PENNSYLVANIA HOUSE OF REPRESENTATIVES
REPUBLICAN POLICY COMMITTEE HEARING
- - - - -

IN RE: WATERSHED RESTORATION ASSESSMENTS UTILIZING THE SWIM TOOL

- - - - -
MONDAY, APRIL 13, 2009
- - - - -

BEFORE: HON. STAN SAYLOR, CHAIRMAN
HON. SANDY MAJOR, MEMBER
HON. JOHN EVANS, MEMBER
HON. BRIAN ELLIS, MEMBER
HON. ADAM HARRIS, MEMBER
HON. CHRIS ROSS, MEMBER

Held at the Academy of Natural Sciences, Ewell Sale Stewart Library, 1900 Benjamin Franklin Parkway, Philadelphia, Pennsylvania, commencing at 1:30 p.m., on the above date, before Virginia Mack, Professional Court Reporter and Notary Public.

CLASS ACT REPORTING AGENCY
REGISTERED PROFESSIONAL REPORTERS
1420 Walnut Street
Suite 1200
Philadelphia, PA 19103
133H Gaither Drive
Mt. Laurel, NJ 08054
(856) 235-5108

I N D E X T O T E S T I F I E R S

(Whereupon, portions of the transcript are marked inaudible, no sound system.)

P R O C E E D I N G S

THE CHAIRMAN: Good afternoon, and welcome. The Academy of Natural Sciences traces its origin back to 1812 involvement in environmental research.

Several months ago I had the pleasure of meeting with the Academy, at which point they informed me that they had the ability to track and measure the performance of specific Commonwealth environmental programs, and given our recent focus of cutting costs of programs -- the State legislators -- that are ineffective. Part of the main reason is the current budge crisis.

I thought it would be beneficial for us, as our task force of cutting the budget, to come down and look and listen to what the Academy can do and perform for us, and I believe that a review of the effectiveness of the Select B Program would be beneficial to all of us to realize what the Academy can

offer us, as legislators, in cutting costs in Harrisburg.

With that we will move forward with the hearing.

MR. PECK: Thank you, Mr. Chairman, and good afternoon ladies and gentlemen. We are delighted to have you here today. My name is Bob Peck and I am the Senior Fellow of the Academy, and it's my pleasure to welcome you here on behalf of our President and CEO Dr. William Brown, who unfortunately, is traveling out of the country today and is unable to be with you. He joins us all in extending a warm greeting. He has asked me to give just a brief bit of background of the Academy's history to put into context the testimony that you'll be hearing from my colleagues in just a few moments.

We're seated here in the Reading Room of the Ewell Sale Stewart Library, which is arguably the best natural history library in North American. We have about 200,000 volumes here, not all of which are visible, obviously, they're back in the stacks, they date from the 16th Century right up to the present time and we're also surrounded by wonderful portraits of some of the leading scientists of the 19th Century and

running up to the present time. These were the people who really pioneered the study of natural history here in North America.

Since our founding in 1812, the Academy has played a leading role in biological research. Its mission early on was to identify organisms throughout the country and around the world and to begin to understand how they were related to one another. In the course of that time, over almost 200 years, we have amassed over 17 million biological specimens here at the Academy, which are kept more or less as a library of the living world unrivaled resources for a study of DNA and many other things. These include important historical collections.

He have, for example, Thomas Jefferson's Fossil collection here, you may have heard a little bit about that at lunch. We have the plants that were collected by Lewis and Clark on their famous voyage across the -- journey across the country. We have John James Audubon's bird skins, the actual specimens that he used as the models for his great book "Birds of America" which you also seen our subscription copy in the case over there.

So for almost 200 years it's through the

Academy that students, scientists, government agencies, museums, conservation organizations and leaders like you have turned to under the complex intricacies of nature.

Many of the disciplines of science, the study of birds, ornithology; the study of insects, entomology; the study of fossils, paleontology had their start right here in the Academy and these portraits reflect some of the founding fathers of those disciplines: Botany, the study of plants; the study of reptiles and amphibians, herpetology; the study of fish, Ichthyology; study of mammals and minerals, mammalogy and mineralogy also gained international prominence under the auspices of the Academy. And many of the early findings were published in our journal proceedings.

The other area that we have led in is the study of environmental quality, and particularly water quality, fresh water quality. Beginning in the 1930s Dr. Ruth Patrick, whose portrait is hanging there, just to the left the door, pioneered ways of looking at water and you'll be hearing much more about this from my colleagues David Velinsky and Jerry Mead.

During the 1940s and '50s she defined criteria for aquatic health that are now used as

standards around the world. She has also won virtually every medal there is to win in the field of science, short of the Nobel Prize, and she is still coming in to see us everyday. She is 101 now -- at least until Christmastime she came in to the Academy every weekday from 9 to 5. She is quite a formidable figure and a role model for many of us.

At the Patrick Center for Environmental research, named in her honor, we undertake large and complex environmental assessments of fresh water systems in Pennsylvania and around the world.

I have spoken very briefly of our scientific research. We have about 150 scientists who do work all over the world in virtually every discipline, but I should also mention our educational outreach programs. Since the earliest days in the Academy's existence, we have been committed to public education. Our public lectures on topics ranging from botany to mineralogy began as early as 1813 and our museum became a public space forum as early as 1828.

The museum is a wonderful welcoming and non-threatening setting where people of all ages, beliefs and educational backgrounds can come to learn about the natural world, and I think you saw some of

that energy and activity out in the public halls today.

Our award winning WINS program, which is an acronym for Women In Natural Sciences, now in its 27th year, provides a safe, after school setting where traditionally underserved girls have been given rigorous scientific training, and many of them have gone on to careers in the natural sciences.

As we approach our bicentennial, in 2012, we are poised to strengthen and expand our role as a leader in the environmental research, education and exhibition.

We have done a master plan as part of that anniversary and are now also poised to begin to bring our 133 year old building up to modern standards for our research and education programs.

We greatly appreciate the support we have received from the Commonwealth of Pennsylvania over the years, beginning in 1817, when you approved our charter.

Now, I realize that the Committee has other business today, but I would be remissed if I didn't mention that we have recently requested some funding for our renovation efforts and we will look forward to talking to you further about that.

Of all of America's natural science museums, none has a longer or more distinguished record of environmental research, education and exhibition. Yet, because of the enormous scope of the Academy's activities not many of our fellow citizens are aware of all that we do. We are delighted, therefore, that you are visiting us today to get a firsthand overview of the institution and its activities.

We have chosen just one of these activities, our work on fresh water ecology, to talk to you in detail about this afternoon.

With that, I would like to introduce my friend and colleague Dr. David Velinsky.

THE CHAIRMAN: As he is making his way forward and preparing to show, Brian, why don't you go around and start the introduction.

MEMBER ELLIS: I'm State Representative Brian Ellis, from the 11th District, in Butler County.

MEMBER HARRIS: I'm Adam Harris, 82nd District, Juniata County, Mifflin County and Snyder County.

MEMBER EVANS: John Evans, representative of the 5th Legislative District in Erie and Crawford Counties.

MEMBER MAJOR: Sandy Major, representing the 111th Legislative District which includes part of Susquehanna, Wayne and Wyoming up in Northeastern Pennsylvania.

MEMBER ROSS: Chris Ross, 158th District for Central and Southern Chester County.

THE CHAIRMAN: I'm State Representative Stan Saylor, York County, 94th District and I'm the Republican Policy Chairman. I would like to add that Representative Major is our Republican Caucus Chairman of the Republican Caucus, so we have two republican leaders here today.

Go ahead, David.

MR. VELINSKY: Thank you, Chairman Saylor and members of the Republican Policy Committee. Welcome to the Academy of Natural Sciences. I am David Velinsky, head of the Patrick Center for Environmental Research here at the Academy.

It is an honor and privilege for us to host and address this important legislative body. We applaud your efforts to make the government of our Commonwealth more efficient and effective, specifically in the areas of environmental programs. We also want to help you understand the ways that our institution can

act as a source of information and expertise as you struggle to make the determination on how best to apportion scarce funding.

My colleague, Bob Peck, has told you a little bit about the history of the Academy and the Patrick Center and the current activities. I would like to now expand a little bit on the Patrick Center's history, looking specifically at our investigations on how humans affect water and watershed systems.

My colleague, Jerry Mead, after I give up speaking, will then demonstrate a particular computer based tool to make watershed restoration more goal-directed and cost-effective.

Environmental research at the Academy began in earnest in 1947 with Dr. Ruth Patrick's groundbreaking research on the environmental health of the Conestoga River in Central Pennsylvania. Dr. Patrick went on to pioneer an entirely new field of research that focused on assessing and improving the health of ecosystems. She developed the use of indicator organisms, a method now universally applied in ecosystem assessment on local and state environmental managers. She made early advances in evaluating how human activities affect the environment, especially

aquatic systems and watersheds.

Dr. Patrick, now nearing 101 1/2, to be more specific, has received many honors and accolades for her work, including membership in the National Academy of Sciences and the National Science Medal, I guess in the late 1990s is when she got that medal. She is recognized as one of the most important environmental scientists of the 20th century. Some folks call her the "Den Mother of Ecology," but some of us here call her mom, believe it or not.

The work created some of the basic premises that are still part of the Academy's research today. They add up to the core idea of environmental understanding, which is a systems approach. Understanding the whole system is the best way to understand the subject and the best way to make policies that will protect the natural systems and improve the quality of human life.

There are five areas I would like to, sort of, summarize a little bit about Dr. Patrick:

First Dr. Patrick's work demonstrated the importance of streams and rivers to both the natural and human environments. They are sort of like the blood vessels in the watershed. They transport the water

through the watershed and act as sort of a conduit of all the energy flowing through the watershed.

Understanding and managing the central role of freshwater systems remains a critical goal of the Academy of Natural Sciences.

Second, to study these systems, Dr. Patrick and the Academy, unlike many others at that time, considered the entire ecosystem within a watershed, that is all of the living and non-living systems that make up the overall waterway and watershed.

Third, understanding ecology at this level requires interdisciplinary approach. Over the years, the Academy has been the home of some of the world's greatest freshwater ecologists on topics such as fish, insects, aquatic plants, microscopic algae, streambank morphology, water quality and a host of other important areas.

Fourth, the Academy researchers determined that the quality of water for human and natural use requires a healthy functioning ecosystem with a variety of organisms all interacting. The importance of biodiversity is a central concept for ecology today, and it was first demonstrated by Dr. Ruth Patrick's field team. One of her quotes is "Diversity

Is The Key Of A Healthy Ecosystem," and when we do the tour of the Patrick Center you will see the sign with that saying. That's something that she coined.

Fifth, our work on the environment has always recognized that humans are constantly impacting the ecosystems. The goal set down by Ruth Patrick, use without abuse, is just as relevant today and is the basis of the modern concept of sustainability.

Lastly, the Academy has maintained and practiced scrupulous scientific objectivity in their work. The studies of nearly 18 million specimens in our collection represent a storehouse of data that she has collected, as well as others in the Academy, for future work and study.

We are, of course, extremely proud of Dr. Patrick's work and the role she played in developing our environmental research program and in the historical contributions the Academy has made to the overall environmental sciences.

But we also understand that this is only the beginning of the high level research by the Academy that continues to this day. Over the years, environmental research has become a major segment of the Academy's operations, representing about 20 percent of

the staff and 1/3 of the annual operating budget. We are, in fact, one of the few natural history museums in the country that conducts research on both theoretical and applied environmental science along with collection-based science that goes on in the Academy, and we believe that this mix of collections-based and environmentally-based provides us with the information to make practical, real world solutions to a lot of different problems.

Today, the Academy's environmental group, named in Dr. Patrick’s honor in 1983, is involved in a variety of research projects. Many of them relate to watershed health and management, and in understanding human impacts on the aquatic environment. Our work covers topics with intense social and economic implications: Water supply, water quality, flood control, stormwater abatement, chemical contamination of the ecosystem, and the overall health of the natural systems on which both our health and economy all depend.

The Center is currently organized by scientific discipline with about 5 sections, headed by a Ph.D. level scientist, and staffed by a team of junior scientists and technicians.

Fisheries, which focuses on the dynamics

of fish populations and how they affect the ecological conditions; Biogeochemistry, which is my section, which studies the movement and fate of nutrients, contaminants and other materials through the environment.

Stream macro invertebrate ecology, which studies the various insects in the stream, and this position we currently have an opening for.

Phycology, which is the study of algae, particularly the environmentally important algae known as diatoms -- this is a diatom here (indicating) -- this is what Ms. Patrick used in her research for her doctorate in the '30s and '40s -- and how diatoms can be used to understand water quality and ecosystem health.

And lastly Watershed Modeling, which uses sophisticated statistical and computer-based methods to assess and predict the conditions and changes of watersheds.

Last year we initiated a new group called the Center for Environmental Policy in the Patrick Center. The purpose is to enhance and expand the Academy’s contributions to environmental policy making by building public awareness, supporting decision making, and researching specific policy areas. The Center for Environmental Policy acts as the outreach arm

for the Patrick Center and the Academy.

How can this long and deep interdisciplinary expertise be used to improve the effectiveness of environmental work carried out by the Commonwealth? That's the question. In particular, in recent years a great deal of effort and money has been put into environmental restoration projects through programs like Growing Greener. Through which the Academy has received its support in the past years. Often these are popular undertakings, these restoration efforts, and can involve the active participation of various community groups. However, because these projects involve long-term changes over time and space, it is difficult to assess what, if any, positive effects these restoration programs are actually having.

These programs also cost money, and your presence here today demonstrates how seriously you take your obligation to ask: Are we spending wisely? I say that, speaking for an institution that firmly believes in the need for ecological restoration, but I am also a taxpayer. I think we must spend money, to be sure, but with a clear understanding of the limits of its effectiveness, and more importantly, we should undertake it with a determined effort to develop techniques that

will help reduce the uncertainty and increase the effectiveness. This is true in the environment as it is in education, transportation or any other matter that is the obligation of the Government when times are good as well as when times are bad.

We are here today to look at some of these tools to make efforts more efficient. Why environmental restoration has become such an important issue -- the question is, Why do we do this restoration? Despite 30 years of efforts to control discharges and contaminants, the U.S. Environmental Protection Agency's 2004 National Water Quality Inventory estimates that over 40 percent of the rivers and streams in this country remain ecologically impaired.

Local, state and federal efforts have been effectively controlling the so-called point source pollution, but we now realize the majority of stream and river impairments are the result of non-point source pollutants. These include agricultural runoff, erosion and urban stormwater runoff as well. Pennsylvania's efforts, on behalf of the Chesapeake and Delaware Bay Program, sometimes with the assistance of the Academy, have helped to demonstrate this fact.

It is now well understood, in part

because of the pioneering work of Ruth Patrick and others at the Academy, that human actions can impair waterways and degrade water quality. These impairments have enormous social and economic impacts. Safe, adequate water supplies are essential to the life and livelihood, and badly managed watersheds can cause major disruptions to individual, civic and commercial activities.

Maintaining water supplies and the watersheds that support them has been recognized as a Government responsibility for many years. In fact, an interesting example of this can be found right here upstream from where the Academy is on the Schuylkill. The vast Fairmount Park system, the largest urban park in the world, exists solely because it was recognized in 1840 that deforestation degraded water quality. The forested regions of Fairmont Park were intended to ensure the protection of the Schuylkill River, from which the City drew its drinking water supply.

It should also be noted that protecting and restoring healthy ecosystems to ensure water quality has enormous economic implications. Sometimes called “ecosystem services,” the financial value of such processes can be calculated using good scientific

information and a cost-benefit technique. A famous example of this was in New York City where a billion dollar purchase of riparian forests ultimately saved the City almost $7 billion in capital costs for water filtration. Similarly, flood damage is regularly the most costly natural disaster in any given year; prevention of flooding, due to proper watershed management, offers huge potential savings.

As we have become more aware of the complex interactions of waterways and their watersheds, and of the damage to them that can result from human actions, both state and local governments have taken a variety of actions to prevent or correct problems. These have ranged from land acquisition and protection of wetlands to replanting trees, reconstructing stream banks and removing dams that have outlived their usefulness. These latter activities are part of a group of efforts sometimes known as watershed restoration.

The EPA defines restoration as "the return of an ecosystem to a close approximation of conditions that existed prior to disturbance." In restoration, ecological damage is repaired, not to pristine condition but to better ecosystem function or service. But the structure and functions of the

ecosystem are only recreated.

Because the riparian zone of the stream represents the direct point of contact between the stream and surrounding landscape -- this area here is the riparian zone (indicating) -- it is often the site of many restoration efforts. Usually these projects attempt to re-establish the natural stream bank features that were disturbed by human activities; they might involve enforcing an undeveloped buffer of a distance around the waterway, re-introducing trees and other plants to the riparian zone or correcting damages to the stream bank.

It has just recently been found that stream restorations near urban areas can substantially and measurably reduce the amount of nutrient flowing through a stream system.

Because the damage done to watersheds is often obvious, like deforestation or damming of a river, it is assumed that restoration methods should be equally obvious. Reforestation, dam removal and other methods may be undertaken with limited study or consideration. But sometimes obvious is not so clear. Dam removal is a good example of this paradox. Back in the day small dams were used for local power, like a grist mill or

flood control. Many of these dams have now fallen in disrepair and in some cases are hazards. Dam removal is one of many practices that are used to accomplish stream and watershed protection and restoration. Here's a photograph of a restoration project we undertook in the Manatawny Dam in Pottstown.

The Academy's interdisciplinary team of scientific specialists has pioneered the study of dam impacts and removal. The Patrick Center has received two Growing Greener awards to focus specifically on dam removal and have published numerous research and management articles outlining the monitoring, restoration impacts and their removal.

Even less attention has been given to assessing the overall, long-term impacts of other restoration methods. Reforestation of stream banks, for example, requires considerable effort and resources. The types of projects are undertaken as much for social, political or aesthetic considerations than for any scientifically established purpose. Importantly, the benefits may never be clearly demonstrated or known, as there are an enormous number of factors besides deforestation that may impact a stream.

From what I've said so far, it might

sound like I'm contradicting myself. On the one hand, human actions have impaired and degraded a variety of streams and rivers, have impacted the functions of the watershed and endangered the supply and safety of usable water. Given the circumstances, it only seems logical that I would be in favor of any programs or expenditures to repair or restore these functions and to implement policies to address the most critically impacted streams with the most comprehensive methods available.

However, as a scientist, I know we sometimes undertake these actions with limited or even non-existent information as to their likely outcomes. In fact, there are excellent chances that riparian restoration projects are being undertaken, even as we speak, often by very hard working, well-meaning groups and individuals, which will have no discernible impact on the ecosystem.

This is not to demean the important role of people working to restore the environment in the restoration projects, but one of the goals as a scientist is to enhance the environmental protection and restoration by ensuring its effectiveness. More importantly, we would like to get the biggest bank for the buck in any of these restoration projects.

With this in mind, I would like to introduce a specific project that we are developing that will improve the quality of predicting the outcomes of restoration. The Academy of Natural Sciences is developing and plans to disseminate a streamlined, computer-based watershed planning tool that could easily be applied by stakeholders and communities as well as local planning authorities, regulatory and granting officials. The tool would be based on the Academy's expertise in understanding how watersheds work in our expertise in modeling watershed functions. The tool will allow planners to observe the outcomes of computer-simulated form in making informed decisions on targeting resources.

I would like now to introduce my colleague, the principal investigator on this project and key developer, Dr. Jerry Mead, to go over some specifics of this tool.

MR. MEAD: Thank you, Dr. Velinsky.

Good afternoon, Mr. Chairman. I would like to join my colleagues and thank you all for coming here to hear us today. My name is Jerry Mead. I lead the Watershed and Systems Ecology Section of the Patrick Center.

What my section is, is I study the disruption dynamics in development of ecosystems, primarily aquatic ecosystems.

As a systems scientist, this often involves building computer models that formalize how these systems function. Computer models are a perfect venue to build a bridge to a manager, so they have access to scientific models or complex analysis. So stakeholders, such as managers, planners who want to allocate resources for restoration, these types of tools are of critical interest.

The tool I would like to describe to you today could be a tool to increase the efficacy and efficiency at which we go about restoring the functions of aquatic ecosystems. As Dr. Velinsky described, restoration of these aquatic resources is extremely important to the health of our communities, our drinking water -- but the problem is these issues are very complex. The landscape has many different impacts. The impacts occur at many spacial scales, local scales, say at right near the stream reach, or the whole watershed.

To add to this complexity is the problem of building a management solution is that it's very costly to implement restoration at these large scales.

So you should have a good idea what the benefits will be at these large scales with such a great investment.

SWIM, the tool that I'm presenting here today, the Streamline Watershed Integration Model, is a tool that could be used to do this, to target the use of money for restoration much more effectively, and take some of the uncertainty and trial and error out of the current process at which we restore aquatic ecosystems.

First, I would like to clarify how the model works in general. It's based on a GIS or a Geographic Information Systems. This is basically a piece of software that stores digital maps of the landscape and then I use computer programs to analyze that landscape at multiple scales, say, a local reach scale or a whole watershed scale.

This information can then be coupled with things that are monitored by the Patrick Center or other research institutions, such as diatoms or indicators of environmental health, to formalize a relationship between the ecosystem and the landscape.

So one example that I can give you on how this could be useful is the role of riparian forest cover. As Dr. Velinsky described, the band of land neighboring the stream is of vital importance to

function. This tool has been developed in a way that you can run scenarios to see what is the potential effect of different reforestation efforts on different indicators.

So SWIM has two primary functions: First, you get to assess the current conditions of your watershed at multiple spots; second, is this kind of planning scenario. You can play games. If the landscape is developed or we implement restoration activities, what is the potential benefits to ecosystems services. The real critical thing to SWIM, which is different from the set of models that we have seen developed by places like EPA, is its ease of use. It's not reinventing the wheel. It's making complex analyses available to managers. So that is its key objective.

So the interface can be used with minimal amounts of training and that's the goal for its development. So anyone, say, from a local watershed group could get on there and use the tool and focus their efforts. So it minimizes training costs to use -- I guess at this point, it would be best if I just give a simple demonstration of the software.

So here we have SWIM, the streamlined Watershed Integration Model. So it's the interface that

we're promoting here or trying to develop links to existing functions that formalize the relation between the landscape and the health of streams. So the tool makes it easy for people to use this type of sophisticated analysis.

The objectives of SWIM is to guide and evaluate stream ecosystem restoration. First, it's easy to use. Its a geographic information system, very simple to use, and I'll demonstrate that in a minute. The framework is for groups to understand potential benefits of land planning.

And then last, what we're proposing is once we establish this that PCER will build a growing capacity for this model. So the Patrick Center would act as a filter for quality of the tool, not excluding other research institutions to add their findings and models, but we would have a formal review policy of new research items that could be added to this tool.

So just to give you an overview, a conceptual overview of how this works; first the user selects, they go on a screen, they see a map of streams, images, real photos -- kind of like Google Earth -- with maps and municipalities and roads, and they select the streams they are interested in. It could be one little

stream, it could be a whole base.

Then they select the variables of interest. Right now there's about eight ready-to-go tools or models in the system. So they select which ones they're interested in, and they chose a reference plan. What are you going to compare the impact of management strategy to? Current conditions, what the watershed is now or do you want to compare it to some other management approach? And then next you chose that alternate plan. So what you are comparing to, and then you compare plans with this graphical tool, then you implement the plan, but it doesn't end here.

Good scientists have feedback from the users, so people can send comments and request needs for this tool to build capacity.

Research to implement the plan: You have a forecasted impact. We can see 15 years from now, 5 years from now, how well did the tool work? Do we have to revise the system? So we can work towards a better tool.

Then last, research testing the tool. All these things unite where you have a woven bridge between managers and what they need and the scientists answering those calls. Here's a prototype of what you

would see on the front of this tool. The way you would use it, in this system I didn't devise this interactive system myself, this is based on a shared vision model approach that I have done work with in the Saint Lawrence system. So I'm basically reusing these concepts for this tool.

What we see here, the way you would use the tool generally, in procedural steps is from top to down and left to right. First you select your streams of interest, then you can assess the conditions. You just want to find out what is the forest cover at multiple scales on the banks, upstream on the banks, in the watershed, pervious cover, anything so you can quickly learn about what the status is in terms of environmental conditions of your selected streams.

Then you can identify your risks. Once you identify your risks, you can plan for action. This is this plan comparison approach, and I believe all models and tools should be very transparent so then this last bottom thing is a nice link where you can go to all the documentation where anyone who wants to learn about how things really function, there is no hidden mechanics to this model.

So here I'm going to walk you through

just briefly how it works, and this is how I have it set up now for the Delaware River Basin. You see I have all the streams for the Delaware River Basin split up into these 120 meter long reaches. So stream reach is the fundamental unit.

What you do is, is you zoom in. Say you're interested in just this area, you zoom and you can add towns or whatever and you select. Here, the light-blue are the reaches I was interested in. So that starts out the system. It says, this is my area of interest.

Then next you use this bulls-eye approach. This is the main graphical tool to understand how the plans compare, in terms of effectiveness. So what you see here, there are two circles, the red circle and the black circle, and what the red circle means, any point or response variable that falls on here is 1/1 or no change.

In other words, if we're comparing -- in this case -- current condition to reforesting all the riparian zones we see here total phosphorus -- this is just an example. There was no change for small streams, medium size streams and large streams selected.

But as the points move towards the

center, you get a greater positive change from the reference to the alternate plan. So the real power of this graphical approach is you can see multiple indicators at once and quickly identify that these three triangles of small streams had a very large positive response. These three had a very positive response, but these had a very low response, and all the indicators.

And these are the indicators now ready in the model: Total suspended solids; water temperature; total phosphorus; I have models of fish growth potential, brook trout the State fish; carbon storage. You can quickly say which ones were positively affected and sometimes ones that were negatively affected.

You can use this to compare plans. You can look at it and say, what's a risk level. You could say, if it goes into the center. You can define what is a criteria for water quality. You can say how does this response variable perform relative to the current plan, an alternate and current plan.

So it's based on a GIS of stream networks. We split it into 120 meter long reaches. I will just give you a little more detail how the model works. I have automated all these things with codes so

it can be computer-programmed. It can be expanded to very large geographic areas easily. Here is that 120 meter long reach. The code shoots out search vectors and automated fashion, assesses land use and climate at multiple spacial scales. When I say multiple spacial scales, here's our little reach, that 120 meter reach. Then you have reaches that are upstream. Things on the side of the bank. Then you have cold watershed variables.

So I have done this for almost 100 different land use characteristics. So I have a database that this tool is linked to.

Just some of the indicators that we have, a few of them I developed as a post-doc at the University of Pennsylvania, a couple of other ones were developed here by James McNair. This was a USDA report service total phosphorus, total suspended solids, mayfly, stonefly, trichoptera, richness these are the macro invertebrates. A lot of this work has been done, it's just not that accessible to your average planner and that's what the goal of this tool is to do, make it available.

So here's just an example of a water temperature model that I constructed graphically showing

how things interrelate and to determine water temperature at a site. So we have climate, air temperature interacting with impervious surfaces in riparian zones. We have forest cover. Negative affect on water temperature, riparian zone. The amount of limestone in the banks.

So we have assessed this type of data, for the whole basin for each one of those little reaches and we can predict water temperature. That's one example.

Water temperature is then used. You can estimate things like growth potential of fish. So here is the State fish, Brook Trout, and I assess the impact of climate change on growth potential of brook trout, but additionally I could use the tool to say where could we reforest these riparian zones to counter-act the climate change so we can really direct that restoration measure.

Thank you very much and I would like to turn the podium back over to Dr. Velinsky.

MR. VELINSKY: Chairman Saylor and the Committee, I thank you for allowing Bob, Jerry and myself to share with you our plan for the SWIM model. The tools that have been used as environmental

conditions are ready for application. We are certain that the user-friendly tool we have presented to you will increase its efficacy to protect and restore our streams' environment.

Thank you, again, for your time. We will be happy to answers questions related to the Academy of Natural Sciences, the Patrick Center and our programs.

THE CHAIRMAN: Questions.

MEMBER ELLIS: The question I wanted to ask. It's really interesting to hear your presentation after working with some in my region who were very frustrated with the existing improvement control program, known as MS4, and also seeing TMDL coming down, and having had some experience listening in silence at the Stradford Research Center the former allies -- former partners, that there is kind of an assessment needed to be done to the streams, is along the lines of what you're talking about, that you fed into the computer model.

Then I listened to what the regulations are asking, and they are basically focusing on extended solids and solid extensions primary through the system.

And I hear the focus, at the municipal

planning level, a real need for this tool. I'm curious as to the degree which you have gotten this in front of the regulators at DEP and EPA and whether or not they are actually starting to try to absorb the kind of data processes that you all are doing to give us a more practical approach than the one that they are currently using. As I say, they're extremely frustrated and I'm hopeful we will start to change that.

Have you been able to get your model through to DEP and EPA?

MR. VELINSKY: More to EPA. They're very interested in this model. They're interested in us to get the model so that it has a user-friendly interface. That's one of the things they're very interested in. So watershed groups can use that tool to assess where should we restore certain parts of --

MEMBER ELLIS: That's not quite what I'm getting at. I'm getting at more the regulatory view that they are asking the municipalities (inaudible) currently to meet because the way this is shaking out with EPA telling DEP what to do, and DEP trying to tell the individual municipalities what to do, they're saying things like cut your suspended totals and suddenly the stream is about 85 percent. You might be able to do

that by dredging the streams in some cases because there are sediments lying in there, which is extremely expensive, probably pretty bad for the stream, then we would be in compliance. I'm worried about why aren't we using tools like yours to spend money more wisely and more focused to improve the real health of the streams, such as knowing whether the critters in there are doing okay and fish are doing okay.

We have plenty of science. You guys have been working on it for years, when you say Ms. Patrick, and then I go and talk to the regulator, we're going to measure the extended solids in there and other stuff we worry about, but we are not going to have any regulation associated with that.

MR. VELINSKY: We haven't gotten that far into the grass with this model.

MEMBER ELLIS: This is important.

MR. VELINSKY: We are just now trying to get the model here to your group and out there so people can see it and can see the benefits of using that model, that's where we are now.

MEMBER ELLIS: I mentioned to you the group that I have been working with is extremely frustrated with the MS4 program. Currently they have

been in operation for three years out in Chester County. They are working on this, though. They're not bad out there. They have some good resources. It's just with the water resource authority and the folks at the Planning Commission and others who have been studying and working on this issue for years, conservation districts, working to keep the dirt out of the streams and they are frustrated with the way this is going.

So we've got to get your information into DEP and get them engaged and I hope we will all be working on helping you to do that, get some people involved in your organization that are familiar with DEP and we need to push that a little bit more, perhaps.

Thank you, Mr. Chairman.

THE CHAIRMAN: I want to follow up a little bit more with Chris on the DEP.

I kind of come from my experience a number of years ago when I tried to deal with them on the runoff. The problem I had with DEP over the years is particularly going into a lot of areas and I have looked at Connecticut and a lot of other states around the country, particularly northeast. It seems like DEP is very resistant to new ideas. Any comment on that? The problem I have had is getting them in my area.

York County has very good soil Lancaster, York that region, Chester County has very good soil as well. It seems like we are constantly eating up farm land and putting it into housing and the soil we would like to see people building on they can't because we haven't -- DEP have not accepted some of the other practices that happens in other states for septic sewage disposal.

Rather than just -- my problem is I believe sewer plants are the worse thing that can come around unless you're in a very urban setting, I believe, because what happens it seems to me is we take all this sewage, we ship it off to the plant, we take the water supply and we plunge it into a stream, and thereby, the water supply -- the ground level water goes away. It goes lower and lower. I have seen that in York County and other places, there is no natural cleansing of that system. Am I wrong? Can you give me that to kind of follow-up.

It just seems to me DEP has not been working to avoid it. It seems like they're sticking to old technology. It may work in Vermont, it may work in Connecticut or Massachusetts, but we're not willing to accept that until after we have tested it for 25 years,

I found that in sewage more than anything else.

That concerns me because of both sewage systems and farm planning.

MR. VELINSKY: I mean, I'm not that well versed on the part of DEP. I would imagine that not one system fits all areas.

THE CHAIRMAN: Can you tell me in the case of sewage plants versus say, the nature septic system that we're filtering through the ground and everything because, again, you have to be very careful. You need sewage facilities.

When you're out in the country and you build 20 acre lots, which everybody now wants. We're not helping our environment by this sewage system; am I wrong with that?

MR. VELINSKY: Think about it this way, if you can look at the area we're developing and make the assessment that the load of nutrients that will go through the septic tanks is too much for your watershed to handle, then you need to go to more of a centralized treatment. Remember, that centralized treatment can treat it far better than sceptic systems, given the volume.

So again, it depends on where you are in

the watershed, what's the density of the flow through the ground of the system. There is not one answer to that question.

THE CHAIRMAN: I guess the concern is we are flushing more water into the stream than it naturally normally does because it's coming out of the sewer and the water is treated and now the DEP is involved.

And I'm just wondering again -- at least my own philosophy is it would be better if it would naturally fill the ground water or ground systems and so on and we're increasing the amount of flow into these streams from sewage because everything is being shipped from one location and dispersed from there rather than natural systems.

MR. MEAD: I think the point you were trying to make is there is a balance between the ecosystem's capacity to hold to process a certain load and then there is a scientific debate on how much nutrients can continue to abate and intercept their scientific evaporation response. I don't know if we quite figured that out yet.

I agree with you totally that the environment can provide a lot of services we have

probably not used them to capacity but there is a danger to exceed the threshold to the environment.

THE CHAIRMAN: I guess that's my concern, as we develop, as Central PA is developing very rapidly, it seems like Pennsylvania taxes are so much lower compared to Maryland, New York and New Jersey and we're getting a lot of new residents. And the concern I have, what does that do to our streams and our water quality plus the flooding concern coming about, plus because we are continuing we have water running into the streams.

We'll move on.

Brian, go ahead.

MEMBER ELLIS: Just a couple of things: You have gotten the Growing Green Grants to study the dam removal. Did you study before you used these types of analyses to see what it would do and then remove it?

MR. VELINSKY: At the time, this analysis wasn't there at all. There was a separate set of projects where we started to develop the process to start developing this type of tool 2002, '3, '4 and '5 that's when we started to fully look at this type of watershed model. At the time we did the dam research at the Manatawny, that was specific to the Manatawny, it

wasn't on the books at that point.

MEMBER ELLIS: I guess what I'm looking at -- and Chris and I generally look at things a little bit different -- I want to know, can a business who is about to come in and use this software and say, If we do this, but we also do this, we'll be able to not have an adverse affect on the streams?

MR. MEAD: That's the idea.

MR. VELINSKY: That's the idea or if a watershed group says we want to restore this 100 meter reach at this point in the stream, and you would say, All right, what kind of benefit will it have to the stream system? One would love to be able to say, Well, at this point down the stream, this point of the restoration process, you're going to find this kind of quality in the stream, as opposed to, well, it looks like it's good and we want to get the community involved, but you might want to know a little bit about the (inaudible) of the ecosystem. That's what this tool is for.

MEMBER ELLIS: I understand.

And then, if you can sum up for me real quickly, just so I understand it, as simple as you can, how do we, as a Commonwealth, benefit? How do we save

money? You said it's going to save us money in the long-run, specifically, how would the implementation help us?

MR. VELINSKY: A group might come to the Commonwealth to say here we need $100,000 to improve the riparian zone in Pennsylvania's Brandywine Creek or Mill Creek. We go to the model of this tool in the development part of that restoration process and say, Well, you could spend that money here and you're not going to see any benefit. So you say, Well, should we even do the project or should we say let's move it to another location that will have benefits. Then the judgment is, is the benefits worth the $100,000 investment. That's another question.

Right there you know, I mean, if you're going to say, Well, we'll put this new riparian buffer in and we'll see the ecosystem improve down stream. Well, what we would hope to say is, That recreational area is back, now you would have more people come back to do whatever they like in that area boating or fishing or whatever, versus not having that area. There is a benefit downstream, depending on what you do upstream.

THE CHAIRMAN: It's almost like if you would take a highway. Do I start reconstructing the

road in the south or north evaluating where you should do something on the street.

MEMBER ROSS: There is some real life experience in here where the fellow was trying to put in a new development and he was being asked to have no negative affect on the system, and you can't. After a certain point, you can treat it, but there is going to be some negative affect. So they ultimately wind up letting the application go through because he then went and purchased (inaudible).

Also were the watersheds to improve the quality? The question is how much should those cost in -- down in the City of Wilmington, in the bottom of the Brandywine River watershed, in Christina, they have defined storm and sewer pipes effectively, the storm water going into the sewers if have you a big (inaudible) come back and up; and it's not effective to tear that apart and completely reform the entire City of Wilmington to its (inaudible) completely drop the (inaudible) again by doing stuff up stream.

If you don't have a mechanism like this to measure it, then you're going to be guessing whether or not you want to do it or not.

And probably what the regulatory agency

tend to do is over-do it a little bit to make sure that they are getting enough in return. If you are able to make it more exact, you can keep the cost down and actually you get a better stream and you're building.

MEMBER ELLIS: Everyone is learning. So continuing on with this -- and I understand the logic behind it. How do you say to the legislative members of the Republican Committee -- Chris does a great job -- then we'd say to the DEP we are going to use this. Where would it be mandated? Would it be mandated using it somewhere? Do you know the road? How is it --

MR. PECK: We have the Clean Water Act. There is stuff coming down at us already. We are having trouble right now trying to figure out how to absolve that and trying to figure out how to manage this stuff. So the place where this needs -- I think need to be (inaudible) in the regulatory federal in DEP and EPA that way, whether it's a business that wants to do something new or whether it's a municipal system that is struggling with staying in compliance, they will know what they can do -- the best to get the best results in getting in compliance, but we have got to get some (inaudible) to fix the streams, but it's not getting recognized through the regulatory system. You are not

getting any credit for it. Then we are coming up (inaudible) you want to spend something else on this other thing which is more trouble.

MR. VELINSKY: Another way I look for the Growing Greener application when these groups have submitted proposals to restore stream XYZ which, in that submission, it could be required in the FOP that they have to use something to show what the potential benefits are and try to quantify it as best as possible. It's not in the regulatory sense, it's more in the program sense. Another type of granting opportunity.

THE CHAIRMAN: Sandy.

MEMBER MAJOR: Which ties into -- if you can help clarify for me. My northern legislative districts Wayne County, the Delaware River comes in and then Susquehanna River comes from New York State, I have both rivers that I deal with. And in saying that I also deal with the Delaware River Basin Commission and the Susquehanna Commission. So my question to you is how do you interact with that?

What we are talking about is all fine and good, but I hear so much from those two Commissions that they oversee and regulate so much that goes on in the two rivers that run through my district.

MR. VELINSKY: I know, I interact with the DRC very closely. I'm both on their committee and in their program. This program that Jerry has been talking about is developed through them. We would work with them, Carol Collier and that group, to make sure it some how becomes part of what they can use in their planning -- one of their tools in their tool box, as you might say.

I don't know if Paul Swartz is still in the Susquehanna River Basin Commission, but we try to and in the Chesapeake Bay, primarily Delaware, they are all over there too. I have good relationships with various people on their Green Programs. This is something that if we really develop it further, which we hope to, that we would go to our road trip and show it and try to get it done if it's in the regulatory sense or more in the program development sense.

MEMBER ROSS: Both David and you are saying definitely in the regulatory sense.

MR. VELINSKY: At least people can use it. So when they apply for project money they can at least say they have used this tool and it's going to show a 50 percent in stream health, whatever you want to call it, at this location, isn't that what we want? And

the people who are funding it can say, yes, this is what we want as opposed to going to the (inaudible), well, it might have no impact. You will say why we are spending the money or why don't we spend the money somewhere else? And that, in fact, well may be the case in (inaudible) the model can actually say let's put the (inaudible) up here versus start down, start up stream. You can sort of do the planning beforehand as well as during and after.

THE CHAIRMAN: Any another questions?

MEMBER ELLIS: I have a concern. I mean I see the benefits of it. If we give this to the DEP and it ends up shooting down more problems, creating more problems requiring more money and all the time this could have the exact opposite reaction to what we want to accomplish, which is to create cleaner streams and better streams, but it could completely stagnate the ground of any kind and it could also put communities and municipalities into situations where they are spending way more money. Taxes are going up because of this great system that you guys came up with. What if it goes -- am I looking at it wrong?

MEMBER ROSS: I think you are because I think what happens is the standard winds up coming down

from EPA and DEP (inaudible), the phosphorus in the streams will be reduced by X the (inaudible) will be reduced by Y. The regulatory side, the part that you're worrying about (inaudible) what tools we are after. That's why I'm saying that you (inaudible) benefits but it prevents sort of combined efforts to try to get into clients that aren't going to be very selective.

I worry a lot about some of our municipalities spending money on stuff that isn't going to improve the situation at all, a lot of time, of filling out the paperwork and hiring engineers, getting people to (inaudible) around costs a lot of money, if it's not focused and you don't know for sure what you're doing, you're going to waste money going forward. Your concern would be more directly with the regulatory policy in the first place.

The fact is that the regulatory policy is ultimately affected by facts. Sometimes it's slower than you like. The enforcement policy is what makes it slow. You have to do this or a policy of picking one parameter and making out the (inaudible) for everything you have to do, which is wrong, I think, but there are so many other aspects of the regulatory policy that could affect efficiency. (Inaudible) your model you

don't have to treat that much which, in another part, you need to treat even more than you have to.

For the first years of environmental regulatory policy it was ready-fire-aim. The best thing to do is, of course, is to aim first. And by picking what part of a stream you want to do something with, based upon the outcome, which is policy decisions, not scientific ones. You find the problem, that's targeted and every resource that you allocate is targeted. That sometimes helps.

The other thing is with a specific project, you'll do something which will actually help. For example, clean up a stream. The development of a brown field or gray field actually has a benefit if done right. So development isn't a dirty word. The model will tell you yes or no. We don't take a position about whether it's a good thing. You have to take a position that says I want the result, and we could start (inaudible) about whether one thing or another will spring you that result. If we have these kinds of tools, that's important.

The other thing, you have resources before you start. Where do you investigate? Where do you do inspections? Where do you do enforcement? What

if you, as the Attorney General, levy a penalty and want some benefit to come from it. Where do you say, do this or do that? What did you get for that dollar? What did the wrong doer get in violating that in a particular place? So quantification ends a lot of fights or puts them where they ought to be.

Okay. Now, we know what the cost is. Do we want to pay that or not? Not is a definite answer, but if you're arguing about yes, it will; no, it won't; then you haven't done very much.

You also want to know later if any individual efforts that has been made in enforcement initiative, in case a stream bank changes, a municipal water stream lowered or raised, did it work and if it didn't, don't do it again or do something else similar as the model.

I think if the model were developed for other parameters besides the aid that we have, if it were developed for other things like, in particular, urban run-off for some of our areas, if it were developed for other kinds of watershed in Pennsylvania at least -- and if the powerpoint were demonstrated in a couple of environmental hearings or court cases, you would then see -- and people could make that happen with

the right expert witnesses and a few bucks -- then you would see enforcement policy getting changed.

If all you can come in and say, My project won't do what you say, but you say it did and EPA says it will, then you don't win. If you have this, you could show them something.

The final area is if you are given or you have gotten over $39 million to make stream banks better. Okay, which ones? And will a $10,000 project actually be more efficient in a given area? I would give my money to the (inaudible) if I had something that could tell me I could get more bank for the buck. What if I could get more (inaudible) for that result, I would. That's how I would spend the money, the more specific way.

Then (inaudible) whatever, you can afford, show us some results by that method, that would be a real good use of oversite. If you had confidence in the tools from other experiences, rather than say I don't like it or (inaudible) and everybody loves you because the money is coming to them. How about having a real answer.

THE CHAIRMAN: I think that's the concern I have. A lot of times we'll throw money at

something to solve a problem. We do the project and nothing has changed. It kind of puts me in mind of a municipal planning in New York. It was kind of interesting. You have to spend the money for highways. We many times see the traffic impact is elsewhere on that major road, but you can't use it there, you have to use it here, which is really a waste of money and you're not really solving the problem for that county. And that's what you're -- kind of what you're telling us here. Let's find out where the most impact for those dollars is. We can solve that problem before we just go out and throw money at a problem.

I'm pleased to have Mr. Seif with us. Would you like to make comments?

MR. SEIF: I think David Velinsky said in his testimony it's through education and so on because this is a scientific area, because the Academy had been looking at this for several decades, I think we are little bit further ahead where we can say something works in this area.

Again, Bob, it comes down to the highways. Who set the legislation (inaudible) set it and we pass the orders on the highway expansion, then we say it has to be used here where you approved it. The

real problem is, if there is no problem here, then you have a problem. I think it is amazing use scientific fact or (inaudible) fact rather than just legislators (inaudible) numbers in cases.

Brian, you and I agree. Chris, may not (inaudible) where an environmental plan you need to do something here no matter what you do here, you really don't solve the problem.

MEMBER ELLIS: Obviously, by your statement it would help more (inaudible) for projects, it's not just, you asked for results. This would say there is a better likelihood if we do this rather than that, that could actually simply take the politics out of (inaudible) the democrats have had very bad streams, the republicans that had (inaudible). We may be able to (inaudible) any circumstance.

MR. SEIF: That's the picture of the State that I had when I was in office, but I understand your point. And the fact is that isn't true and it's a shame that there is even a perception of that.

If we have targetable tools, let's use them and stop bickering about it. David, that's one of the main purposes of the tools to help the (inaudible) we want to do this at this location. Do we have any

idea what the impact is.

THE CHAIRMAN: If there are no other questions. I want to thank you guys for -- as somebody who comes in here who is not a techie and not an expert on those kinds of things, it's easy to see there is something out there to show really how we're spending our dollars and educating ourselves.

We had good membership here. Chris is kind of our environmental guy. We pick on him a lot, but he teaches us. Chris is one of our smarter guys, in terms of environment. We just have fun with Chris a lot.

Again, thank you. Because from our point of view, I think we, as legislators, tend to feel that sometimes everyone feels that the legislators know all the problems as well (inaudible) then we just go to Harrisburg and we look to fight and argue.

Of course, I always tell people in my district, the problem is when you get to Harrisburg no matter what part of the state you come from, you have different problems that other regions have to get a (inaudible) there is a problem, and then you have to get a (inaudible) of one.

Thank you for taking time out of your

schedules to help educate a few of us.

MEMBER ELLIS: I look forward to the road show.

(Whereupon, the above-entitled matter was concluded at 2:30 p.m., this date.)

C E R T I F I C A T E

I hereby certify that the proceedings and evidence are contained fully and accurately in the stenographic notes taken by me on the hearing of the within cause and that this is a correct transcript of the same.

VIRGINIA MACK
PROFESSIONAL COURT REPORTER