Section **4**

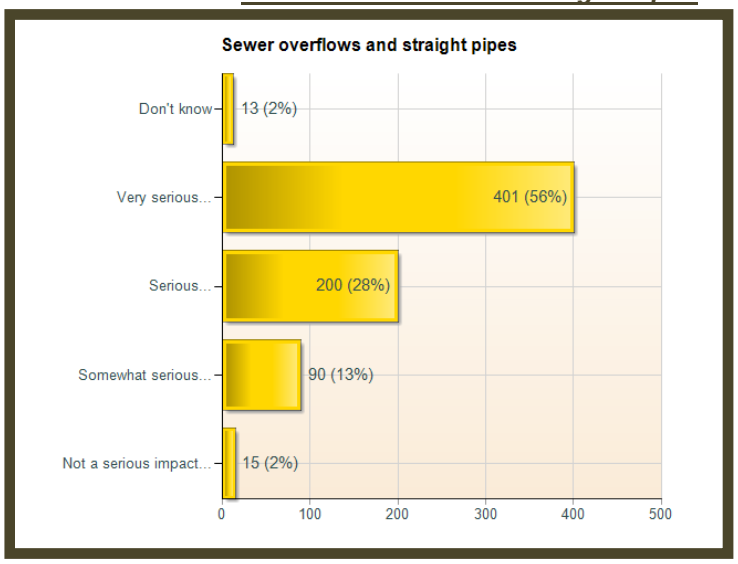
MAJOR IMPACTS and CHALLENGES FACING KENTUCKY'S STREAMS AND WETLANDS : *Growth and Energy Development*

SOME OF THE MOST CITED IMPACTS TO KENTUCKY'S STREAMS AND WETLANDS:

When asked to reflect on the major challenges affecting Kentucky's streams and wetlands, many Steering Committee members, as well as other stakeholders from across the state, made reference to either the impacts of development or resource extraction. Both were cited as two of the greatest challenges in protecting our state's water resources from further degradation and decline.

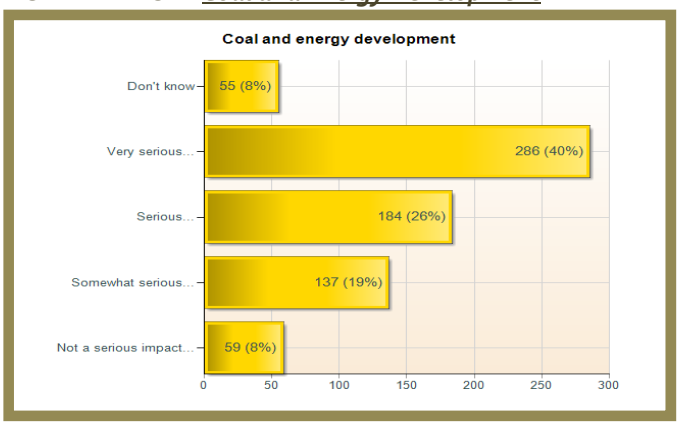
This was also mirrored in online survey results (n=723) insofar as the effects of development (sewage, residential growth and storm water) as well as the effects of coal were rated as some as some of the most serious ("very serious") impacts. Percentage ratings for each of these rated impacts are presented below.

TOP IMPACT #1 ***Sewer Overflows and Straight Pipes***



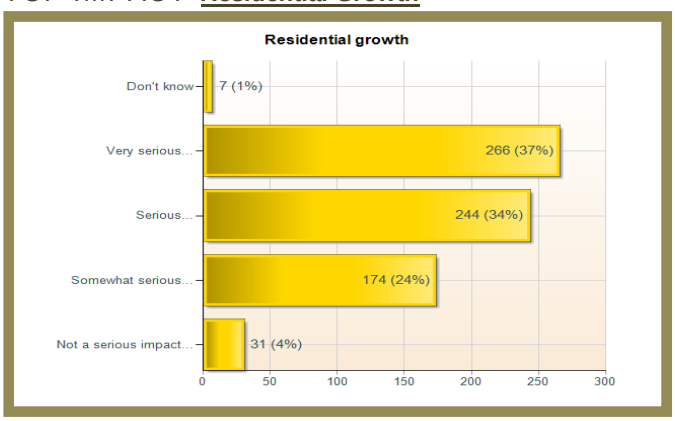
Fifty-six percent (401) of respondents rated sewer overflows and straight pipes as a "very serious" impact.

TOP IMPACT ***Coal and Energy Development***



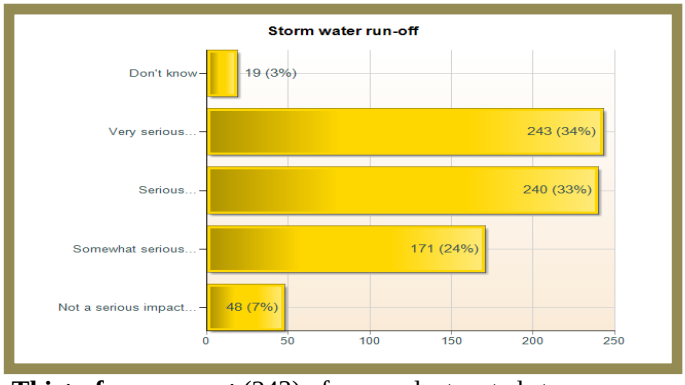
Forty percent (286) of respondents rated coal and energy development as a "very serious" impact.

TOP IMPACT ***Residential Growth***



Thirty-seven percent (266) of respondents rated residential growth as a "very serious" impact.

TOP IMPACT ***Storm water run-off***



Thirty-four percent (243) of respondents rated storm water run-off as a "very serious" impact to streams and wetlands.

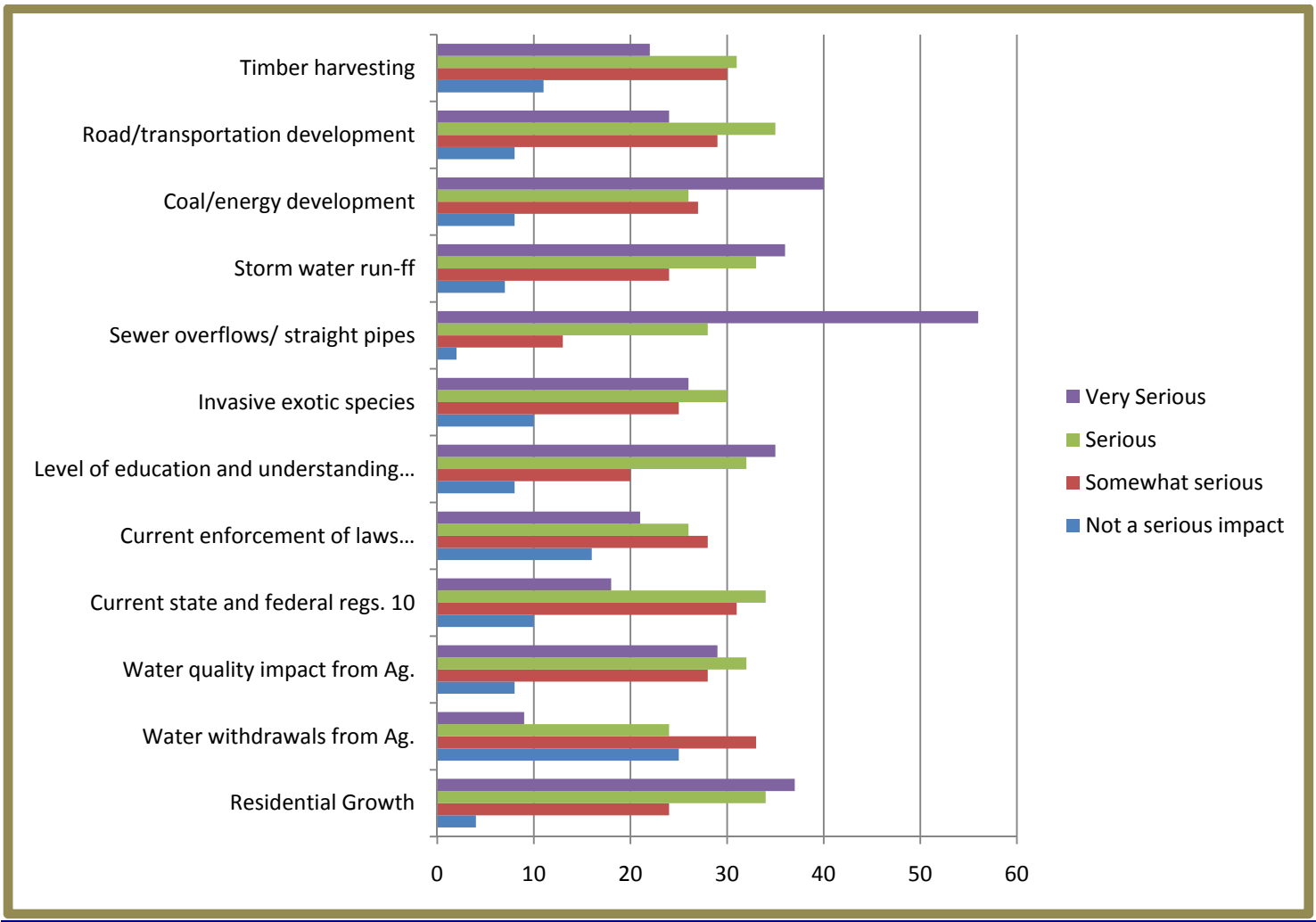
The above five factors were the top rated items from a potential list of 12 survey items that included the following:

- Residential growth, water withdrawals from agriculture, water quality impacts from agriculture, current state and federal regulations, enforcement of state and federal regulation, level of education and understanding to care and protection of streams and wetlands, invasive species, sewer overflows and straight pipes, storm water run-off, coal and energy development, road and transportation development and timber harvesting.

To provide an even fuller picture, the chart below shows each of the above 12 items with the percentage of persons that rated each accordingly. Overall trends shown below tend to reinforce the perceived detrimental impacts of residential, energy and economic development on our state's water resources. Yet, it is also clear from the bottom percentages that sewer overflows and straight pipes were seen as the biggest detriment to the health of our streams and wetlands by knowledgeable survey respondents. The following subsection reports in more depth on steering committee, stakeholder and survey respondents views on this number one listed priority concern.

Photo: Typical straight pipe somewhere in eastern Kentucky. Survey respondents rated "sewer overflows and straight pipes" as the most significant threat to Kentucky's streams and wetlands.

Perceived Impacts to Kentucky's Streams and Wetlands (n=723)



SEWER OVERFLOWS AND STRAIGHT PIPES

When survey respondents were asked to "offer some critical advice for those doing long-term strategic planning" via an open-ended question, many survey respondents spoke generally about the watershed impacts associated with "human encroachment" and development. However, several spoke specifically about the impacts of "human waste" and to discharges associated with sewer overflows and straight pipes, -a sampling of some these comments and their advice is provided in the inset box below:

Survey Respondents who provided comment and advice on Streams and Wetlands Conservation by referencing the impacts of Sewage and Straight Pipes on Kentucky's Water Resources:

- The most important impacts in Kentucky comes from (not in any particular order) agriculture, _human waste_, lumbering and coal. Unless these are seriously addressed our streams will continue to deteriorate.

- There are at least three sewer systems with straight pipes to [name of creek] within an 800 feet section near me. If the homeowners cannot fix their systems, the only alternative may be to require hook-up to a newer sewer line in the area. I am sure that the three straight pipes that I am aware of are just a fraction of those currently polluting the creek.

- …Get houses on sewer/ working septic systems…

- Stop sewer overflow and straight pipe discharges by any means necessary. Fund installation of systems and repair systems where required. There is no other means to fix this problem.
- Invest in sewage disposal.

- We as concerned conservationists and concerned citizens need to provide the necessary funding for the protection and policing of all our waterways and wetlands. The straight pipes and sewer overflows should be stopped and the violators fined heavily, whether it is residential, industrial or municipal. We must protect and enhance what we have now and stop the polluting of our streams and wetlands.
- Our biggest problem in eastern Kentucky is sewers not coal mining. We need to be smarter when we look at this issue.

- Watch sewage treatment plants more closely.
- Local engineers and planners are not on the same page. They are all about tax revenues and there are too many building permits being granted without exploring the outdated sewer systems in the area.

- I have seen raw sewage from overflow due to rains dumping in the river…

- We need more help and education about sewer systems. There needs to be payment plans for those that cannot afford to pay for these systems. Not enough is being done.

- It seems to me that innovative ideas for both municipal and residential sewer treatment are not being considered. Kentucky could be well served if government planners and private contractors were better educated on the potential of new technologies in this area.

Photo: Sewage impaired stream.

-People have no idea the streams their kids play in are dangerous at certain times. Can we post signs, educate the people who live along them more? *–Survey Respondent*

My wife and I were interstate long haul truck drivers… we have seen all manner of waterways and water problems across this great land. We have come to believe that Kentucky (especially eastern Kentucky) has some of the nastiest waterways we've ever seen… it makes me ashamed to look at our waterways… *-Survey Respondent*

A few years ago, this is very gross, -I was doing some work in eastern Kentucky. One of my graduate students and I were sampling in this area. They were going to put a gas pipeline in, and that's what the project was about. But we were sampling in this stream that was 20 feet from the front door of this house. These kids were playing in the stream there and the yard. We took nets and went through there. There were things like tampons, condoms and raw sewage that were coming up in the net. It took us about 30 minutes and a couple of hauls, and I said, "Eve, we're getting out of here. This is a dangerous situation." This is how these people were living. How do you fix that? I don't know. The kids were playing right there. Like I said, there are thousands and thousands of homes that are like that. It's not an easy fix.. *–Steering Committee Member*

Along with the majority of survey respondents, several other steering committee members also mentioned the major watershed impacts associated with raw sewage and straight pipes. In fact, one mentioned that "straight piping" was one the biggest challenges facing the health and viability of Kentucky's surface waters and also mentioned their concerns not only with stream health but public health. They said:

- We need to educate the public. I have heard that many public officials don't see straight pipes as effecting drinking water quality. I have seen folks at a community center with rope swings into the creek and fisher bobbers in the creek, -evidence that kids are obviously playing in the creek – and you can see straight pipes going right into the creek and so, public education is a barrier, -but that can be overcome pretty easily. It's really the lack of money and the geography of eastern Kentucky and the lack of money in these communities and it is question of where do you take the waste?

For this steering committee member, when asked about current efforts to restore and conserve Kentucky's streams and wetlands, their response was that current efforts were "fairly limited" and cited straight pipes (as well as coal) as the "most serious problems, -that are not being addressed." Yet, they also recognized, as did other committee members that these problems were more difficult to confront than, as they said, "keeping cattle out of a stream." One advisory member, for example, also acknowledged the impacts from straight pipes and "that there are still probably hundreds and thousands of straight pipes that are going into streams" and then commented,

- This is a really, really tough thing to figure out. The reason is because a lot of these homes are up in the hollows. The soil is not good enough for septic fields. The houses are too far apart to make it economically feasible to have sewage treatment plants, or even packaged treatment plants, so the alternative that the people have is straight pipes. Of course, we know that that's not good for any of us. So, that's a really difficult problem.

When asked whether "there was anything that could be put in the place of those straight pipes?" the above advisory member paused and then said, "I think that's the problem. They don't have soils that are deep enough to sustain septic tanks," but then mentioned possible prospects for new greener treatments through assimilation wetlands: "There's a technology in which individual landowners can develop their own private wetlands, in which the raw sewage would go into the wetland. It's like a big field where you've got a variety of plants that grow in there. Then the water, as it trickles through, the vegetation takes up a lot of the organic waste, but those are pretty costly. When your house is on land with a slope like this [indicates a steep slope]....it doesn't work very well."

Given the significant percentage of survey respondents that rated "sewer overflows and straight pipes" as the major impact facing Kentucky's streams and wetlands, a special advisory panel was held to address issues related to grey and green infrastructure and managing waste water. Whereas parts of eastern Kentucky face major challenges to both stream and public health from straight piping, some of the most significant innovations and partnerships in mitigating the effects of untreated sewage from combined storm water and sewer overflows (SSOs) are occurring in several of Kentucky's major municipal sanitation districts. These state efforts have even been featured in various US EPA webcasts on green infrastructure techniques and developments.

Kentucky's smaller municipal utilities are also becoming more proactive in addressing sewer overflows through regionalization and the elimination of small package treatment plants, as one steering committee mentioned:

- The majority of our utility's efforts are concentrated on eliminating the package treatment plants. We have extended service to and eliminated 28 package treatment plants. Generally, package treatment plants discharge to small streams. They also are essentially some of the entire flows in smaller streams during dry times. The elimination of these strongly impacts the water quality of the streams that the plants were previously affecting….We also try to reduce combined sewer overflows through the development of retention basins and to redirect sanitary flow out of the combined systems. Therefore, the sanitary flow is not in the combined system when a rain event occurs.

For this steering committee member, regionalization also represented one of the many challenges facing the protection of Kentucky's water resources, especially in the current stimulus package climate, with smaller perhaps more politically popular package projects perhaps taking priority over a more planned and coordinated regional focus:

- In order to look forward, we need someone on the political level backing up projects that may be expensive but that is because they are being done correctly. Regionalization is a great idea instead of building a bunch of small municipal plants which hurt the environment more and they cost more in regards to up-keep. There needs to be a more global approach as to how stimulus money is spent and how decisions are made.

STORM WATER AND RESIDENTIALGROWTH

The new "fad" in "green thinking" was mentioned by one steering committee member as a positive opportunity for streams and wetlands conservation. Such green thinking has become a key trend within the field of waste water/ storm water management. And again, several of Kentucky's larger sanitation districts are taking a lead role in developing green methods to handle and mitigate the impacts of combined storm and sewer overflows into Kentucky's streams and creeks. But as one steering committee stressed, it is not only green but also standard "gray" infrastructure improvements that are required to mitigate for storm and waste water impacts. They also stressed that beyond technological innovations in green and gray infrastructure that, -from a sanitation district's perspective, establishing partnerships was also essential in mitigating and preventing storm and sewage overflows from "rushing out" into creeks and streams:

- We are always looking for lots of partners. Local planning and zoning partners are important because they write the regulations that govern the development process. Sanitation Districts are not a municipality so it works with many different entities. We look for folks who are major property owners in Kentucky such as public utilities. You do not want to spend all of your money buying up private residents' lands if you can get easements for free; other public lands. Covington has been a major partner with us. The Covington Housing Authority is another large partner that we have completed missions with. School districts have a lot of land and they traditionally do not like a lot of water on their land so we work with them through water issues. What we have seen as successful is getting both parties to understand why storm water management is so vital. Trying to educate people is a very important task that we all should undertake. Grant opportunities can be looked at in certain situations.

Through these types of partnerships, they state that more opportunities develop to create more "sustainable systems that can treat waters and runoffs as nature intended that to happen." Another panelist also viewed mitigating municipal waste water through green techniques as a positive step towards conserving and protecting our state's water resources. They also saw possible opportunities in using stimulus funds to promote such green technologies:

- My top two opportunities are going to be; number one is addressing storm water, through a green infrastructure. The other one, I might be totally way too optimistic about this, but, financial stimulus funds and hopefully some shovel ready type projects. We have a need, just to get some funds allocated to getting people jobs restoring watersheds… that would be something….

Though for two other advisory members, funding and education remain a challenge:

- It is easy to say we do not want sewage being discharged into our waters. Surveys that have been conducted show that people want swimmable waters but is the public willing to pay for clean water? The answer so far seems to be 'no.'

- Right now we are trying to look at the homeowners who have drain spouts. We want to work with them to regenerate ground water. People will not make environmental conscious efforts without understanding their benefits.

Top photo: Bio-filtration swale.
Middle photo: Permeable concrete at a Farmers Market.
Bottom photo: Sistern to capture storm water run-off from the roof of the SD-1 Facility.
Photos provided by: Jim Gibson, Sanitation District 1, Northern Kentucky, March 18 Presentation.

In an earlier telephone conversation with one advisory member, they mentioned the need for possible changes in technical training and certification of waste water operators through the Division of Compliance/ DOW to possibly include more innovative courses and training in storm and sewer water management that include green infrastructure and constructed wetland methods.

One of the main challenges facing steering committee members, who are water works professionals, was "getting the water into the ground so that it can recharge the ground." Yet, for many other advisory members, storm water and other municipal and industrial discharges into our creeks and streams was a symptom of development, urbanization, suburban sprawl and population growth. For one advisory member, any parcel of land that is still "permeable and not paved over "is worth our efforts at 'conservation'." Most advisory members were of a similar view and marked "development" and "growth" as one of the biggest challenges facing the restoration and conservation of our streams and wetlands:

- … because we're having an increase in population as a whole we're getting an increase in land use overall, and with an increase in the land use, we're contributing to the watersheds, and with that, we're adding a lot more stress to them….. more impervious surfaces; with putting more strip malls in and so forth, the towns grow, so it's kind of difficult, I think, when you have an increase in population, when you have an increase in land use, -for restoration efforts to actually take hold,…

- …you know, with economic growth and development, human population expansion, such as urbanization, the nature of planning… I think long-term planning is a problem. When you think about when a town or a city is undergoing growth and expansion, often the mindset is – it's more immediate. It's short-term. The general thinking seems to be to maximize profit rather than trying to implement sustainable growth or grow in a sustainable way. …

- One of the biggest challenges is how Kentucky is always growing and developing. This is good for stimulating job growth and the economy. However, growth tends to undermine or hurt natural resources. Streams and watersheds need to be incorporated in the continuing growth and given an equal value in that growth. It would be nice to not have to say 'we are restoring this or taking care of this impairment' but to be able to say 'we did a great job here; this resource is in such great shape still.' That is the biggest challenge: to grow smart.

- Small towns and cities with few regulations. Many of the State's important resources are found in close proximity to smaller towns. Yet, the large towns are the ones that have the attention and focus projected onto them. There should be more enforcement in effect to keep small cities and towns updated on conservation techniques.

- I think some of the challenges are definitely development, having suitable regulations for development and making sure that there is the manpower and dollars out there to oversee those regulations and any type of actions that could impair streams with continued pressure for development and agriculture and all those issues. We've got to protect our streams and a lot of time it takes regulations to do that.

- Looking at impacts, there are many harsh ones. For example, a property developer wants to squish together as many houses as he can so that he can make more money and cut costs for his customers who want to pay an exorbitant amount of money on a house. There is no regard to the environment and what is best for it.

- I think a couple of challenges; one that comes to mind is growth and development. That's something that every state has been facing, especially in this part of the country and others. In Kentucky, because of our landscape, our topography, a lot of times some of the more prime real estate to develop is in those more sensitive areas that are in the stream valleys and so forth. So, smart growth.

- *Continued from above:* It would be nice to see more zoning. Zoning laws used throughout the state, that's something that's usually really negatively looked upon by a large facet of the communities out there. But it's some way to be smart in the way we grow and be judicious with the resources that we have, especially the good resources that we have left, instead of just the urban sprawl, the growth that we see. –When you start getting impervious surfaces above about 10 percent in a watershed, that statistic alone will tell you probably already that you have an impaired watershed. Trying to go back and rectify those problems once you start down that road of not-smart growth, it becomes almost impossible. In fact, it really is impossible oftentimes.

- Probably the biggest challenge of all is that we keep expanding as a population and moving out. In just the last few decades, what once was land covered by large expansive farms is now land dominated by shopping centers, housing sub-divisions, and a plethora of buildings. No longer is water able to move freely in and out of these places. There are no longer open fields where when it rains the water can be soaked up. This is so detrimental to a stream. The Center on Watershed Protection did a study that concluded that if more than 10% of a watershed is impervious (paved over, water cannot get through), then you begin to see negative impacts on the stream. Subsequent studies show this percentage to be closer to 6% than to 10%. Roads, parking lots, houses, etc. fill cities very quickly taking up the 6% in no time flat. How do we move forwards economically without moving backwards environmentally? That is going to be our biggest challenge.

In telephone interviews with other stakeholders, the impacts associated with economic growth and development were also seen as a major hurdle to streams and wetlands protection. Many noted the inherent dilemma. One, for example, noted that as we "build more we need more natural resource" and which is "definitely a barrier to restoring anything." Like many advisory committee members, many stakeholders had not only much to say regarding the conflict between economic development and environmental protection but some of them also provided some critical advice and direction:

- Locally we've been trying to encourage the counties, the local municipalities, to adopt stream buffer regulations, (or) ordinances. We've also been working with the municipal sanitation district and other local entities, to try to strengthen stream protection practices. Generally, overall, from my perspective the effort from the state and federal governments are very weak which is bad because the local governments kind of look to them for that. It just hasn't been a consideration around here. In fact when I first started we were dealing with some sediment erosion control issues on construction sites, and I asked the building inspector, not really knowing at the time, 'What is your stream setback regulation?', and he said 'Well, we go by what the Army Corps suggests.' I said 'Well, what's that?' and he said 'Top of bank.' So there is no local ordinance at this time; in fact, we're getting ready to participate in the review of the subdivision regulations. That will be a big issue, to try to get that in there. Statewide it is really disappointing that the state isn't stronger about that sort of thing.

- One of the biggest barriers, from my vantage point, is local regulations. Speaking mostly about zoning, housing, subdivision regulations, -one group will be talking about green infrastructure regulations we should establish and that they are arguing for and then there is another group that are making storm water issues worse, and they are in the same area and they are not working together. Local regulations and perhaps state regulations don't specify what should be expected in terms of managing storm water. Second, it would be public education. The public simply does not recognize that storm water effects stream water quality problem. They don't realize it. And then third, some of the agencies… I see the Corps of Engineers to be one of the biggest problems in giving permits, and the confusion about these permits. The Corps doesn't do a good job of permitting when it allows subdivisions to go forward when there is a lack of storm water control.

Constructed wetland designed to handle surface run-off.
Photo provided by: Sanitation District 1, Northern Kentucky.

- I think most land owners in the private sector want to do the right thing with the environment, so the availability of good information and technical expertise on how to protect those resources is probably very valuable, - informing folks on how to accomplish that on their own property

- I think there have been some good strides made over the years in conservation. There could be a lot more primarily on the wetlands and stream protection. Things like wet zones need a little more public education for people to be aware of their role in the water cycle.

- The biggest challenge is probably the loss of wetlands due to urban sprawl and urban development.

Likewise, when offering "critical advice" to those doing long-term strategic planning, a number of survey respondents provided sound advice on potential ways to curb some of the impacts of development on Kentucky's streams and wetlands:

- Watershed protection begins at the source - the headwaters - which is tied to land use activities - any protection or restoration must include land use planning there.

- Private residential development along streams, lakes and wetlands has resulted in more damage to these water bodies than has any other activity by society. It has also confounded public access to public waters for fishing, hunting, and viewing. Regulation of discharges from these sources and prohibition of modification of the shoreline and water body for these private uses will be necessary to preserve them for our future. Combined sewer overflows and urban runoff must be addressed before any meaningful water quality programs can be implemented along major water bodies.

- County Judges are the "Local Flood Plain Coordinators"- The Rooling Fork River runs through our county from end to end and has many creeks, streams and tributaries- that originate on mostly woodland and farmland tracts that lie adjacent to the flow lines that impact the overall water quality. The Rolling Fork is the source of raw water for the water treatment plant that provides our water supply for the entire county. It is very important that we protect these watershed areas and continue to eliminate the threats- illegal dumpsites, litter and debris, control burn areas, and flooding that may release contaminants into the stream network. More funding would help restore and protect our water quality assurance efforts.

- Use local Flood Plain Managers knowledge and experience and you will be able to have a historical and current perspective on what it is like in all areas of the State. We are ignored most of the time. We do not provide false info. I can't afford or the County cannot afford law suits for erroneous info.

- The regulatory agencies have failed to educate the right people on storm water regulations and BMPs. To this day larger developers and contractors still do not comply with storm water regulations. Tougher enforcement is required. However I realize that the manpower to properly enforce is not always available. Preventing the construction of mobile homes or homes in the floodplain/floodway without permits is difficult even at the local level…

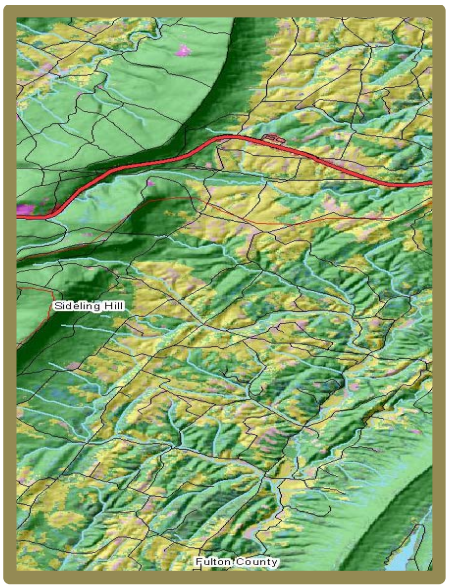
- I feel like there is a lack of education in KY about development and the impact on our waterways. Lack of planning and zoning in many parts of rural KY has allowed for the destruction of shared resources to benefit the few. A look at how to educate and encourage environmentally sound planning & zoning in high risk areas would be a top priority for me.

- The planning of workable buffering of streams and wetlands from development and industry is a priority. Retention and detention basins are of high value in creating settlement areas for runoff.

- Need stronger local government involvement of water resources, stronger ordinances and buffers for development, incorporation of low impact development into designs for new development, more involvement in riparian buffer restoration in agricultural areas - work with local farmers.

- Although it's good that there is now regulation limiting the percentage of trees that can be removed from stream-banks during timber harvests, there appears to be minimal regulation to prevent developers and farmers from doing the exact same thing. They should not be allowed to remove such a large percentage of trees from perennial streams either.

- Success is determined by the ability of State and Local Government to recruit and work with the business community. The business community is far ahead of government in terms of developing and implementing water quality improvement, and remediation programs. Most local governments have yet to understand BMP's…. for example, Lexington requires storm receptors by developers yet does not require them on their own projects.



Impervious surface and tree canopy for an area of Kentucky. *Slide provided by* Demetrio Zourarakis. Kentucky Division of Geographic Information Systems.

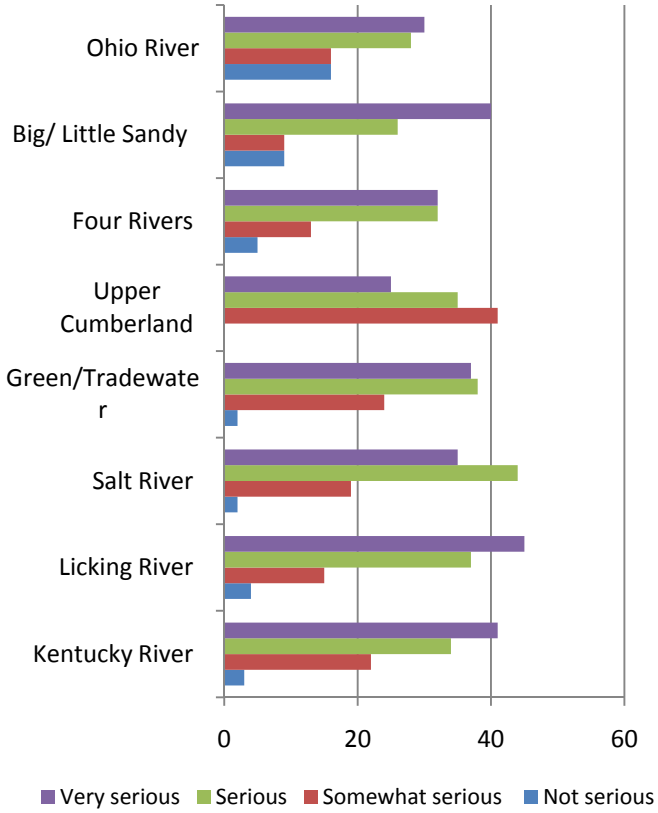
- …. "Developers need to be educated on the importance of these riparian zones so that they can be protected. Our community has the ability through GIS to send out information to all property owners. There needs to be some way to educate the public throughout Kentucky about this matter. Our extension offices would be a great place to start…" *–Open-ended Comment, Survey respondent*

URBAN AND RESIDENTIALGROWTH, *CONTINUED…*

As with stakeholders who were interviewed over the telephone and, as with steering committee members, survey respondents were also broadly concerned with impacts of urban growth and development on the state's water resources. When asked, for example, to openly respond to the question on "what do you see as the greatest potential threat to Kentucky's streams," most respondents wrote in "development" or one of its effects (storm water, sewage, road and transportation development etc). For example, of the 668 written responses, approximately half (48% or 323 persons) made some reference to urban or resident development as the greatest potential threat to Kentucky streams. Similarly, of those 638 persons who responded to a similar question on wetlands, well over half (60% or 386 persons) mentioned the effects of urban or residential growth as the biggest threat to Kentucky's remaining wetlands.

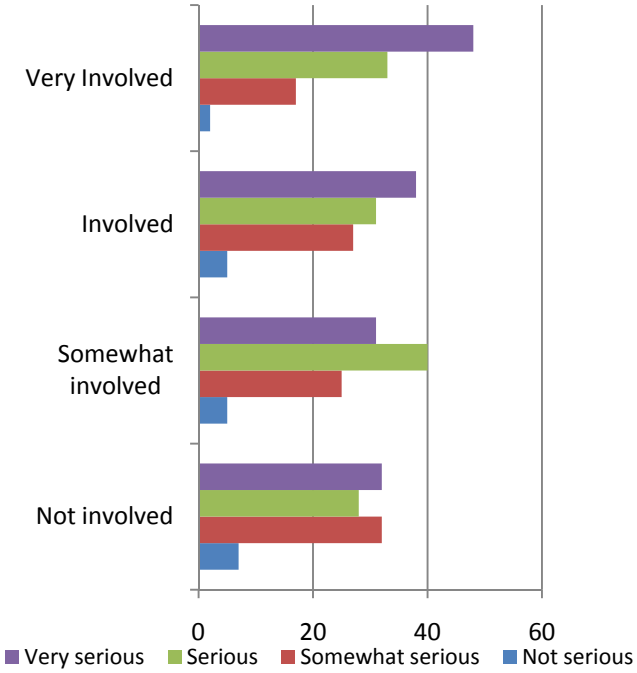
Below are some further analyses of survey respondent views on the impacts of economic development and growth. As stated at the outset of this section, overall, respondents rated residential growth as one of the top five greatest impacts to stream and wetlands. Graph 1 provides further analysis of views of residential growth by watershed while Graph 2 provides a breakdown of views on residential growth by level of involvement in streams and wetlands issues. Finally, Graph 3 on the following page provides a breakdown by respondent role or job position in relation to streams and wetlands.

Bar Graph #1 ***Residential Growth by Watershed***



N= 703; X^2=47.8, *df*=27, sig=.008

Bar Graph #2 ***Residential Growth by Level of Involvement in Streams and Wetlands Issues***



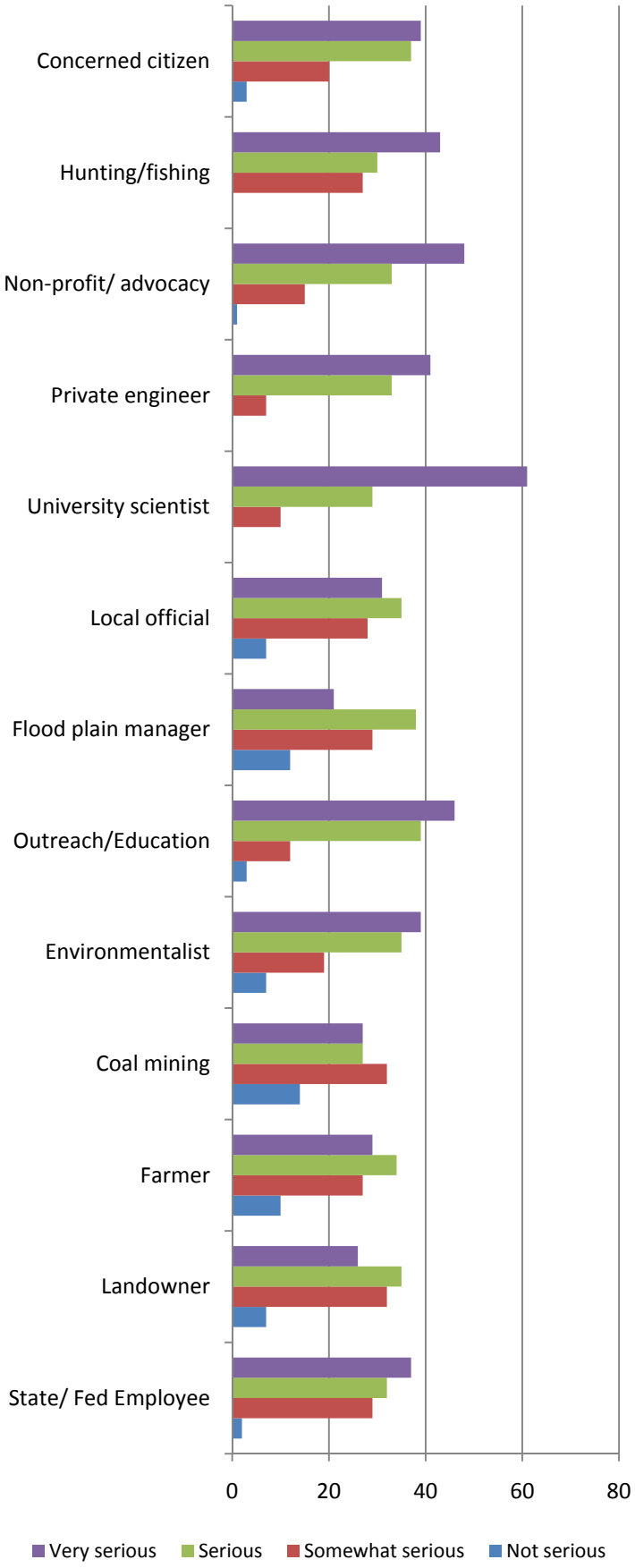
N= 715; X^2=22.5, *df*=9, sig=.007

Graph 1: The first chart shows some variation in views on the impacts of residential growth on the state's water resources by watershed. Findings show that persons from the Kentucky River (41%), Licking River (42%) and Big/ Little Sandy (40%) were significantly more likely than persons from other river basins to view the threats of residential growth as a "serious impact" on the state's streams and wetlands.

Graph 2: Likewise, there was some difference in opinion between those who reported themselves as "very involved" in stream and wetlands issues and others who were less involved. According to Graph 2, those who reported themselves as very involved were more likely to rate the impacts of residential growth as a very serious threat (48%) in comparison to those who were somewhat involved (31%) or not involved (31%).

Graph 3: Finally, there was some further difference in opinion between different stakeholder groups on the threats or impacts of residential growth to streams and wetlands. According to Graph 3 on the following page, university scientists were mostly likely (61%) to highly rate the impacts of residential growth as "very serious." Other groups followed suit with non-profit advocacy (48%), hunters and fishers (43%) and those involved in outreach and education (46%) most likely to rate the threats from residential growth as "very serious." On the other hand, local flood plain managers (21%), local officials (31%), landowners (26%) and those involved in farming (29%) and coal mining (27%) were less likely to view the impacts of residential growth as a serious threat to our state's water resources.

Bar Graph #3 ***Residential Growth by Role or Job Positior Relation to Streams and Wetlands***



N= 715; X^2=65.3, *df*=9, s

University students working with instructor on a GIS/ mapping project.

When remarking on the current challenges and opportunities facing stream and wetland conservation and restoration, several steering committee members mentioned geographic information systems (GIS)/ remote sensing (RS) technologies as important tools that Kentucky could better use in watershed planning and protection. Though one mentioned, "We're making good strides in making GIS data available" and that "we're headed in the right direction," -while others had this to say:

- …we hope to have a line of datasets at some point… Flood plains, wetlands go together hand in hand, low-lying places, right? You want to have good elevation models through that and be able to map them and see which pieces are there. Maybe you can find new wetlands that no one knew about….

- You start looking at your GIS products, remote sensing, you start looking at those riparian corridors that are kind of being compromised, you're going to have, in all likelihood, a good functioning aquatic ecosystem there, one of high water quality.… [*Later in panel*] … Where it bothers me, where it kind of rubs me a little bit, …is that I see, from my standpoint, so many more opportunities to produce those GIS products that could make an impact for decision making and public use because nobody really has the time or the attention span to read a 305B report that that's thick. But they sure will take maps and use them. We just need more resources, more folks out there that can actually produce these products.

- I do GIS work and this has an educational component. It can help determine what makes a stream good or bad? What is going on around the stream? It can help people visualize what is going on in their backyards.

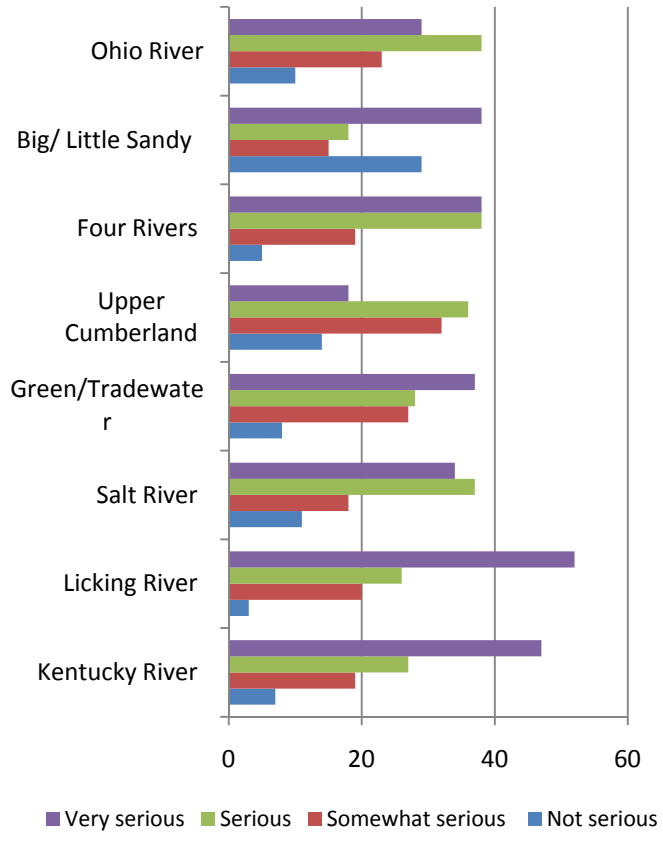
- Use the GIS data that we have. GIS is underfunded though and needs attention. We need better equipment.

COAL AND ENERGY DEVELOPMENT

Recall, from the initial reported trends (first page) that 56 percent of survey respondents rated sewer and straight pipes as a very serious impact to Kentucky's streams and wetlands, while 40% of respondents perceived the impacts of coal and energy development as "very serious." This percentage difference is, in itself, significant and may suggest that sewage and straight pipes is the priority area of main concern among survey respondents. However, along with sewage and straight pipes and other impacts associated with growth and development (storm water and residential growth), coal and energy development was also rated as a priority concern or "very serious" impact to Kentucky's streams and wetlands by those that were surveyed.

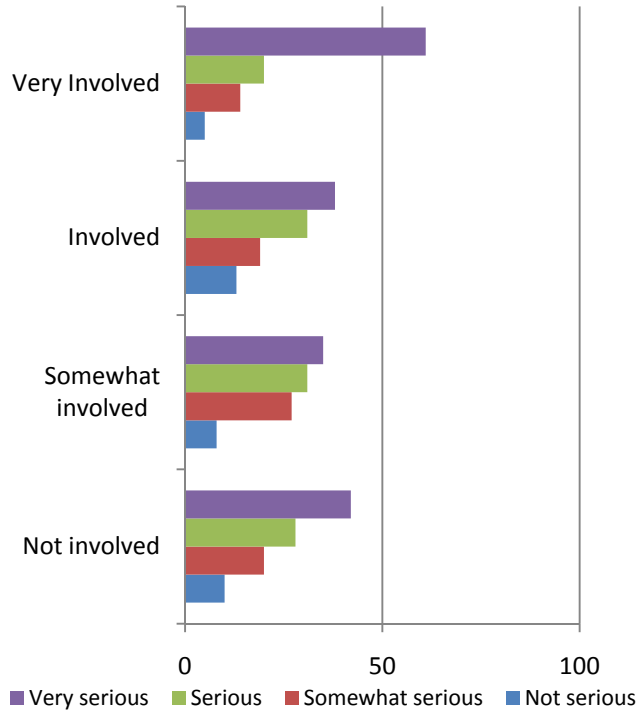
Below are some further analyses of survey respondent views on the impacts of coal and energy development. As with residential growth, Graph 4 provides additional analysis of views of coal and energy by watershed while Graph 5 provides a breakdown on views on coal by level of involvement in streams and wetlands issues. Finally, as with the last analysis on residential growth, Graph 6 on the following page provides a breakdown by respondent role or job position in relation to streams and wetlands.

Bar Graph #4 ***Coal and Energy Development by Watershed***



N= 654; X^2=62.3, *df*=27, sig=.000

Bar Graph #5 ***Coal and Energy Development by Level of Involvement in Streams and Wetlands Issues***



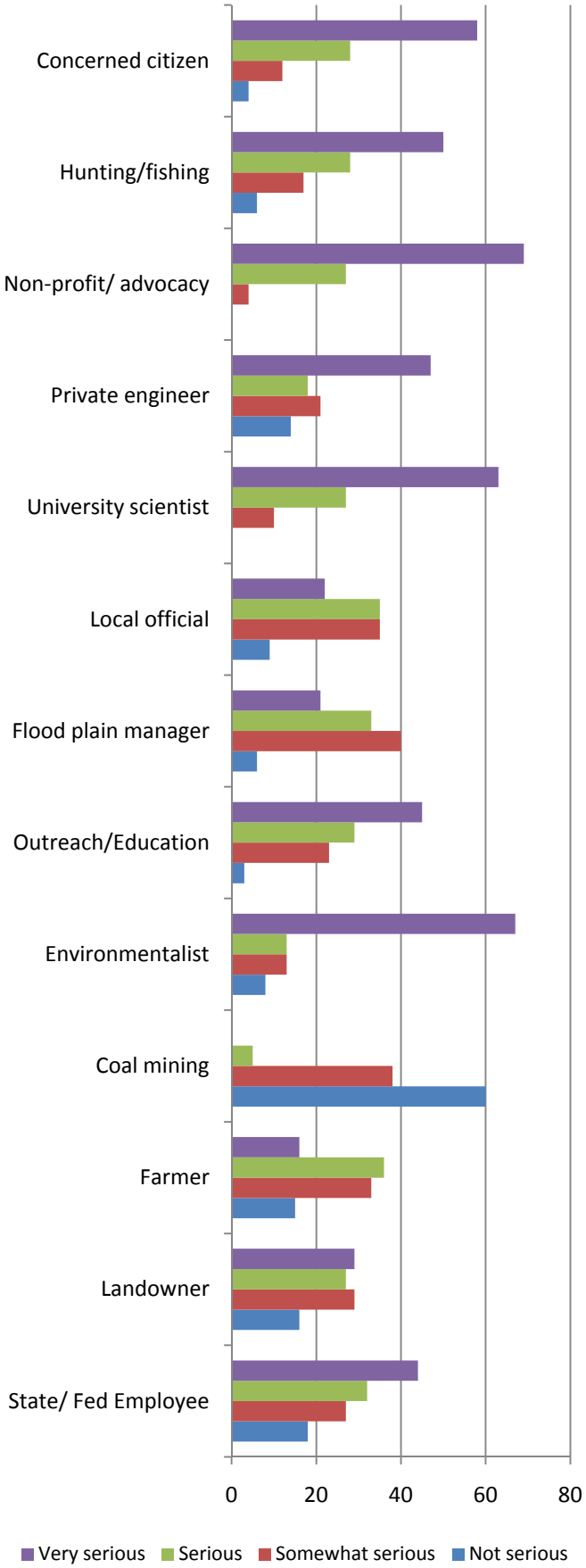
N= 665; X^2=18.6, *df*=9, sig=.028

Graph 4: The first chart shows some variation in views on the impacts of coal mining on the state's water resources by watershed. Findings show that persons from the Kentucky River (47%) , Licking River (52%) were significantly more likely to view the threats of coal and energy development as a "serious impact" on the state's stream and wetlands. Interestingly, persons from the Big Sandy Region (38%) and Upper Cumberland (18%) were less likely to perceive the impacts of coal mining as a "very serious" impact.

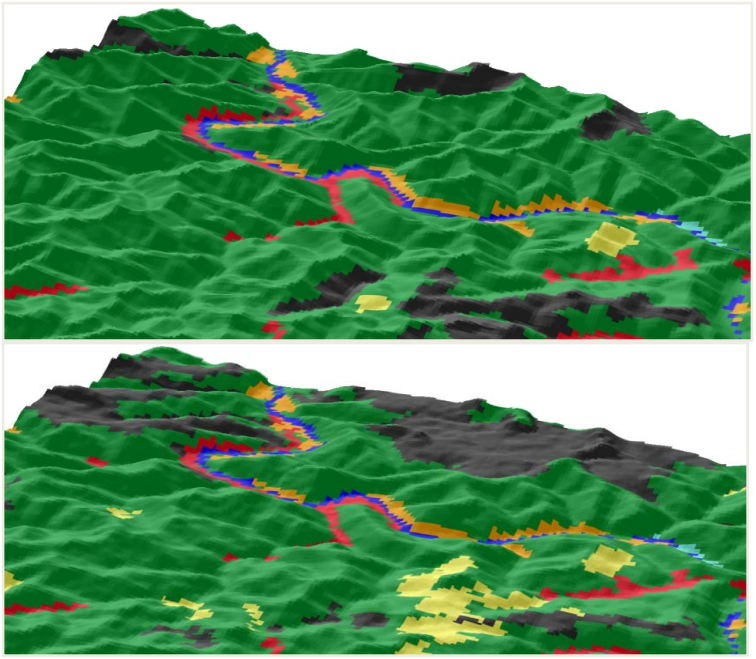
Graph 5: Likewise, there was some difference in opinion between those who reported themselves as "very involved" in stream and wetlands issues and other who were less involved. According to Graph 5, those who reported themselves as very involved were more likely to rate the impacts of energy development as a very serious impact (61%) in comparison to those who were somewhat involved (35%) or not involved (42%).

Graph 6: Finally, as with residential growth, there was some difference in opinion between different stakeholder groups on the threats or impacts of coal and energy development to stream and wetlands. According to Graph 6 on the following page, persons involved in non-profit or advocacy work were mostly likely (69%) to highly rate the impacts of coal as "a very serious impact." Other groups similarly followed suit with environmentalists (67%) and university scientists (63%) most likely to rate the threats from coal mining as "very serious." On the other hand, local flood plain managers (21%), local officials (22%) and those involved in farming (16%) and coal mining (0%) were far less likely to view the impacts of coal and energy development as a "serious threat" to our state's water resources.

Bar Chart #3 ***Residential Growth by Role or Job Position in Relation to Streams and Wetlands***

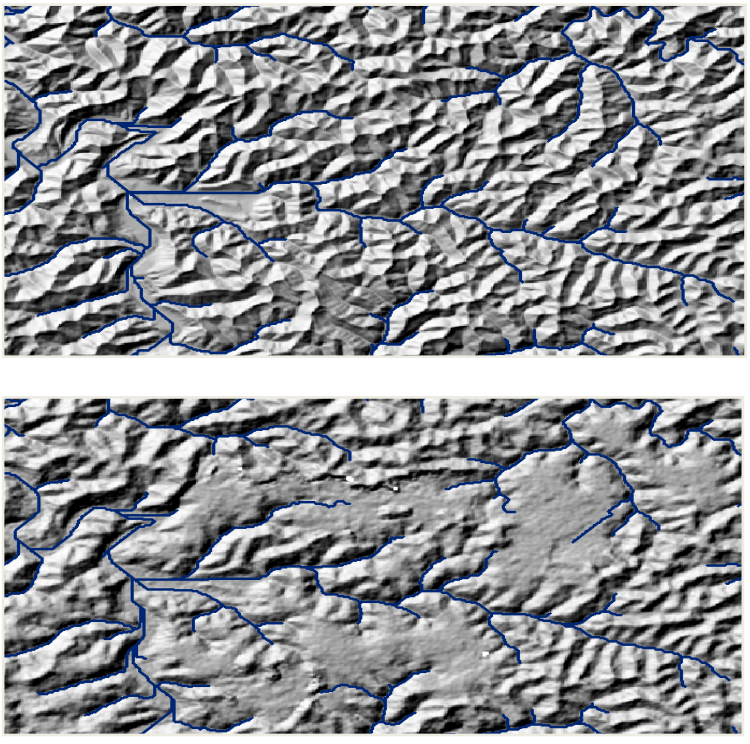


N= 665; X^2=166.5, *df*=54, sig=.000



- … for surface mining, we've got the Federal Office of Surface Mining. They provide a lot of our GIS data support. They can go out and acquire imagery that we would never be able to afford. They provide all of our licensing and things like that for our GIS software and provide us with equipment that we'd never be able to get on our own. So, that partnership works really well.

  -Steering Committee member



Top and Bottom Photos: Land cover and topographic surface change, Eastern Kentucky surface mines: Pre disturbance and post disturbance. *Slides provided by* Demetrio Zourarakis, Kentucky Division of Geographic Information Systems, March 25 presentation.

The challenges posed by coal and energy development were discussed, often at some length, by survey respondents in their open-ended comments. Likewise, stakeholders in their telephone interviews and steering committee members during their advisory sessions had much to say about the challenges facing the State's resource dependent regions. Many recognized the balancing act and trade-offs of coal and energy production and protecting streams and wetlands in the intensive coal mining regions of both eastern and western Kentucky. This balance, for many, posed one of the greatest challenges to stream and wetlands conservation within the state:

- I think another daunting challenge out there is with resource extraction. We all want our electricity. Coal is a very important source for that, but it's also one of the largest footprints on our landscape as far as water quality is concerned, especially now with some of the practices, the mountaintop or near-mountaintop removal, where there's lots of valley fills, hollow fills taking place because that fills up those headwater streams. You get the leaching of the groundwater then into the surface water. That's coming through all those geologic strata that, at one time, was capped, and that was groundwater. So, now you have all these ions and these metals, total dissolved solids that are being leached now into the surface water. That is a legacy effect that's probably going to be with us for hundreds of years.

- [*Continued from above]* So, it's a huge challenge to be able to be smart, maybe spend a little bit more, if – again, it comes back to the public. The public – are you willing to trade a little bit of your dollars for better protection of your resources? But I can tell you that for water quality in eastern Kentucky – there are some real challenges out there.

- I think that the other issue is that a lot of forces would be unwilling to change how we do water quality issues. I talk about coal because it's one of the things that I know a little bit more about. They are unwilling to change and they have the financial resources to promote their viewpoint more effectively than a lot of other groups.

- I think probably that one of the two biggest problems in eastern Kentucky is coal. Today, if you looked at the Lexington Herald on the editorial page, there was an Op/Ed piece entitled "How Coal is Good" or something along those lines. Of course, they are arguing from more of an economic viewpoint and who can argue that?

- *[Continued from above]* But when you look at it from an environmental viewpoint there are very little good things about coal, especially now with mountaintop removal, where they just flatten it and take the tops off of mountains, and with filling in the small tributaries at the tops of the mountains…. [Some] will tell you, "They're nothing more than ditches and they only run after it rains." But from an ecologic point of view, that's basically crap. Those streams are the feeder streams to all of the rivers and all of the water in Kentucky. If you mess up the feeder streams, then you are messing up everything. So, coal is certainly a huge, huge challenge.

- Mining minerals is a big problem; we all know that; we all know what's going on in eastern Kentucky. That's not going to stop tomorrow. We need the energy; the energy is feeding the room that we're in right now to have this meeting. So while we have to have it, we need to try to focus on doing that within the most responsible means necessary. It's just not feasible that we're going to quit mining or pulling oil from this Earth anytime soon, so doing so, we need to focus on the way we can mine it responsibly and get material that's used in the most economic and efficient manner as we can possibly get.

- I'm thinking more from a species perspective, -that is kind of what I do is worry about threats to species, and the same threats are to the streams where they live. For the Upper Cumberland it's mining, you know the demand for energy, as it is today, isn't going away anytime soon. Mining permits, I don't know if we get 2 a day, but it's close to that. We do a lot of review of mining permits through the year. Unfortunately those kinds of projects can have very long lasting impacts on streams because they alter water quality. Especially if you have a hollow filled on a mine site where they, you know basically fill the upper most reaches of the watershed. It can contribute some significant metals and stuff long term into the stream, and increase the conductivity.

- [*Continued from above]* That pretty much takes care of the Blackside Dace or other sensitive species that are in the system. Mining you know, -that is the main threat that I worry about, -mining is right up there at the top. Of course there's logging, you also get issues with siltation and sedimentation with logging of course it's a short term thing, -it's not long term. It does alter water quality and it's very destructive to habitat. And of course general development can do the same thing as logging… it's mainly siltation….

- I'm not going to get into politics but you have the mountain topping where all that debris is going into intermittent streams polluting them that eventually end up in flood plain areas below where this sediment is ending up. We have talked to people in Eastern Kentucky where you have to dig down twenty feet to get to the original flood plains. So that is certainly a big challenge there and in Western Kentucky we continue to see farmers who ignore regulations and restrictions with the Farm Bill. You still see farmers who continue to encroach on wetlands and agencies are trying to stop them.

- Balancing our difficulty is trying to curb certain kinds of mining practices, which cause a great deal of sedimentation, over a lengthy period of time. Barriers are, primarily, I think, political...

- Another thing that concerns us would be the splitting of the 401 water quality certifications where the Department for Natural Resources, which of course issues all the coal permits, is now in charge of all of those 401 certifications. First of all, they are not clean water act experts; it's the Division of Water who is the delegated authority for that program, not DNR. I don't know that DNR really knows what they're doing, and I think it's a bit of a conflict of interest in a way, to have the same people who are also approving the coal permits for filling or… mining through or otherwise…destroying streams and impacting streams. We've looked at DNR stream buffer zone variances for the last seven years, and more than, I think it was more than, seventy percent of the time, when a stream buffer zone variance was requested, it was granted. That tells me that we're not doing enough to protect or conserve or restore our streams and our wetlands areas.

- Mining, flooding…the big issue here in eastern Kentucky is the mining that is taking place. I see that as a barrier both to the damage it has done to the environment, and also to the agencies that could push to have stuff done, but they are just kind of sitting around with their hands in their pockets waiting for the coal companies to tell them what to do.

- Another challenge is the enforcement of mining laws. They need to be re-addressed. (CHIA) [*Cumulative Hydrologic Impact Assessment*] is part of the surface mining law and it is not being enforced well enough. Before a mining company is permitted to do a mine, they are supposed to assess all potential impacts in the future. Essentially in Kentucky, no one has ever done these -they get overlooked by the mining companies and the Corps of Engineers. Going back and looking at (SMCRA) Surface Mining Authority Control and Reclamation Act is an essential challenge for the future

- Mountain Top Removal Coal Mining MUST BE STOPPED. Educational efforts are needed to protect stream bank riparian zones by encouraging wide buffer zones & planting native trees and plants.

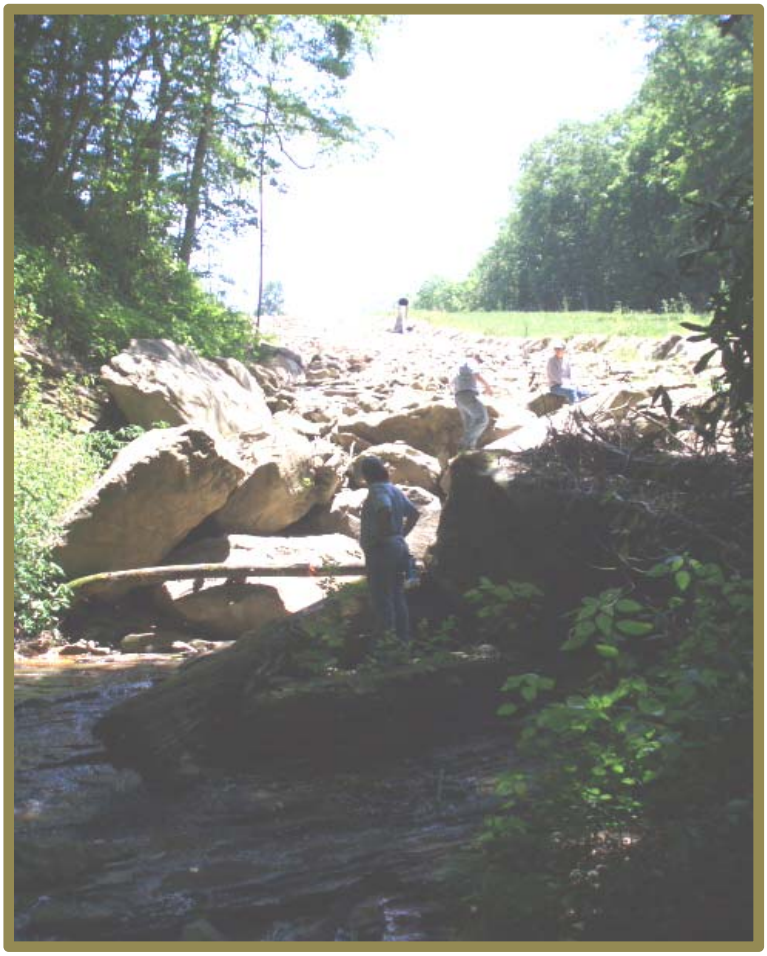


Photo: A "valley fill" from a mountaintop removal coal mining operation somewhere in eastern Kentucky. *Photo provided by:* The Kentucky Division of Water. *Note:* As of 2007, State 401 Water Quality Certification permits for coal mining activities are now issued through the Kentucky Division of Mine Permits rather than KDOW.

- I think one of the first challenges is the possible lack of enforcement of rules on headwater fills because again that's still kind of up in the air…

- ...oh, I think, first, would be the coal industry. They work hard to stop any meaningful rule changes as it relates to these Kentucky streams.

- You need to increase regulations on coal and timber…

- Regulation of coal mining is key, -but before that can happen, the people of the affected counties need to know the whole story and need to be able to support themselves without mountain top removal. Otherwise, our legislature will do nothing - as I was told point blank by our local State rep.

- Coal mining impacts to streams and wetlands need to be better addressed. For those of us in the western Kentucky coal fields, we see the impacts daily of past and present mining activities. The runoff from these sites is extremely detrimental to the ecology of our water resources and these activities should be better regulated and enforced.

Others, on the other hand, from the survey, telephone interviews and on steering committee, were of the view that the coal industry was already well-regulated (far more so, in their view, than agriculture and urban development). Some of these advocates mentioned that the industry and its partners (private reclamation firms and university centers) were making significant inroads in developing stream reclamation methods and techniques to restore mining impacted waterways and regions. Some of their comments are below:

- I feel that coal mining is regulated as much as need be at this time, However the encroachment of residential growth, logging operations and highway construction are not regulated to the extremes that mining has been subjected to. With the exception of coal mining, these other areas need to be regulated more to provide additional protection for our streams and wetlands.

- The coal industry is currently well-regulated, but more strict enforcement would help. Tighter regulations are needed for logging, oil and gas development, and urban development. Increased enforcement is needed regarding "straight pipe" sewage discharges.

- I think people and news media do NOT have facts concerning mining issues. The regulatory folks also need to be consistent with information they want provided. It cost our client money every time they change their minds. We need a Professional Biological Certification to help with the trust issues between "us & them." Blackball folks that do not do the right thing. In this day and age no-one wants to lose their jobs. Clients need to understand that putting these things together takes some time, and field work.

- Well there is a lot of activity in that area currently. I think in particular in the mining sector there is more going on now than in any time in past history. The emphasis on stream restoration and mitigation and the attention to how mining operations can be conducted in such a way as to adequately restore the streams and headwater resources.

- I think in the long term is that as we gather more and more knowledge on the problems and challenges created by surface mining, -just the challenge of keeping up with our knowledge is going to be a long term problem…The surface mining industry right now is very interested in doing everything they can to react to that new information. You know, I deal with these folks all the time and they're very willing, from a public relations standpoint and as people who are interested in the environment,-they are interested in meeting those challenges as that information is gathered.

Photo: Reconstructed stream (2007) Harlan County.
Photo from: Kentucky Coal Association.

- …there seems to be a mindset…, -that if you mine you permanently destroy the land and the streams and you bury the streams, -and some of that is correct. But I don't agree that you completely destroy the land because since 1996 there are demonstration sights where they are doing this loose dump soil and growing high value hardwood trees very successfully. It has made this a very important component when we look at the stream because if we just try to reconstruct the stream it isn't always very successful. If we don't have reconstructed forces of watersheds, - then obviously we don't have the right hydrology, we don't have the rainfall runoff response, we don't have the nutrients or carbon source, the organics, the leaves and stuff like that. So to me we have to approach stream restoration with a systems approach where we integrate the watershed with the streams and that seems to be the key. The other point is somewhat related and again, this mindset that you cannot recreate a stream on a valley fill or a head of a hollow fill: There was certainly court cases won recently in West Virginia… where, -absolutely you bury the stream. But consultants are now recommending that coal companies and restoration firms do first, is that prior to burying that stream, go ahead and remove the trees, the rocks, and basically stockpile that. What we are seeing is that you will take those materials and recycle a stream. So it is varied and we are changing ingredients to some extent. There is no doubt about that, and basically on top of a valley fill or head of hollow fill, and you don't just put in rock channels like they do, but rather actually design and construct a natural channel again.

- *[Continued from above]* Just got finished with an equipment pullout in December, the trees got planted two weeks ago. I was out there in January and if my back was to it, you would hear the pool ripple environment, you could hear it when you would turn around and I could certainly envision what it would look like as a forest because of the one we did back in 1996-1997, that one now has trees that are 30-35 ft. tall, canopy closed, looking like a forest.

Photo: A constructed hillside wetland.
Photo provided by: Tom Biebighauser, US. Forest Service

- …mining sites, and newly proposed ones, and abandoned land mine sites -all of those provide enormous opportunity for doing work.

- The mining potential is so great; right now the wetlands and stream work that are being done, in association with mining, are generally because it is for required mitigation, and there is the potential, after the mining is done, to go into these areas, and actually build wetlands, because it's a good thing to do, and that gets us into this realm of, okay, required mitigation versus it's a good thing to do, and working with these mining companies and private land owners towards that…

- One of the things the Tracy Farmer Center did when we partnered with Tom Biebighauser of the US Forest Service is to do a wetland restoration workshop… It was a really nice program and we did it in the Daniel Boon National Forest for a week, and it was really, really great, but the Forest Service wasn't able to get funding this year, so we are not able to do it again this year.

Based on a separate telephone follow-up, the focus of the workshop this year was scheduled to be wetlands construction on mining sites and the construction of hillside wetlands. The above third comment by a steering committee was confirmed insofar as the US Forest Service has not yet been able to secure funding to conduct its scheduled week-long workshop for fall (2009).

Photo: Reconstructed stream (2003) in Floyd County at reclaimed mine site. Restored with "recycled" / recovered original materials from pre-disturbance site.

Photo: Teaching the techniques of hillside wetlands construction, Tom Biebighauser with university students.