The Arlin M. Adams Center
FOR LAW AND SOCIETY
Susquehanna University

Established in 2001, the center focuses on the law and its impact on institutions and people, providing a rich learning and experiential resource for students, faculty, visiting scholars and members of the community.

The family of Sigfried and Janet Weis and The Degenstein Foundation of Sunbury, Pa., with support from the Annenberg Foundation, founded the center in honor of prominent Philadelphia jurist Arlin M. Adams whose distinguished legal career includes 17 years on the bench of the 3rd U.S. Circuit Court of Appeals.

The center explores the significant place law occupies in our everchanging social, political, economic and cultural life. It provides a forum for thought-provoking examination of contemporary issues in areas such as human freedoms and civil rights, social responsibility, technology and privacy, and constitutional interpretation.

Susquehanna's emphasis on undergraduate liberal arts education and preprofessional studies offers an ideal home for the Adams Center. The center supports activities and resources that expose students to the theory and practice of law through internships and field experiences, networking, professional seminars, independent study, research projects, and enhanced library resources. The interdisciplinary programs and activities of the Adams Center enrich and inform civic life in the Central Susquehanna Valley and nationally.

Welcome Remarks

Allan D. Sobel, Director

Good afternoon. Welcome to all SU grads, students, faculty, staff, and community members. I am Allan Sobel. I am the director of the Arlin M. Adams Center for Law and Society at Susquehanna University and I hope this will be the first of many annual events at homecoming weekend which showcase the talents, the knowledge, and the professional competence of our Susquehanna University graduates, because, in my way of thinking, that is the highest honor that we can give to them.

The Adams Center was created in 2001, to look at those contemporary, important societal issues that arise where the law intersects with different disciplines. I was hired last year to become the first full-time director of the Adams Center and since I joined the University, we've had programs looking at the underlying causes of wrongful convictions in this country and how science might help us address those problems, looking at whether government should regulate adult pornography to prevent exposure to minors, and, most recently, just last week, a program that looked at whether intelligent design theory has a scientific foundation and whether intelligent design theory, quite apart from whether it's a scientific theory, has a place anywhere in a public school curriculum.

Future Adams Center programs, the next one coming up at the end of this month, will look at the role and responsibilities of the judiciary when faced with a case involving a controversial issue, specifically referencing the Dover School District decision by Judge John Jones, who will participate in the program, and a case decided last year by the Pennsylvania Supreme Court striking down an attempted rollback of judicial pay increases.

Later in the academic year we will have another water-related program looking at the issue of how water affects the Middle East peace efforts and the different interests of the respective countries in the Middle East to the limited water resources in that region.

We also have planned for the spring a three-day symposium looking at whether the death penalty in this country should be abolished.

The Adams Center, in addition to programming, is involved in many other activities, all intended to enrich the lives of students at Susquehanna University and the faculty of this University and the people who live in this region. Currently we are collaborating with school districts throughout the region, hoping to place justice systems units of study in public schools throughout 12 school districts in this area. I have a weekly radio system talk show that is on WQSU. By the way, if you wanted to listen, even if you aren't in the listening area, you can go to our Adams Center website. The website address is on the back of today's program book. All of the past programs are accessible on the website and you may also go on the website to listen to tapes or read transcripts of some of our past programs.

And one of the projects that we have in mind – and we can't say that it's going to happen, but we can say we sure hope it will happen and look forward to it happening soon -- is the creation of a clinic that would offer guidance to people in the tri-county area of Northumberland, Snyder, and Union Counties who are unrepresented, but nonetheless in civil proceedings, needing help, indigent and unable to secure legal services. So we have a lot going on. We hope to add more activities. And if any of you are interested in keeping up with the Adams Center activities and being notified of our

upcoming events, let me know or leave a piece of paper on your seat with your contact information and we will certainly add you to our mailing list. Without any further comment from me, I would like now to call upon Professor Jack Holt, a science professor long standing at the University who is the director of our ecology program and somebody who is much better suited than I am to introduce today's topic and our speakers. Jack.

Introductory Remarks

Jack Holt, Professor

Thank you, Allan. This morning when I was pulling these clothes together my wife looked at me as I pulled out the tie and she said, "Are you sure you know how to tie that thing?" I guess I'll have to let you be the judge of that.

Two weeks ago I was at a meeting wearing another tie with a bunch of people from NASA and we went to -- we were doing some stuff at Goddard Space Flight Center. I sat down at lunch with a group of people and one of them was from Johnson Space Flight Center. And she looked at my name tag and said, "Susquehanna. Why did you name your school after a Native American? Why did you give your school a Native American name?" And I looked at her and I said, "No. That's the name of a river that is also named for a tribe, but it's the name of a river. We are right on that river." "Oh, well, tell me about that river." She never heard of it.

So I went on, waxed poetic about the Susquehanna River and its relationship to the Chesapeake Bay, which she had heard of. And then, when I finished this or was nearly finished, because it's clear that I said more than she wanted to hear, she said, "You really love it, don't you," and I said, "Yeah, I do." I could forgive her for not knowing about those things because, after all, she is only a rocket scientist and we all know that environmental problems and ecology both are far more difficult and far more challenging than rocket science.

So here today we have four people who actually span a number of decades. It's very nice to see graduates from different decades and I have to say that I came right in the middle of this, so I dealt directly with two of the people on this panel and could probably tell you a lot of stories that they don't want you to know. But the others I've only just met today and I am very happy to introduce them.

Terry Bossert graduated from SU in 1968 and earned a J.D. from Dickinson. He is a partner with Post and Schell in Harrisburg and is chair of the firm's environmental regulation and litigation group. Next to him is Michael Smith, who graduated from Susquehanna just before I came in 1979 with a degree in geology and environmental science. He obtained his Master's degree from Penn State and he is currently the district mining manager of the Pennsylvania Department of Environmental Resources in this district that includes Snyder County.

Next to him is Fred Lubnow, who is director of the Aquatic Programs at Princeton Hydro. Fred graduated from Susquehanna in 1988 with a degree in biology and went from here to California, UC Davis, where he earned a Ph.D. in limnology. Next to him is Tony Buda, who graduated most recently in 1998 and just completed his Ph.D. this last May at Penn State. So I would hand this over to them. The rules hereare that each person on the panel will speak for 10 minutes and that should give us time afterwards for you to ask
questions of them.

The Dialogue

MR. BOSSERT: Thank you, Jack. As the oldest member of the panel, I'm upholding that tradition by not having any technology. I also want to express my gratitude to be able to have this presentation in the room where compulsory chapel was held. This is the first time I've been in here voluntarily.

I would also like to thank, although he's not here, Frank Fletcher, who was a professor here when I was here who really got my feet started on the path of appreciating the natural sciences. And although I thought for a while I was going to be a criminal prosecutor, and I did do that for a while, I kept coming back to the environment thanks to Frank and spent most of my legal career in the basin of the Susquehanna River.

To give you an idea about the Susquehanna River, I'm -- obviously, again, being the oldest one, I am going to give the historical perspective -- the Susquehanna River is the largest single source of fresh water to the Chesapeake Bay. It provides half of the Bay's fresh water and the average daily flow at the mouth of the Susquehanna River is 22 billion gallons. Obviously they are -- in significant rain events it's considerably more than that.

You know, those of us who like the river like to address this next fact, which is what people in Maryland call the Chesapeake Bay is really just the Susquehanna River that's submerged now because the sea shelf is higher than it used to be. But it's still the Susquehanna River. Okay.

I will read you a statement that the Susquehanna River Basin Commission has on its website, which I think is a good starting point for this discussion. "The Susquehanna River, though still relatively wild and undeveloped, has a history of past environmental negligence. Vast areas of its virgin forest were stripped and huge quantities of coal were mined. The land was left scarred by erosion and many streams were polluted with acid mine drainage," things we are all going to talk about today. "Industrial wastes and raw sewage were indiscriminately discharged into the waterways. Years of water pollution, dam building and over fishing virtually destroyed the vast runs of migratory fish that once extended to Binghamton, New York."

If anyone is familiar with the Delaware River, you may know that the shad migration is a significant event in the Delaware River. It has not happened in the Susquehanna River in Pennsylvania since approximately 1910, when the first dam was built across the river just 20 miles or so from the Maryland border. Those efforts obviously have changed over the years to try to promote fish migration around those dams, but that's a lingering issue.

Now, a quick legal framework for all of this. Against that background you probably all think that nobody paid any attention to this issue until April 22nd, 1970. Any of you know what that date is? That's the first Earth Day. The truth of the matter is in Pennsylvania there was a law called the Purity of Waters Act that was enacted in 1905. Somewhat reflective of the political power of the day, it didn't apply to coal mines, tanneries or railroads. You could sort of figure out why that might have been.

But that Act was on the books and it did apply to sewage. That was the first attempt to get sewage discharges treated to some level.

That law was followed in 1937, by the Clean Streams Law, which really was one of the first laws in the state -- laws in the nation to

really start a comprehensive program of regulation of water quality, but, unfortunately, it had ideas reflective of the time. One, it only applied to waters that were still clean. If water was already polluted, there wasn't any effort to clean it up. Guess what? It still didn't apply to coal mines.

However, starting in 1965, there were amendments to that law in '65, in '70, and again in '80 that really created the modern environmental programs that we have for water quality in Pennsylvania. The EPA likes to think that they were the ones that made everybody get on the environmental band wagon. The truth of the matter is, Pennsylvania, admittedly with fits and starts, was working in that direction.

But this legacy had to be dealt with. When I used to drive up here, up along the Susquehanna River from coming up from the Harrisburg area, there was still dredges out there in the river dredging the coal out of the river. The coal that washed out of all the coal mines and lined the bottom of the river was being dredged and resold. Now, the problem with that was the dredges also dredged up every aquatic insect that lived on the bottom of the river, so that wasn't exactly the thing to do.

In addition to the Clean Streams Law -- and Michael will probably talk about this a little more -- the Surface Mining Control and Reclamation Act was enacted. Actually enacted in '45, but amended again in 1971 and 1980 to really first deal with acid mine drainage.

Again, I think if you are going to think about water quality in Pennsylvania you have to think about what I think the landmark decision of the Pennsylvania Supreme Court, a case called Barnes and Tucker, Commonwealth vs. Barnes and Tucker. It really abolished the concepts that had existed before. Those concepts were if the stream was already polluted it stays polluted and you didn't have to worry about it. If you had an operating mine already, you couldn't have new obligations imposed upon you; arguments of due process, taking, et cetera. This decision -- unanimous decision of the Pennsylvania Supreme Court was an opinion written by the Chief Justice. And, you know, if you are not in the legal field those things may not mean anything to you, but usually when you have a unanimous decision and the Chief Justice writes it, it means something. It means that the court is sending a big message to people that they are making a monumental change in the law.

This made a monumental change in the law, not just as it applied to coal mines. It basically established the principle that you could not by prescriptive right – you didn't earn some right to continue to pollute. The police power of the state extended to even past activity that was causing present pollution. It was not an unconstitutional taking of your property and even though the state had tolerated it for decades, the state was obligated and entitled to say, We are not going to tolerate it anymore.

Most of this was based on this 1965 and 1970 amendments to the Act. In many ways that really kicked off the modern day of regulating the discharges on the Susquehanna River.

Now, the statement I read to you earlier about it being relatively wild and undeveloped was really a mixed blessing for the Susquehanna. It was not so heavily industrialized, it was not the Cuyahoga River in Ohio, which actually caught on fire. Somewhat odd concept that the river was burning, but the river actually was burning. It was also neglected in many ways because it was so rural and didn't have maybe the political clout to really focus on the river.

I think you have to think about regulation -- and I think the other speakers will touch on this -- and compare the federal approach and the state approach. The federal approach is to determine what's the best technology. The state approach is actually to develop what's called water quality criteria and that says the stream can handle -- we want the stream to have this quality and if it has that quality, it can handle and absorb this much pollution.

In my experience, what that's led to is on the main stem of the river EPA standards are more stringent, because they are based on technology. On small tributaries the B standards are more stringent because they are based on water quality criteria and the relative flow of the river. All of this leads up to -- the Chesapeake Bay is mentioned a lot. And it really leads up to the whole Chesapeake Bay issue at this point, because the Chesapeake Bay initiatives are all driven by water quality criteria. The federal law says that no state can have water quality in an interstate water body -- which, of course, the river is -- that interferes with another state's attainment of its water quality criteria.

So really all the things you read about the agreements among the Chesapeake Bay states and the initiatives and the programs are really all derived from the fact that the water quality in the Susquehanna River is preventing the Chesapeake bay from meeting its water quality criteria and it's interfering with what in the water quality jargon is called existing uses. In other words, the law says if the water can support this use, you can't do something that deprives it of the ability to support that use.

Where do we end up and what are the other speakers going to talk about? Well, we have had laws and regulations of some sort or another for more than a quarter of a century. Does a pretty good job of addressing sewage discharges and does a pretty good job of addressing industrial charges. Does a pretty good job of addressing current mining operations. But there have been areas that have been lacking and areas we are really just starting to appreciate.

One we have appreciated for a long time is abandoned mine drainage. That's really been an issue of funding to address discharge from abandoned mines. Storm water, storm water runoff from construction, storm water runoff from development, agricultural discharges.

Frankly, agriculture has gotten a pass in environmental laws for a long time in Pennsylvania. Still is not under the same kind of rigorous regulation that other discharges are.

Why is that important? Because maybe the most overwhelming issue right now with regard to the Chesapeake Bay is nutrient loading. That is runoff that comes from the farms. Frankly, comes from your yard. If you put your Scott's on the yard and it rains and then runs off in the storm sewer, it finds its way into the river basin. And the nutrient discharge from those kinds of discharges and as well as from sewage treatment plants is the biggest issue that the Bay is facing at this time.

Now, all those can be dealt with under the Clean Streams law and requires some new regulations and some new programs that are in effect. But those are the things that are really affecting the river right now and the things – the legal tools that we have to deal with them.

I think with that I'll just turn it over to whoever is next and we will talk about some of these specific types of pollutants that are having impact on the river. Thanks.

MR. SMITH: I'm the second oldest one here, which means I have technology but I have no idea how to use it, so we'll see.

Which one is mine here? Somebody loaded it on for me. Way over there. Okay. I told you. We don't happen to have a laser pointer here, do we?

Being in Selinsgrove is sort of kind of far from most people's minds when everybody thinks about the issue, but not so much about mining issues and mine drainage issues. But the reality is acid mine drainage is the big -- single biggest source of impairment to the Susquehanna River. I want to talk about that and sort of the prognosis for the future.

So this is -- if you haven't seen it and you've been anywhere in kind of north central or over in the anthracite site region or the western part of the watershed, I'm sure you have seen plenty of it. That is the acid mine drain problem in the Susquehanna River. There is a lot in the North Branch coming from the anthracite coal field and a lot more in the West Branch coming from the bituminous coal mines.

This happens to be a photograph of where the acid mine drainage stream enters the river. Of course, here, here. Here is the bituminous coal field. The West Branch is up in this area towards the anthracite coal mines.

This is a map of the West Branch showing all the impaired streams. As you can see, Selinsgrove will be here. I'm pretty loud. Maybe I'll just do it without the speaker.

All the red are basically streams that are dead, biologically dead because of acid mine drainage. There is nothing living in them. As you can see, there's a lot of them in the West Branch. There's over a thousand streams that are dead.

Now, just a little primer on acid mine drainage – I don't expect you to know this -- but acid mine drainage is caused by the mineral pyrite, which is iron sulfide. Iron sulfide is contained in coal and a lot of rocks associated with coal. The process of mining physically breaks up that rock, exposes it to air, exposes it to water, and it forms acid mine drainage.

If you care, that's the formula. I'm assuming you don't care.

However, one thing you should know is that not all coal mining necessarily makes acid mine drainage. It's a little more complicated than that. It also involves calcium carbonate, which is the mineral for limestone. It involves sort of a balance between how much pyrite is in the rock, how much limestone is available, because limestone neutralizes it and does some chemical things that prevent acid mine drainage formation.

I need to talk a little bit about the background. The gist of all of this is that, as Terry Bossert says, the acid mine drainage problem really isn't so much of a current one anymore. It's really from our legacy of abandoned mines done virtually under no regulation from the 1800s up through 1964.

And so just a brief note on current mining. Now you have to do geotechnical testing. You look at that balance between the amount of pyrite in the rock and how much limestone in the rock. If it's going to make acid mine drainage in Pennsylvania, you are not allowed to mine it.

Just to give you an idea of how this works, I think Terry also mentioned that the surface mining law in Pennsylvania was last modified in a big way in 1980; the general mining law, actually. This is a graph showing the number of mining permits issued in Pennsylvania. That's the blue.

So it's sort of on a gradual decline. But actually the permits have gotten bigger. This is the permit that resulted in acid mine drainage pollution. As you can see, back in the late '70s, early '80s, roughly 20 percent of the permits to be issued resulted in acid mine drainage pollution. The reason for that is back in the late '70s, all you had to do is draw a circle on the map and come to DEP and say, I need a permit. We would rubber stamp it and say, Have fun.

Then when the law changed in 1980, we started taking seriously, but it didn't happen overnight. It really took us about five years to apply the science and figure out how to use the science to predict whether it's going to produce acid mine drainage and not issue those permits. That's step number one. The whole emphasis of what we do now is restore the West Branch, clean up the West Branch, and bring it back from the dead.

So step number one is to stop the bleeding. Make sure we don't cause any new problems. We have pretty effectively done that. Remaining coal reserves, where people are actively mining and go back into areas of acid mine drainage problems, you can actually correct those problems in the past. Then the second and third items is treatment of abandoned mine drainage. Our ability to do it has been pretty limited in the past by funding, but there's new sources of funding opening up.

Just a little bit about remining. This is a current mine site. This is before. This is after. You can see that's all acid forming rock so the water just goes in there, festers, turns into acid mine drainage, creates tremendous problems. Remining to current standards tends to fix up a lot of problems in the past. Another thing we do a lot of when an area is remined or new mining, they add limestone waste into it at a very high rate. That limestone decreases the acid mine drainage problem. Current mining actually, instead of causing problems, fixes problems.

Another thing is surface mining oftentimes now goes in with equipment so large (indicating) to go back in and dig up old areas that were deep mined in the past. This is an old mine void. This is an acid mine drainage factory. If you go back in and strip it out -- here is a surface mine. You can see those are the old coal pillars that were left. You strip it out and you can fix those problems from the past, too.

A quick example of this -- I see Mike Filter is here. He is involved with this project. Cedar Run, Lycoming County was dead. Fisher mining company went in, stripped it out, added a lot of lime, and day lighted the deep mines. Here is the old mine discharge. This blew out like in '69, and killed everything in the creek. And then you can see the red is acid.

Then this is when remining of it started. This is when it was completed, so you can see that discharge went from acid to alkaline. So that stream now is capable of supporting trout, which is a good thing.

Next thing I want to touch on -- and I'm really doing this fast. Cover everything I can in ten minutes. It's not easy. This is a thing that we are very heavily involved with in the West Branch now. There are lots of watershed groups that are seeking funding for this sort of thing. Some of you might even be here that were involved in that.

Building acid mine drainage treatment systems, it's come into fruition in the last ten or so years. It includes a layer of limestone, mushroom compost, and naturally treated it.

This is a large treatment system that was built up in Tioga County which is now under construction here. It's not completed yet.

This is probably the largest one of these types anywhere in the world. That was a two million dollar system. They are not cheap, but they are very effective. Here's some of them in construction.

And right now $18 million has been spent on these sorts of treatments in the West Branch. It's beginning to have a real impact. To tell you the truth, the price tag if we were to treat every discharge in the West Branch is up around $400 million, so that's a lot of money.

Now, it just so happens there is a tax. Every kind of coal that's mined in the country has a tax on it. That tax goes into an Abandoned Mine Reclamation Fund. We were just reauthorized a couple months ago. That Abandoned Mine Reclamation Fund allows each state to spend up to 30 percent of those monies on acid mine drainage remediation. Pennsylvania stands to get a pretty good amount of that funding because the funding is based on a formula that takes into account the abandoned mine problem you have in your state. Of course, Pennsylvania has more mining over the last century than any other state, so Pennsylvania gets a pretty good share of that money. So that's a plus. Of course, there's always chemical treatment. The problem is it's very expensive and labor intensive and chemical intensive and power intensive and money intensive. But the issue is there's just some discharges that are so severe in quality the only way you can treat them is chemically.

Now, with that background, we are going to take a quick tour down the West Branch of the Susquehanna River. This picture is a little dated. This is from 1858. This is back when they had the log rafts and were logging the river.

We are going to go from the very source of the river up here around Carolltown in Cambria County, coming down all the way to Northumberland. We are going to do it really fast.

The source -- actually, the river starts in a mine tunnel, so it gets acid mine drainage pollution at its very birth. Then 20 miles or so downstream, by then it's got a pretty good slug of mine drainage in it. It's not a very large river. It's still small enough to practically jump over.

At Curwensville you are at the Clearfield Run. That's Curwensville Reservoir. Then down below Clearfield the river is in a recovery mode. Used to be dead as a door nail. Now it's actually got some fish in it. You can see there is a little stream coming in here that's dumping its share of acid mine drainage in the river, but the river is at this point nice enough to have some fish in it, have some reclamation potential. And the long-term reclamation potential down the road, is absolutely huge. This is a nice wilderness area.

Then we get down to Moshannon Creek, which give it another good wallop. The locals call it the Red Moshannon Creek for a reason.

The major contributory coming into the Venice branch of the Mahanoy Creek, it used to be dead. Now, at this point, it's a recovering stream with a good smallmouth bass population. We have a very large treatment project up on the Venice branch of the Mahanoy Creek. It will make a huge difference.

Then we are getting down on the bigger water down below Renovo. See, it's a beautiful river corridor.

At Renovo in the '50s, '60s, '70s, the pH was about four. Even up into the mid '80s, four. 2004 -- I pulled up some old data -- it was averaging six. Now it's averaging into the six and eight range. People think that that river has been dead for a hundred years. It's always going to be dead. I tell you what, it ain't so.

Here it is at the West Branch at Lock Haven. I know when I was a kid and when I was a Susquehanna student this was orange. The river still has its problems, but things are looking up.

In fact, this is the amphitheater they built. It looks into the river. Thirty years ago you would have never had it because nobody would have wanted to look at the river. It was pretty nasty.

Then, finally, here is where the branches of the river come together at Northumberland. The North Branch has some acid mine drainage problems with it, but nothing in comparison to the West Branch. Real quick, I just want to talk about one success story, because this is a success story that's done now. We are repeating these success stories on different watersheds. This is Bass Creek. This is the major contributory to Pine Creek. Bass Creek has been dead for over 100 years. This is up at Pine Creek, Grand Canyon of Pennsylvania. We over the last 15, 16 years spent about – along with mainly the efforts of the Watershed Association, spent about $10 million building various projects in Bass Creek. This is an abandoned course. It was reclaimed with sewage sledge from Pennsylvania. This is a passive wetland treatment system. This is another one. After 100 years of being dead, it's now a native brook trout fishery. Bob McCollough sort of spearheaded the whole thing. He got to stock the first ceremonial trout.

I'm just wrapping things up. I just want to mention, this is a real bright spot for the future of Pennsylvania. You probably heard about the Pennsylvania Wilds Initiative. The governor is trying to increase tourism in north-central Pennsylvania. When you are in the Pennsylvania wilds, be careful. He's out there. Now, as we get younger, the technology will get better.

DR. LUBNOW: My name is Fred Lubnow. I am sort of the transitional technology person. I remember starting at Susquehanna in '84, when we had three Macs in the biology department that were about twice the size of the podium. So that's pretty amazing.

I know enough about technology to be dangerous. You could actually ask any of the GIS people I work with. They will tell you that.

So my presentation is going to cover nutrient loading, but I'll talk a little bit in general about non-point source pollution and its impacts on the Susquehanna River.

This is just showing the size of the Susquehanna River. It starts, obviously, in New York and drains into the Chesapeake. The watershed of the Susquehanna River is about 17.6 million acres. Approximately half of Pennsylvania is in that watershed. Starts in New York; ends in the Chesapeake Bay. And then in Pennsylvania you can see the land use distribution. You have about 47 percent agricultural, 47 percent forest, four percent urban, and then two percent of barren mines, which includes a lot of the mining that we were talking about a little earlier. What's interesting, as you go from the head waters down to the Chesapeake the amount of urban land increases. So when you are in New York it's about two percent urban. When you are down at the Chesapeake it's about 16 percent urban.

Impacts of non-point source pollution and just pollution in general on the Susquehanna, you can divide them into three main categories. This is physical impairments. What that has to do with is water being withdrawn, whether it's for potable water or industrial use, as well as storm water impacts, the flooding associated with a lot of the impacts on residential and commercial property.

Another impact is chemical. That's what I'll really focus on in this presentation. We will talk a little bit about point source pollution and a lot about non-point source pollution.

Then biological. Think of the invasive species that have affected not just the Susquehanna River, but a lot of water bodies and waterways throughout the United States; West Nile Virus, zebra mussels, flat head catfish come from other areas and they have a devastating impact on the local native communities.

I am going to focus on non-point source pollution. What exactly is that? The best way to describe non-point source pollution is to describe point source. Point source is that pollution that comes from an easily identifiable source, from a pipe, a specific pipe. So it's a waste water discharge pipe or an industrial pipe where that pollution is coming from one source. It's relatively easy to correct it. Might be expensive, but it's relatively easy to correct.

Non-point source pollution is a more diffuse type pollution. It's coming from the atmosphere. It's coming from surface runoff, storm water, agricultural runoff, septic loading. So there is a lot of wide variety of sources that contribute. It can be relatively difficult to correct.

This is just showing some of the more common sources of non-point source pollution. You have construction associated with development, waste water disposal with on-site waste water disposal technologies, agricultural, logging,
mining, and home and garden.

I am going to go through some of the more commonly identified pollutants for the Susquehanna River. Then I will focus on nutrients. The first one, I'm sure everyone has heard of PCBs. They were widely used earlier in our history for a lot of industrial uses. Well, PCBs, a lot of them are still in sediments. There are a lot of questions and issues in terms of how to deal with those pollutants. They have impacts that vary from carcinogenic, impacts on developing fetuses.

Mercury, I'm sure you have heard of that in fish flesh. It comes from industrial use as well as the atmosphere. There are issues from the accumulation of Mercury in fish flesh.

Acidity, which we previously talked about, low pH and the impact of acid mine drainage. Nutrients such as nitrogen and phosphorus, which really have an impact on the more local setting as well as the Chesapeake Bay.

There are suspended solids in the water, soils, and sediments that go into the waterways. So there are a wide variety of pollutants that impact the Susquehanna River.

Let's focus on the nutrients. What are some of the impacts of nutrients? One is recreational. Algae blooms, fish kills. That can have a big impact on the recreational use of the river.

You can have human potable impacts. Increased cost with treating water to make it drinkable, as well as removing toxins. You can have taste and odor problems.

There are certain ecological impacts. You can have more nutrients, you can have more algae, which can mean submerged aquatic vegetation, which we call ASV, submerged aquatic vegetation. It can also contribute to fish kills as well as favoring invasive species.

All of this has a direct impact on the economy both regionally and locally if you are dealing with providing people with drinkable water or property damage associated with flooding. So nutrients, not just the quantity but the quality of the nutrients, how much nutrients

are in the volume of water, delivering those nutrients can have a human impact on associated waterways.

What can be done to deal with non-point source pollution? This is showing some examples; pipe conveying storm water runoff, as well as roadside swale transporting nutrients and solids into a receiving waterway.

Let me show you what can be done with non-point source pollution. We worked on a number of projects throughout the Susquehanna drainage basin. I am going to focus on Harvey's Lake, which is up in Luzerne County. It's a water body that drains into the Susquehanna River. It's the largest natural lake by volume within Pennsylvania. That's important, by volume, because they are competing with Conneaut, which always brags they are the largest lake by surface area. They compete with one another.

It has a mean depth of 11 meters, maximum death of 29 meters. It just gets algae blooms from time to time. The watershed only accounts for .024 percent of the entire drainage basin of the Susquehanna River.

It's that old phrase, think regionally or globally, but act locally. That's really what they are doing at Harvey's Lake.

For a lot of pollution and types of pollutants there is something called the TMDL approach to use. Stands for total maximum daily loads. In the case of nutrients we are focusing more on annual loads. This is showing you the existing phosphorus loading into Harvey's Lake and what the target load, what the desirable load, what we want it to be. That's important because that targeted load is based on water quality models. We want an accepted level of water quality conditions.

So essentially what this graph is telling you is Harvey's Lake has to go on a diet. If has to reduce its annual phosphorus load by 104 kilograms per year. This is a map of the Harvey's Lake watershed. All the pink area, which are the low density, urban, and transitional areas, those are the developed areas. Even though the watershed is only developed about 20 percent, almost all of it is immediately around the lake. It's probably one of the most poorly planned lake communities I've ever seen.

Again, you've got to remember back around the turn the century, non-point pollution issues weren't something of concern with people.

So the idea is, how do we reach that targeted TMDL? We implemented a number of projects that focused on stream bank stabilization and road side swale projects. We have installed a number of small scale storm water retrofits in the existing infrastructure to collect the phosphorus and solids. In the storm water a lot of your phosphorus is stuck on the sediment particles.

We have installed a number of larger Best Management Practices. So when I say BMV, that's what I mean. It stands for a hot type of technology to reduce a pollutant load.

They have also banned the use of phosphorus fertilizers. There are some studies that came out of Minnesota that show if you can shift your own personal private property from phosphorus fertilizers to non-phosphorus fertilizers you can reduce your phosphorus load by 12 to 18 percent on an annual basis. If you think of a lake community, that can be a sizable reduction.

We are also in the process of developing a storm water implementation plan. This is a map of Harvey's Lake. This is showing you some of the projects we have installed.

I'm going to show you some of the technology we are working with. These are small break inlet skimmer boxes and snouts. We have installed a number of these in existing catch basins. This one we are actually

installing this fall or next spring. It's called an aqua filter. It will remove solids, but dissolved phosphorus as well.

Road side swale stabilization. This is really. We've done some stabilization with the public works department to regrade and then fill it in with rock to help collect the solids.

This is a large storm water project. We have actually taken runoff from a 28-acre drain-off within the watershed. Here it's being treated. There is more water going into the structure. It looks like chocolate milk. Coming out in a lower volume the water looks gray.

This is something we've done at Harvey's Lake, but I have some better shots at Lake Luxenbourg, which is down in Bucks County, Pennsylvania. Here are some students. This isn't child labor. They actually wanted to help us with the project. We actually paid them lunch. They came out from the middle school and helped us plant vegetation along the lake. This was in April of 2001. This is October of 2001. This is what the vegetation looks like as of last year. So we had great success in stabilizing the shoreline of this particular lake in a county park with vegetation. Again, to suck up the nutrients before they go into the lake. Some of the other projects we are working on, storm water treatment facilities that use wetland plants for removal of solids and nutrients.

This is a small pocket wetland in Bucks County. You can see these yellow or white lines going across. That's to prevent the geese from going in and having a little smorgasbord. Literally the first year you have to contain your wetlands system. After a year, though, the vegetation is high enough the geese won't bother it.

This is a 14-acre wetland complex we did in Bucks County, treatment from a road and expanded assisted living community in a development where they wanted to increase the square footage from impervious area.

I am going to conclude here just showing you where we are at Harvey's Lake. We have had some success. We have documented reductions in the phosphorus load going into the lake. We have reduced that existing load we need to get to, that targeted load we need to get to. We are about 30 percent there. So we are in the process of developing a storm water implementation plan which will help us to identify additional projects to get to that targeted load so we can avoid or at least minimize those algae blooms.

So it's a long-term commitment. Harvey's Lake, they've been working on these projects since the early '90s. It takes time. They use a lot of grant work, a lot of local participation. It's a continuous educational program.

So in conclusion, non-point source pollution is a very diffuse form of pollution, very difficult to control. There are a variety of sources of this pollution. It has ecological, recreational, and economical impacts. However, there are a wide variety of options to manage and control this type of pollution. And, you know, this is, again, thinking on a local basis that will not only help that particular water body, but also helps the Susquehanna River on a more regional basis. Thank you very much.

MR. BUDA: My name is Tony Buda. I graduated in 1998. I should be the most technically adept at working this system here since I am the most recent graduate.

I would like to thank, first of all, the organizers for inviting me to come here and speak today. It's really an honor to come back and be able to participate in this program. I would also like to applaud

them for kind of bringing to attention the state of the Susquehanna River.

We have heard some of the panelists talking about the legal issues and water quality issues related to the Susquehanna River. My task today is to talk about how you assess water availability issues and planning issues in the Susquehanna River basin.

So I guess to start off, how much water do we have? How do we assess how many water is available in, say, a river basin and something the size of the Susquehanna River basin?

The way we do this is kind of a fundamental hydrologic concept that we call the water balance. It's analogous to balancing your checkbook on a regular basis, where basically we set stream flow here equal to the amount of precipitation that comes in minus the water we lose due to evaporative transpiration.

We get about 40 inches of rain per year. About 20 percent is returned back to the atmosphere. We have evaporation from soil surfaces and transpiration from trees. Then six inches of that water that actually gets to streams is actually what we call runoff. That gets to streams pretty quickly. The remaining 15 inches actually infiltrates to the soils and slowly discharges throughout the streams through the year.

A drought period like now, that's actually all ground waters being discharged into our streams. We get about 21 inches of rain we can use for many different uses in the basin.

How do we use water in the Susquehanna River basin currently? Here I'm showing you different uses of water in the Susquehanna River basin. Blue is public water supply, green is agricultural, yellow is power generation, this is a combined golf course and ski areas, and then for stream applications here. What I'm showing in this pie chart is actually inches of water used per year. We have the Chemung River basin here, the West Branch, the Juniata, this is the Upper Susquehanna River basin here in red, there the middle is, and the lower Susquehanna River basin. Just to point out, that public water supply, number one, is pretty important to every one of the subcomponents. It makes up a pretty significant component of human use of water.

In the Chemung and Juniata and Upper Susquehanna agriculture is fairly important. Power generation here in the West Branch and that's in the middle Susquehanna River are important uses of water. These are human uses of water.

As a percentage of average actual flow, we get about 21 inches of flow in an average year. We use at most about an inch of water for human uses. We are talking about five percent of that average annual basis. That's if you look at an average year. We don't always have an average year. We like to talk in averages. It's really important to report averages and means.

Here is within this green bar -- the bars are actually flow in inches of the Susquehanna River in Harrisburg. This line here is precipitation. I just plotted the last 50 years of climate record I was able to dig up.

We also have years we have a lot of water. I'm sure some of you remember in 1972, we had the Agnes flood. More recently we had the floods of 1996, back in 2004 the Ivan, the remnants of the topical storm water.

But there is also the years where we have very little water. Some of the worst droughts on record, at least in the past 50 years, occurred in the mid 1960s. Even recently, in 1999, we had a pretty severe drought in the basin. We fluctuate between really extreme

drought and floods and mean years. Just to point out, it's not always average conditions we are talking about.

If you look spatially across the basin, not everyone gets 41 inches of rain. So, for example, if you live up here in Corning, New York, you may be getting only about 31 inches per year. From 1961 to 1990, the mean annual precipitation, if you live in Clearfield you might be getting closer to 47 or 48 inches on an average year. So spatially we don't get the same amount of water in an average year to use.

On top of that, water availability is affected by seasons. There's not always the same amount of water in the different times of year. The main point to show you is that there is different amounts of flow we get for the amount of precipitation that comes in. If we are talking about winter, some of this precipitation is coming in as snow and certain percentages of that is translated into river flow, but a lot of this is actually snow that's stored and hasn't melted yet.

As we move to the spring, we get some snow melt once trees leaf out and a lot of this, that water is being he transvaporated back to the atmosphere. We really get some low flows in the Susquehanna River. July, August, September, October are all low flow months. When we are talking about water use we should talk about times when we have a lot of water or a little water; not just average years.

What I want to show you, here is Susquehanna River water use as a percent of natural flow. The green bar is when we have mean flows. This is an average flow for a particular month of the year. There's times when we have a lot of water, maximum flows, and red is when we have very low flows.

You can see that there are certain times of years, especially in the drier months, if we have very low flows we are using anywhere from 30 to 40 percent of the actual river flows for our particular uses. There could be times we are using 40 or 45 percent of that water. We need to be cognizant of these seasonal variations in flow.

One of the often neglected uses of water that we often think of, how can I get my water to run my faucet, how can I get my water to water the lawn, and some of those particular uses, or for power? We also forget about the need for protecting aquatic life. It's important to maintain the stream flows to protect aquatic life. Mayflies here -- and I am not professing my talent at catching fish. I just want to show that we need to protect aquatic life and fish species because these organisms, they have adapted their lifestyle for natural variations in flow. That increase in flow is another thing we need to take into account.

Now that I have talked about how much water we have and how it's varied by season and some of the uses, I want to touch on issues that may affect future water availability throughout the Susquehanna River basin. One of those is climate. The 1999 drought is the most significant drought we have had recently. It's one of the worst droughts since the 1960s.

This is cumulative stream flow in the Susquehanna River basin. So the red line is the '99 drought. The blue line is actually an average year. This actually darker blue line shows what it looked like in the '99 drought. So we can see by June, July or August we have about five inches below a normal year and ten inches below a really wet year.

With drought emergencies -- we learned a lot from that drought. Now we have improvements in drought monitoring where we look at precipitation deficits, stream flow records, soil moisture -- and that's beyond water levels -- so we can properly advise people in terms

of whether we should issue a drought watch, drought warning or drought emergency.

Now, flooding, you might not think of flooding as an important issue of water supply. Flooding is important because flooding creates problems for water quality. If you have a lot of quality you can have excess pathogens or sediments getting into your water supply. They might have to shut that down and boil water. Water supplies have to be able to deal with floods and provide safe water during those periods.

A real important issue is we have learned a lot from extreme events, droughts and floods, in climate change. As we are projected to have more of these extreme events, then we need to learn from these past events so we can properly prepare for times of drought and times of flood, and be able to supply safe, usable water and how to protect the ecosystem.

Land use is another potential issue we need to be cognizant of. These points are really protecting recharge areas. Recharge I talked about in the first slide. It's really important.

It's been estimated that in the valley region, especially where we are at right now, these forest ridges can supply over 70 percent of the water we see in our streams. We need to protect these areas. They are sensitive recharge waters for groundwater.

Minimizing the impacts of urbanization is really critical. Storm water is a big issue. So as we pave over more of our landscape when we develop, this water is not about to infiltrate into the ground and it runs off directly and you get things like this. This is State College, several inches of water in an hour. That storm water moves quickly through the system. We don't benefit from it and get a chance to use it. We need to be cognizant.

Water quality is a very important issue, as well. Because we have -- there are areas in the basin that have an abundant supply of water, but that water might not be useable for drinking water or industrial uses. So there is an effort going with a pair of water bodies.

So a lot of streams and rivers in the Susquehanna River basin are not meeting the designated uses. We need to work to improve water quality in these areas. They need to be cleaned up so we can have access to use for recreational purposes or fishing or for drinking water or some of these other uses we value in the river basin.

Finally, I will just touch a little bit on water plans. We needed to incorporate knowledge we gain about how much water we have and what we use it for. Act 220 in Pennsylvania was passed in order to update the state water plan. The last time this plan was updated was more than 25 years go, so it's severely and grossly out of date.

And essentially, once we update this plan, it's going to be updated every five years after that. So we will update it by March of 2009, and then every five years we are going to continue to go back and update it.

It requires we register if water use is greater than 10,000 gallons a day. We can identify critical water planning areas, so -- areas where demand exceeds supply. So we can look at more detailed water budget analysis and maybe find ways to protect those areas.

Also looking at voluntary water conservation. That's clearly important. We have drought watches issued right now.

Just to conclude, there are adequate water supplies within the Susquehanna River basin to support a variety of uses, especially during the average to above average flow periods. We have periodic droughts. This results in stresses to water supplies and aquatic ecosystems. The future availability of water in the Susquehanna River will be

dictated by our ability to balance the ecosystem needs and future demands coupled with changes in land use, water quality, and climate that we may see in the future.

I would just like to acknowledge two people from the Susquehanna River basin, Drew Dayhoff and Susan Gouda, in helping me gather information for this talk. Thank you very much.

DR. HOLT: Before I open it up for questions, let me try to get back to the over-arching question, the state of the Susquehanna, by asking a question. Let me preface it by saying that the Chesapeake Bay Foundation once a year issues a grade report for the Chesapeake Bay. I would like to know what the panel, if they had to grade the Susquehanna River, what grade would they give it, so an A, B, C. I think right now the Chesapeake Bay Foundation has given the Chesapeake Bay a D minus. That's up from an F.

MR. BOSSERT: Probably, particularly from their perspective, which deals with the health of the Bay and the rivers impacting on the health of the Bay, I would agree with that. I think in some other respects, like Mike pointed out, it's got considerably better grades than it used to have.

MR. SMITH: I say D minus is a little bit harsh for the same reasons Terry said. I think I would give it a C minus. There is a lot of good things going on, a lot of strides and improvements. D minus is little harsh. I think they need to grade on a curve.

DR. LUBNOW: I agree with you. I think around C, C minus just because there is still a lot of potential to preserve and protect a lot of the resources, as we mentioned. There are impacts and a wide variety of impacts, but a portion of those are being addressed. I think whoever is doing that work needs to brag about it, if it's EPA or DEP or whoever. That information needs to get out so other communities and people who are having those impacts need to know what can be done to take care of their local waterways.

DR. BUDA: I think it's important to kind of take a look at what -- I think we are into an era where now people are more environmentally aware than maybe in past decades. So I think grading it gives people kind of a picture of where we may be, but I think there is clear opportunities for us to do a lot of good in the Susquehanna River basin. I think with people being more environmentally aware there is going to be a push to clean up the acid mine drainage and do some of the activities in a more intelligent and environmentally sensitive way.

Grading is useful. I think it's also useful to think about what we can do and the kind of changes we would make. I don't know if I would go ahead and give a grade, actually. I'm hedging the point.

DR. HOLT: I realize that no one else on the panel makes a living by giving grades. Are there any questions from the audience?

QUESTION: If one of you could comment on the state of the river around here involving the water use and the ability to use for recreation; if that's improved, not improved, what the environmental conditions are.

MR. BOSSERT: I think it's improved. I would just say when I first started working for the Department of Environmental Resources in 1974,

we used to joke that Northumberland was the state's largest waste water treatment plant because sewage-laden water from the North Branch would intersect with the acid laden water from the West Branch and, therefore, neutralize the effect. Of course, we didn't talk too much about what precipitated out from the bottom of the river from that area.

I think from that perspective things have improved in this area. Both of those loads have really diminished, as all the speakers pointed out. So I think from what I've seen, the water quality in this stretch of the river has improved considerably over the last 20 years.

MR. SMITH: I agree with that for the same reasons. The sewage issue is a lot stronger now than it was 20 years ago. Certainly the mine drainage issue is. Maybe farther down the watershed, down in Lancaster County, where there is a lot of nutrient issues, it might be a different story. I think in this part of the watershed it's technically better now.

DR. LUBNOW: I grew up in Shamokin. Growing up right next to Shamokin Creek, to me a creek -- or a crick, as we called it -- was crystal clear with orange on the bottom. That's just the way I thought it was until I went to Susquehanna and started checking other sites out. I do still have relatives who are there and I go home every once in a while. They show me there's actual fish now and it doesn't look orange on the bottom. I believe, from a personal view, we've seen changes in our lifetime, so there have been improvements within the area. Absolutely.

DR. BUDA: I have to echo the comments from the other three panelists. It's in much better shape now than it was in the '70s or before we had major regulations to protect it. That being said, I think we still have a little bit of a ways to go. It depends what metric you are using to evaluate the river. I think we still have improvements we can continue to make. Sure, it's certainly safe for drinking and fishing and a lot of the recreational activities. We can take pride in that and go from there.

DR. HOLT: There was a question earlier.

QUESTION: I have a specific question for Mr. Lubnow. You showed some snout or different storm water means. Do they have filters in them?

DR. LUBNOW: The snout thing is actually a device that goes on the outflow pipe of the catch basin. All it does is prevent the solids from shooting through the structure.
The solids sit on the bottom.

The other thing I showed is the aqua filter. That's made of a combination of ground-up plant material and silica. That absorbs the dissolved phosphorus. That has to be changed about once a year to two years. Having a vested interest in the lake community, there is that definite relationship between phosphorus and algae blooms. When you are dealing with a marine river community, you have to say it helps the local economy, it affects your health, environment. In lakes it's actually easier to make those connections than in a river ecosystem.

QUESTION: I have to disagree with the panel, first of all. I'm here as a smallmouth bass fisherman and have recently been concerned about the situation on the Susquehanna River. I graduated from this University in

'67, and I've fished the river here and south of here for 35 or 40 years.

There are species of fish in this section of the river that have disappeared. There are no more smallmouth bass. There are no more pan fish. We are currently trying to lobby the Fish Commission to make changes, because in the last eight years there's only been two or three good spawns of smallmouth bass. Until 2005, there was a huge kill from smallmouth bass from bacteria that was traced to sewage that had overflowed into the Susquehanna River apparently.

So the condition of the Susquehanna River – while the DEP has cleaned up some of the industrial point source pollution, the condition of the Susquehanna River from a fisheries perspective is really not good.

Now, my question -- my question is that I have recently been frustrated by a small fishery locally that has degraded. I think it's degraded because of non-point source pollution, particularly agricultural, hog farming, chicken and turkey farming, things that come into this fishery at high water points. I've been frustrated by the fact when I directed my concerns to agencies about the fishery, no one seemed interested in responding or testing the situation, looking at it.

Now, I realize there is a money crunch and everybody has an agenda that they're working on. But my question then is, who has the responsibility -- when a citizen sees a problem or points out a problem or realizes a problem and he goes to an agency, who has the responsibility to evaluate the concern and, if the concern is not evaluated by anybody, what is the legal recourse that a citizen may have to get somebody to look at the situation he's concerned about?

MR. BOSSERT: Well, it is the agency's responsibility to look at. In addition to everything else I did, I was also the chief counsel of DEP for a while. So I know it was our obligation when someone came up with a concern to evaluate it thoroughly.

Now, there may or may not be anything you can do about it. I made a comment before. Agriculture gets a pretty big pass. There is actually a law in Pennsylvania that says you may not require -- DEP may not require farmers to put up a fence to keep cows out of a stream. It's actually in the law. So they get a -- so it's difficult to deal with that. It's a difficult issue. But to answer your other question, there are provisions in the Clean Stream laws and most environmental laws that allow citizens to bring their own actions. Not to turn this into a legal seminar, but sometimes if DEP acts you can challenge that act through a certain process.

If they refuse to act, then you really are in a tougher spot where you really need to bring your own action. There are things called citizen suits.

QUESTION: Are there legal groups that help you with that or must I employ a legal counsel privately?

MR. BOSSERT: Well, I have a card here in my wallet. There were several groups that do this. Chesapeake Bay Foundation, for one, will do that. There is an organization in Harrisburg called Citizens for Pennsylvania Future, or PENN Future for short, that does that kind of work. There are a variety of watershed groups out there who sometimes have raised funds in order to bring those kinds of actions. Then there's sometimes just ad hoc groups that

spring up. Usually that means you got to pay for it yourself. But to go back to your earlier comment, you are right and actually that's a very good example of what everybody on the panel was talking about, the smallmouth bass. You had a period of low flows in the river, you had a period of high spring rains, and you had sewage overflows. My answer to that question, water is not so bad around here from my perspective. When you get down to Harrisburg, if it rains too much the sewers overflow directly into the river without any treatment, so you get that combination. Then you get summer low flow that stresses the population. And it was definitely a bad year for fisheries. There is no doubt about it.

DR. BUDA: That's an interesting issue to bring up about the bacterial influences on the smallmouth bass population only because they are experiencing similar problems in the Shenandoah River basin, where they just recorded fish kills. They are losing smallmouth bass and pan fish. They are at a loss to really figure out what's causing that.

QUESTION: I understand from the Shenandoah River Keepers' website they thought they had traced it to turkey farming operations.

DR. BUDA: There is a lot of agricultural land uses. I mean, the hypotheses they are putting forth, some of them are related to nutrients. It could be pesticide related. It could even be the hormones or endocrine disrupting pollutants that get into the rivers that could also be affecting the ability to reproduce. In the Potomac they have smallmouth bass males are becoming more female because of their proximity to sewage treatment plans and some of these chemicals. So these are probably new issues that we face in terms of figuring out what is going on with the smallmouth bass and dealing with some of the other chemicals. So I guess we have made improvements in some areas, but we still have to learn what might be affecting the smallmouth bass in the Susquehanna River. We may be able to learn some things from the other river basins where they are experiencing similar kinds of problems.

I think that's an area where research may come in and address some of those concerns. It's not really clear what is causing the declines in the bass. They don't know what caused this bloom of bacteria in the river, because maybe it is all the time. It may explode certain times because of excess nutrients or low flows or temperatures. We are not particularly sure what that is. These are ways we need to move forward to try to answer some of those questions so we can better manage the fisheries and water quality in the river.

DR. LUBNOW: Tony touched on why we didn't give a grade. It depends on your metric of perspective. From a water quality perspective or acid mine perspective, there have been improvements. If you are looking at the fishery perspective, there are major problems.

It could be loss of habitat due to wide variations in hydrologic loads. That may have contributed to it; as well, excessive sedimentation. A lot of the microorganisms that have been affecting other fish are invasive species similar to the West Nile Virus. They were not originally from here.

So it could be something that is more of an interaction with an invasive species and the smallmouth bass may be susceptible to other impacts because of that microorganism.

So there are a lot of things going on. The one recommendation I would make, because I get this a lot as a consultant, what you really want to do is form an organization. Form a group. And it takes a while, but I've seen it happen.

QUESTION: Do you know how many organizations are on the internet and they are all spinning their wheels?

DR. LUBNOW: Let me finish this. Form an organization and get into the limelight as quickly as possible. Bring cameras down. Take photographs. Because I'll tell you, some of my best clients started out as these little ad hoc groups complained about a certain lake or certain stream. They got out there. It's a continuous educational thing. You got to hammer not just the community, not just the municipality, not just DEP, but the public in general. Get out there. Newspapers. I've seen a lot of success by groups doing that.

DR. HOLT: Thank you. We are going to have to call this at a close. I will let Mr. Sobel conclude it.

MR. SOBEL: Thank you very much. I just want to say thank you to each and every one of the panel members. Thank you for sharing the knowledge that you shared with us today and, I think, maybe more importantly for me is, thank you for filling me with a great deal of pride knowing that a university that I'm affiliated with as a staff person graduates people like the four of you. Thank you very much.

Thank you, too, Professor Holt, for helping pave the path these four gentlemen have taken. To our audience, thank you for joining us today. I hope to see more of you at the discussion on judicial independence and accountability. Thank you.

(Whereupon, the presentation concluded at 1:55 p.m.)