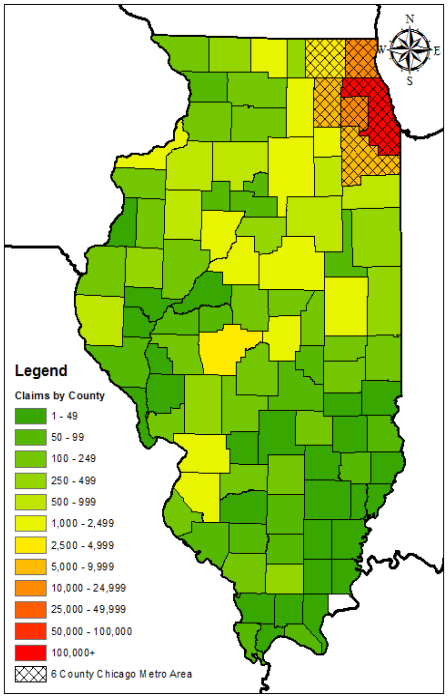
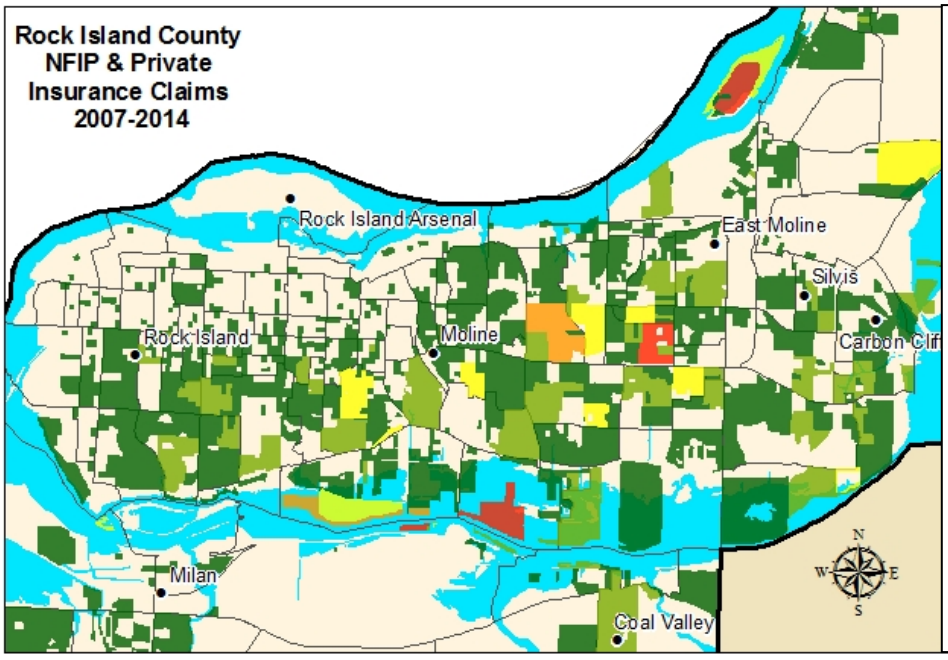
Report for the Urban Flooding Awareness Act
State of Illinois, Illinois Department of Natural Resources
June 2015

Executive Summary

The Illinois General Assembly under the *Urban Flooding Awareness Act* (effective August 3, 2014) tasked the Illinois Department of Natural Resources (IDNR) to prepare a report on the extent, cost, prevalence, and policies related to urban flooding in Illinois and to identify resources and technology that may lead to mitigation of the impact of urban flooding. IDNR has prepared this report in collaboration with the other state agencies identified in the Act. The *Urban Flooding Awareness Act* specifically identifies nine topics to be addressed in the report. These topics fall under three themes: Past, Current and Future flooding; Effectiveness of Projects, Programs and Policies; and Strategies for Reducing Urban Flood Damages. Each of the topics is explored in the main body of the report, with more detailed analyses provided in the appendices.



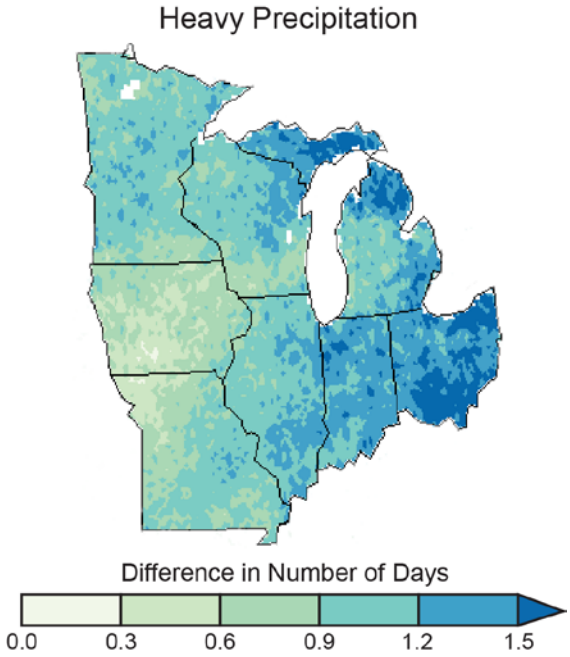
Flooding in urban areas has received increasing attention in the last decade, with at least $2.319 billion in documented damages between 2007 and 2014, of which $1,240 billion were private claims that typically represent basement flooding and sewer backup. **Although the largest percentage of insurance claims is from northeastern Illinois, urban flood damages and problems occur statewide in urban areas.** Urban flooding as defined by the Act is "The inundation of property in a built environment, particularly in more densely populated areas, caused by rainfall overwhelming the capacity of drainage systems, such as storm sewers. 'Urban flooding' does not include flooding in undeveloped or agricultural areas." **Over 90% of urban flooding damage claims from 2007 to 2014 were outside the mapped floodplain,** which is roughly proportional to the developed floodplains within Illinois urban areas.



Between 2007 and 2014 there have been a total of 1972 urban flood damage claims within Rock Island County. Roughly three-fourths (71.3%) of the claims occurred outside the mapped floodplain.

There are numerous contributing factors to urban flooding, and in any location the causes may be unique. Urban flooding is most common in older sections of communities where original storm sewers were not designed to present-day standards; urbanization has increased runoff, and climate is trending to more frequent and intense storm events. In counties which have been granted countywide authority to establish funded stormwater management programs, progress is being made to reduce urban flooding, but much remains to be done. Most counties do not have authority to establish programs to manage the effects of urbanization. **Communities may have the authority to impose design standards and ordinances but often do not have the legal authority to establish a dedicated funding stream,** making it difficult to maintain and improve storm sewer systems when these repair projects must compete for general funding support.

Urban flooding is expected to increase unless action is taken. There are a number of factors contributing to increased precipitation and more heavy rain events in recent decades, and several lines of evidence suggest that the current patterns will continue in the future. Technology provides numerous tools to analyze data and develop strategies to deal with existing and future urban flooding. However, current basic data collection and analyses are inadequate, and efforts should be extended to ensure Illinois is collecting information needed to guide programs and policies to reduce flood damages. There are many options to mitigate urban flood damages, such as green and gray infrastructure, and increasing open areas in areas of redevelopment. **Storm sewer infrastructure is the underpinning of urban drainage, and action is needed to update aging, undersized systems.**



Possible increases in the heaviest 2-percent storms from the 1971-2000 base period to the period 2041-2070 based on the A2 high emission scenario. Source NCA (2014).

Changes to infrastructure and the urban landscape will take years; however, communities and individuals can take action now to reduce risk and damages. Programs such as the Community Rating System provide guidance for higher standards and community actions to reduce risk. Individuals can purchase sewer and basement insurance as riders to homeowners insurance and flood insurance through the National Flood Insurance Program. Education and training for communities, insurance agents and property owners is critical to understanding risks and how to mitigate and correctly insure those at risk. Sustained outreach is needed for better informed stakeholders.

The state can provide leadership for communities. The state can develop tools, provide technical assistance and raise awareness. The state can incentivize communities through a variety of mechanisms including access to grants and revolving funds for communities that take responsibility for addressing flooding issues. Most importantly, the state can assist communities by aligning the authorities for justification of state capital projects. These are currently inconsistent, making it more

difficult to seek funding from one state agency versus another for similar flood damage reduction purposes.

The responsibility for urban flooding lies at all levels, from state government to individual property owners, and a tiered approach is required for all aspects of stormwater management. The research presented in this report has led to 33 recommendations that have been grouped by four levels of responsibility **(see Urban Flooding Awareness Act Report Recommendations, page 78)**, some of which require legislative action, executive authority, state agency engagement, community action, and action by an informed public.

As recommended in this report, the Illinois Department of Natural Resources is already working with other key state agencies to: develop a draft state model stormwater ordinance for local communities, determine how best to appropriate expenditures of state revolving funds for stormwater management measures; and coordinate federal and state mitigation grant programs and projects potentially addressing urban flood measures through the Illinois Mitigation Advisory Group. **The remaining recommendations in the report address the need for authorities, education and awareness, local regulations, collaboration between government agencies and communities, and funding for programs and data collection efforts to reduce future flood damage costs in the State of Illinois.**

Harlem & Irving Park, April 2013, (WGNTV)

Lake Zurich basement, June 2013 (Chicago Tribune, Dan Waters)

Chapter 9: Strategies for Minimizing Damage to Property from Urban Flooding

This chapter provides information on strategies for minimizing damage to property from urban flooding, with a focus on rapid, low-cost approaches, such as non-structural and natural infrastructure, and methods for financing them.

The three most common types of urban flood damage reported in the survey of Illinois community officials (see Appendix B) are basement water seepage, basement sewer backup and water coming in through basement windows. Urban flooding is known to cause numerous public health and safety concerns, such as mold and sewage contamination in homes, and limited emergency vehicle access on city streets. Selecting appropriate strategies to reduce urban flood damages requires knowledge of the cause of the urban flooding.

Key Findings

- The three most common types of urban flood damage reported in the survey of Illinois community officials (see Appendix B) are basement water seepage, basement sewer backup and water coming in through basement windows.
- Strategies to mitigate the problems vary based on the local conditions. Thus, effective mitigation generally is implemented at the community, neighborhood, and/or property level.
- There are a number of flood damage reduction strategies that can be used to reduce damages experienced by property owners, including many that are low cost. Identification of the source of flooding is fundamental to successfully mitigating future damages.
- Education and outreach on identification of root causes is necessary to empower homeowners to solve flooding issues that can only be addressed on their property.
- Neither green nor gray infrastructure should be considered a single solution to urban flooding. Both complement each other while being subject to their own limitations.
- Development of a comprehensive stormwater management plan is a key component in reducing urban flood damage at a neighborhood or community scale.
- Illinois' Residential Real Property Disclosure Act provides a comprehensive list of material defects that must be disclosed when property is sold.
- A home rule municipality stormwater utility program assesses a fee to all those who benefit from the stormwater infrastructure and services provided. Dedicated stormwater program fees provide a stable, dedicated source of funding.

Green and Gray Infrastructure

Strategies to reduce urban flooding are often described as either gray or green infrastructure. Gray infrastructure is used to describe traditional engineering methods including storm sewers and detention ponds—built systems employed to collect runoff and discharge it quickly through the system. Green infrastructure is used to describe methods that utilize the natural functions of soil infiltration, evaporation and transpiration, emphasizing the reduction of rainfall runoff where it is produced. Green infrastructure techniques common in Illinois include rain gardens, downspout disconnection, bioswales, stormwater trees, permeable pavement, and green roofs.

Typical stormwater management systems are based on traditional gray infrastructure solutions, such as road gutters, storm sewers, and retention ponds. Most urban communities have design requirements for these systems (see Chapters 4 and 5). Stormwater infrastructure designed to modern standards most often performs acceptably for many years. Capital projects for replacement of gray infrastructure are costly and, due to funding constraints, many communities cannot prioritize addressing appropriate maintenance needs of these systems until they fail.

> "The City is working hard to improve our aging infrastructure, but there are 4,400 miles of sewer main in Chicago, and mere replacement is not the answer. The key is to keep as much water out of the sewer as possible during the heaviest rains."
>
> City of Chicago Basement Flooding Partnership website

Green infrastructure has several advantages over traditional gray infrastructure as well as its own limitations. Prompted by the Clean Water Act and the regulation of post-construction stormwater quality, communities are already looking to green infrastructure to achieve multi-objective benefits. In 2009, the Illinois Environmental Protection Agency (IEPA) submitted several recommendations concerning green infrastructure as required by Public Act 96-26, and reported that green infrastructure is effective in achieving stormwater quality goals as well as being cost-effective when compared to other methods (Jaffee, 2009). Recent green infrastructure pilot projects completed across the country continue to support the cost saving benefits of using green infrastructure (Copeland, 2014). Most green infrastructure projects will have some impact on reducing stormwater runoff and the result can be significant in some cases. Several green infrastructure resources are available via the IEPA. The primary limitation of green infrastructure for urban flood reduction is the dependence on soil conditions. Once the soil is saturated, the excess runoff may still need to be controlled by gray infrastructure to avoid flood damages. Successful use of green infrastructure relies on several site-specific parameters including drainage area, groundwater table levels, soil type, ground slope and performance of maintenance. Green infrastructure is often less costly, but when used in areas that are already urbanized, successful green infrastructure projects may still require engineering design. Green infrastructure will be most successful addressing urban flooding caused by more frequent lower volume rainfall events and should be part of a comprehensive plan to reduce volume entering over-taxed drainage systems (Schueler et al, 2007).

Neither green nor gray infrastructure should be considered a single solution to urban flooding. Gray infrastructure is costly and does not typically address the reduction of stormwater runoff volume. Green

infrastructure has the ability to reduce runoff volume but due to the influence of location-specific parameters, its potential to reduce urban flooding damages is difficult to evaluate on a large scale.

Single Property Flood Reduction Strategies

There are a number of flood damage reduction strategies that can be used by property owners, including many that are low cost. Identification of the source of flooding is fundamental to successfully mitigating future damages. Educating property owners about their flood risk is essential to correctly address property-specific flooding problems. Coordination with the local community officials is often required to identify and confirm the most appropriate flood reduction strategy.

Common Causes and Mitigation Options

A particular structure may experience "flooding" when storm runoff enters a structure as overland flow, infiltration, or sewer backup. Figure 9.1 identifies several of the typical ways water can enter a basement. Table 9.1 lists mitigation measures.

Table 9.1: Summary of basement flood risk reduction options to address damages on site.

Mitigation Options	Cause of Flooding			Damage reduction	Estimated Cost
	Overland	Infiltration	Sewer backup		
Structural Inspection					$250-$800 each
Raise utilities and other valuable items				x	
Insurance				x	Based on coverage
Gutter maintenance	o	x	o		
Downspout disconnection			x		
Site grading, downspout extension	o	x			
Rain gardens	o				$3-40 per square foot
Permeable/porous pavement	x				$2-$10 per square foot
Exterior drain tile		x			$185 per foot
Interior drain tile		x	x		$40-50 per foot
Seal wall and floor cracks		x	o		$300-$600 each
Sump pump with check valve	x	x	x		$400-$1,000 each
Sewer backup valves			x		$3,000-$5,000
Overhead sewer installation			x		$2,000-$10,000
x - primary reduction o - secondary reduction					

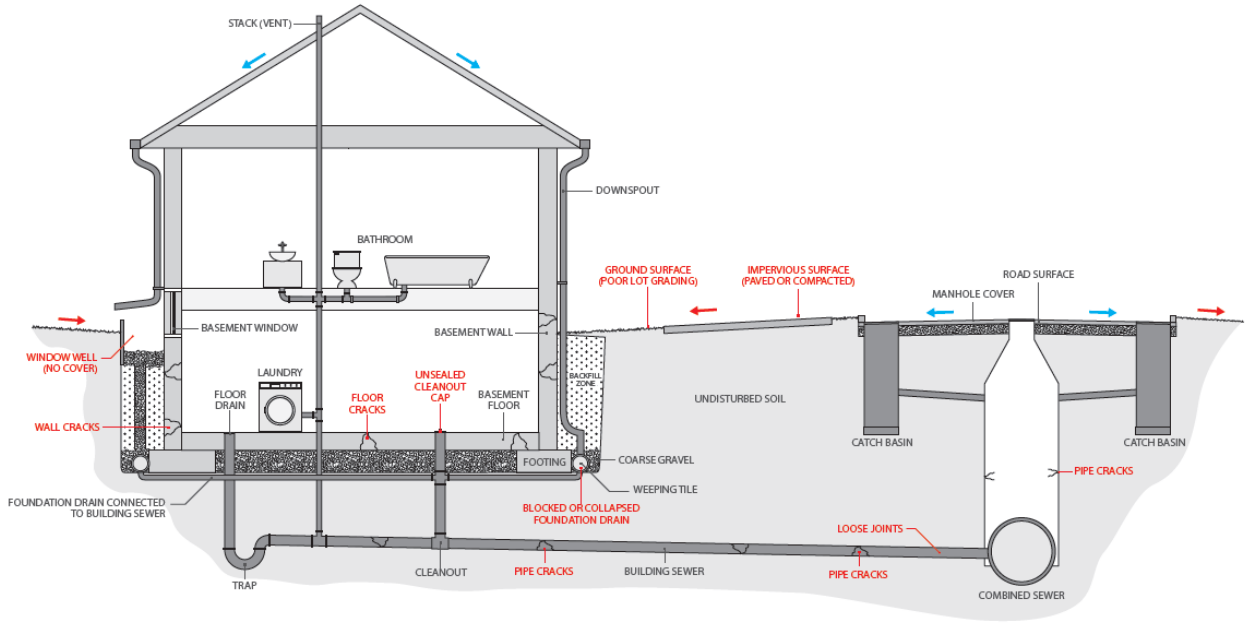


Figure 9.1: Types of urban flooding that can affect a residence. (Credit: Modified from Institute for Catastrophic Loss Reduction, 2009)

Educating Property Owners

Homeowners are often not prepared to evaluate the root cause of flooding and take action to mitigate. While several resources are available online that provide information on identification of problems and appropriate strategies for prevention and maintenance that may assist homeowners in evaluating their flood risk, such as the "Guide to Flood Protection in Northeastern Illinois" (IAFSM, 2006), additional tools and information specific to the local area are needed to reduce flood losses. Education and outreach on identification of root causes is necessary to empower homeowners to solve flooding issues that can only be addressed on their property. Some communities, such as the City of Wheaton, offer drainage reviews for their property owners free of charge, but many communities do not have the resources for such a program. "RainReady Home" (CNT, 2015) is a Center for Neighborhood Technology program that addresses this missing link and, upon completion of the preliminary phase, should be evaluated to document best practices for community response and outreach to urban flooding.

Limitations and Consequences to Reporting Flooding

Evaluation of flood risk should begin at the time of purchase of a property and continue over the ownership of the property. However, flood disclosure laws have gaps, and there is not always a mechanism to disseminate certain historical information. Unlike the Flood Insurance Rate Maps produced by FEMA for riverine flooding, there is not a similar risk evaluation tool for urban flooding issues.

The State of Illinois requires disclosure at sale of the seller's knowledge of material defects to the property. Basement flood disclosure to renters is not explicitly required but is implied in the

requirement to disclose any latent basement defect that would make it unfit for occupancy. Illinois' Residential Real Property Disclosure Act provides a comprehensive list of material defects that must be disclosed when property is sold. However, there is hesitancy on the part of property owners to report or disclose flooding issues typically due to a concern that it would lessen the property value. Renters are often uninformed of their risk. There are multiple consequences of not reporting flood issues: new owners do not have the information to mitigate potential flooding and may be caught unaware; renters may experience unexpected losses; communities do not have complete information to develop plans. The issue of communities disclosing full knowledge of historical or studied risk is controversial and has legal repercussions on both sides of the issue.

(765 ILCS 77/35The Residential Real Property Disclosure Act Sec. 35. Disclosure Report Form Excerpts

2. I am aware of flooding or recurring leakage problems in the crawl space or basement.
3. I am aware that the property is located in a flood plain or that I currently have flood hazard insurance on the property.
4. I am aware of material defects in the basement or foundation (including cracks and bulges).
8. I am aware of material defects in the plumbing system (includes such things as water heater, sump pump, water treatment system, sprinkler system, and swimming pool).

Community Level Flood Reduction Strategies

Other causes of urban flood damages must be mitigated at a neighborhood scale with assistance from the community. At this scale, urban flooding is the result of inadequate storm sewer maintenance or overland drainage patterns, and the community is in the best position to implement reduction strategies.

Solving community-level flooding issues can be achieved with some of the same methods, including runoff volume reduction and drainage system maintenance, used for private property but on a larger scale within the context of a comprehensive plan. Successful strategies for communities addressed here are not focused on a specific engineering analysis, which must be determined locally, but rather provide a framework to support local solutions to urban flooding. These strategies include planning, regulation, public-private partnerships and financing. Development of a comprehensive stormwater management plan is a key component in reducing urban flood damage at a neighborhood or community scale, just as it is critical for utilizing green infrastructure and addressing water quality issues (Kramer, 2014; American Rivers et al., 2012). Examples of successful community-based programs at the county level are provided in Chapter 4. These examples demonstrate the success of countywide stormwater authority and programs.

Communities can support sustainable growth economically with municipal regulations that incorporate the stormwater management goal of minimizing runoff volume and thereby reducing urban flooding. Communities should plan for flood routing and prioritize protecting areas of open space with high infiltration and runoff reduction value. The largest communities in Illinois already have stormwater ordinances regulating new development, but many of these could be updated to incorporate more sustainable, low impact development practices and to encourage green infrastructure methods.

Examples of low impact development regulations to address urban flooding issues are listed below.

- Incorporation of green infrastructure practices into stormwater regulations for development
- Maximum parking space requirements rather than minimum parking space requirements; reduce minimum road width to reduce impervious area
- Increase setbacks, increase landscaping requirements, add maximum lot coverage
- Requirement of holding first inch of rainfall
- Encourage re-development rather than new development

Communities should review local regulations to ensure current requirements are not limiting stormwater infiltration and green infrastructure practices. The Center for Watershed Protection published a Code and Ordinance Worksheet to evaluate how supportive a community's regulations are toward sustainable development. The adoption of International building codes (I-codes) assists communities by ensuring structures meet NFIP requirements through the flood provisions incorporated in the code, and providing consistent regulations.

In addition to regulation of new development, there is a need to address stormwater solutions in urban areas that are being redeveloped. Redevelopment can create more urban flooding if an appropriate plan is not in place to use the opportunity to reduce flooding. The Watershed Management Ordinance adopted in Cook County and the DuPage County Stormwater Ordinance requires runoff reduction in redevelopment areas. Additional local regulations can be enacted to address existing plumbing cross connections that direct stormwater into sanitary sewer systems with required inspection prior to closing of a home sale or building permit. However, often regulations do not utilize the opportunity to address urban flooding issues during redevelopment.

In some urban flood areas, public-private partnerships offer an opportunity to address historical flooding areas with solutions on private property. Community cost sharing programs encourage private property owners to implement runoff reduction measures that benefit the property owner and the neighborhood or "sewer-shed." Cost share programs are often used to address limited capacity sewer systems that easily become overwhelmed and back up into basements. These programs have been successful in reducing urban flood damages in communities such as Niles, Northbrook and Wheaton, which offer 50% grant funding to their residents up to $3,000 to $5,000. These programs benefit home owners and are often less expensive for the community than a larger capital improvement project. Program details from the City of Ottawa and the City of Bloomington have been included in Appendix J. The City of Chicago Basement Flooding Partnership (BFP) is a public private partnership that does not require financial contribution from residents and has a large focus on outreach and education.

Flood Routing of Excess Storm Runoff

Flood Route: "A designated strip or piece of land that will receive excess surface runoff not accommodated by storm sewers or other drainage facilities to provide conveyance through developed areas so as to minimize adverse effects of flooding. A flood route shall be provided through the proposed development. The flood route shall be designed for the runoff expected from a 100 year storm frequency in post development conditions or pre development conditions, whichever generates higher flow. Flood Routes shall be located in either public right-of-way, or a dedicated public drainage easement of sufficient width to contain and maintain the channel."
- City of Bloomington flood route requirement for new development

Financing Options

To combat urban flooding and support education and outreach to property owners experiencing flooding, a community must have funding to address local urban flooding issues. While some communities have a dedicated source of funding for stormwater management, many Illinois communities finance stormwater management initiatives out of general revenues at a project level without a consistent source of funding (Appendix B and Appendix C). USEPA recommendations for financing the increasing cost of stormwater management include:

- service fees (often stormwater utilities)
- property taxes/general funds, sales tax,
- special assessment districts,
- system development charges,
- municipal bonds and state grants, and
- low interest loans. (USEPA, 2009).

Table 9.2: Communities with utility fee assessments

Community	Fee Assessment	Year
Aurora	$3.45	1998
Bloomington	$4.35	2004
Champaign	$5.24	2012
Decatur	$3.67	2014
Downers Grove	$8.40	2012
East Moline	$2.61	2009
Freeport	$4.00	
Highland Park	$4.50	
Hoffman Estates	$2.00	2014
Moline	$3.75	2000
Morton	$4.74	2005
Normal	$4.60	2006
Northbrook	$9.00	
Palatine	$5.00	
Rantoul	$3.43	2001
Richton Park	$5.63	
Rock Island	$3.95	2002
Rolling Meadows	$3.36	2001
Tinley Park	$1.68	1983
Urbana	$4.75	2013
Winnetka	$29.67	2014

Consistent funding at an appropriate level enables communities to create stormwater management positions dedicated to comprehensive planning and education and outreach to accomplish urban flood risk reduction.

In recent years, there have been increases in the number of communities enacting stormwater utilities. Illinois still has fewer stormwater utilities than many neighboring Midwestern states (Campbell, 2013). Table 9.2 lists 21 communities with utility fee assessments.

Home-rule and non-home rule communities in Illinois have established stormwater utility programs. Article VIII, Section 6 of the Illinois Constitution established home-rule communities and enables implementation of stormwater fees. Home-rule communities have a more direct path to establishing stormwater utility programs, but non-home rule communities have set up stormwater utilities though they have not yet been challenged. The Illinois Municipal Code allows communities to operate utilities (CMAP, 2013), and townships also have the ability to create a stormwater program and assess a user fee per Public Works Statutes, Article 205 of the Township Code in the Illinois Compiled Statutes

(60 ILCS) (Tri-County Regional Planning Commission, 2013). A Tri-State stormwater utility feasibility study determined that, per 55 ILCS 5/5-1062.3, DuPage and Peoria Counties are able to create stormwater programs and assess fees only if approved by a voter referendum (TCRPC, 2013). The remaining counties in Illinois are currently more limited as the Public Works Statute does not include separate storm sewers.

The USEPA currently provides funds to the State of Illinois for the Clean Water State Revolving Fund, which provides low interest loans for projects that assist with meeting the Clean Water Act goals and better the quality of the watershed (USEPA, 1999). Borrowers include municipalities, communities, businesses, homeowners, and not-for-profit organizations.

While many projects reducing stormwater runoff may already meet the requirements for loans under the Water Pollution Control Loan Program, recent federal legislation expands authority to finance stormwater projects. These new authorities outlined in the Water Resources Reform and Development Act (WRRDA) of 2014 have not yet been adopted by the State of Illinois. Collaboration is required between the Illinois Department of Natural Resources and Illinois Environmental Protection Agency to appropriately expend portions of the state revolving fund for implementation of stormwater management measures.

Water Resources Reform and Development Act of 2014

Title V: Water Infrastructure Financing - Subtitle A: State Water Pollution Control Revolving Funds - (Sec. 5001) Amends the Federal Water Pollution Control Act (commonly known as the Clean Water Act [CWA]) to grant the EPA Administrator general authority to make capitalization grants to states to establish a water pollution control revolving fund to accomplish the objectives, goals, and policies of such Act.

Recommendations

1. The authority to generate revenue from fees, to plan, implement and maintain stormwater management/drainage programs/facilities should be granted to all County Stormwater Planning and Management Agencies (55 ILCS 5/5-1062), counties (55 ILCS 5/Div. 5-15) and municipalities regardless of home rule status.
2. Stormwater Planning and Management authority should be granted to all Illinois counties to adopt countywide stormwater ordinances, projects and programs.
3. The State should provide an annual funding stream for Illinois Department of Natural Resources to buy out both floodplain and urban flood prone repetitive flood loss properties statewide to reduce flood damages and create open space parcels, with deed restriction in perpetuity. The State should provide grants or revolving loan opportunities to communities to support local cost sharing programs for residents impacted by urban flooding for the implementation of mitigation activities.

4. The State should provide grants or revolving loan opportunities to communities to support implementation of local cost sharing mitigation programs for residents impacted by urban flooding, to evaluate stormwater system capacity and flood risk, and to encourage stormwater management planning.
5. Communities should investigate existing property evaluation programs to help homeowners analyze their homes for urban flooding potential and to identify flood damage reduction actions.
6. Communities should consider adoption of ordinances to address drainage for below-grade construction, such as requiring sewers to exit structures within 2 to 3 feet of the finished exterior grade of buildings. Adoption of International Building Code Sections R405 and R406 for foundation drainage and waterproofing should also be considered.
7. The Illinois Department of Natural Resources and Illinois State Water Survey should develop a state model local stormwater ordinance based on concepts in the report which can be used as a template by counties and local communities. The following should be included along with other actions to address urban drainage issues:
    a. Incorporate green infrastructure into municipal and county development regulations by modifying regulations that restrict use of green infrastructure and add regulations to encourage use of green infrastructure in capital improvement projects when possible.
    b. Stormwater infiltration, evapotranspiration and storage should be incorporated into new development and redevelopment wherever possible.
    c. Developers and property owners should be incentivized to dedicate property for increased open space in developing areas, and current open space should be protected to allow for evapotranspiration, infiltration and stormwater storage.
    d. Require a licensed plumber to inspect for sump pump and downspout connections to sanitary sewers when houses are sold.
8. The Illinois Department of Natural Resources and Illinois Environmental Protection Agency should collaborate to appropriately expend portions of the state revolving fund for implementation of stormwater management measures.
9. The State of Illinois should incorporate green infrastructure options in state funded capital improvement projects when practical.