WATER RESOURCES
IMPACT

INTEGRATED WATER RESOURCES MANAGEMENT: BRINGING IT ALL TOGETHER

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INTRODUCTION

Integrated Water Resources Management (IWRM) has been a key topic of discussion over the past decade. The recognition that for the best environmental outcomes water should be managed holistically rather than in compartments is seldom disputed. The benefits of integrated management include improvements in water supply planning, better water quality control, scale appropriate system management, equitable protection of in-stream and off-stream uses, and more cost effective solutions. Yet implementation of IWRM has gained little traction due to the inherent difficulties of this management approach.

So why is integrated management so hard? Why has the approach advanced so slowly and typically only at the conceptual level? What would it take to propel this concept into reality with improved measurable resource outcomes? This article explores the obstacles to integrated management, reviews the flip side to demonstrate the opportunities for improved water resource outcomes, and presents case studies.

OBSTACLES TO INTEGRATED MANAGEMENT

Managing water resources is akin to solving a jigsaw puzzle that continually changes, so you never really get to finish it, frame it and put it on a wall. Figure 1 illustrates the water management puzzle and technical context of its pieces in two dimensions. Yet it falls short of describing a multidimensional puzzle that stretches the imagination. The puzzle really includes many physical, behavioral and political pieces that are continually changing yet must fit together. Thus, the shape and size of the puzzle is subject to change on continual temporal and spatial bases. One might look at the physical puzzle as one that can be readily solved through science, engineering and planning. However, water remains mysterious even in the physical realm as it decides its own course through soils and geology, on the surface, and in the atmosphere. Throw in the stochastic (random) nature of nature (climate, rainfall, transport, storage, etc.) and managing water to meet human and environmental needs is already a daunting task.

Now, let's have some fun and add in some of the political aspects of water management. **Inconvenient fact:** watershed boundaries differ from political boundaries. Furthermore, political boundaries are clearly understood by the public, as states, counties, and municipalities continue to define the lands in their jurisdictions, and in many cases further distancing themselves from neighboring jurisdictions. Watershed boundaries are not clearly defined and/or understood in the minds of most people. Yet in order to manage water effectively political barriers need to be softened and watershed boundaries need to be respected. Since many federal, state, and local laws and regulations provide water resources management on limited geographic areas or for single purposes (e.g., water quality), the opportunities for united planning and management become limited. In addition, rules and regulations from a variety of regulatory bodies are often uncoordinated in meeting environmental endpoints. For example, approvals issued by a state public utility commission may conflict with water supply and conservation objectives in a region or watershed.

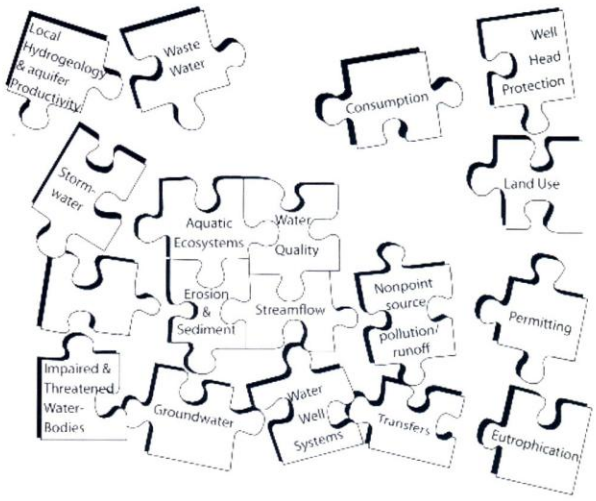

Figure 1: The Water Management Puzzle
(Source: Delaware River Basin Commission, 2011).

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Finally, we must look to human behavior to see if integrated management is at all possible given that our minds prefer to organize by division. Ultimately, the way our water resources are managed depends on how water is viewed, either as private property that individuals are entitled to, or as a common resource that needs to be protected for future generations. Managing water resources on a watershed basis and integrating all aspects – water supply, water quality, ground water, surface water, flooding, stormwater, droughts, stream flows, channel stability, etc. – will require a lot of public education and collaboration in order to realize the necessary cultural and behavioral changes.

OPPORTUNITIES FOR IMPROVED WATER RESOURCE OUTCOMES

Can we really perform integrated water management within the framework of existing federal and state laws or do we need to rethink our approach to water? At this time, there is no one agency tasked with water management. The duty is spread over multiple agencies at the federal and state level as well as local governments. It makes sense to have different water management schemes across the country due to the vast environmental and socioeconomic differences, but do we need a national water vision and management strategy in order to be better stewards of the resource as well as more internationally competitive as a country?

No matter if we are thinking nationally or for a local watershed, some of the considerations for an IWRM program are:

- Holistically manage water as a single resource – "one water."
- Manage by watershed boundaries.
- Consider how upstream actions affect downstream uses.
- Coordinate regulatory and grant programs.
- Merge water quantity and quality programs.
- Jointly manage surface and ground water.
- Integrate water uses/withdrawals, discharges, runoff, and in-stream flows.
- Consider water supply needs for humans and ecological communities.
- Plan regionally and implement locally.
- Collaborate on watershed efforts – bringing people together.
- Provide decision makers with evidence of the economic and environmental value of IWRM.
- Educate for protection at the local level.

CASE STUDIES

So let's see what happens when we try to implement a program to holistically manage water resources. Two case studies will be used to illustrate IWRM: (1) Delaware River Basin – a multistate, 13,500 mi^2 river basin, and (2) Wissahickon Creek (Montgomery County, Pennsylvania) – a 40 sq. mi. watershed.

Delaware River Basin

How do you manage a 13,500 square mile watershed (see Figure 2) that drains portions of four states and supplies water to over 15 million people, including the residents of New York City and Philadelphia? This is an especially difficult question in an area of the country with "local rule" where the 838 municipalities of the basin control land use decisions. Figure 3 illustrates this daunting task by overlaying municipal as well as county and state boundaries on the basin map. It was determined back in the 1950s that no one state was able to manage the shared waters of the basin so a Delaware River Basin Interstate/Federal Compact was signed into law by President Kennedy and the Delaware River Basin Commission (or DRBC) was formed in 1961 (DRBC, 1961).

While there is not complete integration of water management in the basin, the Commission does regulate surface water and ground water withdrawals, sets water quality standards, regulates effluent discharges, and provides for equitable water allocation among the four states. The members of the Commission are the Governors of the four basin states – Pennsylvania (PA), New Jersey (NJ), New York (NY), and Delaware (DE), as well as a general in the U.S. Army Corps of Engineers (USACE) who represents the President and all federal agencies.

The commission has a small staff and the work is done in partnership with the state and federal agencies and multiple stakeholders. One of the most important aspects of the Commission is that it provides a forum for adaptive management. Natural resources are always changing – new science, new storms of record, new analytical techniques, etc. – and the DRBC provides the venue to assess the impacts and change course when needed. Over the years major issues have included: cleaning up conventional pollutants in the urban areas of the basin, facilitating changes to the Supreme Court Decree on allocation of water to New York City and the down basin states, mitigating flood impacts, cleaning up of persistent bioaccumulative toxics, and regulating natural gas development. For more information check the Commission's website at www.DRBC.net.

Wissahickon Creek

A microcosm of integrated river basin management is watershed management. The watershed scale is much smaller, which may not make it much simpler to manage, but it offers greater opportunity for cooperation. One application of IWRM on the watershed level is a Special Area Management Plan (SAMP) prepared for the Upper Wissahickon Creek watershed in Montgomery County, PA in 2008 (DRBC and Montgomery County Planning Commission, 2008). The plan was prepared in accordance with the Pennsylvania Water Resources Planning Act 220 and is expected to be used as a model for future SAMPs in PA. One of the key requirements of Act 220 is the identification of critical water planning areas where projected future demands exceed or nearly exceed the amount of water that will be available for use or where other significant water resource impacts are expected. PA Act 220 calls for a plan to be prepared for these watersheds to evaluate future water conflicts and provide a more detailed analysis of water supply, water quality, stormwater, and flooding issues.

Wissahickon Creek is a tributary of the Schuylkill River, which is the largest tributary to the Delaware River (see Figure 4). The Upper Wissahickon Creek study area occupies 40 square miles, constituting the upper two-thirds of the Wissahickon Creek watershed. Wissahickon Creek supports a diversity of uses, including fishing, swimming, and drinking water within its watershed boundaries. Despite its urban/suburban setting, Wissahickon Creek has great historical significance and is ecologically diverse.

Figure 2. Map of Delaware River Basin
(Source: Delaware River Basin Commission, 2011).

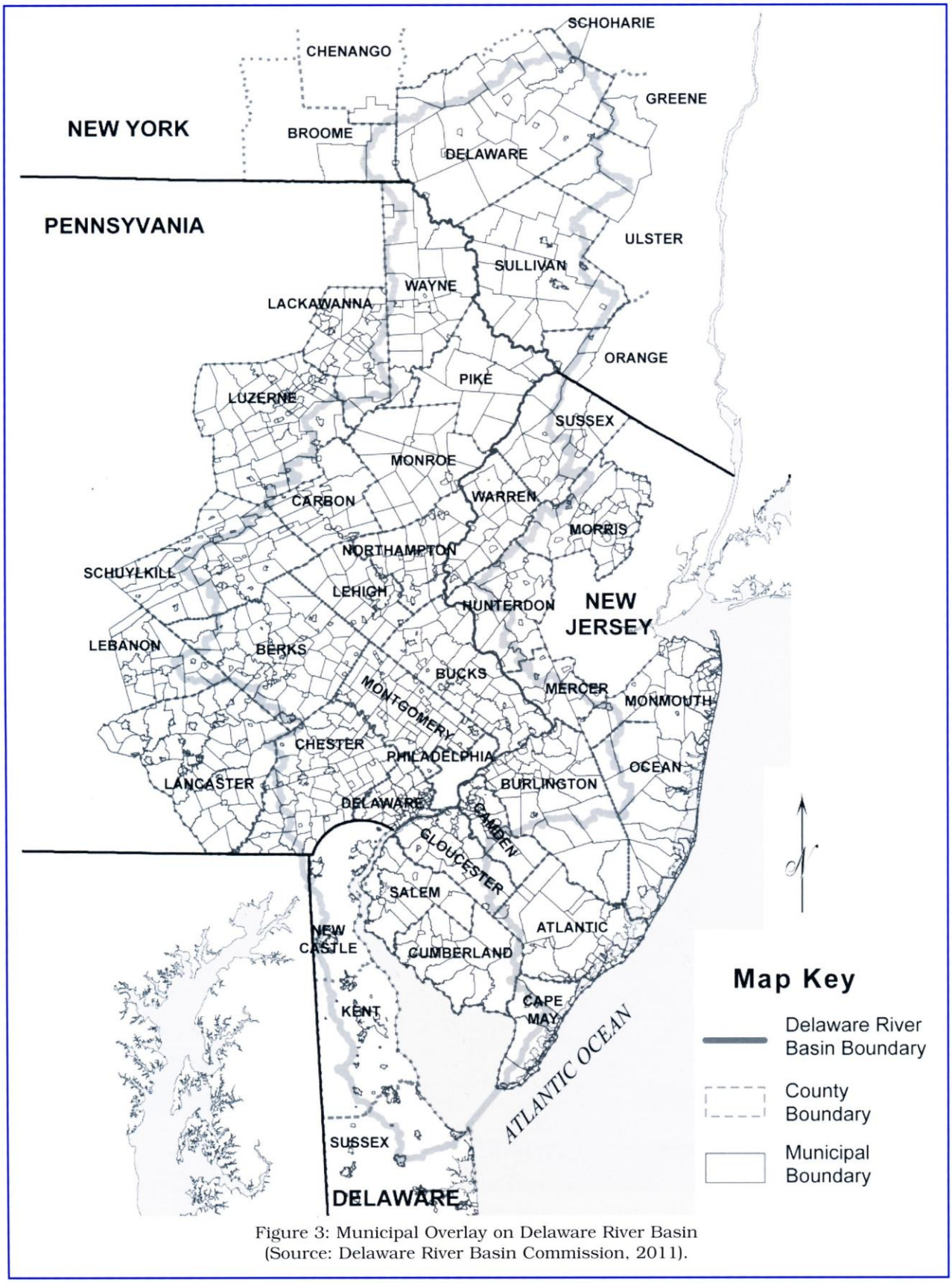

Figure 3: Municipal Overlay on Delaware River Basin (Source: Delaware River Basin Commission, 2011).

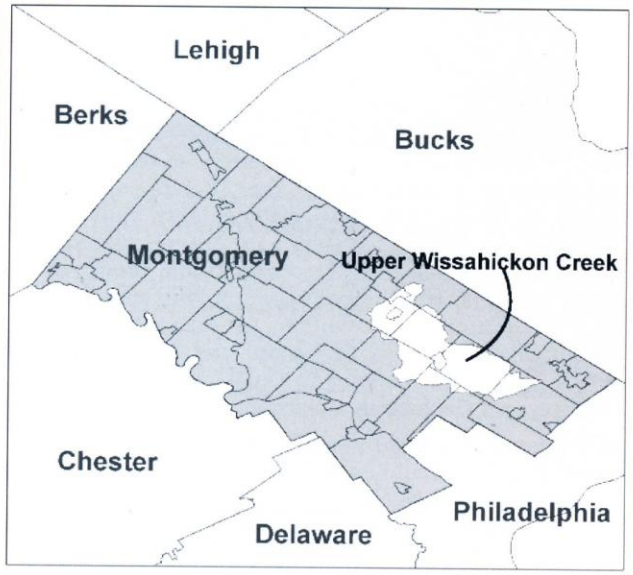

Figure 4. Upper Wissahickon Creek Location Map (Source: Montgomery County Planning Planning Commission, 2011).

The Upper Wissahickon Creek study area (see Figure 5) is facing numerous issues affecting its water quality and flow. Since 1970, over 7,500 acres (30% of the watershed area) have been developed, placing an ever-increasing demand on Wissahickon Creek to provide for and support commercial and residential users, within and outside of the study area. Since the Upper Wissahickon watershed is projected to continue growing at a steady pace over the next several decades, it is critical to ensure an adequate supply of suitable quality water for existing and anticipated human uses and ecosystem needs. Some of the challenges to achieving this outcome include: low base flow, channel instability, degraded water quality, and flooding.

The success of the Upper Wissahickon Creek SAMP lies in two critical aspects of the project: (1) the ability to integrate previously separate water resource problems into a single planning process and (2) a strong collaboration effort. In our view the only possible way to integrate water resources management that merges the technical, political and behavioral aspects noted above, is through a collaborative process.

Stakeholders brought together for the project were asked to address the water resource concerns of the watershed. The Upper Wissahickon Advisory Committee consists of over 40 stakeholders from a diverse spectrum of disciplines and interests, including environmental and

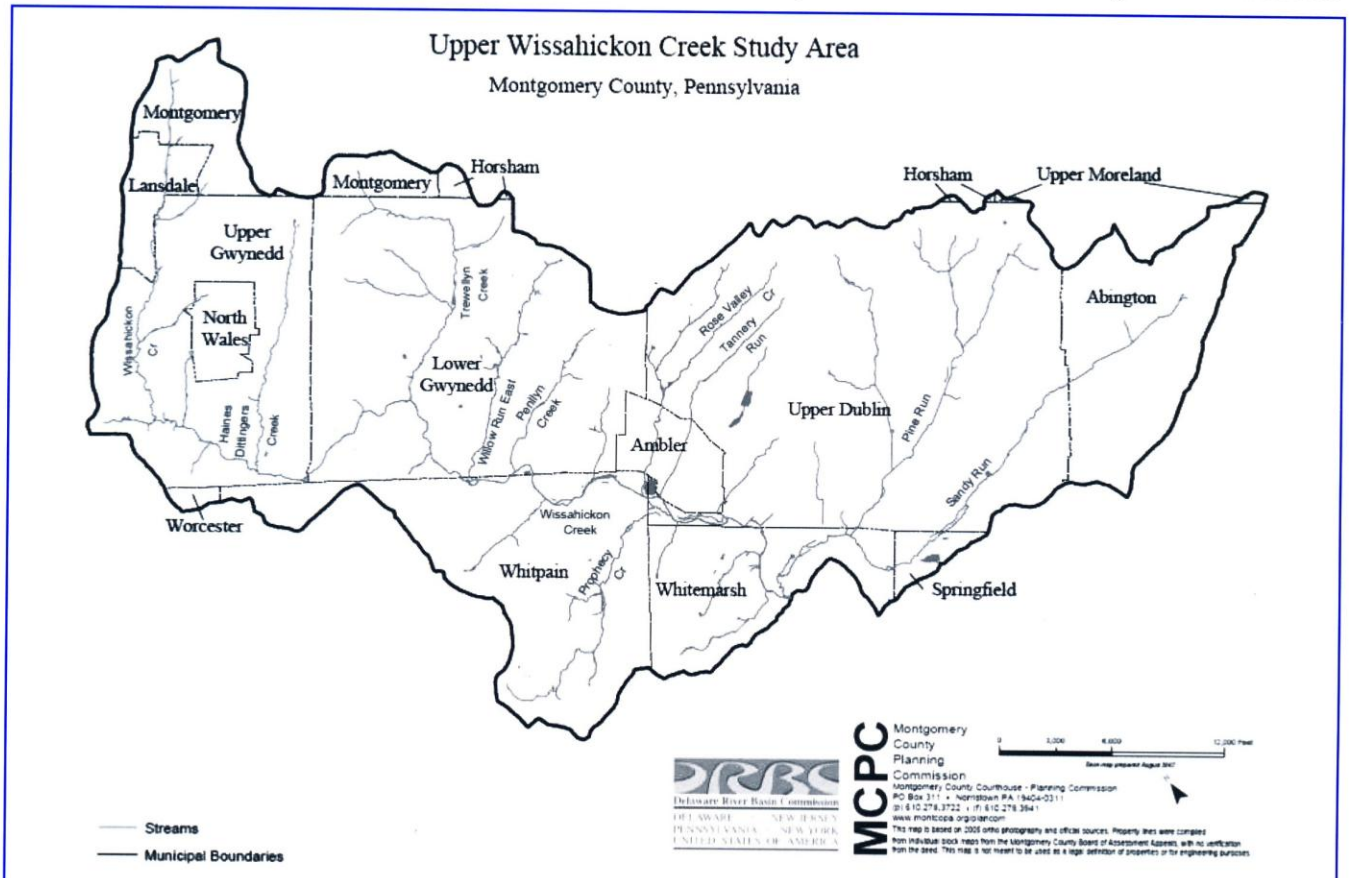

Figure 5. Upper Wissahickon Creek Location Map (Source: Montgomery County Planning Commission, 2011).

watershed organizations, municipal officials, water suppliers, industrial representatives, and state and regional officials with expertise in the watershed. Facilitators with technical and planning expertise provided a collaborative and interactive environment for the advisory committee to share their expertise on local impacts to water resources and potential future improvements during four meetings over one year. One meeting in particular included breakout sessions to facilitate problem solving by utilizing a planning toolkit for focused discussion and break-out sessions.

It became clear during the process that the solution set required to address water resource impacts in the Upper Wissahickon watershed would be too broad without some way of integrating across problem areas for multipurpose solutions (i.e., the most bang for the buck). This established an economic incentive for integration. The results of collaborative efforts towards IWRM include the development of six recommendations:

1. Retrofit Stormwater Basins,
2. Review and Update Ordinances.
3. Protect Source Water.
4. Restore Stream Channels and Riparian Corridors,
5. Educate Homeowners to Implement Backyard Best Management Practices.
6. Create a Stormwater Partnership.

Each recommendation focuses on an identified problem and includes a specific implementation strategy for each area of the watershed. Implementation of the plan will help balance economic vitality and environmental quality in this area. The recommendations developed to address these issues can be helpful to watersheds faced with water supply, water quality and other problems that are best addressed through integrated management.

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