To: **Isiah Leggett**
Montgomery County Executive
Fr: **Scott Fosler**
Re: **Outline for a Study of Development Impact on Little Seneca Reservoir**
Date: **October 11, 2013**

During our recent tour of Clarksburg and Little Seneca Reservoir with a number of other government officials and citizens, you asked me if I would outline a study of the impact of proposed amendments to the Clarksburg Master Plan on Little Seneca Reservoir as an emergency drinking water supply for Montgomery County and the greater Washington region. This memo responds to that request, summarizing the key points in such a study which are elaborated in the attached Appendix.

In composing this outline, I consulted a number of people who made significant contributions. I would like to thank all of them, and recognize in particular Royce Hanson, John Hochheimer, Ephraim King and John Menke. While the contributors never met as a group or attempted to reach a consensus, this memo, and the Appendix, draws together their contributions to fashion an approach intended to be in the best interest of Montgomery County and the Washington region.

Purpose of the study. The principal purpose of the study would be to assess the impact of existing and proposed development projects, and other factors, on Little Seneca Reservoir. These would include the impact of existing and proposed development projects in the Clarksburg Master Plan for Ten Mile Creek. Because Little Seneca Reservoir is the proximate emergency water supply backup for Montgomery County and the entire Washington Region, and because the existing and proposed Clarksburg developments are in the headwaters of the reservoir, the overarching purpose of the study would be to assure that our county and regional emergency water supply will be there when we need it.

Background. Planning regarding Little Seneca Reservoir over the years has proceeded along two principal tracks, one for land use and one for water supply, and the two have not always been clearly joined. The land use planning has followed the broad outlines of the General Plan in creating green wedges and high density corridors. On the water supply side, in the early 1980s Montgomery County joined with other jurisdictions in the Washington region to fashion a region-wide water supply system in which Little Seneca Reservoir played a key role of emergency backup. Meanwhile, the county's land use planning configuration placed the headwaters of the reservoir in the Clarksburg-Hyattstown master plan area, while Little Seneca Reservoir itself was placed in the Boyds master plan area. One consequence of this planning configuration was that the impact of a Clarksburg corridor city on Little Seneca Reservoir has never been directly and systematically assessed. The proposed study aims to remedy that deficiency.

Analytical Framework. The immediate technical questions the study would address, which are enumerated below, will only be useful if placed in a well-designed framework for analysis with these key elements:

- Definition of terms, for instance clarifying the meaning of *Washington regional water supply system;*
- Creating a baseline, "business as usual" model, against which to assess the future impacts on Little Seneca Reservoir;
- Projecting future supply and demand against the baseline;
- Considering the full set of forces that could have important impacts;
- Defining the impacts on the quantity and quality of water in Little Seneca Reservoir in terms of key metrics and water quality parameters;
- Identifying key policies and protection measures; and
- Establishing a time frame suitable to the problem.

Key study questions. Given this context, the study can then focus with precision on the more immediate questions of concern related to the impact of proposed Clarksburg development on Little Seneca Reservoir, including the following:

- Will Little Seneca Reservoir be able to serve its emergency water supply function for Montgomery County and the Greater Washington region in the future?
- What will be the impact of proposed policy changes in the Clarksburg Limited Master Plan for the Ten Mile Creek watershed on the Little Seneca Reservoir as a key component of water supply for Montgomery County and the Washington Region? What are the long term impacts on the Little Seneca Reservoir as Clarksburg is built out?
- How do potential changes in Little Seneca Reservoir water quantity and quality affect its potential use as a Potomac low-flow water augmentation source?
- What are the possibilities for using Little Seneca Reservoir as a direct backup when the Potomac Filtration Plant fails?
- What other uses of, or demands on, Little Seneca Reservoir are likely in the future?

Modeling. The usefulness of the study will depend to a large extent on how the Little Seneca Reservoir and its watershed are modeled in order to account for the potential impacts of existing and potential development. Key issues of modeling for this study are summarized in the Appendix and elaborated in an attached note.

Other issues. The study should also address several other methodological issues, including:

- Scenarios
- Environmental Site Design (ESD)
- Monitoring

Case studies. The study should benchmark our community's water supply policies and practices with other major urban water supply systems, including, for instance:

- New York City, which since 2002 has spent more than $1.5 billion to purchase forests and other lands surrounding its reservoirs in the Catskills so that clean drinking water will be available for future generations;

- New Jersey, which in 2004 set aside 415,000 acres in the New Jersey Highlands as a Preservation Area to protect important natural resources and watersheds feeding several drinking water reservoirs; and
- Baltimore County, which has used zoning to protect its drinking water supply, including establishing an Urban-Rural Demarcation Line to protect its 3 reservoirs, and imposing a minimum lot size of 50 acres on parts of the watershed outside the urban zone.

Organization of the study. A study of this scope and importance should be commissioned by the Montgomery County Government, including the option of a regional coalition, perhaps under the auspices of the Washington Metropolitan Council of Governments (COG) or the Interstate Commission on the Potomac River Basin (ICPRB). An independent oversight committee should be formed comprised of key agencies with an interest and/or responsibility regarding this issue, as well as citizen representatives. Criteria to guide the selection of an entity to perform the study include professional capacity, integrity, objectivity and public trust and credibility. Depending on its scale, the study might take anywhere from 4 months to a year or more, and cost between $200,000 and $1 million. Costs might be borne directly by the county or shared with other agencies and donors in various ways.

Implications. This study and the issues it raises have broad implications, including the following:

- Little Seneca Reservoir is the proximate emergency water supply for Montgomery County;
- Little Seneca Reservoir is the proximate emergency water supply for the entire Washington metropolitan area, and hence our nation's capital;
- Montgomery County already has a huge investment in Little Seneca Reservoir;
- Little Seneca Reservoir should be seen in the even broader context of the Potomac River and Chesapeake Bay watersheds;
- Montgomery County's regional stewardship for Little Seneca Reservoir involves not just the well-being of the resource itself, but also of the trust and credibility that is vital to regional cooperation; and
- The capacity of our county and the Washington region to continue to exercise local and regional autonomy with regard to our water supply depends on our ability to live up to the responsibilities we have already taken on as a county and as a region for such critical assets as Little Seneca Reservoir.

Concluding thoughts. We greatly appreciate your interest in this issue, as demonstrated by your willingness to tour the area and discuss the important issues at stake, including the nature of a study that could go a long way toward addressing major concerns about our community's water supply. Any of the people who have contributed to shaping this outline would be happy to meet with you to address whatever further questions you may have.

APPENDIX: OUTLINE FOR A STUDY OF DEVELOPMENT IMPACT ON LITTLE SENECA RESERVOIR

Appendix to memo
to
Isiah Leggett,
Montgomery County Executive
from
Scott Fosler
October 11, 2013

PURPOSE OF THE STUDY

The principal purpose of the study would be to assess the impact of existing and proposed development projects, and other factors, on Little Seneca Reservoir. These would include the impact of existing and proposed development projects in the Clarksburg Master Plan for Ten Mile Creek. Because Little Seneca Reservoir is the proximate emergency water supply backup for Montgomery County and the entire Washington Region, and because the existing and proposed Clarksburg developments are in the headwaters of the reservoir, the overarching purpose of the study would be to assure that our county and regional emergency water supply will be there when we need it.

It comes as something of a surprise to people when they learn that such a study has not already been done. Actually, some people – including some water resource professionals -- assume that it is just common sense that you don't build in the headwaters of your water supply, and you really don't need a study to tell you that. Others assume that if you are thinking of building in the headwaters of your water supply you would naturally first assess what impact that would have on its future water quality.

Some people have raised the concern that the planning studies to date have focused on how much development can be shoehorned into the reservoir's headwaters, as opposed to assessing the risks to our community's water supply of going ahead with further development. And still others have assumed that not only would Montgomery County take care to protect its own water supply, but that it would feel a special obligation to protect the emergency water supply that serves the entire Washington region.

The study outlined here is intended to address all of these concerns.

BACKGROUND

Little Seneca Reservoir is in a precarious position. It is a vital part of our county's and the Washington region's water supply, and yet its headwaters are in the midst of a developing corridor city. We have come to this situation in part because of the parallel, buttoo often disconnected, trajectories of two principal policy streams – one for land use and one for water resources.

The county's broad patterns of land use were established by the General Plan for the greater Washington region, known as the "Wedges and Corridors Plan," adopted by the Maryland National Capital Park and Planning Commission (MNCPPC) in 1964, and updated and approved by the Montgomery County Council in 1969. In broad outline, this plan envisioned relatively high density corridors radiating out from Washington, D.C. with green wedges in between.

Then, in the 1980s, Montgomery County joined with other jurisdictions in the Washington region to fashion a region-wide plan to assure adequate water supply for the entire National Capital Region (NCR). This joint regional initiative had its origins in the severe 1960s drought that affected the entire northeast United States, one of the longest and deepest droughts in the region's recorded history. In response to that drought, Congress commissioned the U. S. Army Corps of Engineers to undertake the Northeastern United States Water Supply (NEWS) Study which proposed long range plans to meet the water supply needs for the entire northeastern part of our country. The NEWS Study included the Washington Metropolitan Area as one of the critical urban water supply systems, both because it was vulnerable to short-term water supply deficits, and because it was unique in being "river-dependent," taking nearly all of its supply from the Potomac without the kinds of storage and transmission systems typical of other large urban centers such as Boston and New York City.

To remedy these problems, the Corps of Engineers proposed 16 major reservoirs to meet the needs of the Potomac River basin for a fifty-year planning period then extending to 2010. The projected costs of the Corps' proposal were substantial. In addition to the financial cost, the 16 major reservoir systems would have inundated vast areas of the Potomac basin, causing, by the Corps' own assessment: "ecologic alteration at the project sites; disruption of cultural and socio-economic patterns; and the diminishing open space and unique wilderness recreational opportunities." The Corps also acknowledged that the upper estuary of the Potomac was not at that time thought of as a prime recreational or esthetic resource, but only as a source of water for the Washington Metropolitan Area.

Concerned about the scale and cost of the Corps' proposal, Montgomery County initiated a collaboration with the other major jurisdictions in the National Capital Region, working through the good offices of the Metropolitan Washington Council of Governments (MWCOG), to fashion a more efficient and less environmentally damaging alternative. The solution was a coordinated system of interconnections and mutual backup and just two reservoirs (in contrast to the 16 proposed by the Corps), in order to augment Potomac flows during droughts. The Jennings Randolph Reservoir (which straddles the Maryland-West Virginia border) was to provide the main backup in volume, storing some 13 billion gallons of water. But because it was in the upper reaches of the Potomac River Basin, the water released from that reservoir required 7-9 days before reaching the Washington region and the intakes for the major water supply agencies. Little Seneca Lake Reservoir would be smaller, with some 4 billion gallons of storage, but because it was located in Montgomery County it could more quickly augment the flow in the Potomac to reach the intakes, and thus would be the main backup in proximity.

This new regional system was formalized in the 1982 Water Supply Coordination Agreement (WSCA), signed by the region's major water utilities, including the Washington Suburban Sanitary Commission (WSSC), the Fairfax County Water Authority (FCWA), and the Washington Aqueduct Division of the U.S. Army Corps of Engineers (WAD), which provides raw water to the District of Columbia, Arlington County, Falls Church, and part of Fairfax County, as well as the Interstate Commission on the Potomac River Basin (ICPRB). (The three supply agencies together accounted then and now for about 95 percent of the water drawn from the Potomac for the region). The WSCA was directed at coordinating the region's water utilities during droughts in a way that would minimize the possibility of having to implement the restrictive stages of the Low Flow Allocation Agreement (LFAA), which had been signed in 1978 by those same signatories (plus the states) in order to maintain adequate flow in the Potomac River during droughts.

In the late 1980s and 1990s, Montgomery's land use planning began to focus on developing another corridor city in the Clarksburg area, located in the headwaters of Little Seneca Reservoir. The Clarksburg-Hyattstown and Germantown master plans were drawn in a way that included the reservoir's headwaters, but excluded Little Seneca Reservoir itself, which was included in the adjacent, but separate, Boyds master plan area. One consequence of this planning configuration was that while planners were charged with considering the impact of development in Clarksburg on tributaries to Little Seneca Lake, including Little Seneca Creek, Cabin Branch, and then Ten Mile Creek, they have not been specifically charged with considering the impact on the reservoir itself. And so when the Germantown and Clarksburg-Hyattstown master plans were approved by the Montgomery County Council in 1989 and 1994 respectively, the consideration of their impact on Little Seneca Reservoir was barely-mentioned in the planning calculus, honored mostly in the breach.

Similarly, the planning staff's proposed amendment to the Clarksburg plan did not directly and systematically assess the potential impact of prospective development on the Little Seneca Reservoir (though some citizens testified that drinking water supply protection should be the core objective of the Clarksburg plan amendment for Stage 4/Ten Mile Creek). The main reason the proposed amendment omitted this clear commitment to source water protection is, apparently once again, that Little Seneca Reservoir is not considered part of the Clarksburg master plan area. The lake is essentially "off the map" of the draft plan and is hardly mentioned in it in words or graphics. The focus of the plan and the consultant reports in the appendix is on Ten Mile Creek, with the assumption that a corridor city should be fully developed in the Clarksburg area. The planning approach was not so much to ask "Should this be done?" but rather to accept that "This can't be good, but how can we do it so it will have minimum negative impact?"

So, in the end, the principal concern here is both easily understandable and easily remedied: undertake a serious study that *does* assess the cumulative impact on the Little Seneca Reservoir of development – existing and proposed – in its watershed.

ANALYTICAL FRAMEWORK

The immediate technical questions the study would address, which are enumerated below, will only be useful if placed in a well-designed framework for analysis. Following are key elements that should be part of the framework.

Definition of Terms. The study could usefully begin with a clear definition of key terms. Disagreement and misunderstanding over terms seems to have unnecessarily complicated the conversation, so clarity could go a long way to reducing the confusion.

In particular, it would be useful to clarify that the *Washington regional water supply system* refers to the entire complex of natural resources, infrastructure and organizations responsible for the intake, filtration, treatment, distribution, monitoring, and consumption of water supply to customers in the National Capital Region (NCR) in a safe, healthy, reliable and efficient manner. (Note that the region's water supply system needs also to be considered as part of the broader regional water resources system, including waste water collection and disposal, as well as other uses related to water resources).

The principal source of raw water for the regional water supply system is the Potomac River, which serves some 4.3 million customers, the majority of the residents in the NCR. However, the system also depends on ground water sources, including the Piedmont Sole Source Aquifer, as a primary source of supply for many people. Little Seneca Reservoir and Jennings Randolph Reservoir are the two principal emergency backup sources of water supply for the region, both by way of low flow augmentation of the Potomac. (As noted earlier, Little Seneca Reservoir serves as the proximate emergency backup, since it could release water that would reach the Potomac intakes in one day, while Jennings Randolph Reservoir could provide a much larger volume of water over a period of 7 to 9 days.) The function of both reservoirs is to provide low flow augmentation of the Potomac River in drought or other emergency situations. Neither reservoir is currently viewed as a direct source of emergency supply – that is, pumping water directly into the WSSC system – although that is a possibility for Little Seneca Reservoir.

By some definitions, the Little Seneca Reservoir is so integral to the regional water supply in meeting drinking water demands during expected "normal" low-flow fluctuations that it is more than an "emergency backup" supply. If that is the case, then it would be useful to discuss what supplies are available to the region in the event of "unforeseen emergencies." The key point here is that such terms need to be carefully defined and widely understood.

Baseline. A baseline should be established for assessing future impacts on Little Seneca Reservoir as an emergency water supply for the Washington region. Such a baseline should include trends and policies already in force (or likely to be so) that permit us to project the capacity of the reservoir to perform its emergency function at some point in the future. In other words, the baseline should not be just a static snapshot of the current condition of the reservoir today, but a dynamic reading of where it probably will be in the future given the knowledge we have today of the forces acting on it. This is, in essence, a dynamic "business as usual" projection, a starting point from which to assess further impacts. (Or, to cite the Wayne Gretsky rule: don't skate to where the puck is, but to where the puck is going to be.)

The baseline would pose basic framework questions: What is the state of our water supply today, and what will it be at some point in the future if we pursue "business as usual"? What would we need to do at that point in the future to assure we have an adequate emergency water supply? What can we do *now* to avoid a failure to have an adequate water supply in the future, as well as avoiding the escalating costs of compensating for that failure once it has occurred?

If "business as usual" currently puts our water supply on a satisfactory trajectory, which includes accounting for the impacts of policies already in place, and anticipating and adjusting to future changes, and there are no unexpected events, we shouldn't have to do anything further to assure we have an adequate emergency water supply. However, if the state of our water supply today is already deficient, or if our "business as usual" practices will not otherwise correct those deficiencies, or, worse, lead to further degradation, then we will not have an adequate emergency water supply when we need it.

In short, what do we need to do *now* to assure that we will have an adequate emergency water supply in the future, including actions we need to take, or refrain from taking, or otherwise are required to correct deficiencies caused by past actions that already jeopardize our water supply?

Future supply and demand. With a clear baseline "business as usual" established, we can then project future expected and possible regional water supply demands, and the implications for Little Seneca Reservoir, in the context of supply capacities and demands on the entire Washington regional water supply system.

Other forces to consider. The baseline projection should already incorporate forces that we know about and can reasonably predict will definitely impact the reservoir. Demand and supply factors can also be predicted with a relatively high degree of probability. But there are also other forces that may be known but are difficult to predict with high probability, as well as speculative forces that might have an impact, not to mention the inevitable "unknown unknowns" that we can only continue to speculate about and otherwise remain vigilant. Some of these forces include:

- changes in policies, both within the region and beyond it;
- changing demand and supply behaviors and patterns;
- changing climate and weather patterns;
- other environmental stressors and impacts;
- corrections of previous assumptions based on new knowledge, both empirical knowledge about the changing condition of the reservoir, and theoretical knowledge based on improvements in the disciplines associated with domestic water supply planning and operation.

Policies and protection measures. With a clear baseline in place, and sound predictions – or at least vigilance -- regarding forces that could alter it, we will be in a better position to consider specific policies and protection measures that will need to be put into place for Little Seneca Reservoir, especially after we have addressed the key technical questions for this study as enumerated below.

Time Frame. There is an apparent discrepancy in the planning horizon time lines used by our land use planners and water resource planners. Generally, the county's master plans look ahead about 20 years, at which point it is assumed that a given master plan will be updated and otherwise revised. However, the planning horizon for water resource planning is generally much longer than that.

The Corps of Engineers NEWS study, which was driven by the 1960s drought and which led to the establishment of Little Seneca Reservoir as a critical emergency water backup for the Washington region, was based on a 100 year time frame. Fortunately, we have not had a recurrence of a drought of the 1960s severity (although we have come too close for comfort a couple of times). But even a 50 year planning horizon today would ignore such an occurrence, not a wise policy, especially in light of the living memory hardships and safety hazards posed by that drought.

Moreover, we now have the added uncertainly of climate change, and the increasing unpredictability of climate patterns and extreme weather events. Following Superstorm Sandy in 2012, New York Governor Andrew Cuomo quipped that his region had recently had two 100 year storms, so that they wouldn't have to worry about another one for 200 years. Climate and weather patterns have always been uncertain, but today we are living in a period of increasing uncertainty. That is all the more reason to be clear, and realistic, about our time horizons, and adjust our planning assumptions accordingly.

Some years ago, after a series of devastating floods attributed to rising sea levels and more violent storms, the Dutch government adopted a 10,000-year planning horizon in order to build needed strength and resilience into the reconstruction and maintenance of their system of dikes and major water barriers in certain parts of their country. That may seem like a stretch, but it was only a few years ago that residents of Tennessee were hit by massive flooding, characterized as a "thousand year storm event" for which none of them had prepared with either physical barriers or insurance simply because such a thing had "never happened before." The point is that when dealing with such literally vital issues as floods and water supply, it is now prudent to consider – and hopefully be prepared for, but certainly not to be surprised by – a wide range of possible contingencies that do not necessarily conform neatly to past experience.

KEY QUESTIONS

Given this context, the study can then focus with greater precision on the more immediate questions of concern here related to the impact of proposed Clarksburg development on Little Seneca Reservoir, including the following:

Will Little Seneca Reservoir be able to serve its emergency water supply function for Montgomery County and the Greater Washington region in the future? It is worth repeating, so that it does not get lost in the detail of other increasingly technical questions, the overarching purpose of the study: will we have the water supply we need when we need it?

What will be the impact of proposed policy changes in the Clarksburg Limited Master Plan for the Ten Mile Creek watershed on the Little Seneca Reservoir as a key component of water supply for Montgomery County and the Washington Region? What are the long term impacts on the Little Seneca Reservoir as Clarksburg and the rest of the Little Seneca Reservoir watershed are built out? This is the key technical question that the study needs to address. It should be stressed that this question needs to be placed in the context of the analytical framework.

As research has demonstrated, there is already evidence of degradation of Little Seneca Reservoir on its east side as a consequence of development that has already occurred in the Little Seneca Creek watershed (as reflected in sediment plumes and levels of dissolved oxygen, for instance). So the operative question is not just whether there will be future impacts from further development, but whether further development will exacerbate the degradation that has already occurred from the development now in place.

The Planning Board's 10 Mile Creek Environmental Analysis provided an assessment of the potential impact on Ten Mile Creek of prospective developments in the Clarksburg area, and this is a good starting point in addressing this question. By and large, it is not an optimistic assessment. We need to be clear what that analysis says about the impact of Clarksburg development on Little Seneca Reservoir so we can be equally clear about what it *doesn't* say, and therefore what we still need to find out.

How do potential changes in the Little Seneca Reservoir water quantity and quality affect its potential use as a Potomac low-flow augmentation source? The reservoir's principal function as an emergency backup is to augment the flow of the Potomac when necessary, so the study will want to directly address that factor. The quality of water available for that purpose is obviously important. But too often the quantity of water in a reservoir is miscalculated as sedimentation raises the bottom of the lake and reduces the total quantity of water it can hold, a non-trivial phenomenon known to reduce the holding capacity of reservoirs by as much as one-third or more.

What are the possibilities for using Little Seneca Reservoir as a direct backup when the Potomac Filtration Plant goes down? While the reservoir's current emergency value is that it can quickly augment Potomac flows during droughts, it is not connected directly into the WSSC system and therefore would not serve as a safety backup in the event of (another) failure of the Potomac Filtration Plant (PFP), a critical emergency function that has gotten less attention than it deserves. With appropriate new connections, a pump station and minimal treatment**,** Little Seneca Reservoir might provide a direct backup to Montgomery County and Prince George's water users in the event of PFP failure. But if the turbidity of the reservoir is permitted to deteriorate further, such an emergency backup would not work without a major new and costly filtration system.

What other uses of, or demands on, Little Seneca Reservoir are possible in the future? This question is posed initially in the analytical framework, but there it is focused principally on future water supply demands. The study also needs to consider other, non-water supply demands placed on Little Seneca Reservoir as well, such as for recreation or other water resource uses, as well as uses, demands or pressures not necessarily related to water resources that could nonetheless affect the reservoir's water supply function.

MODELING

The watershed should be modeled to determine the level of mitigation that would be required to achieve and maintain safe standards of water quantity and quality. There is a need for a combined watershed and receiving water model that utilizes existing data both on water flows as well as pollutant loadings. This will permit the analysis to connect different development options, including the impacts on the Ten Mile Creek watershed, and on the reservoir itself.

Storm water treatment models are important, the more so given the potential for more frequent and heavier flooding with or without more intense development. Models should also take account of different forms of land tenure after development, since such factors as who is responsible for maintenance can affect such critical practices as fertilizer and pesticide applications, maintenance of conservation parks and easements, landscaping and storm water management. A key question is whether the initial and ongoing cost of maintaining the mitigation practices in perpetuity would be sustainable for developers, subsequent owners, and ultimately the county, which would bear responsibility if others default on theirs.

Modeling needs to account for all of the potential impacts on Little Seneca Reservoir that may result from existing and potential future development (especially prospective developments included in official land use planning and zoning) in its watershed. Special emphasis should be given to watershed peak flow modeling under different development and weather scenarios coupled with downstream impacts on the reservoir, including the central role and impacts of peak flows both in the 10 Mile Creek Watershed and the reservoir. To be sure, annual average flows need to be modeled, but averages can obscure the extraordinary damage caused by peak flows. It is the more infrequent high peak flows associated with severe or multiple consecutive storm events which can simply overwhelm Environmental Site Design (ESD) practices, regardless of maintenance, which are typically designed for the smaller and more frequent storm scenarios. Stream flow from such events can jump in volume and acceleration over a very short period of time, carry substantial Total Suspended Solids (TSS) loadings, and result in severe scouring, streambed erosion and habitat destruction. Once this process has begun, restoration becomes very difficult and stream bed and bank erosion will increase rapidly and dramatically.

Even if they are done correctly, models have limited accuracy and reliability in simulating the long run impacts. Not only are they limited in dealing with the wide ranges of rainfall and flow that occur, but they do not account well for the inevitable degradation of effectiveness with time of the devices (even if maintained), nor with the higher risk of unforeseen events (e.g., spills, illegal discharges, etc) that inevitably go along with dense development. The study would need to look at a wide range of modeling results, not just the predictions of standard development models.

To proceed with proposed development without addressing the impact questions would constitute a kind of real life, real time model, or natural experiment that says, in essence: "Let's do it and see what happens." Needless to say, if that experiment fails, Montgomery County and the Washington region will have lost their proximate emergency water supply.

Further issues regarding modeling are included in the “Note on Modeling Support for Watershed Management and Reservoir Impacts” in the Appendix to this memo.

OTHER ISSUES

The study should also address several other methodological issues, including the following:

Scenarios. Models both incorporate various scenarios and can be used to test a wide range of scenarios, which should include, among others:

- projection of water outages for Montgomery County and the Washington region. For instance, could Montgomery County withstand an outage of two weeks, or even of three days?
- Little Seneca Reservoir as a direct backup to the WSSC system, both filtered, and unfiltered;
- Projected population increases in the Little Seneca Reservoir watershed, and the potential resulting sediment, chemical and pathogenic inputs into the Reservoir through legal and illicit discharges;
- specific policies and protection measures that are needed to be put into place to protect the quality of drinking water, given the answers to the basic study questions;
- the impact of other public policies, such as SDWA source water protection/assessment, and Clean Water Act anti-degradation.

Environmental Site Design (ESD). The study should examine the reliability of predictions that Environmental Site Design will improve the streams. There is already evidence that Germantown development on the east end of Little Seneca Reservoir in the Little Seneca Creek watershed is clearly degrading the reservoir, even though the development in Germantown has presumably used ESD practices (or, if they have not, why haven’t they?). The effectiveness of ESD could be demonstrated by going back into a couple of sub-basins of Little Seneca Creek and retrofitting, and measuring the results over five years.

ESD is new and as the appendices to the draft plan indicate, no sub-watershed empirical studies of their effectiveness have been done. The studies already done by the Montgomery County Department of Environmental Protection showed that the BMP measures taken in Little Seneca and elsewhere in Clarksburg had underperformed. The plan consultants and the planning staff concluded from the evidence that does exist that any development will degrade water quality in Ten Mile Creek. That cannot be good for the lake.

Monitoring. So far as can be determined, there is no monitoring plan for Little Seneca Reservoir. At a minimum, the data taking should be done every year.

Concerns have been raised that tight fiscal times and budget cuts have reduced the monitoring to below what is necessary to keep track of the fitness of Little Seneca Reservoir as an emergency water supply. Adequate monitoring is absolutely essential in order to provide real-time information on the condition of the reservoir, and to assess the impact of development and other stresses on it. Advances in monitoring techniques and technology – including the use of sensors connected to wireless communications systems – now make monitoring more effective, reliable and in some instances cheaper (for example, real-time sensors can collect and transmit data without requiring more costly labor to visit monitoring sites. Wireless systems can also immediately alert monitors when sensors have failed and need to be repaired or replaced, something human checkers would not discover until their next visit, and therefore entailing a critical loss of valuable data on the condition of the reservoir).

CASE STUDIES

The study should benchmark the Washington region's water supply, and in particular Montgomery County's policies and practices, with other major urban water supply systems. Following are some examples that suggest how a preliminary benchmarking might tell us a great deal about how our water supply policies and practices stack up with those of other major systems, and do could so at very little cost.

New York City. New York City, which has one of the highest quality water supplies in the world, views its water resources not just as vital to the health and safety of its residents, but also as integral to its economic prosperity. The city's long-range master plan, PlaNYC 2030, notes proudly that "Our water supply system was developed through the foresight and vision of previous leaders who understood the importance of clean water to the long-term prosperity of the city. "

Since 2002, New York City has spent more than $1.5 billion to purchase forests and other lands surrounding its reservoirs in the Catskills so that clean drinking water will be available for future generations. Like the Ten Mile Creek watershed, these reservoirs are in steeply-sloped pristine natural areas. New York now owns more than 115,000 acres in these watersheds and plans to acquire up to 50,000 more acres each year. Planners reasoned that "ownership of land ensures that crucial natural areas remain undeveloped, while eliminating the threat from more damaging uses" to the watersheds. Also, the City has found that land acquisition is more cost-effective than constructing and operating new filtration plants and less destructive than the chemicals used in filtration. This course is prudent, too. The City anticipates its population doubling by 2030, along with substantial economic growth, and will need to provide enough water for all of those residents and businesses.

New Jersey Highlands. The State of New Jersey, too, has been purchasing and preserving lands to ensure adequate clean drinking water for its population. In 2004, it set aside 415,000 acres in the Highlands, an area in the northwestern part of the state, as a Preservation Area to protect important natural resources and watersheds feeding several drinking water reservoirs. Watersheds were being fragmented and lost to rapid development, while surface and ground waters were being depleted. A regional master plan now protects large areas of contiguous forest; steep slopes, including those with shallow and erodible soils; critical habitat areas; riparian buffers; and groundwater recharge areas. Development is limited to pre-existing uses; deforestation is prohibited; and impaired forests are to be restored. A 300-foot riparian buffer has been prescribed for all water sources, and may be expanded if needed to protect critical habitat and steep slopes.

Baltimore County. Baltimore County has used zoning to protect its drinking water supply, establishing an Urban-Rural Demarcation Line (URDL) to protect its 3 reservoirs. Most of the reservoirs and their watersheds are outside the URDL in an area similar to Montgomery County's Agricultural Reserve, except that the minimum lot size is 50 acres, not 25 as in Montgomery County. The reservoirs are further protected by large tracts of forested land, county and state parks, and conservation easements. This approach is similar to the one envisioned by the Montgomery County Planning Board in 1993, when it put both the east and west sides of the Ten Mile Creek watershed in the Agricultural Reserve, a policy that would serve our region well today.

It should be noted that the key reservoirs in Baltimore County, and the immediate perimeter of land around them, are actually owned by Baltimore City, which also operates the region's principal water supply. Baltimore County provides *additional layers of land use protection* to Baltimore City's reservoirs throughout their respective watersheds, because they are vital water supplies that serve the region, including Baltimore County users.

Other case studies. It would also be useful to look at other major urban water supply systems such as San Francisco, and Portland, OR, which provide largely untreated drinking water from well-protected reservoirs, as well as some cases within our region, including Fairfax/Prince William County (Occoquan) and Watts Branch (for lessons both good and bad).

If Montgomery County, which prides itself on being in the lead of best practice planning and policy, were to simply benchmark itself to the best practices elsewhere and applied them to the Ten Mile Creek watershed, that might go a long way toward protecting the

Little Seneca reservoir for the 4.3 million people who depend on it. Areas of high resource value, as identified by the consultants in the Appendix to the Planning Board's draft plan -- steep slopes; erodible soils; hydric soils; forests and interior forests; 100-year floodplains; perennial and intermittent streams; ephemeral channels; wetlands; springs, seeps, and seasonal ponds – would not have to succumb to housing, industrial and commercial developments , but could all be preserved. Streams could be better protected by wider riparian buffers. Forests could be replanted or allowed to regenerate to stabilize the watershed.

ORGANIZATION OF THE STUDY

A study of this scope and importance should be commissioned by the Montgomery County Government, meaning some combination of our top policy-makers, the County Executive and/or County Council. The study should be performed by an entity that meets strict criteria of high quality professional capacity, integrity, objectivity and public trust and credibility.

Montgomery County may want to initiate a regional collaboration engaging key jurisdictional neighbors, including those involved in the 1982 regional water agreement. One option here would be for the Washington Metropolitan Council of Governments (COG) to either direct the study or to provide a context for a regional coalition that might direct it. A similar role could be played by the Interstate Commission for the Potomac River Basin (ICPRB). The U.S. Geological Survey has undertaken similar kinds of scientific studies. Other government agencies, as well as non-governmental organizations, including universities and research and consulting organizations, have also performed studies of this kind. For any of these options, an independent oversight committee should be formed comprised of key agencies with an public official interest and/or responsibility regarding this issue, as well as citizen representatives.

The time and cost of the study would obviously depend on its scale, and the number and complexity of the questions to be addressed. It is difficult to conceive of a study of this kind, properly done, taking any less than 4-6 months, and more likely a year, and perhaps two. The cost could range from $200,000 to $1 million, depending both on the scope of work and the cost structure of the entity performing the study.

The study might be financed in any number of ways. The simplest would be for the county to fund a study that it commissioned and directed itself. But if it chose to join in a regional coalition, that would presumably spread the cost. It is conceivable that other entities would be willing to share part of the cost, including agencies performing the study. For instance, if the USGS were to do the study, perhaps the federal government might pick up part, if not all, of the cost. A university might be willing to share in some of the cost by offering an attractive cost structure. And there may be private donors who would be willing to contribute to such a study, either because they recognize its direct importance to them and the region, or because, as in the case of some foundations, they see an opportunity to support a study that could have more wide-spread policy implications and public benefits.

Further discussion of the cost and timing of the watershed modeling (and major) portion of the study is included in the "Note on Modeling Support for Watershed Management and Reservoir Impacts" in the Appendix to this memo.

IMPLICATIONS

The immediate scope of the proposed study – once set in proper context -- is comparatively narrow, focusing as it does on the impact of development on Little Seneca Reservoir. But it is important to keep in mind what is more broadly at stake here, including the following points:

- ***Little Seneca Reservoir is the principal emergency water supply for Montgomery County.*** If it is slowly degraded over time, it will not be there when we need it.

- ***Little Seneca Reservoir is the main proximate emergency water supply for the entire Washington metropolitan area.*** Montgomery County has a major responsibility to protect Little Seneca Reservoir not just for its own citizens, but for the citizens of the entire National Capital Region. (A good example of such regional stewardship is found in Baltimore County, which goes to extraordinary lengths to protect the Baltimore City reservoirs within the county which serve a regional water supply system.)

- ***Montgomery County already has a huge investment in Little Seneca Reservoir.*** While the two-reservoir/inter-jurisdictional water supply coordination solution of 1982 was far less costly than the 16-reservoir solution proposed by the Corps of Engineers, the investment made in the Little Seneca Reservoir should not be underestimated or forgotten. In addition to the financial cost, this includes the loss of theTen Mile Creek stream valley and habitat, as well as the time and cost required to undertake numerous regional studies and agreements over the years, dating back to the BiCounty Water Supply Task Force in 1977 and right up to the present.

- ***Little Seneca Reservoir should be seen in the even broader context of the Potomac River and Chesapeake Bay watersheds***. Recall that this reservoir was pivotal to a water supply plan that began by considering the entire northeastern United States, and was vital in considering the overall health and future of the Potomac River basin, and of the Chesapeake watershed of which the Potomac forms a critical part. The only way in which those broader ecosystems will be repaired and protected is if each jurisdiction within them takes seriously their particular stewardship responsibilities. And Montgomery County's responsibility for the health of Little Seneca Reservoir could not be more critical in that regard. Moreover, should the 1982 regional water supply agreement fail for want of Montgomery County's taking seriously its stewardship responsibilities, it is not implausible to suppose that other regional participants, including the nation's capital and the U. S. Army Corps of Engineers, might resurrect the Corps's NEWS study and argue that the National Capital Region requires a larger and more secure number of backup reservoirs in the Potomac River Basin.

- ***Montgomery County's regional stewardship for Little Seneca Reservoir involves not just the well-being of the resource itself, but also of the trust and credibility that is vital to regional cooperation***. The Maryland-National Capital Park and Planning Commission (MNCPPC) acquired Little Seneca Reservoir, including the land underneath the water and immediately surrounding the reservoir, which is operated by the Washington Suburban Sanitary Commission (WSSC). This proprietary and operating responsibility is held by the two Commissions in trust for the benefit of the public. Montgomery County, through MNCPPC and WSSC, has a stewardship obligation for this Reservoir with a geographic and a time dimension. Each generation has a duty to pass on to those that follow the common resources of the public in a condition at least as good as it received them. It is not just the vital tangible resource of a particular reservoir that is at stake here, but also intangible resources of trust, credibility and a tradition of regional cooperation required to undertake other joint regional projects, including the many serious challenges we see on the horizon that can only be addressed on a regional basis. If our regional neighbors can't trust us with their water supply, what can they trust us with?

- ***The capacity of our county and the Washington region to continue to exercise local and regional autonomy with regard to our water supply depends on our ability to live up to the responsibilities we have already taken on as a county and as a region for such critical assets as Little Seneca Reservoir.*** Recall that following the severe droughts of the 1960s, the federal government was prepared to step in and essentially take over the responsibility for assuring an adequate water supply for the entire National Capital Region, proposing a plan that would have had huge financial and environmental costs for our region and the broader Potomac and Chesapeake watersheds. Our county, in conjunction with our regional neighbors, said to the federal government on this occasion: thanks for your concern, but we can handle this pretty much on our own. Now we need to demonstrate that we were serious, and that we can.

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NOTE ON MODELING SUPPORT FOR WATERSHED MANAGEMENT AND RESERVOIR IMPACTS

Overview of Models

- Watershed models are tools that simulate the movement of rainfall and pollutants over land and in stream channels within a watershed:

o Numerous watershed models are available, ranging from simple spreadsheet tools (that rely on general assumptions about land use, rainfall, soils, and other characteristics within a watershed) to sophisticated computer applications (that use a combination of historical data about the land use, precipitation, and pollutant characteristics of the watershed);
o Watershed models can be used to evaluate water quality and quantity changes resulting from changes to a watershed, such as development;
o Watershed modeling tools are available to evaluate the impacts of climate change and urbanization on runoff water quantity and quality.

- Receiving water models are tools that simulate the hydrology (water movement) and water quality in rivers, lakes, reservoirs, and coastal waters:

  o Numerous models are available that simulate the fate and transport of sediment and pollutants in 1, 2, and 3 dimensions within a water body; studying more dimensions provides more detail about effects and requires more sophisticated models;
  o Receiving water models can be coupled with watershed models to show how changes in a watershed (such as urbanization and development) result in changes in a water body.

- Integrated modeling platforms are tools that use geographic information systems (also known as GIS) to link watershed, receiving water, and planning/management applications together for comprehensive evaluations of changes in a watershed, receiving water impacts, and scenario evaluations to determine effectiveness of various management practices and infrastructure additions to reduce impacts

Examples of modeling applications as management tools

- Using watershed and receiving water models to determine the assimilative capacity in rivers, lakes, and reservoirs for land use planning on a regional scale;
- Developing custom watershed models for evaluating management scenarios for developing areas of a sensitive watershed;
- Applying watershed and receiving water models to develop a comprehensive watershed management and protection plan for water supply reservoirs;
- Developing watershed management and decision support for storm water management to optimize water quality and infrastructure costs for developing watersheds;
- Demonstrating integrated site-scale water management (note: Environmental Site Design, or ESD, is a site-scale practice) that includes low impact development, green infrastructure, water reuse, and on-site wastewater management.

Limitations and Assumptions

- The use of higher-end, sophisticated models requires local data for input to build and calibrate the models; this will presume that some historic climate, water quality and quantity, land use, and infrastructure data are available;
- Performing receiving water analyses requires some knowledge about the physical characteristics of the water body (i.e., area and depth profiles of the reservoir).

Applying Models to Ten Mile Creek and Little Seneca Reservoir

- Determine what data are available - prior to making final recommendations about modeling, available data will be cataloged and assessed; this includes data such as water quality and quantity data, climate and weather data, existing land use, physical features of the land and reservoir;
- Develop a model of the Ten Mile Creek watershed with sufficient detail to allow for analyses at site-scale levels; use the model that is matched to the available data;
- Model Little Seneca Reservoir; apply a 3-dimensional physical and water quality model if sufficient data are available;
- Couple the watershed and reservoir models to allow the watershed model to serve as input for changing conditions in the watershed and determine potential impacts (such as water quality, water quantity, and sedimentation) to the reservoir;
- Perform scenario evaluations of development changes (resulting in changes to impervious surfaces) combined with application of different control and treatment strategies to determine resulting effects to the reservoir; vary storm intensities and frequencies to determine a range of possible impacts;
- Use available modeling tools to develop options for optimal mixes of controls and management practices to minimize export of sediment and pollutants and maximize water quality to and in the reservoir;
- Look at a variety of loading scenarios resulting in options for land use and determine the impacts to the reservoir; combine these with management/control strategies to determine impacts to reservoir volume and quality.

Cost estimates. Several factors will drive the cost, including:

- Availability of data and the suitability of the data for modeling; the data availability and quality will govern the model(s) used and the complexity of modeling that is possible;
- Amount of time required to prepare and check the quality of the data; formatting the data for use in the models;
- Models used and amount of time required to calibrate
- Number and complexity of scenarios evaluated;
- Estimate ranges from $150,000-200,000 (likely) to over $300,000 if the data are in poor shape and there are many changes required.

Timing. The elapsed time required for the kind of high quality professional modeling envisioned would depend upon:

- getting the agreement, funding, and request to design, set up and execute it.
- actual modeling work itself, between approximately 4 - 6 months
- reviewing the results and considering whether there are any additional implications or sub-options the model should inform.

Further considerations:

- At some point, there should be a policy discussion to determine the level of acceptability for, and limits on, potential changes to the reservoir resulting from sedimentation, water quantity, and pollutant loading;

- Based on the level(s) of acceptability selected, evaluate the model scenarios with respect to these desired reservoir conditions;

- After evaluating the available data, more complete recommendations can be made about different tools that can be used and the levels of certainty that will be expected with the results.