ECONOMY AND ECOLOGY: NEW APPROACHES TO STORMWATER MANAGEMENT

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Traditional Stormwater Management Approaches are Changing

For decades, municipalities have watched budget dollars go down the drain, along with stormwater. When subdivisions, local roads and commercial developments are built or improved, municipalities must find the funding to manage storm runoff. Cities need to install catch basins to capture stormwater and storm sewers to convey the stormwater to detention basins, streams or rivers, ensuring it doesn’t wash into the wastewater systems and create overflows. Furthermore, they must maintain the entire system.

In most instances, cities have carried out these actions without a dedicated revenue source. They simply use money from the general budget, often taking funds away from other critical programs.

For many years, stormwater has been an expensive piece of municipal water infrastructure. Water and wastewater each have their own revenue sources. Water delivery systems operate with their own revenue streams, users pay fees for utilities and wastewater bills are calculated based on water consumption. Until recent years, that has not been the case with stormwater management, which has had no fees or base rate attached to it.

Now, however, municipalities across the country are changing their view of stormwater management systems and looking at them as a utility similar to their water and sewerage systems. They are formulating local authorities or stormwater management districts to develop a stormwater fee structure, accomplish the planning, administer ordinances, manage flood recovery, ensure water quality and carry out mitigation and capital projects.

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Establishing an Agency

Often municipalities will work closely with a consultant, like L.R. Kimball, to determine the best type of agency to form or join to meet their particular needs. Some agency alternatives include:

- A joint municipal authority encompassing multiple municipalities
- A county authority
- A county department
- An environmental improvement company
- A contract with a private company
- Franchising stormwater management to a private company
- A stormwater management district

When a stormwater management district is determined to be the most appropriate choice, the district must develop a comprehensive watershed approach to stormwater management. A district will need to:

- Set consistent, enforceable construction standards for stormwater management facilities
- Schedule, monitor and control facility maintenance efforts
- Establish effective inspection mechanisms to create a preventive approach to stormwater management
- Strive to define future stormwater management initiatives that maximize safety and minimize cost
- Provide for the financial viability of the district’s efforts
- Determine precisely how it will implement fees to maintain a revenue stream.

Counting Driveways

The first stormwater management districts calculated fees separately for every house in the community. Charges were based on the amount of impervious surfaces on and around individual homes. However, this method posed some accounting challenges, causing municipalities to reverse the calculation process. They determined the amount of revenue they needed to manage the community’s stormwater and assigned a single rate that was applicable to every household, apportioning the total cost to the inventory of homes.

Under this utility approach, the fees for stormwater management at commercial and industrial sites are calculated based on the equivalent number of dwelling units the site would encompass. For example, the
impervious surface area of a manufacturing plant might be charged the rate for 500 houses.

**Ecological Concerns**

Parallel to the municipality’s need to establish a fee-based stormwater management system is the need to address environmental issues created by stormwater runoff. While engineers calculate both the peak flow and the total runoff volume from properties during storms, traditional stormwater management accounted only for peak flow.

Producing hydrologic models and building hydrographs based on design storm scenarios has enabled communities to calculate the amount of water that needs to be detained upstream to prevent excessive runoff during peak flows. However, increases in total runoff volume, thermal pollution, stream channel destabilization, and reduction in stream base flow also need to be considered when evaluating the ecological impacts of stormwater runoff.

**New Approaches to Sustainability**

To reduce total runoff volume, many municipalities and business sites within them are developing novel approaches. One such approach that is rising in popularity is the “green roof.” Rather than presenting a vast impervious area for runoff, the roofs of some buildings are being landscaped with soil and plants. During storms, much of the water drains into the soil, rather than flowing off the roof. It nourishes the plants and creates an elevated garden and recreation area. The roof remains water tight while creating an ecosystem where plants can thrive. These roofs incorporate a waterproofing layer over the roof deck, drainage, a filter fabric, several inches of soil and the plants. Green roofs also can be created from thin mats or even trays set atop a waterproof base. Waterfalls and ponds can be incorporated into the most intensive designs.

Green roofs can transform once-damaging stormwaters into community assets. The water that does run off from these roofs is controlled and is
As little as one tenth of an inch of rain can cause a combined sewer to OVERFLOW.

cleaner than conventional runoff. The air around them is filtered, with plants absorbing carbon dioxide and the greenery lowers temperatures, reducing the heat-island effect in urban areas. In addition, green roofs keep the areas under them cooler in summer and warmer in winter, lowering energy costs. The roofs protect structural elements from wind, UV light and temperature fluctuations, significantly increasing the lifespan of the roof structure and dramatically reducing maintenance costs.

Another way the municipalities are turning stormwater into a more useful resource is by creating underground storage, whereby the runoff can be recycled as gray water. This water can be used for irrigation and cleaning, reducing the usage and cost of using potable water.

Homeowners concerned about sustainability have returned to using rain barrels to capture water that can be applied to household uses. Many are also creating rain gardens to capture runoff and grow beneficial and attractive plants. These gardens can receive water from downspouts that previously would have poured into parking lots, driveways or sidewalks or that may have caused sanitary sewer overflows because they were mistakenly connected to sanitary sewers.

**Smarter Strategies for Pavement**

Businesses are also becoming more informed about the way they use paving materials to manage stormwater. Pervious concrete pavement, which allows rainwater to flow through the surface to be absorbed by the ground, has not always proven to be sufficiently durable for high-traffic areas. Therefore, engineers are now designing parking lots differently. They are specifying conventional concrete or asphalt for heavily used driveways and internal roads but are using pervious pavement for parking spaces, which are subjected to far less wear. Additionally, systems have also been developed to capture the runoff that drains through the concrete. This capability produces an underground cistern with gray water that can be used for nourishing plants and exterior washing.

Yet another recent movement to manage stormwater is the “daylighting” of urban streams that run through culverts. When the weather is dry, culverts tend to collect pollutants in the discharges that they do receive, because flows are insufficient to dilute and wash them out. The result can be an undesirable concentration of contaminated sludge in and around the streams. In heavy rain, this sludge discharges from the culvert and contaminates surrounding areas. For example, as little as one tenth of an inch of rain can cause a combined sewer (sanitary and storm sewer) to overflow into its receiving stream, contaminating the environment.
Now, however, as redevelopment takes place in urban areas, urban streams are being diverted and day lighted incrementally to restore a natural habitat. Open streams maintain a healthier base flow, make the area safer for the public, increase biodiversity and raise property values by creating a water feature for residents of nearby communities. In the Northeast, the rails-to-trails phenomenon and environmental concerns are leading to the restoration of rivers that were once polluted by local industries, and the promotion of sustainability in stormwater management.

**Incentives to Turn Green**

Despite all these benefits of sustainable stormwater management, municipalities often have difficulty convincing local businesses and developers to adopt them. Recently, some communities have been offering incentives for going green with stormwater management. These communities offer manufacturers or the owners of shopping centers a credit against the stormwater utility rate if they take actions that control their total runoff volume, reducing their monthly fee. In Pennsylvania, Philadelphia has been at the forefront of offering incentives to those who use green technology to control peak and volume flow.

Increasingly, municipalities have realized that they would benefit by moving away from the compartmentalization of water resources, with separate bureaus managing water, sewage and stormwater. In some communities, like Jefferson County (Louisville), Kentucky, a single agency, the metropolitan sewer authority, manages potable water, sewerage and stormwater. Elsewhere, the South Florida Water Management System developed concurrent planning requirements for land developers that take a holistic approach to management of all water resources.

**The L.R. Kimball View**

L.R. Kimball believes the most important next step in Pennsylvania and many other states is for municipalities to create stormwater...
Management utilities. To obtain stormwater management grants under the Pennsylvania Infrastructure Investment Fund, utilities must have a revenue stream. By creating a watershed plan under the provisions of Act 167, municipalities gain a comprehensive inventory of stormwater problem areas to determine where to apply capital budgets. Building a revenue stream to address these areas is essential.

L.R. Kimball believes that individuals should continue to contact state legislators to argue for their support of reinstating Act 167 funding. These funds were authorized to create stormwater management plans and standards in communities across Pennsylvania. Many municipalities completed the first phase of this plan but now are unable to advance the project because the legislature has zeroed out the Act 167 allocation in the state budget.

L.R. Kimball believes that, in establishing stormwater as a utility, municipalities should incorporate project management disciplines, just as they would for development of any physical system. Often, hiring experienced consultants can help municipalities uncover and manage hidden costs and challenges. Leveraging project management expertise, water resources experts can help stormwater authorities to ensure that rates are set fairly and that the municipality is fully recovering its costs. These experts can also translate plans for future developments of subdivisions or commercial areas into projections for stormwater management requirements and potential fee revenue.

**Accomplishing Targeted Results for Stormwater Management Projects**

To carry out these analyses, L.R. Kimball seeks to gain a full understanding of the municipality’s requirements. Water resources experts work closely with the municipality to obtain an in-depth understanding of its needs. They interview personnel, conduct surveys, and/or observe to obtain comprehensive knowledge of the municipality’s operations, processes and technologies. In helping to deploy plans, L.R. Kimball maintains best practices to achieve smooth, seamless implementation. L.R. Kimball can recommend, help procure, implement and train staff on new technology that may be required for the fee-based system and can act as a systems integrator so that critical time is not lost during transitions.

Stormwater can be a valuable resource for communities when they apply the latest techniques to manage it. For six decades, L.R. Kimball has been advising municipalities and managing their water-related projects to implement effective stormwater management measures.

**Contact:**

If you would like to consult with L.R. Kimball water resources engineers, scientists, and project managers, please contact Tim Dean, (Water Resources Discipline Leader) with L.R. Kimball, at 814.472.7700, or tim.dean@lrkimball.com. We promise to deliver targeted results, expertly managed.
Highlights

• Comprehensive watershed approach to stormwater management

• Green roofs: transforming once-damaging stormwaters into community assets

• Best practices to achieve smooth, seamless implementation

• Stormwater: a valuable resource for communities

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