

THE COMMUNITY DYNAMICS OF SOURCE WATER PROTECTION:
The Structure and Dynamics of the Human Dimensions of Source Water Protection
in the Memphis Metropolitan Area

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Having been involved in resource management issues for many years, one desire among resource managers that I have encountered over and over again is that they could turn back the clock and do things over again. All too often, as the saying goes, hindsight is 20/20, and in hindsight it is all too obvious what could have been, should have been done differently to avoid a current crisis. Resource managers, impacted citizens, and politicians facing crisis decisions are all too painfully aware of how much easier it would have been to avoid a current crisis than to solve it. If only we could turn back the clock. I would even go so far as to speculate that if many of the people that others presenting in this session have spoken to in the course of their research were given the chance to turn back the clock and do it over again differently, they would jump at it.

In Memphis today, the clock is just now beginning to tick. We have what Dr. Jerry Anderson, head of the University of Memphis's Groundwater Institute and my community host calls, a Natural treasure, not just a natural resource, but a natural treasure. Memphis has a large supply of what is arguably the highest quality drinking water of any major metropolitan area in the nation, if not the world.

Unfortunately, however, the clock has started ticking on this natural treasure. The water supply of the Memphis metropolitan area is rapidly coming under increasing threats; threats whose major impacts may not, repeat **may not**, be felt for 50 to 100 years. But if something is not done soon, and very soon in some cases, a natural treasure, much of which has sat in the ground for 2000 years, will be severely but needlessly diminished in both quantity and quality. And at that time, just as I suspect some of the people in your studies do now, Memphians will be wishing they could turn back the clock and do it differently.

The challenge, then, is to find ways to overcome people's tendency to focus on short-term concerns and to focus on long-term issues. And although many of the people that must take action on these longer term issues may never see the results of their efforts, their children and grandchildren certainly will.

I would like to briefly describe the source water situation in Memphis. Without a basic understanding of the nature of sourcewater in the Memphis metropolitan area, it will be difficult to understand some of the difficulties that arise in getting people to focus on long term issues.

I would then like to characterize the social structure and social dynamics of sourcewater issues in the Memphis metropolitan area. There are a variety of actors involved in source water

protection issues. What I found most surprising at the outset of my research was the high level of consensus that there seemed to be concerning the issues. It was only as we delved more deeply that the fissures could be seen.

And finally, I would like to discuss what are our preliminary recommendations as to what needs to be done in the future to prevent the scenario of future Memphians looking back and saying Aif only we could do it again differently. @

Memphis relies almost entirely on groundwater for most of its needs. Memphis is the largest city in the world to rely solely on artesian wells for its water supply (MLGW 1998) The region is underlain by four water-bearing layers of sand and gravel situated from 50 to 2,600 feet below Memphis ground surface (MLGW 1998). These water-bearing layers of sand and gravel, which are part of the larger Mississippi Embayment, are separated and held under pressure by alternating layers of almost impermeable clay (MLGW 1998; Outlaw 1995). Water is drawn by 10 water pumping stations operating more than 170 wells (MLGW 1998).

Water is drawn mainly from the Memphis Sand aquifer. This aquifer is between 500 to 890 feet thick. It is confined on the top by the Jackson-upper Claiborne formation. This confining layer consists mainly of clay, silt and lignite. It is nearly impermeable and serves as a seal, protecting the underlying aquifer from surface contamination. The thickness of this unit ranges from zero to 360 feet inside Shelby County. Beneath the city of Memphis, itself, the unit is generally thick enough to protect the aquifer from urban runoff. There are, however, several areas, or Awindows@ within the city where the unit is quite thin or non-existent. The unit also thins in an eastward direction. It is generally non-existent in the southeastern part of Shelby County and across the border in Mississippi in the areas of the fast-growing town of Collierville and the communities of DeSoto County. These areas are collectively referred to as the Arecharge area;@ the area from which surface water enters the aquifer and replaces the water removed.

Lateral movement of water through the aquifer is thought to be quite slow although experiments are being designed to test this assumption (Anderson personal communication). The rate of lateral movement can be affected locally by changes in the piezometric pressure. Piezometric pressure can be affected on a local basis by the draw down of water in the immediate vicinity of a well. As water is withdrawn a cone of depression forms. This increases the rate of inflow from surrounding areas. Criner et al. (1964) estimated that the flow of water from the eastern recharge area doubled between 1886 and 1960 in response to withdrawals under Memphis. The good new is that as long as nothing threatens the integrity of the recharge area, large withdrawals of water from the Memphis Sand should be sustainable over a long period of time (Criner et al. 1964; Outlaw 1995). The bad new is, that as the inflow from the recharge area increases, the threat of contamination in this geologically unprotected area also increases.

Threats to the recharge area were the most commonly mentioned problems facing Memphis source water. Some of the most rapid growth and development in the region is occurring in the recharge area. Both residential and industrial development pose threats to the long term quality and supply of Memphis groundwater. As large areas are covered by pavement and structures, the flow of water into the ground will be reduced. Currently, most runoff water from developed areas is channeled into local streams and rivers, which themselves have been channelized to speed flow to the Mississippi River to the west. As water demand increases in

the future, reduced inflow from the recharge area will increase costs of pumping from existing wells, and also could lead to diminished quality (Outlaw 1995).

The problems facing the region have been summarized by Dr. John Smith, the former and first director of the University of Memphis Groundwater Institute and one of the leading hydrogeologists in the region. *The major problem is going to be one of long-term availability of water due to urban encroachment on the recharge area. When I came to Memphis in 1970 we viewed the recharge area, that area where rain water hits the ground, soaks down and eventually becomes our drinking water, as being Fayette and Hardemann Counties, two counties to the east of us, and that the water was 2000 to 3000 years old. Which is phenomenal. To stop and think about it, the water that people were drinking down in the North Parkway area, the older part of Memphis, entered the ground at the time of the birth of Christ. And that concept stayed valid until the mid-80s when we started seeing [the] Collierville problems and others. We then started looking at the water as maybe more of the water comes in locally than we thought it did. The latest data indicates that up to as much as 50% of the water we drink actually enters the water within Shelby County through windows and the recharge area.*

Now that has two problems with it. One, that means our potential for contamination of that water is much greater because we have a higher intensity industrial base here. Second is, that the water doesn't stay in the ground as long so the natural purification cannot take place. But then thirdly, as we urbanize Shelby County, and as we change grassland and farmland to concrete, asphalt and rooftops, the water that would naturally percolate into the soil and be available for drinking now runs off into the Mississippi and New Orleans picks it up. That I believe is the largest, the major problem we've got. @

In addition to supply, the other major issue arising from development in the recharge area is increased threat of contamination. Because the confining layer is thin to non-existent in this area, surface contamination can run directly into the groundwater. If contamination became severe enough, large areas of the aquifer would have to be abandoned. The overall area affected would depend upon the severity of the contamination and the rate of lateral flow of water. The former is unpredictable and the latter is only poorly understood at this time. And unlike surface water, if contamination occurs, it won't just be a matter of waiting for the system to flush itself out or for the contamination to run on downstream. Once a groundwater source is contaminated, it is contaminated for a very long time. While remedial efforts are not out of the question, they will be very expensive.

Windows in the confining layer present a similar problem. They are particularly problematic because they occur in the most densely developed portion of the region. At least one of these windows is located near a now closed landfill in east Shelby County. Water quality changes have already been noted in two wells located nearby (Outlaw 1995). Another window is thought to lie beneath the Wolf River, itself heavily polluted and the recipient of much urban and agricultural runoff. Because of their proximity to areas with the greatest rates of withdrawals, large cones of depression, and large dependent populations, contamination at windows probably comprise the most immediate short-term threat to local water quality.

Other potential threats come from private wells and septic tanks. While most private wells rely on the surface aquifer for water, to the extent that the surface aquifer flows into the Memphis Sand aquifer, these wells are a potential source of contamination. This is especially

true in DeSoto County, Mississippi where there a large number of private wells and the Memphis Sand aquifer is quite shallow. One informant also mentioned monitoring wells as potential sources of contamination. There are several industrial plants in Memphis, including pesticide and chemical manufacturers, that maintain monitoring wells to watch for possible contamination. This informant made the point that, should a spill occur, these wells could themselves become conduits into the aquifer.

SOCIAL OR COMMUNITY STRUCTURE OF SOURCE WATER PROTECTION

Very generally speaking, there are three, not mutually exclusive, groups, or maybe more accurately, points of view, involved in source water protection efforts in the Memphis area: politicians, scientists/engineers and environmentalists. I use the term politicians not necessarily to refer to people in elected office but also bureaucrats. People for whom source water protection is only one issue that must be balanced against other competing issues. Scientists/engineers are those who approach source water protection from a more technical standpoint. Their focus is on understanding the physical dynamics of source water protection and what these dynamics mean in terms of managing and/or protecting the resource. Finally, there are the environmentalists. Their focus is almost exclusively on protecting the resource, regardless of what the costs of this protection may be.

I emphasize that these are not mutually exclusive groups. For example, several of the scientists and engineers interviewed hold positions where they themselves are decision makers or directly influence the political decision making process. Consequently, they must strike a balance between their technical knowledge of the aquifer and the costs and benefits of various actions. On the other hand, several of the scientists and engineers hold views typically associated with environmentalists. Their technical understanding of the aquifer has led them to emphasize the value and vulnerability of the resource. And finally, some environmentalists interviewed support groundwater protection, to some extent, to achieve other goals, an approach I would more generally associate with politicians.

The Politicos

Of the three groups described above, the politicians are those whose attitudes are most driven by short term concerns and in particular, economic development. Economic development most directly impacts the source water through development in the recharge zones east and south of the city of Memphis. As stated earlier, these include some of the fastest growing areas in the country. The tension exists between economic incentives to develop open land versus environmental and public health, safety and welfare in terms of protecting the water.

As one city councilman interviewed stated Economic returns are more immediate and therefore more conceivable to people involved in [the political] process. Aquifer recharge is more ethereal or philosophical because we are dealing with something we can't see. The water is 2000 years old. For people who don't spend a lot of time thinking about the air that we breathe or the water we drink, it is difficult to imagine that there are limits to that resource in quantity or quality. Politically, it makes it difficult to protect...[And] rooftops generate more taxes than open space. Property that may earn tax revenues of \$600 as farmland can earn \$40,000 as development.@

A similar sentiment was expressed by an interviewee from DeSoto County, Mississippi. *AJobs are it. Environmental concerns and all those other things take a back seat to >l=m going to bring you 2000 jobs....[And it=s] not really in the county=s best interest to protect the floodplain unless the Feds can come up with assistance to offset loss of tax revenues. Then we are willing to help protect the environment.@*

The politicians are also very sensitive to the interjurisdictional issues as well. A Mississippian characterized the attitude of many in his county as *AY=all have messed up in your backyard and you don=t want us to mess up in our backyard like you have messed up in your backyard. We are willing to protect the recharge area as much as you are willing to give us financial incentives to do that, but unless there is some reason for our developers to set it aside they deserve the same chance at development; the same right to muck it up that y=all had.@*

Political issues also extend to the state and regional level as well. According to Dr. John Smith *Athe groundwater problems of the state are not the groundwater problems of Shelby County. And that=s been one of our problems throughout history. Shelby County has always been politically viewed as part of north Mississippi as far a Nashville was concerned. And even yet today, the people at Tennessee Department of Environment and Conservation, TDEC, in the groundwater area, pay very, very little attention to Memphis and Shelby County. We are unique in this part of the world, or in the world really, and definitely unique in Tennessee, so the problems that the state are seeing are not the problems that Shelby County sees, and vice versa.@*

Interstate issues are also present. As told to us by a Mississippi interviewee in DeSoto County *Aan official from the DEQ, [Mississippi Department of Environmental Quality] came up here and gave our supervisors, who are our elected officials, a speech and said >Memphis is stealing DeSoto County=s water= and that made front page of the newspaper.@*

An overriding dilemma in addressing many of these problems was best summarized by Dr. John Smith when he stated, *Alt is not an immediate problem, and that in itself causes those of us who advocate environmental awareness a problem. Human perception is very short. It might be 4 years for an elected official because that=s when you=re going to run for reelection again. It might be 6 years for a college student because then you=re going to be out of college. It might be 20 years if you are an adult male getting out of college thinking towards retirement. If you=re really long term thinking, it=s the rest of your life which might be 40 years. But we=re talking about problems that might occur a hundred years from now and it=s extremely difficult to get people interested in addressing a potential problem. And I say potential because we can=t prove it. A potential problem that might occur a hundred years form now. It=s just hard to get people interested in it.@*

Scientists/engineers

Several interviewees credited the local scientific community with the interest in source water issues that currently exists. In fact, the history of concern over groundwater issues in Memphis closely mirrors the development of scientific understanding of the aquifer. This history was described by Dr. John Smith: *AI came to Memphis State in 1970 as part of the civil engineering program. In the era of 1970, even though that was the beginning of Earth Day and the recognition of Earth Day and that time frame, groundwater resources in Shelby County were viewed as something to be totally infinite in nature, of high quality, as something we didn=t have*

to worry about. For the next 15 years I saw very little emphasis on groundwater research in Shelby County because it was just assumed based on best available knowledge that the water was protected by a thick clay layer; that it was taken from 500 to a thousand feet below the ground, there was no contamination, it was infinite in supply.

Then in 1985-86, somewhere along in there, we started seeing a series of data bases develop that indicated that the ground water levels in the county were dropping at a high rate due to over pumping. We were pumping it out faster than it could come in. Then in Collierville, at about the same time, some of the residents of Collierville began to drink a water out of their tap that had a very sweet taste to it. And after they complained to the city fathers for a while, EPA got involved there was found to be a cleaning solvent, trichloroethylene, and they traced that solvent back to an industry in Collierville who finally admitted that they had released anywhere from six to twenty thousand gallons of this stuff. What amazed everybody was that it got to the drinking water supply so quickly. And that started a whole series of studies by USGS to try to verify this premise that we really did have this barrier in between man on the surface and drinking water below us.

So beginning in 1985, the University started getting involved and interested in it, there was community awareness that part of the community had a problem. Then in 1988 or 89 the University started a ground water research program [which Dr. Smith started up] dealing with trying to develop a better understanding of what the ground water resources were in Shelby County.

The emphasis of that initial effort was not the university. It was one man at Memphis Light, Gas and Water [the City of Memphis utility company]. The President, vice-President at that time, a man by the name of Bill Crawford. It was only through Bill Crawford's foresight and knowledge and interest in preserving this resource that any groundwater research was ever done. And Bill deserves all the credit for all the improved awareness of that and anything that L, G & W or the University has been done can be traced back to Bill's interest. But due to Bill's interest and the University's resources we began intensive study of groundwater data that were available. We quickly got into computer mapping and computer modeling of the resources and that evolved into the Ground Water Institute. @

The Ground Water Institute is still considered one of the premier local repositories of expertise on water issues in the region. The Institute was cited by virtually every interviewee and serves as a source of information for both the politicians, the environmentalists as well as others interested in water issues. The research that they have done has been instrumental in altering attitudes in the region. And as knowledge has increased, concerns toward the water have also increased.

Even when scientists and engineers basically interpret the physical data in the same way, not all draw the same conclusions from it. While some scientists and engineers such as John Smith and Jerry Anderson which were cited earlier, see need for immediate action, others, especially in bureaucratic positions, tend to adopt a less immediate view. An example of this view is the following response to an interview question addressing the need to modify zoning laws with respect to the windows in the clay confining layer *Awe need to study it, but I don't think we need to react until we have some real reason. @* In response to the interview question *Do you think there are any problems that need to be addressed? @*, the same interviewee responded *Apersonally, I'm not aware of any. @* Likewise, in response to the question *Do you*

see any potential problems, things that we need to be looking out for and potentially, at least, be ready to make some changes for?@ *Al don=t see anything particularly in Shelby County.*@ And finally, in response to the potential problems associated with urban sprawl cited by other interviewees, this same official emphatically stated *Athere=s absolutely no indication that the aquifer in this area couldn=t accomodate all the growth it would ever take in Memphis.*@ Although after a long pause, he did add *Aas long as its judiciously used, as long as we don=t use it up.*@

In general, most of the scientists and engineers we talked to that worked for municipal water suppliers tended to have optimistic outlooks on water issues although they were well informed about recharge zones, windows, etc. This in part may reflect their role as providers of water whose jobs depend to some extent on the perception of the politicians who are their ultimate bosses. The demands they are most interested in meeting are the short term demands of economic development. And, as even but the most pessimistic agree, there probably are no immediate problems with meeting these demands.

On the other hand, scientists and engineers that worked in academia or consulting positions tended to be somewhat less optimistic. While agreeing that there were no immediate problems per se, they emphasized that action is needed now to prevent problems in the future. Given their positions away from the political arena, they are in a better position to take what Dr. John Smith described as a more philosophical position; a viewpoint more in line with long term issues rather than the short term issues that dominate those in government and politics.

This subtle paradox: i.e., consensus on the data, but disagreement on the response, typifies ground water issues in the Memphis region.

Environmentalists

The environmentalists interviewed tended to take a broader and some what less relativistic view of source water issues. By broader I mean, they were much more likely to link groundwater issues with other environmental issue such as surface water and also to quality of life issues. They frequently cited floodplain development, urban and agricultural runoff, mining and road construction activities, urban sprawl etc. as being ground water issues. By less relativistic, I mean they focused less on timing issues, i.e., problems would actually arise, but were more concerned with the Aethics@ of current practices in a more absolute sense.

One interviewee stated *Al think we=re being a little cavalier with our use of water here. We have such a great water supply. I think that we=re just using it up a little too fast. I have no proof of this but if you just go and look at how people do their yards and lawns and all their watering, whereas the other option is to use plants native to this area that don=t require that sort of water. In fact, that=s how we landscaped this place....When I plant stuff I try to think in terms of how much water it=s going to take....People are building larger houses, more bathrooms, more luxurious stuff that just requires more water. There just not emphasizing conservation because there is so much of it.*@

Many of the environmentalists became involved in source water protection issues when they themselves experienced significant declines in their own quality of life. One of the most well know environmental activists on water issues in the area became involved when her private

well water was destroyed by nearby mining activities. As she relates, when she was told that the mining activities would probably dry up her well she said *AWhat! That=s my only source of drinking water.*@ She has remained active in local water issues for over 8 years.

The environmentalists also tend to be much more cynical. When asked why more wasn=t being done to conserve the resource one environmentalist replied *AWhy? Because its always been done that way, there=s money to be made in it, and it costs money to do it right.... They want everybody else to pay so that they can maximize their profits.*@ Another was shocked to discover that a member of the county commission was employed by the mining company whose activities she was trying to halt. *AWe also found out that there had been a county commissioner who had actively been working for — construction company. One of the county commissioners was actually under contract with them at the time and had been for the previous 8 years doing their environmental engineering work for them. And yet he had actively lobbied for the passage of the permit and had voted for it at the commission meeting.*@ This same interviewee remarked that she should contact John Grisham to do a novel about the political intrigue of environmental issues in Shelby County.

While the environmentalists we interviewed tended to be very well informed on the issues, even if their particular concerns were sometimes somewhat narrower this is probably not the typical case. According to the local president of a national environmental organization *Aa lot of people that you find interested, are involved in water management issues, are people that have been lumped together under the designation >not in my back yard= types. Which means you have folks that have a direct or immediate stake in a ground water management issue or just a water management issue. [Prior to the emergence of their particular issue] they might not have ever been concerned about ground water management just trusting that the City of Memphis or Shelby County keeps my water clean and I=m always going to have water delivered to my tap; they never even worried about it at all. But then they become interested in ground water issues [in response to their particular issue]. Those people get really engaged in an issue. They want to be a part of the public process in making decisions, but they=re not willing to be facilitated in a consensus environment. Consensus environments usually bring together a whole bunch of people that are on all different sides of an issue trying to find common ground and trying to get them to work together. A lot of these folks that are interested in the issue for one specific reason or cause, they don=t like to sit down at the table and feel like they=re being facilitated or led toward a compromise.*@

Of course under these circumstances, difficult problems becomes what one resource manager once referred to as wicked problems which defy resolution.

In summary, then, the community structure of source water protection in the Memphis region revolves around these three groups. Politicos who tend to be focused on short term problems and trade offs. Scientists and engineers who take a more technical approach to water issues though they can break in the direction of either a short term or long term approach to the issues. And finally the environmentalists who tend to make broader linkages between ground water and other environmental and quality of life issues, tend to take a more ethical rather than pragmatic approach, but who sometimes can be very narrowly focused with little room for compromise.

RECOMMENDATIONS

Within this social milieu, we attempted to identify ways of moving forward. While there were a number of suggestions, the one recommendation that came up over and over was education. The following quotes exemplify the need for education.

Alf asked where the drinking water comes from, most would say their kitchen sink. Maybe if pressed, some would say the Mississippi River. @

A Very few people have the overall picture, the long range view. What I do over here on my little piece of the puzzle doesn't directly impact the big picture. But when everybody is doing things a certain way, to their little pieces, it does impact the big picture. @

Alf the citizens knew how important it was then they would help be the police. They would help if they knew. If everybody knew more clearly the connections between what I do and how it affects all of us they wouldn't do bad things so much. @

A One of the biggest problems is lack of education. People don't know the problems exist. @

A We need to educate people. Let them know what the potential problems are; how important water is, what an important asset it is; and what are the things we need to do to protect it. @

Where those educational efforts should be addressed is another issue. Some noted the need to educate the politicians. They are the decision makers.

Others stressed the need to address the local business community. Educate them on the valuable asset Memphis water represents. Several interviewees felt that there really hadn't been enough efforts put into promoting the economic value of this high quality, inexpensive resource which in and of itself is a major economic attractor. One interviewee cited a study where the top 10 water using businesses in the Memphis region were asked why they chose to locate here and all ten listed water as one of their top 3 answers. A case in point is Coors Brewing Co. Coors, has of course built their entire advertising campaign on the quality of the Rocky Mountain water that goes into their beer. Well folks, let me tell you something. Many of those cans contain good old Memphis Sands aquifer water, not Rocky Mountain stream water.

Finally, many felt that the place to start was with children. Not only are children more open to new ideas and values, but they have the potential to influence the actions of their parents more than any adult.

We still must also continue to focus on adding to our knowledge of the physical dynamics of the aquifer.

In my opinion, it will take efforts on all of these fronts to truly change the attitudes, values and behavior of people in the Memphis region.

It is, unfortunately, rare in today's world of rapid population growth, increasing consumption rates, expanding economic development and the consequent demands on environmental resources for an area like Memphis, or any other urban area in the world for that matter, to have

the opportunity to actually preserve and sustain such a high valued resource rather than confronting the situation of trying to undo past abuses; rather than trying to salvage, often at a much lower level of quality, a natural resource. Just as this resource is rare, this opportunity is also rare, and should not be squandered by the people of Memphis. The globe is already too littered with devastated resources and lost opportunities. The people of Memphis must use this opportunity so that someday, they too are not looking back saying Aif only we could do it again differently.@

One last quote from Bill Crawford, the man most credited with raising concerns over Memphis water. *All my life, my family, I can remember going on vacations and all and my father always came back and said it sure was good to get back to Memphis to get a good glass of water.*@

Well, Bill, let=s hope our children and grandchildren can say the same thing.@