Volume 2

Chapter 21 Urban Runoff Management

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Chapter 21 *Urban Runoff Management*

Urban runoff management is a broad series of activities to manage both stormwater and dry-weather runoff. Dry weather runoff occurs when, for example, excess landscape irrigation water flows to the storm drain. Urban runoff management is linked to several other resource strategies including pollution prevention, land use management, watershed management, water use efficiency, recycled water, protecting recharge areas, and conjunctive management. Traditionally, urban runoff management was viewed as a response to flood control concerns resulting from the effects of urbanization. Concerns about the water quality impacts of urban runoff have led water agencies to look at watershed approaches to control runoff and provide other benefits.

Urban Runoff Management in California

The traditional approach to runoff management views urban runoff as a flood management problem where water needs to be conveyed as quickly as possible from urban areas to waterways to get rid of it. Urbanization alters flow pathways, water storage, pollutant levels, rates of evaporation, groundwater recharge and surface runoff, the timing and extent of flooding, the sediment yield of rivers, and the suitability and viability of aquatic habitats. The traditional approach has been successful at preventing flood damage, but has several disadvantages. In order to convey water quickly, natural waterways are often straightened and lined with concrete, resulting in a loss of habitat, a reduction in groundwater recharge from streams, and impacts to natural stream physical and biological processes. This collects pollutants and increases runoff volume and speeds its flow, resulting in pollution, stream bank erosion, and potentially flooding problems downstream. Because of the emphasis on removing the water quickly, the opportunity to use water for multiple benefits is reduced.

The watershed approach for urban runoff management tries to emulate and preserve the natural hydrologic cycle that is altered by urbanization. The watershed approach consists of a series of best management practices (BMPs) designed to reduce the pollutant load, volume, and flow rate of urban runoff reaching waterways. These BMPs may include requiring new facilities to capture, treat, and recharge groundwater with urban runoff, conducting public education campaigns for the

Box 21-1 Objectives of Urban Runoff Management

- Protection and restoration of surface waters by the minimization of pollutant loadings and negative impacts resulting from urbanization
- Protection of environmental quality and social well-being
- Protection of natural resources, e.g., wetlands and other important aquatic and terrestrial ecosystems
- Minimization of soil erosion and sedimentation problems
- Maintenance of the predevelopment hydrologic conditions
- Protection and augmentation of groundwater supplies
- Control and management of runoff to reduce or prevent flooding
- Management of aquatic and riparian resources for active and passive pollution control

proper use and disposal of household chemicals, and providing technical assistance and storm water pollution prevention training. Some areas advocate collecting rainfall from roofs into cisterns for later use. Methods for recharging groundwater with urban runoff include draining runoff from parking lots, driveways, and walkways into landscape areas with permeable soils, using drywells, and using permeable surfaces. These BMPs may include source control and pretreatment before infiltration. Infiltration enables the soil to naturally filter many of the pollutants found in runoff and reduces the volume and pollutant load of the remaining water when it reaches the outfall. The watershed approach will not prevent all urban runoff from entering waterways, so elements of the traditional conveyance and storage strategy will still be needed.

Urban runoff management has become more important and controversial over the last decade as municipal governments have been held increasingly responsible for nonpoint source pollutants washed into waterways from developed areas within their jurisdictions. Nonpoint source pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. Nonpoint source pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and potentially into groundwater. Nonpoint source pollution also occurs from non-storm event activities, such as movement by wind, flows from landscape irrigation, improper disposal of trash or yard waste, and leaky septic systems.

The 1987 amendments to the federal Clean Water Act directed the U.S. Environmental Protection Agency (USEPA) to establish a permitting system under the National Pollutant Discharge Elimination System (NPDES) to regulate nonpoint source pollution from certain urban areas in order to protect water quality. In California, the authority to regulate urban and stormwater runoff under the NPDES system has been delegated by USEPA to the State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs). The state of California is required under Clean Water Act (CWA) section 303(d) and federal regulations (40 CFR 130) to prepare a list of and set priorities for waterways requiring Total Maximum Daily Loads (TMDLs) because they do not meet water quality standards. The section 303(d) list was last revised in 2002. Federal regulations require the section 303(d) list to be updated every two years. TMDLs represent the total pollutant load a waterway can assimilate before the waterway's beneficial uses are impacted. Nonpoint source runoff is frequently a significant source of pollutants in a waterway's total pollutant loading.

Because municipal governments are responsible for controlling urban runoff from streets and other public facilities within their jurisdictions, they are required to obtain an NPDES permit and implement specific measures to reduce the amount of pollutants in urban runoff. Permits for discharge to listed waterways having a TMDL must be consistent with the load assignments in a TMDL. Under California law TMDLs include implementation plans for meeting water quality standards. The implementation plans allow for time to implement control strategies to meet water quality standards. Under the initial NPDES permits issued in the 1990s municipalities were required to establish land use and development guidelines for both new and existing development to reduce the discharge of pollutants into waterways. These guidelines are usually a series of BMPs as described above. It has become clear with continued beach closures and other pollution problems associated with urban runoff that more advanced measures will be required in some areas to comply with water quality regulations.

Box 21-2 Examples of Nonpoint Source Pollution

- Herbicides and insecticides from residential landscaped areas, golf courses, city parks, etc.
- Oil, grease, and heavy metals illegally/improperly disposed of or accumulated on parking lots, streets and highways from automobiles, trucks, and busses
- Sediment from improperly managed construction activities
- Litter and green wastes
- Bacteria and nutrients from excess fertilizers, improperly maintained septic systems, and wastes from pets and wildlife

Potential Benefits of Urban Runoff Management

The primary benefits from urban runoff management are to reduce nonpoint source water pollution and improve flood protection. Additional benefits may be to increase water supply through groundwater recharge in areas with suitable soil and geological conditions, and improve wildlife habitat, parks and open space. Groundwater recharge and stormwater retention sites can be designed to provide additional benefits to wildlife habitat, parks, and open space. Underground infiltration facilities can temporarily store runoff and release it gradually to the aquifer while allowing the unimpaired use of the surfaces above them. For instance, a school campus can solve its flooding problem and develop a new sports field at the same time. These may provide secondary benefits to the local economy by creating more desirable communities in which to live. By keeping runoff onsite, storm drain systems can be downsized, reducing installation and maintenance costs of such systems. A watershed planning approach to manage urban runoff allows communities to pool economic resources and obtain broader benefits to water supply, flood control, water quality, open space, and the environment.

Statewide information on the benefits of increased management of urban runoff is not available, although examples from local efforts exist. The Fresno-Clovis metropolitan area has built an extensive network of storm water retention basins that not only recharges more than 70 percent of the annual storm water runoff (17,000 acre-feet) and removes most conventional storm water pollutants, but also recharges excess Sierra snow melt during the late spring and summer (27,000 acre-feet). Los Angeles County recharges an average 210,000 acre-feet storm runoff a year, which reduces the need for expensive imported water. Agencies in the Santa Ana Watershed recharge about 78,000 acre-feet of local storm runoff a year. The Los Angeles and San Gabriel Watershed Council has estimated that if 80 percent of the rainfall that falls on just a quarter of the urban area within the watershed (15 percent of the total watershed) was captured and reused, total runoff would be reduced by about 30 percent. That translates into a new supply of 132,000 acre-feet of water per year or enough to supply 800,000 people for a year.

Santa Monica is an example of a municipality that is taking a watershed approach to managing urban runoff. Santa Monica's primary goal is to treat and reuse all urban runoff. This turns a perceived waste product into a local water resource. Not only is water quality achieved, but a new water resource is harvested. This decreases the dependence on imported water, leaving this water supply in distant watersheds for uses there, especially in the case of Southern California where most of its water comes from Northern California rivers, Eastern Sierra snow melt and Colorado River. If necessary, because of high runoff, the city's secondary goal is to release only treated runoff into waterways. Both goals improve water quality of the Santa Monica Bay. The city's goals promote low-impact development and smart growth, two similar approaches to land use, in which urbanization works with nature and the hydrologic cycle.

Box 21-3 Five Year Implementation Plan for Nonpoint Source Pollution Program

The SWRCB and the California Coastal Commission in coordination with 26 other State agencies are finalizing the Five Year Implementation Plan for the Nonpoint Source Pollution Program, which includes management of urban runoff. The Implementation Plan recommends the following State actions:

- Promote coordination of interagency programs that protect water quality from urban runoff pollution.
- Reduce the potential for contamination of surface and groundwater that results from uncontrolled or poorly-controlled urban runoff practices.
- Develop tools to assess the effectiveness of urban water pollution programs.
- Increase the availability of regulatory and guidance documents and/or instructional workshops to demonstrate effective urban runoff pollution control programs and policies.
- Reduce the number of uncontrolled urban NPS pollution sources by increasing the number of municipalities, industries and construction sites that utilize NPS management measures and fit under the permitted State Storm Water Program.
- Develop and implement watershed-based plans, including TMDLs and Storm Water Pollution Prevention Plans (SWPPPs), in order to identify and address impacts from urban land use.

Potential Costs of Urban Runoff Management

Information is not available on statewide costs to implement urban runoff management activities. However, the State Water Resources Control Board has recently contracted with the Office of Water Programs, California State University, Sacramento, to survey six communities to estimate the costs of complying with their NPDES storm water permits. While this may address the cost for a municipality to comply with an NPDES permit, it may not be the most applicable for looking at watershed programs seeking multiple benefits.

An example from the city of Santa Monica illustrates the costs of managing urban runoff. The city has a stormwater utility fee that generates about $1.2 million annually, and has been in place since 1995. These funds are used for various programs to reduce or treat runoff. These funds go to the Urban Runoff Management Coordinator, the maintenance of the storm drain system, and help support other city staff that support runoff work. Additional funds are spent by other divisions to support runoff management, such as street sweeping, some trash collection, sidewalk cleaning, and purchase and maintenance of equipment. The city has also received five grants totaling more than $3.5 million for the installation of structural BMP systems, all of which will require long-term maintenance and monitoring by the city. The culmination of the city's program is the $12 million Santa Monica Urban Runoff Recycling Facility (SMURRF), a joint project of the cities of Santa Monica and Los Angeles. The SMURFF project is a state-of-the-art facility that treats dry weather runoff water before it reaches Santa Monica Bay. Up to 500,000 gallons per day of urban runoff generated in parts of the cities of Santa Monica and Los Angeles can be treated by conventional and advanced treatment systems at the SMURRF.

Major Issues

Lack of Integration with Other Resource Management Strategies

Land use planning is not conducted on a watershed-wide basis. Many agencies spend millions of dollars annually addressing urban runoff problems with very little interagency coordination even though downstream cities can be impacted by activities upstream. Solutions to managing urban runoff are closely tied to many interrelated resource management strategies including land use planning, watershed planning, water use efficiency, recycled water, protecting recharge areas, and conjunctive management.

Lack of Funding

The two main aspects of implementing urban runoff management measures are source control, including education, and structural controls. In highly urbanized areas, major costs include purchasing land for facilities and constructing treatment facilities. Local municipalities have limited ability to pay for retrofitting existing developed areas within existing budgets and there is a concern by some about the economic impacts of raising taxes and requiring residents and businesses to pay for retrofitting existing development.

Effects of Urban Runoff on Groundwater Quality

The movement of pollutants in urban runoff is a concern. Urban runoff contains chemical constituents and pathogenic indicator organisms that could impair water quality. The actual threat to groundwater quality from recharging urban runoff is dependent on several factors, including soil type, source control, pre-treatment, solubility of pollutants, maintenance of recharge basins, and depth to groundwater. Studies by USEPA (USEPA, 1983) and the U.S. Geological Survey (USGS, 1995) indicate that all monitored pollutants stayed within the top 16 centimeters of the soil in the recharge basins.

Nuisance Problems

Presence of standing water in recharge basins can lead to vector problems, such as mosquitoes and increasing concern related to the transmission of West Nile Virus.

Protecting Recharge Areas

Local land use plans often do not recognize and protect groundwater recharge and discharge areas. Areas with soil and geologic conditions that allow groundwater recharge should be protected where appropriate. Refer to the Recharge Areas Protection, Chapter 15 in Volume 2, for additional information.

Understanding

The general public and elected officials do not always understand the link between land use management and other resource management strategies and how home and business practices can affect nonpoint source pollution in waterways.

Recommendations to Promote Additional Urban Runoff Management

State

1. State agencies should coordinate their efforts to decide how the Five Year Implementation Plan for Nonpoint Source Pollution Program should be integrated into their workplans.

2. Encourage public outreach and education about the benefits and concerns related to funding and implementation of urban runoff measures.
3. Provide leadership in the integration of water management activities by assisting, guiding, and modeling watershed and urban runoff projects.
4. Work with local government agencies to evaluate and develop ways to improve existing codes and ordinances that currently stand as a barrier to implementing and funding urban runoff management.
5. Provide funding and develop legislation to support development of urban runoff and watershed management plans, enable local agencies and organizations to pursue joint venture, multipurpose projects, and collect information on regional urban runoff management efforts.
6. Assist agencies with developing recharge programs with appropriate measures to protect human health, the environment, and groundwater quality.
7. Work with federal policy makers and industry to create research and development incentives and to develop standards to reduce nonpoint source pollution from transportation related sources including lubricant systems, cooling systems, brake systems, tires, and coatings.

Local Agencies and Governments

8. Local agencies and governments should design recharge basins to minimize physical, chemical, or biological clogging, periodically excavate recharge basins when needed to maintain infiltration capacity, develop a groundwater management plan with objectives for protecting both the available quantity and quality of groundwater, and cooperate with vector control agencies to ensure the proper mosquito control mechanisms and maintenance practices are being followed.
9. When developing Urban Runoff Management Plans, local agencies and governments should:
   - Understand how land use affects urban runoff.
   - Look for opportunities to require features that con serve, clean up, and reduce urban runoff in new development, or in more established areas, when redevelopment is proposed.
   - Be aware of technological advances in products and programs.
   - Learn about urban runoff and watershed ordinances already in place. For example, The city of Santa Monica and the Fresno Metropolitan Flood Control District already have extensive urban runoff management programs in place.
   - Integrate urban runoff management with other resource strategies including land use planning, watershed planning, water use efficiency, recycled water, protecting recharge areas, and conjunctive management, and coordinate both within and across municipal boundaries.

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