To: Nate Leggett
Cc:
Subject: NPDES Oxford West - Rush twp

Nate - We have reviewed the information provided with the NOI for this proposed operation and supplemental information provided by OEPA. We still have some questions that I think may be most efficiently addressed by Oxford. Would it be possible to talk with you this week? I have 9 to 1 open on Wednesday and 8 - 10 on Thursday (central time) if either of those times work for you. Please let me know.

thanks

* * *

From: Nate Leggett
To: Kevin Pierard/R5/USEPA/US@EPA
Date: 01/24/2011 01:11 PM
Subject: RE: NPDES Oxford West - Rush twp

Kevin,
Yes, I can make myself available for a discussion on our pending West NOI. Let me know if 11:00 on Wednesday will work out for you. Also, let me know what you want to talk about so I can better prepare for the discussion. Thanks.

* * *

-----Original Message-----
From: Pierard Kevin [mailto:I
Sent: Monday, January 24, 2011 2:43 PM
To: Nate Leggett
Cc:
Subject: RE: NPDES Oxford West - Rush twp

Thanks Nate - 10 central (11 eastern) on Wednesday works. We have questions concerning sediment pond design. It seems the ponds are intended to control sediment but we need to confirm. Pond monitoring and maintenance procedures. Residence time and flow rates. Effluent monitoring information including effluent sampling and monitoring locations. Information on the overflow spillway including design capacity, expected flow, and monitoring during overflow. Those are a few items we wanted to discuss so we have a better understanding of the project. Please call my direct number

* * *

From: Nate Leggett
To: Kevin Pierard/R5/USEPA/US@EPA
Date: 01/25/2011 08:32 AM
Subject: RE: NPDES Oxford West - Rush twp

Kevin,
I apologize, but I am not going to be available for the call tomorrow.
The consultant in charge of preparing the ODNR ponds (who was going to join the call as he prepared the pond designs), is not available. Also, is this going to be the normal protocol for a coal operator to obtain a State of Ohio permit? I'm all for problem solving and open lines of communication, but I didn't see where the OEPA was going to be involved with the call. Any info in this regard would be appreciated. Thanks.

Nate

* * *

-----Original Message-----
From: Pierard Kevin [mailto:
Sent: Tuesday, January 25, 2011 11:15 AM
To: Nate Leggett
Cc:
Subject: RE: NPDES Oxford West - Rush twp

Nate - We discussed this site with OEPA and had several questions for them which caused them to gather more information I believe from DNR and from Oxford. The information we got resulted in additional questions.
We discussed with Paul but he did not have answers to our questions readily available. Paul indicated that he would not have any problem with us going directly to you with our questions, and in previous communications between us you had offered to help with any questions we may have. This approach reduces the burden on OEPA and improves our timeliness. I will invite Paul and his staff to participate when we get the call set up.

This is not a normal protocol for us. We have reviewed many NOI's and worked with OEPA to address any questions that we have, but I believe this is the first where we are communicating directly with the company.
I have more experience in the 404 arena where we have routinely worked directly with companies on specific projects. This has worked very well and led to a better understanding of environmental and business issues and concerns in the mining sector and allowed us to work collaboratively to address these on a site by site basis. I expect we will do more of this in 402 as part of our ongoing oversight of the Ohio program and commitment to assist Ohio. This approach reduces costs and improves quality while not significantly impacting timeliness of permit decisions.

Look forward to talking with you about Oxford West. I still have Thursday 8-10 central open if that helps otherwise I am generally available any day next week.

* * *

From: "David Longfellow" <c
To: Krista McKim/R5/USEPA/US@EPA
Date: 01/27/2011 01:39 PM
Subject: NPDES Oxford West - Rush twp

Attached is a reference page from one of my wastewater manuals showing how detention time (residence time) is calculated. It is the pond (tank) volume times the flow period divided by a flow volume for the same flow period.

I have revised the Pond Design document to correct a typo and to reflect the results from the attached calculations. The detention time for the 10 year 24 hour storm event has actually increased to 11.53 hours (see calculation sheet).

The Pond Design document you presently have lists a detention time for the 1 year 6 hour storm as 50 days. That is a typo and should have been 50 hours. When this was calculated, we assumed that the 1.5 inches of rain occurred over a 24 hour period so a time factor of 24 times the pond volume was used in the initial calculation. After reviewing this information we have decided to go with a more conservative approach and use a time factor of 6 to match the storm event. After correcting the storm time factor to 6, drops the detention time down to 13.887 hours (see calculation sheet).

I hope this helps to clear this issue up. If not, please feel free to get back in touch with me.

David Longfellow
Buckeye Mineral Services, Inc.
P.O. Box 546
New Philadelphia, Ohio 44663
d

[attachment "Pond Design 5.pdf" deleted by Krista McKim/R5/USEPA/US] [attachment "WWTPCalculationsBook3.09 Detention time.pdf" deleted by Krista McKim/R5/USEPA/US] [attachment "Detention Time Calculations.pdf" deleted by Krista McKim/R5/USEPA/US]

* * *

**From:**
**Sent:** Tuesday, February 01, 2011 3:40 PM
**To:** David Longfellow
**Subject:** Re: NPDES Oxford West - Rush twp

Dear Dave,

Thank you for the additional information and the new documents. I'm glad we spoke last week as it did help to clear up some of our questions. However, I do have some more questions for you if you don't mind.

Can you tell me the size of the watershed for Pond 001? I think this will help me to follow the calculations, as the design document lists only the peak flows.

As I read the drawing, the water level during the 10 yr, 24 hr event is 916 ft elevation, but the document lists a peak elevation of 917.6 feet for the same storm event. Is flow somehow restricted at the spillway in order to cause the waterlevel to reach 1.6 ft above the spillway elevation?

I would think your capacity is the same regardless of the storm event - whatever the available storage is between 916 and 913 feet. However, the document states that the capacity is higher for the 10 yr, 24 hr storm than for the 1 yr, 6 hr storm - so I think the numbers in the document are the capacity that is expected to be consumed for the different storm events. What is the available storage between 913 and 916 ft?

Thanks,
Krista

Krista McKim, PE
Environmental Engineer
NPDES Programs Branch, Water Division
US Environmental Protection Agency
Region 5, WN-16J
77 W Jackson Blvd
Chicago, IL 60604

* * *

**From:** David Longfellow [n com]
**Sent:** Tuesday, February 01, 2011 8:27 PM
**To:**
**Cc:** Nate Leggett
**Subject:** RE: NPDES Oxford West - Rush twp

The answers to your questions follow. If you have any other, just get back with me.

Can you tell me the size of the watershed for Pond 001? 64.543 acres (SedCAD Page 4)

As I read the drawing, the water level during the 10 yr, 24 hr event is 916 ft elevation, but the document lists a peak elevation of 917.6 feet for the same storm event. This is what happens when you get in too big of a hurry. The drawing you have should indicate "Water Level at 1 year 6 hour storm event 916 elev". Normal water level is 913, the 1 yr, 6 hr peak is 916, 10 yr, 24 hr peak is 917.6, 25 yr, 24 hr peak is 917.99.
Is flow somehow restricted at the spillway in order to cause the waterlevel to reach 1.6 ft above the spillway elevation? No flow restrictions, just drawdown pipe.

I would think your capacity is the same regardless of the storm event - whatever the available storage is between 916 and 913 feet. However, the document states that the capacity is higher for the 10 yr, 24 hr storm than for the 1 yr, 6 hr storm - so I think the numbers in the document are the capacity that is expected to be consumed for the different storm events. (Capacities are listed on SedCAD page 6) @913 = 2.124 ac ft, @916 = 3.613 ac ft, @917.6 = 4.567 ac ft, top of dam @919 = 5.499 ac ft.

What is the available storage between 913 and 916 ft? 3.613 ac ft – 2.124 ac ft = 1.489 ac ft

David Longfellow
Buckeye Mineral Services, Inc.
P.O. Box 546
New Philadelphia, Ohio 44663
n

* * *

**From:** McKim Krista [mailto:]
**Sent:** Tuesday, February 08, 2011 9:54 AM
**To:** Nate Leggett
**Subject:** Oxford West NPDES discharges and monitoring locations

Hi Nate,

Thanks for checking in. I was just talking with Scott McWhorter from 404 about this project.

Would you be able to locate the NPDES monitoring points on one of your maps - I am looking right now at the "Application/Hydrology Map" which locates SMCRA sampling points but not NPDES sampling locations. Also this map does not depict flow out of the ponds. Is this shown on a different map? We would like to see flow out of the ponds depicted on a map.

The pond drawing that was emailed to me also does not locate the NPDES sampling points. We would like to see, in detail, where the NPDES sampling points will be.

Thank you,
Krista

Krista McKim, PE
Environmental Engineer
NPDES Programs Branch, Water Division
US Environmental Protection Agency
Region 5, WN-16J
77 W Jackson Blvd
Chicago, IL 60604

* * *

**From:** Nate Leggett
**Sent:** Tuesday, February 08, 2011 10:24 AM
**To:**
**Subject:** RE: Oxford West NPDES discharges and monitoring locations

The designated monitoring location for pond discharge is at the discharge point. Depending on the type of pond design, it will either be directly from the pipe or in the open channel directly downstream of the slope toe. These sampling points are not shown on the map as it is understood that a point source discharge will be sampled at the point source.

I guess I don't understand the need to show flow out of the pond. If it does discharge, it will flow from the pipe or open channel.

# Exhibit M

## EXHIBIT M

## OXFORD ELK RUN AND EAST CANTON APPLICATIONS
## USEPA CWA §402 INTERFERENCE

**Abstract:** Elk Run and East Canton are two separate mining projects discussed collectively to illustrate the point that EPA has taken Enhanced Coordination to interfere with Ohio EPA lawfully issuing its Coal General NPDES permit where the Corps had previously Corps determine there were no jurisdictional waters of the US for purposes of the Clean Water Act Section 404. Attached are email communications highlighting between Ohio EPA and USEPA Region 5 inquiring if Ohio can still issue General NPDES Permits. Email exchanges September 29, 2010 through October 18, 2010. Ohio EPA concluded that it could not issue the Coal General NPDES permit and that Oxford needed to submit Individual NPDES permit applications. Ultimately, Ohio EPA reversed its position and issued the General NPDES Permits in October 25, 2011, 3 months after denying Oxford's West Coal General NPDES permit as a result of Enhanced Coordination.

>>> Nate Leggett

I hate to be a pest about these two jobs, but I need to know about the NPDES permits for Elk Run and East Canton. Please let me know whenever you get a chance. Thanks.

Oxford
Resource Partners
Reliability Matters

Nate Leggett

P
C 7
F
E n

PO Box 135
Strasburg, OH 44680

www.oxfordresources.com



* * *

**From:** Brian Hall [mailto:
**Sent:** Thursday, September 30, 2010 8:44 AM
**To:** Nate Leggett
**Cc:** Ric Queen
**Subject:** Re: NPDES

Nate

We understand your need to continue to ask for status updates. I left a voice mail with the US EPA Region 5 yesterday asking if Ohio could issue general NPDES permits to the two sites. The response I got back was that they are working with the Corps and they are trying to move them along.

We have a conference call with Region this afternoon and issuing these permits will be on the agenda. You are welcome to send me an email or phone me tomorrow for the results of our call with them today.

Brian

Brian W Hall, P.E.
Assistant Chief
Ohio Environmental Protection Agency
Division of Surface Water

* * *

>>> Nate Leggett < 9/30/2010 9:28 AM >>>

Since when does the Corps have input on the NPDES process? This process makes no sense at all. Let me know when you anticipate the call ending, or just email me an update when it's over. Thanks.

* * *

**From:** Brian Hall [mailto:
**Sent:** Thursday, September 30, 2010 9:56 AM
**To:** Nate Leggett
**Subject:** RE: NPDES

The Corps doesn't, but I think the US EPA is trying to confirm the Corps JD for the sites. We all knows what happens when there are too many cooks in the kitchen.

* * *

>>> Nate Leggett < > 9/30/2010 10:30 PM >>>

Brian,
Hope the conference call went well. When you get a chance, please let me know the outcome as these NPDES permits have the potential to hold up some high priority jobs. Thanks.

Nate

* * *

**From:** Brian Hall [mailto
**Sent:** Friday, October 01, 2010 8:27 AM
**To:** Nate Leggett
**Cc:** Ric Queen
**Subject:** RE: NPDES

Nate

The Region is still reviewing the proposals. I guess that Watershed and Wetland Branch of the Office of Water needs to do a little more follow up on the Corps JD letters.

http://www.epa.gov/r5water/org.htm

I explained that you are really hoping that these can be issue. Kevin Pierard, Chief of the NPDES Program Branch is willing to talk to you about these projects. Kevin's phone number is and email is

I suggest that you contact him to see what concerns they still have.

Brian

* * *

>>> Nate Leggett <                                        10/12/2010 4:14 PM >>>

Any updates on the general NDPES applications for Elk Run or East Canton? I spoke with Kevin Pierard last week (or the week before) and he was having a few of his staff review some info the Corps was forwarding to him. I was just wondering if you'd heard anything. Thanks.

Oxford
Resource Partners
Reliability Matters

Nate Leggett

P 3
C 7
F
E n
PO Box 135
Strasburg, OH 44680
www.oxfordresources.com



* * *

**From:** Brian Hall [mailto
**Sent:** Wednesday, October 13, 2010 1:39 PM
**To:** Nate Leggett
**Cc:** Paul Novak; Ric Queen
**Subject:** Re: NPDES

Nate

We talked with Region 5 and got direction on the NPDES permits. We have to brief Director Korleski before we can discuss. The Director had a medical procedure late last week and hasn't been in the office. He should be in tomorrow or Friday. We will review with him and then I'll give you a call.

Brian

* * *

>>> Nate Leggett < 10/13/2010 1:41 PM >>>

Brian,
I don't know if you'll be able to tell me or not, but is the general permit still applicable for these jobs? If not, please tell me so we can exercise other options. Thanks for the update.

Nate

* * *

**From**: Brian Hall [mailto:
**Sent**: Wednesday, October 13, 2010 02:06 PM
**To**: Nate Leggett
**Subject**: RE: NPDES

Sorry Nate. We have to talk to the Director first. As soon as I can I'll let you know what's going on.

* * *

**From:** Nate Leggett
**Sent:** Friday, October 15, 2010 11:12 AM
**To:** '
**Subject:** Re: NPDES

Once you speak with the Director and are able to contact me, please let me know about the pending 402 applications. Thanks.

* * *

>>> Nate Leggett < '0/18/10 8:50 AM >>>

Just a reminder for a follow up. Let me know if there is an update on these pending 402 applications. Thanks Brian.

* * *

**From:** Brian Hall [mailto:
**Sent:** Monday, October 18, 2010 4:31 PM
**To:** Nate Leggett
**Subject:** Re: NPDES

Nate

Just confirming that George Elmaraghy talked to someone at Oxford (sorry been out of the office, not sure who he talked to) about the need to submit individual NPDES permit applications for East Canton and Elk Run. This was based on direction from Region 5 and their concern with 402 discharges into impaired receiving waters. Determination of the impairment is based on discharging into the Little Sandy/Black Creek (05040001 06 04, 05040001 06 03) watershed and the Brushy Fork (05040001 14 02) watershed.

More information about the impairments can be found in Ohio's 2010 Integrated Water Quality Report.

http://wwwapp.epa.ohio.gov/dsw/ir2010/basin.php

Hope you understand that we needed the Director's input before contacting Oxford.

Brian

* * *

# Exhibit N

**EXHIBIT N**

**DARON CONSOL**
**CWA §404 USEPA ENHANCED COORDINATION;**
**SECONDARY EFFECTS ON CORPS DECISION-MAKING**

**Abstract:** USEPA undue influence and scrutiny of Corps CWA §404 permitting resulted in denial of an ordinary request for permit modification to extent the time required for construction activities that would not have resulted in any additional impacts to water resources or any decision adverse to the public interest. Original 404 permit was submitted as an Individual 404 Permit ("IP") to avoid USEPA induced controversy over previously issued General Nationwide Permit 21 ("NWP 21") for surface coal mining activities, that would have been covered this project with an automatic 5 year term. This was one of the first IPs issued by the Corps Huntington District for surface coal mining activities and was erroneously issued with a three-year term that was overlooked by all until discovered in December 2010 more than a year after the original term had expired. The original term of three years was manifestly unreasonable for a 1,700-acre mining project when issued, juxtaposed against a concomitantly issued IP for Oxford's Cole mine, a 400-acre project issued with a five-year term. This reasonable request could have easily been addressed by simply fixing the original error and granting a minimum 5-year term that automatically applied to the NWP 21 permits for which this IP was substituted. Instead Oxford has no practicable alternative but to unnecessarily resubmit an application for a 404 permit for the same project that was approved by the Corps in 2006.

**DEPARTMENT OF THE ARMY**
HUNTINGTON DISTRICT, CORPS OF ENGINEERS
502 EIGHTH STREET
HUNTINGTON, WEST VIRGINIA 25701-2070

MAR 2 4 2011

Regulatory Branch
OR-FE
LRH-2004-1249-UT Standingstone Fork

Mr. Nathan Leggett
Oxford Mining Company
544 Chestnut Street
Post Office Box 547
Coshocton, Ohio 43812

Dear Mr. Leggett:

This letter is in response to your February 4, 2011 request for extension of time for Department of Army individual permit LRH-2004-1249-UT Standingstone Fork. The individual permit was issued August 21, 2006 authorizing impacts to 9,154 linear feet of stream, 15.19 acres of wetlands and 41.24 acres of open water impoundments associated with the Daron-Consol Mine Site located in Cadiz, Harrison County, Ohio. The time limit for completing the work authorized expired on December 31, 2009.

The terms and conditions of the individual permit were accepted by the applicant as indicated by the signature on the permit document. General Condition 1 of the permit states the expiration date of the permit and the procedure to request a time extension prior to that expiration date.

As the permit authorization has expired, the applicant is no longer authorized for work in jurisdictional waters of the United States. The applicant must submit a new permit application for any proposed impacts to jurisdictional waters of the United States associated with the above referenced permit area. The proposal will be processed in accordance with 33 CFR 325: Processing of Department of the Army Permits to include a 30 day public notice period.

If you have any questions, please contact M

Sincerely,

Ginger Mullins
Ginger Mullins
Chief, Regulatory Branch

Oxford
Resource Partners

Reliability Matters

February 4, 2011

41 South High Street
Suite 3450
Columbus, OH 43215-6150

Mrs. Sheila Newman
Department of the Army
Corps of Engineers, Huntington District
Dillon Dam Office, 4969 Dillon Dam Rd.
Zanesville, OH 43701

***VIA Email:***

RE: Daron Consol – Ohio Division of Mineral Resources Management Permit D-2277
Individual §404 Permit No. UNTrib Standingstone Fork - 200401249
Request for Extension of Time – Construction Period

Dear Mrs. Newman:

On August 21, 2006, the Huntington District Corps of Engineers issued an Individual Clean Water Act §404 Permit (IP) to Oxford Mining Company (Oxford) for surface coal mining operations at its Daron Consol mine, authorizing dredge and fill activities in waters of the United States (attached). This IP contained a construction period for completing the work or authorized activities that ended on December 31, 2009. This date, established by the issuing official, did not provide a reasonable time for completing the work or authorized activities, contrary to 33 CFR 325.6(c).

Immediately upon discovering this circumstance, you contacted me and on January 10, 2011, I submitted a request for extension of time for the authorization or permit. My letter to you dated January 10, 2011 is hereby rescinded and should be replaced by this request enclosed.

Oxford hereby requests an extension of time limit of the construction period, which ended December 31, 2009, until December 31, 2015. The basis for the request is the unreasonable time period provided by the issuing official for a mine of ~1700 acres with 9514 l.f. of jurisdictional streams, which is contrary to 33 CFR 325.6(c). The time limit of the construction period in the permit was only 2 years and 4 months. As of December 13, 2010, nearly a year after that limit ended, only ~2/3 of the wetland and ~1/4 of the stream impacts have occurred (see, Project Status Report, attached). The unreasonableness of the time limit provided is underscored by the fact that an IP was issued for Oxford's Cole mine (~400 acres with 5331 l.f. of stream) on August 22, 2006 (the day after the Daron Consol IP was issued) by the same issuing official with a construction period that ended on December 31, 2011 (*see*, IP No. Un Trib Tuscarawas River 200400434-1, attached). A five-year construction period is the least amount of time that should have been authorized. Five years is as long of a construction period as was provided by the former NWP-21 that the IP process superseded and further illustrates the unreasonableness of this time limit. Every other IP issued to Oxford for mines of similar size and similar impacts as Daron Consol contained a time limit out at least five years from the year of issuance.

For the foregoing reasons, Oxford expects that this request will be granted as to do so would not be contrary to the public interest (*see*, 33 CFR 325.6(d)). Therefore, Oxford considers that the construction period is continuing (*Id.*).

{OXF-0188.5}

Mrs. Sheila Newman
February 4, 2011
Page 2

Further, Oxford has every reason to expect that this request will be processed in accordance with the regular procedures of 33 CFR 325.2, except that public notice is not required because there have been no significant changes in the attendant circumstances since the authorization was issued (*Id.*).

Oxford regrets not having submitted this request at least one month before the time limit of the construction period ended, in accordance with General Condition 1 (GC1). As a matter of fact, Oxford only recently realized that it needed additional time to complete the authorized activities and proceeded with all dispatch to request an extension of time.

Under all of the attendant circumstances regarding the unreasonableness of the time limit in GC1 described above, and with Daron Consol being one of the first IPs issued to Oxford for activities previously eligible for coverage under a nationwide permit, Oxford trusts that the Corps will view any lack of strict adherence to GC1 at most as excusable neglect and grant the requested extension of time to complete the authorized activities. Please accept our apology for any undue inconvenience.

However, and more importantly, Oxford considers that IP No. UNTrib Standingstone Fork - 200401249 continues in effect until the work or authorized activities are completed, which is when the permit/ authorization would automatically expire, unless modified, suspended or revoked (see, 33 CFR 325.6(a)). Any contrary position would be an extreme and unwarrantable penalty for the lack of strict adherence to a permit general condition as well as untenable.

Consider a situation where Oxford completed the work within the allotted time limit, commenced monitoring and ultimately it was determined that more work was required after the time limit had elapsed. What would be the Corps' position or response? Certainly not that the authorization expired; only the period authorized for completing the work. In response to a request for an extension of time after-the-fact that the time limit had lapsed, one would reasonably expect the Corps to either allow the work to proceed informally under the valid and existing authorization or formally grant the request and modify the term of the construction period. Such a grant of an extension of time would not be contrary to the public interest nor would the public interest be further served by a public notice.

If you have any questions or would like additional information regarding these matters, please feel free to contact me. Thank you for your consideration.

Sincerely,

OXFORD MINING COMPANY, LLC

Nathan L. Leggett
Environmental Compliance Manager

Enclosures

cc: Charles C. Ungurean
Meg Smith, Corps Regulatory Branch Chief

{OXF-0188.5}

**The Environmental Council of the States**
Subcommittee on Water Resources and Environment
Hearing on EPA Mining Policies: Assault on Appalachian Jobs

Summary:

States object to US Environmental Protection Agency's (EPA) practice of combining "interim guidance" with "objection authority" which is being used for Clean Water Act requirements associated with mountain top removal mining. There are many problems with this new technique, not the least of which is that it forces state environmental agencies to violate either federal law or their own state laws. States believe EPA's practice is contrary to the Administrative Procedures Act and is bad public policy. By using "interim" guidance, EPA insulates itself from court review because courts routinely reject cases that are filed based on interim actions by saying that the action is not final. Fortunately, EPA can easily remedy our objection by finalizing its guidance and making it judicially reviewable.

For more information please contact:

Teresa Marks, Secretary-Treasurer
Environmental Council of the States (ECOS)

Testimony:

I am testifying on behalf of the leaders of the state and territorial environmental agencies that are the members of the Environmental Council of the States (ECOS). I am the current Secretary-Treasurer of ECOS, and the director of Arkansas' Department of Environmental Quality.

The reason I am testifying is to let this committee know that the states and ECOS are concerned about the manner in which the US Environmental Protection Agency (EPA) is combining "interim guidance" with its "objection authority" powers. This combination creates a situation in which EPA can require a state to insert virtually any provisions EPA wants into a permit, without the benefits of the due process procedures of the Administrative Procedures Act (APA), such as public comment and judicial review. This practice is unwelcome and is potentially dangerous. It obviously thwarts the cooperative procedures that the APA was designed to foster. Fortunately, from the states' point of view, the solution is simple and one which we have often expressed to EPA: finalize your guidance before you ask states and the regulated community to implement it.

The states' environmental agencies operate nearly all of the permitting, inspections, enforcement, monitoring, and data collection, (and some of the standard setting as well) on behalf of EPA, through the system commonly called "delegation." As of April 2011, EPA has delegated to the states 50 of the 50 state air programs, 49 of the 50 state drinking water programs, 46 of the 50 state water permitting programs, and 48 of the 50 hazardous waste programs[1]. States also operate many other smaller programs on behalf of EPA, such as radon, lead abatement, beaches, pesticides, etc.

The states' relationship with EPA is often termed "co-regulator." This is because EPA and the states share the responsibility of putting the nation's environmental laws into practice. Through our delegated programs the states are the primary regulators in permitting and enforcement actions, with EPA exercising oversight to insure that the states are correctly and consistently applying the nation's environmental laws.

The usual way EPA conducts its role is to issue rules to carry out the federal law. It may also issue guidance to assist the states and regulated entities in the implementation and interpretation of those rules. EPA also may (and does) review state-issued permits and may, under the Clean Water Act (CWA or "the Act"), "object" to a state-issued permit that it believes does not conform to EPA's interpretation of the Act. This latter action is referred to as "objection authority."[2]

ECOS and the states have no general concern about the use of "guidance" or "objection authority." EPA has issued guidance for many years, and so do most states. Guidance that is poorly crafted, or exceeds the agency's authority has always been dealt with on a case by case basis. Also, EPA routinely includes disclaimers on its guidance documents reassuring the states and the regulated community that the guidance does not impose legally binding requirements.[3]. The CWA specifically allows EPA to use objection authority in the permitting process[4] and states do not object to the use of this

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[1] *Delegation by Environmental Act*, ECOS, November 2010. http://www.ecos.org/section/states/enviro_actlist

[2] States are notified and given a fixed time to change a permit's "conditions" (i.e., requirements) in order to comply with EPA's objection. If a state is unable or unwilling to change the permit, EPA may (and does) take control of the permit and the state-issued permit is no longer in effect. EPA may then issue the permit with the terms it seeks, or hold it for further study. See footnote 4 for details.

[3] *Detailed Guidance: Improving EPA Review of Appalachian Surface Coal Mining Operations under the Clean Water Act, National Policy Act, and the Environmental Justice Executive Order.* (April 1, 2010). "The CWA and NEPA provisions and regulations described in this document contain legally binding requirements. **This guidance does not substitute for those provisions or regulations, nor is it a regulation itself. It does not impose legally binding requirements on EPA, the U.S. Army Corps of Engineers (Corps), the States, or the regulated community**, and may not apply to a particular situation depending on the circumstances. Any decisions regarding a particular permit will be based on the applicable statutes, regulations, case-specific facts and circumstances, and case law. Therefore, interested persons are free to raise questions about the appropriateness of the application of this guidance to a particular situation, and EPA and/or the Corps will consider whether or not the recommendations or interpretations of this guidance are appropriate in that situation based on the statutes, regulations, and case law." (emphasis added)

[4] Clean Water Act, Section 402 (d)(2) "if the Administrator within ninety days of the date of transmittal of the proposed permit by the State objects in writing to the issuance of such permit as being outside the guidelines and requirements of this chapter. Whenever the Administrator objects to the issuance of a permit

power in principle. Although the states do not necessarily have a problem with either the use of "guidance" or the use of "objection authority" as separate, non-connected tools, mandating the use of guidance through the exercise of objection authority creates a binding final agency action without benefit of the due process requirements of the Administrative Procedures Act.

Although it may choose to do so, the EPA is not required to publish non-binding guidance nor is it required to accept public comments on such guidance. Therefore, the EPA may choose to issue interim guidance and expect full implementation in the permitting process regardless of the disclaimer language issued with the guidance or the fact that the guidance has not been finalized. Guidance, by the way, is seldom reviewed by the Office of Management and Budget and so is usually issued directly from the agency without further executive oversight.

EPA produces a rule in a similar fashion, only with many more steps and definitely with public comment opportunities. Although EPA will readily admit that it cannot, in theory, compel compliance with guidance -final or otherwise - it is a clear matter of law that it cannot mandate compliance with a rule until it is "final" and published as such in the Federal Register.

ECOS does not believe that EPA has ever attempted to require states to implement "interim guidance" until recently. No state can implement interim guidance for the following two reasons: 1) a state may have a law that says their rules cannot be more stringent than the federal government's rule. Since an "interim guidance" is not final, it is always interpreted within a state as "not yet in effect" and so the state cannot implement it. The second case is: 2) a state without such a stringency law would instead have to issue the guidance itself. Since EPA never finished an "interim" guidance, the state would find itself defending a proposal that even EPA had not decided to complete. The justifications for such an action within a state would be thin. Even if a state decided to proceed, it would have to follow its own administrative procedures for issuing rules and it could not implement such guidance legally until the state had completed that process.

Requiring states to implement interim guidance puts each state in the position of deciding whether it will break federal law or state law. At the very least, this should be a good enough reason why a federal agency should never ask a state to implement something that is not final. However, the problem for states does not end with this dilemma.

EPA's regular use of its "objection authority" contributes to the marginalization of a state-delegated program. ECOS believes that the "objection authority" was intended to be used rarely and to prevent cases which were not routine – not as a tool to conduct micromanagement of a state program. In fact, the objection authority power has been

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under this paragraph such written objection shall contain a statement of the reasons for such objection and the effluent limitations and conditions which such permit would include if it were issued by the Administrator."

rarely used, although it is difficult to obtain data on its frequency. We suggest the Committee ask the agency to supply this data. Kentucky environmental agency leaders told ECOS that it could only recall two or three instances of its use since the program had been delegated in the 1970s. By regularly using the objection authority, EPA leaves a state in the position of issuing a permit that has no value (since its likely to face an objection) and therefore a regulated entity is left wondering where to turn to get its permit. Should it approach EPA directly, or continue to work with the state? Furthermore, a regulated entity is left to defend each of its permits separately – the certainty of understanding the permitting process is gone.

Finally, there is the matter of how courts treat any federal action that is not "final." In short, courts routinely decline to review cases based on a request to rule on a guidance, rule, or action that is not "final." Because EPA has issued an "interim guidance" we might expect that a court would decline to review it. Courts also refuse to rule on permits that have not yet been issued, since there is no final agency action. So, if EPA objects to a state-issued permit because EPA asserts that the permit does not comply with interim guidance, but then EPA does not act on the permit, no court is likely to review the case. This means that EPA has created a system where it can stop a permit but not be held accountable for its actions in court.

We hope that the committee can see why the issuance of interim guidance which is mandated in fact through the use of objection authority is an unfair and indefensible position in which to place the states and the regulated community, and must not be allowed to continue.

**Dr. Leonard K. Peters**

**Secretary**

**Kentucky Energy and Environment Cabinet**

**Before the House Committee on Transportation and Infrastructure**

**Subcommittee on Water Resources and Environment**

**May 5, 2011**

Mr. Chairman, members of the committee, thank you for the opportunity to testify today. My name is Len Peters, and I am secretary of Kentucky's Energy and Environment Cabinet, the state's executive branch agency that has been delegated by the federal government primacy over environmental protection and coal mine permitting programs. The cabinet's mission also includes development of the state's energy resources in an environmentally responsible manner, including implementing programs for energy efficiency and renewable energy.

In October of last year, the Commonwealth of Kentucky intervened in support of the Kentucky Coal Association in its lawsuit against the U.S. Environmental Protection Agency. The grounds for the state's intervention differed somewhat from the Kentucky Coal Association's. Specifically, we took this very unusual step because we strongly believe the EPA's objections to recent proposed draft permits for Clean Water Act 402 permits for surface mining operations in Kentucky were arbitrary. The U.S. EPA, since April 1, 2010, when it issued its "Interim Final Guidance," is requiring Kentucky's regulators to adhere to permitting conditions that have not been promulgated through proper administrative protocols in line with the federal Administrative Procedures Act. Specifically, in our complaint, the Commonwealth of Kentucky contends that, notwithstanding the States' delegation under the Clean Water Act in developing water quality standards, and without promulgating a standard through required notice and comment procedures, EPA has since April 1, 2010, unlawfully reviewed, and objected to, 402 permits proposed for coal mining operations in six Appalachian states, including Kentucky, for compliance with an unpromulgated water quality standard for conductivity.

I'll give a little background on the situation specific to Kentucky. Between December 21, 2009, and March 18, 2010, EPA issued comment letters on 29 individual draft Clean Water Act 402 coal permits proposed by the Cabinet's Division of Water. In response to EPA's comments and after extensive discussions with EPA, the Division of Water included additional requirements in the draft permits. EPA did not object to the revised draft permits, and the permits were issued beginning in March 2010. Then, on April 1, 2010, EPA issued its "Final Interim Guidance" for Appalachian coal mining operations in six states seeking to establish new Clean Water Act permitting requirements regarding in-stream conductivity. A little more than a month later, EPA issued Interim Objection letters on 11 of Kentucky's Clean Water Act 402 coal permits drafted by the Division of Water, despite the fact that these permits were drafted ***in the same manner as those permits issued immediately prior to the April 1 guidance***

***that were deemed acceptable by EPA at that time.*** The Interim Objection letters referenced the April 1 guidance.

We responded to EPA's interim objections, stating that they were improper and instead they should be treated as comments to the permits. EPA replied to this response by taking the full 90 days to review the permits as allowed under law. On September 16, 2010, EPA issued its first formal specific objection letters. The agency has received 21 formal specific objection letters since September 16, 2010. Kentucky has since provided revised draft permits or permit actions to EPA with a request of a public hearing in response to each of these EPA specific objection letters. Resolution of this issue is still pending before EPA.

I'd like to point out that in its guidance documents, EPA acknowledges that, "coal is an essential part of our energy future" and that the EPA is "committed to an Appalachian economy that provides coal mining jobs within a strong, diverse, and sustainable Appalachian regional economy." However, the agency's actions since it issued the April 1 guidance are inconsistent with this assertion because we are faced with continuing uncertainty, and this uncertainty directly affects the business operations of coal companies and supporting industries.

As someone responsible for overseeing the state's environmental protection programs, I am by no means opposed to regulations necessary to protect our land, air, and water resources. We can and must do all that is reasonably possible to protect our environment and the lives and health of our citizens. At the same time, environmental permitting is not designed to stop legitimate business activities, but rather to ensure they are done in accordance with existing laws and regulations. Regulators and the regulated community need certainty in the process. In Kentucky, coal mining employs 18,000 people, brings in more than three and a half billion dollars from out-of-state each year, and pays more than a billion dollars in direct wages. Kentucky is the third largest coal producing state. And our low electricity rates, based on our primary production of electricity from coal, allow us to produce a large share of the nation's stainless steel, aluminum, automobiles, and other manufactured goods. It is for these reasons that Kentucky's Governor, Steve Beshear, reminds us that coal is not a local issue, it's not a state issue, it's a national issue; and the importance of coal to our nation's economy and security cannot be overstated.

Coal can be and is being mined in an environmentally responsible manner—we continue to make improvements, and the industry has been willing to do things better. Coal production and use has an environmental impact—all sources of energy production and use have an impact—but existing laws and regulations are in place to minimize impacts and to reclaim mined land. That is why it is disconcerting to us that EPA has applied a specific water quality standard (that is, conductivity) to Appalachian coal mining—a standard that was based on, in our minds and in the minds of others, incomplete science. That EPA did not establish a Science Advisory Board to look into the science until after they started using the standard to object to permits is additionally troubling. Because of the variability and inconclusiveness of the data, establishing appropriate conductivity standards to protect water quality requires additional research, a point made, in fact, by the EPA's Science Advisory Board in its March 25, 2011, report.

Thus, we do not agree with the method (the issuance of interim final guidance) nor do we, quite frankly, agree with the certainty of the science. We filed suit against EPA on the method, and we are engaged in ongoing discussions with EPA and others on the science. From a regulatory viewpoint, we are concerned that "interim guidance" is not a legally defensible policy for the states or EPA, yet it is still being used as a basis to object to state-delegated permitting actions. Any guidance (interim or final) that goes beyond the scope of existing statutory or regulatory authority should not be imposed by EPA without having gone through the appropriate congressional or regulatory processes.

Furthermore, as a regulatory agency, we are concerned about interim guidance on conductivity standards for another reason—EPA is assuming that one size fits all regarding a numeric standard, as opposed to a narrative standard, which each of the Appalachian states affected by the EPA guidance has in place to meet the specific geographic conditions of the respective states. The scientific understanding of the water quality impacts from conductivity are still evolving, and it may be that, in fact, one size does not fit all.

There are many discussions regarding states' rights on this and other regulatory issues. Governor Beshear and I recognize and respect that EPA has a responsibility and obligation to revise and update regulations and program requirements as necessary to protect human health and the environment. However, EPA should not create new regulatory requirements that have not undergone the appropriate congressional or rulemaking processes. As it is, today EPA is preventing, through its objection process, the delegated states from issuing permits, with no recourse for the states or the regulated community.

I'll reiterate comments we made to ECOS on this issue: "EPA has insulated itself from judicial review in making formal objections to proposed permit actions by delegated states, and can therefore object to permits based on reasons that have not undergone the formal rulemaking process without the affected interests having any recourse." We recommend that the EPA permit objection process be revised to designate that a formal permit objection by EPA is deemed to be a final agency determination subject to potential judicial review by an affected or interested party. The process also needs to be revised to establish a specific deadline under which EPA is obligated to make a final permit determination in the event that EPA makes a formal permit objection and becomes the permitting authority for that permit action instead of the delegated state. It is troubling, that, absent a timeframe to make a final permit determination—whether that is permit issuance or permit denial—there is currently no obligation upon EPA to make any final permit action, leaving both the state and the regulated community in a prolonged state of uncertainty. This uncertainty costs jobs and affects the livelihoods of thousands of families in Appalachia.

I'll conclude by saying that we have not been silent on this issue with EPA, nor have we been in a combative relationship. The U.S. EPA is our partner in helping us to protect the environment and health of our citizens in Kentucky. As I mentioned, we respect their mission and authority to establish federal rules to ensure consistency and fairness across the nation in environmental protection. We certainly do not want a "race to the bottom" system. People on my staff and I have been in ongoing discussions with our regional EPA administrator (Region IV) attempting to resolve the issues to the satisfaction of all parties—the EPA, the state, the regulated community, and citizens of Kentucky. Unfortunately, I am not highly optimistic that such a resolution will occur.

Thank you again for the opportunity to provide comments today.

**Testimony of**

**Hal Quinn**

**President and CEO**

**National Mining Association**

**Before the**

**United States House of Representatives**

**Committee on Transportation and Infrastructure**

**Subcommittee on Water Resources and Environment**

***EPA Mining Policies: Assault on Appalachian Jobs—Part I***

**May 5, 2011**

Good Morning. I am Hal Quinn, president and chief executive officer of the National Mining Association (NMA). NMA is the national trade association representing the producers of most of the nation's coal, metals, industrial and agricultural minerals; manufacturers of mining and mineral processing machinery, equipment and supplies; and the engineering and consulting firms, financial institutions and other firms serving the mining industry.

I want to thank the Subcommittee for holding this hearing to examine policies that have been choking off economic and job-creating opportunities in the Appalachian coal fields. The Appalachian region produces one-third of our nation's coal supply. This coal is vital to the generation of the most reliable and lowest cost electricity and essential to the operation of our steel mills, cement plants and factories.

Twenty one of the twenty-five states with the lowest electricity costs rely upon coal for forty percent or more of their electricity supply. It is no coincidence that these states also have the highest concentration of manufacturing. The deliberate and disruptive policies that have slowed and stopped coal mines from receiving permits to open or expand have consequences that reverberate throughout the region. The consequences begin with the coal supply chain and the destruction of:

- High-wage coal mining jobs that on average pay almost twice the state average.
- The direct and indirect support jobs of suppliers, engineers and technicians.
- The jobs of those who design, build and maintain mining equipment.
- Railroad, barge and trucking jobs that move coal from mine to market.
- Power plant, steel mill, cement plant and other industrial jobs at facilities that consume coal as fuel or feedstock to make their products.

The collateral damage goes beyond the immediate supply chain and spreads to those who benefit from low-cost coal energy. Households earning less than $50,000—50 percent of U.S. households—spend as much as 20 percent of their after-tax income on energy, nearly twice the national average. Eugene M. Trisko, *Energy Cost Impacts on American Families, 2001-2011* (Jan. 2011). Increased gasoline costs account for 75 percent of the average household energy cost increase since 2001. More expensive electricity further erodes their economic position and spending power for such things as food, housing or health care. Higher energy costs—especially higher electricity rates—are the most regressive of all taxes that can be placed on our citizens.

Our manufacturing sector is especially vulnerable to higher energy costs. We should all remember that any product that can be made today in the USA can be made elsewhere and imported. Kentucky, Ohio, Pennsylvania and West Virginia are industrial centers for automobile, chemical, steel and aluminum production—all energy intensive sectors. Access to low-cost and reliable coal electricity keeps them globally competitive by offsetting higher labor and regulatory costs. Last year, Kentucky Governor Beshear expressed to the President deep dissatisfaction about EPA's coal permitting policies. In doing so the Governor reminded the President that, "Kentucky's industrial development has occurred because . . . of relatively low electricity rates based on coal-fired generation."

**The Permit Moratorium**

Coal mining operations require various permits to commence operations, including two types of permits under the Clean Water Act (CWA): (1) section 404 permits, issued by the Army Corps of Engineers, to discharge fill material; and (2) section 402 permits, issued by states, for the discharge of water. A timely and efficient permit review process is critical to the success of the mining enterprise since new permits are necessary to expand existing operations or start new operations.

On February 13, 2009, the United States Court of Appeals for the Fourth Circuit issued an important decision upholding the longstanding § 404 permitting process administered by the Army Corps of Engineers. *Ohio Valley Envtl. Coalition v. Aracoma Coal Co.*, 556 F. 3d 177 (4th Cir. 2009). At a time when our economy was losing 600,000 jobs a month, the appeals court decision was welcome news because it allowed the Corps to finish the permit process for about 150 coal mine permit applications that the agency placed on hold pending a decision from the appeals court.

Shortly thereafter, EPA announced that it was going to take another look at several permit applications for which the agency had already had ample opportunity to provide comments to the Corps. We smelled a *de facto* moratorium, and we publicly said so. EPA quickly rebuked our characterization of the agency's plans saying "EPA is not halting, holding or placing a moratorium on any of the mining permit applications. Plain and simple." USEPA, Newsroom, EPA Statement on Mining Permit Applications (March 24, 2009).

However, the numbers plainly tell a different story. By May 2009, the permit backlog had grown to 235 applications, and two-thirds of them, or 190, had been previously deemed complete for final processing by the Corps of Engineers. June

23, 2009 Letter from General John Peabody, Division Engineer, to Rep. Zach Space. Yet, no permit decisions were forthcoming. A report prepared by the Minority Staff of the United States Senate Committee on Environment and Public Works documented that the permit moratorium was putting at risk 17,806 new and existing jobs, two billion tons of coal supply and 81 small businesses in the region. United States Senate Committee on Environment and Public Works, Minority Staff, *The Obama Administration's Obstruction of Coal Mining Permits in Appalachia* (May 21, 2010).

**EPA Creates New and Unlawful Permit Process and Standards**

EPA assured Rep. Hal Rogers (R-Ky.) that "EPA does not anticipate that the time requirements associated with [its] review of proposed permits for surface coal mining will be significantly different than the past." May 28, 2009 Letter from Michael Shapiro, Acting Assistant Administrator. This assurance was no less deceptive than the earlier EPA statement that the agency was not placing a moratorium on permits. Within weeks, EPA proceeded to radically alter the process and standards for obtaining CWA permits for coal mines by issuing:

- A Memorandum of Understanding (MOU) that set forth a series of actions designed to disrupt the timely and orderly processing of coal mine permits. The MOU committed several federal agencies to: eliminating Nationwide Permit 21 for coal mines; increasing EPA interference with CWA § 404 permit decisions by the Corps and CWA § 402 permit decisions by states; vacating an Office of Surface Mining regulation that provided much needed clarity on SMCRA's application to both surface and underground mines that encounter stream channels; and raising state-federal tensions in permitting by states under SMCRA.

- A so-called "Enhanced Coordination Procedures" (ECP) that restarts and revisits more than 100 permit applications that were ready to be issued when the Court of Appeals cleared the way for decisions by the Corps of Engineers. The ECP allows EPA to commandeer the CWA §404 permit process by placing itself as the initial screener of all applications filed with the Corps and, for all practical purposes, the final decision maker. The Corps is relegated to nothing more than a mail box for sending permit applications. See Exhibit A.

- A new *de-facto* water quality standard for CWA § 402 permits issued by states. Relying upon a draft agency report, EPA imposed a presumptive threshold for conductivity in streams—a level that was derived from data that did not follow the agency's standard methodology. The point and purpose of this new standard was revealed by the EPA Administrator's description of its intended effect: "You're talking about no, or very few, valley fills that are going to meet this [new] standard." *Environmental regulations to curtail mountaintop mining*, Washington Post, April 2, 2010.

**Bad Law and Bad Science**

This was all accomplished through guidance documents and memoranda that did not resemble anything contained in the CWA or implementing regulations. Had the agency pursued the lawful route of first proposing and taking comment on policies that change existing regulations as required by the Administrative Procedures Act, it would have been forced to answer fundamental questions that reveal why its actions are unlawful.

- The CWA authorizes the Corps of Engineers to decide when and how to process §404 permits. The CWA does not authorize EPA to displace the Corps or to elevate itself to screen, negotiate or decide for the Corps when permits will be reviewed or issued. The Corps' regulations contain time frames for processing permits. The new policies ignore all of them.
- The CWA authorizes states with delegated programs to establish, interpret and apply water quality standards. It also provides those states with the sole authority for certifying whether a project meets those standards. Their certification is binding on the Corps. Nothing in the CWA provides EPA with the authority summarily displace states' water quality standards and certifications.

In short, EPA has exceeded its authority by improperly expanding its role, displacing the Corps and encroaching upon the role reserved to the states under the CWA. The agency has also changed the permit review process in a manner that is inconsistent with existing statutes and the codified regulations.

The science EPA relies upon for its new policy is tentative, weak and flawed. EPA's obsession with using conductivity as a measure of water quality impairment is simplistic and unfounded.

- The study upon which EPA based its new water quality standard for the Appalachian region did not find any direct correlation between changes in water quality and aquatic life based upon the number or location of excess spoil fills.
- EPA did not follow its own methodology guidelines. It relied on field data from uncontrolled settings rather than laboratory data as required by its standard methodology.

- EPA ignored robust data that show good aquatic organism populations in streams with conductivity substantially higher than the threshold it imposes under its new policies.
- The background conditions of streams in the region frequently exceed the threshold EPA established. In other words, there is no feasible way for the industry to meet the new standard under those conditions.
- Recent studies on mined and unmined watersheds within the same region EPA conducted its studies show no difference in terms of ability to perform stream functions.
- Various states have determined that using a composite variable like conductivity is not appropriate for developing a water quality criterion.

In sum, EPA's new standard is not based on sound scientific rationale or scientifically defensible standards. See Exhibit B.

**Bad Consequences**

These policies have exacted a serious toll. Coal mine operators have grown weary and many have withdrawn their permit applications. In fact, more permits have been withdrawn than issued. This was not what we had hoped would be the method for reducing the permit backlog.

Because of these policies, the Energy Information Administration has recently lowered its productivity projections for Central Appalachian surface mines by as much as 20 percent. U.S. Energy Information Administration, *Annual Energy Outlook- 2011,* pp 11-12 (April 2011). This represents a substantial regulatory penalty that will erode companies' competitiveness and threaten more coal jobs.

**Conclusion**

When you talk to coal miners about mining coal you hear in their voices the great pride they have in what they do and how well they do it. They often speak about their families, their country and jobs. But the jobs they speak about first are not their own jobs; rather they typically speak about all the other jobs they know depend upon them doing their job well.

Today, many of them question why their own government at times seems to put so much effort into working against them rather than supporting them and what they do for their country. They deserve a good answer. I remain at a loss for one.

Exhibit A

## Overview of the Corps' CWA Section 404 Permitting Procedure

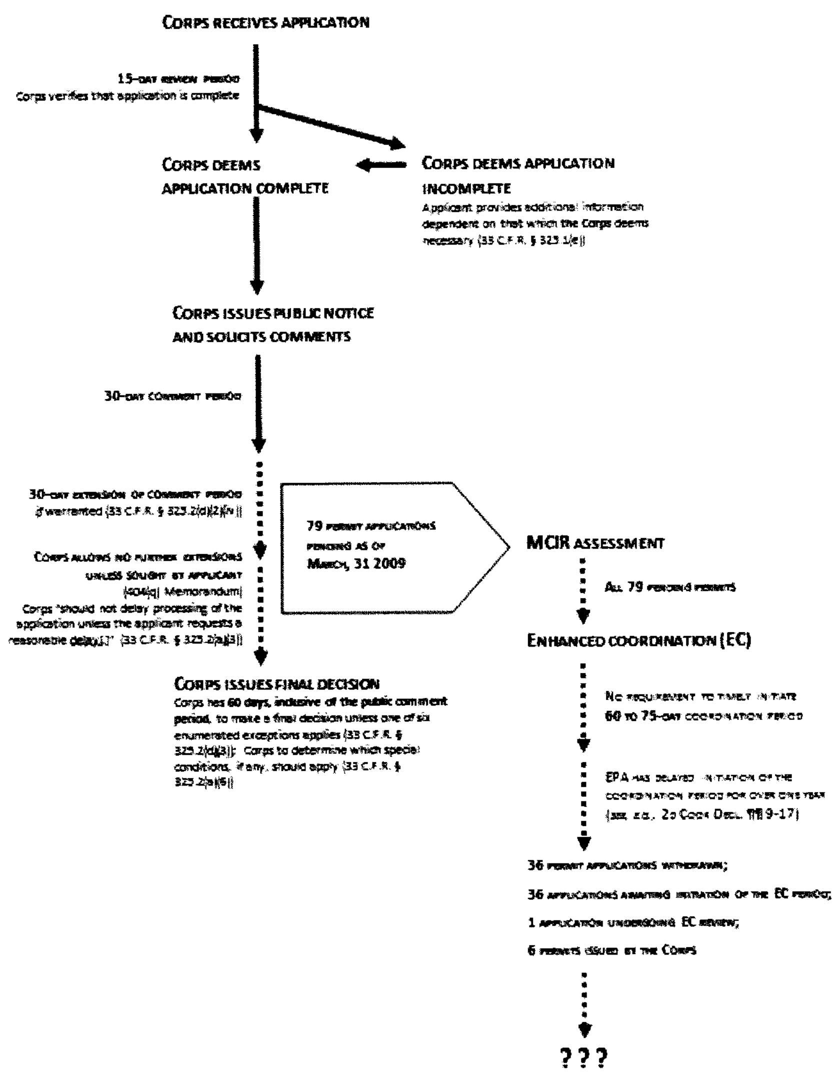

Exhibit B

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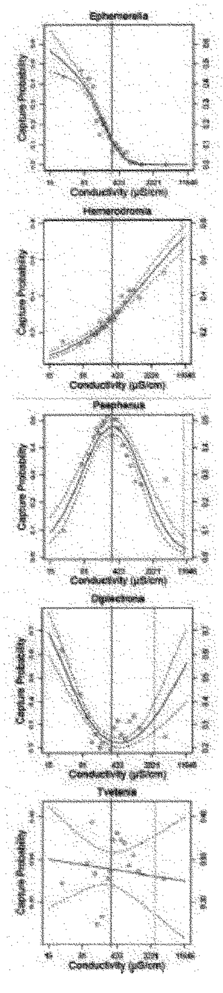
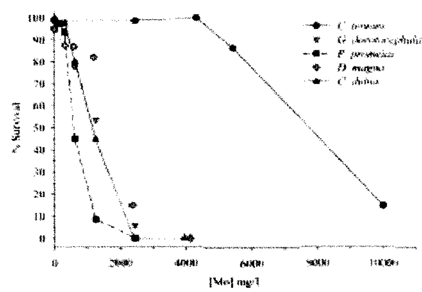
## Primary Technical Concerns with Proposed EPA Conductivity Benchmark

### 1. Issues with conflicting stressor-response profiles and species-sensitivity methods




- As outlined in GEI (2010), the prime underlying principle governing the use of a species-sensitivity distribution (SSD) is that all of the organisms in the distribution exhibit a consistent response to the stressor.
- Specifically, each of the taxa should respond negatively to the stressor – only differing in their degree of sensitivity – as shown below (Canton et al. 2010).




- However, as illustrated to the left (from EPA 2010), there are five different ways the organisms used to derive EPA's benchmark respond to conductivity.
    - These differences do not reflect varying levels of sensitivity over a consistent response profile – rather, they are fundamentally different types of stressor-response profiles.
- These five stressor-response profiles provide substantially different answers to the question "*what conductivity concentration is necessary to provide the level of protection used by EPA?*"
    - Decreasing (*Ephemerella*): <300 µs/cm
    - Increasing (*Hemerodromia*): >300 µs/cm
    - Optimum (*Psephenus*): >75 and <2,500 µs/cm
    - Bimodal (*Diplectrona*): <200 and >2,000 µs/cm
    - No response/bimodal (*Tvetenia*): *None needed*
- There is no way to reconcile these widely conflicting stressor-responses into a single benchmark protective of the entire macroinvertebrate community.

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2. **Issues with EPA's "causal analysis"**

- Although EPA conducted a relatively formal causal analysis, the weight of evidence scoring for each causal element was relatively subjective and open to clearly reasonable alternative interpretations.
- The taxonomic patterns of sensitivity to conductivity are not yet clearly defined.
  - Although laboratory toxicity data exposing mayflies to actual or simulated mining effluents suggest they may be somewhat sensitive, effect concentrations are highly variable.
- Toxicity to ions associated with conductivity also varies strongly as a function of specific ion composition and can be mitigated under conditions of elevated hardness.

3. **Issues with EPA's confounding factor analysis**

- EPA assumed conductivity as a "given" – then tried to see if other factors changed that assumption, when, in fact, a confounding factors analysis should include rigorous and independent tests of the primary hypothesis. In other words, EPA should first determine whether conductivity is indeed the best predictor of biological impairment that is causally related in such a way as to justify the proposed benchmark value.
- EPA's confounding factor analysis would benefit from a closer evaluation to determine whether other factors could provide alternative explanations for patterns in macroinvertebrate community structure relative to coal mining/valley fill activities:
  - *Habitat*: There are three problems with EPA's assertion that habitat presented little potential for confounding in their derivation of the conductivity benchmark:
    - First, the RBP habitat scores used by EPA in their analyses may not be the most rigorous measure of habitat quality.
    - Second, the RBP habitat scores are correlated with both conductivity and the biological response.
    - Third, EPA's analysis of potential confounding habitat factors focused almost exclusively on the relationship of Ephemeroptera, to the exclusion of the rest of the benthic macroinvertebrate community.
  - *In fact, their confounding factors analysis was conducted exclusively with Ephemeroptera*:
    - Relationships between all potential stressors (in addition to habitat) and Ephemeroptera were generally cited as reasons to reject the stressors as potential confounders in the analysis that ultimately relates to the entire aquatic benthic community.
    - There is a clear need to include similar analyses from other members of the invertebrate community to conclusively reject additional environmental factors as potential confounding stressors.
  - *Influence of rare taxa*: EPA attempted to control for the effect of rare taxa by including only those taxa that had been collected in at least one reference site and at least 30 general sites.
    - It may have been more appropriate to have controlled for the effects of rare taxa by including in their SSD only those genera that had a high capture probability in the reference sites.
    - A plausible argument against excluding rare taxa from the SSD would be that the taxon is rare because of the stressor. However, this argument would not be valid if the taxon is naturally rare, a phenomenon that could be analyzed using its capture probability in reference sites.



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**4. Issues with ecological relevance of the proposed conductivity benchmark**

- GEI evaluated trends in macroinvertebrate community structure and function relative to conductivity using the data presented in EPA (2010). There are few observed changes in the proportional abundance of functional feeding groups within the regional pool of taxa at conductivity levels below approximately 2,500 µS/cm to 5,000 µS/cm.
- EPA's proposed conductivity benchmark does not evaluate any other type of aquatic life, so levels of protection for the entire aquatic community is unknown.

## Independent Statistical Evaluation

In addition to the aforementioned technical concerns associated with a detailed review of EPA (2010), GEI conducted an independent statistical evaluation of ecological factors most closely associated with patterns in benthic macroinvertebrate community structure using the WABbase dataset; i.e., the same West Virginia database used to derive EPA's proposed conductivity benchmark (GEI 2010). GEI's analysis indicated the following:

- Conductivity alone is not the most appropriate parameter when trying to explain the variation observed among the Central Appalachian macroinvertebrate communities with respect to water quality and physical habitat.
- Rather, a combination of ionic composition, substrate composition, and channel features appear to be more appropriate stressor variables to consider.
  - Total suspended solids, dissolved oxygen, and fecal coliforms appear to be additional variables to consider, as they are strong indicators of other anthropogenic disturbances in the watersheds.
- These analyses also indicate that other metrics, like total taxa and percent EPT abundance, may be better response variables, as opposed to a singular focus on Ephemeroptera.

## References

Canton SP, Guenzel LG, Pargee S. 2010. Acute and chronic toxicity of molybdenum to the fathead minnow and four aquatic invertebrates. *In preparation*.

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U.S. Environmental Protection Agency (EPA). 2010. *A Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams*. Draft EPA/600/R-10/023A, U.S. Environmental Protection Agency, Washington, DC.



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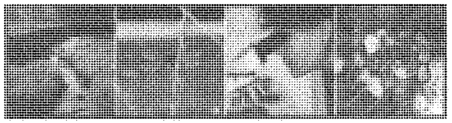

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Environmental
Water Resources
Ecological

**FINAL REPORT**

# Technical Review:

**A Field-based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams**

Submitted to:
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September 2010
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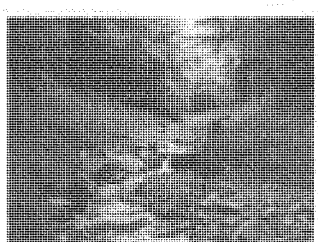

# Table of Contents

## List of Figures

**List of Tables**

# Executive Summary

On behalf of the National Mining Association (NMA), GEI Consultants, Inc. (GEI) has conducted a technical review of the U.S. Environmental Protection Agency's (EPA) external review draft of *A Field-based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams*. In that report, EPA proposed that the correlation between conductivity and benthic macroinvertebrate community structure in Ecoregions 69 and 70 in West Virginia is strong enough that an aquatic life "benchmark" can be derived. EPA also proposed the use of species sensitivity distribution (SSD)-based methods to develop such a benchmark, similar to those used with laboratory-derived toxicity data, to derive numeric ambient water quality criteria for protection of aquatic life and their uses. Based on these two assumptions, EPA used field data from paired stream benthic macroinvertebrate and water quality surveys to derive a proposed aquatic life benchmark of 300 µS/cm conductivity that would be applied to a limited set of specific waters in the Appalachian Region that are dominated by salts of sulfate ($SO_4^{2-}$) and bicarbonate ($HCO_3^-$) at circumneutral to mildly alkaline pH.

We believe there are a number of factual, methodological, and conceptual issues that precludes implementation of their proposed benchmark.

First, significantly different, often conflicting, multiple stressor-response profiles are exhibited by the genera used by EPA to derive the conductivity benchmark. These conflicting stressor-response profiles simply do not represent an internally consistent dataset from which to derive a regulatory benchmark using an SSD approach. This is a key fundamental flaw in the approach, as it suggests that either invertebrate genera are exhibiting fundamentally different responses to elevated salinity or, more likely, that factors other than conductivity are much more closely and functionally related to the capture probability of individual genera across the study region. Therefore, using an SSD of extirpation coefficient (i.e., $XC_{95}$, the 95$^{th}$ percentile of the distribution of a calculated "probability of occurrence" of a genus with respect to conductivity) values based on conflicting stressor-response profiles is a fundamental flaw in their derivation of a regulatory benchmark—this fact, alone, indicates the benchmark should not be used.

Second, there are insufficient data from the scientific literature to rigorously support EPA's conclusion that "conductivities in the region of concern reach levels that are sufficient to cause effects on stream communities" (p. 52, EPA 2010). Although EPA conducted what appears to be a relatively formal causal analysis, the weight of evidence scoring for each causal element was relatively subjective and open to substantially different, and valid, alternative interpretations. While some statistical correlations between conductivity and changes in benthic macroinvertebrate communities exist in locations related to coal mining and valley fill (MTM/VF) activities, there is insufficient evidence in support of salinity ions as the proximate and mechanistic cause of biological impairment. Although elevated salinity can clearly induce adverse effects on aquatic invertebrates, the taxonomic patterns of sensitivity are not yet clearly defined. Toxicity to ions associated with salinity also varies strongly as a function of specific ion composition and can be mitigated under conditions of elevated hardness. In fact, criteria based on individual ions—rather than those based on composite variables such as conductivity—have already been considered in other states as a preferable regulatory approach that best fits the available scientific information. Given that the ratio of key ions such as sulfate and bicarbonate does not remain constant with increasing conductivity in the West Virginia Department of Environmental Protection (WVDEP) Watershed Assessment Branch Data Base (WABbase)—despite EPA assurances to the contrary in their presentation to the Science Advisory Board (SAB) Committee—conductivity by itself is not a reliable indicator of biological response.

Third, the confounding factors analysis in Appendix B of the EPA benchmark document should not take presumed impacts from conductivity *as a given*—especially with the significant weaknesses identified in our review of Appendix A. Rather, a confounding factors analysis should also include rigorous and independent tests of the primary hypothesis and first determine whether conductivity alone is indeed the best predictor of biological impairment that is causally related in such a way as to justify the proposed benchmark value based on field-collected data. EPA's confounding factor analysis would benefit from a closer evaluation of the following factors, which could provide alternative explanations for patterns in macroinvertebrate community structure relative to MTM/VF activities:

- *Habitat*: EPA's assertion that habitat presented little potential for confounding in their derivation of the conductivity benchmark is flawed. First, the Rapid Bioassessment Protocol (RBP) habitat scores used in EPA's analysis are not the most rigorous measure of habitat quality for benthic macroinvertebrates. Second, RBP habitat scores were shown to be correlated with both conductivity and the biological response (i.e., organism extirpation coefficients). Third, analysis of confounding factors focused almost exclusively on the relationship with Ephemeroptera (mayflies), to the exclusion of the response of the rest of the benthic macroinvertebrate community.

- *Relationship to other invertebrate taxa*: Relationships between all potential stressors (in addition to habitat) and Ephemeroptera were generally cited as reasons to reject the other stressors as potential confounders. There is a clear need to include similar analyses from other members of the entire invertebrate community to conclusively reject (or not reject) additional environmental factors as potential confounding stressors when trying to develop a benchmark to protect all invertebrates, not just mayflies.

- *Influence of rare taxa*: EPA did not sufficiently demonstrate that the taxa identified as rare were rare due to conductivity or any other water quality effect, and not from general rarity itself.

Fourth, we do not agree that EPA's presumed 95% protection level for the conductivity benchmark is ecologically relevant with respect to changes in functional groupings of macroinvertebrate genera. Evaluation of trends in macroinvertebrate community structure and function relative to conductivity found few observed changes in the proportional abundance of functional feeding groups within the regional pool of taxa until conductivity levels exceeded approximately 2,500 µS/cm to 5,000 µS/cm.

Fifth, our analysis of the WABbase dataset used by EPA indicates that conductivity alone is definitely not the most appropriate parameter for explaining the variation observed among the Central Appalachian macroinvertebrate communities with respect to water quality and physical habitat. Rather, contrary to EPA's confounding factor analysis, our own statistical analysis shows that a combination of ionic composition, substrate composition, and channel morphology features may be the most appropriate stressor variables to consider when evaluating the effects of water quality and habitat on invertebrate communities. These analyses also indicate that total taxa and percent EPT abundance are the key response variables to consider when evaluating factors that shape the macroinvertebrate community, as opposed to a singular focus on Ephemeroptera. Additionally, total suspended solids, dissolved oxygen, and fecal coliforms also appear to be other key variables to consider when evaluating these stream sites, as they are strong indicators of other anthropogenic disturbances in the watersheds. It is clear that the use of conductivity alone to build SSDs when there are so many other important variables to consider is another fatal flaw in this benchmark. Specifically, a field-derived benchmark constructed on a single variable like conductivity would only work if no other variables were relevant. This is clearly not the case in the dataset used by EPA.

We conclude that the relationship between conductivity and changes in benthic macroinvertebrate community structure is not reliable enough or singularly strong enough to warrant derivation of a regulatory benchmark at this time. While negative correlations may exist between elevated conductivity and the capture probability of select invertebrate genera, there are also positive correlations and other conflicting patterns, suggesting there is insufficient evidence to conclude that elevated concentrations of ions related to salinity (as measured by conductivity) are responsible for losses of presumed sensitive taxa. For the most part, this lack of evidence is due to the EPA's failure to rigorously or independently test the primary hypothesis that elevated salinity was the best predictor of changes in macroinvertebrate community structure in West Virginia streams associated with MTM/VF activities. Furthermore, insufficient laboratory studies are available to verify either the causal mechanisms or conductivity thresholds that would confirm the proposed benchmark of 300 µS/cm under the specific ion composition of streams in this region. For similar reasons, Illinois, Indiana, and Iowa have rejected the use of total dissolved solids (TDS) or conductivity-based criteria in lieu of criteria for individual ions such as sulfate or chloride.

We also conclude that the use of an SSD of $XC_{95}$ values based on conflicting stressor-response profiles is a fundamentally flawed method for derivation of a regulatory benchmark, especially when evaluated in concert with analyses that show many other variables are important. Additional study is needed to confirm or refute the hypothesis of the conductivity relationship to aquatic life, both through use of additional statistical hypothesis testing with the existing dataset and additional study of West Virginia streams associated with MTM/VF activities.

Therefore, we believe it is inappropriate and inadvisable to adopt this conductivity benchmark until or unless such additional studies are conducted.

# 1.0 Introduction

It has been recently proposed that mountain top mining and valley fill (MTM/VF) activities in West Virginia lead to increases in the conductivity of surface waters located immediately downstream of activities, and that these increases in conductivity are related to adverse changes in the structure of benthic macroinvertebrate communities (Pond et al. 2008). In particular, reduced abundances of mayflies (represented by the aquatic insect order Ephemeroptera) were considered to be most closely related to elevated water conductivity. The relationships identified in Pond et al. (2008) were based purely on statistical correlations between water quality characteristics and benthic macroinvertebrate community structure and do not represent a formal or mechanistic test of the hypothesis that conductivity (or the chemical parameters detected by the composite measure of conductivity) is the primary cause of changes in the macroinvertebrate communities downstream of MTM/VF activities. This and other potentially confounding issues challenging this conclusion were summarized in earlier GEI analyses (GEI 2009a,b).

The U.S. Environmental Protection Agency (EPA) is now proposing that the correlation between conductivity and benthic macroinvertebrate community structure is strong enough that an aquatic life "benchmark" can be derived (EPA 2010) and that the relationship is strong enough that methods similar to those used to derive numeric ambient water quality criteria (AWQC) for protection of aquatic life and their uses (Stephan et al. 1985, hereafter referred to as the "1985 Guidelines") can be used to develop such a benchmark. In this context, aquatic life criteria (or "benchmarks" in the case of the conductivity proposal) represent concentrations of chemicals that, if not exceeded, would ensure protection of aquatic communities at levels set forth in the Clean Water Act (CWA). The draft conductivity benchmark that is the subject of this review was released in March 2010 as an external review draft (EPA 2010). This benchmark document is also the subject of an external peer review by a committee of EPA's Science Advisory Board (SAB).

On behalf of the National Mining Association (NMA), GEI Consultants, Inc. (GEI) has prepared this technical review of the external review draft of *A Field-based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams* (EPA 2010). This report uses field data from stream benthic macroinvertebrate surveys to derive a proposed aquatic life benchmark for conductivity that, according to EPA, may be applied to waters in the Appalachian Region that are dominated by salts of sulfate ($SO_4^{2-}$) and bicarbonate ($HCO_3^-$) at circumneutral to mildly alkaline pH. While the EPA states that this conductivity benchmark was derived using a method modeled after the 1985 Guidelines, the use of field benthic macroinvertebrate community data as opposed to individual species laboratory toxicity data represents a significant technical departure from this guidance. Given its potential regulatory implications, this aquatic life benchmark for conductivity must be carefully reviewed to determine whether it represents a scientifically plausible and reliable means of ensuring aquatic life protection.

This report summarizes the results of GEI's technical review of the EPA conductivity benchmark document. The primary scope of this review was to evaluate the overall technical basis of how the conductivity benchmark was derived, with a particular focus on evidence presented by EPA in support of the mechanistic plausibility of using conductivity as the basis for deriving a field-based aquatic life benchmark, and the extent to which confounding factors other than conductivity were addressed. GEI's review also presents an independent statistical evaluation of the ecological factors most likely associated with patterns in benthic macroinvertebrate community structure in West Virginia headwater streams associated with MTM/VF activities. This analysis utilizes the same raw data and field sites used in EPA (2010) to derive the conductivity benchmark, but uses different sets of statistical tools to provide a more robust analysis of the potential impacts of MTM/VF activities.

GEI's technical review consists of the following main elements:

- Summary of the proposed conductivity benchmark and its technical basis
- Summary of GEI's primary concerns with the scientific plausibility and reliability of the proposed conductivity benchmark, including:
  - Diversity of conflicting stressor-response profiles and the use of species-sensitivity distribution methods for benchmark derivation
  - The outcome of the causal analysis, including the plausibility of physiological mechanisms proposed as causes of extirpation of sensitive taxa
  - Analysis of confounding factors other than conductivity
  - Ecological relevance of the protection level intended from the proposed conductivity benchmark
- Independent statistical evaluation of ecological factors most closely associated with patterns in benthic macroinvertebrate community structure.

# 2.0 Proposed Conductivity Benchmark

## 2.1 Summary of Proposed Benchmark

EPA (2010) used field data to derive an aquatic life benchmark for conductivity that is intended to be applied only to a limited set of waters in the Appalachian Region that are dominated by salts of $SO_4^{2-}$ and $HCO_3^-$ at circumneutral to mildly alkaline pH (see benchmark definition and limitations below). Conductivity is presented as a surrogate for salinity, which is a property of water that represents the total concentration of dissolved mineral salts or "major ions", including $Na^+$, $Ca^{2+}$, $Mg^{2+}$, $K^+$, $Cl^-$, $HCO_3^-$, $CO_3^{2-}$, and $SO_4^{2-}$. One of the basic premises of EPA (2010) is that elevated concentrations of these ions cause physiological stress in macroinvertebrates, ultimately leading to the extirpation of the most sensitive species in waters with conductivity levels that exceed the proposed benchmark of 300 μS/cm. It is not derived using EPA's standard methodology. Instead, the benchmark was derived by a method modeled on EPA's standard methodology for deriving AWQC, except that the methodology was substantially altered for use of field data. Field data were used because EPA stated that sufficient and appropriate laboratory data were not available and "high quality" field data were available to relate conductivity to effects on aquatic life.

The method used in EPA (2010) has the appearance of being based on the 1985 Guidelines primarily because it used the 5$^{th}$ percentile of a species sensitivity distribution (SSD) as the basis for mathematical derivation of the benchmark value. An SSD represents the response of aquatic life as a distribution with respect to exposure and is a widely used statistical approach for derivation of regulatory aquatic life criteria worldwide. It is implicitly assumed that if the exposure level is kept below the 5$^{th}$ percentile of the SSD, at least 95% of tested aquatic species (or their surrogates) comprising the distribution will be protected. In this respect, EPA's data analysis followed the standard methodology in aggregating species to genera and using interpolation to estimate the percentile.

However, the method used in EPA (2010) differs significantly from the 1985 Guidelines in that the points in the SSDs are so-called extirpation concentrations (XCs) rather than median lethal concentrations ($LC_{50}$s) or chronic response values from exposure to a single chemical. The XC is defined by EPA as the level of exposure above which a genus is "effectively absent" from waterbodies in a region. For this benchmark value, the 95$^{th}$ percentile of the distribution of a calculated "probability of occurrence" of a genus with respect to conductivity was used as a 95$^{th}$ percentile extirpation concentration ($XC_{95}$). Hence, this aquatic life benchmark for conductivity is expected to avoid the local extirpation of 95% of native species (based on the hazardous concentration [$HC_{05}$]—the 5$^{th}$ percentile of the SSD) in surface waters that include neutral to alkaline effluents containing a mixture of dissolved ions "dominated by salts of $SO_4^{2-}$ and $HCO_3^-$"—although no numerical values or "bounds" on the concentrations of these ions were given by EPA in their document.

***The chronic aquatic life benchmark value for conductivity derived using all-year data from West Virginia was calculated to be 300 µS/cm.*** According to EPA (2010), this benchmark is only applicable to specific parts of West Virginia and Kentucky, although they expect it to be applicable to the same ecoregions in Ohio, Pennsylvania, Tennessee, and Maryland (but data from those states have not been analyzed). EPA states that this benchmark could also be appropriate for other nearby regions such as Ecoregion 67, but has only been validated for use in Ecoregions 68, 69, and 70 at this time. However, EPA further states that this benchmark may not apply when the relative concentrations of dissolved ions are not dominated by salts of $SO_4^{-2}$ and $HCO_3^-$ (again, no quantitative indication or bounds were provided on what is meant by "dominated by").

## 2.2 Analysis of Causal Mechanisms and Confounding Factors

Because numeric aquatic life criteria are based on laboratory toxicity tests from single chemical exposures, the causes of biological impairment (i.e., toxicity) are generally clear, test results are repeatable, and confounding factors are minimized or eliminated under controlled laboratory conditions. However, associations between biological patterns as a function of one or more chemical stressors in the field are not necessarily causal, nor are they free from other factors that may confound or obscure the presumed association. Therefore, EPA conducted a causal assessment (Appendix A of EPA 2010) based on epidemiological approaches (e.g., Hill 1965) and EPA guidance for conducting stressor identification and diagnosis (EPA 2000; www.epa.gov/caddis). From these assessments, EPA concluded that the available evidence indicated that salts, as measured by conductivity, are a common cause of impairment in aquatic macroinvertebrates in the region of concern (i.e., Ecoregions 68 and 69 of West Virginia).

EPA also conducted a confounding factors assessment (Appendix B of EPA 2010) to evaluate the extent to which variables that may co-occur with conductivity might limit or alter their ability to quantify the effects of conductivity (i.e., derive a quantitative benchmark). A weight of evidence approach was used to evaluate each confounding factor and, to the extent possible, test whether removal of confounding factors might alter the ultimate derivation of the conductivity benchmark. EPA concluded that "the effect of confounders was found to be minimal and manageable," and that only the elimination of sites with pH < 6 was needed to remove this potentially significant confounding factor.

# 3.0 Primary Technical Concerns

The EPA (2010) conductivity benchmark represents a fundamentally different application of an SSD approach for derivation of a regulatory benchmark when compared to other aquatic life criteria derived using laboratory toxicity databases. In particular, the proposed conductivity benchmark is based on field surveys and correlations between the stressor and biological response in uncontrolled field environments, with multiple species present and all possible biotic (predation/competition/etc.) and abiotic (temperature/flow/season/etc.) interactions occurring. Most other regulatory thresholds (including AWQC) are derived using laboratory data on individual species in which the relationship between the stressor and the biological response are directly manipulated and studied in a controlled manner following prescribed protocols.

As summarized in EPA (2010), there may be some advantages to using a field-based approach. Because it is based on biological surveys, it may be more directly relevant to the streams where the benchmark may be applied and represent the actual aquatic life use in these streams. Another advantage is that field-based biological measurements of whole communities integrate the effects of all life stages and ecological interactions (although only for benthic macroinvertebrates). Further, the data represent actual exposure conditions in the region, the actual temporal variation in exposure (assuming the sampling protocol was designed to capture this variation), and the actual mixture of ions that contribute to salinity as measured by conductivity.

However, there are several disadvantages to the field-based approach that outweigh the advantages and greatly limit the scientific reliability of using this approach to set specific regulatory thresholds for a composite water quality measurement such as conductivity. The primary disadvantages of using field data result from the fact that exposures are not controlled, so the causal nature of the relationship between conductivity and associated biological responses are very difficult to parse out from other biotic and abiotic parameters. As discussed below, we contend that EPA's arguments supporting the mechanistic plausibility of conductivity as the (virtually only) cause of "impairment" are relatively weak, and so cast considerable doubt on the overall reliability of its calculated conductivity benchmark.

Furthermore, any chemical or biological variables that are correlated with either conductivity or the biotic response may confound the presumed relationship between conductivity and biological impairment. To address this, EPA (2010) conducted a relatively formal analysis of confounding factors—which was an improvement over the purely statistical approach taken by Pond et al. (2008). EPA concluded that although plausible confounding factors likely exist, their influence is not *strong enough* to prevent use of the conductivity benchmark as presented in EPA (2010). We do not agree that all of the confounding factors are so easily dismissed. In fact, we believe many of the confounding factors require a more in-depth analysis to evaluate whether or not conductivity alone is in fact a strong enough indicator of adverse changes in biological communities to allow for its use in derivation of a regulatory benchmark.

The discussion above provides the highlights of issues that need to be more fully evaluated before the conductivity benchmark is adopted. Below we summarize the key primary technical concerns with the proposed EPA conductivity benchmark, to be discussed in greater detail in this report. These concerns are not presented in any particular order of priority. The rest of this report is focused on four primary questions:

- How might the diversity of conflicting stressor-response profiles exhibited in EPA's SSD of $XC_{95}$ values influence the benchmark value derived from this SSD, and is use of an SSD a valid approach when the stressor-response profiles are not consistent?

- How does the methodology used to derive the conductivity benchmark compare to methods used for typical aquatic life criteria?

- Is the underlying assumed mechanism for impairment—toxicity from ions associated with salinity—mechanistically plausible and is the proposed benchmark value consistent with thresholds obtained in controlled laboratory-based toxicity tests?

- Is the confounding factors analysis convincing, i.e., do we agree that factors correlated with conductivity do not substantially confound or obscure biological relationships with conductivity?

- What is the ecological relevance of the proposed benchmark value?

## 3.1 Diversity of Conflicting Stressor-Response Profiles

One of the underlying principles governing the use of an SSD to derive biological thresholds is that all of the organisms represented in the distribution exhibit the same type of response to the stressor in question (Posthuma et al. 2002). However, three types of stressor-responses are recognized by EPA (2010), as exemplified in Figure 5 of EPA (2010, p. 30):

- decreasing probability of observation with increasing conductivity,
- increasing probability of observation with increasing conductivity, and
- optimal or "bell-curve" probability of observation with increasing conductivity.

In addition to these three stressor-response profiles, a fourth type not recognized by EPA—but frequently observed in their dataset— is characterized by basically no response or a bimodal, "inverse optimal" response to conductivity (Figure 1).

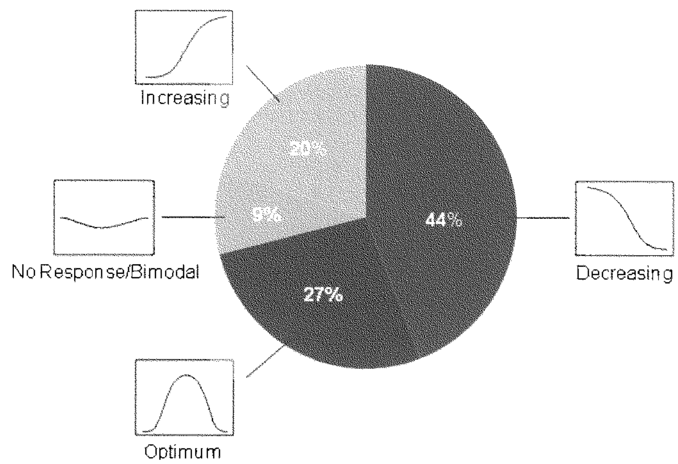


**Figure 1: Percentage of genera with different types of stressor-response profiles with respect to conductivity and probability of capture (data from EPA 2010).**

A more typical response would be for each of the taxa to respond negatively (e.g., decreased survival, growth, or reproduction) to the presence of a particular contaminant. A graphical representation of this type of response (i.e., the stressor-response profile) would resemble the "decreasing" probability distribution for *Ephemerella* in Figure D-1 of EPA (2010; Figure 2 below), where the y-axis shows the response (i.e., capture probability) and the x-axis shows the concentration of the stressor that is presumably inducing that response (i.e., conductivity). In this case, to be protective, it appears that conductivity should always be below roughly 300 µS/cm.

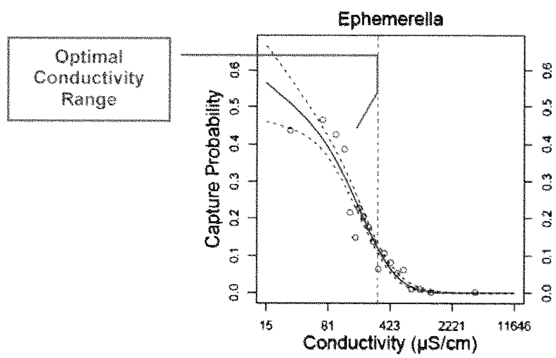


**Figure 2: *Ephemerella* capture probability versus conductivity (Figure D-1 from EPA 2010). The approximate conductivity protective of this genus is indicated by the Optimal Conductivity Range.**

Under this circumstance, the effect concentration at which a negative response is observed and also corresponds to the desired level of protection can be calculated for each species. The effect concentration can take many forms (e.g., a 10, 20, or 50% effect concentration—often represented as $EC_{10}$, $EC_{20}$, $EC_{50}$—where 10, 20, or 50% of the organisms are adversely affected), but under a decreasing stressor-response profile, the effect concentration will always be on the low end of the x-axis scale (i.e., where the adverse response occurs to a lesser extent). These calculated effect concentrations can then all be compiled into one SSD and the percentile of the distribution that corresponds to the desired level of protection for the community can be derived (e.g., most often the 5th percentile "hazard concentration" or $HC_{05}$).

Note, however, that this approach to building an SSD is *only valid* when all of the organisms incorporated into the SSD respond similarly to the stressor, since it assumes a protective level set at the lower end of the distribution (i.e., where organisms are more sensitive) will also protect all of the species at the upper end of the distribution (i.e., where organisms are less sensitive). This is simply not the case with the data used by EPA (2010).

For example, some organisms in the EPA analysis appear to respond favorably in the presence of conductivity, as shown in the "increasing" stressor-response profile exhibited by *Hemerodromia* in Figure D-1 of EPA (2010; Figure 3 below). Under this circumstance, to be protective, it appears that conductivity should always be *above* roughly 300 µS/cm—a direct contradiction to the "decreasing" stressor-response profile shown above.

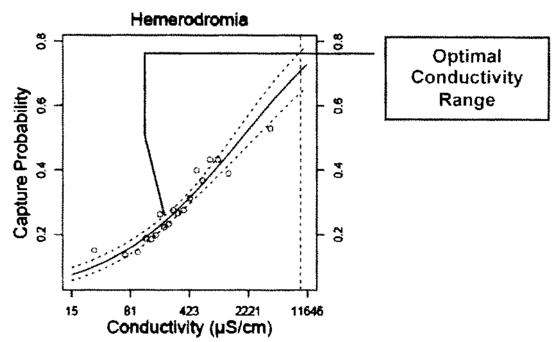


**Figure 3: *Hemerodromia* capture probability versus conductivity (Figure D-1 from EPA 2010). The approximate conductivity protective of this genus is indicated by the Optimal Conductivity Range.**

Additionally, some organisms appear to respond *negatively* at both the low and high end of the range of conductivity levels, but favorably in the middle of that same range. This "optimum" type of stressor-response profile would resemble that shown in the *Psephenus* panel in Figure D-1 of EPA (2010; Figure 4 below). Here, it would theoretically be necessary to always have conductivity greater than roughly 75 µS/cm and less than roughly 2,500 µS/cm; i.e., one threshold at the low and one at the high end of the x-axis where negative responses are observed.

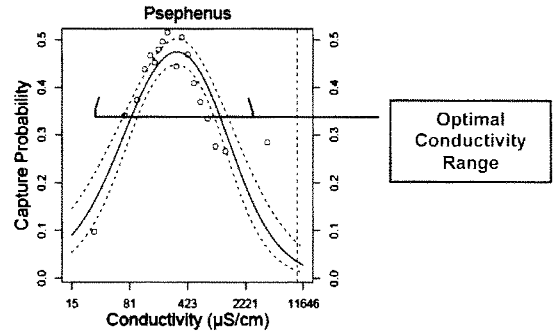


**Figure 4:** ***Psephenus*** **capture probability versus conductivity (Figure D-1 from EPA 2010). The approximate conductivity protective of this genus is indicated by the Optimal Conductivity Range.**

Alternatively, some organisms appear to respond *positively* at both the low and high end of the range of conductivity levels, but poorly in the middle of that same range. This type of "bimodal" stressor-response profile would resemble that shown in the *Diplectrona* panel in Figure D-1 of EPA (2010; Figure 5 below). Here, it would theoretically be necessary to always have conductivity less than roughly 200 µS/cm and greater than roughly 2,000 µS/cm; i.e., two thresholds bracketing the middle of the x-axis to capture the range where negative responses are observed.

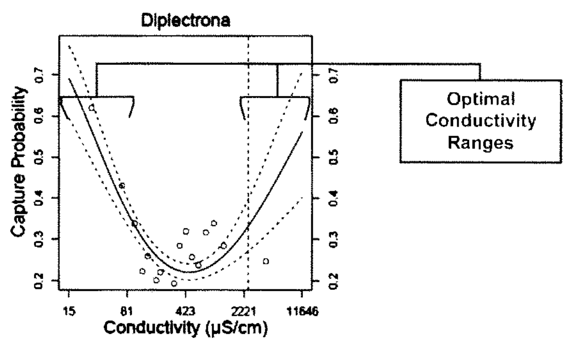


**Figure 5:** ***Diplectrona*** **capture probability versus conductivity (Figure D-1 from EPA 2010). The approximate conductivity protective of this genus is indicated by the Optimal Conductivity Range.**

Finally, some organisms would appear to have very little response to a stressor at all, as shown in the "No-response" *Tvetenia* stressor-response profile in Figure D-1 of EPA (2010; Figure 6 below), making it difficult to identify any kind of effect concentration indicative of a negative response.

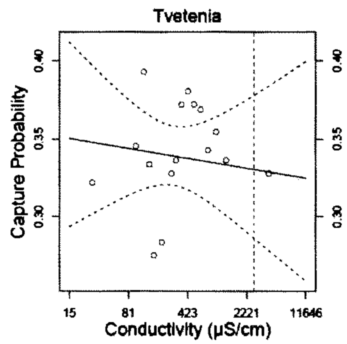


**Figure 6: *Tvetenia* capture probability versus conductivity (Figure D-1 from EPA 2010). There does not appear to be an Optimal Conductivity Range for this genus.**

In summary, the approximate conductivity concentration necessary to provide a level of protection used by EPA, based on capture probability, for the five stressor-response profiles discussed above would be as follows:

- Decreasing (*Ephemerella*): < 300 µs/cm
- Increasing (*Hemerodromia*): > 300 µs/cm
- Optimum (*Psephenus*): > 75 and < 2,500 µs/cm
- Bimodal (Diplectrona): < 200 and > 2,000 µs/cm
- No response/bimodal (*Tvetenia*): none

As this example shows, there is simply no way to reconcile these widely conflicting stressor-responses into a single benchmark. More specifically, if one accepts that the capture probability curves in Appendix D (EPA 2010) represent actual stressor-response relationships, selecting a protective benchmark at the lower end of the distribution will actually result in organisms with increasing and/or optimal stressor-response profiles ***not*** being protected.

If these types of varied effect concentrations were combined into one SSD and a percentile at the low end of that distribution were selected as the protective benchmark, only the *Ephemerella* would be protected since both *Hemerodromia* and *Psephenus* would require a much higher benchmark to ensure a similar capture probability. In fact, an effect concentration of 80 µs/cm (required for a capture probability of 40% for *Ephemerella*) would correspond to a capture probability of less than 20% for *Hemerodromia* and less than 35% for *Psephenus*. Inversely, an effect concentration of 1400 µs/cm (required for a capture probability of 40% for *Hemerodromia*) would correspond to a capture probability of zero percent for *Ephemerella*. Thus, for 56% of the total genera that do not follow the classic stressor-response profile, the proposed benchmark of 300 µS/cm could actually be interpreted as harmful—i.e., not protective. As evidenced by their conflicting stressor-response profiles, these organisms would appear to respond to the stressor in fundamentally different ways.

The natural variability of organisms in their response to stressors is to be expected given the corresponding variability in species-specific physiological and ecological mechanisms for responding to stressors in the environment. This phenomenon becomes problematic, however, when trying to establish a single numerical benchmark for protection of a community in which species exhibit multiple stressor-response profiles. This is because, as discussed above, the effect concentration corresponding to a negative response has the potential to exist on both ends of the x-axis (i.e., low end for decreasing, high end for increasing, low and high end for optimum) or even potentially in the middle of the distribution.

It is understood that there is some subjectivity in the interpretation of the shape of the individual stressor-response profiles. However, the increasing, optimum, and decreasing stressor-response profiles are each well represented in the dataset used in the SSD to derive the benchmark (Figure 1), with less than half of the taxa in EPA's final dataset exhibiting the stressor-response profile of decreasing abundance with increasing levels of the presumed stressor. Thus, 56% of the taxa used by EPA to generate their SSD *do not* actually show the classic dose-response of decreasing probability of capture with increasing conductivity—yet were still used by EPA in their SSD calculations. It is not appropriate to say that the proposed benchmark would prevent extirpation of 95% of taxa when 56% of the taxa in the dataset do not exhibit a decreasing stressor-response profile and would potentially be absent if conductivity were restricted to those low conductivity levels.

The EPA dataset includes organisms from numerous taxonomic orders. The best represented groups include Ephemeroptera, Plecoptera, Trichoptera, Coleoptera, and Diptera. Even among these taxa, each of the groups exhibit the multiple conflicting stressor-response profiles noted above, although the Ephemeroptera and Plecoptera were only represented by the decreasing and optimum profiles (Figure 7). Interestingly, the Plecoptera and Trichoptera tended to have higher proportions of decreasing stressor-response profiles than the Ephemeroptera, with 76 and 63%, respectively.

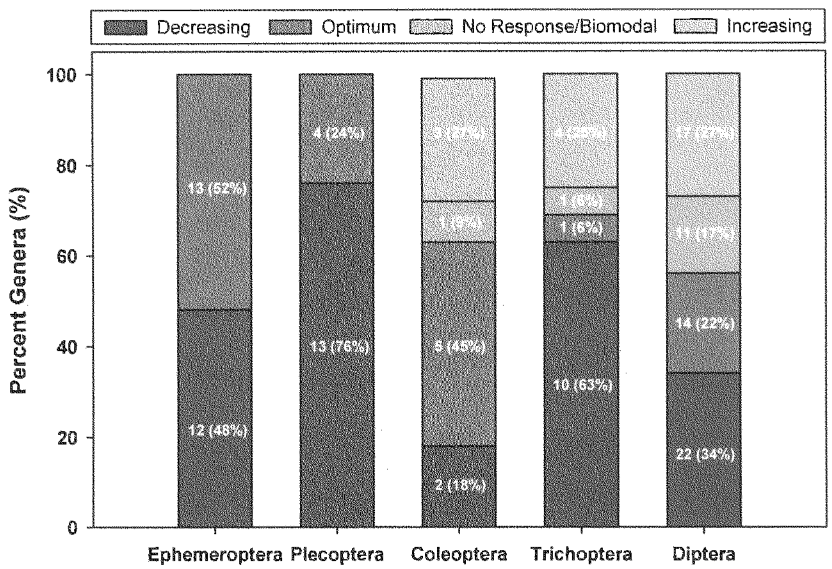


**Figure 7: Percent of genera (based on total number of taxa) in selected insect orders with identified stressor-response profiles (data from EPA 2010).**

Conflicting stressor-response profiles by individual genera strongly indicate that conductivity is not the dominant or singular stressor that can be shown to limit the entire macroinvertebrate community above a single fixed threshold or benchmark value. This suggests that either different invertebrate genera exhibit fundamentally different responses to elevated conductivity, or factors other than conductivity are more closely and functionally related to the capture probability of individual genera across the study region.

In summary, we believe that there is a fundamental flaw associated with using SSDs to derive an $HC_{05}$ level on the basis of such conflicting stressor-response profiles. An SSD is intended to depict the distribution of sensitivity across numerous genera to a single stressor (Posthuma et al. 2002). However, if some of the genera on the SSD are responding to the stressor in fundamentally different ways (see above), then it is inappropriate to include them in the same SSD. Additionally, since the derivation of this benchmark is based solely on field-derived data, the same stressor (conductivity) may not be accurately depicted in the individual $XC_{95}$s or the subsequent SSD. Therefore, the use of an SSD of $XC_{95}$ values based on conflicting stressor-response profiles is a fundamentally flawed method for derivation of a regulatory benchmark. This, alone, is grounds for not adopting this benchmark.

## 3.2 Comparison of Derivation Method to Typical Aquatic Life Criteria

Although EPA (2010) states that methods for derivation of the conductivity benchmark are "based upon" the 1985 Guidelines for derivation of AWQC, the only similarity is that both derive the benchmark/criteria concentration as the 5th percentile of species sensitivities using an SSD. However, the SSDs used for derivation of AWQC are based on controlled laboratory toxicity data from studies in which the stressor (e.g., a toxic chemical) is empirically and unambiguously manipulated in studies that follow standardized and scientifically valid protocols for individual species. The biological endpoints used (based on survival, growth, or reproduction) in AWQC derivation are based on relatively uniform and consistent stressor-response profiles generated from statistical analysis of the laboratory toxicity test data. In other words, even though individual organism "sensitivities" to a given chemical will differ from one another, they all must demonstrate similar kinds of monotonically increasing adverse effects in response to increasing chemical exposure concentrations (i.e., each test must exhibit a consistent "dose-response") to be included in the SSD. In addition, to help ensure that the total range of chemical sensitivities of organisms likely to be encountered in a broad range of field conditions is represented, a minimum database of eight specific types of aquatic organisms (i.e., the "eight family rule") is required before an AWQC can be derived (Stephan et al. 1985).

In contrast, the conductivity benchmark is derived based on a large number of macroinvertebrate genera, but does not represent the total range of aquatic organisms that inhabit these ecosystems. The 1985 Guidelines' eight family rule requires data from fish, planktonic crustaceans, and aquatic plants or algae to ensure protection of all aquatic life, so a benchmark based only on benthic macroinvertebrates will not necessarily represent a concentration that is protective of the entire aquatic ecosystem.

Furthermore, as stated in Section 3.1, the SSD used to derive the conductivity benchmark is not based upon a consistent set of stressor-response profiles. As before, it may be that those genera with narrow optima or increasing stressor-response profiles are, in fact, responding more strongly to something other than conductivity within the ranges of conductivity being observed. Further, it is very clear for those genera that have no response or a bimodal response that their distribution is related to something other than conductivity. Therefore, the use of an SSD of $XC_{95}$ values based on conflicting stressor-respond profiles is a fundamental flaw in the approach proposed by EPA and is not consistent with Stephan et al. (1985).

## 3.3 Evidence of Causation

It is well known that associations between biological patterns as a function of one or more chemical stressors in the field are not necessarily causal, nor are they free from other factors that may confound or obscure the presumed association. Therefore, EPA conducted a causal assessment (Appendix A of EPA 2010) which was reportedly based on epidemiological approaches (e.g., Hill 1965, Cormier et al. 2010) and EPA guidance for conducting stressor identification and diagnosis (EPA 2000; www.epa.gov/caddis).

The general elements evaluated in EPA's causal analysis were as follows (adapted from Table A-1 in EPA 2010):

- *Co-occurrence*: Evaluates whether the presumed cause co-occurs with the unaffected entity[1] in space and time
- *Preceding causation and time order*: Evaluates whether each presumed causal relationship is a result of a larger web of cause and effect relationships, and whether the presumed cause precedes the effect in time
- *Interaction*: Evaluates whether the presumed cause physically interacts with the entity in such a way that induces the effect, and results from known and reliable biological or physiological mechanisms
- *Specific alteration*: Evaluates whether the entity is changed by the interaction with the presumed cause
- *Sufficiency*: Evaluates whether the intensity, frequency, and duration of the presumed cause are adequate, and that the entity is susceptible (i.e., will exhibit biological impairment) at the appropriate levels of the presumed cause.

For each of these causal elements, EPA (2010) presented a series of weight of evidence scores to indicate their interpretation of how different lines of evidence support or weaken evidence of causation for that particular element. It was not entirely clear how individual scores were assigned or summarized for each causal element, but they appear to have generally followed guidance from CADDIS, in which a score of "+" indicates evidence that strengthens the case in support of the cause, a score of "-" indicates evidence that weakens the case in support of the cause, and a score of "0" indicates inconclusive evidence. However, EPA did not provide any indication of how summary scores were provided for each causal element, nor did they include "refutation" which is a logical process which recognizes that a causal hypothesis can be falsified (i.e., refuted) with greater confidence than it can be accepted. Unlike CADDIS, EPA (2010) made no apparent attempt to evaluate whether any given line of evidence might have refuted conductivity as the presumed cause of impairment.

While causal analysis is a highly logical and structured process, assigning weights to lines of evidence is a highly subjective task based on professional judgment. Below we summarize and review our impressions of the subjective weighting assignments used by EPA in Appendix A, and offer alternative interpretation of the strength or weakness of each causal element based on our own professional judgment and the data EPA provided.

[1] In this context, "entity" represents the benthic macroinvertebrate community and presumed loss of sensitive taxa under conditions of elevated salinity or conductivity.

### 3.3.1 Co-occurrence

Based on a relatively limited set of correlational data from the WABbase and Pond et al. (2008), EPA concludes that "the evidence for co-occurrence of conductivity with biological effects is strong, relevant, consistent, and of high quality and is, therefore conclusive" (p. 45, EPA 2010). However, we do not agree that this evidence is sufficiently strong or consistent, and so is inconclusive to weakly conclusive at best. In particular, the relationships between conductivity and the number of ephemeropteran genera (Figures A-1 and A-2; EPA 2010) exhibit a substantial amount of variability around the regression lines plotted on these figures. Temporal increases in conductivity (Table A-5; EPA 2010) do exist in two sites with permitted mining operations over the same time period. Conductivity did not increase in the unmined Ash Fork. But these data are extremely limited, and invertebrate data are not available for most of times that conductivity was measured. Finally, like the confounding factors analysis in Appendix B (EPA 2010), only conductivity relationships with mayflies were evaluated by EPA. Given the diversity in conductivity-response patterns exhibited by all the taxa in the WABbase (Section 3.1), correlations with conductivity are neither consistent nor strong for many taxa.

Based on our evaluation of co-occurrence as a causal element, we suggest the following adjustments to the weight of evidence scores (Table 1). These scores lead to an overall conclusion that evidence in support of this causal element is neither sufficiently strong nor consistent, and so are inconclusive to weakly conclusive in support of conductivity as a cause of impairment.

**Table 1: Summary of evidences and scores for co-occurrence, including alternative interpretations (adapted from Table A-6; EPA 2010).**

| Type of Evidence | Evidence | EPA Score | Suggested Score |
|---|---|---|---|
| Correlation of Cause and Effect | Ephemeroptera were correlated with conductivity in two studies $r = -0.63$ (see Figure A-1) and $r = -0.90$. This is strong quantitative evidence from multiple studies.<br>*Alternative Interpretation: High variability in Figures A-1 and A-2 exists, and relationships with other taxa are inconsistent.* | + + + | 0 |
| Contingency Table | The contingency table (see Table A-4) provides strong quantitative evidence that high conductivity is strongly associated with severe effects (Ephemeroptera absent at >75% of sites).<br>*Alternative interpretation: Relationships are based only on mayflies, and relationships with other taxa inconsistent.* | + + | + |
| Co-occurrence in Paired Watersheds Over Time | 24% to 100% difference (see Table A-5) is large and quantitative.<br>*Alternative interpretation: Limited temporal dataset; somewhat inconclusive.* | + + | 0 to + |
| Overall Score | Relevant, strong, consistent.<br>*Alternative interpretation: Relevant, weak, inconsistent.* | + + + | 0 to + |

### *3.3.2 Preceding Causation*

EPA cites several literature sources, as well as data from the WABbase, to conclude that conductivity is consistently elevated downstream of MTM/VF activities in this region. Furthermore, evidence is presented that the waters with elevated conductivity represent a relatively uniform and "characteristic" composition consisting of elevated concentrations of $Ca^{2+}$, $HCO_3^-$, $Mg^{2+}$, and $SO_4^{2-}$ (EPA 2010). We recognize that conductivities can be elevated in waters associated with these activities, but we do not agree that the ionic composition of waters with elevated conductivity is necessarily consistent (Section 3.3.2.1). As we summarize in Table 2, our interpretation of the data supporting preceding causation is relevant and strong, but because ionic composition varies with conductivity, these relationships are not necessarily consistent.

**Table 2: Summary of evidences and scores for preceding causation, including alternative interpretations (adapted from Table A-8; EPA 2010).**

| Type of Evidence | Evidence | EPA Score | Suggested Score |
|---|---|---|---|
| Complete Source-to-Cause Pathway | Sources are present, and no intermediate steps in the pathway are required.<br>*Agree.* | + | + |
| Correlation of Conductivity with Sources | Figure A-3, *r* = 0.61. This is moderately strong quantitative evidence from the case.<br>*Agree.* | + + | ++ |
| Evidence from Literature | Multiple publications link conductivity to sources in the region and eliminate some other land uses as sources.<br>*Agree.* | + | + |
| Co-occurrence of Sources and Conductivity | When valley fills are present, conductivity is 12- to 90-fold greater than at unmined sites (see Tables A-5 and A-7). This is strong quantitative evidence from the case.<br>*Agree.* | + + | ++ |
| Characteristic Composition | Ambient mixtures of ions have characteristic compositions that can be associated with particular sources. Most sites with elevated conductivities have compositions characteristic of coal mining with valley fill. This is relevant but quantitatively weak evidence.<br>*Alternative interpretation: Ionic composition not necessarily consistent with elevated conductivity.* | + | - |
| Overall Score | Relevant, strong, consistent.<br>*Alternative interpretation: Relevant and strong, but not consistent with respect to ionic composition.* | + + + | ++ |

#### 3.3.2.1 Sulfate—alkalinity relationships

One of EPA's basic premises is that conductivity is a good predictor of biological responses because it is a strong surrogate for ionic stressors, such as sulfate ($SO_4^{2-}$) and bicarbonate ($HCO_3^-$), ions that are more functionally related to biological effects. However, this premise is only valid if the relative composition of these ions remains relatively constant regardless of conductivity. This is particularly important because the biological effects of major ions related to salinity are most strongly related to ion composition, not conductivity (Mount et al. 1997; see Section 3.3.5 for additional discussion).

To evaluate this issue, we examined the relationships between conductivity, sulfate, and total alkalinity (the most proximate empirical measure of bicarbonate) for the filtered WABbase dataset (n = 2,152). Total alkalinity ($CaCO_3$) measures (n = 1,370) were assumed to represent bicarbonate alkalinity, even though values were not converted to bicarbonate fraction using pH in the dataset provided by EPA. Still, the vast majority of sites revealed pH levels between 6 and

8.5 units, indicating total alkalinity would primarily consist of bicarbonate alkalinity.
The relationship between total alkalinity and sulfate indicates there is a shift in the relative dominance of these two ions across the range of available conductivity values. Bicarbonate alkalinity is largely influenced by pH; thus, the relationship exhibits an upper threshold, while sulfate ions continue to increase in concentration (Figure 8). In general, sites that exhibit sulfate concentrations less than 70 mg/L typically revealed that bicarbonate ions were the more dominant ion with respect to these two ions. However, at approximately 70 mg/L there is a shift in the relationship and sulfate ions become more dominant. Overall, given the lack of a true one-to-one relationship between these ions, it is clear they do not "move together" as conductivity increases, in contrast to what EPA said during their presentation to the SAB Committee.

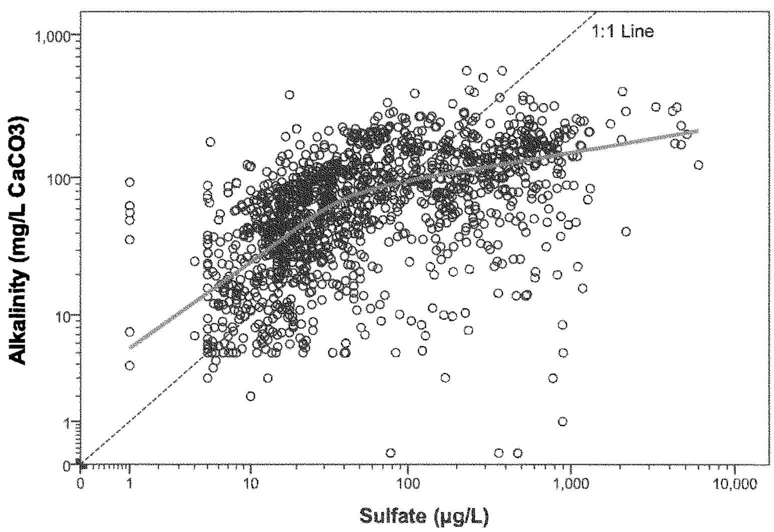


**Figure 8: Relationship between total alkalinity and total sulfate in streams of West Virginia, Ecoregions 69 and 70. Locally weighted scatterplot smoothing (LOESS) regression line is based on 66% smoothing function.**

To further explore assumption that these ions "move together" with increasing conductivity, a sulfate to total alkalinity ratio was computed for the available samples and plotted with specific conductance (Figure 9). A ratio of 1 indicates a balance between the ions, in terms of mass, a value greater than 1 indicates sulfate is the more dominant ion, and a value less than 1 indicates total alkalinity is more dominant. The LOESS regression (66%) line shows a distinct inflection point in the ratios at approximately 300 µS/cm. The trend in the ratios is slightly negative when conductivity values range between 15 and 300 µS/cm, indicating alkalinity is the more dominant ion at lower conductivity values. In contrast, the trend increases greatly when conductivity is greater than 300 µS/cm, indicating the sulfate ion becomes more dominant as conductivity increases. This difference in sulfate and alkalinity dominance and their relationship to conductivity indicates that conductivity is not a consistent or reliable surrogate for concentrations of these individual ions. Given that major ion toxicity is a function of ion ratios and total concentration, conductivity is likely to be a poor predictor of toxicity in this dataset.

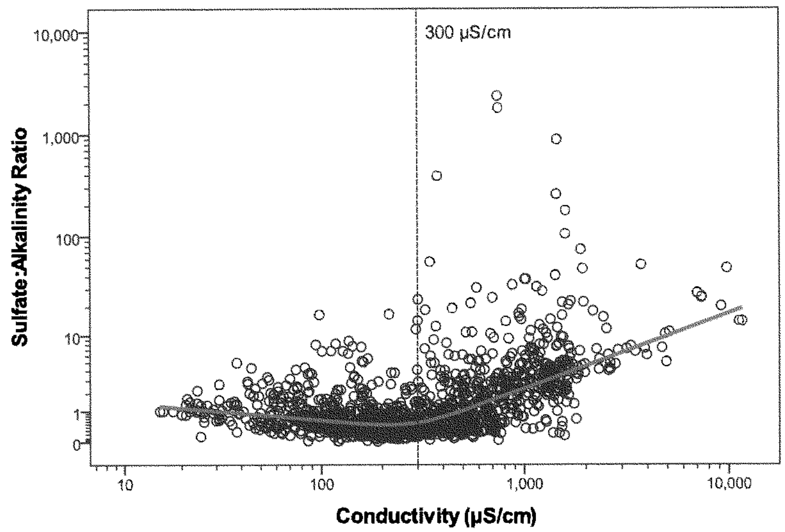


**Figure 9: Relationship between total sulfate and total alkalinity ratio and conductivity in streams of West Virginia, Ecoregions 69 and 70. LOESS regression line is based on 66% smoothing function.**

### *3.3.3 Interaction and Physiological Mechanisms*

Physiological stress from inorganic ions related to salinity was cited by EPA as one of the most plausible mechanistic reasons supporting use of a conductivity benchmark for macroinvertebrate community impairment. In particular, in Appendix A of EPA (2010), salinity is regarded as the mechanistically plausible, primary cause of macroinvertebrate community impairment. Salinity (and its resulting empirical measure, conductivity) is a property of water that represents the total concentration of dissolved mineral salts or "major ions", including $Na^+$, $Ca^{2+}$, $Mg^{2+}$, $K^+$, $Cl^-$, $HCO_3^-$, $CO_3^{2-}$, and $SO_4^{2-}$. One of the basic premises of EPA (2010) is that elevated concentrations of these ions causes physiological stress in macroinvertebrates, ultimately leading to the extirpation of the most sensitive species in waters with conductivity levels that exceed the proposed benchmark of 300 µS/cm.

From the literature they summarize, EPA (2010) concludes that evidence in support of this causal element is relevant, but not case-specific (Table A-9; EPA 2010). To a limited extent we agree with this conclusion, but our interpretation of the physiological literature suggests relationships between conductivity and specific macroinvertebrate taxa are neither strong nor consistent. Therefore, even though this mechanism may be to some extent plausible, additional study is needed for this to provide conclusive support for this causal element. Our interpretation of the physiological literature is provided below.

#### 3.3.3.1 Effects of salinity on osmoregulation and ionic homeostasis of aquatic organisms

The importance of osmoregulatory mechanisms in maintaining ionic balance (i.e., homeostasis) within all freshwater invertebrates is well documented. Most of the documents cited by EPA in this section are animal physiology and biochemistry books that adequately address the topic. As we discuss below, however, the specific comparative mechanisms of osmoregulatory disruption in different taxonomic groups which might be used to explain differential tolerance to salinity are not yet well understood. Ultimately, we suggest there is a need for further investigation of sub-lethal responses to high salinity exposure for a wide variety of sensitive and tolerant freshwater invertebrate taxa to confirm the mechanistic reasons which might explain taxonomic patterns of sensitivity.

Our review provided additional literature not cited by EPA and discussed active ion absorption by specialized body structures, particularly in snails, mussels, leeches, dragonfly nymphs, crayfish, and some dipteran larvae (Smith 2001). In the insects, these structures include individual chloride cells, fields of chloride cells (known as chloride epithelia), and other absorptive structures on papillae or within the gut system. Individual chloride cells are present in some members of Ephemeroptera, Plecoptera, and Hemiptera, while chloride epithelia are present in some members of Trichoptera, Odonata, and Diptera (Komnick 1977). In addition, some Diptera, Trichoptera, and Coleoptera have intestinal or papillar ion absorption sites (Komnick 1977). Osmoregulation by aquatic invertebrates may also depend upon integument permeability, which varies by taxonomic group (Pennack 1978, cited in Pillard et al. 1999) and age, because older organisms may have thicker and less permeable surfaces (Pillard et al. 1999).

EPA (2010) acknowledged the existence of numerous physiological mechanisms involved in the toxicity of high conductivity waters. EPA (2010) mentioned mortality as one of the effects of elevated salinity, citing Kefford et al. (2003, 2005a). We confirmed the accuracy of the first citation; however, Kefford and Nugegoda (2005) (as the citation appeared in the EPA references section, page 54, not Kefford et al. 2005a which is an incorrect citation) reported sublethal effects (growth and reproduction), and not mortality, from elevated salinity to the fresh water snail *Physa acuta*. EPA (2010) also described sublethal effects from salinity, such as reduced growth, reproduction, and hatching success, citing Clark et al. (2004), but this study showed salinity had opposite effects on two mosquito species, indicating differing or inconsistent physiological responses. A negative effect on growth rate due to increased salinity was observed in *Aedes aegypti*, while increased salinity had a positive effect with increased pupal mass in *Ochlerotatus taeniorhynchus* (Clark et al. 2004).

Several studies suggest tolerance of Diptera and Crustacea to elevated salinity. Dipterans are the most diverse group of insects in the aquatic environment (40% of insect taxa), and they possess morphological adaptations, such the presence of papillae, for regulation of salt concentration (Thorp and Covich 2001). Furthermore, because some dipteran species are capable of hypo-osmotic regulation, they are the only insect order that has successfully colonized highly saline waters (Hart et al. 1991). Some amino acids and carbohydrates in the hemolymph of the mosquito *Culex tarsalis* have an osmoregulatory role, allowing them to adapt to water with increasing salinity (Bradley and Garret 1986, cited in Natochin and Parnova 1987).

Freshwater crustaceans are relatively competent osmoregulators (Thorp and Covich 2001). The extreme tolerance of some freshwater decapods (*Amarinus lacustris*, *Paratya australiensis*, and *Caridina nilotica*) to salinity may be phylogenetically derived (Kefford et al. 2003). Adaptations in decapods include the epicuticular layer of the gill laminae, with a high selectivity to $Cl^-$ and $OH^-$ over all other ions normally present in freshwater and in the hemolymph (Avenet and Lignon 1985). Additionally, cladocerans frequently demonstrate very refined physiological adaptations to elevated salinity, as effective as those of decapods or even teleost fish (Aladin and Potts 1995).

Some studies reported negative effects of elevated salinity or conductivity on some Plecoptera, Nematoda, Oligochaeta, and Hydracarina. Salinity tolerance and osmotic stress were evaluated on the nymphs of the stonefly *Paragnetina media*, where mortality reached 80% in 1.2% NaCl (382 mOsm/L) and survivors after the 72-h exposure had slightly hyperosmotic hemolymph when compared to the exposure medium (Kapoor 1979). Piscart et al. (2006) observed changes in the distribution of macroinvertebrate life history traits (i.e., salinity preferences, maximum size, life cycle duration, reproduction, potential generations per year, respiration, dispersal, and feeding habits) among sites with varying salinity in France. For example, taxa with multivoltine life cycles, asexual reproduction, ovoviviparity, and filter-feeding traits were more frequent at sites with higher salinity levels. The authors concluded that salinity promotes more generalist and permanently aquatic taxa and the reduction of specialized, semi-aquatic taxa (Piscart et al. 2006).

Although several studies (Hassell et al. 2006; Kefford and Nugegoda 2005; Kefford et al., 2004, 2006, 2007) evaluated the effects of elevated salinity on other types of aquatic macroinvertebrates, the authors do not claim conclusive support of negative effects, but rather recommend further testing. In addition, EPA (2010) cited Zalizniak et al. (2007) as stating that reduced population density occurs over generations after elevated conductivity exposure. Based on the journal and article title from the Literature Cited section of EPA (2010), this citation should have been Zalizniak et al. (2009). We were unable to find any statement in Zalizniak et al. (2009) that supports this conclusion.

In summary, osmoregulatory mechanisms for maintaining ionic balance in freshwater invertebrates are well documented. However, the specific comparative mechanisms of osmoregulatory disruption in each of these taxonomic groups which explain differential tolerance to salinity are not yet well understood. There is a need for further investigation of sub-lethal responses to high salinity exposure for a wide variety of sensitive and tolerant freshwater invertebrate taxa to confirm the mechanistic reasons which might explain taxonomic patterns of sensitivity. Therefore, we conclude that evidence in support of this causal element is relevant and not case-specific, but not necessarily strong or consistent (Table 3).

**Table 3: Summary of evidences and scores for interaction and physiological mechanism, with alternative interpretations (adapted from Table A-9; EPA 2010).**

| Type of Evidence | Evidence | EPA Score | Suggested Score |
|---|---|---|---|
| Mechanism of Exposure | Salts readily dissolve in water and interact directly with aquatic organisms.<br>*Agree.* | + | + |
| Mechanism of Effect | Many mechanistic studies show that osmoregulation and homeostasis of specific ions are sensitive to disruption, particularly in mayflies.<br>*Alternative interpretation: Taxonomic patterns of sensitivity are not necessarily consistent, and are highly dependent on specific ionic composition of exposure solutions.* | + | 0 |
| Direct Evidence | No studies of ionic compensation are available for organisms in the region.<br>*Agree.* | NE | NE |
| Overall Score | Relevant but not case-specific.<br>*Alternative interpretation: Relevant and not case-specific, but not necessarily strong or consistent.* | + | 0 to + |

### *3.3.4 Specific Alteration*

#### 3.3.4.1 Sensitivity and tolerance of specific genera to salinity

Section A.2.4 of EPA (2010) cites what they believe to be strong, relevant, and consistent evidence supporting the specific effects of elevated conductivity on benthic invertebrates, particularly for Ephemeroptera. However, as discussed above, there is a lack of physiological studies to explain the specific mechanisms of ion toxicity and the reported higher sensitivity of Ephemeroptera to salinity compared to other macroinvertebrates. As noted above, some studies have found increased sensitivity of Ephemeroptera, Plecoptera, and Trichoptera taxa to higher salinity levels (Kefford et al 2003, 2004); however, there is considerable variability even within these orders, and little is known about the physiological mechanisms that drive the proposed sensitivity of these taxa.

EPA (2010) relied on relatively few studies that evaluated empirical relationships between field occurrence of Ephemeroptera and water chemistry. For example, Pond (2010) (incorrectly cited in EPA 2010 as Pond 2009) evaluated data from 92 headwater streams in the Appalachian Mountains of Kentucky to explore and describe regional patterns of diversity and distribution of lotic Ephemeroptera in relation to two stressors: coal mining and rural residential land uses. Although Pond (2010) demonstrated a strong correlation between low population densities and taxa richness of mayflies and specific conductance in regions of coal MTM/VF, the study also suggested that other sources of toxicity to mayflies, including exposure to heavy metals, nutrients, organic waste due to bacterial infestation, and a mixture of potentially harmful chemicals, could also have existed. Therefore, Pond (2010) suggested using specific conductance data, in conjunction with a human disturbance metric, to predict mayfly abundance and richness. EPA (2010) also cited Pond et al. (2008), which concluded that MTM/VF causes downstream biological degradation, given the changes on landscape, hydrology, and potential toxicants discharged. However, Pond et al. (2008) also recognized that additional studies are needed to test ambient downstream waters and synthesized waters that would mimic the ionic components downstream of mines but would not contain any other toxicants (e.g., metals).

In summary, the evidence cited by EPA in support of the specific alteration of presumed sensitive taxa (e.g., mayflies) to elevated conductivity is based only on correlations between field abundance and water chemistry (Pond et al. 2008; Pond 2010) and not from experimental studies. In general, there is a lack of physiological or other laboratory studies to explain and/or confirm the sensitivity of the Ephemeroptera, Plecoptera, and Trichoptera taxa to increased salinity. Therefore, it is difficult to conclude from these data whether the presumed effects from conductivity are strong, relevant, consistent, and of high quality (Table 4).

**Table 4: Summary of evidences and scores for specific alteration, with alternative interpretations (adapted from Table A-10; EPA 2010).**

| Type of Evidence | Evidence | EPA Score | Suggested Score |
|---|---|---|---|
| Specificity of Genera | Specific genera are consistently sensitive to conductivity. This quantitative evidence is independently confirmed. | ++ | |
| | *Alternative interpretation: While some taxa appear to be consistent related to conductivity, this is not true for all taxa considered in the benchmark derivation.* | | 0 |
| Specificity of Assemblage | A model based on specific biology discriminated effects of conductivity associated with mining. | + | |
| | *Alternative interpretation: Statistical Analysis in Section 4 does not conclude that conductivity is so strongly associated with changes in species composition as opposed to other factors.* | | - |
| Overall Score for Interaction | Relevant, independently confirmed, and consistent, but only two types of evidence. | ++ | |
| | *Alternative interpretation: Relevant, but neither strong or consistent.* | | - to 0 |

### *3.3.5 Sufficiency of Exposure*

#### 3.3.5.1 Laboratory tests of defined ion mixtures

In Section A.2.5, EPA (2010) evaluated evidence that laboratory-based exposure to salinity would cause adverse effects to invertebrates (especially mayflies) at concentrations near or above the proposed conductivity benchmark.

There are substantial differences in the toxicity of major ion salts; therefore, it would be expected that there would be differing toxicity in waters of different ionic composition (Mount et al. 1997). For example, Pillard et al. (1999) found that $K^+$, $Mg^{2+}$, and $HCO^{3-}$ are the most acutely toxic ions to freshwater organisms; however, ion toxicity is not just a function of the total concentration of any one ion, but also of the balance or ratios between individual cations and anions in any given aqueous solution. This was demonstrated by Mount et al. (1997), which found that the most toxic combination of salts was a 1:1 mixture of $K_2SO_4$ and $KHCO_3$. The $LC_{50}$ values reported for this ion combination were 390 mg/L for *Ceriodaphnia dubia* and 720 mg/L for *Pimephales promelas* (Mount et al. 1997). EPA (2010) reported that each of these $LC_{50}$s for *C. dubia* and *P. promelas* corresponds to 438 µS/cm and 1,082 µS/cm, respectively, although the basis of their conversion of ionic concentrations to conductivity is not clear.

Toxicity studies in Mount et al. (1997) were used to derive a salinity/toxicity relationship (STR) model to predict the acute toxicity of specific combinations of major ions related to salinity. EPA (2009; with the same result summarized in EPA 2010) used the STR model to suggest that salt mixtures in some streams below MTM/VF would cause acute lethality in *C. dubia*. However, the STR analysis provided in EPA (2009) does not appear to be entirely correct. EPA (2009) stated that more than 75% mortality is predicted for *C. dubia* using maximum concentrations for ions reported downstream of MTM/VF in Pond et al. (2008); however, one portion of the STR equations listed in EPA (2009), which were apparently used for these calculations, is incorrect[2]. To evaluate this further, we used the maximum ion concentrations from Pond et al. (2008) as inputs to the correct version of the STR model, and found that the predicted mortality for *C. dubia* is actually 57.4%. Regardless, a salt mixture based on the maximum values from a large dataset does not necessarily represent the salt mixture of an actual site or water sample. Therefore, toxicity predictions from a "mixture" based on the maximum concentration of each ion has limited or no environmental relevance.

A more relevant approach would be to use the STR model to predict toxicity of actual water sample chemistries from the dataset used to derive the conductivity benchmark. Therefore, for sites in which such data were available, the concentrations of ions needed to run the STR model were compiled from the WVDEP data for all sites used in derivation of the conductivity benchmark. Notably, potassium concentrations were not available for any of these sites, so STR model runs were conducted at the mean "mined" site concentration (9.9 mg K/L) as reported in Pond et al. (2008) to be conservative. These data were then used to predict 48-hr $LC_{50}$ values for *C. dubia* using the STR model (Mount et al. 1997), and plotted against conductivity for the same water samples (Figure 10). Additional STR model runs were also conducted at mean unmined potassium concentrations, but results did not differ substantially, and so are not presented here.

STR model predictions from the natural water chemistries demonstrated a consistent pattern of decreased percent survival when plotted against conductivity, but significant (i.e., < 90% survivorship) mortality only occurred as conductivity values exceeded 1,000 µS/cm (Figure 10). It should be cautioned that the STR model may not accurately predict the toxicity of ions in these mining-impacted natural waters given that empirical effluent and simulated effluent tests cited below suggest chronic lowest observed effect concentrations (LOECs) for *C. dubia* that are three to four times higher than the acute toxicity predictions from the STR model. Additional study is needed to determine the full extent to which the STR model accurately represents chronic toxicity to sensitive organisms.

Other studies not cited in EPA (2010) investigated the toxicity of various ion mixtures to freshwater invertebrates in laboratory waters. Soucek and Kennedy (2005) found that increasing chloride concentrations reduced the toxicity of sulfate to *Hyalella azteca*, and increasing water hardness ameliorated the toxicity of sodium sulfate to both *H. azteca* and

[2] The equation for *C. dubia* 48-hr mortality in Mount et al. (1997) is in the form of the regression constant, 8.83 *plus* the remaining equation terms, whereas EPA (2009) shows this same equation in their footnote 11 as 8.83 *multiplied by* the remaining equation terms.

*C. dubia*. Further studies on the relationship between chloride and sulfate showed that increasing chloride reduced sulfate toxicity over the 5-25 mg/L chloride range, but resulted in increasing mortality over the 25-500 mg/L range (Soucek 2007). In addition, it was determined that the STR model does not account for the protective effect of elevated hardness on TDS toxicity (Soucek 2007). While both of these studies concluded that increasing hardness mitigated sulfate toxicity, both tests were conducted using sodium sulfate salts, and so may not fully represent hardness effects in the presence of cations other than sodium. However, Soucek and Kennedy (2005) hypothesized that toxicity mitigation occurred because increasing calcium concentrations would decrease the permeability of epithelial cells to water and ions, thus reducing the energy required for osmoregulation. There is no reason such a mechanism would not also cause hardness mitigation of sulfate toxicity in the presence of cations other than sodium (e.g., potassium), but this has not yet been subject to experimental test.

As a result of this and similar studies, Soucek (2007) stated, "Clearly, any attempt at water quality standard development, whether based on TDS, conductivity, sodium, or sulfate, should incorporate the fact that the water quality parameters like hardness and chloride strongly regulate the toxicity of high TDS solutions." Therefore, any attempts to use conductivity to evaluate the toxicity of specific water chemistries related to elevated conductivity must be interpreted carefully to ensure that the potentially confounding factors of hardness and chloride have been accounted for.

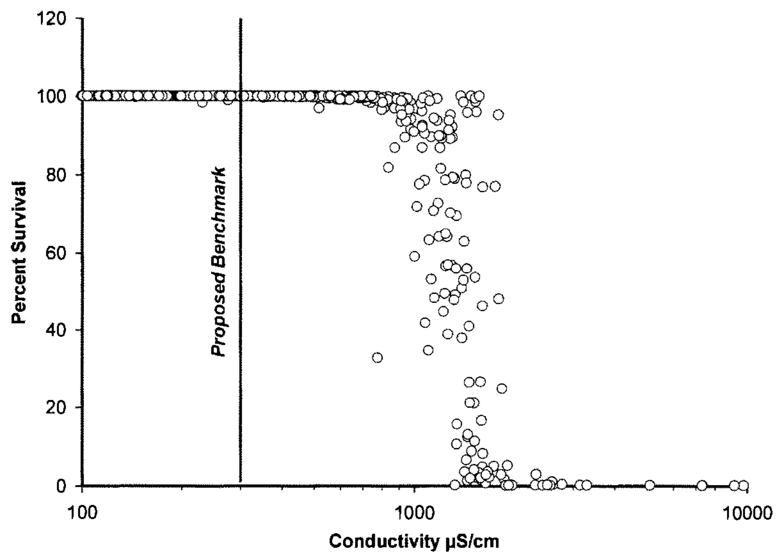


**Figure 10: Predicted acute toxicity of natural waters from the WABbase to *Ceriodaphnia dubia* according to the STR model (Mount et al. 1997).**

#### 3.3.5.2 Laboratory tests of mine discharges

To evaluate the potential toxicity of coal mine effluents, EPA (2010) cited the Kennedy et al. (2004) study, in which *Isonychia bicolor* mayflies were exposed to simulated coal mine effluent in 7-day tests. The study reported LOECs of 1,562 µS/cm, 966 µS/cm, and 987 µS/cm for mayfly survival at 20°C. These values bracketed the 95th percentile extirpation concentration ($XC_{95}$) of 1,177 µS/cm, calculated in EPA (2010) for the genus *Isonychia*. However, EPA (2010) failed to include all of the information from Kennedy et al. (2004). In the bioassay test conducted at 12°C on *I. bicolor*, the LOEC for survival was 4,973 µS/cm, which is substantially higher than the calculated $XC_{95}$. This difference in toxicity can possibly be attributed to the temperature the organisms were accustomed to in the natural environment prior to use in the test, since the organisms used in both the 20°C and 12°C tests were from an over-wintering cohort. Given that the proposed conductivity benchmark is intended to be applied for all times of the year, including tests using various temperatures is important. Additionally, EPA (2010) implied that the *Isonychia* tests were conducted on coal mine discharge waters, when they were actually conducted on simulated effluent.

Effects on *C. dubia* survival and reproduction in 7-day tests were also determined in the Kennedy et al. (2004) study on coal mine effluent and simulated effluent. In the effluent tests, no significant effects on survival were observed at conductivity levels up to 4,730 µS/cm. The LOEC for reproductive effects was observed at 3,254 µS/cm in mine effluent (Kennedy et al. 2004). In simulated effluent, no significant effects on survival occurred up to 4,530 µS/cm and the LOEC for reproductive effects was 3,730 µS/cm. Similarly, chronic effects in simulated effluent tests for which toxicity was most likely attributable to sodium or sulfate (Kennedy et al. 2005) were observed at approximately 3,200 µS/cm in very hard waters (792 mg/L), but as low as approximately 2,000 µS/cm in soft waters (88 mg/L). Kennedy et al. (2003) also conducted 7-day tests on coal processing effluent (from the same sources used in Kennedy et al. 2004) using *C. dubia*. In duplicate tests, the chronic LOECs for *C. dubia* mortality were 4,730 µS/cm and 6,040 µS/cm, and the LOECs for reproduction were 2,910 µS/cm and 3,710 µS/cm.

Echols et al. (2009) also conducted tests on the effects of coal processing effluent on *Isonychia* sp. and *C. dubia*. EPA (2010) provided the LOEC values for *Isonychia* survival, which ranged from 1,508 µS/cm to 4,101 µS/cm; however, *C. dubia* tests conducted in the same study resulted in broadly overlapping LOEC values ranging from 2,132 µS/cm to 4,240 µS/cm (Echols et al. 2009). These data indicate that *Isonychia* and *C. dubia* had similar sensitivities to high conductivity waters, which is contrary to Kennedy et al. (2003, 2004). The variability seen in the tests is not entirely unexpected; salinity tolerance for most species appears to be variable and may fluctuate, depending on abiotic factors such as temperature, pH, and dissolved oxygen (Pillard et al. 1999). Since not all of these factors were reported in Echols et al. (2009), we cannot confirm whether they might have been responsible for some of the variability between tests.

In Echols et al. (2009), three mayfly bioassays and five *C. dubia* bioassays were also run on the coal processing effluent; it is unclear if the studies were concurrent. LOEC values from the three mayfly bioassays ranged from 1,508 µS/cm to 4,101 µS/cm. The final mayfly bioassay exhibited the lowest LOEC, and EPA (2010) attributed this to the dominance of sodium in that test. However, Echols et al. (2009) speculated that the lower LOEC may have been because the mayflies used in that test were from a summer cohort and may have been more sensitive. EPA (2010) also stated that Echols et al. (2009) attributed toxicity to mayflies in all of the studies to salinity because the effluent contained no detectable toxic metals, except for selenium (8.5 µg/L). However, the only effluent that was chemically analyzed (and could therefore support or refute such a claim) was the effluent from the first mayfly bioassay test, which had resulted in the highest LOEC (4,101 µS/cm), and in which there was a poor correlation between survival and conductivity for the first seven days, with improved correlations by day 14 (Echols et al. 2009). The effluent from the two other mayfly studies was not analyzed; therefore, it is unknown if there were any metals or unknown toxicants in the effluent.

Woodward et al. (1985) studied the effects of spent shale leachate on the mayfly *Hexagenia bilineata*. Although this is a different water type than the other studies presented here, it is a multi-ion water with high conductivity; measured ions in this water included B, Ca, K, Li, Mg, Mo, Na, Sr, F, Cl, $NO_3$, and $SO_4$. Woodward et al. (1985) reported that magnesium and sulfate represented 81% of the total ions in the leachate. In this study, mayflies were exposed to various dilutions of concentrated leachate and organism survival and growth, i.e., length, were determined at 15 and 30 days. The LOEC values for survival at 15 and 30 days were 2,950 µS/cm and 1,800 µS/cm, respectively (Woodward et al. 1985). There were no significant effects on length in either of the tests. These effect concentrations are comparable to the other mayfly studies previously described.

Some additional conclusions made by the authors in these studies were not reported in EPA (2010). For example, Kennedy et al. (2004) concluded that conductivity levels up to 900 µS/cm appeared to be safe for sensitive benthic invertebrates, based on survival of *Isonychia* in their studies, instream mayfly distributions, and endpoints from previous research. It was further concluded that reductions in the mayfly populations would likely occur between 1,500 to 2,000 µS/cm. Echols et al. (2009) determined that impairment occurred around 1,400 mg/L of total dissolved solids (TDS), which is approximately equivalent to a conductivity level of 2,333 µS/cm.

Therefore, the high levels of variability seen in the results of all of the studies described above further suggest that toxicity cannot easily be predicted from conductivity or TDS concentrations alone. Rather, the toxicity of major ions related to salinity can vary widely as a result of the concentrations and combinations of the ions present (Chapman et al. 2000), as well as other factors not easily compared between tests (Pillard et al. 1999). Short-term chronic toxicity as a function of conductivity in these tests suggested that, although mayflies may indeed be somewhat more sensitive than *C. dubia*, effect levels sometimes overlapped broadly and were highly variable between tests. Therefore, the available toxicity test data do not support EPA's assertion that toxicity is observed at conductivities that are similar to the $XC_{95}$ values for sensitive taxa.

#### 3.3.5.3 Laboratory tests of ambient waters

Merricks et al. (2007) conducted acute bioassay tests on ambient water from streams below valley fills in West Virginia using *C. dubia*. EPA (2010) stated that $LC_{50}$ values were established for *C. dubia* for some but not all of the waters from Lavender Fork. Three of the eight Lavender Fork sites did have $LC_{50}$ values ranging from 1,763 µS/cm to 2,184 µS/cm; however, EPA (2010) did not mention that 19 other sites were tested, with conductivity levels ranging from 923 µS/cm to 2,720 µS/cm, and only one of the 19 tests resulted in significant effects on *C. dubia*. EPA (2010) concluded that these tests had low relevance to the conductivity benchmark and would underestimate toxicity in the field due to the test species, duration, and endpoint. However, the data in Merricks et al. (2007) demonstrate that toxicity in waters below valley fills, whether acute or chronic, is highly variable and cannot be easily predicted based on conductivity alone. This supports our premise that generic measures of ionic concentration, such as TDS or conductivity, are inadequate for assessing the true potential toxicity of major ions present in waterbodies (Mount et al. 1997; Pillard et al. 1999; Goodfellow et al. 2000).

In addition, the USGS Columbia Environmental Research Center (CERC) is currently conducting U.S. EPA Project No. DW-14-92251001O "Toxicity of Total Dissolved Solids to Appalachian Aquatic Invertebrates" (Kemble 2010). These studies are using reconstituted waters that simulate water chemistry from several locations in West Virginia to more directly evaluate the sensitivity of mayflies and other aquatic invertebrates relative to conductivity. In the project summary for fourth quarter 2009 (October 1 to December 31, 2009), USGS reported the results of tests conducted using three reconstituted waters (Board Tree, Upper Dempsey, Winding Shoals) and a control water on *H. azteca* (amphipod), *Lampsilis siliquoidea* (28-day tests) (mussel), *C. dubia* (7-day test) (zooplankter), and mayflies (14-day test using *Hexagenia* spp., likely a mixture of *H. rigida* and *H. limbata*). All species had acceptable control survival except for mayflies; the researchers reported that mayflies "do not do well" after 14 days in exposures without a sediment substrate. However, on day 8 of the mayfly bioassay tests, control survival was satisfactory at 88% survival; therefore, day 8 data were used for comparison to controls. There were no observed effects on *Hexagenia* or *C. dubia* survival in the Board Tree tests, with conductivity levels ranging from 579 µS/cm to 2,386 µS/cm. In the Upper Dempsey test on *Hexagenia*, there were effects on survival at 961 µS/cm, and for *C. dubia*, effects were seen at 1,817 µS/cm. In the Winding Shoals test, effects on *Hexagenia* survival were observed at 798 µS/cm, but no effects on *C. dubia* survival were seen in conductivities up to 1,828 µS/cm. These preliminary data indicate that in some ionic mixtures, mayflies appear to be slightly more sensitive than *C. dubia*, but in others they exhibit similar sensitivities.

#### 3.3.5.4 Conclusions—sufficiency of exposure

In summary, there are insufficient data from the physiological and toxicology literature to support EPA's conclusion that "conductivities in the region of concern reach levels that are sufficient to cause effects on stream communities" (EPA 2010, p. 52). First, although elevated salinity can clearly induce adverse effects on aquatic invertebrates, the taxonomic patterns of sensitivity are not yet clearly defined. Although laboratory toxicity data exposing mayflies to actual or simulated mining effluents suggest they may be somewhat more sensitive than the most sensitive surrogate test species, *C. dubia*, effect concentrations are highly variable and, in some studies, overlap between species. Toxicity to ions associated with salinity (e.g., sulfate) also varies strongly as a function of specific ion composition and can be mitigated under conditions of elevated hardness. Additional study is needed to confirm the relative sensitivity of macroinvertebrate communities to elevated salinity and the extent to which other water quality variables and major ion composition will influence the consistency of these results. Until such relevant studies are conducted, it is premature to suggest that a quantitative conductivity benchmark is an accurate and direct reflection of ions related to salinity, even if restricting the benchmark to waters in which conductivity is dominated by sulfate and bicarbonate. Therefore, we also do not agree with EPA's conclusions that there is "positive evidence that the conductivity levels observed are sufficient to cause the associated effects" (Table 5).

**Table 5: Summary of evidences and scores for sufficiency, with alternative interpretations (Table A-11; EPA 2010).**

| Type of Evidence | Evidence | EPA Score | Suggested Score |
|---|---|---|---|
| Laboratory Tests of Defined Ion Mixtures | The tests were high quality, but the species and durations have low relevance for determining the conductivity level at which effects occur, and the effect levels are supportive only if assumptions are made about acute/chronic and intertaxa extrapolations. | 0 | |
| | *Alternative interpretation: Differences in ion composition between different test solutions were not properly accounted for, nor were the potential mitigating effects of hardness on sulfate toxicity. STR model predictions from natural waters demonstrated effects at concentrations greatly exceeding the proposed conductivity benchmark even though the model does not incorporate the potential effects of hardness mitigation.* | | - - |
| Laboratory Tests of Mine Discharges | This evidence is relevant in that it comes from nonacid mine effluents in the region and includes an ephemeropteran; but the ionic mixtures were somewhat different, the effect was lethality and the durations were short. The results for one set of tests matched the $XC_{95}$ for the test genus, but were higher for the other. | + | |
| | *Alternative interpretation: Additional studies obtained showed effects did not occur until conductivity levels in excess of $XC_{95}$ levels.* | | - |
| Laboratory Tests of Ambient Waters | These tests showed acute lethality to an apparently resistant species at high conductivity levels. Its relevance is too low to support or weaken. | 0 | |
| | *Alternative interpretation: The effects observed here at higher conductivity levels are no more or less relevant than mine discharge laboratory tests. Therefore, these do not support the presumed effects at lower conductivity levels.* | | - |
| Field Exposure-Response Relationships for Ephemeroptera | This is strong evidence because it is highly relevant, was obtained independently in two separate datasets, with moderate to strong correlations. It is not convincing in itself because of the potential for confounding, which is treated in Appendix B. | + + | |
| | *Alternative interpretation: The potential for confounding is a significant factor that has not yet been fully resolved, and field correlations are not always strong (e.g., Figures A-1 and A-2; EPA 2010).* | | - |
| Field Exposure-response Relationships for Genera | As conductivity increases, genera are no longer observed. | ++ | |
| | *Alternative interpretation: The potential for confounding is a significant factor that has not yet been fully resolved, and field correlations are not always strong (e.g., Figures A-1 and A-2; EPA 2010).* | | - |

| Type of Evidence | Evidence | EPA Score | Suggested Score |
|---|---|---|---|
| General Knowledge | General knowledge indicates that salinity can cause the loss of species but does not indicate that the salinity levels observed in this case are sufficient.<br>*Alternative interpretation: We generally agree with this statement, but the lack of sufficiency does not warrant a score of 0, but rather a score of – because it weakens the case in support of sufficiency.* | 0 | - |
| Overall Score | The exposure-response relationships in the field, with some support from laboratory studies, provide positive evidence that the conductivity levels observed are sufficient to cause the associated effects.<br>*Alternative interpretation: It is unclear how EPA concludes such a strong positive score (+++) from mixed conclusions from the various lines of evidence. Our analysis of the available literature suggests a consistent lack of support for sufficiency of the proposed conductivity threshold because most studies suggest effects would occur at much higher conductivities, and ion composition and hardness mitigation have not clearly been accounted for in EPA's analysis. Use of surrogate test species somewhat reduces the relevance of this conclusion.* | +++ | - - |

### *3.3.6 Relevant Standards in Other States*

It is noteworthy that three other states, Illinois, Indiana, and Iowa, have all rejected conductivity or TDS-based aquatic life standards in lieu of numeric standards for sulfate and chloride that also depend on water hardness. For Iowa, the current final rules (http://www.iowadnr.gov/water/standards/chloride.html) indicate that the existing scientific data support the importance of individual ions over composite variables such as TDS because "chloride and sulfate are better indicators than integral parameters such as TDS, conductivity, and salinity for water quality protection" (IDNR 2009). Similarly, the Illinois EPA proposed a numeric sulfate standard, which was also ultimately approved by EPA, to replace TDS standards for the same technical reasons (Norwest Co. 2010). Indiana proposed essentially the same sulfate and chloride criteria equations, which were also approved by EPA because ". . . the TDS standard currently in place is inappropriate. By definition TDS is a measure of all dissolved solids, yet we know that the toxicity of TDS is exerted by its individual components" (EPA 2008). Therefore, the available scientific information does not support development of regulatory thresholds based on composite variables such as conductivity or TDS, but rather the development of individual numeric criteria for specific ions.

#### 3.3.6.1 Illinois sulfate criteria

To illustrate the outcome of using the single-ion approach preferred by Illinois, the WABbase chemical data were used to derive aquatic life criteria for sulfate as modified by chloride and hardness. Using this example, the revised Illinois sulfate criteria are based on a range of total hardness and chloride concentrations (Table 6). Given site-specific conditions, sulfate criteria are either set at a constant 500 mg/L for samples exhibiting less than 100 mg/L total hardness, or a constant 2,000 mg/L for samples exhibiting total hardness greater than 500 mg/L and chloride concentrations greater than 5 mg/L. In addition, two equations are used to calculate site-specific sulfate criteria for samples exhibiting total hardness in the range of 100 to 500 mg/L and chloride in the range of 5 to 500 mg/L (Table 6).

The WABbase dataset contained 1,591 samples with paired hardness, chloride, and sulfate values, and represented a wide range of concentrations. Each sample was categorized based on total hardness and chloride concentrations and assigned a sulfate value based on the Illinois sulfate criteria rules (Table 6). The assigned sulfate value was then compared to the measured sulfate value to determine whether the sample achieved the Illinois sulfate criteria. Less than 1% (15 samples) of the WABbase samples exceeded the Illinois sulfate criteria, with the majority of exceedances occurring in the samples with hardness levels greater than 500 mg/L. There are a total of 54 samples exhibiting hardness values greater than 500 mg/L over a range of chloride concentrations, and 14 of these samples exceeded the sulfate criteria. In contrast, 26% of these WABbase samples exceed the proposed conductivity benchmark.

**Table 6: Illinois sulfate criteria (mg/L, bold values) based on a range of hardness and chloride ion concentrations. The number of WABbase water samples within each range is identified by n.**

| Ion Ranges | Chloride <5 mg/L | Chloride 5 to <25 mg/L | Chloride 25 to <500 mg/L | Chloride ≥500 mg/L |
|---|---|---|---|---|
| **Hardness <100 mg/L** | **500**<br>n = 696 | **500**<br>n = 350 | **500**<br>n = 23 | **500**<br>n = 0 |
| **Hardness 100 to <500 mg/L** | **500**<br>n = 113 | **Eqn 1**<br>n = 84<br>*1 of 84 exceeded criteria* | **Eqn 2**<br>n = 270 | **2,000**<br>n = 1 |
| **Hardness ≥500 mg/L** | **500**<br>n = 10<br>*6 of 10 exceeded criteria* | **2,000**<br>n = 26 | **2,000**<br>n = 15<br>*7 of 15 exceeded criteria* | **2,000**<br>n = 3<br>*1 of 3 exceeded criteria* |
| Eqn 1: Sulfate = [-57.478 + 5.79(Hardness) + 54.163(Chloride)] x 0.65 | | | | |
| Eqn 2: Sulfate = [1,276.7 + 5.508(Hardness) – 1.457(Chloride)] x 0.65 | | | | |

This analysis suggests that using a single ion criteria approach that incorporates the effects of hardness and chloride provides a significantly different indication of which and how many waters are likely to impair aquatic life. While elevated hardness and chloride concentrations are known to ameliorate sulfate toxicity, it is unknown whether the specific ionic composition of streams in West Virginia differs enough from Illinois streams in such a way that would make the single ion approach applicable. Notably, the State of Iowa is also considering adopting the same criteria that EPA and Illinois adopted in 2008. Nonetheless, given the empirical relationships between total hardness, chloride ions, and sulfate toxicity; the single ion approach warrants closer examination for use in Ecoregions 69 and 70 of West Virginia instead of the proposed conductivity benchmark.

### *3.3.7 Conclusions—Causal Analysis*

Based on our review of this causal analysis (Appendix A), we do not agree that the available evidence rigorously indicates that salts, as measured by conductivity, are a common cause of impairment in aquatic macroinvertebrates in the region of concern (i.e., Ecoregions 68 and 69 of West Virginia). Rather, while some elements of causation can be shown to exist, other elements are weak or inconclusive, and so the underlying hypothesis that salinity ions are the major causes of biological impairment has not yet been subject to sufficient test. Therefore, it is also premature to take it "as a given" that the functional relationship between conductivity and impairment is strong enough so that the confounding factor analysis in Appendix B need only address conductivity confounders (Section 3.4).

## 3.4 Confounding Factors Analysis

The confounding factors analysis in Appendix B of EPA (2010) uses a weight of evidence approach to evaluate whether environmental factors other than conductivity could substantially interfere with or otherwise bias the presumed relationships between conductivity and biological impairment in West Virginia streams. However, EPA's goal was not to eliminate confounding variables, nor was it an attempt to independently test the hypothesis that conductivity was the best predictor of biological impairment. As stated on page 69 of EPA (2010), "This assessment of confounding takes the result of the causal assessment as a given (*emphasis added*) and attempts to determine whether any of the known potential confounders interfere with estimating effects of conductivity to a significant degree." Furthermore, the confounding factors analysis was based entirely on patterns related to mayfly abundance "(b)ecause the sensitive genera are primarily Ephemeroptera and the endpoint effect is extirpation of 5% of genera…" (EPA 2010, p. 69).

We agree that it is an important and relevant exercise to evaluate the potential influence of confounding factors on the primary factor(s) presumed to be the strongest predictor(s) of biological response and also causally related to the response. As discussed above in Section 3.3, we do not agree that sufficient evidence exists to determine that conductivity is necessarily causally related to extirpation of "sensitive" species at the concentration represented by the proposed benchmark. Nor do we agree that conductivity is the single or best predictor of patterns in macroinvertebrate community structure related to coal MTM/VF activities, especially as manifested by mayfly abundance (see Section 4.0). Therefore, we also do not agree that a confounding factor analysis should take it *as a given* that these are the only or primary relationships that require evaluation. Rather, we contend that a confounding factors analysis should also include rigorous and independent tests of the primary hypothesis by determining whether conductivity is indeed the best predictor of biological impairment that is causally related in such a way as to justify the proposed benchmark value. Indeed, the causal assessment in Appendix A does not present or evaluate potential causal factors other than conductivity, so the overall analysis presented by EPA (2010) does not thoroughly test alternative hypotheses.

The sections that follow present observations on a selection of confounding factors addressed by EPA in Appendix B that we suggest may correlate with and potentially confound conductivity relationships. We also suggest that these may represent factors that could be as or more important to benthic macroinvertebrate community structure than conductivity and, hence, require a more formal analysis to determine whether they represent viable alternatives to the hypothesis that conductivity is the primary factor responsible for impairment.

### 3.4.1 Evidence Rejecting Habitat Differences as Possible Cause of Extirpation

The assertion in EPA (2010) that habitat presented little potential for confounding in their derivation of the conductivity benchmark needs considerable additional scrutiny. There are three clear problems with this assertion.

First, the Rapid Bioassessment Protocol (RBP) habitat scores used by EPA in their analyses may not be the most rigorous measure of habitat quality. Rates of mayfly presence were nearly identical between poor quality and high quality habitat at low conductivity levels in the contingency table (Table B-8 of EPA 2010), indicating that RBP habitat scores are not the best predictor of habitat quality for mayflies. This may be because RBP habitat scores are more directed toward identification of fish habitat and they are influenced by a significant level of subjectivity, even if the method itself results in some level of quantification.

Second, the RBP habitat scores were correlated with conductivity and the biological response, i.e., the $HC_{05}$ (Section B.4.1. of EPA 2010). This in itself should suggest that habitat may be a significant confounding factor. Because RBP habitat scores do not appear to tell the whole story, a more detailed analysis of habitat quality and its relationship to the benthic macroinvertebrate community needs to be conducted before EPA can conclusively state that "low RBP was judged to have little effect on the derivation of the $5^{th}$ percentile hazardous concentration ($HC_{05}$) for conductivity" (Section B.4.1. of EPA 2010).

Third, as noted below in Section 3.4.2, the analysis of the potential confounding factors in EPA (2010) focused almost exclusively on the response of Ephemeroptera to conductivity levels, to the exclusion of the rest of the benthic macroinvertebrate community. The Ephemeroptera are represented by 25 genera in the database, which is only 16.5% of the total number of genera. Furthermore, while some genera of Ephemeroptera do appear to be sensitive, they do not appear to be the most sensitive genera. Based on the $XC_{95}$ calculations, *Remenus* (a stonefly) and *Lepidostoma* (a caddisfly) are ranked more sensitive than the most sensitive mayfly genus, *Cinygmula*. Because mayflies are not the most sensitive organisms in the database, the other ordinal taxa should be investigated to determine their response to conductivity across gradients of habitat quality. Furthermore, because of the variety of conflicting stressor-response profiles exhibited by all of the genera in the database, it would be more informative and conclusive to analyze the response of a representative subset of genera representing all of the stressor-response profiles, not just the mayflies, to habitat variables and conductivity.

Even if the RBP habitat scores can appropriately be eliminated as a potential confounding stressor for Ephemeroptera, EPA has not sufficiently demonstrated that habitat (by RBP scores or by a more detailed analysis of habitat quality) can be eliminated as a potential confounding factor to the rest of the benthic macroinvertebrate community.

### *3.4.2 Rejection of Confounding Factors Based Almost Exclusively on Ephemeroptera (Mayflies)*

In EPA (2010), an attempt was made to reject as many potential confounding stressors as possible. However, lack of correlation between number or presence of Ephemeroptera genera and each potential confounding stressor was most often cited in Appendix B as being a strong reason to reject most potential stressors as confounding influences with conductivity. As noted above, Ephemeroptera genera represented only 16.5% of the dataset, yet it does not appear that the other taxonomic orders or the entire invertebrate assemblage were similarly tested to determine their relationships to the potential confounding stressors. Because several taxonomic groups were present in the community, and because the Ephemeroptera genera differed in their responses to conductivity, it is inappropriate to focus only on Ephemeroptera in elimination of potential confounding stressors.

Furthermore, it also does not appear that individual genera were examined to determine their stressor-response to the other potential confounding stressors to eliminate those stressors definitively. If such testing had been conducted for representative genera in the database, it may have been found that many of the genera (particularly those with optimum or increasing stressor-response patterns) were in fact responding to some of the other potentially confounding stressors.

Relationships between all potential stressors and Ephemeroptera were generally cited as reasons to reject the stressors as potential confounders in the analysis that ultimately relates to the entire aquatic benthic community. There is a clear need to include similar analyses from the other invertebrate orders and the entire invertebrate community to conclusively reject the stressors as potential confounding stressors.

### *3.4.3 Natural Rarity as a Reason for Low Capture Probability*

The original, full WVDEP WABbase used by EPA included 559 taxa, of which 498 were identified to genus; the others were identified to family or were "slashed" taxa (e.g., *Leucrocuta/Nixe*). Because EPA (2010) restricted the database with several filters (e.g., particular ecoregions, pH, months, years, watershed size, sulfate dominance instead of chloride, etc.), 328 aquatic macroinvertebrate genera (59%) from West Virginia were excluded from analysis.

EPA (2010) attempted to control for the effect of rare taxa by including only those taxa that had been collected in at least one reference site and at least 30 general sites; therefore, 18 additional genera were excluded from analysis because they were never found at a reference site (EPA 2010, Table 3, p. 26). There were 2,145 samples represented in the total dataset, based on Table 2 on page 26 (EPA 2010). According to Figure 2 (EPA 2010, p. 28), there were 97 reference samples from 70 individual sites used in EPA (2010), although page 7 of EPA (2010) said there were 70 reference sites. Therefore, if a genus had a collection probability of at least 1.0% in the reference sites and at least 1.4% in the general sites, it was considered to be common enough to include in the SSD. The number of occurrences of each genus in the reference samples was provided in Appendix C of EPA (2010).

Even though the number of taxa included would necessarily be constrained (Table 7), it would have been more appropriate for EPA to have controlled for the effects of rare taxa by including in their SSD only those genera that had a high capture probability in the reference sites. Such an approach would be analogous to a laboratory study in which mortality in the control is a major determinant of the validity of a study. In discussing criteria development, the 1985 Guidelines stated that "data should usually be rejected if they are from . . . tests in which too many organisms in the control treatment died or showed signs of stress of disease. . . ." Many laboratory studies are rejected for inclusion in a criterion calculation because mortality in the control exceeded a certain percentage. Although "too many organisms" was not specifically defined in the 1985 Guidelines, many criteria we are familiar with used cutoffs near 20% mortality (or 80% survival) in the controls. EPA (2010) considered a 1% collection probability in reference sites to be acceptable, but a 1% survival rate in a laboratory test would clearly not be acceptable.

**Table 7:**
**Number of genera available for SSD calculation based on capture probability in reference samples.**

| Capture Probability in the Reference Samples | Number of Genera Included |
|---|---|
| All | 151 |
| >1% | 138 |
| >5% | 100 |
| >10% | 75 |
| >20% | 49 |
| >50% | 14 |

The most sensitive taxon in the database, the stonefly *Remenus*, had a calculated $XC_{95}$ of 101 µS/cm. This taxon was found in three of the reference samples (3%) and 35 of the general samples (1.6%). Even though there were 38 data points (excluding non-detects) used to derive a stressor-response relationship, it is clear that the genus is rare even in reference streams where conductivity levels are low. It cannot be clearly demonstrated that the relationship observed in *Remenus* of a decreasing capture probability with increasing conductivity is accurate when there is only a 3% probability of capture in reference streams. (Using the laboratory control analogy, this is similar to only 3% survival in the control—a result that would strongly invalidate a study.) Furthermore, *Remenus* is so rare that nothing is known about the biology of the nymphs, except limited information on timing of emergence from collection records (Stewart and Stark 2002). There is not sufficient information for EPA (2010) to assume that high conductivity levels are responsible for the rarity of *Remenus* when it is naturally rare in the general population.

A total of 72 taxa (48%) had a higher capture probability in the general sites than in the reference sites (Figure 11). Of those taxa, the difference between the two probabilities was less than a full percentage point in many taxa; however, 27 taxa had a capture probability at least 5% higher in the general sites than in the reference sites. The largest difference was in the chironomid genus complex *Cricotopus/Orthocladius*, which was not used in the calculations. The second largest difference was in *Stenelmis*, which had a capture probability of 51% in the general sites, but only a 13% capture probability in the reference sites (difference = 38%).

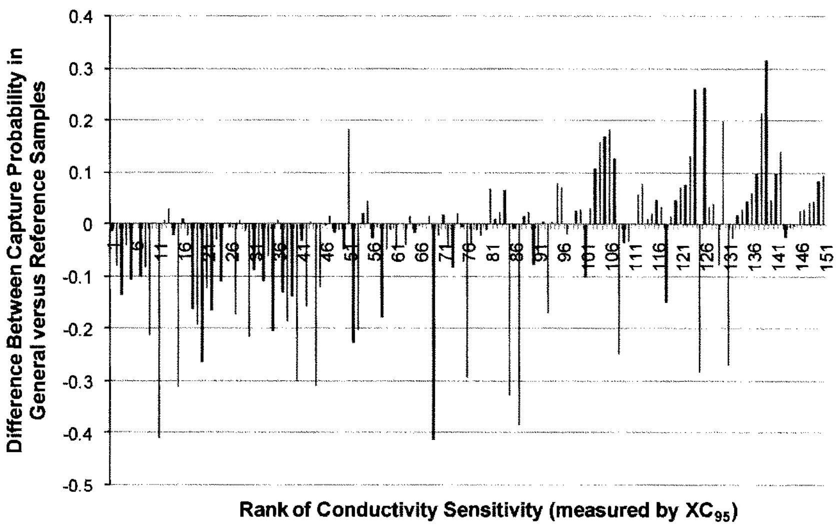


**Figure 11: Difference between capture probability in general versus reference samples, ranked by sensitivity to conductivity. Positive values indicate that the genus had a higher capture probability in general samples than in reference samples.**

A plausible argument against excluding rare taxa from the SSD would be that the taxon is rare because of the stressor. However, this argument would not be valid if the taxon is naturally rare, a phenomenon that could be analyzed using its capture probability in reference sites. EPA (2010) did not sufficiently demonstrate that the rare taxa were rare due to conductivity or any other water quality effect, and not from general rarity itself.

## 3.5 Ecological Relevance of Presumed Impairment as a Function of Conductivity

The ultimate protection goal of EPA's proposed conductivity benchmark is to determine a conductivity level that, if not exceeded, would prevent extirpation of 95% of the aquatic macroinvertebrate genera. This is similar to the protection goals of numeric criteria for protection of aquatic life and their uses (1985 Guidelines). However, it is important to evaluate the relevance of this protection goal when the criterion or benchmark is derived from a very large number of genera, as is the case with the proposed conductivity benchmark. For even the most data rich numeric criteria, far less than 100—and often less than 20—genera are used to derive the acute and chronic criteria. However, with the conductivity benchmark, 151 genera are used and yet only a few mayfly taxa are truly considered indicative of "sensitivity" to conductivity, potentially requiring protection. In addition, even if one accepts the role of conductivity in being directly correlated with and responsible for loss of taxa at elevated levels, is this 95% protection level ecologically relevant, i.e., do communities in the presence of elevated conductivity lose important ecological functionality?

To address these questions, we evaluated trends in macroinvertebrate community structure and function relative to conductivity from the data presented in EPA (2010). Numerous functional feeding groups (FFGs) were represented in the dataset used in EPA (2010), including filter-collectors, gather-collectors, omnivores, predators, scrapers, shredders, and one piercer. Gather-collectors and predators were the most abundant FFGs. Filter-collectors, gather-collectors, predators, and shredders were each represented by genera with each of the identified and conflicting stressor-response profiles (Table 8). Scrapers were represented by genera in each of the stressor-response profiles except for the profile that increased with respect to increasing conductivity values. Twelve to 27% of the genera in each FFG, except scrapers, exhibit an increasing stressor-response profile, and thus would potentially not be protected by the proposed conductivity benchmark.

**Table 8: Number of genera in particular functional feeding groups in identified stressor-response profiles. Piercers and omnivores not included due to low numbers of taxa.**

| Functional Feeding Group | All | Decreasing | Optimum | No Response/ Bimodal | Increasing |
|---|---|---|---|---|---|
| FILTER-COLLECTORS | | | | | |
| Number of genera | 15 | 4 (27%) | 5 (33%) | 2 (13%) | 4 (27%) |
| GATHER-COLLECTORS | | | | | |
| Number of genera | 57 | 27 (47%) | 12 (21%) | 6 (11%) | 12 (21%) |
| PREDATORS | | | | | |
| Number of genera | 46 | 22 (48%) | 11 (24%) | 4 (9%) | 9 (20%) |
| SCRAPERS | | | | | |
| Number of genera | 17 | 6 (35%) | 10 (59%) | 1 (6%) | 0 |
| SHREDDERS | | | | | |
| Number of genera | 12 | 7 (58%) | 2 (17%) | 1 (8%) | 2 (12%) |

We conducted an analysis to determine what changes would occur in the FFG balance within the regional taxa pool at various conductivity levels, based on the $XC_{95}$ value for each genus. For example, if the conductivity value was 400 µS/cm, it was assumed for this analysis that all genera with an $XC_{95}$ value less than 400 µS/cm would be extirpated. The trophic balance of the remaining taxa available from the regional taxa pool was then analyzed (Figure 12).

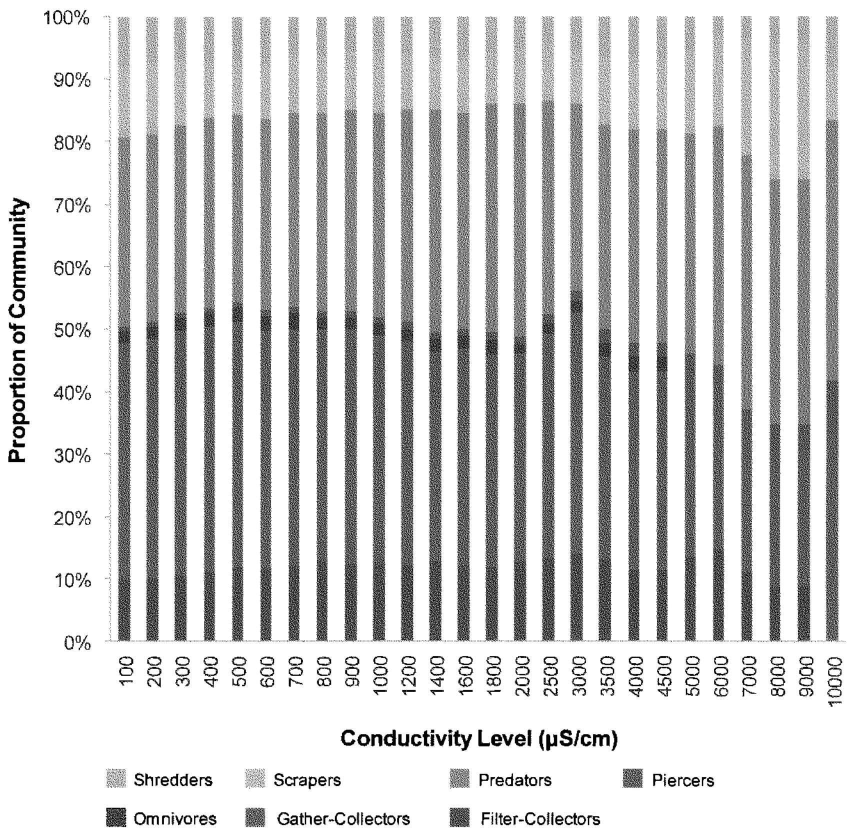


**Figure 12: Proportion of generic richness by functional feeding group within the regional taxa pool at varying conductivity levels. All genera with an $XC_{95}$ less than the conductivity level are considered to be unavailable. Note that the x-axis is not evenly divided.**

There are few observed changes in the proportional abundance of FFGs within the regional pool of taxa at conductivity levels below approximately 2,500 µS/cm to 5,000 µS/cm. Excluding the omnivores and piercers, which were poorly represented in the first place, the first major FFG predicted to undergo extirpation of all its member genera was the filter-collectors, when conductivity values exceeded 10,000 μS/cm. This indicates that the functional aspect of the stream community may not change due to conductivity levels above 300 μS/cm, since genera from all FFGs remain available in the regional taxa pool.

# 4.0 Independent Analysis of Factors Shaping Macroinvertebrate Communities

The conductivity benchmark analysis (EPA 2010) relies on the Pond et al. (2008) and EPA's causal analysis to presuppose as a "given" that conductivity is the best predictor that is functionally and causally related to the response of macroinvertebrate communities in Central Appalachian streams, while disregarding many other factors that may influence community composition. The WVDEP database (WABbase) used by EPA provides an opportunity to examine other possible factors that may shape macroinvertebrate community composition. Therefore, we have conducted an independent analysis based on a data mining approach that considers all of the available information and strives to elucidate key water quality and physical parameters that are most strongly associated with biotic responses.

We used the EPA dataset that was originally extracted from the WABbase (http://oaspub.epa.gov/eims/eimscomm.getfile?p_download_id=496202) as provided by EPA (http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=220171). This dataset includes results for 3,286 sampling events representing 3,121 unique Station ID codes. The dataset contains a variety of variables that present site-specific information regarding regional landscape, water quality, and aquatic habitat conditions as well as macroinvertebrate community composition. Following EPA's rationale for excluding samples (EPA 2010, Section 2), the dataset used in our analysis contained 2,152 sampling events representing 2,073 unique Station ID codes. Our attempt to follow EPA's exclusion process resulted in an additional seven sites being included in the data subset. This is different from the EPA's final dataset which contained 2,145 sample events, but when summary statistics for measured water quality parameters as presented in EPA 2010 Table 1 are compared with those calculated from our dataset, the results appear to be nearly identical. Notably, of the 2,152 sampling events selected from the EPA dataset, approximately 43% are missing ion or metal chemistry results, including selenium or dissolved manganese, which were analyzed infrequently.

Our data mining analysis of the subset we generated using EPA's data-exclusion rationale (2,152 events) was based on an integrated approach to identify factors that best describe the observed variability between and among sites, and strongly correlate with each other, rather than trying to establish causal relationships. In the absence of a rigorous study design conducted under controlled experimental conditions, it is more important to identify data relationships rather than attempt to establish cause-effect relationships.

Our integrated data analysis approach relied on a series of statistical analyses that reduced the total number of parameters to a more ecologically meaningful subset of variables with respect to the available data. The original dataset was initially subdivided into independent stressor and dependent response variables. Independent stressor variables in a stream ecosystem include chemical and physical habitat variables, such as metal and ion concentrations in the water column and the percent substrate composition (Paulson et al. 2001). Dependent response variables were selected to represent the biological component of the stream, such as macroinvertebrate density or taxa richness. The independent stressor variables generally represent a mix of both quantitative (e.g., major ion or metal concentrations) and qualitative (e.g., embeddedness) variables, as well as composite variables (e.g., RBP score, conductivity). Thus, understanding the general categories of each variable also helped reduce the overall list of variables.

The integrated analysis follows a series of statistical procedures (Paulson et al. 2001), as presented below, to identify key variables that can be used to characterize water quality, aquatic habitat, and macroinvertebrate communities.

1. Apply basic statistics
    a. Generate descriptive statistics and data plots
    b. Normalize data as needed to meet statistical assumptions
    c. Compile correlation matrices
2. Identify key stressor and response variables using the following methods:
    a. Principle Components Analysis (PCA)
    b. All Possible Regressions (APR)
    c. Chi-square Automatic Interaction Detection (CHAID)
3. Rank variables according to relative influence
    a. Develop matrix of key independent stressor variables and relationships found in Step 2
    b. Repeat Steps 2 and 3 until the two most influential independent stressor variables are identified for each dependent response variable
4. Fit equation to describe interactions between stressor and response variables
    a. Use three-dimensional modeling program to identify non-linear relationships (*note, as described below, no relationship could be developed that represented a significant portion of the variability in the data.*)

Using the data subset, basic statistical procedures (e.g., Spearman rank correlation, scatter and box plots) were used to evaluate the characteristics of independent stressor and dependent response variables, as well as relationships between the two variable types. All variables were evaluated for approximation of a normal distribution using Shapiro-Wilkes normality tests and Q-Q probability plots. When appropriate, variables were transformed and re-evaluated for fit with an expected normal distribution. A logarithm base10 transformation (log) was used for water quality variables and macroinvertebrate density, while the arcsine-square root transformation was used for variables reported as percentages (e.g., percent fines and percent Ephemeroptera). The water quality variables—temperature and pH, as well as the physical habitat and macroinvertebrate variables such as embeddedness and genera-based metrics—did not require transformation. Two macroinvertebrate metrics (Trichoptera taxa and percent Trichoptera) were not included in the database provided by EPA, so were calculated based on subtraction of reported Ephemeroptera and Plecoptera metrics from summary EPT results provided in the data subset. Using the basic summary statistics, as well as professional judgment, the entire list of variables was initially reduced to a smaller subset of variables that we believed to be the most ecologically relevant when evaluating factors that explain the variability observed between sites, in terms of macroinvertebrate communities in Central Appalachian streams (Table 9).

**Table 9: List of independent stressor and dependent response variables used in the integrated analysis.**

| Independent Stressor Variables | | Dependent Response Variables |
|---|---|---|
| **Water Quality** | **Physical Habitat** | **Macroinvertebrate** |
| Temperature | Bank stabilization | Clinger taxa, genera |
| Dissolved oxygen | Bank vegetation | Ephemeroptera, genera |
| Alkalinity | Undisturbed vegetation | EPT, genera |
| pH | Channel alteration | HBI, genera |
| Chloride | Channel flow | Intolerant taxa, genera |
| Sulfate | Riffle sinuosity | Plecoptera taxa, genera |
| Total aluminum | Embeddedness | Trichoptera taxa, genera* |
| Total calcium | Sediment deposition | Total taxa, genera |
| Total iron | Epifaunal substrate | Density |
| Total magnesium | Velocity of pool | Percent Chironomidae |
| Total manganese | Percent fines | Percent Ephemeroptera |
| Total suspended solids | Percent sand | Percent Ephemeroptera minus Baetidae |
| Total phosphorus | Percent silt | Percent EPT |
| Nitrate – Nitrite nitrogen | | Percent EPT minus Cheumatopsyche |
| Fecal coliforms | | Percent EPT minus Cheumatopsyche and Baetidae |
| | | Percent Hydropsyche |
| | | Percent Orthocladiinae |
| | | Percent Plecoptera |
| | | Percent Trichoptera* |
| | | Percent Simuliidae |
| | | Percent dominant 5 taxa, genera |

* Calculated metric.

It is important to note that composite type variables are often not very useful when evaluating biological responses to environmental stressors. For example, the total RBP score for aquatic habitat evaluation may appear to strongly correlate with select biotic responses, yet this index provides little insight into the environmental characteristics that may be influencing biotic communities, because it is comprised of many metrics. To the extent possible, we have excluded such composite independent stressor variables in our data analyses, including conductivity and hardness, because they provide little information above and beyond the individual variables when trying to isolate water quality factors that may be most strongly associated with a biotic response.

## 4.1 Principal Component Analysis

Principle Component Analysis (PCA) is a variable reduction procedure that helps identify redundancy among numerous variables, and is used to identify groups of observed variables that tend to move together or in opposite directions (Johnson and Wichern, 1992). PCA was used to identify variables that best explained the variability observed between sites and how those variables relate to one another, as well as whether one variable could be used as a surrogate for other variables within each grouping (water quality, physical habitat, macroinvertebrate). When such variables are replaced with a surrogate that explains the same amount of variation, the power of the statistic to identify relationships is maximized (Paulson et al. 2001). An iterative process was used for the PCA analyses, such that all variables from each grouping were loaded into separate PCA models. This initially created three distinct groupings, two for stressor variables and one for response variables. The PCA extraction method was based on a correlation matrix with a varimax rotated solution, pairwise deletion of missing values, and extracted eigenvalues[3] greater than 1.0. The rotated component matrix[4] for each variable grouping was examined, with variables exhibiting coefficients greater than 0.6 considered a significant part of the component. If the component contained multiple significant variables, the Spearman rank correlation values for those variables were also evaluated. If variables were highly correlated (i.e., > 0.6 or < -0.6) with each other, the variable with the largest component coefficient (i.e., heavily weighted) was selected. Up to five components were examined with the most heavily weighted or unique variables (either positive or negative) being selected for inclusion in a subsequent PCA model.

### *4.1.1 Principal Component Analysis—Water Quality*

The goal of this type of evaluation was to understand how the water quality variables "move together" (i.e., are positively or negatively correlated with one another) and to select variables that may be a surrogate for other variables. For example, in the first component, the log transformed variables for total magnesium, sulfate, and total calcium weighted the most heavily (Table 10). This weighting and movement (all positive) of the variables along the first component was to be expected, based on the chemical relationship between all of these variables and their Spearman Rank correlation values. In the second component, the log transformed variables for total iron, total aluminum, and manganese were weighted the most heavily with all variables showing positive movement with each other (Table 10). In the third component, fecal coliforms, pH, and alkalinity revealed the strongest weighting coefficients (Table 10). Temperature and dissolved oxygen were key variables in the fourth component, and moved in opposite directions as is to be expected, while the nutrients—total phosphorus and nitrate-nitrite—were the most heavily weighted variables in the fifth component (Table 10). In

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[3] An eigenvalue is a measure of the strength of a principal component axis, the amount of variation along the axis, and ideally the importance of an ecological gradient.
[4] Matrix showing the results of varimax orthogonal rotation that minimizes the number of heavily weighted variables on each principal component.

combination, these variables with the greatest weighting best explained the variability observed between sites in the database.

**Table 10: Rotated component matrix for selected water quality variables. Bolded and shaded values denote which variables are considered the most heavily weighted part of the component.**

| Variable | Component | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| temp | 0.254 | -0.092 | 0.444 | **0.620** | -0.035 |
| pH | 0.329 | -0.303 | **0.695** | -0.243 | 0.056 |
| log_do | -0.033 | -0.044 | 0.064 | **-0.882** | -0.045 |
| log_alk | 0.556 | -0.185 | **0.641** | 0.065 | 0.004 |
| log_fecal | 0.074 | 0.299 | **0.651** | 0.145 | -0.074 |
| log_mg_tot | **0.934** | 0.067 | 0.166 | 0.069 | -0.008 |
| log_sulfate | **0.914** | 0.031 | 0.109 | 0.035 | 0.020 |
| log_tp | -0.130 | 0.064 | 0.157 | 0.220 | **0.745** |
| log_al_tot | -0.064 | **0.815** | -0.036 | -0.121 | 0.087 |
| log_ca_tot | **0.861** | 0.067 | 0.322 | 0.120 | -0.055 |
| log_chloride | 0.468 | -0.015 | 0.485 | 0.080 | 0.241 |
| log_fe_tot | 0.119 | **0.856** | 0.011 | 0.100 | -0.068 |
| log_mn_tot | 0.450 | **0.601** | -0.172 | 0.401 | -0.038 |
| log_no23 | 0.243 | -0.071 | -0.230 | -0.185 | **0.738** |
| log_tss | -0.133 | 0.548 | 0.148 | -0.097 | 0.511 |

The selected variables within the first five components accounted for a total of 72% of the variation observed among sample sites with respect to the water quality variables contained within the WVDEP/EPA dataset (Table 11). Parameters such as calcium, sulfate, and magnesium, along with parameters that characterize overall ionic strength, explained approximately 38% of the variation among sample sites with respect to water quality.

**Table 11:**
**Variance explained by each component for the initial water quality PCA analysis.**

| Component | Partial and Cumulative Variation | |
|---|---|---|
| | % of Variance | Cumulative % |
| 1 | 23.158 | 23.158 |
| 2 | 15.364 | 38.522 |
| 3 | 13.506 | 52.029 |
| 4 | 10.344 | 62.373 |
| 5 | 9.654 | 72.026 |

The following variables were selected to be surrogates for other less heavily weighted variables in each component and were consequently determined important to include in subsequent PCA analyses:

1. total magnesium
2. total iron
3. pH

4. fecal coliforms
5. dissolved oxygen
6. total phosphorus
7. total suspended solids

We selected TSS even though it did not initially meet our original selection criteria. Based on its relative moderate weighting in two of the five components, as well as its relationship to geological and hydrological underpinnings within the watersheds, we believed this to be an important variable that may influence macroinvertebrate communities.

The seven selected water quality variables were subsequently loaded into a second PCA model, with the same evaluative process being performed on the rotated component matrix. The rotated component matrix converged in the first two components, with the first component comprised of the log transformed variables—total magnesium (0.800), pH (0.692), and fecal coliform (0.638). In the second component, the log transformed variables for total iron (0.698) and dissolved oxygen (0.661) weighted the most heavily, while total suspended solids (0.780) and total phosphorus (0.743) were considered part of the third component.

The final water quality variables that were selected to be included in the overall PCA model evaluating relationships between water quality, habitat, and macroinvertebrate variables were:

1. total magnesium—also surrogate for Ca, $SO_4$, pH
2. fecal coliforms
3. total iron—also surrogate for Al and Mn
4. dissolved oxygen—also surrogate for temperature, and
5. total suspended solids—also surrogate for TP

### *4.1.2 Principal Component Analysis—Physical Habitat*

The iterative PCA process described above was also performed using the independent physical habitat stressor variables. The initial PCA model using physical habitat characteristics extracted four components, with the first component being comprised of sediment deposition (0.832), embeddedness (0.735), riffle sinuosity (0.675), and epifaunal substrate (0.643), all of which exemplify substrate quality in these watersheds. The second component included undisturbed vegetation (0.855), bank vegetation (0.833), and channel alteration (0.755), all of which are characteristic of riparian habitat. The third component included the arcsine-square root transformation for percent fines (0.950), percent sand (0.844), and percent silt (0.678), which characterize substrate composition. The fourth component only included channel flow, which had a weighting coefficient of 0.810. These four components accounted for a total of 66% of the variation observed among sample sites with respect to physical habitat conditions. The first component accounted for approximately 20% of the variation in physical habitat observed among sample sites.

From our initial analysis, we selected the following physical habitat variables to be included in a subsequent PCA analysis:

1. sediment deposition
2. undisturbed vegetation
3. percent fines, and
4. channel flow

The second physical habitat PCA extracted two components with sediment deposition (0.795) and percent fines (-0.769) weighted heavily and in opposite directions in the first component, even though they are not strongly correlated (Spearman, -0.376). Channel flow (0.909) weighted heavily in the second component. All three variables were selected to be included in the overall PCA model evaluating relationships between water quality, habitat, and macroinvertebrate variables.

### *4.1.3 Principal Component Analysis—Macroinvertebrates*

The initial macroinvertebrate PCA model resulted in four components being extracted (Table 12), with the first component comprised of the arcsine-square root transformations for the percent EPT variable and its derivatives, along with percent Ephemeroptera and its derivatives, percent Chironomidae, and the genera-based Hilsenhoff Biotic Index (HBI). Even though the genera-based HBI is not very informative from the standpoint of identifying key macroinvertebrate response variables, it is informative from a community health perspective. The second component weighted the genera-based metrics for total taxa, clinger taxa, EPT taxa and its derivatives Ephemeroptera and Trichoptera taxa, as well as intolerant taxa and arcsine-square root transformed percent dominant 5 taxa (negative weighting). The third component was comprised of the arcsine-square root transformed percent Trichoptera, percent Hydropsyche, and the genera-based Trichoptera taxa, all of which characterize the caddisfly assemblage. The fourth component only included the log transformed macroinvertebrate density variable. All four components explained a total of 76% of the variation observed in sample sites with respect to the macroinvertebrate metrics contained in the WVDEP/EPA dataset. The first component, which was mainly comprised of EPT metrics and a Chironomidae metric, accounted for approximately 31% of the variation among sample sites with respect to macroinvertebrates.

**Table 12: Rotated component matrix for selected macroinvertebrate variables. Bolded and shaded values denote which variables are considered the most heavily weighted part of the component.**

| | Component | | | |
|---|---|---|---|---|
| **Variable** | **1** | **2** | **3** | **4** |
| G_Clinger Taxa | 0.265 | **0.836** | 0.261 | 0.176 |
| G_Ephemeroptera Taxa | 0.424 | **0.622** | -0.355 | 0.323 |
| G_EPT | 0.502 | **0.819** | -0.085 | 0.048 |
| G_HBI | **-0.722** | -0.373 | 0.053 | 0.359 |
| G_IntolTaxa | 0.459 | **0.753** | -0.157 | -0.215 |
| G_PlecopteraTaxa | 0.457 | **0.603** | -0.316 | -0.332 |
| G_TricopteraTaxa | 0.165 | 0.532 | **0.649** | 0.036 |
| G_Tot_Taxa | -0.007 | **0.922** | 0.006 | 0.015 |
| log_density | 0.162 | 0.104 | 0.063 | **0.603** |
| arcsin_pct_chiron | **-0.790** | 0.010 | -0.260 | -0.122 |
| arcsin_pct_ephem | **0.637** | 0.202 | -0.383 | 0.471 |
| arcsin_pct_ephembaet | **0.891** | 0.255 | -0.025 | -0.200 |
| G_Clinger Taxa | 0.265 | **0.836** | 0.261 | 0.176 |
| G_Ephemeroptera Taxa | 0.424 | **0.622** | -0.355 | 0.323 |
| arcsin_pct_ept | **0.906** | 0.145 | 0.226 | 0.070 |
| arcsin_pct_eptchemat | **0.921** | 0.217 | -0.044 | -0.040 |
| arcsin_pct_eptchematbaet | **0.890** | 0.255 | -0.025 | -0.200 |
| arcsin_pct_hydrosych | 0.062 | -0.106 | **0.929** | 0.114 |
| arcsin_pct_orthoclad | -0.584 | -0.025 | -0.263 | -0.191 |
| arcsin_pct_plecopt | 0.536 | 0.338 | -0.334 | -0.524 |
| arcsin_pct_tricopt | 0.140 | -0.027 | **0.949** | 0.093 |
| arcsin_pct_simul | -0.139 | -0.019 | 0.054 | 0.399 |
| arcsin_pct_dom5 | 0.026 | **-0.822** | -0.030 | 0.021 |

The percent EPT was strongly correlated with percent Chironomidae (Spearman, -0.686) and the EPT derivatives; therefore, the percent EPT variable was selected from the first component. Similarly, the genera-based total taxa (total taxa) was strongly correlated with the percent dominant 5 taxa (Spearman, -0.789), clinger taxa (Spearman, 0.763), Ephemeroptera taxa (Spearman, 0.625), EPT taxa (Spearman, 0.724), and intolerant taxa (Spearman, 0.662); therefore, the total taxa metric was selected from the second component. The third component was comprised of caddisfly metrics; thus, the most heavily weighted variable of percent Trichoptera was selected. From our initial macroinvertebrate PCA, we selected the following variables to be included in a subsequent PCA analysis:

1. percent EPT
2. genera-based total taxa
3. percent Trichoptera, and
4. density

The second macroinvertebrate PCA extracted two components with the arcsine-square root transformed variables of percent Trichoptera (0.801) and percent EPT (0.785) weighting in the first component and the total taxa (0.940) being heavily weighted in the second component. These two components explained approximately 64% of the variation observed among sample sites with respect to macroinvertebrate metrics. The percent EPT variable was selected from the first component due to its inclusion of both mayflies and stoneflies, and total taxa was also selected for inclusion in the overall PCA model evaluating relationships between water quality, habitat, and macroinvertebrate variables.

### *4.1.4 Principal Component Analysis—Overall*

As a result of the individual PCAs described above, a total of 10 variables were selected for inclusion in the overall PCA to evaluate the relative importance of key water quality (5), physical habitat (3), and macroinvertebrate (2) variables in characterizing sample sites with respect to the available data. The PCA extracted four components (Table 13), with the first component weighting the log transformed total magnesium with total taxa, and the second component weighting sediment deposition and arcsine-square root transformed percent fines. The log transformed total suspended solids and total iron were strongly weighted in the third component. Channel flow and log transformed dissolved oxygen were weighted heavily in the fourth component. These four components explained approximately 55% of the variation observed among sampling sites with respect to the available dataset.

**Table 13: Rotated component matrix for the overall PCA including water quality, physical habitat, and macroinvertebrate variables. Bolded and shaded values denote which variables are considered the most heavily weighted part of the component.**

| | Component | | | |
|---|---|---|---|---|
| **Variable** | **1** | **2** | **3** | **4** |
| log_mg_tot | **0.797** | -0.123 | -0.063 | -0.048 |
| log_fecal | 0.497 | -0.110 | 0.264 | -0.057 |
| log_fe_tot | 0.183 | -0.267 | **0.760** | 0.113 |
| log_do | -0.077 | 0.090 | -0.181 | **0.752** |
| log_tss | -0.059 | 0.096 | **0.820** | -0.077 |
| Sed_Dep | -0.074 | **0.781** | -0.053 | 0.072 |
| arcsin_pct_fine | 0.057 | **-0.817** | 0.037 | -0.040 |
| Chan_Flow | 0.049 | 0.038 | 0.188 | **0.803** |
| arcsin_pct_ept | -0.492 | 0.419 | -0.080 | 0.083 |
| G_Tot_Taxa | **-0.726** | -0.078 | 0.025 | -0.094 |

The first component in the overall PCA indicates that total macroinvertebrate taxa is moving in the opposite direction of major ions such as magnesium, indicating a strong relationship between the response of the macroinvertebrate community and ionic chemistry. In the initial water quality PCA, total magnesium was selected as a surrogate for sulfate, calcium, and pH, which may also be important factors to consider regarding biological response. The second component indicates that substrate characteristics also are an important factor when trying to explain the variation observed among sample sites in Central Appalachian streams. Lastly, total suspended solids, total iron, channel flow, and dissolved oxygen also appear to be important factors to consider when evaluating these stream site conditions. Notably, the percent EPT metric did not weight heavily in any of the components, although its coefficients for both the first and second component indicate this metric may be weakly related to ionic chemistry and substrate conditions.

The key variables identified in the PCA analyses were retained and placed into a matrix for further evaluation with results from the All Possible Regressions and Chi-square Automatic Interaction Detection. This matrix will be used to refine the key variables for inclusion in a three dimensional model to evaluate the non-linear relationships between water quality, physical habitat, and macroinvertebrate metrics.

## 4.2 All Possible Regressions

All Possible Regressions (APR) is another iterative method that combines one dependent response variable with many independent stressor variables, using all possible combinations of the stressor variables, to maximize the variance explained in the response variable. This data mining approach identifies the best single variable or subset of variables that explains the most variation observed in the biological response variable. For this analysis, the total taxa and percent EPT variables were selected as the biological response variables, as identified in the PCA analysis. All of the independent stressor variables identified in Table 9 were initially included in each of the water quality and physical habitat APR models. Similar to the PCA approach, the water quality variables and physical habitat variables were first analyzed independently then combined in an overall APR model for each biological response variable. The R-squared ($R^2$) and root mean square error for each APR model were reviewed to identify a model with the largest $R^2$ and smallest error term, while minimizing the variable count (Figure 13). The goal of APR analysis is to identify the smallest subset of variables that explains most of the variation, rather than to provide a predictive equation for the subset of variables.

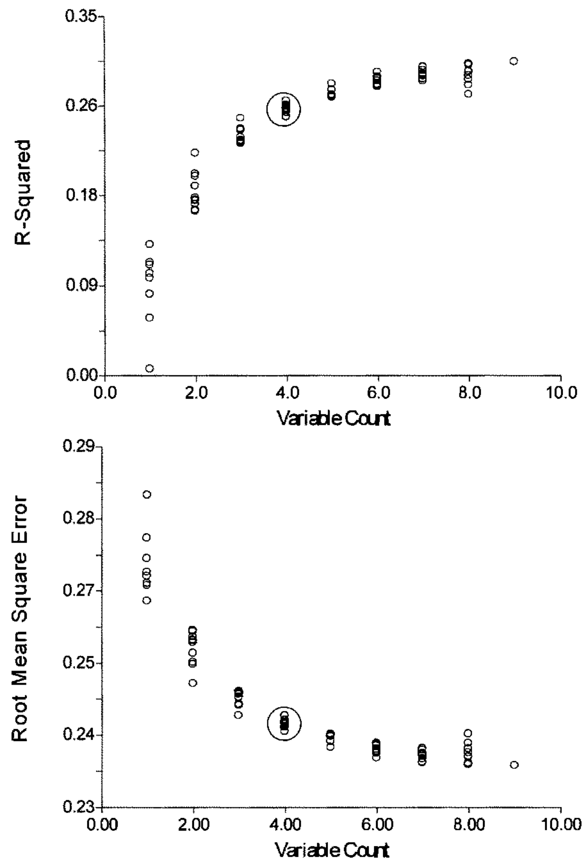


**Figure 13: Example of an APR model that maximizes the R-squared and minimizes the root mean square term when four independent stressor variables are selected (red circles). An APR model with 5 or more variables would not substantially increase the R-squared value or substantially minimize the root mean square term.**

When the total taxa metric was regressed with the water quality variables, the best fit APR model was based on three variables that included log transformed alkalinity, sulfate, and total aluminum. However, these three variables only explained approximately 17% of the total variation observed in total taxa. The maximum amount of variation explained by any of the models was only 19%. The best fit physical habitat-based total taxa APR weighted four variables: bank stabilization, undisturbed vegetation, channel alteration, and embeddedness, although the maximized $R^2$ was even lower at 9%.

The six variables identified as contributing to the best fit APR models for macroinvertebrate total taxa were combined for an overall APR analysis. The best fit model using both water quality and physical habitat variables weighted three variables: undisturbed vegetation, channel alteration, and log transformed sulfate, and accounted for approximately 21% of the variation observed in total taxa.

The APR analysis of the transformed percent EPT with water quality variables resulted in a best fit model containing five variables: fecal coliform, total aluminum, total calcium, chloride, and total manganese, and accounted for approximately 24% of the variation observed in the percent EPT. The maximum amount of variation that could be explained using all water quality variables was 27%. The physical habitat APR resulted in a best fit model that included undisturbed vegetation, embeddedness, epifaunal substrate, and percent fines, which explained 16% of the variation in the percent EPT metric. When these water quality and habitat variables were combined in an overall APR analysis, the best fit model included five variables: epifaunal substrate, log transformed fecal coliforms, total aluminum, chloride, and total manganese. This model accounted for 28% of the variation observed in the percent EPT variable.

## 4.3 Chi-square Automatic Interaction Detection

Chi-square Automatic Interaction Detection (CHAID) is a nonparametric exploratory model used to evaluate contingent relationships between a dependent variable and a series of independent stressor variables, including non-linear relationships (Paulson et al. 2001). CHAID selects a subset of stressor variables that best predicts the dependent variable, and presents these variables in a decision tree. The decision tree starts with the dependent variable and progressively splits into smaller branches (nodes) based on groupings of the stressor variables that best predict the dependent variable. CHAID is a sequential fitting algorithm similar to a forward stepwise model, although the decision to split or combine independent variables is dependent or contingent upon earlier effects, rather than simultaneously as in regression analysis. Both the dependent and independent variables were raw untransformed values treated as interval scale variables, rather than nominal or ordinal variables.

Similar to the PCA and APR analyses, an iterative process was used to evaluate both water quality and physical habitat variables independently, and then select a subset of variables from each analysis to be combined in a final decision tree for each dependent variable. Individual CHAID models were developed for total taxa and percent EPT, which included all of the water quality or physical habitat parameters listed in Table 9. Thus, four separate CHAID decision trees were created: two for total taxa (water quality and physical habitat tree) and two for percent EPT (water quality and physical habitat tree). Each decision tree was evaluated and the most important independent stressor variables were selected from each analysis (Table 14). The independent stressor variables listed for each dependent variable were included in a combined CHAID model to evaluate the relationships between both types of stressor variables and the biological response variable.

**Table 14:**
**Selected water quality and physical habitat variables for each dependent variable based on CHAID analyses.**

| Water Quality | Physical Habitat |
|---|---|
| ***Genera-based Total Taxa*** | |
| Sulfate | Channel alteration |
| Total magnesium | Embeddedness |
| Dissolved oxygen | Channel flow |
| Temperature | Percent fines |
| pH | Undisturbed vegetation |
| | Epifaunal substrate |
| | Sediment deposition |
| ***Percent EPT*** | |
| Fecal coliforms | Epifaunal substrate |
| Total manganese | Channel alteration |
| pH | Percent fines |
| Dissolved oxygen | Bank Vegetation |
| | Riffle sinuosity |

When evaluating a CHAID decision tree, the first variable after the dependent response variable is considered the most important stressor in the tree (Figure 14). The CHAID decision tree presented in Figure 14 is the combined water quality/physical habitat CHAID model for percent EPT. In this model, epifaunal substrate is the most important stressor variable (parent Node 0) for percent EPT. The box at each node shows the mean percent EPT value, the standard deviation for percent EPT, the number and percentage of sites with epifaunal substrate values in the listed range, and the predicted percent EPT at such sample sites. The nodes that branch from parent Node 0 (child nodes), list ranges of epifaunal substrate values (in brackets), such that Node 1 represents sample sites that scored less than or equal to 9.0 for epifaunal substrate. As epifaunal substrate scores increase (range from 0 to 20), the mean percent EPT value generally increases with each node. This response in percent EPT is to be expected, because as epifaunal substrate values increase, the quality of the habitat measure transitions from poor to optimal conditions. Sample sites that scored relatively high in this metric present a wide variety of natural structures in the stream, including fallen trees, large rocks, and cobble, all of which create a more complex habitat for aquatic life (Barbour et al. 1999).

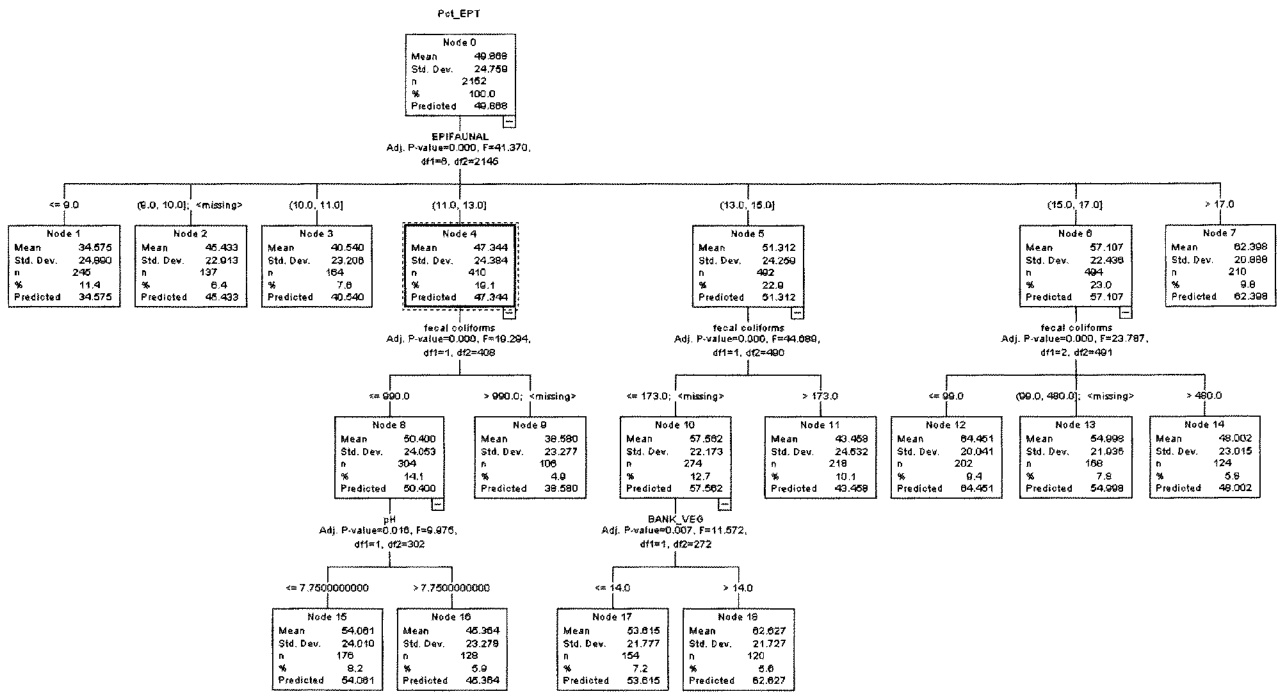


**Figure 14: The combined water quality and physical habitat CHAID tree for percent EPT.**

Based on the information provided within Nodes 1-3, approximately 25% of the sample sites are categorized as having marginal to poor epifaunal substrate habitat (i.e., scored less than 11); thus, the habitat is less than desirable for benthic invertebrates, especially EPT taxa.

The second most important variable in the percent EPT CHAID analysis is fecal coliforms, which branch from three of the epifaunal substrate nodes. At sites that scored greater than 11 for epifaunal substrate (i.e., suboptimal to optimal), fecal coliform is an important secondary measure that influences the percent EPT metric. Sites that scored 11-13 for epifaunal substrate (Node 4) and exhibited fecal coliform levels less than or equal to 999 cfu/ml also exhibited a greater percent EPT value (50.4%) as compared to sites with fecal coliforms greater than 999 cfu/ml (38.6%). This relationship is consistent among all of the sample sites, such that greater levels of fecal coliforms result in a lower percent EPT value. This relationship suggests that other anthropogenic disturbances may be affecting the EPT taxa. Additional factors that influence percent EPT CHAID analysis are pH and bank vegetation, which branch out from two of the fecal coliform nodes. These factors appear to influence invertebrate communities in streams that scored 11-15 for epifaunal substrate (i.e., suboptimal range) and contained relative low fecal coliform levels.

The combined water quality/physical habitat CHAID model for total taxa showed that sulfate concentration was the most important stressor variable (Figure 15). The model distinguished seven child nodes for sulfate concentrations, with the mean total taxa ranging from approximately 21 taxa for nodes that exhibited sulfate concentrations greater than 504 mg/L, to 31 taxa for nodes that exhibited concentrations less than 9.8 mg/L. However, these seven nodes essentially represent a breakpoint between sample sites that exhibit sulfate concentrations less than 61 mg/L or greater than 61 mg /L (i.e., between nodes 4 and 5).

In general, the mean total taxa ranged from 26 to 31 taxa for nodes that exhibited sulfate concentrations less than 61 mg /L. This range in sulfate concentrations is very similar to that observed for Level 1 Reference sites, which ranged from the detection limit to 65 mg/L. For the nodes representing sulfate concentrations greater than 61 mg/L, the mean total taxa ranged from 21 to 23 taxa. While mean total taxa varies by approximately 10 taxa across the full range of concentrations, the variability in mean total taxa for nodes representing concentrations greater than 61 mg/L is considerably less.

Notably, CHAID analysis excludes any missing dependent variable data, but includes all independent data, even if there is a missing value for one of the independent variables. For example, there are 2,152 valid total taxa values; however, there are only 1,370 valid sulfate values. CHAID analysis considers the total taxa information for the 782 samples with missing sulfate data, and treats them as a separate predictor category. The separate predictor category is compared to the existing nodes and merged with the node that is the most similar (denoted by <missing>). For example, the samples with missing sulfate values were combined with Node 4, because the mean total taxa values were the most similar.

Secondary stressor variables for the combined total taxa model include total magnesium and channel alteration. These two variables are important variables to consider when sulfate concentrations are generally less than 61 mg/L. For sample sites characterized by Node 4, channel alteration is important to consider because this metric provides information regarding large-scale changes in the shape of the channel, such as channelization or bank stabilization using rip-rap (Barbour et al. 1999). Channel alteration values less than or equal to 10 (Figure 15, Node 10) represent poor to marginal conditions for this metric, whereas values greater than 16 represent optimal conditions for this metric. The total taxa metric responds predictably to channel alteration, such that poor to marginal conditions result in fewer total taxa when compared to optimal conditions. Other factors that influence total taxa are embeddedness and epifaunal substrate conditions. Both of these variables characterize the available substrate conditions, a critical consideration for benthic invertebrates.

## 4.4 Summary of PCA, APR, and CHAID Analyses

Our analyses indicate that a single composite parameter, like conductivity, is not the most appropriate parameter when trying to explain the variation observed among the Central Appalachian macroinvertebrate communities with respect to water quality and physical habitat. Rather, some combination of ionic composition, substrate, and channel features may be the most appropriate stressor variables to consider.

These analyses also indicate that total taxa and percent EPT abundance are the key response variables to consider when evaluating factors that shape the macroinvertebrate community, as opposed to a singular focus on Ephemeroptera.

Additionally, total suspended solids, dissolved oxygen, and fecal coliforms appear to be key variables to consider when evaluating these stream sites, as they are strong indicators of other anthropogenic disturbances in the watersheds.

Despite EPA's underlying assumption that conductivity is the key driver in structuring macroinvertebrate community composition in the Central Appalachian streams, our analyses indicate that it is more appropriate to evaluate multiple possible stressors, including the specific ions that comprise the measure of specific conductance (Table 15). Furthermore, it is also important to consider substrate characteristics and habitat disturbance when evaluating macroinvertebrate responses.

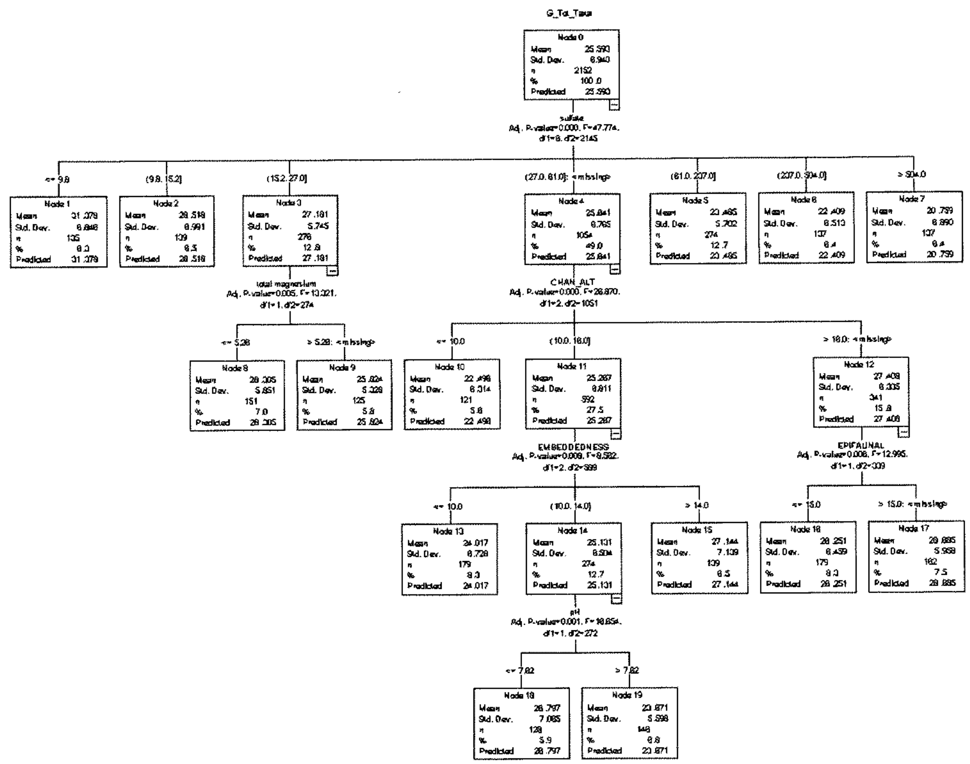


**Figure 15: The combined water quality and physical habitat CHAID tree for total taxa.**

**Table 15: List of independent stressor variables considered important in the data reduction approach when evaluating stream sites and the two dependent response variables (genera-based total taxa and percent EPT).**

| Principal Component Analysis | All Possible Regressions | Chi-square Automatic Interaction Detection |
|---|---|---|
| ***Genera-based Total Taxa*** | | |
| Total magnesium | Undisturbed vegetation | Sulfate |
| Percent fines | Channel alteration | Channel alteration |
| | Sulfate | Total magnesium |
| | | Embeddedness |
| | | Epifaunal substrate |
| ***Percent EPT*** | | |
| Percent fines | Undisturbed vegetation | Epifaunal substrate |
| Total magnesium | Epifaunal substrate | Fecal coliforms |
| Total suspended solids | Fecal coliforms | Bank vegetation |
| | Chloride | pH |
| | Total manganese | |

The list of independent stressor variables represents the most important variables and their relative ranking of importance for each analysis. For example, the PCA model that considered percent EPT along with the key water quality and physical habitat variables revealed that percent fines and total magnesium weighted heavily in the first component and in the opposite direction of percent EPT. The total suspended solids weighted heavily in the second component. Thus, these three variables are considered important factors that influence the percent EPT metric. Similarly, for the total taxa APR model, three important factors, including undisturbed vegetation, channel alteration, and sulfate, were sequentially weighted into the APR model, indicating that of the three variables, undisturbed vegetation explained the most variation in the model.

The list of independent stressor variables were reviewed for their commonality among analyses, as well as their relative influence on each dependent response variable. The variables were then ranked to determine the most influential stressor variables for each biological response variable (Table 16). For example, based on our data reduction approach, channel alteration and sulfate concentration are the two most influential variables with respect to total taxa, while epifaunal substrate cover and fecal coliform concentrations are the two most influential variables with respect to percent EPT. The two primary stressor variables for each biological response variable are related to both physical habitat and water quality conditions, although ionic composition appears to be more influential on total taxa than percent EPT. The relative influence of fecal coliforms on percent EPT indicates that other anthropogenic disturbances are important factors to consider with respect to the benthic macroinvertebrate assemblages in Ecoregions 69 and 70 of West Virginia.

**Table 16: Matrix of sorted and ranked independent stressor variables for two dependent response variables (genera-based total taxa and percent EPT).**

| Principal Component Analysis | All Possible Regressions | Chi-square Automatic Interaction Detection |
|---|---|---|
| ***Genera-based Total Taxa*** | | |
| 1 | Channel alteration | Channel alteration |
| 2 | Sulfate | Sulfate |
| 3 Total magnesium | | Total magnesium |
| 4 | Undisturbed vegetation | |
| 5 Percent fines | | |
| 6 | | Embeddedness |
| 7 | | Epifaunal substrate |
| ***Percent EPT*** | | |
| 1 | Epifaunal substrate | Epifaunal substrate |
| 2 | Fecal coliforms | Fecal coliforms |
| 3 Percent fines | | |
| 4 | Undisturbed vegetation | |
| 5 Total magnesium | | |
| 6 | | |
| 7 Total suspended solids | | |
| 8 | | Bank vegetation |
| 9 | Chloride | |
| 10 | Total manganese | |
| 11 | | pH |

Based on the results of the PCA, APR, and CHAID analyses, the top two ranked stressor variables for each biological response variable were included in a 3-dimensional model (TableCurve 3D v4.0.01) to evaluate the non-linear relationships. Total taxa was modeled as a function of channel alteration and sulfate, while percent EPT was modeled as a function of epifaunal substrate cover and fecal coliforms. The best fit model for total taxa explained 21% of the variation observed in this metric, while the model for percent EPT explained only 14%. While the data reduction analyses provide insight into the key variables that influence total taxa and percent EPT, the outcome of the 3-dimensional modeling is not surprising. It is well known that multiple physicochemical and physical habitat characteristics elicit a variety of biological responses, thus a poorly fit model that explains little variation in a community composition metric is not unexpected.

Despite the poor 3-dimensional modeling outcome, this data reduction approach indicates that physical habitat characteristics such as channel alteration, epifaunal substrate cover, and other sediment-based metrics are important factors to consider, in addition to ionic composition (e.g., sulfate and total magnesium), when evaluating macroinvertebrate responses. Additionally, the fecal coliforms variable indicates that other anthropogenic disturbances may play a key role in EPT composition of West Virginia streams.

# 5.0 Summary and Conclusions

The EPA (2010) conductivity benchmark represents a fundamentally different application of an SSD approach than is typically used for derivation of regulatory criteria or benchmarks. In particular, the proposed conductivity benchmark is based on field surveys and correlations between the stressor and biological response in uncontrolled field environments, with multiple species present and all possible biotic (predation/competition/etc.) and abiotic (temperature/flow/season/etc.) interactions occurring. There are several aspects to using a field-based approach that may greatly limit the scientific reliability of using this approach to set specific regulatory thresholds for a composite water quality measurement such as conductivity. The primary disadvantages of using field data result from the fact that exposures are not controlled, and so the causal nature of the relationship between conductivity and the associated biological responses are very difficult to evaluate. As we describe in this report, EPA's arguments supporting the mechanistic plausibility of conductivity as the (virtually only) cause of "impairment" are not convincing, and so cast considerable doubt on the overall reliability of the conductivity benchmark.

Furthermore, any chemical or biological variables that are correlated with conductivity or the biotic response may confound the presumed relationship between conductivity and biological impairment. To address this, EPA (2010) conducts a relatively formal, yet not convincing, analysis of causal mechanisms and confounding factors. EPA concludes that although plausible confounding factors likely exist, their influence is not *strong enough* to prevent use of the conductivity benchmark as presented in this document. The evidence cited by EPA as supporting the causes of impairment related to conductivity is relatively weak and inconsistent. Therefore, it is as yet an unanswered question as to whether or not conductivity—as opposed to other potentially explanatory factors—is in fact the best and most reliable indicator of adverse changes in biological communities in this region.

The following discussions summarize the major conclusions from each element of our review.

## 5.1 Conflicting Stressor Response Profiles Preclude Benchmark Derivation

Multiple conflicting stressor-response profiles are exhibited by the genera used in EPA (2010) to derive the conductivity benchmark and, thus, do not represent an internally consistent dataset from which to derive a regulatory benchmark. This suggests that either different invertebrate genera exhibit fundamentally different responses to elevated conductivity, or factors other than conductivity are more closely and functionally related to the capture probability of individual genera across the study region. Therefore, the inclusion of all taxa from the dataset, regardless of their stressor-response profile to conductivity, is inappropriate for the derivation of a benchmark based on an SSD approach. Indeed, for taxa that exhibit increasing capture probabilities with increasing conductivity, it is possible that extirpation of these species would occur at low conductivities, so the benchmark would clearly not be "protective" with respect to their presence in stream sites in the region.

Therefore, we contend that the use of an SSD of $XC_{95}$ values based on conflicting stressor-respond profiles is a fundamentally flawed method for derivation of a regulatory benchmark.

## 5.2 Evidence of Causation

There are insufficient data from the scientific literature to support EPA's conclusion that "conductivities in the region of concern reach levels that are sufficient to cause effects on stream communities" (EPA 2010, p. 52). Although EPA conducted a relatively formal causal analysis, the weight of evidence scoring for each causal element was relatively subjective and open to reasonable alternative interpretation. First, although elevated conductivity can clearly induce adverse effects on aquatic invertebrates, the taxonomic patterns of sensitivity are not yet clearly defined. Although laboratory toxicity data exposing mayflies to actual or simulated mining effluents suggest they may be somewhat more sensitive than the most sensitive surrogate test species, *C. dubia*, effect concentrations are highly variable and, in some studies, overlap between species. Toxicity to ions associated with conductivity also varies strongly as a function of specific ion composition and can be mitigated under conditions of elevated hardness. In fact, criteria based on individual ions—rather than those based on composite variables such as conductivity—have already been implemented in other states as a preferable regulatory approach that best fits the available scientific information.

## 5.3 Confounding Factors Analysis

The confounding factors analysis in Appendix B of EPA (2010) was clearly not an attempt to eliminate true confounding variables, nor was it an attempt to independently test the hypothesis that conductivity was the best predictor of biological impairment. We do not agree that a confounding factor analysis should take it *as a given* that these are the only relationships that require evaluation. Rather, we contend that a confounding factors analysis should also include rigorous and independent tests of the primary hypothesis and first determine whether conductivity is indeed the best predictor of biological impairment that is causally related in such a way as to justify the proposed benchmark value.

We further suggest that elements of EPA's confounding factor analysis would benefit from a closer evaluation to determine whether any of the following factors could provide alternative explanations for patterns in macroinvertebrate community structure relative to MTM/VF activities:

- *Habitat*: There are three clear problems with EPA's assertion that habitat presented little potential for confounding in their derivation of the conductivity benchmark needs additional scrutiny. First, the RBP habitat scores used by EPA in their analyses may not be the most rigorous measure of habitat quality. Second, the RBP habitat scores were correlated with conductivity and the biological response (i.e., the $HC_{05}$ value). Third, the analysis of potential confounding factors in EPA (2010) focused almost exclusively on the relationship of Ephemeroptera to habitat metrics, to the exclusion of the rest of the benthic macroinvertebrate community.

- *Confounding factors analysis conducted exclusively with Ephemeroptera*: Relationships between all potential stressors (in addition to habitat) and Ephemeroptera were generally cited as reasons to reject the stressors as potential confounders in the analysis that ultimately relates to the entire aquatic benthic community. There is a clear need to include similar analyses from other members of the entire invertebrate community to conclusively reject (or not reject) additional environmental factors as potential confounding stressors.

- *Influence of rare taxa*: EPA (2010) attempted to control for the effect of rare taxa by including only those taxa that had been collected in at least one reference site and at least 30 general sites. It would have been more appropriate for EPA to have controlled for the effects of rare taxa by including in their SSD only those genera that had a high capture probability in the reference sites. A plausible argument against excluding rare taxa from the SSD would be that the taxon is rare because of the stressor. However, this argument would not be valid if the taxon is naturally rare, a phenomenon that could be analyzed using its capture probability in reference sites. EPA (2010) did not sufficiently demonstrate that the rare taxa were rare due to conductivity or any other water quality effect, and not from general rarity itself.

## 5.4 Ecological Relevance of Presumed Impairment

The ultimate goal of EPA's proposed conductivity benchmark is to determine a conductivity level that, if not exceeded, would prevent extirpation of 95% of the aquatic macroinvertebrate genera. However, it is important to evaluate the relevance of this protection goal when the criterion or benchmark is derived from a very large number of genera, as is the case with the proposed conductivity benchmark. Even if one accepts the role of conductivity in being directly correlated with and responsible for loss of taxa at elevated conductivity, is this 95% protection level ecologically relevant, i.e., do communities in the presence of elevated conductivity lose important ecological functionality?

We evaluated trends in macroinvertebrate community structure and function relative to conductivity from the data presented in EPA (2010). There are few observed changes in the proportional abundance of functional feeding groups within the regional pool of taxa at conductivity levels below approximately 2,500 µS/cm to 5,000 µS/cm. This indicates that the functional aspect of the stream community may not change due to conductivity levels above 300 µS/cm, since genera from all functional feeding groups remain available in the regional taxa pool.

## 5.5 Independent Statistical Analysis

Our analyses of the WABbase dataset indicate that conductivity alone is not the most appropriate parameter when trying to explain the variation observed among the Central Appalachian macroinvertebrate communities with respect to water quality and physical habitat. Rather, ionic composition, substrate composition, and channel features may be the most appropriate stressor variables to consider. These analyses also indicate that total taxa and percent EPT abundance are the key response variables to consider when evaluating factors that shape the macroinvertebrate community, as opposed to a singular focus on Ephemeroptera. Additionally, total suspended solids, dissolved oxygen, and fecal coliforms appear to be key variables to consider when evaluating these stream sites, as they are strong indicators of other anthropogenic disturbances in the watersheds.

## 5.6 Conclusions

We conclude that the relationship between conductivity and changes in benthic macroinvertebrate community structure is neither strong nor reliable enough to warrant derivation of a regulatory benchmark at this time. For the most part, this is because EPA (2010) did not rigorously or independently test the primary hypothesis that elevated salinity (as measured by conductivity) was the best predictor of changes in macroinvertebrate community structure in West Virginia streams associated with MTM/VF activities. Rather, most of the analysis conducted in EPA (2010) takes it as a given that conductivity is the best predictor. Furthermore, insufficient laboratory studies are available to confirm either the causal mechanisms or conductivity thresholds that would confirm the proposed benchmark of 300 μS/cm under the specific ion composition of streams in this region. For similar reasons, Illinois, Indiana, and Iowa have rejected the use of TDS or conductivity-based criteria in lieu of criteria for individual ions such as sulfate or chloride.

More importantly, the use of an SSD of $XC_{95}$ values based on conflicting stressor-response profiles is a fundamentally flawed method for derivation of a regulatory benchmark. EPA (2010) contends that this approach is appropriate "because sufficient and appropriate laboratory data were not available and because high quality field data were available to relate conductivity to effects on aquatic life in streams and rivers." We agree that sufficient and appropriate laboratory data are not available, but a preferred approach would be to generate such data as could be used for derivation of aquatic life criteria using standard methods (Stephan et al. 1985). This would avoid the use of conflicting stressor-response profiles in deriving the $HC_{05}$ benchmark value, and would also help to confirm or refute the causal linkages between elevated concentrations of salinity and biological impairment to invertebrates. We disagree, however, that the field data rigorously support the hypothesis that conductivity is the best predictor of changes in benthic macroinvertebrate community structure in West Virginia streams. Additional study is needed to confirm or refute this hypothesis, both through use of additional statistical hypothesis testing with the existing dataset, and through additional study of West Virginia streams associated with coal MTM/VF activities.

Therefore, we strongly believe that it is inappropriate and inadvisable to adopt a conductivity benchmark until or unless such additional study is conducted

## 5.7 Response to EPA Science Advisory Board Charges to Reviewers for the Conductivity Benchmark Report

EPA released the following charges to reviewers on the SAB for their meeting to discuss the conductivity benchmark on July 20 – 22, 2010 (Slimak 2010). To further summarize the review presented in this report, we provide suggested responses to these charge questions.

**Charge Question 1:** The datasets used to derive a conductivity benchmark (described in Section 2 of this report) were developed primarily by two central Appalachian states (WV and KY). Please comment on the adequacy of these data and their use in developing a conductivity benchmark.

> *Response: In terms of data quality, the dataset is generally acceptable. However, its use to derive a conductivity benchmark is not appropriate. First, multiple conflicting stressor-response profiles are exhibited by the genera used in EPA (2010) to derive the conductivity benchmark and, thus, do not represent an internally consistent dataset from which to derive a regulatory benchmark. Second, the use of field data to derive a benchmark greatly limits the scientific reliability of using this approach to set specific regulatory thresholds for a composite water quality measurement such as conductivity. In addition, most of the analyses conducted by EPA take it as a given that conductivity is the best predictor. Our independent analyses indicate this is not the case.*

**Charge Question 2:** The derivation of a benchmark value for conductivity was adapted from EPA's methods for deriving water quality criteria. The water quality criteria methodology relies on a lab-based procedure, whereas this report uses a field-based approach. Has the report adapted the water quality criteria methodology to derive a water quality advisory for conductivity using field data in a way that is clear, transparent and reasonable?

> *Response: While their document appears clear and transparent, we do not believe the approach is reasonable and does not appropriately follow water quality criteria methodology. It is simply not appropriate to use a SSD approach with data representing conflicting stressor-response profiles. Nor were factors other than conductivity fully or adequately evaluated, and so the benchmark "takes it as a given" that conductivity is the best or most appropriate predictor of biological impairment.*

**Charge Question 3:** Appendix A of the report describes the process used to establish a causal relationship between the extirpation of invertebrate genera and levels of conductivity. Has the report effectively made the case for a causal relationship between species extirpation and high levels of conductivity due to surface coal mining activities?

*Response: No, the report has not adequately made this case. The report did not adequately test the primary hypothesis that conductivity is the best predictor of impairment. While the causal analysis followed a logical process, weight of evidence conclusions were subjective and alternative scorings are supportable. Additional laboratory studies are also needed with appropriate test durations and species to confirm or refute sensitivity to conductivity of the appropriate ionic composition, and under appropriate conditions of hardness. In addition, potential for habitat, temperature, flow and other abiotic, as well as biotic, parameters to be important predictors of benthic invertebrate community structure are poorly addressed.*

**Charge Question 4:** In using field data, other variables and factors have to be accounted for in determining causal relationships. Appendix B of the report describes the techniques for dealing with confounding factors. Does the report effectively consider other factors that may confound the relationship between conductivity and extirpation of invertebrates? If not, how can the analysis be improved?

*Response: No, the report does not effectively consider other factors, but rather takes it as a given that conductivity is the appropriate and primary stressor of interest. See report and comments from CQ3 for suggestions for improvement*

**Charge Question 5:** Uncertainty values were analyzed using a boot-strapped statistical approach. Does the SAB agree with the approach used to evaluate uncertainty in the benchmark value? If not, how can the uncertainty analysis be improved?

*Response: We did not evaluate this specifically, but this generally seemed reasonable, although the effect of the uncertainty—which was often quite large for any particular genus in the SSD—was not addressed in the final benchmark. Nor was the issue of conflicting stressor-response profiles addressed in their approach.*

**Charge Question 6:** The field-based method results in a benchmark value that the report authors believe is comparable to a chronic endpoint. Does the Panel agree that the benchmark derived using this method provides for a degree of protection comparable to the chronic endpoint of conventional ambient water quality criteria?

*Response: Not necessarily. These are not really directly comparable, except that field populations clearly are impacted by and integrate survival, growth, and reproduction. Field populations also affected by and integrate acute endpoints as well. As a practical matter, comparison to chronic endpoints may be most appropriate, but chronic endpoints are still largely organismal endpoints, whereas the field data integrate population and community (even* *ecosystem) level impacts that combine all possible combinations of abiotic and biotic interactions.*

**Charge Question 7:** As described, the conductivity benchmark is derived using central Appalachian field data and has been validated within Ecoregions 68, 69, and 70. Under what conditions does the SAB believe this method would be transferable to developing a conductivity benchmark for other regions of the United States whose streams have a different ionic signature?

*Response: Until or unless this conductivity benchmark can be validated (we believe it has not been), it is not at all appropriate to consider transferring this method to other regions—or even apply to these regions. In particular, until the effects of all stressors, such as different ionic signatures and hardness and other potential and likely stressors such as habitat, temperature, and flow are better understood for a wide range of species, it is very premature to extrapolate this method of using field correlations for only conductivity from one region to another region.*

**Charge Question 8:** The amount and quality of field data available from the states and the federal government have substantially increased throughout the years. In addition, the computing power available to analysts continues to increase. Given these enhancements in data availability and quality and computing power, does the Panel feel it feasible and advisable to apply this field-based method to other pollutants? What issues should be considered when applying the method to other pollutants?

*Response: This is not so much a question of data availability or computing power, but rather whether or not we can rigorously determine whether individual chemical stressors are powerful and reliable enough predictors of biological response—separate from all the other components of an organism's environment—and whether these responses are causal. This requires taking hypotheses generated from large datasets, "data mining", and objectively testing these hypotheses to ensure the patterns are reliable and causally related. To date, we have not yet seen this done adequately for any stressor, including iron, nutrients, or conductivity. So, no, this field-based method should not be applied to other pollutants, just like it should not be applied to conductivity.*

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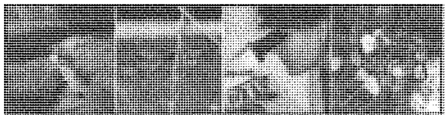

GEI Consultants

Geotechnical
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Water Resources
Ecological

**FINAL REPORT**

# Variability of Benthic Invertebrate Communities of Headwater Streams in Southern West Virginia

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# Table of Contents

## List of Figures



## List of Photos

## List of Tables

## List of Appendices



## List of Abbreviations and Acronyms

| | |
|---|---|
| Al | aluminum |
| AWWQRP | Arid West Water Quality Research Project |
| $Ca^{2+}$ | calcium |
| $Cl^{-}$ | chloride |
| CM/VF | coal mining/valley fill |
| $CO_3^{-2}$ | carbonate |
| DL | detection limit |
| E | expected |
| EF | east fork |
| EPA | U.S. Environmental Protection Agency |
| EPT | Ephemeroptera, Plecoptera, Trichoptera |
| Fe | iron |
| FFG | functional feeding group |
| ft | feet |
| GLIMPSS | Genus Level Index of Most Probable Stream Status |
| $HCO_3^{-}$ | bicarbonate |
| ICP-MS | Inductively Coupled Plasma Mass Spectrometry (ICP-MS) |
| ITIS | Integrated Taxonomic Information System |
| $K^{+}$ | potassium |
| m | meter |
| mg/L | milligrams per liter |
| $Mg^{2+}$ | magnesium |
| Mn | manganese |
| µm | micrometer |
| µS/cm | microSiemens per centimeter |
| $Na^{+}$ | sodium |
| NPDES | National Pollution Discharge Elimination System |
| QA/QC | quality assurance/quality control |
| QAP | Quality Assurance Plan |
| Se | selenium |
| SF | State Forest |
| $SO_4^{-}$ | sulfate |
| sp., spp. | species |
| S.U. | standard units |
| USACE | U.S. Army Corps of Engineers |
| USGS | U.S. Geological Survey |
| U.T. | unnamed tributary |
| WABBase | Water Assessment Branch database |
| WMA | Wildlife Management Area |
| WVDEP | West Virginia Department of Environmental Protection |
| WVSCI | West Virginia Stream Condition Index |

# Executive Summary

Mountaintop coal mining/valley fill (CM/VF) operations remove the upper contours of a mountain to expose coal seams, and excess spoil material left over after the mined area is restored is placed in valley fills in headwater stream channels. The U.S. Environmental Protection Agency (EPA 2009) has stated that headwater streams are spatially and temporally dynamic, supporting diverse biological communities. They have hypothesized that small differences in abiotic and biotic parameters among individual streams result in a wide variety of habitats, and therefore, a wide variety of communities are feasible. EPA then postulates that the diverse biological communities in each stream are unique/irreplaceable resources. For this to be true, each stream's specific habitat and water quality characteristics would *deterministically* result in an invertebrate community composed of taxa that require those specific conditions.

The present study was designed to describe the benthic invertebrate communities that inhabit the extreme upper reaches of headwater streams in the coal mining region of southern West Virginia. Most CM/VF operations bury only ephemeral or intermittent stream systems, so it was of interest to evaluate the invertebrate communities of these reaches. The goal of this natural history study was to identify the presence/absence of invertebrate communities in these reaches and measure the variability in the invertebrate community composition between streams, allowing evaluation of EPA's hypothesis.

GEI sampled 12 headwater streams in three different protected natural areas of southern West Virginia to evaluate the natural variability of their benthic invertebrate communities. On each stream, two sites were sampled in May 2010, with one being at the upstream terminus of flowing water, and the other approximately 10 to 400 meters downstream. A benthic invertebrate sweep sample was collected at each site, sampling each different habitat type present as thoroughly as possible. Since habitat conditions in these extreme headwaters are different from those used to build regional metrics like the West Virginia Stream Condition Index (WVSCI), those specific protocols were not used. Collected invertebrates were identified and counted to provide taxonomic lists and estimates of relative density and species diversity.

This study demonstrated that a diverse benthic invertebrate fauna consisting of at least 129 benthic invertebrate taxa was present in the extreme headwaters of the streams of southern West Virginia. These extreme headwater sites were generally characterized by less than 50 percent similarity between sites on the same stream and between those on one stream and those on other streams using Jaccard coefficients of similarity, which are based on "presence-absence" patterns. In fact, statistical cluster analyses used to group the sites based on similarities in the composition of their benthic invertebrate communities concluded that the communities were sufficiently different from each other such that sites on the same stream frequently did not group together.

This between-site/between-stream variability is not any greater than the normal within-site variability found throughout the region. Data from other sites in West Virginia that were sampled multiple times within the same season (both within the same year and between years) and replicate data from another companion GEI study in the region indicated that within-site similarity is typically less than 50 percent.

Mayflies (Ephemeroptera) were not as dominant in these headwaters streams as has been postulated by other studies conducted in the region. Those studies state that 25 to 50 percent of the total invertebrate abundance in central Appalachian headwater streams should be comprised of mayflies, and a "core community" of certain mayfly genera would be expected to be present in undisturbed streams. Even though our headwater sites and sampling methods do not specifically match those used in those previous studies, it is important to note that mayflies frequently comprised less than 10 percent of the community at most sites in our study and were completely absent from one-fourth of the streams studied. The proposed core mayfly community does not occur in these headwaters sites, and the expectation of high proportions of the community being mayflies may not be met in all undisturbed headwaters communities in southern West Virginia.

Benthic habitat was similar among sites, with the same kinds of habitat features (riffles, runs, pools, etc.) occurring at most sites. Substrate characteristics, especially dominance of silt at a site, could not consistently be linked to community diversity patterns. Water chemistry parameters also were similar among sites, showing weak relationships to the invertebrate population parameters. pH was low (<6.0) at some sites where EPT taxa were not encountered as frequently—but this was not a consistent pattern. Therefore, invertebrate colonization patterns did not appear to be restricted or driven by variations in habitat, substrate, or water chemistry.

Instead of being related to site-specific habitat, substrate, or water chemistry differences, low similarity between stream invertebrate communities appears to be related to regional colonization patterns, both spatially and temporally. Our results are consistent with the broken stick model of species importance (random niche boundary hypothesis) described in biogeography theory in that the benthic macroinvertebrate communities were comprised of few common taxa and many less common taxa. It was the differences in the presence/absence of uncommon taxa that were the primary contributors to low similarity among sites. However, the widespread geographic ranges and broad habitat requirements of these uncommon taxa indicate that they are not restricted to these extreme headwater habitats.

We conclude that the common taxa and less common taxa appear to be part of a large regional pool of available taxa that colonize streams opportunistically, including ephemeral habitats such as these extreme headwater sites. Opportunistic colonization is supported by the less than 50 percent similarity in their invertebrate community composition. Normal within-site variability is less than 50 percent even though habitat and water chemistry would be expected to change little between sample events, and replicate samples collected in similar habitat at the same time even showed that level of variability. Consequently, different invertebrate communities were found in each sample event, indicating that the streams are being colonized by whichever invertebrates happen to find the water.

Further, data from body measurements of several "long-lived" taxa collected in this study further support the conclusion of opportunistic colonization. Long-lived taxa with life history strategies such as burrowing into the substrate maintain viable populations in such headwater stream segments by utilizing those survival strategies when surface water ceases to flow. Other long-lived taxa without such life history traits may also be present in these sites, but these taxa were generally represented in the extreme headwater sites by only small individuals (i.e., early instars), suggesting that these taxa may not finish their life cycles before the stream dries up. The presence of primarily younger individuals of such non-burrowing, long-lived taxa in these extreme headwater stream segments is further indication that the colonization by these organisms is opportunistic.

In summary, the taxa encountered and low levels of similarity between the invertebrate communities in headwaters streams with otherwise similar habitat and water quality are consistent with the hypothesis that headwaters communities are established opportunistically from a larger regional pool of organisms. Between-site diversity analysis also indicated that there are, on average, two to four invertebrate communities among the 24 sites and 12 streams even though the taxonomic composition of each of these headwaters communities would likely change with each sampling event due to opportunistic colonization patterns. A reasonable portion of the headwater streams with suitable habitat availability and sufficient interconnectivity should be conserved in order to support the regional diversity, but since the widespread regional fauna appear to colonize these stream reaches opportunistically, loss of a limited number of individual streams should not jeopardize the overall diversity in the extreme headwater streams of southern West Virginia.

# 1.0 Introduction

Mountaintop coal mining/valley fill (CM/VF) coal mining operations remove the upper contours of a mountain to expose coal seams within the mountain, and the excess spoil material left over after the mined area is restored is placed in valley fills in the headwater stream channels. National Pollution Discharge Elimination System (NPDES) and U.S. Army Corps of Engineers (USACE) permits for existing and proposed CM/VF operations have been recently challenged by EPA and other groups. These challenges are based in large part on Pond et al. (2008a, 2008b) and U.S. Environmental Protection Agency (EPA) (2009, 2010).

EPA (2009) highlighted the importance of headwater streams, indicating that they are spatially and temporally dynamic, thereby supporting diverse biological communities. They have hypothesized that small differences in abiotic and biotic parameters among individual streams potentially result in a wide variety of habitats, and therefore, a wide variety of communities specific to a site are feasible (Meyer et al. 2007). Stout and Wallace (2003) stated, "the view that there are so many small streams and springbrooks in the Appalachians that destroying a small portion represents a minor threat to biodiversity appears to be incorrect."

For these hypotheses to be true, three expectations must be met: 1) each stream would have a specific habitat and chemistry profile; 2) those abiotic profiles would structure the niches that support each stream's specific invertebrate community; and 3) each stream's specific invertebrate community would be composed of taxa that deterministically require those specific niches. However, if the different headwater streams instead exhibit similar invertebrate communities due to redundancy among streams or merely reflect a larger regional community, then smaller areas may be protected and still conserve the regional biodiversity (Clarke et al. 2010).

Few data exist on the invertebrate populations of the extreme uppermost reaches of headwater streams in southern West Virginia that would potentially be susceptible to direct burial by CM/VF activities; thus, knowledge of what type of invertebrate "headwaters community" is typical in these reaches is limited. Most studies conducted in the extreme headwaters environment have been concerned with terrestrial/aquatic linkages and not aquatic community surveys. Stout and Wallace (2003) surveyed the invertebrate populations in the extreme headwaters of 36 streams and spring seeps scheduled for burial via VF construction in southern West Virginia and eastern Kentucky. More than 73 genera were identified from these streams and seeps, with eight common insect orders collected. The number of families and genera collected from each of these orders was given, with Diptera (true fly) and Plecoptera (stoneflies) taxa comprising over half of the number of genera collected. Functionally, taxa classified as predators, collectors, shredders, scrapers, and facultative collector-scraper taxa were represented, with predator taxa being most common in terms of number of taxa (Stout and Wallace 2003).

Several long-lived taxa with life cycles lasting more than a year were collected in many of the extreme headwater sites studied in Stout and Wallace (2003). Long-lived taxa reported in Wallace and Stout (2003) included *Peltoperla*, *Tallaperla*, *Eccoptura*, and *Acroneuria* (Plecoptera); *Lanthus*, *Cordulegaster*, and *Stylogomphus* (Odonata); *Nigronia* (Megaloptera); and *Anchytarsus* (Coleoptera). The presence of these taxa in extreme headwater stream sites that flow only in response to precipitation and that dry seasonally led those researchers to conclude that the organisms may have burrowed into hyporheic zones or migrated to intermittent pools during periods of no flow, even though none of these taxa reportedly had obvious specialized adaptations for surviving dry conditions (Stout and Wallace 2003).

Unfortunately, the similarity, or lack thereof, between sites and streams in the Stout and Wallace (2003) study cannot be estimated, since the researchers did not provide lists of taxa by site and stream. No other studies describing the invertebrate communities in the extreme headwater reaches within this southern West Virginia region were available.

The present study was designed to provide further information on the invertebrate communities that inhabit the extreme upper reaches of headwaters streams in the coal mining region of southern West Virginia. Most CM/VF operations bury only ephemeral or intermittent stream systems, so it was of interest to determine the potential invertebrate communities of these extreme headwaters. Furthermore, this study specifically addresses the variability in the specific composition of the benthic macroinvertebrate communities within these streams.

To accomplish these goals, GEI conducted a natural history study on the headwaters of 12 streams in protected, unmined areas within the coal-mining region of southern West Virginia. Two sites were established on each stream, with the first site located at the upstream terminus of flowing water, and the second site located approximately 100 meters (m) or more downstream where the stream wetted width equaled one foot. The downstream site was typically no more than a few hundred meters downstream from the upper terminus of flowing water where the first site was established; thus, the results and implications of this study pertain only to the uppermost reaches of headwater streams in the region.

Presence/absence and relative abundance data were analyzed to determine the degree of similarity in the invertebrate communities between streams and to estimate the number of taxonomically distinct benthic invertebrate communities in the region. General habitat characteristics were described and differences in water chemistry between streams also were evaluated to determine the range of various analytes that occurred in such streams and to investigate if differences in water chemistry or general habitat features could explain patterns in the benthic invertebrate communities.

# 2.0 Methods

## 2.1 Stream Selection and Study Design

The rationale behind this study was to determine the variability of the headwaters macroinvertebrate communities in southern West Virginia. As such, a survey of the benthic macroinvertebrate communities of headwaters of 12 unmined streams in southern West Virginia was conducted. This was two more streams than were originally proposed for sampling in the Standard Operating Procedures (GEI 2010). Site selection, field methods, and laboratory methods were conducted in accordance with GEI (2010), except in a few cases where noted.

### *2.1.1 Study Design*

On each stream, two stations were established, with benthic macroinvertebrate and water samples collected from within each station. The upstream station (Site 1) was established at the upstream terminus of flowing surface water. The downstream station (Site 2) was established further downstream at a point at which stream wetted width equaled approximately one foot (ft) at the time of sampling. Although cues from channel morphology (i.e., presence of a defined channel, flowing water, etc.) were used to locate the sites, it was not possible to identify these sites as ephemeral, intermittent, or perennial, as continuous hydrology data do not exist. Accordingly, hydrologic status was not assigned to the sites.

Most CM/VF operations are intended to bury only the uppermost portions of these stream systems, so it was of interest to determine the potential invertebrate communities of these headwater stream systems. In planning the field efforts, isolated pools were expected to exist upgradient of the upstream terminus of flowing water and would be sampled separately. However, the presence of such upstream isolated waters occurred at only one stream, East Fork Paw Paw Branch. These pools were sampled in this stream, providing a third sampling site on the East Fork Paw Paw Branch.

### *2.1.2 Stream Sites*

During a site visit in March 2010, many of the potential headwater stream sites appeared to have limited access due to private property restrictions. To avoid access restrictions and areas of active mining, three protected natural areas located in public lands were selected from which appropriate streams were sampled (Figure 1). These three protected natural areas included the Big Ugly Wildlife Management Area (WMA), Kanawha State Forest (SF), and the Laurel Lake WMA. Topographic maps and atlases indicated several streams that were suitable for the sampling plan in each of these areas, but the specific streams to be sampled were chosen during the sampling trip when access and presence of water could be further verified. Although efforts were made to sample the mainstem of each of the chosen streams, a small headwater tributary or fork was sampled instead of the mainstem on Doss Fork, Chestnut Oak Creek, and Back Fork. GPS coordinates for each site are provided (Table 1), except for sites with poor satellite acquisition.

**Table 1: GPS coordinates for stream sites sampled in southern West Virginia. Upstream site (Site 1) was located at the upstream terminus of flowing water, and downstream site (Site 2) was located where stream width equaled one foot. Site 0 was located in isolated upstream pools, if available. NA = GPS coordinates could not be attained.**

| Stream/Site | Latitude | Longitude |
|---|---|---|
| **Big Ugly Wildlife Management Area** | | |
| Back Fork Site 1 | N38°05'57.1" | W82°02'17.8" |
| Back Fork Site 2 | N38°05'59.3" | W82°02'20.3" |
| Chestnut Oak Creek Site 1 | N38°05'14.3" | W82°00'14.0" |
| Chestnut Oak Creek Site 2 | N38°05'10.1" | W82°00'17.0" |
| Doss Fork Site 1 | N38°05'11.9" | W82°01'34.9" |
| Doss Fork Site 2 | N38°05'06.1" | W82°01'38.9" |
| King Rough Hollow Site 1 | N38°05'17.6" | W82°02'33.4" |
| King Rough Hollow Site 2 | N38°05'19.0" | W82°02'36.7" |
| Mudlick Hollow Site 1 | N38°05'38.3" | W82°03'52.2" |
| Mudlick Hollow Site 2 | n/a | n/a |
| U.T. Laurel Creek Site 1 | N38°04'46.6" | W82°01'18.6" |
| U.T. Laurel Creek Site 2 | N38°04'40.7" | W82°01'18.4" |
| **Kanawha State Forest** | | |
| #2 Store Hollow Site 1 | N38°16'20.2" | W81°40'29.8" |
| #2 Store Hollow Site 2 | N38°16'19.0" | W81°40'30.7" |
| Portercamp Branch Site 1 | N38°15'47.5" | W81°41'03.3" |
| Portercamp Branch Site 2 | N38°15'48.5" | W81°41'00.5" |
| Rattlesnake Run Site 1 | N38°16'41.5" | W81°40'15.0" |
| Rattlesnake Run Site 2 | N38°16'42.8" | W81°40'16.1" |
| White Hollow Site 1 | N38°15'33.6" | W81°39'50.5" |
| White Hollow Site 2 | N38°15'36.3" | W81°39'49.0" |
| **Laurel Lakes Wildlife Management Area** | | |
| EF Paw Paw Branch Site 0 | n/a | n/a |
| EF Paw Paw Branch Site 1 | n/a | n/a |
| EF Paw Paw Branch Site 2 | N37°50'01.0" | W82°11'21.8" |
| Paw Paw Branch Site 1 | N37°50'05.2" | W82°11'26.5 |
| Paw Paw Branch Site 2 | N37°50'05.2" | W82°11'26.5" |

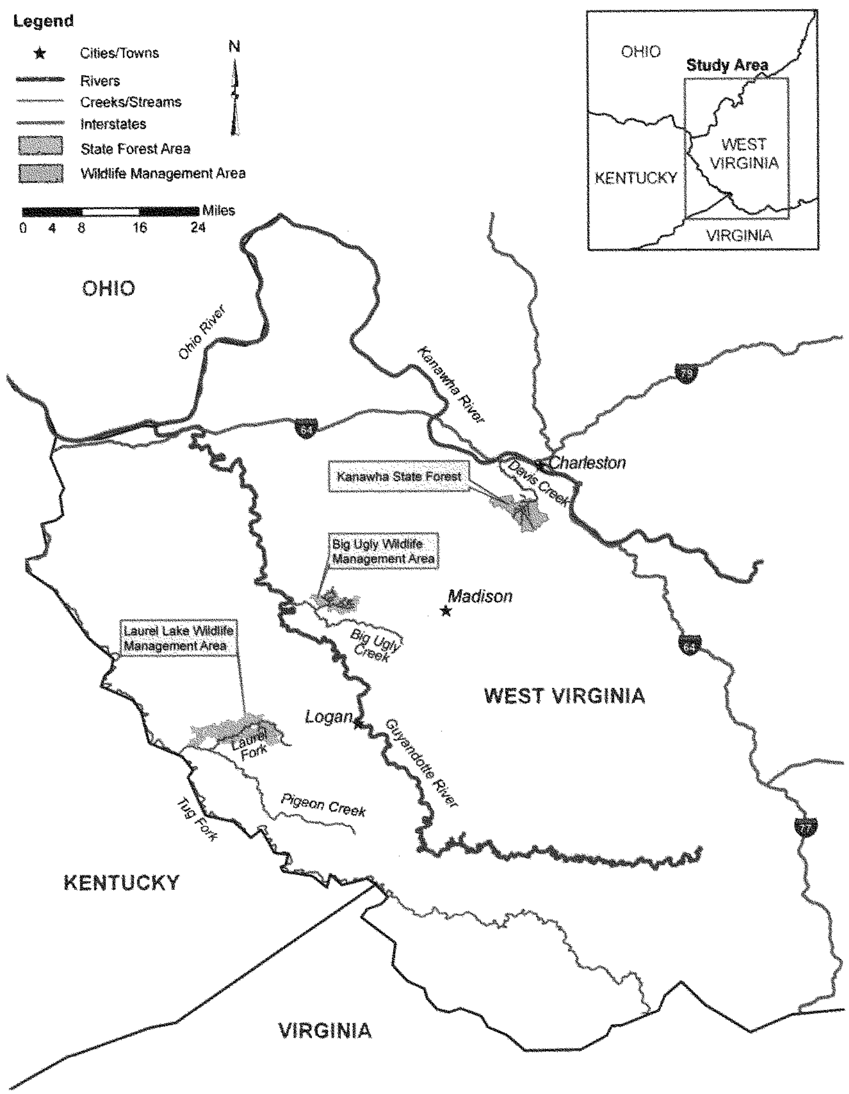



**Figure 1: Map of public areas where sites were located.**

Streams were chosen during the sampling trip, based on accessibility, presence of water, and lack of any likely anthropogenic factors that may influence results. Anthropogenic factors were assessed visually during the sampling trip, and these sites were generally assumed to be relatively undisturbed based on their location within protected natural areas. However, historical mining or other impacts that were not readily apparent from our surveys could have existed at these sites.

#### 2.1.2.1 Big Ugly Wildlife Management Area

Six streams were identified and sampled in the Big Ugly WMA: Back Fork, Chestnut Oak Creek, Doss Fork, King Rough Hollow, Mudlick Hollow, and an unnamed tributary to Laurel Creek (Figure 2). These sites are described in additional detail below.

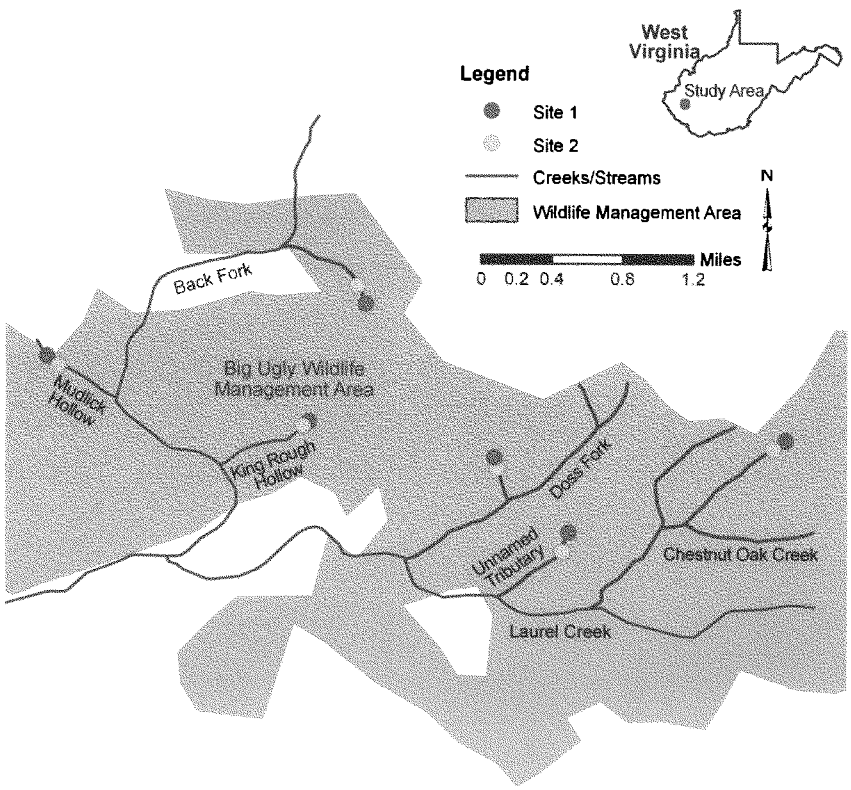



**Figure 2: Map of sampling sites in the Big Ugly Wildlife Management Area.**

### 2.1.2.2 Back Fork

Back Fork is a tributary to Laurel Creek in the Big Ugly WMA (Photos 1 and 2) and was sampled on May 12, 2010. The headwaters of Back Fork are divided into two forks, and the south fork was chosen for sampling as the north fork that was depicted on the USGS topographic maps exited the WMA. Site 2 on the Back Fork was located approximately 200 m downstream of Site 1.

Photo 1: Back Fork, Site 1, May 12, 2010.

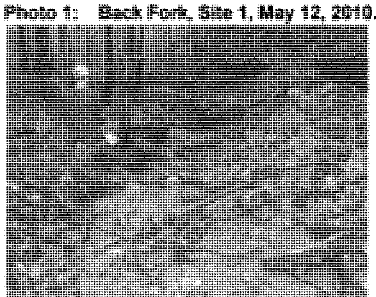
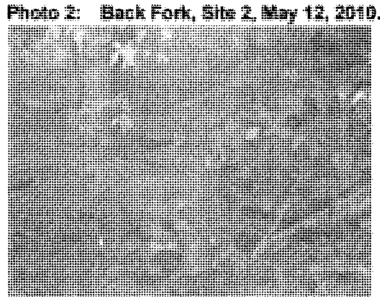


Photo 2: Back Fork, Site 2, May 12, 2010.



#### *2.1.2.2.1 Chestnut Oak Creek*

Chestnut Oak Creek is a tributary to Laurel Creek in the Big Ugly WMA (Photos 3 and 4) and was sampled on May 12, 2010. The headwaters of Chestnut Oak Creek are divided into three forks. The fork chosen for sampling was the middle fork, not the east fork mainstem, which was the only fork depicted on the USGS topographic maps. It was noted in the field that rain had occurred earlier in the day, and that the streams were turbid. However, conditions were sunny at the time of sampling. Such a precipitation event could have altered the terminus of flow so that water was present further upstream than it was before the rainfall. Additionally, the invertebrate data could have been affected through scouring of the streambed, or the increased turbidity could have affected the analysis of the water chemistry samples. Site 2 was located approximately 150 m downstream of Site 1.

**Photo 3: Chestnut Oak Creek, Site 1, May 12, 2010.**

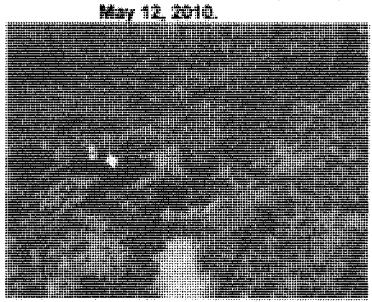
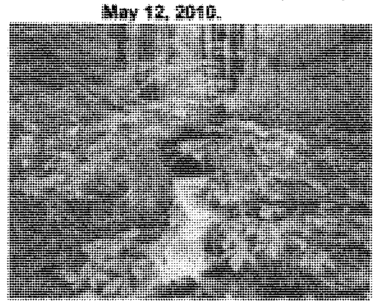


**Photo 4: Chestnut Oak Creek, Site 2, May 12, 2010.**



#### 2.1.2.2.2 Doss Fork

Doss Fork is a tributary to Laurel Creek in the Big Ugly WMA (Photos 5 and 6) and was sampled on May 14, 2010. At approximately half the distance to the mainstem headwaters of Doss Fork was a small, unnamed tributary that was chosen for sampling. The stream subsided intermittently between Site 1 and Site 2, located approximately 400 m downstream of Site 1.

**Photo 5: Doss Fork, Site 1, May 14, 2010.**

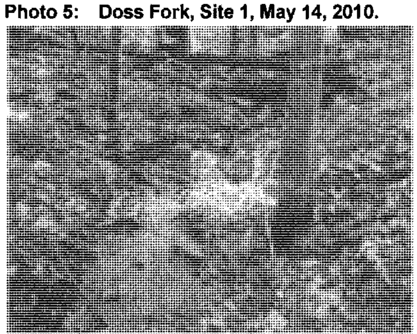
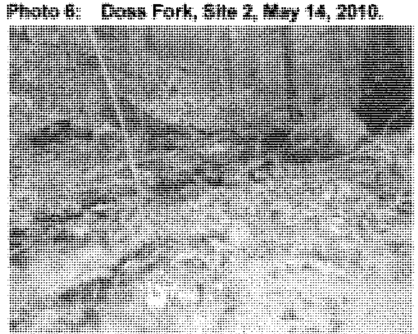


**Photo 6: Doss Fork, Site 2, May 14, 2010.**



#### 2.1.2.2.3 King Rough Hollow

King Rough Hollow is a tributary to Back Fork in the Big Ugly WMA and was sampled on May 12, 2010. Photographs were not included as rain affected photograph clarity. The headwaters of King Rough Hollow are divided into two forks, and the west fork was chosen for sampling as the water was clear, rather than turbid, as it was in the other fork. Site 2 was located approximately 75 m downstream of Site 1 and downstream of a tributary that doubled the flow in the stream.

#### 2.1.2.2.4 Mudlick Hollow

Mudlick Hollow is also a tributary to Back Fork in the Big Ugly WMA and was sampled on May 12, 2010. As with King Rough Hollow, no clear site photos are available because rain obscured the camera lens. The upstream terminus of flowing water was found downgradient of the end of the stream as depicted on the USGS topographic maps. Site 2 was located approximately 200 m downstream of Site 1.

#### 2.1.2.2.5 Unnamed Tributary to Laurel Creek

This tributary to Laurel Creek entered from the north between Doss Fork and Chestnut Oak Creek (Photos 7 and 8) and was sampled on May 14, 2010. Site 2 was located approximately 200 m downstream of Site 1.

Photo 7: Unnamed tributary to Laurel Creek, Site 1, May 14, 2010.

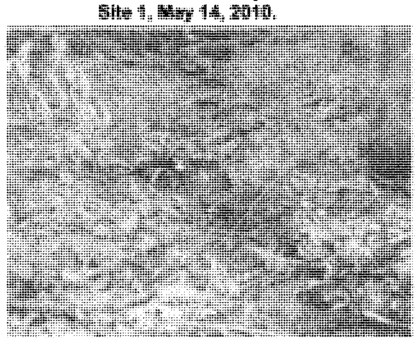
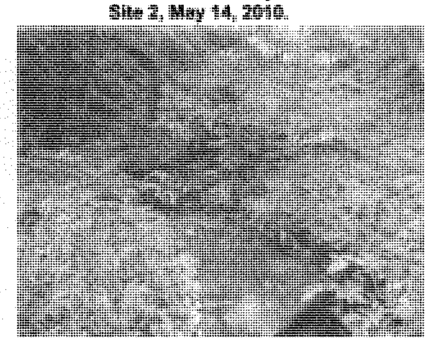


Photo 8: Unnamed tributary to Laurel Creek, Site 2, May 14, 2010.



#### 2.1.2.3 Kanawha State Forest

Four streams were identified and sampled in the Kanawha SF: #2 Store Hollow, Portercamp Branch, Rattlesnake Run, and White Hollow (Figure 3). These streams are described in additional detail below. It was noted that there had been rain the day previous to sampling on these streams.

##### *2.1.2.3.1 #2 Store Hollow*

No. 2 Store Hollow is a tributary to Davis Creek in the Kanawha SF (Photos 9 and 10) and was sampled on May 13, 2010. It appears that a small spring represents the upstream terminus of flowing water. A small tributary entered the stream approximately 10 m downstream of the terminus of flowing water, doubling the flow, and separated Site 1 from Site 2.

Photo 9: #2 Store Hollow, Site 1, May 13, 2010.

Photo 10: #2 Store Hollow, Site 2, May 13, 2010.

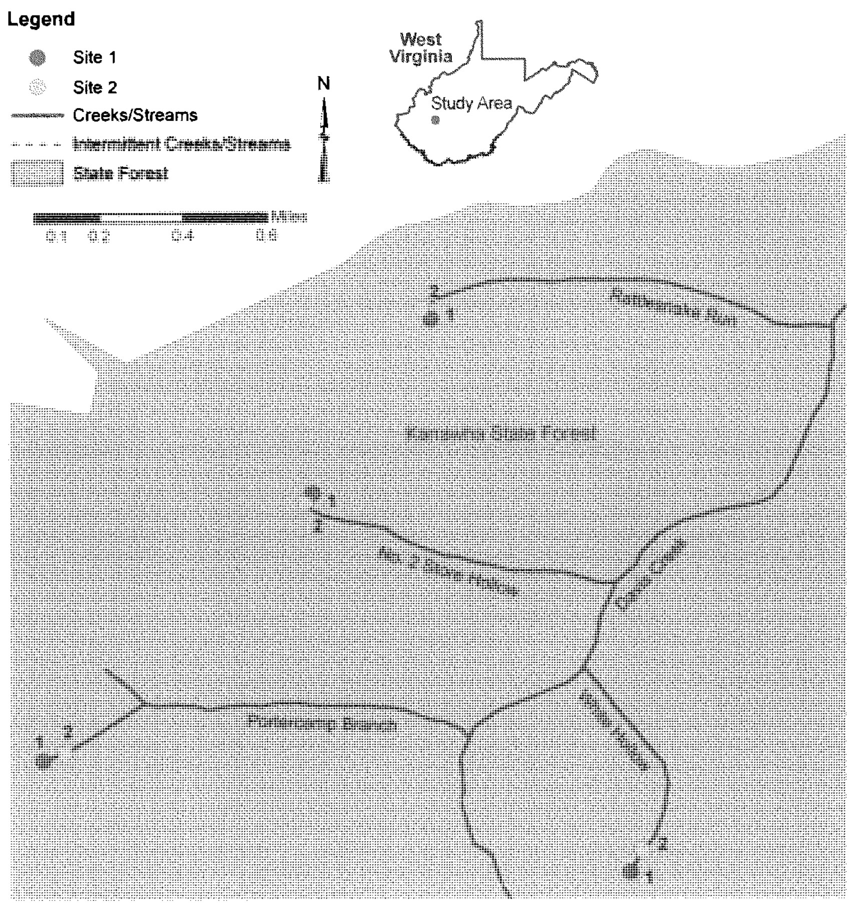



**Figure 3: Map of sampling sites in the Kanawha State Forest.**

#### *2.1.2.3.2 Portercamp Branch*

Portercamp Branch is a tributary to Davis Creek in the Kanawha SF (Photos 11 and 12) and was sampled on May 13, 2010. The headwaters of Portercamp Branch are divided into two forks, and the one chosen for sampling was the south fork, not the north fork mainstem, which was depicted on the USGS topographic maps. The USGS topographic maps did not indicate water in the left fork. Site 2 was located approximately 100 m downstream of Site 1.

Photo 11: Portercamp Branch, Site 1, May 13, 2010.

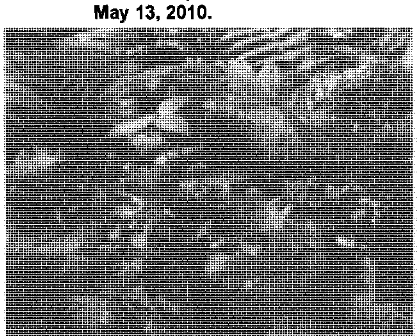
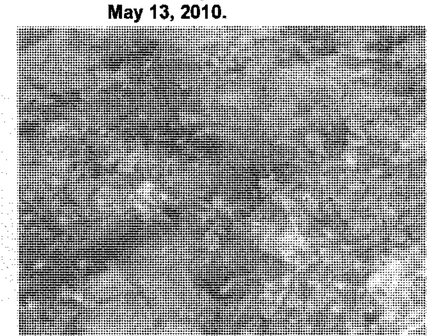


Photo 12: Portercamp Branch, Site 2, May 13, 2010.

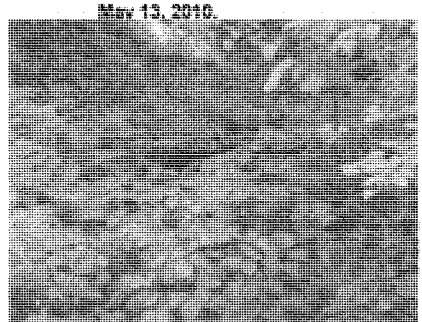


#### *2.1.2.3.3 Rattlesnake Run*

Rattlesnake Run is a tributary to Davis Creek in the Kanawha SF (Photos 13 and 14) and was sampled on May 13, 2010. The upstream terminus of flowing water was found upgradient of the end of the stream as depicted on the USGS topographic maps. Site 2 was located approximately 50 m downstream of Site 1.

Photo 13: Rattlesnake Run, Site 1, May 13, 2010.

Photo 14: Rattlesnake Run, Site 2, May 13, 2010.



#### *2.1.2.3.4 White Hollow*

White Hollow is a tributary to Davis Creek in the Kanawha SF (Photos 15 and 16) and was sampled on May 13, 2010. Site 2 was located approximately 200 m downstream of Site 1.

Photo 15: White Hollow, Site 1, May 13, 2010.

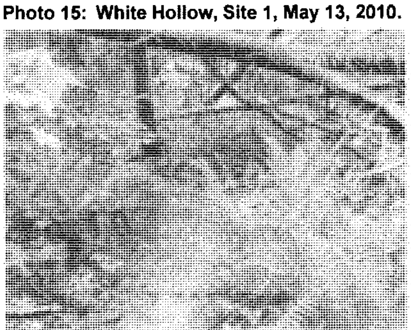
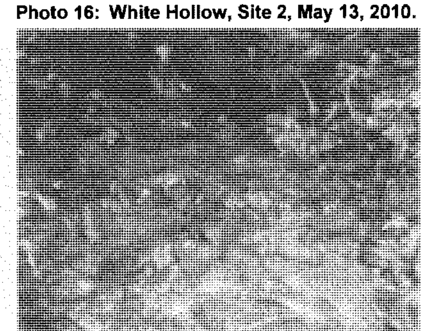


Photo 16: White Hollow, Site 2, May 13, 2010.



### 2.1.2.4 Laurel Lake Wildlife Management Area

Two streams were identified and sampled in the Laurel Lake WMA: Paw Paw Branch and East Fork Paw Paw Branch (Figure 4). These streams are described in additional detail below.

#### *2.1.2.4.1 Paw Paw Branch*

Paw Paw Branch is a tributary to Laurel Fork in the Laurel Lake WMA (Photos 17 and 18) and was sampled on May 11, 2010. Stream width at Site 2 was approximately 0.75 ft (not 1 ft), because the downstream end of the site was at the confluence with another tributary that increased the stream width to nearly 2 feet. Site 2 was approximately 170 m downstream of Site 1.

Photo 17: Paw Paw Branch, Site 1, May 11, 2010.

Photo 18: Paw Paw Branch, Site 2, May 11, 2010.

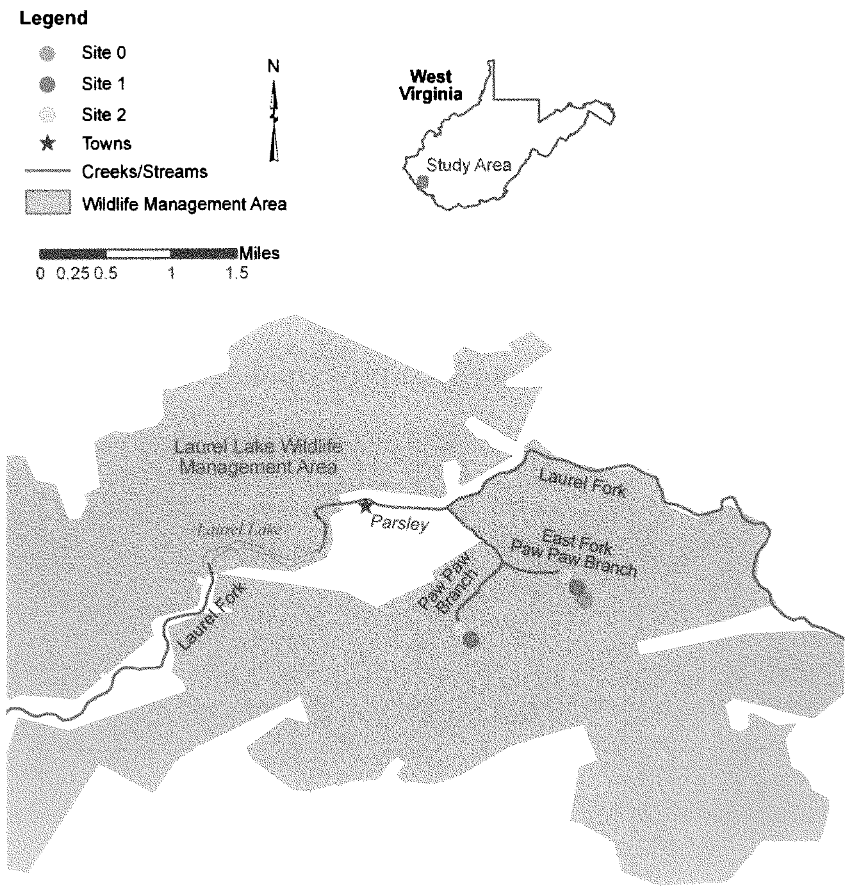



**Figure 4: Map of sampling sites in the Laurel Lake Wildlife Management Area.**

#### *2.1.2.4.2 East Fork Paw Paw Branch*

East Fork (EF) Paw Paw Branch is an unnamed tributary to Paw Paw Branch in the Laurel Lake WMA (Photos 19 to 21) and was sampled on May 11, 2010. Rain was noted during sampling of the sites on EF Paw Paw Branch. Three sites were located on EF Paw Paw Branch, with Site 0 located in intermittent pools approximately 20 m upgradient of the terminus of flowing water. Site 2 was located approximately 150 m downstream of Site 1.

Photo 19: East Fork Paw Paw Branch, Site 0, May 11, 2010.

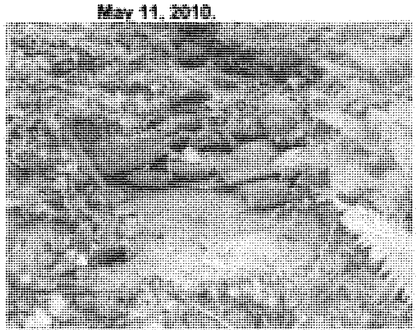


Photo 20: East Fork Paw Paw Branch, Site 1, May 11, 2010.

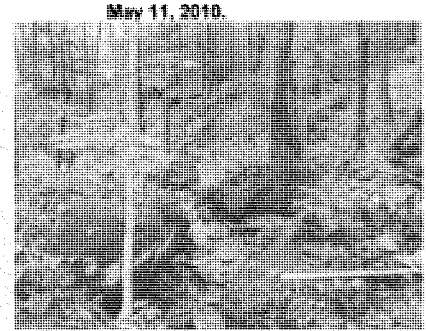


Photo 21: East Fork Paw Paw Branch, Site 2, May 11, 2010.

## 2.2 Field Methods

### *2.2.1 Benthic Invertebrate Sampling*

A single composite kick sample, sampling the variety of habitat types available (e.g., riffles, runs, pools, pocket water, etc.), was collected at each site. Evaluation of habitats is described below in Section 2.2.2 Habitat Evaluation. Presence/absence of invertebrate taxa and relative abundance data that the composite kick sample provides were adequate to characterize the benthic invertebrate communities at these sites (Carter and Resh 2001).

Benthic invertebrate sampling protocols (WVDEP 2010) have been developed for use by Watershed Assessment Branch monitoring programs and calculation of the West Virginia Stream Condition Index (WVSCI). Protocols outlined in WVDEP (2010) provide data that are either "comparable" to the majority of other samples collected by the WAB and used for routine biomonitoring and appropriate calculation of the WVSCI, or "noncomparable," which are used in wetland-type and low-flow habitats and which cannot be appropriately used in calculation of the WVSCI. Comparable WVDEP approaches include kick samples from riffle/run habitat, combined into a single, composite sample that covered an area of 1 $m^2$. Since comparable samples collected using WVDEP protocols only sample riffle/run habitat, many invertebrate taxa that are not found in riffles would potentially be missed. The non-comparable multi-habitat approach in the WVDEP protocols is standardized for monitoring purposes using a specified number of jab-sweeps in each habitat type. WVDEP protocols were not used for this natural history study because "special projects outside of the Watershed Assessment Branch monitoring agenda...may not allow strict adherence to these protocols" (WVDEP 2010, p. 151). Instead of using a specified number of jab-sweeps, we modified that approach by sampling each habitat as comprehensively as possible to help provide information on species composition and the relative abundance of organisms in these headwater sites.

The kick samples were collected with a 0.5 m wide rectangular kick net with a net mesh size of 500 µm. The kick net was jabbed into the various habitat types available or held downstream while the substrate was disturbed by kicking. Although a specific area was not sampled, sufficient effort was expended at each site to ensure that the full community was sampled by making sure that the whole variety of habitats had been sampled. Larger stones within the area sampled were scrubbed by hand to remove any invertebrates. Stream flow carried the organisms into the collection bucket at the downstream end of the net. The net was lifted from the water, rinsed, and visually inspected to ensure all benthic invertebrates were washed into the collection bucket. After collection of each sample, the collection bucket was emptied into separate, labeled jars and rinsed with 95 percent ethyl alcohol to ensure that no organisms remained in the collection bucket.

Samples were preserved in the field in denatured 95 percent ethyl alcohol. The sample equipment and net were rinsed thoroughly between samples, and visually inspected to ensure invertebrates were not transferred between sites.

All samples were labeled, and the sample identifications were recorded in the field book. Sample container labels included the following elements, as appropriate: HS-Stream Name; Site 0, 1, or 2; "Composite Kick"; and date sampled.

All biological sampling activities were conducted under Scientific Collecting Permit No. 2010.116, issued by the West Virginia Department of Natural Resources.

### *2.2.2 Habitat Evaluation*

Specific habitat types within each site to be utilized for benthic invertebrate sampling were identified by consensus decision among field personnel. Habitat evaluation consisted of listing the habitat types (riffle, run, pool, etc.) sampled in the stream and describing the physical conditions that existed at each site. Substrate was characterized by noting the presence of silt/clay, gravel, cobbles, boulders, or bedrock, and indicating if one particular size class was obviously predominant.

### 2.2.3 Water Chemistry Sampling

A grab sample was collected from each site for water chemistry analysis. Samples were collected by inverting a clean, rinsed bottle under the water surface to collect water and avoid collection of surface debris. Analytical samples that required field preservation were transferred from the unpreserved container to a laboratory pre-preserved sampling container. Other samples were collected by direct immersion of the sampling container and capping below the water surface. Due to shallow water depths at some sites, a scoop was required to collect water for transfer to the collection bottles. Disposable nitrile gloves were worn during sample collection, with a new set used at each sample site.

After collection, each sample container was labeled, and all samples were recorded in the field book, with a sequential number system for all samples. Samples were kept on ice until they could be delivered to REIC Laboratories, Beckley, West Virginia, for analysis.
A courier delivered the samples within 48 hours to meet the most restrictive holding times.

### 2.2.4 Benthic Invertebrate Sampling Quality Assurance/Quality Control (QA/QC)

The field crew was led by an experienced aquatic ecologist with a Master's degree in fisheries science. Collection of all samples was conducted by aquatic ecologists with at least three years of experience in collection of aquatic invertebrate samples. All sampling was conducted in compliance with a project-specific Health and Safety Plan.

Field notes were written in a "Rite-in-the-Rain" waterproof field notebook to indicate aspects of field sampling. Photographs of sampling activities and site conditions were taken. The few deviations from the sampling protocol were noted in the field notebook.

All sampling equipment (kick nets, gloves, etc.) was rinsed thoroughly with stream water upon arrival at each site and before leaving each site to minimize the potential for transfer of organisms or any type of contamination between sites or reaches.

## 2.3 Laboratory Methods

### 2.3.1 Benthic Invertebrate Sample Processing

In the laboratory, the benthic invertebrate samples were processed by sorting and removing the organisms from the debris. Sorting of organisms was conducted at GEI's aquatic ecology laboratory in Denver, Colorado. While 12 of the 25 samples were sorted in their entirety, subsampling was required on the remaining samples due to excessive numbers of organisms (>300 organisms). For these samples, a minimum of 300 organisms was sorted (Vinson and Hawkins 1996, Carter and Resh 2001), 50 percent greater than the 200 ± 40 organisms prescribed in the WVDEP (2010) protocols, because this was a natural history study, not a biomonitoring program, and calculation of the WVSCI was not a goal of the study. The minimum of 300 organisms was a change from the Standard Operating Procedures (GEI 2010), in which 1,000 organisms was the proposed minimum. This change was necessary due to the extremely large number of organisms present in some samples and the time constraints placed upon the study. Subsampling to 300 organisms is consistent with GEI's normal practices and many state agency protocols (Carter and Resh 2001) and exceeds the effort prescribed by WVDEP (2010).

Sorting of the sample consisted of placing it in a tray and distributing it evenly throughout the tray, with a ten-cell plastic grid placed in the tray to delineate cells for picking. Cells were chosen at random with a ten-sided die, and each cell was picked sequentially until the target number of 300 organisms was sorted. The cell in which the 300$^{th}$ organism was sorted was picked in its entirety. At least three tenths of each sample was sorted.

All organisms were counted and identified to the lowest practical taxonomic level, usually genus or species (Lenat and Resh 2001), depending on availability of taxonomic literature and the age and condition of each specimen. All benthic invertebrate data are provided in Appendix A.

### *2.3.2 Water Chemistry Analysis*

Water chemistry samples were submitted to REIC Laboratories, Beckley, West Virginia, for filtration, preservation, and analysis of conductivity, major cations (calcium [$Ca^{2+}$], potassium [$K^{+}$], sodium [$Na^{+}$], magnesium [$Mg^{2+}$]) and anions (carbonate [$CO_3^{-2}$], bicarbonate [$HCO_3^{-}$], sulfate [$SO_4^{-}$], chloride [$Cl^{-}$]), pH, hardness, nitrate-N, and total concentrations of the following metals: aluminum (Al), iron (Fe), manganese (Mn), and selenium (Se). This list corresponded to the list of analytes, including metals, that showed statistically significant correlations with invertebrate metrics in Table 4 of Pond et al. (2008b). Analyses were conducted according to the appropriate methods, including Method 300 for ions and Inductively Coupled Plasma Mass Spectrometry (ICP-MS) for metals analysis. Water chemistry data are provided in Appendix C.

### *2.3.3 Benthic Invertebrate Sample Processing QA/QC*

GEI's laboratory adhered to standard protocols as part of a rigorous QA/QC process. All invertebrate samples were submitted to GEI's Laboratory for sorting using a standard Chain of Custody form. Each sample was examined upon arrival to ensure integrity of the sample (e.g., no broken jars, sufficient alcohol preservative). Each sample was assigned a sample number so that it could be tracked as it was processed.

After sorting past the target number of 300 organisms, the sorted samples were checked for completeness by a taxonomist or an experienced technician. All samples were required to pass with greater than 95 percent completeness. Ten percent of the samples were randomly assigned for QA documentation, and all samples passed with greater than 97.4 percent completeness.

Quality assurance for taxonomy and counts (Whittaker 1975, Stribling et al. 2003) was conducted on a randomly assigned set of 10 percent of the samples. A second taxonomist reidentified all of the organisms in the sample, and an abundance-weighted similarity index was calculated between the results from the two taxonomists. A percent similarity greater than 95 percent was required to pass. All QA procedures for identification and enumeration were documented, with all QA samples passing with greater than 96.2 percent similarity. The taxonomist responsible for QA methods maintained at least two Level 2 Taxonomic Certifications for eastern taxa from the North American Benthological Society that verified skill and knowledge in the field of aquatic invertebrate taxonomy.

Data entry was conducted using a GEI proprietary worksheet in Excel. Taxa codes, derived from the Integrated Taxonomic Information System (ITIS) of the U.S. Department of Agriculture (http://www.itis.gov/), were used to ensure accurate spelling of all taxonomic names. All data sheets were completely reviewed and compared to the original bench sheets by a taxonomist to ensure correct data entry.

### *2.3.4 Water Chemistry QA/QC*

All sampling equipment (scoops, etc.) was rinsed thoroughly with stream water upon arrival at each site and before leaving each site to minimize the potential for transfer of debris, organisms or any type of contamination between sites or reaches. One field blank sample was prepared each day to evaluate contamination from field conditions during sampling.

A duplicate sample was also collected at one randomly chosen site per day to determine sampling and analytical error through the evaluation of sample collection, sample preparation, and analytical methods. The sites in which duplicate samples were chosen were the upstream sites on #2 Store Hollow, Back Fork, Doss Fork, and East Fork Paw Paw Branch. All QA/QC samples were labeled and sent to the laboratory with the other samples for analysis.

REIC Laboratories followed their in-house Quality Assurance Plan (QAP) that has been developed with considerable attention given to specific state requirements. Quality assurance procedures for the laboratory included appropriate laboratory blank, matrix spike, and/or matrix spike duplicate samples and demonstrated relatively good data quality for the water chemistry samples.

Field duplicate analysis was considered to be acceptable if the relative percent difference for concentrations above the detection limit was below 25 percent (EPA 1994, 1995). Of the 64 site/analyte combinations, 60 site/analyte combinations had less than 25 percent difference between duplicate water chemistry samples. Duplicate water chemistry samples differed from each other by more than 25 percent in four site/analyte combinations: Fe at Doss Fork (37 percent difference between duplicate field samples) and East Fork Paw Paw Branch

(26 percent), Mn at Back Fork (36 percent), and Nitrate-N at East Fork Paw Paw Branch (140 percent).

## 2.4 Analysis

### *2.4.1 Benthic Invertebrate Community*

#### 2.4.1.1 Community Summary

The composite kick samples provided semi-quantitative data for these sites. Metrics calculated for each of the samples collected included abundance (number of organisms per sample), number of taxa, number of EPT taxa (organisms in the orders Ephemeroptera, Plecoptera, and Trichoptera), and relative abundance of each taxon. The number of EPT taxa in relation to the total number of taxa was calculated as the percent EPT taxa. The total number of long-lived taxa was calculated, based on information in Brigham et al. (1982) and Merritt et al. (2008). The presence/absence of long-lived taxa is presumed to be important since it is thought their presence implies that water is present for a sufficient length of time and is of sufficient quality over that period of time to support long-lived taxa.

The relative abundance and percent of the total number of taxa represented by each of the functional feeding groups (FFGs) present was also calculated for each stream site to determine if functional differences in the benthic invertebrate assemblage existed between streams or sites on each stream. The FFG assigned for each identified taxon was based on data presented in the West Virginia WABBase and Merritt et al. (2008) and included filter/collectors, gatherer/collectors, omnivores, parasites, piercers, predators, scrapers, and shredders.

#### 2.4.1.2 Variability Analysis

Detection and measurement of potential variability among these extreme headwater stream sites was a goal of this study, so variability was analyzed using three methods: cluster analysis, the Jaccard Similarity Index, and diversity analysis.

##### *2.4.1.2.1 Cluster Analysis*

Cluster analysis was conducted on taxon presence/absence data using Euclidean distances and group-average linkages as an assessment of site and stream dissimilarity. The result of cluster analysis is a dendrogram that graphically illustrates the similarity relationships between the invertebrate communities among stream sites. Individual clusters indicate stream sites that are more similar to each other, while stream sites in different clusters are more different in their invertebrate community composition.

#### *2.4.1.2.2 Jaccard Similarity Index*

The Jaccard Similarity Index was calculated between pairs of sites within streams, all pairs of sites within site classes (upstream Site 1 or downstream Site 2), and all pairs of streams within the study area to determine the degree of similarity between the invertebrate communities (Appendix B). The Jaccard Coefficient is calculated using the following equation:

$$Jaccard = \frac{a}{a+b+c},$$

where a = the number of taxa common to both samples, b = the number of taxa collected only in the first sample, and c = the number of taxa collected only in the second sample. The Jaccard Coefficient ranges from 0.0 (no taxa in common) to 1.0 (all taxa in common).

Thresholds have not been developed to determine if values for the Jaccard Coefficient represent high or low similarity/dissimilarity (i.e., the index is relative); therefore, to put any observed similarity/dissimilarity in perspective, replicate samples should be collected at a site to determine the range of within-site variability. However, the collection of replicate samples would have been inappropriate given the logistical limitations of collecting samples for this study (i.e., limited stream widths, depths, and available habitat).

To provide an estimate of the range of within-site variability for southern West Virginia streams in the absence of replicate samples, data from other streams in the area were analyzed that had been sampled multiple times[1] (Table 2). Data from samples collected using normal West Virginia standard protocols (WVDEP 2010) were available for 14 stream sites from the WV WABBase. While the data from WABBase did not represent true replicates, as they were sampled across different years and possibly slightly different locations, paired samples were each chosen within the same season.

GEI's (*in progress*) Longitudinal Study, a separate field study in southern West Virginia conducted on streams with and without CM/VF concurrently with this study, included replicate

[1] The area that was searched for streams that had been sampled multiple times was the entire area south and west of Interstates 64 and 77 in southwestern West Virginia. Ash Fork is tributary to Twentymile Creek near Belva; Bowen Creek is tributary to Beech Fork just east of Beech Fork Lake WMA; Buffalo Creek is tributary to Huff Creek south of Hanover; Crane Creek is located in the Panther State Forest southwest of Iaeger; Crawley Creek is tributary to the Guyandotte River near Chapmanville; Lacey Branch is a tributary to the Pond Fork, 4.1 miles southeast of Rocklick; Little Horse Creek is a tributary to the Little Coal River near Julian; Mash Fork is located in the Camp Creek State Forest, south of Beckley; Neil Branch is tributary to Twentymile Creek near Belva; Plum Branch is a tributary to Tenmile Creek of the Guyandotte River, located near Ranger; Rockcastle Creek is a tributary to the Guyandotte River at Pineville; Rushpatch Branch is tributary to the Mud River, west of Madison; Scrabble Creek is tributary to the Gauley River at Gauley Bridge; White Oak Branch is in the Spruce Fork Watershed near Sharples.

sampling. The uppermost sites on the three streams without mining influences sampled for the Longitudinal Study were considered for this analysis (Table 2). A suite of five Hess or Surber samples were collected in riffle habitat at four locations in each stream, including three streams with no known upstream anthropogenic influences: Ash Fork, Neil Branch, and Rushpatch Branch. Using only the most upstream sites on those reference streams for comparability to these headwater locations, the Jaccard Similarity Index was calculated for all ten possible pairs of replicates (Rep 1 vs. Rep 2, Rep 1 vs. Rep 3, . . ., Rep 4 vs. Rep 5) at each site, and the average Jaccard Coefficient (Cao et al. 2003) was calculated (Table 2).

**Table 2: Jaccard Coefficients for streams sampled multiple times within the same season (within or across years); data from West Virginia WABBase and GEI.**

| Stream | Sample Date 1 | Sample Date 2 | Data Source | Jaccard Coefficient |
|---|---|---|---|---|
| Ash Fork | 5/16/2010 | n/a (replicate samples) | GEI (average from 10 pairs of 5 replicates) | 0.41 (range: 0.28-0.53) |
| Bowen Creek | 5/3/2000 | 5/12/2004 | WV WABBase | 0.33 |
| Buffalo Creek | 8/28/2000 | 9/12/2000 | WV WABBase | 0.28 |
| Crane Creek | 1/5/2006 | 2/23/2006 | WV WABBase | 0.46 |
| Crawley Creek | 9/24/2003 | 9/25/2003 | WV WABBase | 0.47 |
| Lacey Branch | 7/5/2002 | 8/8/2002 | WV WABBase | 0.25 |
| Little Horse Creek | 7/24/2002 | 8/12/2002 | WV WABBase | 0.16 |
| Mash Fork | 7/11/2000 | 12/12/2000 | WV WABBase | 0.31 |
| Mash Fork | 12/12/2000 | 4/3/2001 | WV WABBase | 0.33 |
| Neil Branch | 5/16/2010 | n/a (replicate samples) | GEI (average from 10 pairs of 5 replicates) | 0.36 (range: 0.24-0.50) |
| Plum Branch | 7/10/2000 | 12/11/2000 | WV WABBase | 0.19 |
| Plum Branch | 12/11/2000 | 4/5/2001 | WV WABBase | 0.26 |
| Rockcastle Creek | 9/12/2000 | 8/24/2005 | WV WABBase | 0.43 |
| Rushpatch Branch | 5/15/2010 | n/a (replicate samples) | GEI (average from 10 pairs of 5 replicates) | 0.36 (range: 0.31-0.49) |
| Scrabble Creek | 7/15/2003 | 7/17/2003 | WV WABBase | 0.41 |
| White Oak Branch | 7/8/1998 | 7/10/2000 | WV WABBase | 0.29 |
| White Oak Branch | 1/5/2006 | 2/22/2006 | WV WABBase | 0.42 |

Data from these streams that had been sampled multiple times and replicated data from the Longitudinal Study were compared using Students *t*-tests to the data from the sites and streams from this study to determine how the results of the present study compare to observed, regional within-site variability.

#### 2.4.1.2.3 Diversity Analysis

Additional comparisons between sites and streams were conducted following the methods of Clarke et al. (2010), which conducted a nearly identical study to this study in southeastern Australia, examining the diversity within and among headwater streams. The purpose of that study was to investigate the partitioning of $\gamma$ diversity into its $\alpha$ and $\beta$ components.

The "γ" diversity represents the regional diversity, usually represented as the number of taxa in the entire area of interest (or the total number of taxa collected in all samples from the area of interest). The "α" diversity is the number of taxa at a given site within the region, and represents the within-assemblage diversity (Clarke et al. 2010). The "β" diversity is the diversity among assemblages and represents the change in taxa between sites. In practice, β diversity is the number of taxonomically distinct communities within the region.

The rationale behind partitioning the γ diversity as was done in the Clarke et al. (2010) study was to identify the number of unique types of communities within the region of study, defined as the β diversity. For example, if β diversity is high, then there are many different communities, indicating that a broader range of protection may be required, but if β diversity is small, then potentially a smaller area can be protected and still protect the biodiversity within the region (or in this case, within extreme headwater reaches). From a conservation standpoint, protection of an area protects the biodiversity within the region, and allows it to become a source population for other areas, provided it is close enough to the sink populations (Maloney et al. 2011).

The diversity analysis was conducted on three diversity indices, which were calculated for each sample. The first of these, taxa richness, is the number of taxa in the specified sample. The second diversity index used was the Simpson diversity, which is calculated as the sum of the squares of the proportional abundances of each taxon in the sample. Shannon diversity was the third index calculated. The classic Shannon diversity is the sum of the proportional abundance of each taxon times the natural log of the proportional abundance of that taxon. Jost (2007) demonstrated that the direct application of the diversity index values can be misleading[2], so the values were transformed to their "numbers equivalents" for analysis using the equations in Jost (2007; Table 3), as was also done in Clarke et al. (2010). Jost (2007)

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[2] The use of "numbers equivalents" is illustrated with the following example from Jost (2007):

"To see the contrast between a raw index and its numbers equivalent, suppose a continent with 30 million equally common species is hit by a plague that kills half the species. . . . Species richness drops from 30 million to 15 million . . . [and] the post-plague continent has half the diversity it had before the plague. . . . However, the Shannon entropy only drops from 17.2 to 16.5; according to this index, the plague caused a drop of only 4% in the "diversity" of the continent. This does not agree well with our intuition that the loss of half the species and half the individuals is a large drop in diversity. The Gini-Simpson index drops from 0.99999997 to 0.99999993; if this index is equated with 'diversity,' the continent has lost practically no 'diversity' when half its species and individuals disappeared.

"Converting the diversity indices . . . to their numbers equivalents makes them all behave as biologists would intuitively expect of a diversity [index]. . . . Species richness is its own numbers equivalent, so the numbers equivalent of species richness drops by 50% when the plague kills half the continent's species. The Shannon entropy is converted to its numbers equivalent by taking its exponential (MacArthur 1965); this gives a post-plague to pre-plague diversity ratio of exp(16.5)/exp(17.2), which is exactly 50%. . . . The Gini-Simpson index is converted to its numbers equivalent by subtracting from unity and taking the reciprocal (Jost 2006); this gives a post-plague to pre-plague diversity ratio of [1/(1-0.99999993)]/[1/(1-0.99999997)] = 50%."

demonstrated that a multiplicative rule for diversity partitioning is true for these three indices when numbers equivalents are used; therefore, β diversity values were calculated using the multiplicative relationship between α, β, and γ diversity (Jost 2007; Table 3).

**Table 3: Diversity indices, conversions to "numbers equivalents", and relationship between α, β, and γ diversity. N = number of taxa, $p_i$ = proportional abundance of the $i^{th}$ taxon. Adapted from Jost (2007).**

| Diversity Index | Index Formula | Conversion to Numbers Equivalents | Diversity Partitioning |
|---|---|---|---|
| Taxa Richness | $\Sigma N$ | $\Sigma N$ | $\gamma = \alpha \times \beta$ |
| Simpson's Index | $\Sigma p_i^2$ | $1/\Sigma p_i^2$ | $\gamma = \alpha \times \beta$ |
| Shannon Index | $-\Sigma p_i ln p_i$ | $exp(-\Sigma p_i ln p_i)$ | $\gamma = \alpha \times \beta$ |

Following are two examples, at smaller spatial scales than the entire study area, to illustrate the calculation of β diversity. Using taxa richness, if γ diversity for Back Fork was represented by the two sites on the stream, with a total of 57 taxa, and the α diversity for the upstream was 35 taxa and α diversity for the downstream site was 40 taxa, then the β diversity estimate would be:

$$\beta = \frac{57}{(35+40)/2} = 1.52.$$

Using Shannon's Index, the γ diversity for the streams sampled in Kanawha SF was represented by the eight sites distributed among the four streams, with a final Shannon Index of 3.27. The α diversity for each of the eight sites was 2.70, 2.63, 2.08, 2.16, 1.68, 2.28, 2.54, and 2.82. Each Shannon Index would be converted to its "numbers equivalent" using the formulas in Table 3; those values for the individual sites would be averaged, and the β diversity estimate would be:

$$\beta = \frac{26.29}{(14.89+13.94+7.98+5.69+5.37+9.82+12.74+16.74)/8} = 2.41.$$

Note that β diversity estimates in studies such as this one will always be an underestimation of "absolute" β diversity, because γ diversity is also underestimated (Clarke et al. 2010). This is because some uncommon taxa that are present in a stream, protected area, or region for which γ diversity is being calculated will not be sampled during a one-time sampling event. However, α diversity is also underestimated to some degree, as the possibility of collecting all taxa present at a site during one sampling event is unlikely as well, and therefore may offset the underestimation of β diversity.

The β diversity values approximate the number of taxonomically distinct communities within each region (Clarke et al. 2010). Thus, a value near one indicates that there is one taxonomically distinct community among all of the communities represented; higher β diversity values indicate more distinct communities. The taxa richness index is merely a count of the number of taxa and the resulting β diversity estimates are more sensitive to uncommon taxa, while the other two indices incorporate relative abundance data, which is more representative of entire communities. To estimate the impact of the loss of a single stream for future conservation efforts, the β diversity estimates generated can be compared as a ratio to the 24 sites on 12 streams that were used to generate the estimates.

Because the only habitat type present at EF Paw Paw Branch Site 0 was isolated pools, data from Site 0 on that stream were reported for community analysis and included only in the exploratory cluster analysis. Those data were not included in further Jaccard coefficient or β diversity calculations. All statistical analyses (e.g., cluster analysis, *t*-tests, Pearson correlation analysis, etc.) were conducted in NCSS (Hintze 2009), and a 95 percent significance level ($\alpha = 0.050$) was used for all analyses; no Bonferroni correction factor was applied to modify the significance level for multiple comparisons.

### 2.4.2 Water Chemistry

Values for the various ion concentrations, metal concentrations, and other parameters were compared among streams to determine a range of such values that may occur in unmined streams. The ranges for the various water chemistry parameters derived from this study may be used to determine background concentrations of these ions, metals, and other variables that occur in unmined streams within southern West Virginia.

Water chemistry data were evaluated to determine if any relationships exist between these parameters and macroinvertebrate metrics. This analysis primarily used Pearson correlation analyses to search for discernable patterns in the data (Paulson et al. 2001).

# 3.0 Results and Discussion

## 3.1 Benthic Invertebrate Community

### *3.1.1 Community Summary*

#### 3.1.1.1 Community Metrics and Order-Level Analysis

A total of 129 benthic invertebrate taxa was identified among all samples. Insects, including Ephemeroptera (mayflies), Plecoptera (stoneflies), Odonata (dragonflies), Coleoptera (beetles), Megaloptera (dobsonflies), Trichoptera (caddisflies), and Diptera (true flies), comprised the majority of both taxa and individuals (Tables 4 to 6). Other groups included the Hydracarina (water mites), Annelida (segmented worms), Crustacea (crayfishes, scuds, and isopods), Gastropoda (snails), Nematoda (roundworms), and Turbellaria (flatworms). Most of these taxa are commonly collected throughout West Virginia, when compared to the WV WABBase, indicating that they were not restricted to these headwater sites.

The total of 129 taxa exceeds the more than 73 taxa reported from headwaters streams by Stout and Wallace (2003) from southern West Virginia and eastern Kentucky. However, a total of 70 taxa were found if limited to the eight common insect orders that Stout and Wallace (2003) examined, showing high similarity between the two studies. The total in this study was higher because several additional non-insect orders were reported, and members of the Chironomidae (non-biting midges) were identified to genus. As in Stout and Wallace (2003), the true biodiversity in this study likely exceeds that which was reported, simply because calculations are based on the lowest practical taxonomic level, which usually is not the species level, and because of the inability to collect every taxon present in each stream.

EPT taxa were present at all sites in the Big Ugly WMA and Laurel Lake WMA (Tables 4 and 6). In the Kanawha SF, however, mayflies were present only in #2 Store Hollow, stoneflies were in both sites in #2 Store Hollow and the downstream sites in Rattlesnake Run and White Hollow, and caddisflies were in both sites of #2 Store Hollow and White Hollow, and the upstream site on Rattlesnake Run (Table 5). True flies were found in all sites, while dragonflies, beetles, and dobsonflies were found in fewer sites.

Oligochaeta were collected at all sites. Of the crustaceans, isopods were found only in some of the Big Ugly WMA sites, while amphipods and decapods were found in all three protected natural areas. All decapods mature enough to be identified were the crayfish *Cambarus* and were present at most sites. Branchiobdellida, which are commensal on crayfish, were found in Doss Fork Site 2 and Paw Paw Branch Site 1 (Tables 4 and 6). Other non-insect groups were found in fewer sites.

**Table 4: Order-level taxa list and selected population parameters for headwater streams in the Big Ugly Wildlife Management Area, West Virginia, May 2010.**

| Taxon | Back Fork | | Chestnut Oak Creek | | Doss Fork | | King Rough Hollow | | Mudlick Hollow | | U.T. Laurel Creek | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Site** | **1** | **2** | **1** | **2** | **1** | **2** | **1** | **2** | **1** | **2** | **1** | **2** |
| INSECTA | | | | | | | | | | | | |
| EPHEMEROPTERA | 58 | 176 | 1 | 8 | 6 | 15 | 2 | 106 | 35 | 121 | 14 | 111 |
| ODONATA | -- | 4 | -- | -- | -- | -- | -- | 3 | 6 | 7 | 1 | -- |
| PLECOPTERA | 64 | 373 | 1 | 51 | 44 | 502 | 116 | 571 | 104 | 192 | 15 | 107 |
| MEGALOPTERA | -- | 5 | -- | -- | -- | -- | -- | 3 | 1 | -- | -- | -- |
| COLEOPTERA | -- | 6 | 11 | 9 | -- | 2 | 2 | -- | 13 | 7 | 4 | 10 |
| TRICHOPTERA | 20 | 13 | 11 | 7 | 9 | 16 | 29 | 42 | 31 | 26 | 29 | 22 |
| DIPTERA | 233 | 334 | 579 | 211 | 219 | 307 | 459 | 842 | 245 | 551 | 559 | 296 |
| HYDRACARINA | 1 | -- | -- | -- | -- | 4 | -- | 3 | -- | 10 | 8 | -- |
| CRUSTACEA | | | | | | | | | | | | |
| ISOPODA | 2 | -- | 58 | 6 | -- | 8 | 10 | 23 | -- | -- | -- | -- |
| AMPHIPODA | -- | -- | 1 | 1 | -- | -- | -- | -- | -- | -- | -- | -- |
| DECAPODA | 5 | 15 | -- | -- | 1 | 10 | 2 | 6 | -- | 8 | 2 | 11 |
| TURBELLARIA | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- | -- | -- |
| NEMATODA | -- | 3 | 3 | -- | 46 | 4 | 2 | -- | -- | -- | 3 | -- |
| ANNELIDA | | | | | | | | | | | | |
| OLIGOCHAETA | 5 | 5 | 27 | 8 | 2 | 22 | 70 | 30 | 2 | 47 | 4 | 32 |
| BRANCHIOBDELLIDA | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- | -- | -- |
| **Total (#/sample)** | **388** | **934** | **692** | **301** | **327** | **894** | **692** | **1,629** | **437** | **969** | **639** | **589** |
| **Number of Taxa** | **35** | **40** | **28** | **34** | **25** | **35** | **29** | **45** | **44** | **42** | **31** | **34** |
| **Total EPT Taxa** | **13** | **11** | **4** | **7** | **5** | **9** | **9** | **13** | **14** | **15** | **8** | **12** |
| **% EPT Taxa** | **37** | **28** | **14** | **21** | **20** | **26** | **31** | **29** | **32** | **36** | **26** | **35** |
| **% Ephemeroptera** | **15** | **19** | **<1** | **3** | **2** | **2** | **<1** | **7** | **8** | **12** | **2** | **19** |
| **Long-Lived Taxa** | **1** | **8** | **1** | **1** | **0** | **1** | **0** | **6** | **8** | **4** | **0** | **4** |

Most samples had several hundred organisms present, although one sample, the downstream site on Rattlesnake Run had only 60 organisms, and three sites had over 1,000 organisms (Tables 4 to 6). Total number of taxa ranged from 17 taxa at both sites on Rattlesnake Run to 52 taxa at the downstream site on EF Paw Paw Branch. As many as 21 EPT taxa were collected in any site, with EPT taxa proportionately comprising 0 to 41 percent of the total number of taxa (Tables 4 to 6).

In addition to benthic invertebrates, numerous specimens of the northern dusky salamander, *Desmognathus fuscus fuscus,* were inadvertently collected in some samples. This common salamander species and possibly other salamander species were observed at most sites. No fish were observed in the headwater reaches sampled.

**Table 5: Order-level taxa list and selected population parameters for headwater streams in the Kanawha SF, West Virginia, May 2010.**

| Taxon | #2 Store Hollow | | Portercamp Branch | | Rattlesnake Run | | White Hollow | |
|---|---|---|---|---|---|---|---|---|
| **Site** | **1** | **2** | **1** | **2** | **1** | **2** | **1** | **2** |
| INSECTA | | | | | | | | |
| EPHEMEROPTERA | 6 | 3 | -- | -- | -- | -- | -- | -- |
| ODONATA | -- | -- | -- | -- | -- | -- | -- | 17 |
| PLECOPTERA | 11 | 2 | -- | -- | -- | 7 | -- | 300 |
| MEGALOPTERA | -- | -- | -- | -- | -- | -- | -- | 1 |
| COLEOPTERA | 1 | -- | -- | -- | 3 | -- | 1 | 10 |
| TRICHOPTERA | 4 | 4 | -- | -- | 1 | -- | 2 | 45 |
| DIPTERA | 146 | 234 | 169 | 333 | 177 | 39 | 143 | 656 |
| CRUSTACEA | | | | | | | | |
| AMPHIPODA | 1 | 1 | 5 | 1 | -- | -- | 40 | -- |
| DECAPODA | 1 | -- | 1 | -- | -- | -- | -- | 4 |
| NEMATODA | -- | -- | 1 | 5 | 1 | -- | 2 | 3 |
| ANNELIDA | | | | | | | | |
| OLIGOCHAETA | 56 | 79 | 101 | 82 | 120 | 14 | 14 | 20 |
| **Total (#/sample)** | **226** | **323** | **277** | **421** | **302** | **60** | **202** | **1,056** |
| **Number of Taxa** | **31** | **26** | **21** | **19** | **17** | **17** | **23** | **38** |
| **Total EPT Taxa** | **7** | **5** | **0** | **0** | **1** | **4** | **2** | **10** |
| **% EPT Taxa** | **23** | **19** | **0** | **0** | **6** | **24** | **9** | **26** |
| **% Ephemeroptera** | **3** | **1** | **0** | **0** | **0** | **0** | **0** | **0** |
| **Long-Lived Taxa** | **1** | **0** | **1** | **1** | **2** | **0** | **2** | **5** |

### 3.1.1.2 Importance of Ephemeroptera (Mayflies)

EPA (2010) used patterns in the abundance of mayflies to establish the minor influence of confounding factors in its derivation of its proposed conductivity benchmark, and Pond (2010) stated that mayflies should comprise approximately 25 to 50 percent of the total abundance of invertebrates in spring season samples from relatively undisturbed reference streams in the Appalachian Mountains. In both EPA (2010) and Pond (2010), mayflies are specifically expected to be key members of invertebrate communities in undisturbed Appalachian streams.

This suggested pattern of mayfly relative abundance was not evident in the upper reaches of the headwater streams that were sampled in this study. Mayfly relative abundance averaged only 9.9 percent across all sites (Tables 4 to 6). Mayflies were completely absent from three of the study streams: Portercamp Branch, Rattlesnake Run, and White Hollow (Table 5). In fact, Portercamp Branch was devoid of any EPT taxa (Table 5). When mayflies were collected, they comprised less than 10 percent of the community at 10 of the 12 upstream sites and 7 of the 12 downstream sites (Tables 4 to 6). Only in the three EF Paw Paw Branch sites were mayfly abundances in the range of 25 to 50 percent of the total abundance (Table 6).

**Table 6: Order-level taxa list and selected population parameters for headwater streams in the Laurel Lakes Wildlife Management Area, West Virginia, May 2010.**

| Taxon | East Fork Paw Paw Branch | | | Paw Paw Branch | |
|---|---|---|---|---|---|
| **Site** | **0** | **1** | **2** | **1** | **2** |
| INSECTA | | | | | |
| EPHEMEROPTERA | 281 | 208 | 394 | 22 | 146 |
| ODONATA | -- | -- | 1 | -- | -- |
| PLECOPTERA | 143 | 143 | 374 | 47 | 199 |
| MEGALOPTERA | -- | -- | 1 | -- | -- |
| COLEOPTERA | -- | -- | -- | 1 | -- |
| TRICHOPTERA | 9 | 32 | 19 | 4 | 6 |
| DIPTERA | 123 | 238 | 317 | 138 | 264 |
| HYDRACARINA | -- | 8 | 1 | -- | -- |
| CRUSTACEA | | | | | |
| AMPHIPODA | -- | -- | -- | -- | 1 |
| DECAPODA | 12 | 6 | 18 | 1 | 5 |
| TURBELLARIA | -- | 1 | 1 | -- | -- |
| NEMATODA | -- | 1 | -- | 2 | 1 |
| ANNELIDA | | | | | |
| OLIGOCHAETA | 7 | 81 | 22 | 22 | 53 |
| BRANCHIOBDELLIDA | -- | -- | -- | 1 | -- |
| MOLLUSCA | | | | | |
| GASTROPODA | -- | -- | -- | 1 | -- |
| **Total (#/sample)** | **575** | **718** | **1,148** | **239** | **675** |
| **Number of Taxa** | **22** | **38** | **52** | **34** | **39** |
| **Total EPT Taxa** | **9** | **12** | **21** | **6** | **9** |
| **% EPT Taxa** | **41** | **32** | **40** | **18** | **23** |
| **% Ephemeroptera** | **49** | **29** | **34** | **9** | **22** |
| **Long-Lived Taxa** | **1** | **1** | **4** | **0** | **1** |

Pond (2010) reported the mayfly genera *Ameletus, Cinygmula, Epeorus, Ephemerella*, and *Paraleptophlebia*, as the "core 5 genera" most frequently encountered at least-disturbed reference sites in eastern Kentucky streams, averaging 42, 31, 38, 69, and 15 individuals per 1 $m^2$ sample, respectively. *Epeorus* and *Cinygmula* were also identified as indicator genera for reference streams in the Cheat River watershed in northern West Virginia (Merovich and Petty 2010). With respect to the present study, however, *Cinygmula* was not collected in any sample, and there were generally low average collection rates for most of these genera (*Ameletus* – 36 individuals per sample, *Epeorus* – 3 individuals per sample, *Ephemerella* – 3 individuals per sample). Conversely, the collection rate for *Paraleptophlebia* in this study averaged 99 individuals per sample. The ratios of each taxon to each other are very different from those reported by Pond (2010).

The differences in mayfly presence/absence or relative abundance were likely not the result of different sampling techniques, because, as noted in the methods, the more intense sampling and laboratory analysis methods used in this study would be more likely to increase the odds of capture for taxa, not decrease the likelihood of capture. Notably, the largest abundances of mayflies were found in the Laurel Lake WMA streams, which were the closest geographically to Pond's (2010) sites in Kentucky, while the sites devoid of mayflies were in the Kanawha SF, furthest northeast from Kentucky (Figure 1). The absence of *Cinygmula* at all sites and this apparent southwest-northeast gradient of mayfly presence and abundance could be a result of the fact that these extreme headwater streams differed from those sampled in Pond (2010) in Kentucky and suggest that Pond's expected 25 to 50 percent abundance for mayflies, as well as his definition of "core" mayfly genera may not be appropriate outside of his study area or for extreme headwater sites.

#### 3.1.1.3 Long-lived Taxa

Long-lived taxa were collected at most sites. The number of long-lived taxa collected at each site ranged from 0 taxa to 8 taxa. Long-lived taxa collected in this study included the following 13 taxa: *Ameletus* (Ephemeroptera); *Anchytarsus bicolor*, *Helichus*, and *Oulimnius latiusculus* (Coleoptera); *Constempellina*, *Demicryptochironomus*, *Polypedilum*, *Stempellina*, *Tanytarsus*, and *Tipula* (Diptera); *Nigronia* (Megaloptera); *Sweltsa* (Plecoptera), and Cambaridae (Decapoda).

Stout and Wallace (2003) reported the presence of long-lived taxa in headwater streams all the way to the upstream point of contiguous surface flow in southern West Virginia—comparable to our study locations—surmising that they must survive no-flow conditions by burrowing into the hyporheic zone or moving to intermittent pools. In fact, from the results of our study, it appears that life history strategies, such as the ability to burrow into the substrate, are indeed important in assessing the presence of long-lived taxa in these streams. Intermittent pools may also occasionally be used, but less frequently, since they were observed only on one stream, EF Paw Paw Branch.

Specifically, some long-lived taxa have life history strategies that allow them to survive periods of drying, such as burrowing, and other long-lived taxa do not have comparable life history strategies. Long-lived taxa that burrow into the hyporheic zone could be found in ephemeral/far upstream stream reaches because they could survive even if the site dries. In contrast, if non-burrowing, long-lived taxa were to colonize ephemeral/far upstream reaches, they would be expected to be represented only by smaller, younger individuals. The older, previous years' cohort would be missing, since the resource dried before they could complete their life cycle, and individuals could not persist to the current year. Thus, long-lived taxa could potentially be found at any site, whether flow is perennial, intermittent, or ephemeral, and, therefore, long-lived taxa cannot provide a "signal" of flow permanence.

Observations made during our identifications indicates that burrowing, long-lived taxa, such as Cambaridae and *Tipula*, were, in fact, represented by both smaller/younger and larger/older individuals even in the upstream sites. Conversely, non-burrowing, long-lived taxa, such as *Ameletus*, *O. latiusculus*, and *A. bicolor*, were represented in the upstream sites only by smaller/younger individuals, while they were represented in the downstream sites by both smaller/younger and larger/older individuals (or sometimes only larger individuals).

The lack of the previous years' cohort of non-burrowing, long-lived taxa in the upstream sites indicates that the stream dried before they could complete their life cycle. The presence of both smaller/younger and larger/older individuals at downstream sites indicates that the extreme headwater sites are not required as nursery habitat for their life cycle. The adults may attempt to colonize the extreme headwaters anyway, so that these non-burrowing, long-lived taxa are generally represented in these extreme headwater sites by only small individuals, and the previous years' cohort is missing. The presence of such non-burrowing, long-lived taxa in these extreme headwater stream segments, despite the likelihood of the stream drying, is further indication that the colonization by these organisms is opportunistic.

### 3.1.2 Functional Feeding Groups

Analysis of the FFG composition of the invertebrate assemblages of the twelve headwaters streams indicated that 48 percent of the 129 taxa collected were categorized as gatherer/collectors. Predators comprised another 28 percent of the total number of taxa, and shredders comprised 12 percent. The remaining groups each comprised no more than 8 percent of the total number of taxa. True flies were included in almost all of the FFGs, and comprised the majority of taxa included as gatherer/collectors and predators. One or more stonefly, caddisfly, and beetle taxa collected at these sites were also included in most of the FFGs, while all mayfly taxa were categorized as either gatherer/collectors or scrapers. Omnivorous and parasitic taxa were represented by only a single taxon each, the turbellarian *Girardia* sp. and a nematode, respectively.

The FFG composition of the streams sampled was similar between most streams and sites. Almost every site was dominated by taxa classified as gatherer/collectors, both in terms of relative abundance and proportion of taxa (Tables 7 and 8). Gatherer/collectors comprised 29 to 94 percent of the total abundance, and 35 to 67 percent of the total number of taxa collected at each site. Both sites on #2 Store Hollow and Portercamp Branch were almost completely dominated by gatherer/collectors, as were the upstream sites on King Rough Hollow, Rattlesnake Run, and White Hollow, comprising at least 70 percent of the invertebrates collected. The upstream sites on both Chestnut Oak Creek and Doss Fork were dominated numerically by taxa classified as predators, and the downstream sites on both Back Fork and Doss Fork were dominated numerically by shredders (Table 7). In terms of the number of taxa collected at each site, the FFG composition at all sites but one was dominated by taxa categorized as gatherer/collectors. The upstream site on the Unnamed

Tributary to Laurel Creek had a slightly higher proportion of taxa classified as predators than gatherer/collectors (Table 8).

**Table 7: Relative abundance of functional feeding groups for headwater stream sites. southern West Virginia, May 2010. F/C = Filter/Collector, G/C = Gatherer/Collector, Om = Omnivore, Pa = Parasite, Pr = Predator, Sc = Scraper, Sh = Shredder.**

| Stream Site | Functional Feeding Groups | | | | | | |
|---|---|---|---|---|---|---|---|
| | F/C | G/C | Om | Pa | Pr | Sc | Sh |
| **Big Ugly Wildlife Management Area** | | | | | | | |
| Back Fork Site 1 | 0.0 | 44.6 | 0.0 | 0.0 | 34.0 | 0.5 | 20.9 |
| Back Fork Site 2 | 4.6 | 36.7 | 0.0 | 0.3 | 16.2 | 1.5 | 40.7 |
| Chestnut Oak Creek Site 1 | 0 | 35.8 | 0.0 | 0.4 | 61.6 | 0.0 | 2.2 |
| Chestnut Oak Creek Site 2 | 1.0 | 48.8 | 0.0 | 0.0 | 37.9 | 0.0 | 12.3 |
| Doss Fork Site 1 | 0.3 | 32.1 | 0.0 | 14.1 | 37.6 | 0.0 | 15.9 |
| Doss Fork Site 2 | 0.0 | 28.6 | 0.2 | 0.5 | 16.6 | 0.0 | 54.1 |
| King Rough Hollow Site 1 | 0.0 | 70.4 | 0.0 | 0.3 | 8.5 | 0.6 | 20.2 |
| King Rough Hollow Site 2 | 1.1 | 47.8 | 0.0 | 0.0 | 14.7 | 0.0 | 36.3 |
| Mudlick Hollow Site 1 | 3.7 | 43.7 | 0.0 | 0.0 | 22.9 | 1.4 | 28.4 |
| Mudlick Hollow Site 2 | 2.4 | 53.3 | 0.0 | 0.0 | 23.0 | 0.9 | 20.4 |
| UT Laurel Creek Site 1 | 0.3 | 61.7 | 0.0 | 0.5 | 31.5 | 0.2 | 6.0 |
| UT Laurel Creek Site 2 | 1.0 | 58.7 | 0.0 | 0.0 | 18.3 | 2.4 | 19.5 |
| **Kanawha State Forest** | | | | | | | |
| #2 Store Hollow Site 1 | 1.3 | 70.8 | 0.0 | 0.0 | 22.1 | 0.0 | 5.8 |
| #2 Store Hollow Site 2 | 0.6 | 82.0 | 0.0 | 0 | 16.1 | 0.0 | 1.2 |
| Portercamp Branch Site 1 | 0.0 | 93.5 | 0.0 | 0.4 | 5.4 | 0.0 | 0.7 |
| Portercamp Branch Site 2 | 0.0 | 94.1 | 0.0 | 1.2 | 4.0 | 0.0 | 0.7 |
| Rattlesnake Run Site 1 | 0.3 | 89.7 | 0.0 | 0.3 | 8.0 | 0.0 | 1.7 |
| Rattlesnake Run Site 2 | 0.0 | 51.7 | 0.0 | 0.0 | 35.0 | 0.0 | 13.3 |
| White Hollow Site 1 | 1.0 | 87.1 | 0.0 | 1.0 | 9.4 | 0.5 | 1.0 |
| White Hollow Site 2 | 0.7 | 48.7 | 0.0 | 0.3 | 15.5 | 0.3 | 34.6 |
| **Laurel Lakes Wildlife Management Area** | | | | | | | |
| EF Paw Paw Branch Site 1 | 0.1 | 61.4 | 0.1 | 0.1 | 15.9 | 0.0 | 22.3 |
| EF Paw Paw Branch Site 2 | 0.7 | 54.3 | 0.1 | 0.0 | 14.8 | 0.8 | 29.4 |
| Paw Paw Branch Site 1 | 2.1 | 50.2 | 0.0 | 0.8 | 25.9 | 0.4 | 20.5 |
| Paw Paw Branch Site 2 | 0.0 | 50.5 | 0.0 | 0.2 | 19.0 | 0.3 | 30.1 |

At most sites, predator and shredder taxa also made up a substantial proportion of the abundance and total number of taxa (Tables 7 and 8). Gatherer/collectors, predators, and shredders were present at every stream site. Scraper, filter/collector, and parasitic taxa comprised only small proportions of the abundance and the total number of taxa collected, and were absent at 33 percent of the sites or more. Omnivores were even more infrequently collected, and were only found at three of the 24 sites in low relative abundances. These three sites included the downstream site on Doss Fork and both of the EF Paw Paw Branch sites.

**Table 8: Percent of total taxa for functional feeding groups for headwater stream sites, southern West Virginia, May 2010. F/C = Filter/Collector, G/C = Gatherer/Collector, Om = Omnivore, Pa = Parasite, Pr = Predator, Sc = Scraper, Sh = Shredder.**

| Stream Site | Functional Feeding Groups | | | | | | |
|---|---|---|---|---|---|---|---|
| | F/C | G/C | Om | Pa | Pr | Sc | Sh |
| **Big Ugly Wildlife Management Area** | | | | | | | |
| Back Fork Site 1 | 0.0 | 48.6 | 0.0 | 0.0 | 25.7 | 2.9 | 22.9 |
| Back Fork Site 2 | 2.5 | 40.0 | 0.0 | 2.5 | 32.5 | 7.5 | 15.0 |
| Chestnut Oak Creek Site 1 | 0.0 | 57.1 | 0.0 | 3.6 | 25.0 | 0.0 | 14.3 |
| Chestnut Oak Creek Site 2 | 2.9 | 58.8 | 0.0 | 0.0 | 26.5 | 0.0 | 11.8 |
| Doss Fork Site 1 | 4.0 | 52.0 | 0.0 | 4.0 | 24.0 | 0.0 | 16.0 |
| Doss Fork Site 2 | 0.0 | 45.7 | 2.9 | 2.9 | 34.3 | 0.0 | 14.3 |
| King Rough Hollow Site 1 | 0.0 | 51.7 | 0.0 | 3.5 | 17.2 | 6.9 | 20.7 |
| King Rough Hollow Site 2 | 2.2 | 48.9 | 0.0 | 0.0 | 31.1 | 0.0 | 17.8 |
| Mudlick Hollow Site 1 | 4.6 | 38.6 | 0.0 | 0.0 | 29.6 | 6.8 | 20.5 |
| Mudlick Hollow Site 2 | 2.4 | 50.0 | 0.0 | 0.0 | 33.3 | 4.8 | 9.5 |
| UT Laurel Creek Site 1 | 3.2 | 35.5 | 0.0 | 3.2 | 38.7 | 3.2 | 16.1 |
| UT Laurel Creek Site 2 | 2.9 | 44.1 | 0.0 | 0.0 | 32.4 | 5.9 | 14.7 |
| **Kanawha State Forest** | | | | | | | |
| #2 Store Hollow Site 1 | 6.5 | 58.1 | 0.0 | 0.0 | 22.6 | 0.0 | 12.9 |
| #2 Store Hollow Site 2 | 3.9 | 65.4 | 0.0 | 0.0 | 23.1 | 0.0 | 7.7 |
| Portercamp Branch Site 1 | 0.0 | 66.7 | 0.0 | 4.8 | 19.1 | 0.0 | 9.5 |
| Portercamp Branch Site 2 | 0.0 | 63.2 | 0.0 | 5.3 | 21.1 | 0.0 | 10.5 |
| Rattlesnake Run Site 1 | 5.9 | 52.9 | 0.0 | 5.9 | 23.5 | 0.0 | 11.8 |
| Rattlesnake Run Site 2 | 0.0 | 47.1 | 0.0 | 0.0 | 29.4 | 0.0 | 23.5 |
| White Hollow Site 1 | 4.4 | 65.2 | 0.0 | 4.4 | 13.1 | 4.4 | 8.7 |
| White Hollow Site 2 | 5.3 | 47.4 | 0.0 | 2.6 | 26.3 | 2.6 | 15.8 |
| **Laurel Lakes Wildlife Management Area** | | | | | | | |
| EF Paw Paw Branch Site 1 | 2.6 | 50.0 | 2.6 | 2.6 | 29.0 | 0.0 | 13.2 |
| EF Paw Paw Branch Site 2 | 5.8 | 40.4 | 1.9 | 0.0 | 34.6 | 5.8 | 11.5 |
| Paw Paw Branch Site 1 | 5.9 | 58.8 | 0.0 | 2.9 | 20.6 | 2.9 | 8.8 |
| Paw Paw Branch Site 2 | 0.0 | 59.0 | 0.0 | 2.6 | 20.5 | 2.6 | 15.4 |

When comparing the upstream sites with the downstream sites, the three most common FFGs were present at both sites on all streams, but the less common scraper, filter/collector, parasite, and omnivore taxa were found at either the upstream or downstream site in some streams. The only pattern consistently noted in these distributions was that parasitic taxa tended to be present more frequently at the upstream sites. Parasites were represented by Nematoda, which were present in low abundances in 25 percent of the upstream sites and 58 percent of the downstream sites (Tables 7 and 8).

Comparison of the mean abundances of most FFGs showed little variation between the upstream and downstream sites; however, shredders tended to comprise a higher percentage of the total abundance at the downstream sites. In four streams (Portercamp Branch, Rattlesnake Run, White Hollow, and Paw Paw Branch), the proportion of shredder taxa was higher in the downstream site; however, in the other streams, the proportion of shredder taxa was higher in the upstream site, a result also observed by Stout and Wallace (2003). Mean relative abundance of shredders at the downstream site was 24 percent, while mean relative abundance of this group at the upstream site was 12 percent.

Conversely, gatherer/collectors comprised a slightly higher mean percentage of the total abundance at upstream sites, with an 8 percent difference between the mean upstream and downstream percentages. Differences in the other FFGs were minimal, with less than 5 percent differences in mean relative abundances observed between upstream and downstream sites. The percent to which each FFG contributed to the total number of taxa collected were even more similar between upstream and downstream sites, with the mean percent of the total taxa for each of the FFGs differing by less than 5 percent between the upstream and downstream sites.

While mayflies were absent from both sites on Portercamp Branch, Rattlesnake Run, and White Hollow (Table 5), and no EPT taxa were observed at all in Portercamp Branch, the balance of the FFGs did not shift substantially. One example of this can be seen when comparing the relative abundance of FFGs in Paw Paw Branch 2, a site with abundant mayflies, and White Hollow 2, a site with no mayflies (Figure 5). All mayflies collected were categorized as either gatherer/collectors or scrapers. The percentage of gatherer/collectors tended to be higher in Portercamp Branch, Rattlesnake Run, and White Hollow (48.7 – 94.5 percent) than at the other sites (28.6 – 82.0 percent), indicating that other invertebrate groups were providing that function in these streams. Scrapers were absent or found only at low abundances at the stream sites lacking mayflies, but were also absent from one or both sites on streams such as Chestnut Oak Creek, Doss Fork, King Rough Hollow, #2 Store Hollow, and EF Paw Paw Branch, all of which had mayflies present.

In contrast to the mayflies, most stoneflies were categorized as predators. Relative abundance of predators decreased in those sites without stoneflies (4.0 – 9.4 percent) compared to sites with stoneflies present (8.4 – 61.6 percent). However, the range observed in the percent of predator taxa was not substantially different between sites without stoneflies (13.1 – 21.5 percent) and with stoneflies (17.2 – 38.7 percent), showing that additional taxa, particularly in the true flies, were fulfilling that function, although in a smaller relative abundance.

Overall, it appears that the function of the invertebrate communities at the various sites in this study do not differ substantially from each other, despite loss or gain of various invertebrate taxonomic groups. If a particular taxonomic group is absent at any given site, it appears that redundancy in FFGs among the other invertebrate groups generally fills that gap and allows the streams to continue to function normally.

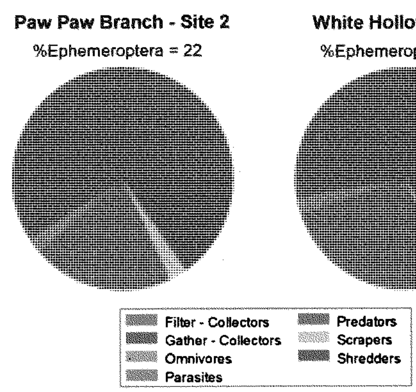


**Figure 5: Relative abundance of benthic invertebrate functional feeding groups in Paw Paw Branch Site 2 and White Hollow Site 2, May 2010.**

### *3.1.3 Within-Stream Variability*

#### 3.1.3.1 Jaccard Similarity Index – within-stream

The Jaccard similarity coefficient was calculated for the pair of sites (Sites 1 and 2) on each stream to estimate the similarity in the benthic invertebrate communities at sites on the same stream (Table 9). Jaccard coefficients ranged from 0.17 to 0.51, indicating that usually less than half of the taxa were shared between the upstream and downstream sites on any stream. When taxa lists for all of the upstream sites were combined and compared to the combined taxa lists for all of the downstream sites, the Jaccard coefficient was 0.66, indicating that, overall, 66 percent of the taxa were shared between the terminus of flowing water and the streams at one foot wetted width.

**Table 9: Jaccard coefficients for similarity of benthic invertebrate communities between sites on the same unmined streams in southern West Virginia, May 2010.**

| Area | Stream | Jaccard Coefficient |
|---|---|---|
| Big Ugly Wildlife Management Area | Back Fork | 0.32 |
| | Chestnut Oak Creek | 0.51 |
| | Doss Fork | 0.40 |
| | King Rough Hollow | 0.35 |
| | Mudlick Hollow | 0.41 |
| | Unnamed Tributary to Laurel Creek | 0.30 |
| Kanawha State Forest | #2 Store Hollow | 0.43 |
| | Portercamp Branch | 0.48 |
| | Rattlesnake Run | 0.36 |
| | White Hollow | 0.17 |
| Laurel Lake Wildlife Management Area | EF Paw Paw Branch | 0.41 |
| | Paw Paw Branch | 0.49 |

As stated above in Section 2.4.1.2.2 Jaccard Similarity Index, there is no developed threshold for similarity as measured using Jaccard coefficients, so replicate data or regional data should be used to estimate normally observed within-site variability for comparison. The data from regional streams (Table 2) provide evidence that it is not unusual for streams in this area of West Virginia to have similarity less than 50 percent between sample dates on the same stream, even when less than a month separated the two sample dates (e.g., Buffalo Creek, Crane Creek, Crawley Creek, Lacey Branch, Little Horse Creek, Scrabble Creek, and White Oak Branch) or within the same site when samples were collected in similar habitats on the same day (Ash Fork, Neil Branch, Rushpatch Branch).

Jaccard coefficients from within-stream comparisons (Table 9) were not significantly different from the within-site comparisons from the regional streams (Table 2) sampled multiple times (two-tailed two-sample $t$-test, $p = 0.169$). Assuming habitat availability was similar across years, interannual within-site variation in benthic invertebrate community composition and the variation within riffle habitat in the five replicate Hess/Surber samples suggest that habitat differences between sites do not fully account for the extensive variation in the composition of invertebrate communities observed in this study. In other words, the high variability among sites observed in this study is not greater than the high variability that is observed within any single site over time in the same region.

When comparing upstream/downstream trends, on average, the downstream sites had more benthic invertebrate taxa than upstream sites. Eight of the twelve downstream sites had a greater number of taxa collected compared to their respective upstream sites; although three streams had more taxa at the upstream site; and one stream, Rattlesnake Run, had no difference in the number of taxa collected between the two sites on the stream.

#### 3.1.3.2 Common and Uncommon Taxa

There were a few taxa common to several sites, and many more that were infrequently collected, being found at one or only a few sites (Figure 5). Only ten taxa were found at more than 10 of the 24 sites sampled, including the segmented worm family Enchytraeidae, the stoneflies *Amphinemura* and *Leuctra*, the caddisfly *Lepidostoma*, and the following true flies: Ceratopogoninae, *Chaetocladius*, Ephydridae, *Ormosia*, *Parachaetocladius*, and *Parametriocnemus*. Based on data in the WABBase, these taxa are also commonly collected at sites throughout West Virginia. In these extreme headwater streams, one taxon (Ceratopogoninae) was found at all downstream sites, two taxa were found at 11 of the 12 downstream sites, three taxa were found at nine of the downstream sites, continuing to the 33 taxa that were found at only one downstream site (Figure 5).

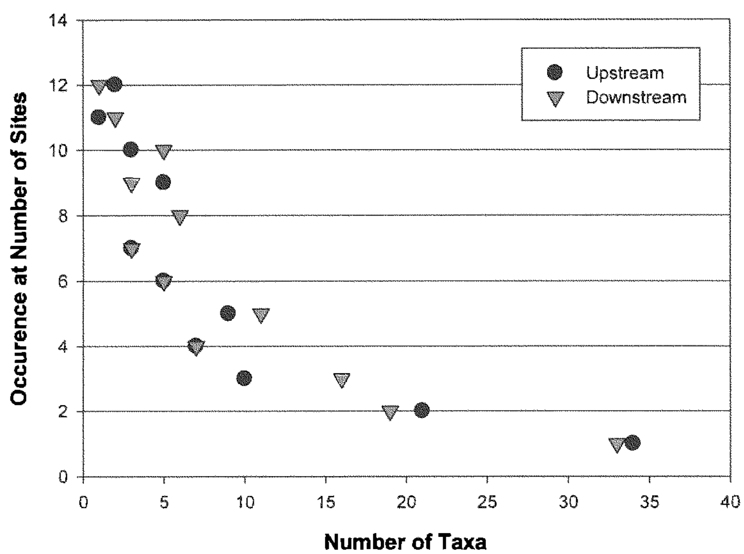


**Figure 6: The number of taxa collected common to the listed number of sites in streams of southern West Virginia, May 2010, which is consistent with MacArthur's (1972) "broken-stick model" of taxon importance.**

Such patterns of taxa occurrence are expected. In fact, these results (Figure 5) are very similar to the "broken stick" model, or random niche boundary hypothesis, for taxon abundances (MacArthur 1972; Whittaker 1975), which postulates that ecological communities should be comprised of a few common taxa and many more less common taxa. Those taxa that are commonly found are usually considered to be the most "important" in shaping the community. As such, those common taxa may indicate a basic community at headwater sites, while the other taxa may be more transient, using the streams more opportunistically. Resh et al. (2005)

found that 17 to 33 percent of taxa were collected only one time over a time span of 19 to 20 years, even when the same site was sampled one or two times per year over that time period.

This general ecological principle predicts that a large proportion of any taxa list will be comprised of less common taxa. A similar distribution of common and less common species has been observed across a wide variety of taxa, including stream algal communities (Patrick 1975), diatoms (Patrick et al. 1954), phytoplankton (Hötzel and Croome 1994), protozoa and bacteria (Hessler and Sanders 1967; Hairston et al. 1968; Patrick 1975), terrestrial plant communities (Watson 1928; Mueller-Dombois and Ellenberg 1974; Whittaker 1978), terrestrial invertebrates (Preston 1948; Halkka et al. 1967, 1971; Hutchinson 1964), aquatic invertebrates (Morgan and Egglishaw 1965; Chutter and Noble 1966; Patrick 1975; Elliott 1977), reptiles (Collins 1959; Pianka 1969, 1975); stream and lake fish (Lowe-McConnell 1975; Patrick 1975; Ono et al. 1983; Hocutt and Wiley 1986; McAllister et al. 1986; Stanford and Ward 1986; Sheldon 1987), birds (Preston 1948; Cody 1966, 1975; Robbins et al. 1966; Diamond 1969, 1975; Recher 1969; Terborgh and Faaborg 1980), and mammals (Hall and Kelson 1958; Brown 1975).

Approximately one-third of the taxa (44 taxa) were found only at the upstream sites or only at the downstream sites. Of these taxa, none was collected from more than five sites in either upstream or downstream sites (Tables 10 and 11). For example, the midge *Cricotopus* was collected only in two upstream sites and never in a downstream site (Table 10), while the caddisfly *Polycentropus* was collected only in three downstream sites and never in an upstream site (Table 11).

While few taxa were present in all or even most of these streams, many of these taxa are widespread throughout the eastern United States, and most have broad habitat requirements (Tables 10 and 11). This suggests that any evaluation of "common" and "uncommon" taxa must take into account this widespread geographic presence and broad habitat needs. In other words, their presence/absence patterns do not appear to be because they are deterministically restricted to any particular stream owing to habitat, resource needs, or chemical sensitivity, but more likely that they colonized these streams opportunistically.

**Table 10: Taxa found only in upstream, Site 1 sites in streams without mining influence in southern West Virginia, May 2010. Regional distribution and habitat requirements of each taxon is provided, when known. Unid. = unidentified due to immature or poor condition specimens.**

| Taxon | Number of Sites | Distribution | Habitat Requirements |
|---|---|---|---|
| **Ephemeroptera** | | | |
| *Maccaffertium* | 1 | Widespread | Broad range of habitats; usually fast flowing streams with cobble bottoms; many species in eastern North America |
| **Coleoptera** | | | |
| Unid. Dytiscidae | 1 | Widespread | Broad range of habitats; with many species in eastern North America |
| *Helichus* | 1 | Widespread | Flowing waters, larvae may be subaquatic/terrestrial |
| Unid. Hydrophilidae | 1 | Widespread | Broad range of habitats; with many species in eastern North America |
| **Trichoptera** | | | |
| *Ironoquia* | 1 | Widespread in eastern U.S. | Temporary pools; marshes, among rooted aquatic macrophytes; slow, small streams |
| **Diptera** | | | |
| *Allognosta* | 1 | Widespread in eastern U.S. | Erosional and depositional margin habitats in streams; littoral habitats of ponds |
| *Cricotopus* | 2 | Widespread | Broad range of habitats including vascular hydrophytes, algal mats, detritus in pools, erosional and depositional habitats in streams |
| *Diamesa* | 1 | Widespread, primarily northern in mountains and uplands | Erosional habitats in streams |
| *Forcipomyia* | 2 | Widespread | Warm springs, erosional margin areas of streams; pools; aquatic plants and leaf litter |
| *Gymnometriocnemus* | 1 | Widespread, primarily northern | Semiaquatic, margins of pools |
| *Haematopota* | 1 | Widespread | Littoral (sediments) habitats in pools |
| *Metriocnemus* | 1 | Widespread | Erosional and depositional in streams; detritus |
| Unid. Orthocladiine | 5 | Widespread | Broad range of habitats, with many species in eastern North America |
| **Crustacea** | | | |
| *Cambarus* | 3 | Genus is widespread; many species are restricted | Broad range of habitats, with >10 species known from WV |
| **Oligochaeta** | | | |
| *Aulodrilus* | 2 | Widespread | Depositional habitats in streams |
| Unid. Sparganophilidae | 1 | Widespread | Depositional habitats in streams |
| **Gastropoda** | | | |
| *Amnicola* | 1 | Most spp. Widespread | Broad range of habitats, with many species in eastern North America |

References: Bednarik and McCafferty (1979); Burian and Gibbs (1991); Larson et al. (2000); Merritt et al. (2008); Brigham et al. (1982); Wiggins (1996); Hobbs, Jr. (1976); Milligan (1997); Dindal (1990); Jokinen (1992)

**Table 11: Taxa found only in downstream, Site 2 sites in streams without mining influence in southern West Virginia, May 2010. Regional distribution and habitat requirements of each taxon is provided, when known. Unid. = unidentified due to immature or poor condition specimens.**

| Taxon | Number of Sites | Distribution | Habitat Requirements |
|---|---|---|---|
| **Ephemeroptera** | | | |
| *Epeorus dispar* | 1 | Widespread | Poorly known for this species, but most *Epeorus* prefer riffle habitat in small streams, loose gravel and cobble substrate |
| *Eurylophella* | 2 | Widespread | Broad range of habitats (depositional and erosional habitats in small streams, substrate from fines to cobbles and organic materials), across the many possible species in eastern North America |
| Unid. Heptageniidae | 2 | Widespread | Broad range of habitats, with many species in eastern North America |
| *Stenonema femoratum* | 1 | Widespread | Small streams to margins of large lakes |
| **Plecoptera** | | | |
| Unid. Nemouridae | 1 | Widespread | Broad range of habitats (springs, streams, often in coarse organic materials); 13 species known from WV |
| *Remenus bilobatus* | 1 | Widespread, but uncommon | Unknown; most other perlodids generally live in permanent streams of all sizes |
| *Sweltsa* | 1 | Widespread | Broad range of habitats, from small streams to large stony rivers |
| *Yugus* | 2 | 1 sp. restricted in NC & VA; other 3 spp. widespread in Appalachia | Unknown; other perlodids generally live in permanent streams of all sizes |
| **Coleoptera** | | | |
| *Heterosternuta* | 3 | 6 of 8 species in WV vicinity are widespread in eastern North America; other 2 are found restricted to TN | Springs, stream margins in both temporary and permanent streams |
| **Trichoptera** | | | |
| *Agapetus minutus* | 1 | Widespread | Other *Agapetus* larvae inhabit broad range of streams from springbrooks to large rivers; one sp. in IL in small temporary streams |
| *Polycentropus* | 3 | Widespread | Wide variety of mountain streams; lake shores |
| *Rhyacophila glaberrima* | 1 | Widespread | Other species of *Rhyacophila* inhabit broad range of waterbodies, from springs and temporary streams to large rivers; generally faster currents |
| Unid. Rhyacophilidae | 1 | Widespread | Broad range of habitats (cf. *R. glaberrima*, above), with 14 species known from WV |
| **Diptera** | | | |
| *Atrichopogon* | 1 | Widespread | Margins and debris jams in erosional areas of streams; plant material in littoral zones of ponds |
| *Cladotanytarsus* | 1 | Widespread | Depositional areas of streams; vascular hydrophytes in ponds |
| *Demicryptochironomus* | 1 | Widespread | Depositional areas of streams |
| *Diplocladius* | 1 | Widespread | Erosional areas of streams |

| Taxon | Number of Sites | Distribution | Habitat Requirements |
|---|---|---|---|
| *Heterotrissocladius* | 1 | Widespread | Erosional in streams; littoral and profundal in lakes |
| *Neoplasta* | 1 | Four widespread species live in vicinity of WV | Erosional and depositional habitats in streams; also water surface moss mats |
| *Neostempellina* | 1 | Widespread in eastern U.S. | Springs and erosional habitats in streams |
| *Nilotanypus* | 1 | Widespread | Erosional areas in streams |
| *Odontomesa* | 1 | Widespread | Erosional areas in streams |
| *Orthocladius* | 1 | Widespread | Erosional habitats in both streams and ponds |
| *Paraboreochlus* | 3 | Widespread in Appalachia | Erosional areas in streams |
| *Rheosmittia* | 2 | Widespread | Sandy substrates in streams |
| Unid. Syrphidae | 2 | Widespread | Broad range of habitats, with many species in eastern North America |
| **Oligochaeta** | | | |
| *Limnodrilus* | 1 | Widespread | Depositional habitats in streams |

References: Brigham et al. (1982); Kondratieff and Voshell (1983); Burian and Gibbs (1991); Long and Kondratieff (1996); McCafferty and Meyer (2008); McCafferty (2009); ); Merritt et al. (2008); Bednarik and McCafferty (1979); Stewart and Stark (2006); Larson et al. (2000); Lake (1984); Tarter (1990); Wiggins (1996); Harris et al. (1991); MacDonald and Turner (1993); Milligan (1997)

### *3.1.4 Variability Among Streams/Sites*

#### 3.1.4.1 Cluster Analysis

When the invertebrate communities were analyzed with cluster analysis, sites on the same stream frequently did not cluster together, nor was there much evidence for the sites clustering within their particular protected natural area (Figure 6). For example, the two sites on Mudlick Fork and the two sites on Back Fork clustered relatively near each other within one cluster, and the two sites on Chestnut Fork clustered together within one cluster, but the other sites in the Big Ugly WMA each were split between two clusters. Site 0 and Site 1 on EF Paw Paw Branch clustered near each other, as did both sites on Paw Paw Branch, but, despite both streams being located near each other in the Laurel Lake WMA, the streams themselves were in two different clusters (Figure 6).

The downstream site on EF Paw Paw Branch was isolated in a cluster all by itself (Figure 6). This site was the only site with bedrock comprising part of the substrate. Four taxa (the mayfly *Epeorus dispar*, the stonefly *Sweltsa*, the caddisfly *Agapetus minutus*, and the biting midge *Atrichopogon*) were unique to this site. The difference in substrate at this site may have resulted in the low similarity in taxonomic composition in comparison to the other sites.

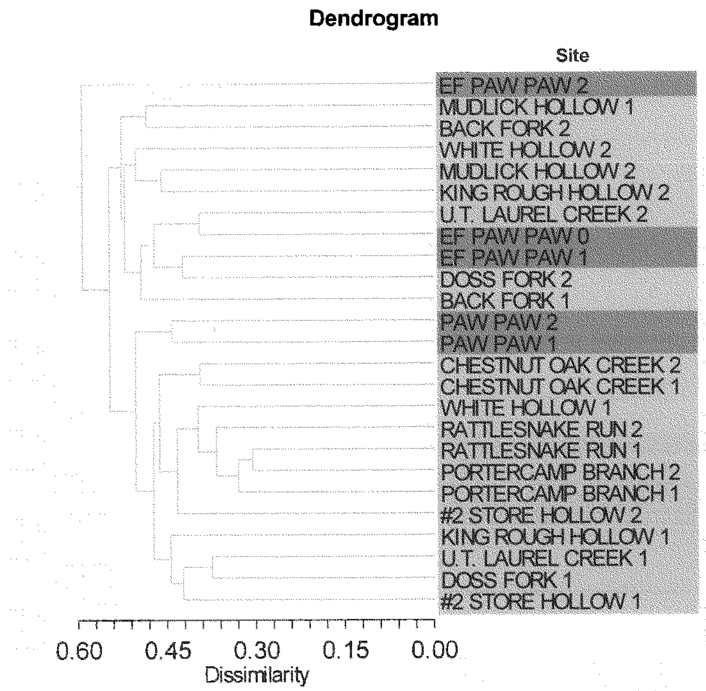


**Figure 7: Cluster analysis (presence/absence) of the benthic invertebrate communities in headwater streams in southern West Virginia, May 2010. Sites in the Big Ugly WMA are highlighted orange; sites in the Kanawha SF are highlighted blue; sites in the Laurel Lake WMA are highlighted green.**

With regard to the clustering between streams within a natural area, streams in the Kanawha SF clustered more consistently together than streams from the other two natural areas. The sites on Portercamp Branch and Rattlesnake Run were grouped closely together, indicating relatively high similarity in the taxonomic composition in these two streams. Substrate composition at both Portercamp sites and the upstream Rattlesnake Run site was dominated by smaller sized substrate classes, which may be a common factor influencing the invertebrate composition at these sites. The sites on #2 Store Hollow were less closely grouped, but were still within the same large cluster as Portercamp Branch and Rattlesnake Run. However, the sites on White Hollow were widely separated in two different clusters.

This lack of biogeographic affinity among sites was also observed using only the downstream sites, in which two obvious clusters were obtained. One cluster contained a mix of #2 Store Hollow, Portercamp Branch, and Rattlesnake Run from the Kanawha SF and Chestnut Oak Creek from the Big Ugly WMA. The other cluster contained a mix of all of the rest of the sites. Paw Paw Branch was near the edge of the larger cluster, but EF Paw Paw Branch clustered in the middle of the other sites. It appears that limiting the analysis to only the downstream sites did not substantially change the results of the cluster analysis.

These data, plus the widespread geographic presence of most of the taxa collected, also indicate that the regional biodiversity extends to more area than just these streams or the southern West Virginia area. Palmer et al. (2010) cited studies suggesting that individual stream biodiversity and water quality suffer when more than 5 to 10 percent of a watershed is affected by anthropogenic influences. Regional biodiversity in southern West Virginia is broader than a single watershed, so, even though individual streams may be lost, regional biodiversity is likely not affected by that level of anthropogenic activity in individual streams or watersheds.

#### 3.1.4.2 Jaccard Similarity Index – between-stream

The Jaccard Similarity Index was calculated for all pairs of sites within site groups (upstream and downstream sites), regardless of protected natural area. Jaccard coefficients were also calculated for all pairs of streams, regardless of the protected natural area in which they were located, by combining the taxa lists from the upstream and downstream sites on each stream. Stout and Wallace (2003) did not provide their lists of taxa by stream or estimates of similarity between streams, so no direct comparisons to that study can be made.

For upstream sites, the Jaccard coefficients for pairwise comparisons ranged from 0.13 to 0.51, averaging 0.29 (Appendix Table B-1). For downstream sites, the Jaccard Coefficients for pairwise comparisons ranged from 0.08 to 0.53, averaging 0.30 (Appendix Table B-2). When both sites on each stream were combined, the Jaccard Coefficients for pairwise stream comparisons ranged from 0.18 to 0.53, averaging 0.37 (Appendix Table B-3). All of these data indicate that similarity between any pair of sites or streams was generally less than 50percent, meaning that each stream generally shared less than half its taxonomic community with any other stream. However, as with the within-stream similarity analysis above, these between-stream data were also compared to regional data to identify if this amount of similarity is consistent with normal, regional, within-site diversity.

The Jaccard coefficients from comparisons among these study streams (Appendix B) are not significantly different from the Jaccard coefficients from the regional streams (Table 2) sampled multiple times for upstream sites, downstream sites, or at the stream level (two-tailed two-sample *t*-tests, $p = 0.069$, $p = 0.172$, and $p = 0.240$, respectively). As discussed above, assuming habitat availability and water chemistry was reasonably similar across years, interannual within-site variation and the variation within riffle habitat in the Hess/Surber samples suggest that habitat differences between sites do not fully account for the extensive variation in the invertebrate community composition observed in this study. Instead, these data suggest that within-site and between-site similarity in benthic invertebrate communities is normally less than 50 percent throughout the study area.

Again, cluster analysis showed that the stream invertebrate communities did not show regional biogeographic affinities, and the uncommon taxa that drive much of the low levels of similarity are neither limited to southern West Virginia nor limited to headwaters streams. The streams had reasonably similar habitat and water chemistry profiles (discussed below), yet the invertebrate communities were very dissimilar. This high within-site variability demonstrates that the sites are not individually unique and also suggests that the communities differ as a result of opportunistic colonization.

#### 3.1.4.3 β diversity – between-stream

Estimates of β diversity were calculated, based on the three diversity indices, for all sites and for all streams within the study area, and ranged widely. Taxa richness, which is more sensitive to uncommon taxa, produced β diversity values higher than the Simpson or Shannon diversity indexes, which also include relative abundance information. Estimates of β diversity when using the 24 individual sites ranged from 1.8 to 4.0 (Table 12), suggesting that there were mathematically as few as two and up to four "distinct" taxonomic communities that should be present among the 24 sites. Using the 12 streams, estimates of β diversity ranged from 1.7 to 2.7 (Table 12), suggesting two to three "distinct" taxonomic communities should be present. However, as discussed previously, these β diversity values may be underestimates of the "absolute" β diversity, because γ diversity and α diversity were both underestimated as a result of the inability of any typical field sampling method to sample every taxon present (Clarke et al. 2010).

**Table 12: Estimates of β diversity based on taxa richness, Simpson Diversity Index, and Shannon Diversity Index for streams and sites across the entire study area in southern West Virginia, May 2010.**

| | β Estimate, Based on Diversity Indices | | |
|---|---|---|---|
| Stream | Taxa Richness | Simpson Diversity Index | Shannon Diversity Index |
| By Site (n=24) | 4.0 | 1.8 | 2.3 |
| By Stream (n=12) | 2.7 | 1.7 | 1.9 |

This analysis indicated that there are two to four distinct communities out of the 24 sites and 12 streams, even though the taxonomic composition of these headwaters communities was variable. A reasonable portion of the headwater streams with suitable habitat should be specifically conserved in order to support this level of regional diversity. Since the regional fauna appears to colonize any of these streams opportunistically, loss of some individual streams should not jeopardize the overall diversity of the extreme headwater reaches of these southern West Virginia streams, if the remaining streams harbor appropriate habitat for the regional fauna and the landscape is not too badly fragmented. CM/VF operations are estimated to currently affect about 2 to 4 percent of headwater streams in West Virginia (EPA 2005), and this level of impact may not have any measureable effect on regional biodiversity.

## 3.2 Habitat Evaluation

Most sites were characterized by similar habitats, including riffles, runs, pools, pocket pools, woody debris, and herbaceous vegetation (Table 13). Of the 24 sites sampled, 15 had all of these habitats present. The upstream site on Rattlesnake Run had the fewest habitat types present to sample, while the upstream site on EF Paw Paw Branch also had undercut bank habitat available for sampling (Table 13).

**Table 13: Habitats and substrate sizes present at study sites on headwater streams in southern West Virginia, May 2010.**

| Stream/Site | Riffles | Runs | Pools | Pocket Pools | LWD | Vegetation | Undercut Banks | Substrate |
|---|---|---|---|---|---|---|---|---|
| **Big Ugly Wildlife Management Area** | | | | | | | | |
| Back Fork Site 1 | X | X | X | X | X | X | | Silt to boulders |
| Back Fork Site 2 | X | X | X | X | X | X | | Silt to boulders |
| Chestnut Oak Creek Site 1 | X | X | X | | X | X | | Silt to boulders (mostly silt) |
| Chestnut Oak Creek Site 2 | X | X | X | | X | X | | Silt to boulders |
| Doss Fork Site 1 | X | X | X | | X | X | | Silt to cobble (mostly silt) |
| Doss Fork Site 2 | X | X | X | X | X | X | | Silt to boulders (mostly silt and sand) |
| King Rough Hollow Site 1 | X | X | X | X | X | X | | Silt/clay to boulders |
| King Rough Hollow Site 2 | X | X | X | X | X | X | | Silt to boulders |
| Mudlick Hollow Site 1 | X | | | X | X | X | | Silt to boulders |
| Mudlick Hollow Site 2 | X | X | X | X | X | X | | Silt to boulders |
| U.T. Laurel Creek Site 1 | X | X | X | X | X | X | | Silt to boulders |
| U.T. Laurel Creek Site 2 | X | X | X | X | X | X | | Silt to boulders |
| **Kanawha State Forest** | | | | | | | | |
| #2 Store Hollow Site 1 | X | X | X | X | X | X | | Silt to boulders |
| #2 Store Hollow Site 2 | X | X | X | X | X | X | | Silt to boulders |
| Portercamp Branch Site 1 | X | X | X | X | X | X | | Silt to cobble |
| Portercamp Branch Site 2 | X | X | X | X | X | X | | Silt to cobble (mostly silt and gravel) |
| Rattlesnake Run Site 1 | X | | | X | | X | | Silt to boulders (mostly silt and leaves) |
| Rattlesnake Run Site 2 | X | X | X | X | X | X | | Silt to boulders (mostly gravel, cobble, and boulders) |
| White Hollow Site 1 | X | X | X | | X | X | | Silt to gravel (mostly silt) |
| White Hollow Site 2 | X | X | X | X | X | X | | Silt to boulders |
| **Laurel Lakes Wildlife Management Area** | | | | | | | | |
| EF Paw Paw Branch Site 1 | X | X | X | | X | X | X | Silt to boulders |
| EF Paw Paw Branch Site 2 | X | X | X | | X | X | | Silt to boulders and bedrock |
| Paw Paw Branch Site 1 | X | X | X | X | X | X | | Silt to boulders |
| Paw Paw Branch Site 2 | X | X | X | X | X | X | | Silt to boulders |

Additionally, most sites also had a range of substrate sizes from silt to boulders, although the upstream sites on Doss Fork, Portercamp Branch, and White Hollow did not have all of the larger size classes present (Table 13). As noted earlier, the downstream site on EF Paw Paw Branch had some bedrock substrate, which was not noted at any of the other sites. At some sites, certain substrate size classes predominated. The upstream sites on Chestnut Oak Creek, Doss Fork, Rattlesnake Run, and White Hollow had several substrate size classes observed, but silt substrate was most common. Abundant leaves within the stream channel were also noted at the upstream site on Rattlesnake Run. The downstream site on Doss Fork had a mixture of silt and sand that predominated, while silt and gravel were most common at the downstream site on Portercamp Branch. The downstream Rattlesnake Run site had substrate classes from silt to boulders present, but the substrate was mostly comprised of gravel, cobble, and boulders (Table 13).

Notably, the smallest Jaccard coefficient (0.17) for pairwise comparison of sites within a stream occurred for White Hollow (Table 9). The differences between the two communities may be, in part, attributable to differences in substrate composition at the two sites (Table 12). The substrate composition at the upstream site ranged from silt to gravel, but was dominated by silt substrate; the downstream site had substrate composition across the size class range from silt to boulders. Even though it appears that these sites are colonized opportunistically, differences in the availability of the larger substrate classes may have restricted some taxa from persisting after initial colonization at both sites on White Hollow (Patrick and Swan 2011). For example, Odonata, Plecoptera, Megaloptera, and most Trichoptera, which often prefer larger substrates (Ward 1975), were found only at the downstream site on White Hollow.

Sites that were dominated by silt substrate did not appear to relate to presence or absence of any particular order-level taxa (Tables 4 to 6) or distribution of FFGs (Tables 7 and 8). The ubiquitous nature of most habitat types suggests that generally similar habitats are available throughout the streams in the study area, even if subtly different as suggested by Meyer et al. (2007), but the broad habitat requirements of most of the taxa (Tables 10 and 11) indicate that they could still use these habitats as they became available.

Since habitat availability appeared to be similar among sites, with the same general habitat features (riffles, runs, pools, etc.) occurring at most sites, and specific substrate characteristics, especially dominance of silt at a site, could not be linked to presence or absence of particular orders of invertebrates or functional feeding groups, it appears that the presence/absence of particular habitats is not a strong factor in driving the early invertebrate colonization patterns (Patrick and Swan 2011). Instead, consistent availability of habitats across the streams sampled may be important, given the broad habitat requirements of the taxa collected in the region.

Observations made during sampling did indicate that rainfall had occurred in the vicinity prior to sampling and occasionally during sampling. Stream gage data from nearby rivers corroborate these observations (Figure 7). Local precipitation may have contributed to moving the upstream terminus of flowing water further upstream.

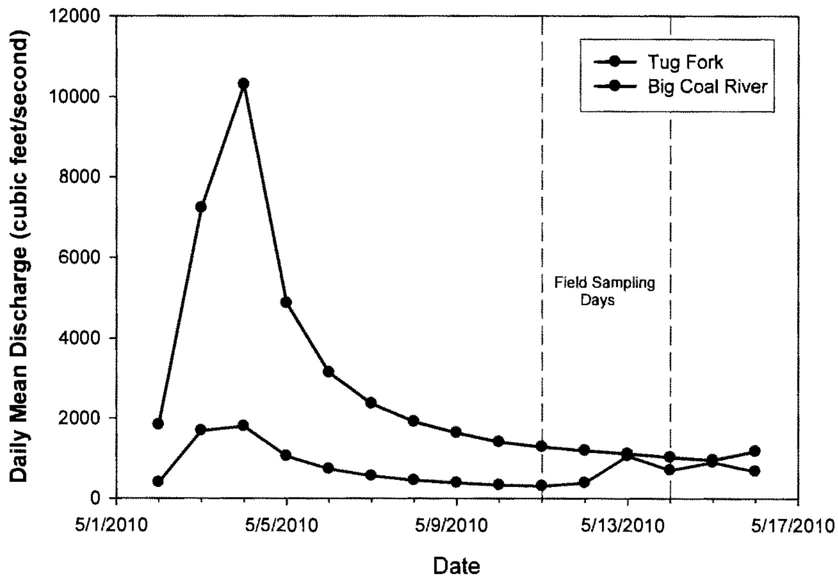


**Figure 8: Hydrograph for the Big Coal River at Ashford, West Virginia, (Gage #03198500) and the Tug Fork at Kermit, West Virginia (Gage #03214500), May 1 – 16, 2010. Sampling was conducted May 11 – 14.**

## 3.3 Water Chemistry

### *3.3.1 Analysis*

Since the water chemistry samples were collected at the extreme headwaters of streams in protected natural areas, free of any overt or obvious anthropogenic influence, water chemistry at these sites should be representative of background conditions. With the exception of the metals Al, Fe, and Mn, all water chemistry parameters ranged over less than an order of magnitude in their measured results (Table 14). Carbonate ions ($CO_3^{-2}$) were below detection limits in all samples, Se concentrations were below detection limits in 23 of the 29 samples (79 percent), and nitrate-N concentrations were below detection limits in 2 of the 29 samples (7 percent) (Table 14). Values for pH were below 6.0 in 21 of the 29 samples (74 percent), suggesting slightly acidic conditions are naturally present in many of these streams.

**Table 14: Water chemistry parameters in headwater streams of southern West Virginia, May 2010. S.U. = standard units.**

| Analyte | Detection Limit (DL) | Minimum Value | Median Value | Maximum Value | Units |
|---|---|---|---|---|---|
| **Cations** | | | | | |
| $Ca^{2+}$ | 0.05 | 1.07 | 2.09 | 10.7 | mg/L |
| $K^{+}$ | 0.05 | 0.91 | 1.29 | 2.18 | mg/L |
| $Na^{+}$ | 0.05 | 0.48 | 0.70 | 1.76 | mg/L |
| $Mg^{2+}$ | 0.05 | 1.13 | 1.89 | 4.72 | mg/L |
| **Anions** | | | | | |
| $CO_3^{-2}$ | n/a | <DL | <DL | <DL | mg/L |
| $HCO_3^{-}$ | n/a | 2.6 | 3.8 | 13.1 | mg/L |
| $SO_4^{-}$ | 1.00 | 4.58 | 9.24 | 34.8 | mg/L |
| $Cl^{-}$ | 0.10 | 0.40 | 0.59 | 1.32 | mg/L |
| **Conductivity** | n/a | 27.4 | 41.5 | 124 | µS/cm |
| **pH** | n/a | 5.15 | 5.7 | 6.69 | S.U. |
| **Hardness** | 1.00 | 7.35 | 13.4 | 46.2 | mg/L $CaCO_3$ |
| **Nitrate-N** | 0.02 | <DL | 0.10 | 0.28 | mg/L |
| **Metals** | | | | | |
| Al | 0.013 | 0.04 | 0.17 | 3.59 | mg/L |
| Fe | 0.01 | 0.02 | 0.12 | 3.09 | mg/L |
| Mn | 0.001 | 0.002 | 0.014 | 0.636 | mg/L |
| Se | 0.001 | <DL | <DL | 0.002 | mg/L |

Most of the field duplicate water chemistry samples showed good agreement, with only 4 of 64 site/analyte combinations differing by more than 25 percent between duplicate samples. The analytes that differed between field duplicate samples included Fe, Mn, and nitrate-N. Since the only water chemistry parameter that had statistically significant correlations with benthic invertebrate community parameters was K concentration, it is unlikely that the field variability identified in the duplicate samples for Fe, Mn, and nitrate-N would be associated with changes in the invertebrate community.

### *3.3.2 Correlations of WQ with Benthic Invertebrate Community*

Correlation analysis of site-specific water chemistry parameters and the benthic invertebrate metrics (number of taxa, number of EPT taxa, percent EPT taxa, Ephemeroptera abundance) show that water chemistry parameters were not strong predictors of the benthic invertebrate metrics (Table 15). The strongest relationship was a negative correlation ($r = -0.427$, $p = 0.038$) between K concentration and the number of EPT taxa, which indicated that less than 20 percent ($r^2 = 0.182$) of the variability of any benthic invertebrate metric was explained by any one water chemistry parameter. Only two correlations between water chemistry and invertebrate community parameters were statistically significant ($p < 0.050$), both involving K concentrations (Table 15).

**Table 15: Strongest Pearson correlation coefficients in comparisons of water chemistry parameters and benthic macroinvertebrate metrics.**

| Benthic Invertebrate Metric | Water Chemistry Parameter | Pearson Correlation Coefficient (r) | p-value |
|---|---|---|---|
| EPT taxa | K | -0.427 | 0.038 |
| %EPT taxa | K | -0.424 | 0.031 |
| | Nitrate-N | -0.387 | 0.061 |
| | pH | 0.306 | 0.147 |
| | Na | -0.304 | 0.149 |
| Ephemeroptera Abundance | pH | 0.404 | 0.051 |
| | K | -0.309 | 0.142 |
| | $SO_4^{-2}$ | 0.284 | 0.178 |
| | Ca | 0.281 | 0.183 |
| Number of Taxa | Nitrate-N | -0.294 | 0.164 |

Weak relationships between pH and both Ephemeropteran abundance (r = 0.404, p = 0.051) and percent EPT taxa (r = 0.306, p = 0.147) were also observed. These correlations were weaker relationships than the correlations with K concentrations. In the sites where mayflies were absent, pH values were less than 6.0, except in the downstream site on Rattlesnake Run, where pH was 6.7 (Appendix C, Tables 4 to 6). Most of these same sites that lacked mayflies had four or fewer EPT taxa present as well, including the two sites on Portercamp Branch, which had no EPT taxa present. However, most other sites had pH values less than 6.0 and had higher abundances of mayflies and greater numbers of EPT taxa present. For example, the upstream site on EF Paw Paw Branch had pH of 5.7 to 5.8, yet mayflies comprised 29 percent of the total abundance. Therefore, given the lack of consistency to the relationship between mayfly presence/absence and pH values above/below 6.0, it appears that other factors were involved in the absence of mayflies from these streams.

There were no significant correlations between conductivity and any benthic invertebrate metric, with the strongest correlation (conductivity and Ephemeroptera abundance) explaining only 6.3 percent of the variation in the invertebrate data (r = 0.251, $r^2 = 0.063$, p = 0.240). This does not seem unusual, given the small range of low conductivity values (27.4 to 124 µS/cm) measured in these streams (Table 14).

Merovich and Petty (2010) demonstrated that invertebrate communities in northern West Virginia did not distinguish among streams with discrete water chemistry profiles, except between reference conditions and the most impaired conditions. Instead, behavior patterns, such as opportunistic colonization (Patrick and Swan 2011, this study) or drift (Merovich and Petty 2010) may prevent correspondence of the benthic invertebrate community with local water chemistry. Given the limited variability in water chemistry in these headwater streams, it is not surprising that water chemistry, with the possible exceptions of K or pH, did not appear to strongly associate with invertebrate distribution patterns in this study.

## 3.4 Synthesis Examining Opportunistic Colonization

The results of this study indicate that the benthic invertebrate communities in the sampled reaches of these West Virginia headwater streams likely resulted from opportunistic colonization of the streams. Opportunistic colonization indicates that the regional pool of available species should be able to colonize just about any stream and persist at the site if conditions are favorable (Patrick and Swan 2011). Favorable conditions include the following: the species has the ability to disperse to the site, water is present, abiotic parameters such as habitat and water chemistry are within tolerable ranges, and the species can coexist with other organisms at the site.

There was low similarity among streams in this study and across southern West Virginia and the invertebrate community within each stream was comprised of organisms that appear to be a subset of fauna found throughout the region, with the subset within each stream including a basic stream invertebrate community comprised of a few common taxa and many more less common taxa. Furthermore, the fact that the streams did not consistently cluster according to protected natural area indicates that the biodiversity is spatially more regional. Water chemistry parameters generally varied by less than one order of magnitude across all sites, suggesting that, with the possible exceptions of K and pH, water quality does not appear to be a strong factor shaping the benthic invertebrate communities in these streams.

Opportunistic use of these headwaters is not unusual, in that there are certain traits that appear to predispose some species to use of potentially ephemeral or intermittent resources, and certain aspects of the stream, itself, may make colonization more or less possible (Williams 1977, 2001; Williams and Hynes 1976; Dieterich and Anderson 2000; Ruegg and Robinson 2004; Arid West Water Quality Research Project [AWWQRP] 2006). For example, insects with good powers of aerial dispersal were the primary species that colonized the temporarily wet reaches of ephemeral streams in the arid southwestern United States, but flow duration can greatly affect colonization and allow poor dispersers to inhabit normally dry streams during longer periods of extended precipitation, simply because water is present for a longer period of time. Most of the taxa that were less commonly collected (Tables 10 and 11) are either good aerial dispersers with short life cycles or have life history traits that allow burrowing into the substrate to persist through dry conditions in temporary habitats. Southern West Virginia's regional physiography, with steep, narrow valleys, may make these methods of colonization even more likely to support opportunistic colonization in this region.

Opportunistic colonization patterns indicate that the streams are not individually unique, but instead that regional diversity is supported by availability of similar habitats throughout the region. This suggests that a reasonable portion of the headwaters streams should remain conserved, with appropriate levels of interconnectivity between streams, to maintain the regional biodiversity (Maloney et al. 2011). Additional studies based on the best science possible would be needed to inform policy-makers about the specific portion that should be conserved. Based on the above results using the Jaccard coefficients and partitioning of the β diversity, it appears that there were between as few as 2 and as many as 4 distinct taxonomic communities present among the 24 sites on 12 streams in the study area.

This type of analysis does not identify the specific taxonomic components of those mathematically-derived two to four distinct communities. In fact, since it appears that opportunistic colonization by the regional fauna is the most likely explanation for diversity patterns among these reaches, the specific community in any stream would be expected to differ with each sampling event (Figure 9). Instead, the ratio of distinct communities to the number of sites or streams used to derive the β diversity estimates could be used in future conservation efforts to estimate the effects of the loss of streams on the regional biodiversity.

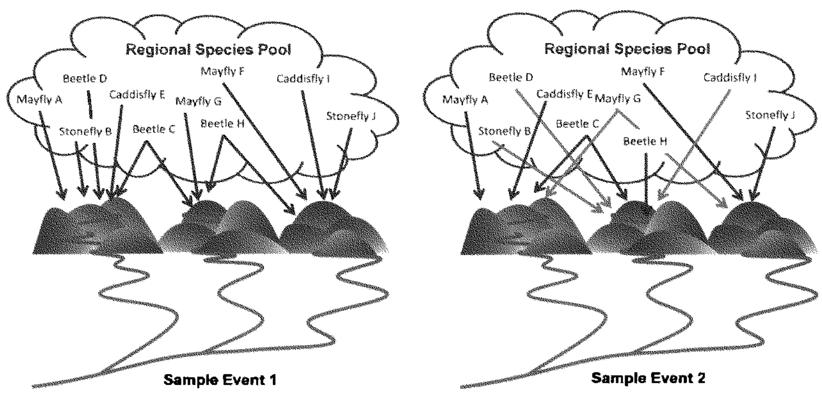


**Figure 9: Conceptual diagram illustrating opportunistic colonization patterns and the possibility of different species colonizing different streams in separate sampling events. Red lines indicate changes in colonization location by a given taxon.**

Palmer et al. (2010) state that individual stream biodiversity and water quality suffer when more than 5 to 10 percent of a watershed's area is affected by anthropogenic activities. However, since each stream is not individually unique and the regional biodiversity is broader than any one watershed, conservation of a reasonable portion of the streams would be sufficient to maintain the regional taxa pool, even if individual streams or watersheds are affected by anthropogenic activities.

# 4.0 Conclusions

One primary objection to CM/VF operations in southern West Virginia, which are estimated to affect 2 to 4 percent (by stream mile) of headwater streams in the region, is the direct burial of ephemeral and intermittent headwater streams, with the assumption that each stream is a unique/irreplaceable resource. For this to be true, three expectations must be met: 1) each stream would have a specific habitat and chemistry profile; 2) those abiotic profiles would structure the niches that support each stream's specific invertebrate community; and 3) each stream's specific invertebrate community would be composed of taxa that deterministically require those specific niches. The present study was designed to describe the headwaters community of relatively undisturbed streams in southern West Virginia and determine the variability among those streams.

This natural history study demonstrated that a diverse benthic invertebrate fauna consisting of at least 129 taxa was present in the extreme headwaters of the streams of southern West Virginia and that low levels of benthic invertebrate community similarity exist between sites on the same stream and between streams. No distinct headwaters community could be identified, since the taxonomic list at any one site generally reflects a subset of the list of taxa found across the state of West Virginia and throughout the central Appalachians.

These extreme headwater sites were generally characterized by less than 50 percent similarity between sites on the same stream and between streams. However, this between-site/between-stream variability is not any greater than the normal within-site variability, spatially and temporally, found throughout the region. Data from other sites that were sampled multiple times within the same season (both within the same year and between years), and replicate data from another GEI study in the region indicate that within-site similarity is also usually less than 50 percent. Continued sampling of these same stream sites would help to confirm or refute these estimates of within-site variability. Furthermore, statistical cluster analysis demonstrated that geographic location of the streams was not a strong factor related to the low similarity of the benthic invertebrate communities between sites and streams. Therefore, the low amount of similarity between sites and streams in these extreme headwater communities appears to be normal for streams in southern West Virginia.

Habitat availability was similar among sites, with the same ubiquitous general habitat features (riffles, runs, pools, etc.) occurring, although substrate composition varied somewhat. Nevertheless, substrate characteristics, especially dominance of silt at a site, could not be linked to presence or absence of particular orders of invertebrates or functional feeding groups. Likewise, water chemistry parameters were generally similar among sites and at best had very weak relationships with invertebrate population parameters.

Mayflies were not as dominant in these streams as postulated by other studies conducted in the region, frequently comprising less than 10 percent of the community at most sites and being completely absent from one-fourth of the streams studied, despite a greater amount of effort in both field and laboratory methods. Only one stream had values for Ephemeroptera abundance that were within the range of 25 to 50 percent suggested to be normal for headwater streams in the central Appalachian Mountains. The sites with highest proportions of mayflies were those closest to Kentucky, where the range of 25 to 50 percent was originally proposed, so there may be a geographic gradient in the expected community composition of mayflies.

Low within-site similarity is caused by changes in taxa both spatially and temporally. Region-wide, the benthic macroinvertebrate communities are comprised of a few common taxa and many less common taxa, similar to the broken stick model of species importance (random niche boundary hypothesis) of biogeography theory. The common taxa and most of the less common taxa present at these sites had a widespread geographic presence in eastern North America and broad habitat requirements. The less common taxa were the primary contributors to low similarity among sites. The widespread geographic ranges of most of these taxa indicates that they are not limited to these streams, and their broad habitat requirements suggest that they are not limited even to these extreme headwater habitats. Instead, together with the common taxa, these uncommon taxa are most likely part of a large regional pool of available taxa that colonize streams opportunistically, including ephemeral habitats such as these extreme headwater sites.

Data from body measurements of several long-lived taxa further support the conclusion of opportunistic colonization. Long-lived taxa without burrowing life history traits (e.g., *Ameletus* mayflies or riffle beetles) were present in these sites, but apparently cannot finish their life cycles before the stream dries up. These taxa are generally represented in these extreme headwater sites by only small individuals, and the previous years' cohort is missing. Further downstream, all sizes/ages of individuals exist. The presence of such non-burrowing, long-lived taxa in these extreme headwater stream segments, despite the likelihood of the stream being ephemeral, is further indication that the colonization by these organisms is opportunistic.

Opportunistic colonization suggests that a regional pool of invertebrate taxa should be able to colonize nearly any site if water is present, and persistence at the site is subject to each taxon's life history and specific habitat requirements, as well as the site's abiotic and biotic constraints, such as water chemistry and space limitations. In the case of these headwater sites, the combination of habitat, substrate, and water chemistry characteristics do not appear to be limiting colonization of any particular taxon in any particular stream, especially since the taxa from the regional pool are generally widespread taxa that have broad habitat requirements. Each stream may have a different community at each sample event because of opportunistic colonization. However, redundancy of functional feeding groups among the invertebrate taxa also allows the streams to function normally despite normal variability in the taxonomic composition of the invertebrate community.

In summary, the taxa encountered and levels of dissimilarity between the invertebrate communities in headwaters streams with otherwise similar habitat and water quality are consistent with the hypothesis that headwaters communities are established opportunistically from a larger regional pool of organisms. Between-site diversity analysis indicated that there are, on average, two to four invertebrate communities out of the 24 sites and 12 streams, even though the taxonomic composition of these communities would likely change with each sampling event due to opportunistic colonization patterns. A portion of the headwater streams with suitable habitat availability and sufficient connectivity between streams should be conserved in order to support this level of regional diversity, although defining the specific number of streams to be conserved within a region would require a substantially deeper analysis. Nevertheless, since the regional fauna appears to colonize these streams opportunistically and the streams are not very different from each other from either a habitat or water quality perspective, loss of a limited number of individual streams should not jeopardize the overall regional diversity that potentially colonizes these extreme headwater reaches of these southern West Virginia streams.

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# Appendix A

**Benthic Macroinvertebrate Data**

Appendix A
A-1

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: #2 STORE HOLLOW 1
Sampled: 5/13/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **6** |
| Leptophlebiidae | 6 |
| PLECOPTERA | **11** |
| Isoperla sp. | 1 |
| Leuctra sp. | 8 |
| Ostrocerca sp. | 2 |
| COLEOPTERA | **1** |
| Cymbiodyta sp. | 1 |
| TRICHOPTERA | **4** |
| Diplectrona modesta | 1 |
| Lepidostoma sp. | 2 |
| Rhyacophila sp. | 1 |
| DIPTERA | **146** |
| Bryophaenocladius sp. | 4 |
| Ceratopogoninae | 40 |
| Chaetocladius sp. | 4 |
| Corynoneura sp. | 16 |
| Dolichopodidae | 4 |
| Ephydridae | 8 |
| Hexatoma sp. | 1 |
| Larsia sp. | 2 |
| Limnophyes sp. | 4 |
| Micropsectra sp. | 2 |
| Ormosia sp. | 8 |
| Unid. Orthocladiinae genus 1 | 2 |
| Parachaetocladius sp. | 24 |
| Parametriocnemus sp. | 9 |
| Psilometriocnemus sp. | 4 |
| Rheocricotopus sp. | 11 |
| Simulium sp. | 2 |
| Tipula sp. | 1 |
| CRUSTACEA | |
| AMPHIPODA | **1** |
| Crangonyctidae | 1 |

Appendix A
A-2

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: #2 STORE HOLLOW 1
Sampled: 5/13/2010

| TAXA | SWEEP |
|---|---|
| DECAPODA | **1** |
| Cambaridae | 1 |
| ANNELIDA | |
| OLIGOCHAETA | **56** |
| Aulodrilus sp. | 1 |
| Enchytraeidae | 50 |
| Pristina sp. | 5 |
| TOTAL (#/sample) | 226 |
| NUMBER OF TAXA | 31 |
| SHANNON-WEAVER (H') | 3.90 |
| TOTAL EPT TAXA | 7 |
| EPT INDEX (% of Total Taxa) | 23 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 3 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: #2 STORE HOLLOW 2
Sampled: 5/13/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **3** |
| Ameletus sp. | 1 |
| Leptophlebiidae | 2 |
| PLECOPTERA | **2** |
| Nemouridae | 2 |
| TRICHOPTERA | **4** |
| Diplectrona modesta | 2 |
| Rhyacophila glaberrima | 2 |
| DIPTERA | **234** |
| Bryophaenocladius sp. | 35 |
| Ceratopogoninae | 28 |
| Chaetocladius sp. | 15 |
| Dolichopodidae | 11 |
| Ephydridae | 4 |
| Georthocladius sp. | 6 |
| Hexatoma sp. | 4 |
| Larsia sp. | 6 |
| Limnophyes sp. | 20 |
| Limonia sp. | 2 |
| Ormosia sp. | 4 |
| Paraboreochlus sp. | 6 |
| Parachaetocladius sp. | 10 |
| Parametriocnemus sp. | 35 |
| Paraphaenocladius sp. | 15 |
| Pilaria sp. | 1 |
| Psilometriocnemus sp. | 6 |
| Rheocricotopus sp. | 20 |
| Stilocladius sp. | 6 |
| CRUSTACEA | |
| AMPHIPODA | **1** |
| Crangonyctidae | 1 |

Appendix A
A-4

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: #2 STORE HOLLOW 2
Sampled: 5/13/2010

| TAXA | SWEEP |
|---|---|
| ANNELIDA | |
| OLIGOCHAETA | **79** |
| Enchytraeidae | 79 |
| TOTAL (#/sample) | 323 |
| NUMBER OF TAXA | 26 |
| SHANNON-WEAVER (H') | 3.80 |
| TOTAL EPT TAXA | 5 |
| EPT INDEX (% of Total Taxa) | 19 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 1 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: BACK FORK 1
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **58** |
| Ameletus sp. | 15 |
| Ephemerella dorothea/excrucians | 1 |
| Maccaffertium sp. | 2 |
| Paraleptophlebia sp. | 40 |
| PLECOPTERA | **64** |
| Amphinemura sp. | 1 |
| Isoperla sp. | 4 |
| Leuctra sp. | 49 |
| Ostrocerca sp. | 5 |
| Peltoperla sp. | 1 |
| Utaperla gaspesiana | 4 |
| TRICHOPTERA | **20** |
| Lepidostoma sp. | 18 |
| Pycnopsyche sp. | 1 |
| Rhyacophila sp. | 1 |
| DIPTERA | **233** |
| Ceratopogoninae | 48 |
| Corynoneura sp. | 35 |
| Cricotopus sp. | 4 |
| Dicranota sp. | 22 |
| Dolichopodidae | 2 |
| Krenosmittia sp. | 9 |
| Molophilus sp. | 2 |
| Ormosia sp. | 3 |
| Unid. Orthocladiinae | 4 |
| Unid. Orthocladiinae genus 1 | 4 |
| Parachaetocladius sp. | 18 |
| Parametriocnemus sp. | 23 |
| Pilaria sp. | 1 |
| Stempellinella sp. | 9 |
| Zavrelimyia sp. | 49 |
| HYDRACARINA | **1** |
| Wandesia sp. | 1 |
| CRUSTACEA | |
| ISOPODA | **2** |
| Caecidotea sp. | 2 |

Appendix A
A-6

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: BACK FORK 1
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| DECAPODA | **5** |
| Cambaridae | 5 |
| ANNELIDA | |
| OLIGOCHAETA | **5** |
| Aulodrilus sp. | 1 |
| Eiseniella tetraedra | 1 |
| Enchytraeidae | 1 |
| Nais communis/variabilis | 2 |
| TOTAL (#/sample) | 388 |
| NUMBER OF TAXA | 35 |
| SHANNON-WEAVER (H') | 4.07 |
| TOTAL EPT TAXA | 13 |
| EPT INDEX (% of Total Taxa) | 37 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 15 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: BACK FORK 2
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **176** |
| Ameletus sp. | 29 |
| Baetis brunneicolor | 5 |
| Paraleptophlebia sp. | 138 |
| Stenonema femoratum | 4 |
| ODONATA | **4** |
| Cordulegaster sp. | 4 |
| PLECOPTERA | **373** |
| Amphinemura sp. | 13 |
| Isoperla sp. | 3 |
| Leuctra sp. | 344 |
| Peltoperlidae | 3 |
| Utaperla gaspesiana | 10 |
| MEGALOPTERA | **5** |
| Nigronia fasciatus | 5 |
| COLEOPTERA | **6** |
| Heterosternuta sp. | 1 |
| Oulimnius sp. | 5 |
| TRICHOPTERA | **13** |
| Lepidostoma sp. | 8 |
| Molanna blenda | 5 |
| DIPTERA | **334** |
| Ceratopogoninae | 43 |
| Chrysops sp. | 1 |
| Conchapelopia/Thienemannimyia gr. | 50 |
| Constempellina sp. | 8 |
| Demicryptochironomus sp. | 8 |
| Dicranota sp. | 8 |
| Ephydridae | 3 |
| Eukiefferiella sp. | 14 |
| Krenosmittia sp. | 8 |
| Limnophila sp. | 7 |
| Micropsectra sp. | 8 |
| Nilotanypus sp. | 8 |
| Ormosia sp. | 5 |
| Parachaetocladius sp. | 29 |

Appendix A
A-8

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: BACK FORK 2
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| DIPTERA (cont.) | |
| Parametriocnemus sp. | 8 |
| Pilaria sp. | 3 |
| Polypedilum sp. | 8 |
| Rheosmittia sp. | 8 |
| Stempellinella sp. | 52 |
| Tanytarsus sp. | 43 |
| Tipula sp. | 4 |
| Zavrelimyia sp. | 8 |
| CRUSTACEA | |
| DECAPODA | **15** |
| Cambaridae | 15 |
| NEMATODA | **3** |
| Unid. Nematoda | 3 |
| ANNELIDA | |
| OLIGOCHAETA | **5** |
| Nais communis/variabilis | 5 |
| TOTAL (#/sample) | 934 |
| NUMBER OF TAXA | 40 |
| SHANNON-WEAVER (H') | 3.66 |
| TOTAL EPT TAXA | 11 |
| EPT INDEX (% of Total Taxa) | 28 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 19 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: CHESTNUT OAK CREEK 1
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **1** |
| Siphlonuridae | 1 |
| PLECOPTERA | **1** |
| Leuctra sp. | 1 |
| COLEOPTERA | **11** |
| Hydrocolus sp. | 11 |
| TRICHOPTERA | **11** |
| Lepidostoma sp. | 10 |
| Pycnopsyche sp. | 1 |
| DIPTERA | **579** |
| Bryophaenocladius sp. | 8 |
| Ceratopogoninae | 404 |
| Chaetocladius sp. | 69 |
| Constempellina sp. | 4 |
| Corynoneura sp. | 4 |
| Dolichopodidae | 1 |
| Ephydridae | 10 |
| Haematopota sp. | 1 |
| Limnophila sp. | 3 |
| Limnophyes sp. | 8 |
| Micropsectra sp. | 4 |
| Molophilus sp. | 3 |
| Ormosia sp. | 18 |
| Unid. Orthocladiinae | 20 |
| Parachaetocladius sp. | 8 |
| Parametriocnemus sp. | 8 |
| Pilaria sp. | 2 |
| Zavrelimyia sp. | 4 |
| CRUSTACEA | |
| ISOPODA | **58** |
| Caecidotea sp. | 58 |
| AMPHIPODA | **1** |
| Crangonyctidae | 1 |

Appendix A
A-10

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: CHESTNUT OAK CREEK 1
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| NEMATODA | **3** |
| Unid. Nematoda | 3 |
| ANNELIDA | |
| OLIGOCHAETA | **27** |
| Eiseniella tetraedra | 4 |
| Enchytraeidae | 23 |
| TOTAL (#/sample) | 692 |
| NUMBER OF TAXA | 28 |
| SHANNON-WEAVER (H') | 2.52 |
| TOTAL EPT TAXA | 4 |
| EPT INDEX (% of Total Taxa) | 14 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | <1 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: CHESTNUT OAK CREEK 2
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **8** |
| Leptophlebiidae | 2 |
| Siphlonuridae | 6 |
| PLECOPTERA | **51** |
| Amphinemura sp. | 2 |
| Isoperla sp. | 21 |
| Leuctra sp. | 28 |
| COLEOPTERA | **9** |
| Cymbiodyta sp. | 4 |
| Hydrocolus sp. | 5 |
| TRICHOPTERA | **7** |
| Lepidostoma sp. | 5 |
| Pycnopsyche sp. | 2 |
| DIPTERA | **211** |
| Bryophaenocladius sp. | 3 |
| Ceratopogoninae | 59 |
| Chaetocladius sp. | 22 |
| Clinocera sp. | 2 |
| Corynoneura sp. | 3 |
| Diplocladius sp. | 8 |
| Dixa sp. | 3 |
| Dolichopodidae | 2 |
| Ephydridae | 6 |
| Limnophila sp. | 1 |
| Limnophyes sp. | 3 |
| Micropsectra sp. | 3 |
| Odontomesa sp. | 3 |
| Ormosia sp. | 32 |
| Parachaetocladius sp. | 14 |
| Parametriocnemus sp. | 18 |
| Pilaria sp. | 2 |
| Pseudosmittia sp. | 3 |
| Syrphidae | 3 |
| Tanytarsus sp. | 3 |
| Zavrelimyia sp. | 18 |

Appendix A
A-12

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: CHESTNUT OAK CREEK 2
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| CRUSTACEA | |
| ISOPODA | **6** |
| Caecidotea sp. | 6 |
| AMPHIPODA | **1** |
| Crangonyx sp. | 1 |
| ANNELIDA | |
| OLIGOCHAETA | **8** |
| Enchytraeidae | 7 |
| Limnodrilus sp. | 1 |
| TOTAL (#/sample) | 301 |
| NUMBER OF TAXA | 34 |
| SHANNON-WEAVER (H') | 4.21 |
| TOTAL EPT TAXA | 7 |
| EPT INDEX (% of Total Taxa) | 21 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 3 |

Appendix A
A-13

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: DOSS FORK 1
Sampled: 5/14/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **6** |
| Ameletus sp. | 6 |
| PLECOPTERA | **44** |
| Leuctra sp. | 33 |
| Ostrocerca sp. | 11 |
| TRICHOPTERA | **9** |
| Lepidostoma sp. | 7 |
| Rhyacophila carolina | 2 |
| DIPTERA | **219** |
| Ceratopogoninae | 96 |
| Chaetocladius sp. | 3 |
| Corynoneura sp. | 10 |
| Dicranota sp. | 1 |
| Georthocladius sp. | 3 |
| Hexatoma sp. | 4 |
| Larsia sp. | 10 |
| Micropsectra sp. | 3 |
| Molophilus sp. | 1 |
| Ormosia sp. | 2 |
| Parachaetocladius sp. | 26 |
| Parametriocnemus sp. | 16 |
| Paraphaenocladius sp. | 7 |
| Psilometriocnemus sp. | 7 |
| Rheocricotopus sp. | 19 |
| Simulium sp. | 1 |
| Zavrelimyia sp. | 10 |
| CRUSTACEA | |
| DECAPODA | **1** |
| Cambaridae | 1 |
| NEMATODA | **46** |
| Unid. Nematoda | 46 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: DOSS FORK 1
Sampled: 5/14/2010

| TAXA | SWEEP |
|---|---|
| ANNELIDA | |
| OLIGOCHAETA | 2 |
| Enchytraeidae | 2 |
| TOTAL (#/sample) | 327 |
| NUMBER OF TAXA | 25 |
| SHANNON-WEAVER (H') | 3.58 |
| TOTAL EPT TAXA | 5 |
| EPT INDEX (% of Total Taxa) | 20 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 2 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: DOSS FORK 2
Sampled: 5/14/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **15** |
| Ameletus sp. | 13 |
| Leptophlebiidae | 2 |
| PLECOPTERA | **502** |
| Amphinemura sp. | 2 |
| Chloroperlidae | 2 |
| Isoperla sp. | 30 |
| Leuctra sp. | 468 |
| COLEOPTERA | **2** |
| Heterostemuta sp. | 2 |
| TRICHOPTERA | **16** |
| Lepidostoma sp. | 10 |
| Pycnopsyche sp. | 2 |
| Rhyacophila carolina | 4 |
| DIPTERA | **307** |
| Ceratopogoninae | 40 |
| Chaetocladius sp. | 6 |
| Corynoneura sp. | 6 |
| Dicranota sp. | 27 |
| Dixa sp. | 36 |
| Ephydridae | 4 |
| Hexatoma sp. | 1 |
| Krenosmittia sp. | 10 |
| Larsia sp. | 6 |
| Ormosia sp. | 10 |
| Parachaetocladius sp. | 41 |
| Parametriocnemus sp. | 86 |
| Pilaria sp. | 1 |
| Tipula sp. | 2 |
| Zavrelimyia sp. | 31 |
| HYDRACARINA | **4** |
| Hygrobates sp. | 2 |
| Wandesia sp. | 2 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: DOSS FORK 2
Sampled: 5/14/2010

| TAXA | SWEEP |
|---|---|
| CRUSTACEA | |
| ISOPODA | **8** |
| Caecidotea sp. | 8 |
| DECAPODA | **10** |
| Cambaridae | 10 |
| TURBELLARIA | **2** |
| Girardia sp. | 2 |
| NEMATODA | **4** |
| Unid. Nematoda | 4 |
| ANNELIDA | |
| OLIGOCHAETA | **22** |
| Enchytraeidae | 4 |
| Nais communis/variabilis | 16 |
| Pristina sp. | 2 |
| BRANCHIOBDELLIDA | **2** |
| Branchiobdellidae | 2 |
| TOTAL (#/sample) | 894 |
| NUMBER OF TAXA | 35 |
| SHANNON-WEAVER (H') | 2.96 |
| TOTAL EPT TAXA | 9 |
| EPT INDEX (% of Total Taxa) | 26 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 2 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: EF PAW PAW 0
Sampled: 5/11/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **281** |
| Ameletus sp. | 139 |
| Baetis brunneicolor | 1 |
| Leptophlebiidae | 141 |
| PLECOPTERA | **143** |
| Amphinemura sp. | 1 |
| Isoperla sp. | 14 |
| Leuctra sp. | 126 |
| Peltoperlidae | 2 |
| TRICHOPTERA | **9** |
| Lepidostoma sp. | 8 |
| Neophylax sp. | 1 |
| DIPTERA | **123** |
| Ceratopogoninae | 48 |
| Clinocera sp. | 1 |
| Constempellina sp. | 14 |
| Corynoneura sp. | 4 |
| Hexatoma sp. | 1 |
| Krenosmittia sp. | 9 |
| Limnophyes sp. | 2 |
| Ormosia sp. | 1 |
| Parametriocnemus sp. | 21 |
| Rheocricotopus sp. | 12 |
| Zavrelimyia sp. | 10 |
| CRUSTACEA | |
| DECAPODA | **12** |
| Cambaridae | 12 |
| ANNELIDA | |
| OLIGOCHAETA | **7** |
| Enchytraeidae | 7 |
| TOTAL (#/sample) | 575 |
| NUMBER OF TAXA | 22 |
| SHANNON-WEAVER (H') | 3.00 |
| TOTAL EPT TAXA | 9 |
| EPT INDEX (% of Total Taxa) | 41 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 49 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: EF PAW PAW 1
Sampled: 5/11/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **208** |
| Ameletus sp. | 91 |
| Ephemerella dorothea/excrucians | 1 |
| Paraleptophlebia sp. | 116 |
| PLECOPTERA | **143** |
| Amphinemura sp. | 6 |
| Chloroperlidae | 3 |
| Isoperla sp. | 7 |
| Leuctra sp. | 114 |
| Peltoperlidae | 9 |
| Utaperla gaspesiana | 4 |
| TRICHOPTERA | **32** |
| Lepidostoma sp. | 30 |
| Rhyacophila sp. | 1 |
| Wormaldia moesta | 1 |
| DIPTERA | **238** |
| Ceratopogoninae | 79 |
| Chaetocladius sp. | 4 |
| Clinocera sp. | 4 |
| Constempellina sp. | 27 |
| Corynoneura sp. | 4 |
| Dicranota sp. | 3 |
| Dixa sp. | 1 |
| Ephydridae | 11 |
| Limonia sp. | 1 |
| Metriocnemus sp. | 4 |
| Ormosia sp. | 3 |
| Parachaetocladius sp. | 27 |
| Parametriocnemus sp. | 11 |
| Pilaria sp. | 1 |
| Pseudosmittia sp. | 7 |
| Rheocricotopus sp. | 40 |
| Tvetenia sp. | 7 |
| Zavrelimyia sp. | 4 |
| HYDRACARINA | **8** |
| Hygrobates sp. | 7 |
| Wandesia sp. | 1 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: EF PAW PAW 1
Sampled: 5/11/2010

| TAXA | SWEEP |
|---|---|
| CRUSTACEA | |
| DECAPODA | **6** |
| Cambaridae | 6 |
| TURBELLARIA | **1** |
| Girardia sp. | 1 |
| NEMATODA | **1** |
| Unid. Nematoda | 1 |
| ANNELIDA | |
| OLIGOCHAETA | **81** |
| Enchytraeidae | 72 |
| Nais communis/variabilis | 7 |
| Pristina sp. | 2 |
| TOTAL (#/sample) | 718 |
| NUMBER OF TAXA | 38 |
| SHANNON-WEAVER (H') | 3.88 |
| TOTAL EPT TAXA | 12 |
| EPT INDEX (% of Total Taxa) | 32 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 29 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: EF PAW PAW 2
Sampled: 5/11/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **394** |
| Ameletus sp. | 70 |
| Baetis brunneicolor | 78 |
| Epeorus dispar | 3 |
| Ephemerella dorothea/excrucians | 4 |
| Eurylophella sp. | 1 |
| Heptageniidae | 3 |
| Paraleptophlebia sp. | 235 |
| ODONATA | **1** |
| Cordulegaster sp. | 1 |
| PLECOPTERA | **374** |
| Amphinemura sp. | 31 |
| Haploperla brevis | 5 |
| Isoperla sp. | 26 |
| Leuctra sp. | 265 |
| Peltoperla sp. | 29 |
| Sweltsa sp. | 1 |
| Utaperla gaspesiana | 14 |
| Yugus sp. | 3 |
| MEGALOPTERA | **1** |
| Nigronia fasciatus | 1 |
| TRICHOPTERA | **19** |
| Agapetus minutus | 3 |
| Diplectrona modesta | 1 |
| Lepidostoma sp. | 8 |
| Neophylax sp. | 3 |
| Polycentropus sp. | 1 |
| Rhyacophila carolina | 3 |
| DIPTERA | **317** |
| Atrichopogon sp. | 1 |
| Ceratopogoninae | 48 |
| Clinocera sp. | 1 |
| Conchapelopia/Thienemannimyia gr. | 32 |
| Corynoneura sp. | 32 |
| Dicranota sp. | 3 |
| Dixa sp. | 12 |
| Ephydridae | 4 |
| Krenosmittia sp. | 32 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: EF PAW PAW 2
Sampled: 5/11/2010

| TAXA | SWEEP |
|---|---|
| DIPTERA (cont.) | |
| Limnophila sp. | 8 |
| Limnophyes sp. | 13 |
| Limonia sp. | 3 |
| Micropsectra sp. | 13 |
| Ormosia sp. | 1 |
| Parachaetocladius sp. | 35 |
| Parametriocnemus sp. | 32 |
| Pilaria sp. | 1 |
| Psilometriocnemus sp. | 6 |
| Simulium sp. | 1 |
| Stilocladius sp. | 6 |
| Tanytarsus sp. | 6 |
| Tipula sp. | 1 |
| Tvetenia sp. | 6 |
| Zavrelimyia sp. | 20 |
| HYDRACARINA | **1** |
| Hygrobates sp. | 1 |
| CRUSTACEA | |
| DECAPODA | **18** |
| Cambaridae | 18 |
| TURBELLARIA | **1** |
| Girardia sp. | 1 |
| ANNELIDA | |
| OLIGOCHAETA | **22** |
| Enchytraeidae | 19 |
| Nais communis/variabilis | 3 |
| TOTAL (#/sample) | 1148 |
| NUMBER OF TAXA | 52 |
| SHANNON-WEAVER (H') | 4.05 |
| TOTAL EPT TAXA | 21 |
| EPT INDEX (% of Total Taxa) | 40 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 34 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: KING ROUGH HOLLOW 1
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **2** |
| Leptophlebiidae | 2 |
| PLECOPTERA | **116** |
| Amphinemura sp. | 2 |
| Isoperla sp. | 7 |
| Leuctra sp. | 91 |
| Ostrocerca sp. | 14 |
| Utaperla gaspesiana | 2 |
| COLEOPTERA | **2** |
| Dytiscidae | 2 |
| TRICHOPTERA | **29** |
| Lepidostoma sp. | 23 |
| Neophylax sp. | 2 |
| Pycnopsyche sp. | 4 |
| DIPTERA | **459** |
| Ceratopogoninae | 37 |
| Chaetocladius sp. | 53 |
| Corynoneura sp. | 53 |
| Dicranota sp. | 11 |
| Dixa sp. | 6 |
| Ephydridae | 16 |
| Forcipomyia sp. | 2 |
| Micropsectra sp. | 43 |
| Molophilus sp. | 6 |
| Ormosia sp. | 8 |
| Unid. Orthocladiinae genus 1 | 11 |
| Parachaetocladius sp. | 75 |
| Parametriocnemus sp. | 74 |
| Psilometriocnemus sp. | 64 |
| CRUSTACEA | |
| ISOPODA | **10** |
| Caecidotea sp. | 10 |
| DECAPODA | **2** |
| Cambarus sp. | 2 |

Appendix A
A-23

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: KING ROUGH HOLLOW 1
Sampled: 5/12/2010

| TAXA | SWEEP |
| --- | --- |
| NEMATODA | **2** |
| Unid. Nematoda | 2 |
| ANNELIDA | |
| OLIGOCHAETA | **70** |
| Enchytraeidae | 68 |
| Pristina sp. | 2 |
| TOTAL (#/sample) | 692 |
| NUMBER OF TAXA | 29 |
| SHANNON-WEAVER (H') | 3.97 |
| TOTAL EPT TAXA | 9 |
| EPT INDEX (% of Total Taxa) | 31 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | <1 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: KING ROUGH HOLLOW 2
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **106** |
| Ameletus sp. | 34 |
| Leptophlebiidae | 72 |
| ODONATA | **3** |
| Cordulegaster sp. | 3 |
| PLECOPTERA | **571** |
| Amphinemura sp. | 43 |
| Isoperla sp. | 9 |
| Leuctra sp. | 434 |
| Ostrocerca sp. | 3 |
| Peltoperla sp. | 52 |
| Utaperla gaspesiana | 30 |
| MEGALOPTERA | **3** |
| Nigronia fasciatus | 3 |
| TRICHOPTERA | **42** |
| Lepidostoma sp. | 33 |
| Polycentropus sp. | 3 |
| Pycnopsyche sp. | 1 |
| Rhyacophila carolina | 4 |
| Rhyacophila sp. | 1 |
| DIPTERA | **842** |
| Ceratopogoninae | 118 |
| Cladotanytarsus sp. | 18 |
| Constempellina sp. | 18 |
| Corynoneura sp. | 37 |
| Dicranota sp. | 7 |
| Dixa sp. | 20 |
| Ephydridae | 4 |
| Hexatoma sp. | 11 |
| Limnophila sp. | 7 |
| Limnophyes sp. | 18 |
| Micropsectra sp. | 92 |
| Ormosia sp. | 18 |
| Orthocladius/Cricotopus sp. | 18 |
| Unid. Orthocladiinae | 37 |
| Paraboreochlus sp. | 18 |
| Parachaetocladius sp. | 96 |
| Parametriocnemus sp. | 92 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: KING ROUGH HOLLOW 2
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| DIPTERA (cont.) | |
| Pilaria sp. | 4 |
| Polypedilum sp. | 18 |
| Rheocricotopus sp. | 18 |
| Stempellinella sp. | 92 |
| Stilocladius sp. | 18 |
| Tanytarsus sp. | 18 |
| Tipula sp. | 8 |
| Zavrelimyia sp. | 37 |
| HYDRACARINA | **3** |
| Wandesia sp. | 3 |
| CRUSTACEA | |
| ISOPODA | **23** |
| Caecidotea sp. | 23 |
| DECAPODA | **6** |
| Cambaridae | 6 |
| ANNELIDA | |
| OLIGOCHAETA | **30** |
| Enchytraeidae | 17 |
| Nais communis/variabilis | 13 |
| TOTAL (#/sample) | 1629 |
| NUMBER OF TAXA | 45 |
| SHANNON-WEAVER (H') | 4.32 |
| TOTAL EPT TAXA | 13 |
| EPT INDEX (% of Total Taxa) | 29 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 7 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: MUDLICK HOLLOW 1
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **35** |
| Ameletus sp. | 5 |
| Baetis brunneicolor | 2 |
| Paraleptophlebia sp. | 28 |
| ODONATA | **6** |
| Cordulegaster sp. | 6 |
| PLECOPTERA | **104** |
| Amphinemura sp. | 9 |
| Haploperla brevis | 2 |
| Isoperla sp. | 4 |
| Leuctra sp. | 59 |
| Peltoperla sp. | 11 |
| Utaperla gaspesiana | 19 |
| MEGALOPTERA | **1** |
| Nigronia fasciatus | 1 |
| COLEOPTERA | **13** |
| Anchytarsus bicolor | 11 |
| Oulimnius latiusculus | 2 |
| TRICHOPTERA | **31** |
| Diplectrona modesta | 5 |
| Lepidostoma sp. | 21 |
| Molanna blenda | 1 |
| Neophylax sp. | 3 |
| Pycnopsyche sp. | 1 |
| DIPTERA | **245** |
| Ceratopogoninae | 8 |
| Chaetocladius sp. | 11 |
| Chrysops sp. | 1 |
| Conchapelopia/Thienemannimyia gr. | 5 |
| Constempellina sp. | 5 |
| Corynoneura sp. | 5 |
| Cricotopus sp. | 5 |
| Diamesa sp. | 5 |
| Dicranota sp. | 21 |
| Dixa sp. | 6 |
| Dolichopodidae | 1 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: MUDLICK HOLLOW 1
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| DIPTERA (cont.) | |
| Krenosmittia sp. | 5 |
| Limnophila sp. | 6 |
| Limnophyes sp. | 5 |
| Orthocladius/Cricotopus sp. | 5 |
| Parachaetocladius sp. | 5 |
| Parametriocnemus sp. | 23 |
| Pilaria sp. | 3 |
| Polypedilum sp. | 5 |
| Psilometriocnemus sp. | 11 |
| Rheocricotopus sp. | 5 |
| Stempellinella sp. | 63 |
| Tanytarsus sp. | 11 |
| Tipula sp. | 2 |
| Zavrelimyia sp. | 23 |
| ANNELIDA | |
| OLIGOCHAETA | **2** |
| Enchytraeidae | 2 |
| TOTAL (#/sample) | 437 |
| NUMBER OF TAXA | 44 |
| SHANNON-WEAVER (H') | 4.65 |
| TOTAL EPT TAXA | 14 |
| EPT INDEX (% of Total Taxa) | 32 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 8 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: MUDLICK HOLLOW 2
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **121** |
| Ameletus sp. | 45 |
| Baetis brunneicolor | 27 |
| Ephemerella dorothea/excrucians | 7 |
| Eurylophella sp. | 7 |
| Heptageniidae | 2 |
| Leptophlebiidae | 33 |
| ODONATA | **7** |
| Cordulegaster sp. | 7 |
| PLECOPTERA | **192** |
| Amphinemura sp. | 8 |
| Isoperla sp. | 7 |
| Leuctra sp. | 161 |
| Peltoperla sp. | 7 |
| Remenus bilobatus | 1 |
| Utaperla gaspesiana | 8 |
| COLEOPTERA | **7** |
| Oulimnius latiusculus | 7 |
| TRICHOPTERA | **26** |
| Lepidostoma sp. | 22 |
| Rhyacophila carolina | 2 |
| Rhyacophila sp. | 2 |
| DIPTERA | **551** |
| Ceratopogoninae | 93 |
| Conchapelopia/Thienemannimyia gr. | 58 |
| Constempellina sp. | 12 |
| Corynoneura sp. | 23 |
| Dicranota sp. | 7 |
| Dixa sp. | 7 |
| Dolichopodidae | 3 |
| Ephydridae | 27 |
| Heterotrissocladius sp. | 12 |
| Limnophila sp. | 2 |
| Nemotelus sp. | 2 |
| Ormosia sp. | 2 |
| Paraboreochlus sp. | 12 |
| Parachaetocladius sp. | 12 |
| Parametriocnemus sp. | 116 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: MUDLICK HOLLOW 2
Sampled: 5/12/2010

| TAXA | SWEEP |
|---|---|
| DIPTERA (cont.) | |
| Rheocricotopus sp. | 12 |
| Rheosmittia sp. | 35 |
| Stempellinella sp. | 70 |
| Tanytarsus sp. | 23 |
| Zavrelimyia sp. | 23 |
| HYDRACARINA | **10** |
| Hydryphantes sp. | 2 |
| Wandesia sp. | 8 |
| CRUSTACEA | |
| DECAPODA | **8** |
| Cambaridae | 8 |
| ANNELIDA | |
| OLIGOCHAETA | **47** |
| Enchytraeidae | 43 |
| Nais communis/variabilis | 4 |
| TOTAL (#/sample) | 969 |
| NUMBER OF TAXA | 42 |
| SHANNON-WEAVER (H') | 4.41 |
| TOTAL EPT TAXA | 15 |
| EPT INDEX (% of Total Taxa) | 36 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 12 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: PAW PAW 1
Sampled: 05/11/10

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **22** |
| Ameletus sp. | 2 |
| Leptophlebiidae | 20 |
| PLECOPTERA | **47** |
| Isoperla sp. | 5 |
| Leuctra sp. | 42 |
| COLEOPTERA | **1** |
| Hydrophilidae | 1 |
| TRICHOPTERA | **4** |
| Diplectrona modesta | 2 |
| Lepidostoma sp. | 2 |
| DIPTERA | **138** |
| Ceratopogoninae | 51 |
| Clinocera sp. | 2 |
| Corynoneura sp. | 1 |
| Dixa sp. | 2 |
| Dolichopodidae | 1 |
| Ephydridae | 35 |
| Eukiefferiella sp. | 3 |
| Limnophila sp. | 1 |
| Limnophyes sp. | 4 |
| Limonia sp. | 5 |
| Ormosia sp. | 4 |
| Orthocladius/Cricotopus sp. | 3 |
| Unid. Orthocladiinae | 3 |
| Parachaetocladius sp. | 1 |
| Parametriocnemus sp. | 4 |
| Pilaria sp. | 1 |
| Psilometriocnemus sp. | 9 |
| Rheocricotopus sp. | 3 |
| Simulium sp. | 3 |
| Stilocladius sp. | 1 |
| Thienemanniella sp. | 1 |
| CRUSTACEA | |
| DECAPODA | **1** |
| Cambarus sp. | 1 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: PAW PAW 1
Sampled: 05/11/10

| TAXA | SWEEP |
|---|---|
| NEMATODA | **2** |
| Unid. Nematoda | 2 |
| ANNELIDA | |
| OLIGOCHAETA | **22** |
| Enchytraeidae | 20 |
| Pristina sp. | 2 |
| BRANCHIOBDELLIDA | **1** |
| Branchiobdellidae | 1 |
| MOLLUSCA | |
| GASTROPODA | **1** |
| Amnicola sp. | 1 |
| TOTAL (#/sample) | 239 |
| NUMBER OF TAXA | 34 |
| SHANNON-WEAVER (H') | 3.79 |
| TOTAL EPT TAXA | 6 |
| EPT INDEX (% of Total Taxa) | 18 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 9 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: PAW PAW 2
Sampled: 5/11/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **146** |
| Ameletus sp. | 35 |
| Baetis brunneicolor | 19 |
| Leptophlebiidae | 92 |
| PLECOPTERA | **199** |
| Amphinemura sp. | 22 |
| Haploperla brevis | 1 |
| Isoperla sp. | 4 |
| Leuctra sp. | 172 |
| TRICHOPTERA | **6** |
| Lepidostoma sp. | 4 |
| Neophylax sp. | 2 |
| DIPTERA | **264** |
| Bryophaenocladius sp. | 7 |
| Ceratopogoninae | 95 |
| Clinocera sp. | 2 |
| Conchapelopia/Thienemannimyia gr. | 3 |
| Corynoneura sp. | 15 |
| Dicranota sp. | 2 |
| Dixa sp. | 6 |
| Dolichopodidae | 3 |
| Ephydridae | 13 |
| Eukiefferiella sp. | 3 |
| Limnophyes sp. | 15 |
| Limonia sp. | 2 |
| Micropsectra sp. | 3 |
| Molophilus sp. | 2 |
| Ormosia sp. | 6 |
| Orthocladius/Cricotopus sp. | 15 |
| Unid. Orthocladiinae | 3 |
| Parametriocnemus sp. | 37 |
| Psilometriocnemus sp. | 7 |
| Rheocricotopus sp. | 3 |
| Thienemanniella sp. | 3 |
| Tipula sp. | 1 |
| Zavrelimyia sp. | 18 |
| CRUSTACEA | |
| AMPHIPODA | **1** |
| Crangonyctidae | 1 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: PAW PAW 2
Sampled: 5/11/2010

| TAXA | SWEEP |
|---|---|
| DECAPODA | **5** |
| Cambaridae | 5 |
| NEMATODA | **1** |
| Unid. Nematoda | 1 |
| ANNELIDA | |
| OLIGOCHAETA | **53** |
| Eiseniella tetraedra | 2 |
| Enchytraeidae | 36 |
| Nais communis/variabilis | 3 |
| Pristina sp. | 12 |
| TOTAL (#/sample) | 675 |
| NUMBER OF TAXA | 39 |
| SHANNON-WEAVER (H') | 3.87 |
| TOTAL EPT TAXA | 9 |
| EPT INDEX (% of Total Taxa) | 23 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 22 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: PORTERCAMP BRANCH 1
Sampled: 5/13/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| DIPTERA | **169** |
| Bryophaenocladius sp. | 37 |
| Ceratopogoninae | 8 |
| Chaetocladius sp. | 3 |
| Dolichopodidae | 3 |
| Ephydridae | 6 |
| Gymnometriocnemus sp. | 7 |
| Limnophila sp. | 2 |
| Limnophyes sp. | 3 |
| Molophilus sp. | 1 |
| Nemotelus sp. | 1 |
| Ormosia sp. | 19 |
| Unid. Orthocladiinae genus 1 | 3 |
| Parachaetocladius sp. | 17 |
| Pilaria sp. | 2 |
| Pseudosmittia sp. | 53 |
| Rheocricotopus sp. | 3 |
| Tipula sp. | 1 |
| CRUSTACEA | |
| AMPHIPODA | **5** |
| Crangonyx sp. | 5 |
| DECAPODA | **1** |
| Cambarus sp. | 1 |
| NEMATODA | **1** |
| Unid. Nematoda | 1 |
| ANNELIDA | |
| OLIGOCHAETA | **101** |
| Enchytraeidae | 101 |
| TOTAL (#/sample) | 277 |
| NUMBER OF TAXA | 21 |
| SHANNON-WEAVER (H') | 3.00 |
| TOTAL EPT TAXA | 0 |
| EPT INDEX (% of Total Taxa) | 0 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 0 |

Appendix A
A-35

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: PORTERCAMP BRANCH 2
Sampled: 5/13/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| DIPTERA | **333** |
| Bryophaenocladius sp. | 103 |
| Ceratopogoninae | 8 |
| Chaetocladius sp. | 6 |
| Clinocera sp. | 2 |
| Dolichopodidae | 6 |
| Ephydridae | 29 |
| Georthocladius sp. | 6 |
| Hexatoma sp. | 1 |
| Molophilus sp. | 2 |
| Ormosia sp. | 58 |
| Orthocladius/Cricotopus sp. | 6 |
| Unid. Orthocladiinae | 13 |
| Pseudosmittia sp. | 24 |
| Rheocricotopus sp. | 67 |
| Syrphidae | 1 |
| Tipula sp. | 1 |
| CRUSTACEA | |
| AMPHIPODA | **1** |
| Crangonyx sp. | 1 |
| NEMATODA | **5** |
| Unid. Nematoda | 5 |
| ANNELIDA | |
| OLIGOCHAETA | **82** |
| Enchytraeidae | 82 |
| TOTAL (#/sample) | 421 |
| NUMBER OF TAXA | 19 |
| SHANNON-WEAVER (H') | 3.12 |
| TOTAL EPT TAXA | 0 |
| EPT INDEX (% of Total Taxa) | 0 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 0 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: RATTLESNAKE RUN 1
Sampled: 5/13/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| COLEOPTERA | **3** |
| Anchytarsus bicolor | 3 |
| TRICHOPTERA | **1** |
| Diplectrona modesta | 1 |
| DIPTERA | **177** |
| Bryophaenocladius sp. | 12 |
| Ceratopogoninae | 19 |
| Chaetocladius sp. | 3 |
| Dolichopodidae | 3 |
| Ephydridae | 101 |
| Hexatoma sp. | 1 |
| Larsia sp. | 1 |
| Limnophyes sp. | 9 |
| Ormosia sp. | 17 |
| Unid. Orthocladiinae | 1 |
| Parachaetocladius sp. | 3 |
| Rheocricotopus sp. | 5 |
| Tipula sp. | 2 |
| NEMATODA | **1** |
| Unid. Nematoda | 1 |
| ANNELIDA | |
| OLIGOCHAETA | **120** |
| Enchytraeidae | 120 |
| TOTAL (#/sample) | 302 |
| NUMBER OF TAXA | 17 |
| SHANNON-WEAVER (H') | 2.42 |
| TOTAL EPT TAXA | 1 |
| EPT INDEX (% of Total Taxa) | 6 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 0 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: RATTLESNAKE RUN 2
Sampled: 5/13/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| PLECOPTERA | **7** |
| Amphinemura sp. | 1 |
| Isoperla sp. | 1 |
| Leuctra sp. | 3 |
| Ostrocerca sp. | 2 |
| DIPTERA | **39** |
| Bryophaenocladius sp. | 3 |
| Ceratopogoninae | 17 |
| Chaetocladius sp. | 1 |
| Clinocera sp. | 1 |
| Corynoneura sp. | 2 |
| Dixa sp. | 2 |
| Dolichopodidae | 1 |
| Ephydridae | 1 |
| Hexatoma sp. | 1 |
| Molophilus sp. | 2 |
| Ormosia sp. | 3 |
| Parachaetocladius sp. | 5 |
| ANNELIDA | |
| OLIGOCHAETA | **14** |
| Enchytraeidae | **14** |
| TOTAL (#/sample) | 60 |
| NUMBER OF TAXA | 17 |
| SHANNON-WEAVER (H') | 3.30 |
| TOTAL EPT TAXA | 4 |
| EPT INDEX (% of Total Taxa) | 24 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 0 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: U.T. LAUREL CREEK 1
Sampled: 5/14/2010

| TAXA | SWEEP |
| --- | --- |
| INSECTA | |
| EPHEMEROPTERA | **14** |
| Ameletus sp. | 14 |
| ODONATA | **1** |
| Cordulegaster sp. | 1 |
| PLECOPTERA | **15** |
| Amphinemura sp. | 3 |
| Isoperla sp. | 3 |
| Leuctra sp. | 6 |
| Ostrocerca sp. | 3 |
| COLEOPTERA | **4** |
| Cymbiodyta sp. | 2 |
| Hydrocolus sp. | 2 |
| TRICHOPTERA | **29** |
| Diplectrona modesta | 2 |
| Lepidostoma sp. | 25 |
| Rhyacophila carolina | 2 |
| DIPTERA | **559** |
| Bryophaenocladius sp. | 22 |
| Ceratopogoninae | 72 |
| Chaetocladius sp. | 22 |
| Clinocera sp. | 1 |
| Corynoneura sp. | 102 |
| Dicranota sp. | 7 |
| Ephydridae | 10 |
| Forcipomyia sp. | 1 |
| Hexatoma sp. | 24 |
| Larsia sp. | 22 |
| Molophilus sp. | 1 |
| Unid. Orthocladinae genus 1 | 46 |
| Parachaetocladius sp. | 11 |
| Parametriocnemus sp. | 34 |
| Rheocricotopus sp. | 127 |
| Zavrelimyia sp. | 57 |
| HYDRACARINA | **8** |
| Hydryphantes sp. | 8 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: U.T. LAUREL CREEK 1
Sampled: 5/14/2010

| TAXA | SWEEP |
|---|---|
| CRUSTACEA | |
| DECAPODA | **2** |
| Cambaridae | 2 |
| NEMATODA | **3** |
| Unid. Nematoda | 3 |
| ANNELIDA | |
| OLIGOCHAETA | **4** |
| Enchytraeidae | 4 |
| TOTAL (#/sample) | 639 |
| NUMBER OF TAXA | 31 |
| SHANNON-WEAVER (H') | 3.82 |
| TOTAL EPT TAXA | 8 |
| EPT INDEX (% of Total Taxa) | 26 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 2 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: U.T. LAUREL CREEK 2
Sampled: 5/14/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| EPHEMEROPTERA | **111** |
| Ameletus sp. | 43 |
| Baetis brunneicolor | 31 |
| Paraleptophlebia sp. | 37 |
| PLECOPTERA | **107** |
| Amphinemura sp. | 21 |
| Isoperla sp. | 7 |
| Leuctra sp. | 73 |
| Peltoperlidae | 1 |
| Utaperla gaspesiana | 1 |
| Yugus sp. | 4 |
| COLEOPTERA | **10** |
| Heterosternuta sp. | 3 |
| Oulimnius latiusculus | 7 |
| TRICHOPTERA | **22** |
| Lepidostoma sp. | 14 |
| Neophylax sp. | 7 |
| Rhyacophilidae | 1 |
| DIPTERA | **296** |
| Ceratopogoninae | 39 |
| Conchapelopia/Thienemannimyia gr. | 6 |
| Constempellina sp. | 38 |
| Corynoneura sp. | 26 |
| Dicranota sp. | 24 |
| Dixa sp. | 6 |
| Hexatoma sp. | 3 |
| Krenosmittia sp. | 6 |
| Parachaetocladius sp. | 19 |
| Parametriocnemus sp. | 59 |
| Pilaria sp. | 1 |
| Polypedilum sp. | 6 |
| Rheocricotopus sp. | 19 |
| Stilocladius sp. | 6 |
| Tanytarsus sp. | 6 |
| Tvetenia sp. | 13 |
| Zavrelimyia sp. | 19 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: U.T. LAUREL CREEK 2
Sampled: 5/14/2010

| TAXA | SWEEP |
|---|---|
| CRUSTACEA | |
| DECAPODA | **11** |
| Cambaridae | 11 |
| ANNELIDA | |
| OLIGOCHAETA | **32** |
| Enchytraeidae | 6 |
| Nais communis/variabilis | 26 |
| TOTAL (#/sample) | 589 |
| NUMBER OF TAXA | 34 |
| SHANNON-WEAVER (H') | 4.45 |
| TOTAL EPT TAXA | 12 |
| EPT INDEX (% of Total Taxa) | 35 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 19 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: WHITE HOLLOW 1
Sampled: 5/13/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| COLEOPTERA | **1** |
| Helichus sp. | 1 |
| TRICHOPTERA | **2** |
| Ironoquia sp. | 1 |
| Lepidostoma sp. | 1 |
| DIPTERA | **143** |
| Allognosta sp. | 1 |
| Bryophaenocladius sp. | 30 |
| Ceratopogoninae | 9 |
| Chaetocladius sp. | 4 |
| Dolichopodidae | 9 |
| Ephydridae | 10 |
| Georthocladius sp. | 11 |
| Limnophyes sp. | 11 |
| Micropsectra sp. | 4 |
| Ormosia sp. | 30 |
| Unid. Orthocladiinae | 4 |
| Unid. Orthocladiinae genus 2 | 15 |
| Pilaria sp. | 1 |
| Pseudosmittia sp. | 2 |
| Tanytarsus sp. | 2 |
| CRUSTACEA | |
| AMPHIPODA | **40** |
| Crangonyx sp. | 40 |
| NEMATODA | **2** |
| Unid. Nematoda | 2 |
| ANNELIDA | |
| OLIGOCHAETA | **14** |
| Enchytraeidae | 12 |
| Pristina sp. | 1 |
| Sparganophilidae | 1 |
| TOTAL (#/sample) | 202 |
| NUMBER OF TAXA | 23 |
| SHANNON-WEAVER (H') | 3.67 |
| TOTAL EPT TAXA | 2 |
| EPT INDEX (% of Total Taxa) | 9 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 0 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: WHITE HOLLOW 2
Sampled: 5/13/2010

| TAXA | SWEEP |
|---|---|
| INSECTA | |
| ODONATA | **17** |
| Cordulegaster sp. | 17 |
| PLECOPTERA | **300** |
| Amphinemura sp. | 20 |
| Leuctra sp. | 230 |
| Peltoperla sp. | 50 |
| MEGALOPTERA | **1** |
| Nigronia fasciatus | 1 |
| COLEOPTERA | **10** |
| Anchytarsus bicolor | 10 |
| TRICHOPTERA | **45** |
| Diplectrona modesta | 4 |
| Lepidostoma sp. | 28 |
| Molanna blenda | 3 |
| Polycentropus sp. | 1 |
| Rhyacophila carolina | 5 |
| Rhyacophila sp. | 1 |
| Wormaldia moesta | 3 |
| DIPTERA | **656** |
| Ceratopogoninae | 64 |
| Constempellina sp. | 109 |
| Corynoneura sp. | 13 |
| Dicranota sp. | 37 |
| Dixa sp. | 3 |
| Ephydridae | 3 |
| Hexatoma sp. | 5 |
| Limnophila sp. | 31 |
| Micropsectra sp. | 13 |
| Neoplasta sp. | 7 |
| Neostempellina sp. | 41 |
| Orthocladius (Symposiocladius) | 13 |
| Orthocladius/Cricotopus sp. | 13 |
| Parachaetocladius sp. | 13 |
| Parametriocnemus sp. | 41 |
| Pilaria sp. | 2 |
| Psilometriocnemus sp. | 28 |
| Rheocricotopus sp. | 28 |
| Stempellinella sp. | 165 |
| Tipula sp. | 27 |

MACROINVERTEBRATE DENSITY
Client: NMA-HS
Site: WHITE HOLLOW 2
Sampled: 5/13/2010

| TAXA | SWEEP |
|---|---|
| CRUSTACEA | |
| DECAPODA | **4** |
| Cambaridae | 4 |
| NEMATODA | **3** |
| Unid. Nematoda | 3 |
| ANNELIDA | |
| OLIGOCHAETA | **20** |
| Enchytraeidae | 10 |
| Nais communis/variabilis | 7 |
| Pristina sp. | 3 |
| TOTAL (#/sample) | 1056 |
| NUMBER OF TAXA | 38 |
| SHANNON-WEAVER (H') | 4.07 |
| TOTAL EPT TAXA | 10 |
| EPT INDEX (% of Total Taxa) | 26 |
| EPHEMEROPTERA ABUNDANCE (% of Total Number) | 0 |

# Appendix B

**Jaccard Coefficients for Pairs of Sites and Streams**

**Table B-1: Jaccard coefficients for pairwise comparison of Site 1 sites in streams in southern West Virginia.**

| Stream | Back Fork | Chestnut Oak Creek | Doss Fork | King Rough Hollow | Mudlick Hollow | U.T. Laurel Creek | # 2 Store Hollow | Portercamp Branch | Rattlesnake Run | White Hollow | EF Paw Paw Branch | Paw Paw Branch |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Big Ugly State Wildlife Area** | | | | | | | | | | | | |
| Back Fork | -- | 0.34 | 0.30 | 0.36 | 0.36 | 0.32 | 0.29 | 0.17 | 0.13 | 0.14 | 0.40 | 0.23 |
| Chestnut Oak Creek | | -- | 0.33 | 0.36 | 0.26 | 0.31 | 0.34 | 0.36 | 0.32 | 0.34 | 0.27 | 0.32 |
| Doss Fork | | | -- | 0.38 | 0.23 | 0.51 | 0.44 | 0.21 | 0.27 | 0.20 | 0.31 | 0.28 |
| King Rough Hollow | | | | -- | 0.28 | 0.40 | 0.40 | 0.25 | 0.18 | 0.21 | 0.34 | 0.34 |
| Mudlick Hollow | | | | | -- | 0.27 | 0.25 | 0.18 | 0.20 | 0.16 | 0.30 | 0.30 |
| U.T. Laurel Creek | | | | | | -- | 0.44 | 0.24 | 0.30 | 0.15 | 0.35 | 0.27 |
| **Kanawha State Forest** | | | | | | | | | | | | |
| #2 Store Hollow | | | | | | | -- | 0.30 | 0.41 | 0.26 | 0.28 | 0.38 |
| Portercamp Branch | | | | | | | | -- | 0.46 | 0.38 | 0.20 | 0.28 |
| Rattlesnake Run | | | | | | | | | -- | 0.33 | 0.17 | 0.28 |
| White Hollow | | | | | | | | | | -- | 0.20 | 0.27 |
| **Laurel Lakes State Wildlife Area** | | | | | | | | | | | | |
| EF Paw Paw Branch | | | | | | | | | | | -- | 0.33 |
| Paw Paw Branch | | | | | | | | | | | | -- |

**Table B-2: Jaccard coefficients for pairwise comparison of Site 2 sites in streams in southern West Virginia.**

| Stream | Back Fork | Chestnut Oak Creek | Doss Fork | King Rough Hollow | Mudlick Hollow | U.T. Laurel Creek | #2 Store Hollow | Portercamp Branch | Rattlesnake Run | White Hollow | EF Paw Paw Branch | Paw Paw Branch |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Big Ugly State Wildlife Area** | | | | | | | | | | | | |
| Back Fork | -- | 0.23 | 0.34 | 0.42 | 0.41 | 0.48 | 0.12 | 0.10 | 0.14 | 0.34 | 0.39 | 0.32 |
| Chestnut Oak Creek | | -- | 0.35 | 0.36 | 0.29 | 0.24 | 0.25 | 0.26 | 0.38 | 0.22 | 0.28 | 0.33 |
| Doss Fork | | | -- | 0.45 | 0.35 | 0.38 | 0.24 | 0.17 | 0.30 | 0.35 | 0.36 | 0.37 |
| King Rough Hollow | | | | -- | 0.53 | 0.41 | 0.25 | 0.16 | 0.24 | 0.51 | 0.45 | 0.38 |
| Mudlick Hollow | | | | | -- | 0.41 | 0.19 | 0.11 | 0.23 | 0.36 | 0.42 | 0.35 |
| U.T. Laurel Creek | | | | | | -- | 0.18 | 0.08 | 0.21 | 0.29 | 0.43 | 0.33 |
| **Kanawha State Forest** | | | | | | | | | | | | |
| #2 Store Hollow | | | | | | | -- | 0.29 | 0.26 | 0.19 | 0.20 | 0.27 |
| Portercamp Branch | | | | | | | | -- | 0.38 | 0.16 | 0.09 | 0.29 |
| Rattlesnake Run | | | | | | | | | -- | 0.20 | 0.19 | 0.30 |
| White Hollow | | | | | | | | | | -- | 0.36 | 0.33 |
| **Laurel Lakes State Wildlife Area** | | | | | | | | | | | | |
| EF Paw Paw Branch | | | | | | | | | | | -- | 0.40 |
| Paw Paw Branch | | | | | | | | | | | | -- |

**Table B-3: Jaccard coefficients for pairwise comparison of streams (sites 1 and 2 on each stream combined) in southern West Virginia.**

| Stream | Back Fork | Chestnut Oak Creek | Doss Fork | King Rough Hollow | Mudlick Hollow | U.T. Laurel Creek | #2 Store Hollow | Portercamp Branch | Rattlesnake Run | White Hollow | EF Paw Paw Branch | Paw Paw Branch |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Big Ugly State Wildlife Area** | | | | | | | | | | | | |
| Back Fork | -- | 0.32 | 0.37 | 0.49 | 0.53 | 0.43 | 0.26 | 0.18 | 0.22 | 0.35 | 0.41 | 0.36 |
| Chestnut Oak Creek | | -- | 0.33 | 0.37 | 0.28 | 0.32 | 0.31 | 0.36 | 0.38 | 0.35 | 0.28 | 0.41 |
| Doss Fork | | | -- | 0.51 | 0.35 | 0.41 | 0.46 | 0.23 | 0.36 | 0.36 | 0.43 | 0.44 |
| King Rough Hollow | | | | -- | 0.53 | 0.46 | 0.40 | 0.28 | 0.31 | 0.51 | 0.49 | 0.46 |
| Mudlick Hollow | | | | | -- | 0.42 | 0.29 | 0.19 | 0.25 | 0.43 | 0.52 | 0.39 |
| U.T. Laurel Creek | | | | | | -- | 0.32 | 0.20 | 0.34 | 0.31 | 0.46 | 0.38 |
| **Kanawha State Forest** | | | | | | | | | | | | |
| #2 Store Hollow | | | | | | | -- | 0.29 | 0.40 | 0.35 | 0.32 | 0.44 |
| Portercamp Branch | | | | | | | | -- | 0.44 | 0.34 | 0.18 | 0.31 |
| Rattlesnake Run | | | | | | | | | -- | 0.35 | 0.24 | 0.37 |
| White Hollow | | | | | | | | | | -- | 0.43 | 0.38 |
| **Laurel Lakes State Wildlife Area** | | | | | | | | | | | | |
| EF Paw Paw Branch | | | | | | | | | | | -- | 0.45 |
| Paw Paw Branch | | | | | | | | | | | | -- |

# Appendix C

**Water Chemistry Data**

Appendix C
C-1

| Medium | (All) |
|---|---|

| Sum of Value<br>Row Labels | Column Labels<br>Alkalinity, Bicarbonate (As CaCO3) | Alkalinity, Carbonate (As CaCO3) |
|---|---|---|
| #2 Store Hollow 1 | 2.8 | 0 |
| #2 Store Hollow 1D | 3 | 0 |
| #2 Store Hollow 2 | 3.8 | 0 |
| Back Fork 1 | 5.5 | 0 |
| Back Fork 1D | 4.8 | 0 |
| Back Fork 2 | 4.7 | 0 |
| Chestnut Oak Creek 1 | 6.9 | 0 |
| Chestnut Oak Creek 2 | 6.4 | 0 |
| Doss Fork 1 | 2.8 | 0 |
| Doss Fork 1D | 2.6 | 0 |
| Doss Fork 2 | 2.7 | 0 |
| E.F. PawPaw 1 | 4 | 0 |
| E.F. PawPaw 1D | 4.4 | 0 |
| E.F. PawPaw 2 | 3.6 | 0 |
| E.F. PawPaw O | 5.4 | 0 |
| King Rough Hollow 1 | 3.3 | 0 |
| King Rough Hollow 2 | 3.8 | 0 |
| Mudlick Hollow 1 | 3.9 | 0 |
| Mudlick Hollow 2 | 6.3 | 0 |
| PawPaw 1 | 12.4 | 0 |
| PawPaw 2 | 13.1 | 0 |
| Portercamp Branch 1 | 3.4 | 0 |
| Portercamp Branch 2 | 3.6 | 0 |
| Rattlesnake Run 1 | 4 | 0 |
| Rattlesnake Run 2 | 11.6 | 0 |
| U.T. Laurel Creek 1 | 3 | 0 |
| U.T. Laurel Creek 2 | 3.7 | 0 |
| White Hollow 1 | 2.9 | 0 |
| White Hollow 2 | 3.3 | 0 |

Medium

| Sum of Value<br>Row Labels | Aluminum | Calcium | Chloride | Conductivity, lab | Hardness | Iron |
|---|---|---|---|---|---|---|
| #2 Store Hollow 1 | 0.202 | 1.4 | 0.82 | 44.3 | 13.5 | 0.14 |
| #2 Store Hollow 1D | 0.197 | 1.31 | 0.81 | 44.7 | 12.9 | 0.124 |
| #2 Store Hollow 2 | 0.226 | 1.72 | 0.83 | 44.6 | 13.9 | 0.237 |
| Back Fork 1 | 0.172 | 2.36 | 0.59 | 41.2 | 12.9 | 0.102 |
| Back Fork 1D | 0.175 | 2.4 | 0.54 | 41.5 | 13 | 0.115 |
| Back Fork 2 | 0.089 | 2.11 | 1.32 | 39.9 | 11.6 | 0.087 |
| Chestnut Oak Creek 1 | 2.6 | 2.64 | 0.4 | 32.4 | 13.3 | 1.56 |
| Chestnut Oak Creek 2 | 3.59 | 2.5 | 0.5 | 32.7 | 14 | 2.76 |
| Doss Fork 1 | 0.324 | 1.07 | 0.56 | 28.4 | 7.37 | 0.215 |
| Doss Fork 1D | 0.283 | 1.07 | 0.55 | 28.3 | 7.35 | 0.157 |
| Doss Fork 2 | 0.241 | 1.21 | 0.53 | 27.4 | 7.85 | 0.224 |
| E.F. PawPaw 1 | 0.057 | 2.94 | 0.59 | 47.6 | 15.6 | 0.05 |
| E.F. PawPaw 1D | 0.067 | 2.94 | 0.58 | 46.2 | 15.7 | 0.063 |
| E.F. PawPaw 2 | 0.084 | 2.88 | 0.59 | 45.7 | 15.4 | 0.085 |
| E.F. PawPaw O | 0.09 | 3.75 | 0.56 | 54.2 | 18.7 | 0.095 |
| King Rough Hollow 1 | 0.442 | 1.13 | 0.47 | 27.6 | 8.29 | 0.153 |
| King Rough Hollow 2 | 0.374 | 1.17 | 0.48 | 28.2 | 8.71 | 0.185 |
| Mudlick Hollow 1 | 0.095 | 1.8 | 0.7 | 33.1 | 10.4 | 0.076 |
| Mudlick Hollow 2 | 1.24 | 3.56 | 0.64 | 37.3 | 15.8 | 3.09 |
| PawPaw 1 | 0.099 | 7.75 | 0.69 | 101 | 35.8 | 0.073 |
| PawPaw 2 | 0.115 | 10.7 | 0.59 | 124 | 46.2 | 0.149 |
| Portercamp Branch 1 | 0.103 | 1.93 | 0.74 | 45.3 | 13.4 | 0.111 |
| Portercamp Branch 2 | 0.271 | 2.09 | 0.72 | 45.6 | 13.9 | 0.244 |
| Rattlesnake Run 1 | 0.163 | 4.01 | 0.83 | 55 | 17.7 | 0.096 |
| Rattlesnake Run 2 | 0.277 | 6.39 | 0.94 | 71.2 | 27.5 | 0.291 |
| U.T. Laurel Creek 1 | 0.043 | 1.42 | 0.52 | 33.3 | 11.2 | 0.021 |
| U.T. Laurel Creek 2 | 0.049 | 1.59 | 0.57 | 35.3 | 11 | 0.049 |
| White Hollow 1 | 0.131 | 1.35 | 0.65 | 39 | 11.1 | 0.058 |
| White Hollow 2 | 0.09 | 1.96 | 0.72 | 44.2 | 13.6 | 0.152 |

Medium

| Sum of Value | | | | | | |
|---|---|---|---|---|---|---|
| Row Labels | Magnesium | Manganese | Nitrate | pH, lab | Potassium | Selenium |
| #2 Store Hollow 1 | 2.43 | 0.007 | 0 | 5.55 | 1.58 | 0 |
| #2 Store Hollow 1D | 2.34 | 0.006 | 0 | 5.6 | 1.52 | 0 |
| #2 Store Hollow 2 | 2.34 | 0.016 | 0.03 | 5.97 | 1.57 | 0 |
| Back Fork 1 | 1.7 | 0.019 | 0.11 | 5.74 | 1.13 | 0.001 |
| Back Fork 1D | 1.7 | 0.014 | 0.13 | 5.67 | 1.13 | 0.001 |
| Back Fork 2 | 1.55 | 0.015 | 0.1 | 6.09 | 1.25 | 0 |
| Chestnut Oak Creek 1 | 1.63 | 0.076 | 0.03 | 5.82 | 2.18 | 0.0016 |
| Chestnut Oak Creek 2 | 1.89 | 0.136 | 0.03 | 6.03 | 2.05 | 0.0013 |
| Doss Fork 1 | 1.14 | 0.035 | 0.05 | 5.22 | 1.32 | 0 |
| Doss Fork 1D | 1.13 | 0.033 | 0.04 | 5.19 | 1.3 | 0 |
| Doss Fork 2 | 1.17 | 0.033 | 0.02 | 5.69 | 1.26 | 0 |
| E.F. PawPaw 1 | 2 | 0.002 | 0.24 | 5.66 | 1.05 | 0 |
| E.F. PawPaw 1D | 2.03 | 0.002 | 0.1 | 5.75 | 1.07 | 0 |
| E.F. PawPaw 2 | 1.98 | 0.009 | 0.1 | 6.01 | 1.07 | 0 |
| E.F. PawPaw O | 2.27 | 0.008 | 0.14 | 6.1 | 1.03 | 0 |
| King Rough Hollow 1 | 1.33 | 0.017 | 0.02 | 5.46 | 1.1 | 0 |
| King Rough Hollow 2 | 1.41 | 0.029 | 0.03 | 5.8 | 1.1 | 0 |
| Mudlick Hollow 1 | 1.44 | 0.01 | 0.04 | 5.7 | 0.903 | 0 |
| Mudlick Hollow 2 | 1.68 | 0.636 | 0.12 | 6.16 | 1.18 | 0.0013 |
| PawPaw 1 | 4 | 0.002 | 0.15 | 6.04 | 1.64 | 0.0011 |
| PawPaw 2 | 4.72 | 0.006 | 0.21 | 6.69 | 1.57 | 0 |
| Portercamp Branch 1 | 2.07 | 0.008 | 0.19 | 5.31 | 1.37 | 0 |
| Portercamp Branch 2 | 2.12 | 0.023 | 0.28 | 5.59 | 1.38 | 0 |
| Rattlesnake Run 1 | 1.87 | 0.004 | 0.2 | 5.54 | 1.13 | 0 |
| Rattlesnake Run 2 | 2.81 | 0.01 | 0.21 | 6.69 | 1.05 | 0 |
| U.T. Laurel Creek 1 | 1.85 | 0.006 | 0.02 | 5.21 | 1.31 | 0 |
| U.T. Laurel Creek 2 | 1.71 | 0.004 | 0.02 | 5.84 | 1.29 | 0 |
| White Hollow 1 | 1.89 | 0.017 | 0.04 | 5.15 | 1.57 | 0 |
| White Hollow 2 | 2.12 | 0.018 | 0.11 | 5.49 | 1.5 | 0 |

Medium

| Sum of Value<br>Row Labels | Sodium | Sulfate |
|---|---|---|
| #2 Store Hollow 1 | 0.964 | 11.4 |
| #2 Store Hollow 1D | 0.926 | 11.3 |
| #2 Store Hollow 2 | 0.849 | 11.1 |
| Back Fork 1 | 0.641 | 8.88 |
| Back Fork 1D | 0.637 | 8.82 |
| Back Fork 2 | 0.986 | 7.54 |
| Chestnut Oak Creek 1 | 0.56 | 4.58 |
| Chestnut Oak Creek 2 | 0.701 | 5.49 |
| Doss Fork 1 | 0.533 | 6.16 |
| Doss Fork 1D | 0.535 | 6.2 |
| Doss Fork 2 | 0.506 | 6.34 |
| E.F. PawPaw 1 | 0.738 | 11.9 |
| E.F. PawPaw 1D | 0.73 | 12 |
| E.F. PawPaw 2 | 0.773 | 11.6 |
| E.F. PawPaw O | 0.774 | 14 |
| King Rough Hollow 1 | 0.485 | 5.74 |
| King Rough Hollow 2 | 0.483 | 5.85 |
| Mudlick Hollow 1 | 0.703 | 7.17 |
| Mudlick Hollow 2 | 0.629 | 6.54 |
| PawPaw 1 | 1.61 | 25.9 |
| PawPaw 2 | 1.76 | 34.8 |
| Portercamp Branch 1 | 1.02 | 10.6 |
| Portercamp Branch 2 | 1.02 | 10.5 |
| Rattlesnake Run 1 | 0.98 | 13.5 |
| Rattlesnake Run 2 | 1.04 | 14.6 |
| U.T. Laurel Creek 1 | 0.53 | 7.66 |
| U.T. Laurel Creek 2 | 0.571 | 8.17 |
| White Hollow 1 | 0.557 | 9.24 |
| White Hollow 2 | 0.613 | 10.9 |

STEVEN L. BESHEAR
GOVERNOR

LEONARD K. PETERS
SECRETARY

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May 17, 2011

Representative Bob Gibbs
Chairman
Water Resources and Environment Subcommittee
B-370A Rayburn House Office Building
Washington, DC 20515-6261

Dear Chairman Gibbs:

I want to thank you again for the opportunity to present testimony to the subcommittee earlier this month regarding EPA's actions relative to Appalachian coal mine permitting. The second hearing on the subject on May 11 was particularly interesting, especially the testimony of Nancy Stoner, Acting Assistant Administrator for the Office of Water.

During Ms. Stoner's testimony, there were several areas where I believe further clarification is needed, and I have written to her to clarify several important issues related to EPA's permitting actions on Appalachian coal mine permitting. I would like to respectfully request that the attached letter to Ms. Stoner be submitted as part of the record related to the hearings on May 5, 2011, and May 11, 2011. I make this request because it is important to clarify several points regarding permit delays as a result of EPA's April 1, 2010, "interim final guidance." In addition, I respectfully request the accompanying documents (the spreadsheet showing EPA objections to Kentucky permits; the ECOS Interim Guidance Resolution; and the National Mining Association Memorandum Opinion) be submitted to the record, as well. These documents all serve to demonstrate the over-reaching authority of the U.S. Environmental Protection Agency in its actions related to Appalachian coal mining.

Thank you for your consideration of these requests.

Sincerely yours,

Leonard K. Peters
Secretary

Enclosure

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May 17, 2011

Ms. Nancy Stoner
Acting Assistant Administrator
Office of Water
US Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Mail Code: 4101M
Washington, DC 20460

Dear Acting Assistant Administrator Stoner:

This letter serves as a follow-up to your appearance and testimony at the May 11, 2011, Water Resources and Environment Subcommittee hearing regarding USEPA mining policies. A number of serious issues were discussed at the hearing that merit further clarification and follow-up for both USEPA and the subcommittee members. My comments in this letter have been prepared in consultation with Mr. R. Bruce Scott, Commissioner of Kentucky's Department for Environmental Protection in our Energy and Environment Cabinet.

Your testimony primarily focused on issues and processes related to the Clean Water Act (CWA) Section 404 permitting program. As you are aware, in all but less than a handful of states, the CWA 404 permitting program is administered by the United States Army Corps of Engineers (USACE). As such, the issuance of CWA 404 permits is predominantly a federal action as opposed to a delegated state action.

There was substantial discussion during the hearing regarding the Enhanced Coordination Process (ECP) that was initiated as a part of the June 11, 2009, Memorandum of Understanding (MOU) between USEPA, U.S. Department of the Army, which includes the USACE, and the U.S. Department of the Interior, which includes the Office of Surface Mining (OSM). In particular, there appeared to be conflicting information regarding how many CWA 404 permits have been issued since the June 11, 2009, ECP was initiated. As a reminder to USEPA and the subcommittee members, there were 108 pending CWA 404 applications identified to be subjected to the new ECP process. As that relates to Kentucky-specific mining operations, there were 49 operations among that list of 108 pending CWA 404 permit applications. Of those 49, one permit has been issued; 34 have been withdrawn; and 14 are pending. The ECP, which established enhanced oversight by USEPA, clearly has not increased the speed of the CWA 404 permitting process, as was testified to in the subcommittee; rather the ECP has effectively stopped the processing of those applications pending in Kentucky that have been subject to the ECP.

Ms. Nancy Stoner
May 17, 2011
Page No. 2

With this in mind, we would notify both USEPA and the subcommittee members of one observation in this regard. Please note the bottom of page 20, top of page 21, of the attached United States District Court for the District of Columbia Memorandum Opinion filed January 14, 2011, in the matter of the National Mining Association (plaintiff) v. Lisa Jackson Administrator, USEPA, Civil Action No. 10-1220 (RBW).

The Court states:

> *"Again, for reasons that mirror its finality analysis, the Court finds the plaintiff's arguments more persuasive and agrees that the plaintiff is likely to prevail on its claim that the EPA has exceeded its statutory authority. As to the MCIR Assessment, the EPA, and only the EPA, evaluates pending permits to determine if they will be subject to the EC Process. Pl.'s PI Mem. at 8. It seems clear, however, that Congress intended the EPA to have a limited role in the issuance of Section 404 permits, and that nothing in Section 404 of the Clean Water Act gives the EPA the authorization to develop a new evaluation or permitting process which expands its role. Likewise, it seems clear that with the implementation of the Guidance Memorandum the EPA has encroached upon the role carved out for the states under the Clean Water Act by setting region-wide conductivity standards. In short, the EPA has modified the Section 404 permitting scheme, authority not granted to it under the Clean Water Act, and has similarly taken an expansive role beyond what was afforded to it in determining Section 303 Water Quality Standards. Accordingly, the plaintiff has established that it will likely succeed in showing that the EPA has exceeded its statutory authority under the Clean Water Act by adopting and implementing the MCIR Assessment, the EC Process, and the Guidance Memorandum."*

As such, while this legal action is clearly still pending, the Court has suggested that USEPA has exceeded its statutory authority with respect to the matters discussed at the May 11, 2011, hearing.

A topic that unfortunately was not discussed during the May 11, 2011, hearing relates to the processing of CWA 402 permits, or NPDES permits as they are commonly referred. In the matter of CWA 402 permits, we believe that USEPA's actions have arguably been even more beyond its authority than in its oversight of the CWA 404 permitting process. As you are aware, in addition to often needing a CWA 404 permit, a coal mining operation always needs a CWA 402 permit. In that regard, the process to obtain a CWA 402 permit is even more important to a coal mining operation given that such a permit is always needed to operate, whereas a CWA 404 permit is not always required. With respect to the April 1, 2010, interim final guidance, this issue is of particular importance to state environmental protection agencies given that most states are delegated to administer the CWA 402 program, whereas less than a handful of states are delegated to administer the CWA 404 program.

Had USEPA or the subcommittee discussed the processing of CWA 402 permits post-April 1, 2010, the results would have been very informative. For example, attached is a spreadsheet listing of all CWA 402 permits that USEPA has objected to over the period January 1, 2000, to October 15, 2010. This information was provided to Kentucky by USEPA on November 5, 2010, in response to a September 30, 2010, request by Kentucky Department for Environmental Protection Commissioner R. Bruce Scott. As indicated by the spreadsheet listing, USEPA has objected to 148 proposed draft CWA 402 permits over the course of that nearly ten-year period. Of the 148, 50 (or 33.8%) of those CWA 402 permit objections have occurred since early 2009. Had this spreadsheet been further completed up to present, Kentucky alone would have added an additional 10 USEPA permit objections to the list, or 60 of the 158. Thus, nearly 40 percent of all of the CWA 402 permit objections during the past 10 years have occurred since early 2009, and this doesn't include objections that may have occurred in other states since October 15, 2010. To illuminate further what the facts actually show, at least 38 of the 60 objections that have occurred since January 20, 2009, have been for coal mining operations, and of those 38, all but 2 have occurred since April 1, 2010.

Clearly, all of the facts show that USEPA has established new requirements and oversight procedures of coal mining operations since April 1, 2010, the date consistent with the issuance of USEPA's interim final guidance for coal mining operations in Appalachia. Testimony provided at the May 11, 2011, hearing repeatedly indicated that the April 1, 2010, guidance is not binding. Of particular note, both Congressman Cravaack and Congressman Lankford (see the 2:30:16 to 2:32:20 mark of the hearing tape) specifically asked about whether a permit could be denied (objected to) as a result of the guidance, and the answer provided was no, the guidance cannot be used as the basis for such an action (paraphrased). Yet, the evidence both in terms of the data provided above and the large amount of correspondence sent by USEPA in response to proposed draft CWA 402 permits for USEPA review, indicate that the April 1, 2010, EPA interim final guidance has in fact been the basis for formal USEPA objections to CWA 402 proposed draft permits by delegated states in at least 36 instances, and has held up the permitting actions in dozens of other instances.

With this in mind, we would notify both USEPA and the subcommittee members of the attached resolution from the Environmental Council of States (ECOS), which was unanimously adopted March 30, 2011, by all of the state environmental agency ECOS members. ECOS clearly states that USEPA should not use its objection authority to object to proposed state draft permits when based entirely or in part on guidance. Testimony provided by Ms. Teresa Marks at the May 5, 2011, hearing on the behalf of ECOS outlines the ECOS position in this matter. Please keep in mind that ECOS is made up of states that have a variety of views and perspectives regarding how best to address environmental protection issues. The fact that ECOS is unanimous in its position relative to how EPA functions with respect to its use of guidance and its objection authority shows the bipartisan nature of this issue. Specific action should be considered with how USEPA uses guidance and its objection authority. We would remind everyone that while the specific issue at hand relates to coal mining and a handful of states, the next instance could be on another issue or in another state, which in fact has already occurred. In that regard, any action should consider how USEPA functions as a whole (air, waste, water, etc.) in its use of guidance and its objection powers. For example, currently, USEPA is insulated from judicial challenge in making a permit objection and is under no time obligation to make a final agency determination, effectively shutting down the state-delegated permitting process with no recourse available to the state or the permit applicant. This must change. If requested, we would be willing to work with Congress to provide recommended changes to provide appropriate balance to the state-federal relationship and to ensure that future overstepping by USEPA does not occur.

Finally, we would remind USEPA that Kentucky has been proactively working with USEPA Region IV for approximately two years on revising our CWA 402 permits for coal mining operations, and in particular in the last 8 months in an effort to resolve the 21 currently pending proposed permit objections. In so doing, several dozen pending permit applications have been temporarily placed on hold while these most recent discussions have cooperatively been occurring between Kentucky and the

Ms. Nancy Stoner
May 17, 2011
Page No. 4

USEPA staff in Atlanta. To that end, Kentucky has proposed numerous changes to its individual CWA 402 permits to the full satisfaction of all of Region IV's concerns. In particular, Kentucky has developed a biological approach that will measure and limit the actual site-specific effect (rather than EPA's guidance conductivity benchmark, which has no force of law and is intended for region-wide consideration rather than site-specific use) of a coal mining operation consistent with applicable statutory and regulatory requirements to implement Kentucky's state narrative water quality standard for conductivity to protect and maintain water quality. In light of USEPA's clear testimony before the committee on May 11, 2011, that the USEPA guidance cannot be the basis for permit objection, we therefore look forward to Region IV's timely acceptance of our revised draft permits. We have worked extensively with regional staff to resolve all of the issues expressed by USEPA Region IV so that the current impasse can be resolved to the satisfaction of all parties.

I want to inform you that I am sending this letter to Chairman Bob Gibbs and others noted below.

Sincerely yours,

Leonard K. Peters

cc: Rep. Bob Gibbs, Chairman, Water Resources and Environment Subcommittee
Ms. Lisa Jackson, Administrator, USEPA
Ms. Gwen Keyes-Fleming, Regional Administrator, USEPA Region IV
Mr. Steve Brown, Executive Director, Environmental Council of the States
Rep. Nick Rahall, Ranking Member, House Transportation and Infrastructure Committee

EPA Specific Permit Obejction - CY2000 to present

| Region | Name of Facility in receipt of specific EPA objection | NPDES permit number | Date of Specific Permit Objection | Date of Permit Issuance following specific permit objection | Permit was issued by State or EPA? | If EPA issued, when did permit & enforcement oversight revert back to state? | Comments |
|---|---|---|---|---|---|---|---|
| R1 | Hartford Quechee WWTF, VT | VT0100978 | 1/15/2010 | Not yet issued | N/A | NA | |
| R1 | Beacon Falls, CT | CT0101061 | 6/18/2010 | Not yet issued | N/A | NA | |
| R3 | Rehoboth Beach WWTP | DE0020028 | 10/10/2003 | 9/21/2005 | State | N/A | |
| R3 | Brockway Area SA | PA0028428 | 9/21/2009 | Not yet Issued | State | N/A | Draft permit |
| R3 | Berwick Area JSA | PA0023248 | 11/14/2000 | 8/29/2001 | State | N/A | |
| R3 | Mahanoy City MA | PA0070041 | 12/21/2000 | 8/21/2001 | State | N/A | |
| R3 | Chalfont-New Britain Twp | PA0025917 | 4/17/2001 | 1/10/2002 | State | N/A | |
| R3 | AK Steel Corp | PA0006343 | 11/21/2000 | 5/1/2002 | State | N/A | |
| R3 | City of Pittsburgh | PA0217611 | 12/11/2000 | 4/22/2004 | State | N/A | |
| R3 | Shenango Inc - Neville | PA0002437 | 2/14/2002 | 9/18/2002 | State | N/A | |
| R3 | Southwest Delaware County Mun | PA0027383 | 3/20/2002 | 3/11/2003 | State | N/A | |
| R3 | Wheatland Tube Co. - Sharon | PA0006378 | 11/23/2001 | 7/29/2003 | State | N/A | |
| R3 | North East Boro | PA0023043 | 4/6/2001 | 7/10/2003 | State | N/A | |
| R3 | New Freedom Boro Auth | PA0043257 | 12/12/2003 | 3/30/2004 | State | N/A | |
| R3 | Upper Moreland-Hatboro JSA | PA0025976 | 6/11/2001 | 9/26/2006 | State | N/A | |
| R3 | Orion Power Midwest - Chesw | PA0001627 | 2/14/2002 | 8/6/2007 | State | N/A | |
| R3 | Lemoyne Boro STP | PA0026441 | 4/25/2009 | 8/21/2009 | State | N/A | |
| R3 | A&G Coal Co.-Ison Rock Ridge | VA1003841 | 12/10/2009 | Not yet Issued | State | N/A | Draft permit |
| R3 | Tenaska Virginia Generating Station | VA0090905 | 2/25/2002 | 5/20/2002 | State | N/A | |
| R3 | Greif Brothers | VA0005408 | 9/25/2001 | 6/28/2002 | State | N/A | |
| R3 | Argus Energy - Copley Trace No. 2 | WV1020013 | 5/27/2010 | Not yet Issued | N/A | N/A | Pending |
| R3 | Alex Energy - Kayford No. 5 | WV1022113 | 12/21/2009 | see Comments | N/A | N/A | Withdrawn |
| R3 | Catenary Coal - Samples Mine | WV1014684 | 5/27/2010 | see Comments | N/A | N/A | Application for Modification Denied |
| R3 | Coal-Mac DBA Phoenix Coal | WV0068764 | 5/27/2010 | see Comments | N/A | N/A | Application for Modification Denied |
| R3 | Mingo Logan Coal - Wolfpen/2-C | WV0005690 | 5/27/2010 | see Comments | N/A | N/A | Application for Modification Denied |
| R3 | Southern WV Resources - Tug | WV0044172 | 5/27/2010 | see Comments | N/A | N/A | Application for Modification Denied |
| R3 | Consolidation Coal Co. | WV0050598 | 2/9/2010 | Not yet Issued | N/A | N/A | Pending |
| R3 | Mingo Logan Coal - Ancillary | WV0066737 | 5/27/2010 | see Comments | N/A | N/A | Application for Modification Denied |
| R3 | Jacks Branch Coal Co. | WV0093929 | 10/8/2010 | Not yet Issued | N/A | N/A | Pending |
| R3 | Mingo Logan Coal - Ardrossan | WV0096369 | 5/27/2010 | see Comments | N/A | N/A | Application for Modification Denied |
| R3 | Catenary Coal - Left Fork | WV0096962 | 5/27/2010 | see Comments | N/A | N/A | Application for Modification Denied |
| R3 | Apogee Coal - Ruffner Mine | WV0099520 | 5/27/2010 | see Comments | N/A | N/A | Application for Modification Denied |
| R3 | Mingo Logan Coal - Left Fork 2 | WV1004956 | 5/27/2010 | see Comments | N/A | N/A | Application for Modification Denied |
| R3 | Maple Coal - Sycamore, N & S | WV1009311 | 8/10/2010 | Not yet Issued | N/A | N/A | Pending |
| R3 | ICG Eastern - Evergreen Mining | WV0094889 | 5/27/2010 | see Comments | N/A | N/A | Application for Modification Denied |
| R3 | Mingo Logan Coal - Monclo | WV0065889 | 5/27/2010 | see Comments | N/A | N/A | Application for Modification Denied |
| R3 | Mingo Logan Coal - Hobet Gut | WV1011120 | 5/27/2010 | see Comments | N/A | N/A | Application for Modification Denied |
| R3 | * Hobet Mining - Spruce No. 1 | WV1017021 | 7/29/2002 | 8/7/2007 | State | N/A | * Objection withdrawn, 12/3/2002, renewed in 2007 |
| R3 | Weirton Steel Corp | WV0003336 | 12/2/2002 | 3/4/2003 | State | N/A | |
| R4 | Timber Energy (Telogia Power) | FL0039951 | 4/15/2003 | 1/28/2010 | State | N/A | |

| Region | Name of Facility in receipt of specific EPA objection | NPDES permit number | Date of Specific Permit Objection | Date of Permit Issuance following specific permit objection | Permit was issued by State or EPA? | If EPA issued, when did permit & enforcement oversight revert back to state? | Comments |
|---|---|---|---|---|---|---|---|
| | EPA Specific Permit Obejction - CY2000 to present | | | | | | |
| R4 | Rayonier Inc | FL0000701 | 9/30/2003 | 12/1/2004 | State | N/A | |
| R4 | Premier Chemical | FL0002607 | 7/28/2003 | 6/10/2008 | State | N/A | |
| R4 | Laurel Mountain Resources | KY0108715 | 9/16/2010 | Not yet issued | N/A | N/A | |
| R4 | Labco LLC | KY0105953 | 9/28/2010 | Not yet issued | N/A | N/A | |
| R4 | Matt/Co Inc | KY0107212 | 9/29/2010 | Not yet issued | N/A | N/A | |
| R4 | Clintwood Elkhorn Coal Co. | KY0107310 | 9/29/2010 | Not yet issued | N/A | N/A | |
| R4 | Enterprise Mining Co LLC | KY0107808 | 9/29/2010 | Not yet issued | N/A | N/A | |
| R4 | PIA Co Inc | KY0107603 | 9/29/2010 | Not yet issued | N/A | N/A | |
| R4 | Nally & Hamilton Enterprises | KY0042765 | 9/29/2010 | Not yet issued | N/A | N/A | |
| R4 | Sandlick Coal Company | KY0108561 | 9/29/2010 | Not yet issued | N/A | N/A | |
| R4 | Sidney Coal Company | KY0107085 | 9/29/2010 | Not yet issued | N/A | N/A | |
| R4 | Matt/Co Inc | KY0107778 | 9/29/2010 | Not yet issued | N/A | N/A | |
| R4 | Matt/Co Inc | KY0107760 | 9/29/2010 | Not yet issued | N/A | N/A | |
| R4 | CNA Holdings | NC0004952 | 11/24/2008 | 4/24/2009 | State | N/A | |
| R4 | Blue Ridge Paper | NC0000272 | 2/22/2010 | 5/26/2010 | State | N/A | |
| R4 | AL Phase II MS4 General Permit | ALR040000 | 8/9/2010 | Not yet issued | N/A | N/A | |
| R4 | LCWSC/Clinton- Joanna WWTP | SC0037974 | 8/18/2004 | 12/1/2005 | EPA | 6/1/2010 | |
| R4 | City of Lancaster/Catawba River WWTP | SC0046892 | 8/18/2004 | 9/30/2005 | EPA | Pending | Administratively continued, State in process of renewing. |
| R4 | Town of Moncks Corner WWTP | SC0021598 | 8/18/2004 | 3/31/2006 | EPA | N/A | |
| R4 | Town of Batesburg-Leesville WWTP | SC0024465 | 8/18/2004 | 12/1/2005 | EPA | 4/1/2010 | |
| R4 | Michelin North America/Sandy Springs | SC0026701 | 8/18/2004 | 12/1/2005 | EPA | 11/1/2008 | |
| R4 | ECW&SA/Johnston #1 Plant | SC0025691 | 8/18/2004 | 5/1/2006 | EPA | 3/1/2010 | |
| R4 | City of Columbia Metro WWTP | SC0020940 | 8/25/2004 | 9/1/2009 | EPA | 11/1/2010 | |
| R4 | Greenwood Metro District/Wilson Creek WWTP | SC0021709 | 8/25/2004 | 2/1/2006 | EPA | 6/1/2009 | |
| R4 | Laurens CPW/City of Laurens | SC0020702 | 7/20/2004 | 2/1/2006 | EPA | 1/1/2010 | |
| R4 | Timmonsville WWTP | SC0025356 | 8/26/2004 | 8/31/2006 | EPA | N/A | |
| R4 | Lexington/Coventry Woods WWTP | SC0026735 | 9/1/2004 | 5/1/2006 | EPA | 2/1/2010 | |
| R4 | Alpine Utilities WWTP | SC0029483 | 9/3/2004 | 12/1/2005 | EPA | 7/1/2010 | |
| R4 | WCRSA/Grove Creek WWTP | SC0024317 | 9/13/2004 | 5/31/2006 | EPA | N/A | |
| R4 | Town of Ninety Six WWTP | SC0036048 | 9/22/2004 | 6/22/2006 | EPA | N/A | |
| R4 | Ware Shoals/Dairy Street WWTP | SC0020214 | 9/22/2004 | 2/2/2006 | EPA | N/A | |
| R4 | Town of Wagener WWTP | SC0026204 | 9/29/2004 | 2/1/2006 | EPA | 12/1/2010 | |
| R4 | Honeywell Nylon, LLC/Columbia Site | SC0003557 | 8/18/2004 | 9/25/2008 | EPA | N/A | |
| R4 | Milliken Abbeville Plant | SC0000353 | 8/18/2004 | 3/1/2006 | EPA | 6/1/2010 | |
| R4 | SCE&G/Cope Station | SC0045772 | 9/22/2004 | 8/1/2006 | EPA | 11/1/2009 | |
| R4 | Easley/Middle Branch WWTP | SC0039853 | 9/29/2004 | 7/28/2006 | EPA | N/A | |
| R4 | HSL, Inc. | SC0001155 | 7/23/2004 | see Comments | EPA | N/A | Facility Closed. |
| R4 | Velcorex, Inc. | SC0043419 | 8/18/2004 | 11/1/2006 | State | 11/1/2006 | |
| R5 | Isabella County Landfill | MI0054003 | 6/4/2004 | 5/17/2005 | EPA (Tribal) | N/A | |
| R5 | TPI Petroleum, Inc. | MI0056537 | 11/5/2001 | 9/3/2002 | EPA | N/A | Discharge terminated, permit inactive since 11/9/06 |

| EPA Specific Permit Obejction - CY2000 to present | | | | | | | |
|---|---|---|---|---|---|---|---|
| Region | Name of Facility in receipt of specific EPA objection | NPDES permit number | Date of Specific Permit Objection | Date of Permit Issuance following specific permit objection | Permit was issued by State or EPA? | If EPA issued, when did permit & enforcement oversight revert back to state? | Comments |
| R5 | Dayton Power and Light | OH0004316 | 9/29/2010 | Not yet Issued | N/A | N/A | |
| R5 | Wausau-Mosinee Paper Corporation | WI0003671 | 7/8/2005 | 9/7/2005 | State | N/A | |
| R5 | US Steel Gary Works | IN0000281 | 10/16/2007 | 1/22/2010 | State | N/A | |
| R5 | General Permit Indv. Sewage Treatment Systems | ILG4 | 11/21/2007 | Not yet Issued | N/A | N/A | EPA is preparing to federalize this permit |
| R6 | Barling | AR0048801 | 6/10/2003 | 10/31/2003 | State | N/A | |
| R6 | Benton Packing Company | AR0049506 | 06/20/03 | 9/30/2003 | State | N/A | |
| R6 | Bentonville | AR0022403 | 06/20/03 | 11/30/2003 | State | N/A | |
| R6 | Clarksville | AR0022187 | 06/20/03 | 11/30/2003 | State | N/A | |
| R6 | Eastman Chemical Company | AR0035386 | 06/20/03 | 10/31/2003 | State | N/A | |
| R6 | El Dorado Chemical | AR0000752 | 2/3/2006 | 2/28/2007 | State | N/A | |
| R6 | El Dorado Joint Pipeline | AR0050296 | 02/03/06 | 2/28/2007 | State | N/A | |
| R6 | International Paper - Pine Bluff | AR0001970 | 11/15/04 | 05/31/05 | State | N/A | |
| R6 | Jonesboro - West Plant | AR0037907 | 09/10/04 | 01/31/05 | State | N/A | |
| R6 | Maumelle SID #500 | AR0033626 | 06/10/03 | 09/30/03 | State | N/A | |
| R6 | Osage Basin | AR0050024 | 4/9/2004 | 12/31/2004 | State | N/A | |
| R6 | NACA | AR0050024 | 1/16/2009 | 10/7/2009 | State | N/A | |
| R6 | Russellville | AR0021768 | 07/28/04 | 02/28/05 | State | N/A | |
| R6 | Sand and Gravel and Rock Quarry Facilities | ARG5000000 | 03/12/04 | 05/31/05 | State | N/A | |
| R6 | Small MS4 | ARR040000 | 09/25/03 | 12/31/03 | State | N/A | |
| R6 | Springdale | AR0022063 | 10/30/03 | 02/29/04 | State | N/A | |
| R6 | Shell Oil Company* | TX0004863 | 4/30/2004 | 7/29/2004 | State | N/A | |
| R6 | City of Seguin | TX0022365 | 3/13/2002 | 3/3/2005 | State | N/A | |
| R6 | K-3 Resources (dba Biosolids) | TXL005009 | 7/26/2002 | 9/10/2002 | State | N/A | |
| R6 | Petroleum Bulk Storage* | TXG340000 | 8/23/2004 | 4/23/2007 | State | N/A | |
| R6 | City of Beeville* | TX0113859 | 4/16/2002 | 3/1/2005 | State | N/A | |
| R6 | Temple Inland* | TX0102156 | 9/9/2003 | 8/4/2005 | State | N/A | |
| R6 | Harris County MUD* | TX0100161 | 4/16/2002 | 10/29/2004 | State | N/A | |
| R6 | City of Henderson | TX0091910 | 10/1/2002 | 9/27/2004 | State | N/A | |
| R6 | North Mission Glen MUD* | TX0087271 | 10/15/2002 | 9/30/2005 | State | N/A | |
| R6 | Cibolo Creek Municipal Authority | TX0077232 | 11/22/2002 | 4/25/2005 | State | N/A | |
| R6 | City of Copperas Cove* | TX0069850 | 3/14/2002 | 7/23/2002 | State | N/A | |
| R6 | City of Seagoville* | TX0054526 | 3/27/2002 | 5/29/2002 | State | N/A | |
| R6 | City of Houston | TX0034886 | 3/6/2002 | 12/29/2005 | State | N/A | |
| R6 | City of Houston* | TX0026875 | 8/1/2002 | 6/24/2003 | State | N/A | |
| R6 | City of Fort Worth* | TX0047295 | 12/21/2001 | 11/28/2006 | State | N/A | |
| R6 | City of Corpus Christi* | TX0047082 | 1/7/2002 | 11/12/2002 | State | N/A | |
| R6 | City of Austin* | TX0046981 | 1/9/2002 | 5/31/2005 | State | N/A | |
| R6 | ARKLA | LA0122432 | 6/22/2007 | Not yet Issued | EPA | N/A | EPA is preparing to federalize this permit |
| R6 | City of Garland | TXS001001 | 3/10/2005 | 12/22/2005 | State | N/A | |
| R6 | City of San Antonio TXDOT, SAWS | TXS001901 | 10/17/2003 | 9/28/2007 | State | N/A | |

| EPA Specific Permit Obejction - CY2000 to present | | | | | | | |
|---|---|---|---|---|---|---|---|
| Region | Name of Facility in receipt of specific EPA objection | NPDES permit number | Date of Specific Permit Objection | Date of Permit Issuance following specific permit objection | Permit was issued by State or EPA? | If EPA issued, when did permit & enforcement oversight revert back to state? | Comments |
| R6 | City of Bridge City | TX0025500 | 2/7/2002 | Not yet Issued | N/A | N/A | Expired as of 3/1/2001 |
| R6 | City of Midlothian* | TX0025011 | 4/2/2002 | 11/12/2002 | State | N/A | |
| R6 | City of Port Lavaca* | TX0047562 | 10/21/02 | 12/2/2002 | State | N/A | |
| R6 | Steely Lumber* | TX0123421 | 9/2/2003 | 6/26/2007 | State | N/A | |
| R6 | City of Longview* | TX0022217 | 10/21/2001 | 5/7/2002 | State | N/A | |
| R6 | San Jacinto River Authority | TX0054186 | 1/6/2006 | 4/12/2006 | EPA | N/A | In Appeal. |
| R7 | Waterloo, IA | IA0042650 | 11/1/2009 | 3/1/2010 | State | N/A | |
| R7 | Johnson County, KS (JoCo) - Nelson | KS0055492 | 5/19/2006 | Not yet issued | N/A | N/A | Administratively Continued |
| R7 | JoCo - Douglas Smith | KS0119601 | 11/2/2009 | Not yet issued | N/A | N/A | Administratively Continued |
| R7 | JoCo - Tomahawk | KS0055484 | 11/2/2009 | Not yet issued | N/A | N/A | Administratively Continued |
| R7 | St Charles, MO | MO0058351 | 5/1/2008 | 2/13/2009 | State | N/A | |
| R8 | Pumpkin Creek Watershed General Permit for CBM | WYG280000 | 11/13/2009 | Not yet issued | N/A | NA | Pending |
| R8 | Willow Creek Watershed General Permit for CBM | WYG290000 | 11/13/2009 | Not yet issued | N/A | NA | Pending |
| R10 | SHORELINE SANITARY DISTRICT TREATMENT FACIITY | OR0022550 | 3/9/2009 | 11/19/2009 | State | N/A | |
| R10 | CITY OF CHILOQUIN WWTP | OR0020320 | 5/1/2009 | Not yet issued | N/A | N/A | |
| R10 | CITY OF COBURG WASTEWATER RECLAMATION FACILITY | OR0044628 | 3/20/2009 | 7/20/2009 | State | N/A | |
| R10 | CITY OF PORTLAND BUREAU OF ENVIRONMENTAL SERVICE FA | OR0026905 | 4/20/2006 | Not yet issued | N/A | N/A | |
| R10 | CITY OF AUMSVILLE SEWAGE TREATMENT PLANT | OR0022721 | 6/1/2009 | 2/8/2010 | State | N/A | |
| R10 | CITY OF TILLAMOOK WWTP | OR0020664 | 3/2/2009 | 11/23/2009 | State | N/A | |
| R10 | SUNDOWN SANITARY DISTRICT TREATMENT FACILITY | OR0027219 | 3/2/2009 | 11/16/2009 | State | N/A | |
| R10 | USDA\US FOREST SERVICE COLUMBIA RIVER GORGE NATION/ | OR0040410 | 3/2/2009 | 11/19/2009 | State | N/A | |
| R10 | WESTPORT SEWER SERVICE DISTRICT TREATMENT PLANT | OR0031496 | 3/2/2009 | Not yet issued | N/A | N/A | |
| R10 | CITY OF WARRENTON TREATMENT FACILITY | OR0020877 | 3/2/2009 | Not yet issued | N/A | N/A | |
| R10 | CITY OF SPOKANE RIVERSIDE PARK WATER RECLAMATION FA | WA0024473 | 12/3/2007 | Not yet issued | N/A | N/A | |
| R10 | LIBERTY LAKE SEWER AND WATER DISTRICT | WA0045144 | 12/3/2007 | Not yet issued | N/A | N/A | |
| R10 | INLAND EMPIRE PAPER COMPANY | WA0000892 | 12/3/207 | Not yet issued | N/A | N/A | |
| R10 | KAISER ALUMINUM FABRICATED PRODUCTS LLC | WA0000892 | 12/3/2007 | Not yet issued | N/A | N/A | |
| R10 | CITY OF PORTLAND COLUMBIA BOULEVARD WWTP | OR0026905 | 4/6/2006 | Not yet issued | N/A | N/A | |

ECOS

Resolution Number 11-1
Approved March 30, 2011
Alexandria, Virginia

As certified by
R. Steven Brown
Executive Director

**OBJECTION TO U.S. ENVIRONMENTAL PROTECTION AGENCY'S IMPOSITION OF INTERIM GUIDANCE, INTERIM RULES, DRAFT POLICY AND REINTERPRETATION POLICY**

WHEREAS, protection of public health and the environment is among the highest priorities of governments, requiring a united and consistent effort at all levels of government; and

WHEREAS, U.S. Congress has provided by statute for delegation, authorization, or primacy (hereinafter referred to as delegation) of certain federal program responsibilities to states; and

WHEREAS, states that have received delegation have demonstrated to the U.S. Environmental Protection Agency (U.S. EPA) that they have adopted laws, regulations, and policies at least as stringent as federal laws, regulations, and policies; and

WHEREAS, states have developed and demonstrated the capability to maintain existing and assume new delegations; and

WHEREAS, U.S. Congress in environmental statutes and the Administrative Procedure Act (APA) establishes a formal rulemaking process to provide a mechanism for public comment, offering amendments, or allowing states to object, and providing standards for judicial review of agency actions; and

WHEREAS, it is a fundamental responsibility of U.S. EPA to work cooperatively and collaboratively with the states as co-regulators to ensure that regulations and programs can be effectively implemented; and

WHEREAS, some states are required by state law to conduct their own rulemaking prior to implementing federal regulations; and

WHEREAS, some states are prohibited by state law from implementing any requirement more stringent than the federal requirement; and

WHEREAS, the states have limited options to challenge U.S. EPA imposition of objection authority based on interim guidance, interim rules, draft policy or reinterpretation policy, and the Courts are inconsistent in their findings for judicial review in these cases; and

WHEREAS, the processes, rather than the environmental substance of the underlying rules, U.S. EPA may be using to impose interim guidance, interim rules, draft policy or reinterpretation policy, may result in a state agency being forced to choose whether it will comply with either U.S. EPA's policy or its own state laws; and

WHEREAS, U.S. EPA interim guidance, interim rules, draft policy or reinterpretation policy may not be legally binding and states using these as the basis for issuing permits or other actions may result in delays and potential job losses; and

WHEREAS, U.S. EPA's continued imposition of interim guidance, interim rules, draft policy or reinterpretation policy may lead to uncertainty regarding actions taken by state and federal regulatory bodies; and

WHEREAS, ECOS published an ECOS Green Report, "Recent U.S. EPA Positions on Interim Guidance, Rules, and Policies", in December 2010 that presents known cases of these policies and discusses some of their implications for state and federal roles in implementing national environmental policies.

NOW, THEREFORE, BE IT RESOLVED THAT THE ENVIRONMENTAL COUNCIL OF THE STATES:

Believes that U.S. EPA should adhere to the requirements of federal environmental statutes, the APA and its own guidance governing rulemaking to provide for adequate public notice and comment on proposed and final actions;

Believes that U.S. EPA should engage the states as co-regulators prior to and during the rulemaking process seeking early, meaningful, and substantial involvement from states to ensure high quality regulations that can be effectively implemented by delegated states;

Believes that U.S. EPA should minimize the use of interim guidance, interim rules, draft policy and reinterpretation policy and eliminate the practice of directing its regional or national program managers to require compliance by states with the same in the implementation of delegated programs;

Urges U.S. EPA, when interim guidance, interim rules, draft policy or reinterpretation policy is deemed necessary, to consult with states and require its regional and national program managers at the earliest possible opportunity to engage in meaningful and consultative discussion with each of their states about the content of interim guidance, interim rules, draft policy or reinterpretation policy and the practicalities of implementation;

Urges U.S. EPA to make its guidance, rules and policies final prior to seeking state adherence and implementation;

Believes U.S. EPA should not use its objection authority when based entirely or in part on interim guidance, interim rules, draft policy or reinterpretation policy;

Requests that for formal objections to state-issued permits, U.S. EPA modify its processes to designate that its objection is a final agency determination subject to judicial review;

Further requests that U.S. EPA establish firm and timely deadlines for it to issue or deny those permits to which it has objected; and

Request that a copy of this resolution be transmitted to the appropriate U.S. Senate and House of Representatives committees and to the U.S. EPA Administrator.

**UNITED STATES DISTRICT COURT**
**FOR THE DISTRICT OF COLUMBIA**

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| NATIONAL MINING ASSOCIATION,<br><br>Plaintiff,<br><br>v.<br><br>LISA JACKSON Administrator,<br>U.S. ENVIRONMENTAL PROTECTION AGENCY, et al.,<br><br>Defendants,<br><br>SIERRA CLUB et al.,<br><br>Defendant-Intervenors. | ) | Civil Action No. 10-1220 (RBW) |

**MEMORANDUM OPINION**

The plaintiff brings this action against the federal defendants pursuant to the Clean Water Act, 33 U.S.C. § 1251 (2006), the Surface Mining Control and Reclamation Act, 30 U.S.C. § 1201 (2006), and the Administrative Procedure Act ("APA"), 5 U.S.C. § 702 (2006), challenging a series of memoranda and a detailed guidance released by the Environmental Protection Agency ("EPA"). The parties appeared before the Court on December 15, 2010, for argument on the federal defendants' motion to dismiss, Defendants' Motion to Dismiss ("Defs.' Mot. to Dismiss"), and the plaintiff's motion for a preliminary injunction, Plaintiff's Motion for a Preliminary Injunction ("Pl.'s PI Mot."). For the reasons that follow, the Court denies both the motion to dismiss and the motion for a preliminary injunction.[1]

[1] In deciding these two motions, the Court also considered: the Complaint for Declaratory and Injunctive Relief ("Compl."); the Defendants' Memorandum in Support of their Motion to Dismiss ("Defs.' Mem. re: Dismiss"); the Plaintiff National Mining Association's Memorandum in Opposition to Defendants' Motion to Dismiss ("Pl.'s Opp'n re: Dismiss"); the United States' Reply Memorandum in Support of its Motion to Dismiss
(Continued . . . )

## I. Statutory Background

This section summarizes the relevant Clean Water Act permit granting scheme.

Clean Water Act Section 404 Permits

Section 404 permits are issued by the United States Army Corps of Engineers ("Corps") "for the discharge of dredged and fill material into navigable waters at specified disposal sites." 33 U.S.C. § 1344(a). The Corps has sole authority to issue Section 404 permits, but in doing so it must apply guidelines that it develops in conjunction with the EPA.[2] Id. § 1344(b). In addition to providing the EPA with the responsibility to develop the guidelines in conjunction with the Corps, the Clean Water Act grants the EPA authority to prevent the Corps from authorizing certain disposal sites.[3] Id. § 1344(c). In the absence of a specific regulatory exception, the Corps must reach a decision on a pending application for a Section 404 permit no later than 60 days after receipt of the application for the permit. See 33 C.F.R. § 325.2(d)(3) (2010) (providing that "[d]istrict engineers will decide on all applications not later than 60 days after receipt of a complete application, unless" one of six exceptions applies).

(. . . continued)
("Defs.' Reply re: Dismiss"); the Plaintiff's Memorandum in Support of a Motion for Preliminary Injunction ("Pl.'s PI Mem."); the United States' Memorandum in Opposition to National Mining Association's Motion for a Preliminary Injunction ("Defs.' PI Opp'n"); the Plaintiff National Mining Association's Reply Memorandum in Support of Motion for Preliminary Injunction ("Pl.'s PI Reply"); the United States' Surreply Brief in Opposition to the National Mining Association's Motion for a Preliminary Injunction ("Defs.' PI Surreply"); and the Memorandum of Sierra Club et al. in Opposition to the Plaintiff's Motion for a Preliminary Injunction ("Def. Ints.' PI Opp'n").

2 The EPA-promulgated 404(b)(1) guidelines, codified at 40 C.F.R. Part 230, guide the Corps' review of the environmental effects of proposed disposal sites. The guidelines provide that "[n]o modifications to the basic application, meaning, or intent of these guidelines will be made without rulemaking by the Administrator under the Administrative Procedure Act." 40 C.F.R. § 230.2(c) (emphasis added).

3 To exercise its authority to prevent the Corps from authorizing a particular dumpsite, known as the 404(c) veto authority, the EPA must determine, after notice and an opportunity for public hearing, that certain unacceptable environmental effects would occur if the disposal site were approved by the Corps and granted a permit.

Clean Water Act Section 402 Permits

Known as National Pollutant Discharge Elimination System ("NPDES") permits, Section 402 permits are typically issued by states for the discharge of non-dredged and non-fill material. 33 U.S.C. § 1342(a)(5). These permits govern pollutants that are assimilated into receiving waters by establishing limits placed on the make-up of wastewater discharge. Once the EPA approves a state permitting program, states have exclusive authority to issue NPDES permits, although thc EPA does have limited authority to review the issuance of such permits by states. 33 U.S.C. § 1342(d). All of the Appalachian States allegedly impacted by the EPA actions at issue in this litigation (Kentucky, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia) have EPA-approved Section 402 permit authority.

Clean Water Act Section 303 Water Quality Standards

Section 303 of the Clean Water Act allocates primary authority for the development of water quality standards to the states. 33 U.S.C. § 1313. A water quality standard designates uses for a particular body of water and establishes criteria for protecting and maintaining those uses. 40 C.F.R. § 131.2 (2010). These standards can be expressed as a specific numeric limitation on pollutants or as a general narrative statement. See 40 C.F.R. § 131.3(b). While states have the responsibility to develop the water quality standards, the EPA reviews the standards for approval. 40 C.F.R §§ 131.4, 131.5. The EPA may promulgate water quality standards to the exclusion of a state only if (1) it determines that a state's proposed new or revised standard does not measure up to the Clean Water Act's requirements and the state refuses to accept EPA-proposed revisions, or (2) a state does not act, but in the EPA's view a new or revised standard is necessary. 33 U.S.C. § 1313(a)(2).

## II. Factual Background[4]

Plaintiff National Mining Association ("NMA") alleges that recent actions taken by the EPA and the Corps have unlawfully obstructed the Clean Water Act permitting processes for coal mining. Complaint ("Compl.") ¶ 2. The plaintiff identifies two series of documents that it asserts unlawfully changed the established permitting process: (1) the June 11, 2009 Enhanced Coordination Process ("EC Process") Memoranda, and (2) the April 1, 2010 Detailed Guidance Memorandum ("Guidance Memorandum"). Id. The plaintiff represents that its member companies are "not seeking to shirk their responsibilities under any environmental protection laws or regulations; rather, they are merely asking [the] EPA and the Corps to regulate" within the bounds of the law. Pl.'s PI Mem. at 41-42.

The plaintiff asserts that the EC Process memoranda formalized an "extraregulatory" practice that commenced in January 2009. Id. at 7. At that time, the EPA issued a series of letters to the Corps raising questions about the legality of Section 404 permits that, the plaintiff claims, the Corps was poised to issue imminently. Id. According to the plaintiff, the EC Process memoranda then "imposed substantive changes to the Section 404 permitting process by creating a new level of review by [the] EPA and an alternate permitting pathway not contemplated by the current regulatory structure." Id. The plaintiff represents that the EC Process utilizes the Multi-Criteria Integrated Resource Assessment ("MCIR Assessment") to screen pending Section 404 permits and determine which of those pending permits will proceed for standard review by the Corps and which will be subject to the EC process. Id. at 8. The plaintiff contends that once a permit is designated for the EC Process, it faces a burdensome review process wholly different

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[4] The following facts are drawn from the allegations contained in the plaintiff's complaint and in the plaintiff's memorandum supporting its motion for a preliminary injunction.

than that contemplated by the Clean Water Act.[5] Id. Ultimately, the EPA announced, in September 2009, that through the MCIR Assessment it had identified 79 coal-related pending Section 404 permits that would be subjected to the EC process. Id. at 9.

Then, in April 2010, the EPA released its Guidance Memorandum in which, the plaintiff asserts, the EPA "made sweeping pronouncements regarding the need for water quality-based limits" in Section 402 and 404 permits. Id. The plaintiff maintains that the Guidance (1) effectively established a region-wide water quality standard based on conductivity levels it associated with adverse impacts to water quality, (2) was being used by the EPA to cause indefinite delays in the permitting process, and (3) caused various permitting authorities to insert the conductivity level into pending permits. Id. at 9-10. Further, the EPA used the Guidance to reopen previously issued permits to impose the conductivity limit, which, the plaintiff alleges "halt[s mining] projects in their tracks." Id. at 10-11. In contrast to the MCIR Assessment and the EC process, which apply only to pending Section 404 permits, the Guidance covers both Section 402 and 404 permits associated with surface mining projects in Appalachia. Defs.' Mem. re: Dismiss at 17 n.7.

### III. The Defendants' Motion to Dismiss

A. Standard of Review

Rule 12(b)(1) of the Federal Rules of Civil Procedure provides for the dismissal of claims for which the complaint does not set forth allegations sufficient to establish the court's jurisdiction over the subject matter of the claims presented. Fed. R. Civ. P. 12(b)(1). In deciding a motion to dismiss challenging the Court's subject matter jurisdiction under Rule 12(b)(1), a

[5] The plaintiff alleges that the EC process adds a minimum of 60 days, and perhaps many months, to the Section 404 review process.

court "must accept as true all of the factual allegations contained in the complaint" and draw all reasonable inferences in favor of the plaintiff, Brown v. District of Columbia, 514 F.3d 1279, 1283 (D.C. Cir. 2008), but courts are "not required . . . to accept inferences unsupported by the facts or legal conclusions that are cast as factual allegations." Rann v. Chao, 154 F. Supp. 2d 61, 64 (D.D.C. 2001). Further, the "court may consider such materials outside the pleadings as it deems appropriate to resolve the question whether it has jurisdiction in the case." Scolaro v. D.C. Bd. of Elections & Ethics, 104 F. Supp. 2d 18, 22 (D.D.C. 2000). Ultimately, however, the plaintiff bears the burden of establishing the Court's jurisdiction, Rasul v. Bush, 215 F. Supp. 2d 55, 61 (D.D.C. 2002), and where subject matter jurisdiction does not exist, "the court cannot proceed at all in any cause." Steel Co. v. Citizens for a Better Env't, 523 U.S. 83, 94 (1998).

B. Legal Analysis

The federal defendants assert three separate but related jurisdictional grounds for dismissal: (1) the lack of final agency action; (2) the plaintiff's claims are not ripe for review; and (3) the plaintiff's lack of standing. The Court will address each argument in turn.

1. Final Agency Action

The APA limits judicial review to "final agency action for which there is no other adequate remedy in court." 5 U.S.C. § 704. In other words, finality is a "threshold question" that determines whether judicial review is available. Fund for Animals, Inc. v. U.S. Bureau of Land Mgmt., 460 F.3d 13, 18 (D.C. Cir. 2006). The Supreme Court has explained that, "[a]s a general matter, two conditions must be satisfied for agency action to be final: First, the action must mark the consummation of the agency's decision[-]making process," Bennett v. Spear, 520 U.S. 154, 177-78 (1997) (quotation marks omitted), and second, "the action must be one by which rights or obligations have been determined, or from which legal consequences will flow."[6] Id. at 178 (quotation marks omitted).

Here, the federal defendants assert that none of the EPA's actions—the MCIR Assessment, the EC Process, or the Guidance Memorandum—qualify as final agency action within the meaning of the APA, and that the plaintiffs claims must therefore be dismissed. Defs.' Mem. re: Dismiss at 13. They maintain that the EPA used the MCIR Assessment to screen permit applications as only the first of several steps in the permitting process, and that the MCIR Assessment therefore did not mark the consummation of the decision-making process or give rise to legal consequences. Id. at 14. The federal defendants similarly argue that neither the EC Process nor the Guidance Memorandum mark the consummation of the decision-making process or give rise to any legal obligations. Id. at 15, 17. Throughout their filings with the Court, the federal defendants emphasize what seems to be their core finality argument: that the EPA's actions are not final because they do not mark the grant or denial of the various permits at issue. See id. at 15 (quoting Chem. Mfrs. Ass'n v. EPA, 26 F. Supp. 2d 180, 183 n.2 (D.D.C.

6 In deciding the question of finality, the Court must also assess the question of whether the EPA's actions constitute a de facto legislative rule, promulgated in violation of the APA's notice and comment requirements. This is so given the similarity between the second aspect of the finality assessment—whether the action gives rise to legal obligations or is one from which legal consequences flow—and the standard for determining whether a challenged action constitutes a regulation or a mere statement of policy—"whether the action has binding effects on private parties or on the agency," Molycorp, Inc. v. EPA, 197 F.3d 543, 545 (D.C. Cir. 1999), or, in other words, "whether the agency action binds private parties or the agency itself with the force of law," Gen. Elec. Co. v. EPA, 290 F.3d 377, 382 (D.C. Cir. 2002). Indeed, the District of Columbia Circuit has recognized the manner in which these standards become interwined:

> In order to sustain their position, appellants must show that the [challenged guidelines] either (1) reflect "final agency action," . . . or, (2) constitute a de facto rule or binding norm that could not properly be promulgated absent the notice-and-comment rulemaking required by [the APA]. These two inquiries are alternative ways of viewing the question before the court. Although, if appellants could demonstrate the latter proposition, they would implicitly prove the former, because the agency's adoption of a binding norm obviously would reflect final agency action.

Ctr. for Auto Safety v. Nat'l Highway Traffic Safety Admin., 452 F.3d 798, 806 (D.C. Cir. 2006). Agency action, however, can meet the first prong of the Bennett test without meeting the second. See, e.g., id. at 431 ("The guidelines are nothing more than general policy statements with no legal force. . . . Therefore, the guidelines cannot be taken as 'final agency action,' nor can they otherwise be seen to constitute a binding legal norm.").

1998), where the Court stated: "the relevant question is not whether the action concludes a decision[-]making process . . . but whether the action concludes the decision[-]making process"), 17 ("As with the [MCIR] Assessment and the EC Process, the Guidance does not mark the consummation of the relevant decision[-] making process here, i.e., the review of permit applications pursuant to the [Clean Water Act]. That process consummates in final agency action only when a permit is issued, denied, or vetoed.").

The plaintiff counters that the federal "defendants' interpretation of finality is too restrictive, as it encompasses only the last possible agency decision." Pl.'s Opp'n re: Dismiss at 24-25. It asserts that the issuance of the MCIR Assessment reflects the EPA's settled, final position concerning how it would screen all pending Section 404 permit applications; that the creation of the EC process reflects the settled, final position to establish an alternate permitting framework, thus changing the legal landscape set forth in the 404(b)(1) guidelines; and that the Guidance Memorandum marks the consummation of the decision-making process and has had practical effects that have changed the legal obligations of the permitting authorities, i.e., the Corps and the state regulators, and the plaintiff's members who are seeking permits. Id. at 26-27.

The plaintiff points to both Appalachian Power Co. v. EPA, 208 F.3d 1015 (D.C. Cir. 2000), and CropLife America v. EPA, 329 F.3d 876 (D.C. Cir. 2003), as supporting its assertions that the EPA's actions here constitute final agency action. In Appalachian Power, power companies alleged that an EPA guidance document imposed unauthorized requirements on states in connection with the operation of permit programs under the Clean Air Act. 208 F.3d at 1015. There, as here, the EPA argued that the guidance was not subject to judicial review because it was neither final agency action nor a binding legislative rule. Id. at 1020. The District of Columbia Circuit, however, disagreed, concluding that

> The short of the matter is that the guidance, insofar as relevant here, is final agency action, reflecting settled agency position which has legal consequences both for State agencies administering their permit programs and for companies like those represented by petitioners who must obtain [Clean Air Act] permits in order to continue operating.[7]

Id. at 1023. There was evidence in Appalachian Power that "State authorities, with EPA's guidance in hand, [were] insisting on continuous opacity monitors," id., i.e., compliance with the standards set forth in the guidance. Next, in CropLife, the District of Columbia Circuit determined that an EPA directive, which had been published in a press release and changed the established practice of relying on third-party studies, was a binding regulation. 329 F.3d at 876. The court held that "the directive clearly establishe[d] a substantive rule declaring that third-party human studies are now deemed immaterial in EPA regulatory decision[-]making," id. at 883, and further concluded that the "disputed directive concretely injures petitioners, because it unambiguously precludes the agency's consideration of all third-party human studies, i.e., studies that petitioners previously have been permitted to use to verify the safety of their products." Id. at 884.

The federal defendants argue that the EC Process memoranda here can be distinguished from the actions in Appalachian Power and CropLife because the EC process memoranda are not binding on their face and the EPA explicitly stated they were not binding. Defs.' Reply re: Dismiss at 3-4. The federal defendants further attempt to distinguish the Guidance by pointing out that it was issued as an interim document and clearly stated, on its face, that it would be issued in final form in 2011. Id. at 9-10. The federal defendants assert that the Court should

7 The court acknowledged that the concluding paragraph of the guidance contained a disclaimer of sorts, indicating that the policies set forth in the document were intended solely as guidance, did not represent final agency action, and could not be relied upon to create enforceable rights, but then pointed out that "this language is boilerplate; since 1991 EPA has been placing it at the end of all of its guidance documents." Appalachian Power, 208 F.3d at 1023.

follow Gem County Mosquito Abatement District v. EPA, 398 F. Supp. 2d 1 (D.D.C. 2005), in which the court held that an interim EPA guidance advising a county mosquito abatement entity that it did not need an NPDES permit to apply pesticides to waters was not final agency action. In Gem County, although believing it did not need one, the plaintiff nonetheless sought an NPDES permit because it had been threatened with being sued and was then sued by organic farmers who asserted that the pesticides used to abate the mosquitoes threatened their certification as organic farms. Id. at 4. The EPA advised the abatement entity that its position that it did not need an NPDES permit was correct, which ultimately lead to dismissal of the case due to the absence of a case or controversy, as both parties agreed that a permit was unnecessary. Id. at 8. In its rejection of the plaintiff's argument that the interim guidance was a final rule, the court found that the EPA had "made clear that the Interim Guidance was just that: interim guidance on which public comment would be solicited and considered before issuing a final interpretation and guidance. In its interim form, [the] guidance is interlocutory and does not finally determine legal rights or obligations." Id. at 11. The court did explain, however, that "the 'finality' element is interpreted in a 'pragmatic way.'" Id. (quoting FTC v. Standard Oil Co. of Cal., 449 U.S. 232, 239 (1980)). Drawing from its analysis of the case and controversy prequisite to its authority to exercise jurisdiction in the matter, the court concluded: "To regard EPA's interim guidance as final where it does not impose a legal obligation to obtain permits would improperly and prematurely interfere with the process by which an agency reaches a final position on maters committed to its discretion." Gem Cnty, 398 F. Supp. 2d at 11. Therefore, the Court's finality assessment seems to have had more to do with what had actually occurred in response to the guidance—the preservation of the status quo—and not the mere fact that the EPA had stated that the document it issued was interim and interlocutory.

Here, because the agency actions more closely resemble those at issue in Appalachian Power and CropLife than was the situation before the Court in Gem County, the MCIR Assessment, the EC Process, and the Guidance Memorandum all meet the criteria of final agency actions. The federal defendants' view of what amounts to finality is too narrow, as it is possible for an agency to take final agency actions during a permit assessment process prior to actually determining whether to grant or deny an application for a permit. Although the federal defendants stress in their filings, and vigorously reiterated at the December 15, 2010 hearing, that the MCIR Assessment, the EC Process, and the Guidance Memorandum impose no new substantive requirements on permit applications, see, e.g., Defs' Mem. re: Dismiss at 18 (asserting that the "Guidance does not . . . establish any new standards that supplement or amend the existing statutory and regulatory requirements"), it is clear to the Court that the EPA has implemented a change in the permitting process.

It appears obvious on the current record that the MCIR Assessment reflects the EPA's final decision to evaluate pending permits to determine whether they would undergo the EC Process. As shown in Appalachian Power, a reworking of the permitting process gives rise to legal consequences for companies that must obtain those permits to operate. 208 F.3d at 1023. From the moment a permit is screened pursuant to the MCIR Assessment, the EPA seems to be imposing an additional step to the permitting process that is not contemplated or set forth in the 404(b)(1) guidelines. This is also true for the EC Process itself. Again, like the documents at issue in Appalachian Power, the EC Process Memoranda impose unequivocal requirements on the exercise of regulatory authority regarding the pending permit applications.[8] Accordingly, as

[8] For example, the June 11, 2009 EC Process Memorandum begins by explaining that the "EPA and the Corps hereby establish a process for enhanced coordination." Pl.'s PI Mot., Ex. 1 (June 11, 2009 Memorandum to the Field on Enhanced Coordination Procedures) (emphasis added).

in CropLife, the EC Process "reflects an obvious change," 329 F.3d at 881, in the permitting regime set forth in Section 404 of the Clean Water Act and in the regulations implementing that provision. Thus, despite the fact that the 404(b)(1) guidelines provide that "[n]o modifications to the basic application . . . of these [g]uidelines will be made without rulemaking . . . under the [APA]", 40 C.F.R. § 230.2(c), it seems quite apparent that the MCIR Assessment and the EC Process enacted a change in the basic application of the permitting procedures for Section 404 permits. Accordingly, these changes to the statutorily established process give rise to the legal consequences necessary to satisfy the second prong of the Bennett finality analysis.

While the Guidance Memorandum is perhaps a closer call than the MCIR Assessment and the EC Process, it too, qualifies as final agency action because, despite the representation that it is an interim document, it is nonetheless being applied in a binding manner and has been implemented in its current version even though the EPA continues to receive comments about it. Therefore, based on the record before the Court at this time, it appears that the EPA is treating the Guidance as binding. See Pl.'s PI Mem. at 21 (quoting an EPA official as saying that the "guidance stands" and "will continue to [be used to ensure] that mining permits issued in West Virginia and other Appalachian states provide the protection required under federal law"). The EPA official's statement can only be interpreted as reflecting the EPA's settled, final stance on its current application of the Guidance Memorandum, even if this position may change at some point in the future once the EPA promulgates a new version of the Guidance Memorandum. See Appalachian Power, 208 F.3d at 1022 (noting that the "EPA may think that because the Guidance . . . is subject to change, it is not binding and therefore not final action," but concluding that "all laws are subject to change . . . . The fact that a law may be altered in the future has nothing to do with whether it is subject to judicial review at the moment.").

Thus, unlike the guidance in Gem County, which merely had the effect of preserving the status quo, the Guidance Memorandum here has a practical impact on the plaintiff's members seeking permits. In other words, despite the EPA's assertions that the Guidance Memorandum is only an interim document, the Guidance Memorandum is being treated and applied in practice as if it were final. The practical impact imposed upon permit applicants by the recent actions of the EPA are sufficient to satisfy the Bennett finality test because the "'finality' element is interpreted in a 'pragmatic way.'" Gem Cnty, 398 F. Supp. 2d at 11 (quoting FTC v. Standard Oil Co. of Cal., 449 U.S. 232, 239 (1980)); accord Nat'l Ass'n of Home Builders v. Norton, 415 F.3d 8, 15 (D.C. Cir. 2005) ("Finality resulting from the practical effect of an ostensibly non-binding agency proclamation is a concept [this Circuit has] recognized in the past.") (citing Gen. Elec. Co. v. EPA, 290 F.3d 377, 383 (D.C. Cir. 2002)).

2. Ripeness

"[R]epresent[ing] a prudential attempt to balance the interests of the court and the agency in delaying review against the petitioner's interest in prompt consideration of allegedly unlawful agency action," Florida Power & Light Co. v. EPA, 145 F.3d 1414, 1420-21 (D.C. Cir. 1998), the ripeness doctrine requires courts to consider the framework set forth by the Supreme Court in Abbott Laboratories v. Gardner, 387 U.S. 136, 148-49 (1967). First, a court must "evaluate the 'fitness of the issues for judicial decision.'" Fla. Power & Light, 145 F.3d at 1421 (quoting Abbott Labs., 387 U.S. at 149). If a challenged decision is not "fit" for review, "the petitioner must show 'hardship' in order to overcome a claim of lack of ripeness." Fla. Power & Light, 145 F.3d at 1421. In assessing the fitness prong, courts evaluate "whether the agency action is final; whether the issue presented for decision is one of law which requires no additional factual development; and whether further administrative action is needed to clarify the agency's position." Action Alliance of Senior Citizens v. Heckler, 789 F.2d 931, 940 (D.C. Cir. 1986).

The federal defendants assert that the plaintiff's claims should be dismissed because they are not ripe for review. Defs.' Mem. re: Dismiss at 19. Specifically, the federal defendants again argue that the MCIR Assessment, the EC Process, and Guidance Memorandum are not final agency actions, and further, that their review "outside the context of a specific permitting decision would entangle the court in abstract considerations." Id. at 21. The plaintiff in turn again contends that the three actions at issue here constitute final agency actions and present primarily, if not purely, legal questions for which further factual development in the context of a specific permitting decision is unnecessary. Pl.'s Opp'n re: Dismiss at 30, 34.

As explained above, based on the record currently before the Court, the MCIR Assessment, the EC Process, and the Guidance all appear to constitute final agency actions. Moreover, the claims raised by the plaintiff, i.e., whether the actions constitute legislative rules and whether the EPA violated the notice and comment requirement of the APA, present purely legal questions. See Cement Kiln Recycling Coal. v. EPA, 493 F.3d 207, 215 (D.C. Cir. 2007) (explaining that it is "well-established that claims that an agency's action is . . . contrary to law present purely legal issues . . . [s]o, too, do claims that an agency violated the APA by failing to provide notice and opportunity for comment."). The federal defendants' insistence on "specific permitting decisions," Defs.' Mem. re: Dismiss at 21, echoes their argument that their actions could not be final as they had not granted or denied any permits it has subjected to the EC process. This, however, misses the point of the plaintiff's claim: that the process itself is unlawful, and not simply any decisions that may result from the application of that process. See Pl.'s Opp'n re: Dismiss at 31 ("NMA's contention is that Defendants acted contrary to law in issuing the EC Process Memoranda, which unambiguously dictated that the memoranda—and not existing regulations—would govern [pending] permit applications."). Thus, no factual developments would clarify these issues or assist the Court in evaluating the plaintiff's claims. See Appalachian Power, 208 F.3d at 1023 n.18 ("Whether EPA properly instructed state authorities to conduct sufficiency reviews of existing state and federal standards and to make those standards more stringent if not enough monitoring was provided will not turn on the specifics of any particular permit."). Accordingly, the Court finds the plaintiff's claims ripe for review on the defendants' dismissal motion.[9]

3. Standing

The irreducible constitutional minimum of standing contains three elements: (1) injury in fact, (2) causation, and (3) the possibility of redress by a favorable decision. Lujan v. Defenders of Wildlife, 504 U.S. 555, 560-61 (1992). These requirements apply whether an organization asserts standing on its own behalf, or on behalf of its members. Havens Realty Corp. v. Coleman, 455 U.S. 363, 378 (1982). "[A]t the pleading stage, general factual allegations of injury resulting from the defendant's conduct may suffice, for on a motion to dismiss we presume that general allegations embrace those specific facts that are necessary to support the claim." Bennett, 520 U.S. at 168 (internal quotations omitted).

The federal defendants assert that the plaintiff has failed to establish the requisite injury-in-fact prong of the test for standing because it has not shown that its members have suffered a particularized and concrete injury traceable to the MCIR Assessment, the EC Process, or the Guidance Memorandum. Defs.' Mem. re: Dismiss at 30. They again rely on the fact that "none

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9 Because the Court, pursuant to the first element of the ripeness doctrine set forth by the Supreme Court in Abbott Laboratories, 387 U.S. 136 (1967), and clarified by this Circuit in Florida Power & Light, 145 F.3d 1414 (D.C. Cir. 1998), concludes that the issues presented in this litigation are "fit" for review, it need not address the second, hardship factor of the ripeness test. See Fla. Power & Light, 145 F.3d at 1421.

of the permit applications subject to the process has been denied by the Corps or vetoed by EPA." Id. The federal defendants' acknowledge that the plaintiff "may allege procedural injury based on its notice and comment claims," id., but assert that deprivation of a procedural right without some concrete interest affected by the deprivation is insufficient to create standing. Id. The plaintiff, however, asserts that "being subject to this additional, illegal process is itself sufficient injury for standing purposes," Pl.'s Opp'n re: Dimiss at 40, an injury which in turn is "threatening the financial viability of proposed mining projects." Id. The plaintiff further alleges that the delays in the permitting process its members have experienced are attributable to the EC Process and that a favorable decision—declaring the EC Process and Guidance Memorandum illegal—would redress the injuries its members are incurring. Id. at 41-42.

The Court agrees that the procedural injury alleged by the plaintiff is more than just that stemming from the claimed notice and comment violations. While the plaintiff does allege notice and comment violations, its main point of contention is that the additional process created by the EPA's actions has and will continue to cause its members "injury that is concrete and particularized." Id. at 39; see id. (asserting that the "EC Process Memoranda have allowed [the] Defendants to restart and pause the clock with respect to Section 404 permit applications pending on March 31, 2009, even in instances where [the] EPA did not comment during the Corps' designated comment period"). As noted above, on the record currently before the Court, it seems clear that the EPA has imposed additional processes—the MCIR Assessment and the EC Process—to the permitting procedures, and that these additional processes are not contemplated or set forth in the 404(b)(1) guidelines. It also appears that the Guidance Memorandum is being applied in a binding manner. There is therefore support for both the plaintiff's allegations of injury in the form of notice and comment violation and, more importantly so far as standing is concerned, in the form of "additional, illegal process." Pl.'s Opp'n re: Dimiss at 39. Thus, on the record currently before it, and in light of the fact that "at the pleading stage, general factual allegations of injury resulting from the defendant's conduct may suffice," Bennett, 520 U.S. at 168, the Court can and does conclude that at this stage of the proceedings the plaintiff's allegations are sufficient to establish that it has standing to maintain this suit.

## IV. The Plaintiff's Motion for a Preliminary Injunction

A. Standard of Review

District courts have the power to grant preliminary injunctions under Rule 65 of the Federal Rules of Civil Procedure. Fed. R. Civ. P. 65. As a general matter, preliminary injunctions are "extraordinary" forms of relief and should be granted sparingly. Mazurek v. Armstrong, 520 U.S. 968, 972 (1997). "An injunction is designed to deter future wrongful acts," United States v. W.T. Grant Co., 345 U.S. 629, 633 (1953), and thus, while past harm is relevant, the ultimate inquiry remains "whether there is a real and immediate threat of repeated injury." D.C. Common Cause v. District of Columbia, 858 F.2d 1, 8-9 (D.C. Cir. 1988).

In evaluating a motion for preliminary injunctive relief, courts must balance: "(1) the [movant's likelihood] of success on the merits; (2) the threat of irreparable injury in the absence of an injunction; (3) the possibility of substantial harm to other interested parties from the issuance of an injunction; and (4) the interests of the public." Wagner v. Taylor, 836 F.2d 566, 575 (D.C. Cir. 1987). Although a particularly strong showing on one factor may compensate for a weak showing on one or more of the other factors, id. at 576, the movant must show that the threat of irreparable harm is "likely," as opposed to just a "possibility." Winter v. Natural Res. Def. Council, Inc., 555 U.S. 7 (2008).

B. Legal Analysis

1. Likelihood of Success on the Merits

Unsurprisingly, the plaintiff argues that it is likely to succeed on the merits of its claims. The plaintiff first asserts that the EC Process Memoranda and the Guidance are legislative rules that were promulgated in violation of the APA. Pl.'s PI Mem. at 12. The plaintiff further maintains that the EPA has exceeded its statutory authority under the Clean Water Act, the National Environmental Policy Act, and the APA. Id. at 24.

a. Whether The EPA's Actions are Legislative Rules

As previously noted, the standard for determining whether an agency pronouncement is a legislative rule is very similar to the second element of the Bennett finality analysis. A legislative rule is agency action that has "the force and effect of law." Appalachian Power, 208 F.3d at 1020. Such a rule "grant[s] rights, impose[s] obligations, or produce[s] other significant effects on private interests;" "narrowly constrict[s] the discretion of agency officials by largely determining the issue addressed"; and "[has] substantive legal effect." Batterton v. Marshall, 648 F.2d 694, 701-02 (D.C. Cir. 1980). A rule that effectively amends a prior legislative rule is a legislative, not an interpretative rule. Am. Mining Cong. v. Mine Safety & Health Admin., 995 F.2d 1106, 1112 (D.C. Cir. 1993). "[N]ew rules that work substantive changes . . . or major substantive legal additions . . . to prior regulations are subject to the APA's procedures." U.S. Telecom Ass'n v. FCC, 400 F.3d 29, 34-35 (D.C. Cir. 2005) (citations omitted). If an agency adopts a new position inconsistent with an existing regulation, or effects a substantive change in the regulation, notice and comment are required. Id. at 35.

As explained above in regard to the Court's finality analysis, based on the record currently before the Court the MCIR Assessment, the EC Process Memoranda, and the Guidance

Memorandum all appear to qualify as legislative rules because they seemingly have altered the permitting procedures under the Clean Water Act by changing the codified administrative review process. Thus, the MCIR Assessment, the EC Process, and the Guidance Memorandum all seem to "effectively amend" the Clean Water Act's permitting process, Am. Mining Cong., 995 F.2d at 1112, and represent the EPA's adoption of a new position inconsistent with an existing regulation. U.S. Telecom Ass'n, 400 F.3d at 34-35. The plaintiff has therefore established that it is likely to succeed on the merits of its claim that the challenged EPA actions are legislative rules that were adopted in violation of the APA's notice and comment requirements.

b. Whether The EPA Exceeded its Statutory Authority

Under the APA, courts must hold unlawful and set aside agency actions found to be in excess of the agency's statutory jurisdiction, authority, or limitations. 5 U.S.C. § 706(2)(C). To determine whether an agency exceeded its statutory authority under the APA, the Court must engage in the two-step inquiry adopted by the Supreme Court in Chevron U.S.A. Inc. v. Natural Res. Def. Council, 467 U.S. 837 (1984). Under Chevron, if the text of a statute shows that Congress has directly addressed the question at issue, then the court and the agency must give effect to the clearly expressed intent of Congress. See id. at 842-43. If, however, the court determines that an agency's enabling statute is silent or unclear with respect to the issue at hand, the question for the court then becomes whether the agency's action is based on a permissible construction of the statute. See id. at 843.

The plaintiff maintains that the EPA and the Corps are violating the plain language of the Clean Water Act. Pl.'s PI Mem. at 25. Specifically, it alleges that the MCIR Assessment and the EC Process Memoranda violate the congressional statutory division of authority between the two agencies as set forth in Section 404 of the Clean Water Act because they improperly expanded the EPA's role in Section 404 permitting decisions. Id. Similarly, the plaintiff maintains that the Guidance Memorandum requires permitting authorities to require adherence to the conductivity levels designated in the Guidance Memorandum, thus resulting in the EPA overstepping the authority it was granted under Section 303 of the Clean Water Act. Id. at 28. By promulgating this region-wide water quality standard and by applying it to Section 404 permits, in addition to Section 402 permits, the plaintiff asserts that the EPA has significantly exceeded its statutory authority. Id. at 30-31.

The federal defendants respond that the Clean Water Act authorizes coordination between the EPA and the Corps during the permit review process and expressly requires the agencies to enter into an agreement to facilitate such coordination. Defs.' PI Opp'n at 23. They contend that nothing more than this has been done and assert that the Corps remains the final decision-maker with respect to issuance of permits, subject only to the EPA's exercise of its 404(c) veto authority. Id. at 24.

Again, for reasons that mirror its finality analysis, the Court finds the plaintiff's arguments more persuasive and agrees that the plaintiff is likely to prevail on its claim that the EPA has exceeded its statutory authority. As to the MCIR Assessment, the EPA, and only the EPA, evaluates pending permits to determine if they will be subject to the EC Process. Pl.'s PI Mem. at 8. It seems clear, however, that Congress intended the EPA to have a limited role in the issuance of Section 404 permits, and that nothing in Section 404 of the Clean Water Act gives the EPA the authorization to develop a new evaluation or permitting process which expands its role. Likewise, it seems clear that with the implementation of the Guidance Memorandum the EPA has encroached upon the role carved out for the states under the Clean Water Act by setting region-wide conductivity standards. In short, the EPA has modified the Section 404 permitting scheme, authority not granted to it under the Clean Water Act, and has similarly taken an expansive role beyond what was afforded to it in determining Section 303 Water Quality Standards. Accordingly, the plaintiff has also established that it will likely succeed in showing that the EPA has exceeded its statutory authority under the Clean Water Act by adopting and implementing the MCIR Assessment, the EC Process, and the Guidance Memorandum.

2. Threat of Irreparable Harm

A preliminary injunction should issue only when irreparable injury is likely to occur in the absence of an injunction. See Brady Campaign to Prevent Gun Violence v. Salazar, 612 F. Supp. 2d 1, 12 (D.D.C. 2009) (explaining that the Supreme Court in Winter rejected as sufficient for the purpose of acquiring a preliminary injunction the plaintiff's showing of a "possibility" of irreparable harm). The failure to demonstrate irreparable harm is "grounds for refusing to issue a preliminary injunction, even if the other three factors entering the [preliminary injunction] calculus merit such relief." Chaplaincy of Full Gospel Churches v. England, 454 F.3d 290, 297 (D.C. Cir. 2006). "[P]roving 'irreparable' injury is a considerable burden, requiring proof that the movant's injury is 'certain, great and actual—not theoretical—and imminent, creating a clear and present need for extraordinary equitable relief to prevent harm.'" Power Mobility Coal. v. Leavitt, 404 F. Supp. 2d 190, 204 (D.D.C. 2005) (Walton, J.) (quoting Wis. Gas Co. v. FERC, 758 F.2d 669, 674 (D.C. Cir. 1985)) (emphasis in original). In this Circuit, it is "well settled that economic loss does not, in and of itself, constitute irreparable harm." Wis. Gas Go., 758 F.2d at 674. However, economic loss that threatens the survival of the movant's business can amount to irreparable harm. Power Mobility Coal., 404 F. Supp. 2d at 204.

Here, the plaintiff asserts that its members face likely irreparable harm in three respects: (1) its "small business members are likely to be driven out of business by the delays in permitting

. . . resulting from the Guidance"; (2) its "members are likely to incur substantial economic losses as a result of [additional] permit[ting] conditions being imposed under the Guidance [Memorandum]"; and, (3) "the EC Process and Guidance [Memorandum] are impermissibly interfering with the exercise of private property rights." Pl.'s PI Mem. at 35-36.

The federal defendants counter all three of these arguments. First, they point out that the president of Best Coal, whose declaration the plaintiff offers to support its small business argument, fails to satisfy the irreparable harm standard because it merely states that his "company will be out of business within [eighteen] months if" it does not receive the requisite mining permits. Defs.' PI Opp'n at 30, 33. Second, the federal defendants assert that the alleged economic losses identified by the plaintiff are "compliance costs," id. at 35, and that the plaintiff has not demonstrated these costs threaten the survival of the plaintiff's member's businesses to the degree required to overcome this Circuit's rule that economic losses do not constitute irreparable harms. Id. at 35-36. Third, the federal defendants argue that a finding by this Court that the type of environmental regulations at issue in this case amount to an infringement on property rights would "create de facto irreparable harm across much of the field of environmental regulation, given that environmental regulations often place conditions on the use of private property." Id. at 38-39. Lastly, the federal defendants contend that the plaintiff's "delay in seeking injunctive relief, though not dispositive, can 'militate against a finding of irreparable harm.'" Id. at 40 (quoting Mylan Pharm., Inc. v. Shalala, 81 F. Supp. 2d 30, 44 (D.D.C. 2000)).

The Court agrees with the federal defendants' position that the plaintiff has not shown that its small business members face irreparable harm in the form of certain or imminent business closings due to delays in receiving permits caused by the Guidance Memorandum. In

Power Mobility Coalition, a case in which a national association whose membership included manufacturers and suppliers of motorized wheelchairs sought an injunction enjoining enforcement of the Department of Health and Human Services regulations that changed the reimbursement structure under Medicare for motorized scooters, 404 F. Supp. 2d at 192, this Court held that the plaintiff had not demonstrated that the new regulation would cause any of its members irreparable harm as a result of being forced out of business. Id. at 205. There, this Court considered a declaration from the president of one member company in which he stated that "'if the new rule take[s] effect as planned . . . [it is anticipated] that Mr. Mobility will wind-down its operations and stop doing business as a supplier of mobility equipment in [five or six months].'" Id. at 204 (quoting Declaration of Philip DeLernia). The Court determined that because the plaintiff was "basically predicting that many of their claims for reimbursement" would be denied, the "plaintiff's claim of imminent harm [was], at best, remote and speculative." Id. at 205.

Here, as the federal defendants aptly recognize, the plaintiff's only support for its claim that its small business members will be driven out of business by the permitting delays being occasioned by the EPA's actions is the declaration of Randy Johnson, president of Best Coal, Inc.[10] Mr. Johnson asserts that

> [o]ur company is in a crisis. We want to finish our [ten] year plan but we are not mining the tonnage sufficient to support even our equipment payments. We survived to this point in 2010 with cash from prior years profit but that cash is now gone. We literally exist from week to week. We have cost[s] that cannot be recovered if the NPDES and Section 404 permits are not issued. Today, we are mining every possible ton to pay our employees, vendor bills, and bank note payments. If these permits are not issued, we will be out of business within [eighteen] months.

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[10] Indeed, this small business argument consumes only two paragraphs of the plaintiff's 45-page memorandum in support of its motion for a preliminary injunction, and is not mentioned whatsoever in its reply in support of its motion for a preliminary injunction. See Pl.'s PI Mem. at 37.

Pl.'s PI Mem., Ex. 4 (Declaration of Randy Johnson ("R. Johnson Decl.")) ¶ 19. Mr. Johnson further maintains that (i) the company's total lost revenue from 2009 and 2010 was nearly $6.7 million; (ii) the company laid off five of its twenty-eight employees; and (iii) the company will likely need to lay off more employees and "'sell[] equipment to lower [its] cost[s] and loan debt in the very near future.'" Pl.'s PI Mem. at 37 (quoting R. Johnson Decl. ¶ 18). Although, Mr. Johnson claims that Best Coal has lost revenues totaling $6,686,751, Pl.'s PI Mem., Ex. 4 (R. Johnson Decl.) ¶ 18, he does not offer a projection of anticipated future losses, tie that to an accounting of the company's current assets, or explain with any specificity how he arrived at the conclusion that he would be forced out of business in eighteen months.

While Mr. Johnson's representations raise legitimate concerns about the current and future health of his company, his declaration falls short of what is necessary to merit a finding of irreparable harm. Much like the plaintiff in Power Mobility Coalition, the plaintiff here is offering nothing more than a "predict[ion]" that is "at best, remote and speculative." 404 F. Supp. 2d at 205. Something more than Mr. Johnson's conclusory projection is necessary to show that any of the plaintiff's small business members currently face certain, imminent business closings. Accordingly, there is no "'clear and present need for extraordinary equitable relief to prevent harm." Id. at 204 (quoting Wis. Gas Co., 758 F.2d at 674).

Likewise, the Court finds that the plaintiff has not shown to the degree required by law that its members are likely to incur substantial economic losses as a result of the additional permitting conditions imposed by the Guidance Memorandum. While it is true that "if a movant seeking a preliminary injunction 'will be unable to sue to recover any monetary damages against' a government agency in the future because of, among other things, sovereign immunity, financial loss can constitute irreparable injury," Pl.'s PI Mem. at 38 (quoting Brendsel v. Office of Fed.

Hous. Enter. Oversight, 339 F. Supp. 2d 52, 66-67 (D.D.C. 2004), the fact that economic losses may be unrecoverable does not absolve the movant from its "considerable burden" of proving that those losses are "'certain, great and actual.'" Power Mobility Coal., 404 F. Supp. 2d at 204 (quoting Wis. Gas Co., 758 F.2d at 674) (emphasis in original).

Although this Circuit has not specifically addressed the issue of how recoverability of economic losses should fit into the irreparable harm analysis, this Court has confronted the issue and repeatedly held that recoverability of the claimed losses is but one element for consideration. First, in Bracco Diagnostics, Inc. v. Shalala, 963 F. Supp. 20 (D.D.C. 1997), a case in which medical device manufacturers sought a preliminary injunction to enjoin FDA action, the Court found that the "plaintiffs' greater financial costs, which are on-going, can never be recouped. Id. at 29. The Court went on to find that while the injury to plaintiffs was 'admittedly economic,' there [wa]s 'no adequate compensatory or other corrective relief' that [could] be provided at a later date, tipping the balance in favor of injunctive relief." Id. (quoting Hoffmann-Laroche, Inc. v. Califano, 453 F. Supp. 900, 903 (D.D.C. 1978)) (finding that "[t]he possibility that adequate compensatory or other corrective relief will be available at a later date, in the ordinary course of litigation, weighs heavily against a claim of irreparable harm"). In Bracco, however, the court also determined that the plaintiffs had shown "two primary sources of non-speculative, on-going, and imminent harm." 963 F. Supp. at 28-29. Next, although this Court held in Feinerman that "where . . . the plaintiff in question cannot recover damages from the defendant due to the defendant's sovereign immunity, . . . any loss of income suffered by the plaintiff is irreparable per se," Feinerman v. Bernardi, 558 F. Supp. 2d 36, 51 (D.D.C. 2008) (Walton, J.) (emphasis in original), the Court also recognized that "the alleged injury must be of such imminence that there is a clear and present need for equitable relief to prevent irreparable harm." Id. at 50 (quoting

Wis. Gas Co., 758 F.2d at 674). Lastly, in Sherley v. Sebelius, 704 F. Supp. 2d 63 (D.D.C. 2010), a case in which the plaintiffs sought to enjoin the Department of Health and Human Services from applying National Institute of Health guidelines regarding the funding of medical research that used embryonic stem cells, the Court concluded "[t]here is no after-the-fact remedy for this injury because the Court cannot compensate plaintiffs for their lost opportunity to receive funds . . . . Accordingly, plaintiffs would suffer irreparable injury in the absence of the injunction." Id. at 72. However, earlier in its opinion, the court noted that "[f]irst . . . the alleged injury must be of 'such imminence that there is a 'clear and present need' for equitable relief to prevent irreparable harm . . . . [and s]econd, the plaintiff's injury 'must be beyond remediation.'" Id. (quoting Wis. Gas Co., 758 F.2d at 674) (emphasis in original). Bracco, Feinerman, and Sherley demonstrate that recoverability of monetary losses can, and should, have some influence on the irreparable harm calculus, but that recoverability is but one factor the court must consider in assessing alleged irreparable harm in the form of economic losses. In other words, the mere fact that economic losses may be unrecoverable does not, in and of itself, compel a finding of irreparable harm.[11]

If a plaintiff has shown that financial losses are certain, imminent, and unrecoverable, then the imposition of a preliminary injunction is appropriate and necessary; here, however, the

[11] Moreover, the Tenth Circuit case cited by the plaintiff in its memorandum supporting its motion for a preliminary injunction seems to confirm this conclusion. Although the court in Chamber of Commerce v. Edmondson, 594 F.3d 742, 770-71 (10th Cir. 2010), found that "imposition of monetary damages that cannot later be recovered for reasons such as sovereign immunity constitutes irreparable injury," it cited as authority for that finding an earlier Tenth Circuit case which determined that "[a]n irreparable harm requirement is met if a plaintiff demonstrates a significant risk that he or she will experience harm that cannot be compensated after the fact by monetary damage." Id. at 771 (quoting Greater Yellowstone Coal. v. Flowers, 321 F.3d 1250, 1258 (10th Cir. 2003)) (emphasis added). Edmondson can be further distinguished from the plaintiff's situation in this case because it dealt with the actual imposition of fines on businesses that failed to comply with a state law on the employment of illegal immigrants, i.e., the actual payment of money by the plaintiff to the authority from which it was then unrecoverable, whereas here, the plaintiff claims that the injury is economic loss due to (1) delay in continuing or starting mining projects, and (2) in one instance, the cost of conducting additional tests to comply with the Guidance.

plaintiff has not demonstrated the certainness or the imminence of any of its members' losses. In fact, and perhaps most importantly to this discussion of the role of recoverability in the irreparable harm calculus, the plaintiff has not even shown that the losses are wholly unrecoverable. While the plaintiff has correctly asserted that it cannot recover economic losses in the form of money damages from the EPA and the Corps due to sovereign immunity, the plaintiff has not demonstrated how or why these losses cannot ultimately be recovered if and when the mining projects in question are permitted to proceed. See Defs.' PI Surreply at 4 (recognizing that the Higgins Declaration, Pl.'s Opp'n re: Dismiss, Ex. 24 (Declaration of James C. Higgins ("Higgins Decl.") ¶ 9, itself asserts that the resolution of this case in favor of the plaintiff would allow reinstatement of his company's mining plans, and arguing that this would allow the company to recoup all or most of the alleged lost revenue).[12]

Nonetheless, even assuming arguendo that the purported losses are totally beyond remediation, the plaintiff has still not shown that they are imminent or certain. The Court has no reason to doubt Mr. Higgins's assertion that the "coal mined from the Paynter Branch South Mine could have produced revenues of about $189 million at today's current sales price," Pl.'s Opp'n re: Dismiss, Ex. 24 (Higgins Decl.) ¶ 8, or his statement that "other costs . . . as a result of [the decision to forego the removal of the coal reserves at Paynter Branch South Mine] include the costs of relocating two spreads of equipment, . . . the relocation of about 20 employees to other mines[,] and the severing of about 20 employees," id., Ex. 24 (Higgins Decl.) ¶ 8. These,

12 Mr. Higgins is the Chief Engineer for Simmons Fork Mining, Inc. and provides services to Paynter Branch Mining, which operates the Paynter Branch South Mine in West Virginia and whose Section 404 permit application is one of those subject to review under the EC Process. Pl.'s Opp'n re: Dismiss, Ex. 24 (Higgins Decl.) ¶¶ 1, 5. Mr. Higgins asserts that since January 2010, Paynter Branch Mining has gathered water quality data in an attempt to meet the conductivity level set forth in the Guidance, an endeavor that has cost it $114,000. Id., Ex. 24 (Higgins Decl.) ¶ 7. Mr. Higgins further maintains that the permitting delays have rendered infeasible proceeding with the Paynter Branch South Mine project, forcing Paynter Branch Mining to forego the retrieval of coal reserves from that mine. Id., Ex. 24 (Higgins Decl.) ¶ 8.

however, are examples of past harm, resulting from a decision made before this case ever reached this Court. Mr. Higgins does not provide any information on currently planned or future projects in jeopardy or at risk of incurring losses.[13] While the plight of the workers allegedly fired by Paynter Branch Mining purportedly due to the delay in the permitted process is unfortunate, that does not change the fact that "the purpose of an injunction is the prevent future violations." W.T. Grant Co., 345 U.S. at 633 (emphasis added). Thus, while past harm is relevant, the ultimate inquiry remains, "'whether there is a real and immediate threat of repeated injury.'" District of Columbia Common Cause, 858 F.2d at 8-9 (quoting O'Shea v. Littleton, 414 U.S. 488, 496 (1974) (emphasis added). Accordingly, whether or not they may ultimately be recovered, the plaintiff has not shown that there is a threat of future substantial losses that warrant the imposition of the "extraordinary" remedy of injunctive relief. Mazurek, 520 U.S. at 972.

To conclude its examination of the plaintiff's allegations of irreparable harm, the Court need merely state that it agrees with the federal defendants that the plaintiff's argument that the EC Process and Guidance are impermissibly interfering with the exercise of private property rights is "baseless." Defs.' PI Opp'n at 38. Indeed, the cases relied upon by the plaintiff do not support a finding that enforcement of the type of environmental regulations at issue here qualify as an infringement on the property interests of the plaintiff's members. See RoDa Drilling Co. v. Siegal, 552 F.3d 1203, 1211 (10th Cir. 2009) (finding that the record clearly established that

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13 The same is true of the re-mining projects described in the declaration of William Wells, the Vice President of United Coal Company. Pl.'s PI Mem., Ex. 9 (Declaration of William Wells, Jr.) ¶¶ 25-26. But even assuming, for the sake of argument, that Mr. Wells had identified pending future losses, it is unclear that the losses would be of the magnitude required in this Circuit to warrant the imposition of injunctive relief, i.e., the losses would threaten the survival of the business. See Power Mobility Coal., 404 F. Supp 2d at 204 (observing that only economic loss that threatens the survival of a movan'ts business amounts to irreparable harm); Defs.' PI Opp'n at 36 & 36 n.20 (noting that although the Wells declaration does not provide a numeric figure or describe the losses purportedly suffered from the decision to forego the reclamation project, United Coal's revenues totaled more than $500 million in 2008).

RoDa was being denied its right to interest in its real property because it had been "denied unfettered ownership" due to the defendant's refusal to transfer record title, and concluding that "while being denied record title, RoDa simply cannot participate in the everyday operations of its own interests, and the damages arising from that are incalculable"); Pelfresne v. Village of Williams Bay, 865 F.2d 877, 883 (7th Cir. 1989) (in a suit seeking to bar demolition of buildings on the plaintiff's land, the court noted that "[a]s a general rule, interference with the enjoyment or possession of land is considered irreparable [because] land is viewed as a unique commodity for which monetary compensation is an inadequate substitute," but found that a similar rule should not necessarily apply to buildings located on a piece of real estate as buildings, unlike land, can be repaired or replaced). Clearly, these two cases do not present issues even remotely comparable to those presented in this case.

While the plaintiff's assertion that a preliminary injunction "in this case will do nothing more than restore the regulatory environment that existed prior to the unlawful application of the EC Process and the Guidance to coal mining operations," Pl.'s PI Mem. at 41, may be true, the fact remains that the plaintiff has made an inadequate showing of irreparable harm. The issuance of a preliminary injunction to "restore" the previously existing regulatory environment would not be in line with the purposes of injunctive relief, as the ultimate inquiry would still remain "whether there is a real and immediate threat of repeated injury." D.C. Common Cause, 858 F.2d at 8-9.

3. Possibility of Substantial Harm to Other Interested Parties

Having concluded that a showing of irreparable harm is lacking, it is not necessary to engage in a lengthy discussion of the remaining two factors, see Chaplaincy of Full Gospel Churches, 454 F.3d at 297 (holding that the failure to demonstrate harm provides "grounds for refusing to issue a preliminary injunction, even if the other three factors entering the [preliminary injunction] calculus merit such relief"), and the Court will therefore address them only briefly. See id. at 304-05 (observing that "[i]t is of the highest importance to a proper review of the action of a court in granting or refusing a preliminary injunction that there should be fair compliance with [Federal Rule of Civil Procedure] 52(a)," which provides that when denying a preliminary injunction a district court "shall . . . set forth the findings of fact and conclusions of law which constitute the grounds of its action." Fed. R. Civ. P. 52(a)).

The plaintiff maintains that a preliminary injunction in this case will not harm the federal defendants or the defendant intervenors as it "will do nothing more than restore the regulatory environment that existed prior to the" MCIR Assessment, the EC Process, and the Guidance Memorandum. Pl.'s PI Mem. at 41. Both the federal defendants and the defendant intervenors, on the other hand, assert that "significant environmental interests are at stake here." Defs.' PI Opp'n at 41. While it may be true that the challenged EPA actions were "designed to significantly reduce the harmful environmental consequences of Appalachian surface coal mining operations, while ensuring that future mining remains consistent with federal laws," id., these environmental interests—the actual environmental impact of surface mining—are not currently before the Court. It may well be the case that the MCIR Assessment, the EC Process, and the Guidance Memorandum are necessary to protect the environment, especially considering the assertion made by counsel for the defendant intervenors that the substantive requirements of the Clean Water Act were essentially ignored by the prior Administration, but the Court need not make that assessment now. Whether the current or the prior Administration's actions are in compliance with the APA and the Clean Water Act is an inquiry that can be left for another day. And the most the Court can say about whether other interested parties would be harmed by the issuance of an injunction is that none of the parties before the Court, based on the record currently before it, have made a sufficiently compelling case to tip the scales in their favor.

4. The Interests of the Public

The plaintiff maintains that a preliminary injunction is in the public interest as it would protect "the integrity of the administrative regulatory process" and because the public has a strong interest in developing domestic sources of energy and job growth. Pl.'s PI Mem. at 42-43. On the other hand, the federal defendants assert that the public interest is served by allowing the Corps and the EPA to complete their review and consideration of permit applications in a thoughtful and considered manner. Defs.' PI Opp'n at 42. The Court, however, finds neither of these arguments determinative of whether preliminary injunctive relief should be granted in this case.

## V. Conclusion

For the above reasons, the federal defendants' motion to dismiss and the plaintiff's motion for a preliminary injunction are both **DENIED**.[14]

/s/
Reggie B. Walton
United States District Judge

[14] The Court has issued a contemporaneous Order consistent with this Memorandum Opinion.