WATERSHED MANAGEMENT – HOLISTIC POLICIES AND PRACTICES THAT ACHIEVE SUSTAINABLE WATER QUALITY SOLUTIONS

Graham W. Rich, P.E., BCEE

AUTHORS: Chief Executive Officer, Central Arkansas Water, 221 East Capitol Avenue, Little Rock, AR. 72202, USA.

ABSTRACT. Water utilities throughout the country are facing uncertainties concerning source water supply quality and quantity. Historically, emphasis on protection of water sources was not a priority with water providers; the prevailing industry wisdom centered on the treatment process to act as the initial and final barrier of pollutant removal. Today, utilities throughout the country are placing a heightened focus on source water protection due to a number of factors such as limited availability, impaired water quality, and unpredictable climate issues.

Central Arkansas Water (CAW) is a regional water provider in the greater Little Rock metropolitan area serving over 400,000 customers. CAW’s largest water supply reservoir, Lake Maumelle is located less than five miles from the western edge of the Little Rock city limits with much of the land within the watershed being owned by a company specializing in timber management and real estate development. Ten years ago, development plans by this company were announced and the location of the proposed development was less than a quarter mile from CAW’s water intake on Lake Maumelle. This caused a significant outcry from concerned citizens and local environmental groups prompting the development of a comprehensive watershed management plan aimed at protecting Lake Maumelle. The Lake Maumelle Watershed Management Plan was a collaborative effort between CAW, an independent contractor (Tetra Tech, Inc.), and over seventy community stakeholders representing a variety of interests. The emphasis of the plan centered on mitigating impacts of new development along with a list of watershed stewardship recommendations aimed at producing sustainable solutions for protection of water quality.

Although much work and expense went in to developing the watershed management plan, implementation proved to be far more difficult and controversial than the original plan development. This was primarily due to the fact that CAW had to rely on other governmental entities to actually administer and enforce program elements that dealt with new development through land use zoning. However, today CAW has a comprehensive watershed management plan in place that protects and in many cases improves water quality in Lake Maumelle.

In summary, lessons learned from CAW’s ten year process of developing and implementing a comprehensive watershed management plan can easily be applied to water utilities throughout the country, especially in the Southeast. Today, CAW’s active management of the watershed integrates resource protection, recreation, research, and storm water management.

INTRODUCTION

Lake Maumelle was constructed in 1957 to serve as the primary water source for the growing greater Little Rock, Arkansas metropolitan area. The 88,000 acre lake was located in the far western edge of Pulaski County with its watershed encompassing portions of two other counties. At that time, the Little Rock city limits were over twenty miles from the lake’s intake structure, making the site location ideal due to the extreme rural nature (lack of development) along with the excellent quality of water from tributaries that would feed the lake.

Today, Little Rock’s city limit boundaries have stretched to within five miles of the lake’s water intake due to rapid growth occurring in Central Arkansas’ western service area primarily from the early 1990’s until 2008 (Figure 1). During that same time period, there was little to no growth occurring in the watershed, primarily due to lack of infrastructure and city services. Until development of the Lake Maumelle Watershed Management Plan, CAW’s policy for new large scale development within the watershed was to either negotiate purchase of proposed land to be developed or exercise its powers under eminent domain. Obviously, with over 88,000 acres in the Lake Maumelle watershed, neither option was a long term sustainable solution.

In 2004, plans were unveiled for a large scale residential development within half a mile of CAW’s water intake. After repeated attempts to negotiate purchase of the land with the developer, CAW exercised its statutory authority to condemn the property. After a lengthy legal battle and significant press exposure, the developer agreed to sell the land to CAW. This contentious battle served as the catalyst for development
of the Lake Maumelle Watershed Management Plan. Shortly after settlement with the developer, the CAW Board of Commissioners voted to develop a comprehensive plan to protect Lake Maumelle from development and other activities in the watershed.

**PLAN DEVELOPMENT**

Beginning in 2005, CAW assembled an advisory group of over 70 stakeholders representing a variety of interests within the community and watershed. A Request for Qualifications (RFQ) was developed which targeted consulting firms whose experience centered around the development of watershed protection plans. After an exhaustive review of qualifications from interested firms, Tetra Tech, Inc. was selected to prepare the Lake Maumelle Watershed Management Plan. During the next eighteen months, with input from community and watershed stakeholders, Tetra Tech, Inc. crafted a science based comprehensive management plan focusing primarily on the reduction of impacts from new development. Table 1 highlights water quality goals that were set utilizing available literature on reservoir trophic states as well as CAW water treatment plant performance data (Tetra Tech, Inc., 2004).

Because reservoir water quality impacts the treatment process and subsequently treated water quality, these targets were set to provide long term protection of the lake for use as a drinking water source. Extensive watershed and reservoir modeling was performed to determine the amount of pollution over time (full build out of watershed) from new development that would cause Lake Maumelle to exceed the targeted water quality goals.

<table>
<thead>
<tr>
<th>Chlorophyll a</th>
<th>TOC</th>
<th>Turbidity</th>
<th>Fecal Coliform</th>
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<td>3.0 µg/L summer median</td>
<td>≤ 3.1 mg/L</td>
<td>≥ 2.6 m</td>
<td>&lt; 0.065 #/100ml</td>
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Table 1. Lake Maumelle water quality targets.
Once this was determined, control strategies for new development were developed. Some of the control strategies recommended included:

- **i.)** limit residential development to either one house per 5 acres or one house per 10 acres depending on terrain slope
- **ii.)** allow denser residential development only if approved best management practices (BMP’s) are used to control stormwater runoff
- **iii.)** cap of 8% for impervious surfaces
- **iv.)** require “set aside” conservation land for developments with higher densities and utilizing BMP’s for stormwater runoff control
- **v.)** prohibition of treated wastewater discharges in the watershed
- **vi.)** CAW would commit to purchase a minimum of 1,500 acres in the watershed to be placed in conservation
- **vii.)** numerical limits established for phosphorus, TOC, and suspended solids for new developments using BMP’s for storm water runoff control
- **viii.)** prohibition of development on steep terrain (>25% slope)

Once all modeling had been completed and control strategies had been accepted, the advisory committee voted to forward the plan to CAW Board of Commissioners for their review and approval.

**PLAN IMPLEMENTATION**

After eighteen months and $1.2M spent crafting a watershed protection document for Lake Maumelle, the CAW Board of Commissioners unanimously approved the plan in February of 2007. While many of the stakeholders and CAW staff involved in the plan’s creation thought the most difficult piece of the process was completed, this turned out not to be true. Although the plan was scientifically sound and was approved by the stakeholder’s advisory committee, implementation proved to be far more controversial. Most of the recommended plan elements for new development required another political entity that had land use regulatory authority to actually administer and enforce recommendations because CAW’s enabling legislation did not give this authority to the utility.

The Lake Maumelle watershed represents approximately five percent of the total land area of Pulaski County. The rest of the watershed rests in extreme rural sections of Perry and Saline Counties. Of the 88,000 acres in the watershed, approximately 43,000 acres reside in Pulaski County. Due to the proximity of Little Rock’s city limits, it was decided to target plan implementation initially in Pulaski County. As mentioned previously, CAW had no land use regulatory authority to implement and enforce most of the recommendations for new development contained in the Lake Maumelle Watershed Management Plan.

In 2008, CAW staff approached Pulaski County staff to gauge interest in assisting in the plan implementation. After initial reluctance, the County agreed to serve as the administrator of the plan provided that CAW would cover all administrative costs. Working with the County Planning Department, a two phased implementation approach was created. Because the County planning department already reviewed subdivision plans for new developments in the County, the quickest and easiest way to implement certain portions of the watershed management plan was to amend the existing subdivision ordinance. Although this met some resistance from private property rights advocates, Pulaski County amended its subdivision regulations to include portions of the watershed management plan. The amended subdivision regulations required new developments to adhere the following plan elements:

- **i.)** sediment and erosion control requirements for pre and post development
- **ii.)** runoff from developments utilizing BMP’s could not exceed limits in Table 2 for post development runoff
- **iii.)** development of a site evaluation tool (SET) to determine pollutant removal efficiencies for developments utilizing approved BMP’s
- **iv.)** roads for new developments must be paved

The last challenge for CAW in fully implementing the watershed management plan involved prescriptive elements of the plan such as density control, prohibition of certain land uses, residential and commercial land use designations, and required set aside land (to be held in conservation) for all developments. In order to achieve this, the County embarked on a comprehensive land use plan for the Pulaski County portion of the watershed. By preparing and approving the watershed land use plan, Pulaski County ultimately adopted zoning regulations in the watershed that implemented the remaining elements of the 2007 Lake Maumelle Watershed Management Plan.

<table>
<thead>
<tr>
<th>Total Phosphorus (lb/ac/yr)</th>
<th>Total Suspended Solids (tons/ac/yr)</th>
<th>Total Organic Carbon (lb/ac/yr)</th>
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<tbody>
<tr>
<td>0.30</td>
<td>0.110</td>
<td>44</td>
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</tbody>
</table>

*Table 2. Post development stormwater runoff limits.*
Although the land use plan and subsequent zoning ordinance finally received approval by Pulaski County in July 2014, five years of public input resulted in many changes to the original land use plan and zoning ordinance, Table 3 illustrates the similarities and differences of key elements between the 2007 Lake Maumelle Watershed Management Plan that was approved by the CAW Board of Commissioners and what is contained in the Pulaski County subdivision regulations and zoning ordinance.

**RESULTS**

Today the Lake Maumelle watershed has a robust set of protections in place for future development. Because limited growth has occurred since the adoption of the County’s zoning ordinance, it is still premature to quantify how well the water quality protections are working. CAW has invested significant resources over the past ten years in water quality monitoring of both the lake and its tributaries. The data derived from this monitoring will provide extensive baseline data to assess the efficiencies of control measures implemented for new development.

**DISCUSSION**

The development of any watershed management plan must have clear and concise goals of desired outcomes before the process is initiated. In this particular case, it was the protection of a reservoir that was created for the sole purpose of providing water for the largest metropolitan area in the State of Arkansas. Many of the overarching goals contained in the original plan may not be necessary for the protection of other water bodies.

The focus of the Lake Maumelle Watershed Management Plan was primarily on the impacts of new development in the watershed. It is felt that a more holistic approach should have been taken with more of a heightened focus on conservation of land. It is important to note that CAW historically purchased land around the reservoir for protection and has purchased over 2,000 acres since the plan’s inception. Today CAW actively manages the almost 10,000 acres CAW owns in the Lake Maumelle watershed and partners with state and federal agencies to promote environmental education, recreation, forest preservation, and stormwater management.

**LITERATURE CITED**


<table>
<thead>
<tr>
<th>Action</th>
<th>2007 Lake Maumelle Watershed Management Plan</th>
<th>Pulaski County Subdivision Regulations and Zoning Ordinance</th>
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<tr>
<td>Ability for new subdivisions to have only one house per 5 acres or one house per 10 acres</td>
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<tr>
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<tr>
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<td>Cap on impervious surfaces</td>
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</tr>
<tr>
<td>Pre and post sediment and erosion control requirements</td>
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Table 3. Comparison of 2007 Lake Maumelle Watershed Management Plan recommendations to current County subdivision and zoning regulations.