City of Berwyn, IL

Stormwater Management Plan

July 2018

City of Berwyn, IL
Stormwater Management Plan

Photo courtesy of Center for Neighborhood Technology

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1.0 Introduction

1.1 Stormwater Background

Like many communities in suburban Chicago, Berwyn is an older urban community that was originally developed with a combined sewer system (as opposed to separate stormwater and sanitary sewage systems that exist in newer communities). In the combined system, raw sewage and stormwater runoff are combined and carried through the local pipe system to interceptors and, ultimately, a treatment plant. When the volume of water exceeds the pipe capacity, as typically seen in significant rain events, the combined stormwater runoff and raw sewage can back up into basements, street drains, and adjacent waterways. For example, the storms of April 2013 caused widespread flooding in Berwyn, including backups into many homes. In light of climate change, experts project an increase in the number and frequency of short and intense rain events in the future, which would strain the City's combined sewer system.

The City of Berwyn has no natural waterways and handles stormwater with its combined sewer system. The City has 100 miles of combined sewer mains ranging from 8 inches to 7.5 feet in diameter. Sewage and wastewater is generated inside homes and businesses through sinks, toilets, dishwashers, washing machines, etc. The stormwater enters the combined sewer system from yards, streets, parking lots, and exterior drains. Because of this dual duty, combined sewers are easily overwhelmed in wet weather conditions and can cause basement flooding. The combined sewer and sanitary systems discharge into Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) sewer lines, which are much larger and commonly referred to as interceptors. In Berwyn there are five interceptor sewer lines owned and maintained by MWRDGC. The combined sewer system conveys both sanitary sewage and stormwater to the MWRDGC interceptors in Berwyn and eventually to the MWRDGC Stickney Water Reclamation Plant.

The combined sewer system in Berwyn is tributary to the MWRDGC interceptors and Tunnel and Reservoir Plan (TARP). Berwyn is at the downstream end of the MWRDGC interceptor system. Chicago, Oak Park, Forest Park, River Forest, and Elmwood Park are all contributors to this system upstream of Berwyn. The ultimate receiving point for TARP is the McCook Reservoir where sewer overflow is then pumped and treated at the Stickney Water Reclamation Plant. Stage 1 of the McCook Reservoir has been completed and provides 3.5 billion gallons of storage; Stage 2 will be complete in 2029 and will provide an additional 6.5 billion gallons of storage.

While the added capacity to the TARP system will benefit some, the majority of combined sewer-related flooding in the City is related to limited capacity in the sewer system upstream of the outfalls to TARP.[1]

1.2 Flooding History

Flooding in Berwyn is generally caused by limited sewer capacity, lack of detention facilities, high groundwater levels resulting from storm events, and inadequate overland flow routes. Except for very special cases, sewers in general are not intended to convey large storm events greater than the 10-year event. This was true both in the past as well as with modern sewer designs used by engineers today.

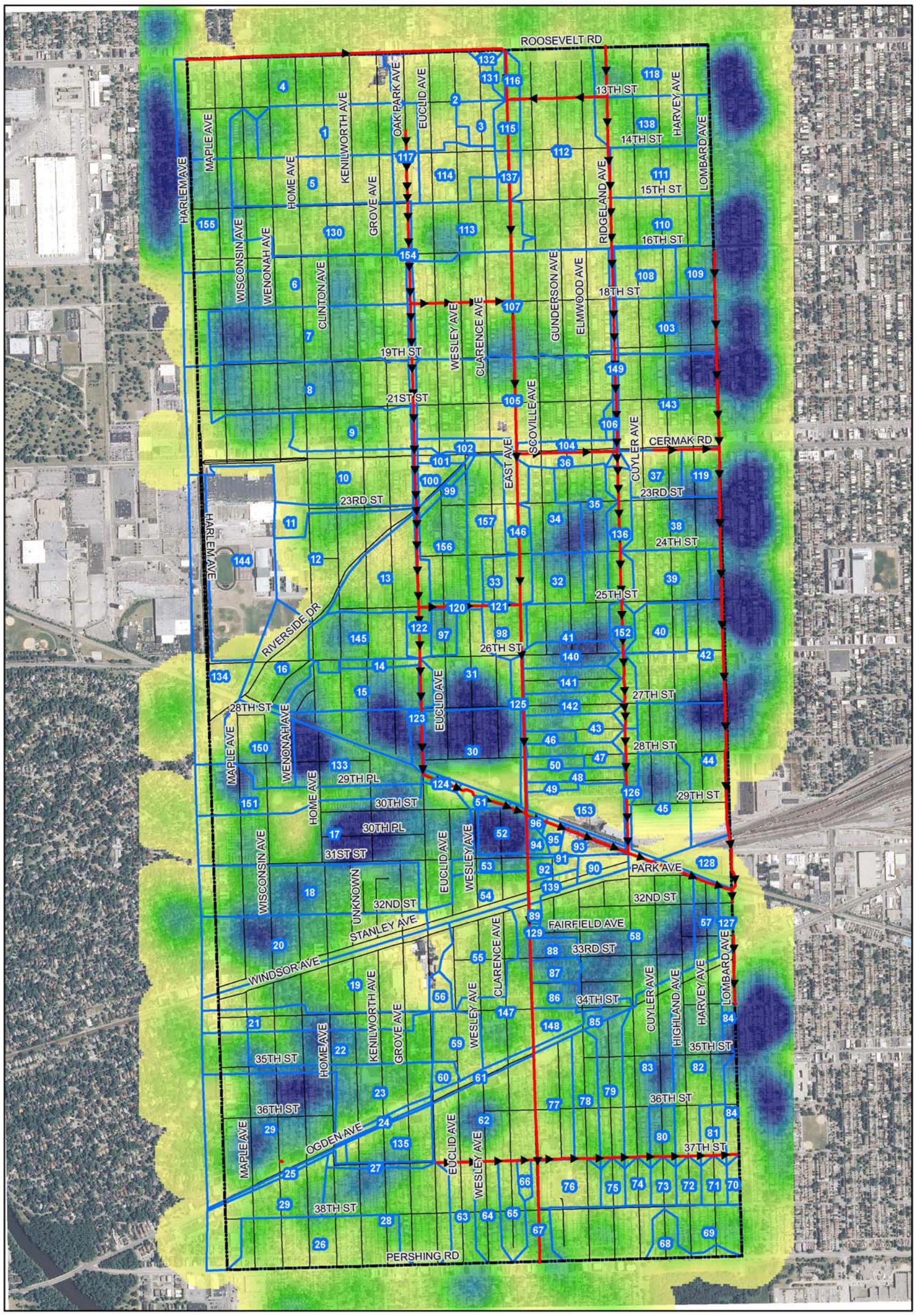
Because Berwyn is an older community, most sewers are undersized due to the increase of impervious area, and the increase of sanitary sewage over time. In Berwyn, many of the neighborhoods have restrictive flows out of their local sewer. When combined sewer systems are undersized or in need of repair, or when large rainfall events occur, water will pond and attempt to find other routes of flow. It is normal to observe water flowing in gutters and ditches during these large storm events. When adequate and safe overland flow pathways are not present to carry runoff that exceeds the sewer capacity, flooding results. Berwyn is relatively flat, which can result in extensive ponding.

In addition to street flooding and ponding, the combined sewer system can cause water to back up into basements during large storm events. Basement flooding is the most common and problematic type of flooding in Berwyn. In some areas of the city, inadequate flow routes out of the alleys can lead to surface ponding and contribute to high groundwater and seepage issues.

In general, storms of a shorter duration and higher intensity cause a higher incidence of flooding issues for a combined sewer system. Since the City began collecting flood reports in 2010, Berwyn has experienced storms causing significant flooding in 2010, 2011, 2013, 2014, 2015, 2016, and 2017. These flood events are widespread among the City's residential neighborhoods. **Figure 1** (Page 1-3) for FEMA individual assistance claims from presidentially declared disasters in August 2007, September 2008, July 2010, and April 2013, as well as reported flooding locations collected by the City from July 2014 to October 2017.

[1] Refer to the MWRDGC handout "Understanding Your Sewer" (included as Appendix 2) for more information on the local combined sewer system, MWRDGC interceptors, and TARP system.

Figure 1: Reported Flooding Locations



Scale:

0 200
Feet

Orientation:

Legend:

Legend

Collector Sewer

Berwyn Limits

Sewershed Boundaries

Density of Reported Flood Occurrences*

High

Low

*Includes FEMA Individual Assistance claims and City flood reports

Project Name:
Berwyn Stormwater Analysis

Prepared for:
CMAP

Information about exhibit:

Project Number: 15-0XXX

Latest Revision: 11/8/2017

Prepared by:

Hey and Associates, Inc.
Engineering, Ecology and Landscape Architecture

Exhibit Title:
Reported Flooding Locations

Figure:
1

The flood events of April 2013 caused widespread flooding in the City of Berwyn (see Appendix 2). In May 2013, President Obama declared that a major disaster (DR-4116) occurred from the severe storms, straight-line winds, and flooding experienced from April 16 to May 5, 2013, in Illinois, including Cook County. After the storm, Cook County engaged the City of Berwyn in a needs assessment to understand the damages experienced by the community. The City reported 87 homes and 3 public schools affected by the storm and that storm sewers reached capacity causing sewer line failures and backups into many homes. Payments totaling $1,267,203 from 303 claims were paid to residents in the City, as a result of the April 2013 storm from Individual Assistance grants federal program. In 2015, IDNR conducted a study of the cost and prevalence of urban flooding and found that 90 percent of damage claims were for locations outside of the mapped 100-year floodplain, highlighting the prevalence of urban flooding that occurs. Given that private insurance claims are not accounted for and some residents and businesses may not have filed a claim or been aware of assistance programs, Berwyn likely experienced additional damages beyond the $1,267,203 documented.

While no road closures were documented in the community by Cook County, there are several low-lying streets, especially beneath the Canadian National viaducts at Oak Park Avenue and East Avenue, which may have become flooded during the storm and could have impeded transportation access of commercial, personal, and emergency trips. During major storm events, the Public Works Department routinely checks these viaducts to clear drains in the event that they become clogged and contribute to flooding.

Floodwaters carry pollutants which result in water quality impairment of rivers and streams, from both combined and separate sewers. Pollutants can include, but are not limited to, sediment, oil, grease, and toxic chemicals from motor vehicles; pesticides and nutrients from lawns and gardens; viruses, bacteria, and nutrients from pet waste and combined sewer overflows; road salts; and heavy metals from roof shingles. All of these pollutants can harm fish and wildlife populations, kill native vegetation, and make water recreation and adjacent recreational areas unsafe and unpleasant. In a combined sewer community such as Berwyn, these pollutants may only discharge to rivers and streams during heavy rainstorms resulting in combined sewer overflows. However, if a basement floods due to sewer backup, these pollutants from the combined sewer system can end up in homes which can create potential health risks that requires diligent cleanup and restoration.

The City of Berwyn will continue to face flooding and water pollution challenges in the future as a result of climate change. The Chicago region has been experiencing increases in annual precipitation and the number of very large storms that produce more than one inch of precipitation. Climate models suggest that the region will see greater variation in annual precipitation, with wetter wet years and drier dry years. These models also suggest that a larger proportion of precipitation will fall during a small number of very large storms, rather

than being distributed evenly throughout the year. The result will place increased strain on the combined sewer system and continue to put vulnerable residents, businesses, and infrastructure at risk of flooding. See Appendix 3 for more information on climate vulnerability.

1.3 Planning Process

The planning process to create the Stormwater Management Plan included multiple steps that were undertaken over approximately 10 months. The process was developed in close consultation with the City of Berwyn and was designed to include input from community residents, business owners, park districts, school districts, and community leaders throughout.

- Project initiation (September 2017)
- Community outreach and engagement (November 2017–February 2018)
- Stormwater analysis (September–November 2017)
- Key recommendations (December 2017–January 2018)
- Plan and concept development (February–May 2018)
- Public review and adoption (June 2018)
- Community implementation of the plan (begins July 2018)

A complementary process took place to assess the City's vulnerability to climate change. The assessment explored climate-related hazards affecting stormwater issues in Berwyn today and in the future, the vulnerability of different populations and areas of the City, as well as the City's capacity to adapt to these changes. The findings of this assessment have been integrated into the Stormwater Management Plan (see also Appendix 3).

1.3.1 Community Engagement Overview

To better understand and address the community's needs and vision for the corridor's future, a number of community engagement activities were conducted to gather public feedback. In addition to the ongoing input of the project steering committee, this included conducting interviews with key stakeholders and conducting a public open house to identify the primary concerns of local residents, business owners, and other stakeholders. Overall, participants held many of the same concerns and generally expressed the desire for the City to continue investing in the stormwater management system, providing assistance to homeowners through the cost share program, and educating residents and businesses on how they can improve stormwater management on their properties. Some key findings include:

- Basement backups are the most severe and unsafe type of flooding and affect homeowners and renters alike.
- Basement seepage is a concern for many residents, especially in older homes with limestone foundations.

- Not all homeowners can discern basement backups from basement seepage, which can result in making improvements to fix one problem and not the other.
- Improvements can be too costly for some residents to make, even with cost assistance from the City.
- Investments should be made in green and grey infrastructure improvements, including larger-scale stormwater projects that can benefit several blocks.
- Regulations for new development and redevelopment have helped reduce the City's stormwater burden, but can be difficult to meet on small lots.

1.4 Previous Plans, Studies, and Improvements

Several plans and studies developed for Berwyn in recent years address stormwater management through a policy and regulatory framework and through the development of design guidelines for infrastructure and site planning. These plans and studies have been reviewed and considered in the development of this plan.

Generally, transportation plans and proposed infrastructure improvements for Berwyn, such as the 2011 Active Transportation Plan and the Complete Streets Policy, create opportunities for managing stormwater and runoff through project development and design requirements. As transportation projects come through the development cycle, thoughtful design will address existing and future conditions that will help manage stormwater in Berwyn. For example, the Depot Drainage Study was prepared specifically to address flooding in the Depot District by establishing a defined drainage area with proposed sewer capacity improvements.

The 2012 Berwyn Comprehensive Plan is the guiding document for land use planning and serves as the policy element of the 2017 Zoning Ordinance. The Natural Environment, Open Space and Recreational Goals and Objectives chapter of the Comprehensive Plan calls for the incorporation of best management practices to reduce flooding and surface water runoff as well as improve overall stormwater management throughout Berwyn. As mentioned previously, the flood events of April 2013 created an immediate need for better flood management planning and general stormwater management.

New development within the Depot District Drainage Study.

A draft Stormwater Management Plan was developed by the City in 2014. Many elements of the plan were incorporated into the 2014 Cook County Multi-Jurisdictional Hazard Mitigation Plan, the 2017 Zoning Ordinance, and other programs and initiatives, as appropriate.

The 2014 Cook County Multi-Jurisdictional Hazard Mitigation Plan includes the City of Berwyn and provides an overall framework for partnership and funding opportunities related to flooding and stormwater management. Various projects and initiatives are identified in the annual plan update and have included successful programs such as the MWRDGC Residential Rain Barrel initiative, grant funding for the Depot District Streetscape Project and the Green Alley program, spot repairs to the sewer system, and larger infrastructure projects such as the 19th Street Generator project.

The 2017 Zoning Ordinance codified stormwater regulations that are generally found in Chapter 1250: Landscape Standards. These new regulations include more robust site plan review for planned developments; design criteria for the construction, expansion, and/or reconstruction of certain parking lots; compliance through a new fee-in-lieu payment structure; and operation and maintenance plans for stormwater management on private property. It is essential that these regulations be implemented and enforced consistently and uniformly by Berwyn's various government departments. This may require additional staff outreach and training.

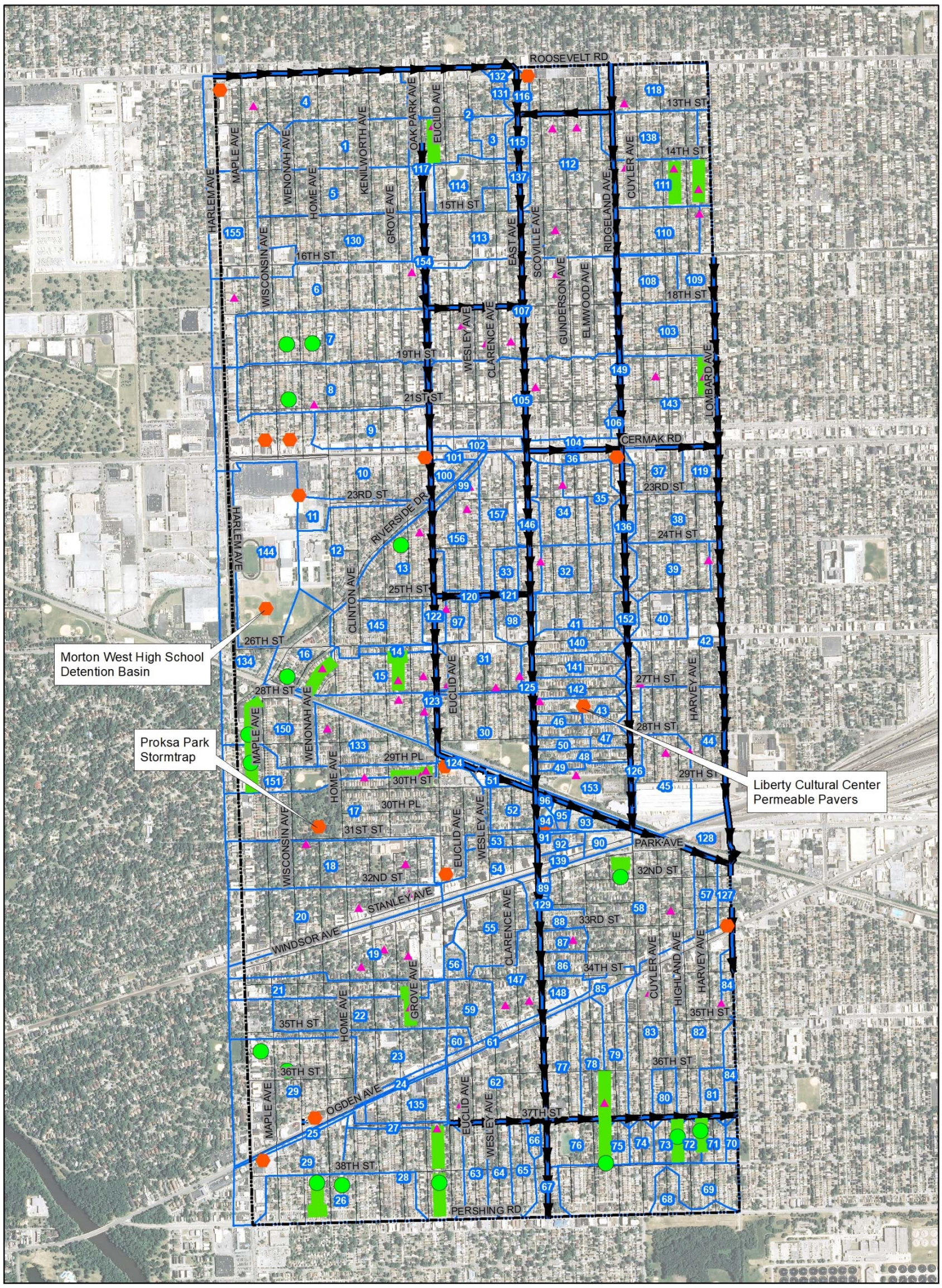
Existing stormwater projects have been implemented by the City, its partners, and private entities across Berwyn (**Figure 2,** Page 1-8). A StormTrap system was installed at Proksa Park to enable usage of the park after rain events as well as provide a neighborhood level flooding benefit. Permeable pavers were installed at the Liberty Cultural Center parking lot. A large detention pond was installed at the Morton West High School. Multiple private developments have installed detention in accordance with the MWRDGC Watershed Management Ordinance that provide a stormwater benefit to Berwyn.

Permeable paver parking lot at Liberty Cultural Center. *Photo courtesy of Berwyn Park District.*

To date, the City has performed 77 soil borings to locate sandy soils that may provide increased stormwater infiltration. These borings were evaluated based on the depth and quality of the sandy soil. As a result of these borings, the Green Alley Program has updated fifteen alleys to date, by converting a traditional alley to an alley with permeable pavers in areas where sandy soils make infiltration possible. The City of Berwyn will continue to coordinate with MWRDGC to implement more Green Alleys where appropriate as funding becomes available.

This plan seeks to combine previous reports, regulations, and ideas in conjunction with input from the Steering Committee and City stakeholders to create a guiding document that will promote better stormwater management through a set of guiding principles.

Figure 2: Previous Plans and Projects



Scale: 0 500 1,000 Feet

Orientation:

Project Number: 17-0256

Latest Revision: 6/6/2018

Prepared by:

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- Detention Projects
- Green Alleys Projects
- Sandy Soil Borings
- Boring Locations
- Collector Sewer
- Berwyn Limits
- Sewershed Boundaries
- 26 Sewershed ID

Project Name: Berwyn Stormwater Analysis

Prepared for: CMAP

Information about exhibit:

Exhibit Title: **Previous Plans and Projects**

Figure: **2**

1.5 Stormwater Analysis

Because Berwyn's main flooding problem is related to limited sewer capacity, a sewershed analysis was performed to identify areas experiencing lower sewer capacity and other issues. In total, 157 sewersheds were delineated with methodology based on similar analyses completed in other communities. Sewersheds are typically defined by identifying the outlet or connection point of the local sewers to larger collector or interceptor sewers, and then identifying the contributing tributary area flowing through this sewer as shown on sewer atlases. The location where the local sewer (approximately 12 inches to 30 inches in diameter) joined a significantly larger collector sewer (60 inches or more in diameter) was used as the downstream point of each sewershed. In the cases of sewers in Berwyn where relief sewers have been added providing a cross-connection between sewersheds, the sewershed delineations were estimated based on the assumption that the pipes were generally flowing toward the larger sewers.

Each sewershed outlet pipe was identified and its basic parameters (i.e., size of pipe) were used to develop the calculations needed to determine the outlet capacity of the sewershed. The outlet capacity provides a straightforward method to determine how the sewer system may perform during storm events and how the sewershed compares to other geographic areas in the City with respect to flood risk due to limited flow capacity. The outlet capacity of the sewersheds was calculated based on standard hydraulic engineering equations and ranked to establish a comparable analysis of flood risk (Table 1). It was noted that much of Berwyn already has limited sewer capacity, to the point that the main outlets of the sewersheds have capacities comparable to allowable detention release rates throughout northeastern Illinois. This means that the existing sewer system is extremely limited in its ability to convey water during storm events and that the sewer system acts as a restriction to flow for larger storm events, which causes stormwater to pond in streets and other low-lying areas and combined sewers to back up in homes.

In addition, stakeholders noted flooding issues in areas of Berwyn where homes discharge to alley sewers. These sewers are typically shallow and have low capacity, which causes a higher risk and incidence of basement flooding than for homes that discharge to street sewers. To account for these conditions, the sewersheds were also evaluated based on whether they included alley sewers, as noted in **Table 1**.

The sewershed capacity and alley sewer presence rankings were combined to determine the sewersheds with the highest risk for flooding. **Figure 3** (Page 1-11) shows the sewershed ranking of the flood risk levels. A higher risk area is denoted by a sewershed ranking of 4 with a lower risk denoted by a sewershed ranking of 1. These rankings provide a prioritization mechanism for risk areas and a lower risk sewershed will likely have flood problems as well. Figure 3 (Page 1-11) provides a calculated analysis of risk based on known data (i.e., sewer sizes), while Figure 1 (Page 1-3) documents actual and known reports of flooding.

Table 1: Range of Calculated Sewer Capacity and Alley Sewer Presence for Each Sewershed

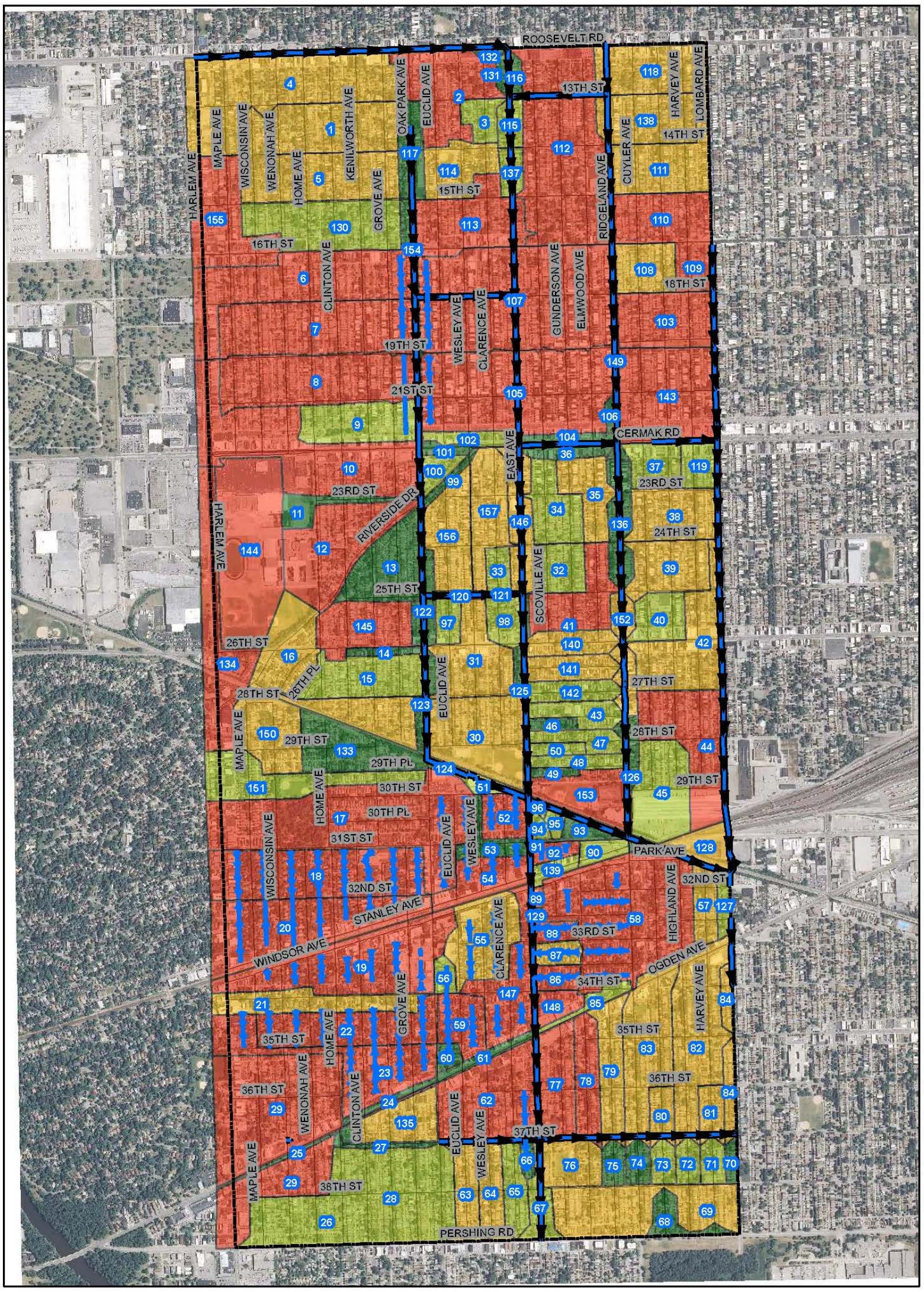
Sewershed Ranking (Higher Risk: 4 / Lower Risk: 1)	Calculated Sewer Capacity Range (cfs/acre)	Alley Sewer
1	0.56-9.83	Not present
2	0.29-0.56	Not present
3	0.15-0.28	Not present
4	0.10-0.33	Present

Note: cfs/acre: cubic feet per second per acre

This rain garden captures runoff from the street and adjacent parking lot.
Courtesy of Center for Neighborhood Technology.

The sewershed analysis identified areas with the lowest outlet capacity where there are also alley sewers. These sewersheds were then compared to sewersheds with sandy soils or potential land use opportunities, as shown in **Figure 4** (Page 1-12), as a way to focus Berwyn's initial efforts in addressing stormwater problems.

Figure 3: Sewershed Flooding Risk Ranking



Scale: 0 500 1,000 Feet

Orientation:

Legend:

- Alley Sewers
- Collector Sewer
- Berwyn Limits
- 26 Sewershed ID

Sewershed Boundaries

Higher Risk Quartiles

- 1
- 2
- 3
- 4

Project Number: 17-0256

Latest Revision: 4/10/2018

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Hey and Associates, Inc.
Engineering, Ecology and Landscape Architecture

Project Name: Berwyn Stormwater Analysis

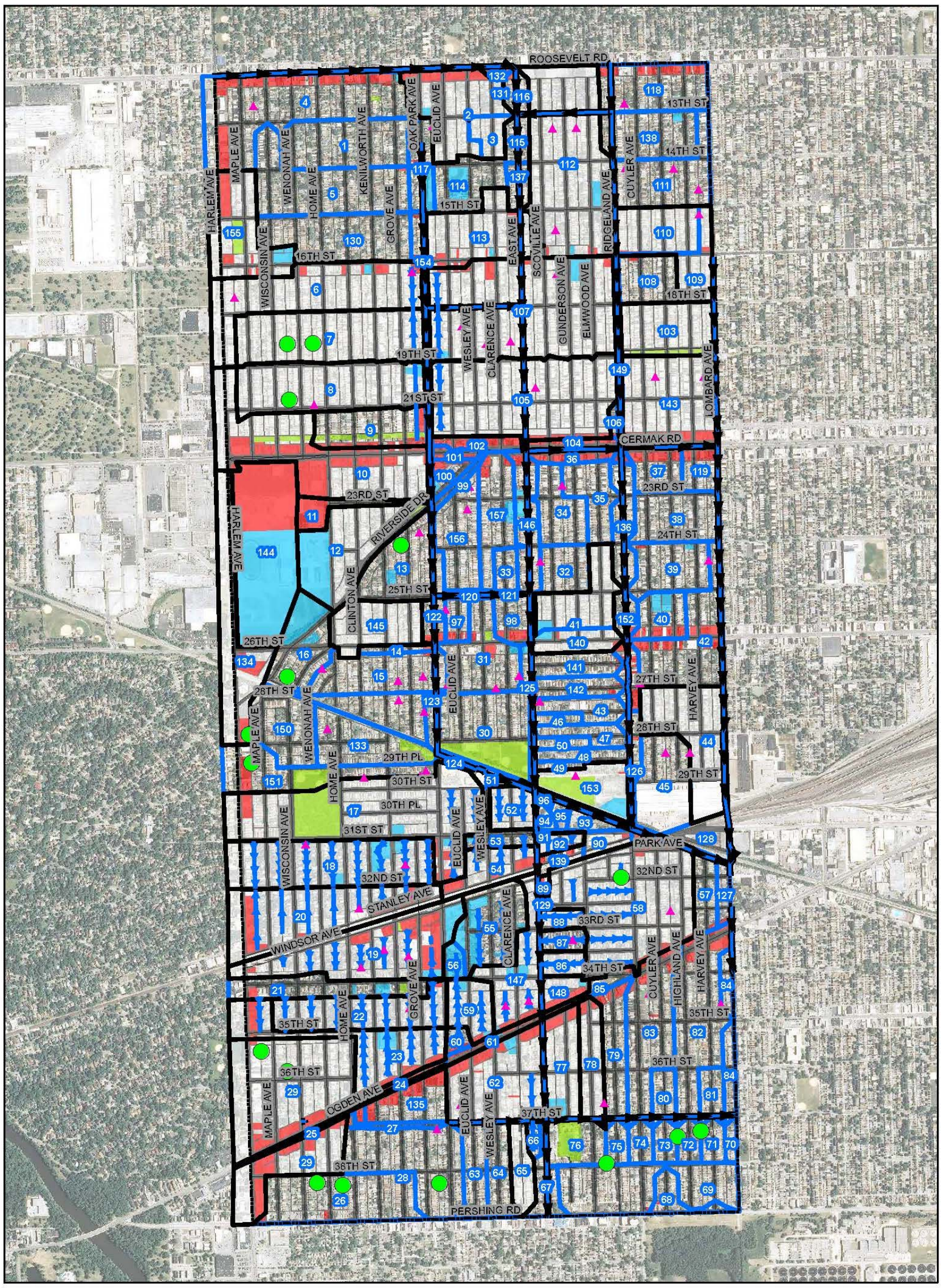
Prepared for: CMAP

Information about exhibit:

Exhibit Title: **Flood Risk Ranking**

Figure: **3**

Figure 4: Sewershed Flooding Risk and Opportunities



Scale: 0 500 1,000 Feet

Orientation:

Project Number: 17-0256

Latest Revision: 6/8/2018

Prepared by:

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Legend

- Higher Flooding Risk Sewersheds (4th Quartile)
- Boring Locations
- Sandy Soil Borings
- Alley Sewers
- Collector Sewer
- Berwyn Limits
- Sewershed Boundaries
- 26 Sewershed ID

Land Use Opportunities

- Commercial
- Institution
- Open Space
- ROW

Project Name: Berwyn Stormwater Analysis

Prepared for: CMAP

Information about exhibit:

Exhibit Title: **Sewershed Flooding Risk and Opportunities**

Figure: **4**

2.0 Guiding Principles

The City of Berwyn is a thriving urban community that strives to protect and enhance community assets and economic prosperity to ensure a high quality of life for residents, businesses and visitors. There is a clear need to enhance flood and stormwater management throughout the City and to reduce surface water runoff into the combined sewer system. Further, there continues to be a need to empower homeowners to make property improvements that can prevent basement and property flooding.

The overall goal of the Stormwater Management Plan is to reduce and prevent flooding in Berwyn, reduce nonpoint source pollution, and produce co-benefits for residents. The plan will prioritize the following flooding types, in order of importance:

1) Basement backups
2) Alley flooding
3) Street flooding
4) Parkway flooding[2]

The plan will aim to provide for effective management of stormwater runoff and to efficiently use available sewer capacity and retention/detention via green and grey infrastructure in both existing and future conditions. Generally, the goal is to avoid and prevent flooding, minimize it if it occurs, and mitigate it once it has occurred.

Essential to tackling these problems will be the integration of effective stormwater management decisions into local planning, municipal operations and budgeting decisions, data and information sharing, and transportation planning and programming.

[2] Parkway flooding is when flood waters are higher than the street curb and gutter and begin to flood grass or paved areas between buildings and the street.

3.0 Recommendations

3.1 Key Recommendations

The City of Berwyn's Stormwater Management Plan is framed by the following topic areas:

- Policy/Regulations
- Flood Control Assistance
- Capital Improvements
- Maintenance and Monitoring
- Education and Outreach

Each topic area will discuss relevant recommendations, most of which are being implemented in nearby communities.

Flooding in Chicago's Albany Park Neighborhood
Photo courtesy of Center for Neighborhood Technology

3.1.1 Policy/Regulations

Regulations are an opportunity to implement baseline standards for stormwater based on the needs of the City's infrastructure. Updates to various regulations pertaining to stormwater can be strengthened to provide short- and long-term improvements. Additional analysis and work may be necessary for some of these recommendations. Below are strategies to strengthen the regulatory requirements in order to address flooding issues.

<u>Stormwater Management Regulations</u>

- Develop green infrastructure/sustainability goals and standards for all City-funded projects. At a minimum, the 50-year storm should be used as a design standard for detention, as well as capturing the first 0.5 inches of rainfall. Any conveyance improvements should be a minimum 10-year design standard. These design standards are the minimum recommended standards for development and projects not regulated by other agencies (i.e., MWRDGC Watershed Management Ordinance). When planning for new or retrofit projects, the sewershed capacity should be considered to determine if additional detention or volume control would be beneficial beyond the minimum standard. Providing and promoting stormwater runoff volume capture can provide a cumulative benefit over time to the City's overall stormwater peak runoff while improving water quality.

- Provide a flow chart or matrix to explain City and MWRDGC stormwater and development requirements. **This is a high priority recommendation.** Clear and concise guidance can assist both the City and those applying for a permit in fully understanding stormwater management, detention and sewer requirements which will promote successful coordination and implementation of development.

- Develop a stormwater detention/retention policy for single residential lots. Many communities throughout northeastern Illinois (i.e., LaGrange, Northbrook, and Elmhurst) have implemented stormwater detention requirements for residential lots which can be related to impervious coverage or land disturbance. These systems typically help reduce the peak stormwater runoff from a residential property by providing underground pipe or vault detention storage systems. The systems may be connected to the municipal sewer system with a restrictor limiting flow or by providing an overflow connection from the detention system back to the sewer system. Depending on site soil suitability, these systems can promote infiltration with an open bottom that allows stormwater runoff to recharge the soil. Guidelines would have to be developed for residential lots with the possibility of providing a fee-in-lieu of system where site constraints may not allow for installation of detention systems. These guidelines could be developed by the City of Berwyn to provide consistent calculations and methodology among the systems and provide for an easier permit review process. In addition, incentivizing residential stormwater detention through grant opportunities, cost-share programs, or permit fee reductions can help promote better stormwater management on the individual residential lots. It is recommended that the permit calculations be performed by a licensed engineer/architect. The City should review several different types of residential lots throughout the City to investigate what could be an adequate detention volume and footprint while allowing for some type of connection to the municipal sewer system. Review of some typical lots will help provide a possible range of detention volume that could be required and would lead to the development of permit guidelines for residential lot detention.

- Review opportunities to encourage stormwater best management practice implementation, such as providing stormwater detention/retention credits or through landscape design techniques, in all types of development. For example, the City of Chicago has developed a stormwater tool[3] for developers to use and provides credits in the form of reduced detention requirements for using green infrastructure practices such as native landscaping, bioinfiltration, and permeable surfaces. **This is a high priority recommendation.** This policy would help promote development to incorporate green infrastructure and other sustainable practices and could be associated with detention required by the City.

Building Permits

- Conduct internal education and outreach for the City and its staff about consistency and uniformly enforcing the stormwater regulations codified in Chapter 1250 of the 2017 Zoning Ordinance and update staff annually on pertinent changes. Internal training and education should also address proper staff communication regarding implemented

[3] See the City of Chicago Department of Water Management webpage (note: link may change): https://www.cityofchicago.org/city/en/depts/water/provdrs/engineer/svcs/2009_sewer_constructionandstormwatermanagementrequirements.html

policy recommendations from Section 3.1.1 of this plan. The City should develop an internal routing flowchart and checklist to ensure adequate understanding of which departments and staff should be included relative to permit applications and ordinance requirements. If new stormwater regulations and requirements are implemented, it will be critical to provide a thorough understanding to all departments involved with enforcement. If the proposed work described in the permit application has a disturbance greater than or equal to 50 square feet, the permit should be routed to the Engineering Department for a stormwater review. **This is a high priority recommendation.**

- Improve tracking of permits (outside of flood control assistance projects) to document and better understand overhead sewers and backflow preventer installations. **This is a high priority recommendation.** The City should establish enhanced tracking to promote coordination within departments and to have a broader understanding of needs throughout the City that may help with future funding or grant opportunities.

- Require backflow preventers or overhead sewers for major home additions. Residents investing in their homes enhances the quality of life of families and ultimately the City. To protect their investments and to provide a reduced risk of future basement flooding, it would be beneficial to require installation of these plumbing measures. Ultimately this program in conjunction with new construction and flood control assistance program could get the City closer to having all residential homes protected from sewer backup. **This is a high priority recommendation.**

- Require downspout disconnecting for building additions, or for any new or updated cost share program Redirecting stormwater runoff from roofs to the ground will reduce the peak discharge to the sewer systems which could in turn reduce the risk of sewer backups. Downspout disconnections should be done in a manner to discharge water away from buildings and onto pervious surfaces to the extent practicable. **This is a high priority recommendation.**

Property Sale

The City should investigate the ability to create and enforce the necessary procedures or forms to implement any of the following recommendations. These options will likely require coordination with the City Attorney for implementation.

- Require backflow preventers/overhead sewers for sales of homes. Many homebuyers are not aware of issues associated with home plumbing and sewers and may not understand the risk of sewer backup. This program could help protect future property owners by providing a reduced risk of future basement flooding.

- Require a basement flooding home assessment or opinion by a certified inspector/ contractor at point of sale for homes. Many new homebuyers are not aware of basement flooding risk nor do they know what to look for with regards to previous issues such as seepage or sewer backups. This program could help educate new homeowners to flood risks and promote more mitigation throughout the City. Prior to any implementation, the City should investigate how this could be applied for City approvals of home sales.

- Require downspout disconnection at point of sale for homes. Redirecting stormwater runoff from roofs to the ground will reduce the peak discharge to the sewer systems which could in turn reduce the risk of sewer backups. **This is a high priority recommendation.**

- Require inspection of lateral sewer at sales of homes by a certified plumber/contractor. Many homeowners and potential buyers are not aware of the need to inspect and maintain the lateral sewer. This will promote education and understanding of how the home plumbing system works while also providing details for a critical home system to the seller and buyer. The City should require a home inspection report that includes sewer televising with the option to sign a waiver that this was not completed. **This is a high priority recommendation.**

- Work with the City attorney to develop a rider to be submitted with the home inspection report that can help document additional flooding issues (i.e., seller was a resident of the home in the last two to five years and can state that there were no known flooding issues, sewer line televising requirements, etc.). **This is a high priority recommendation.**

Financing

Section 3.0 provides recommendations to enhance and improve stormwater management in the Berwyn. But a key component of most of the recommendations is to establish a dedicated and sustainable funding mechanism to ensure constant and consistent applicability and implementation from year to year. In addition, the City should develop a detailed understanding of annual and future costs associated with implemented stormwater management recommendations which would help support the need and basis for funding. Costs can typically include funding of staff and software/hardware, development of a detailed stormwater master plan with design alternatives and costs, short and long-term cost share programs, capital project expenditures, and annual operations and maintenance of stormwater infrastructure.

There are several options to consider when implementing a mechanism for stormwater funding. Among those considered are an additional nominal sewer fee, development fee, fee-in-lieu option, or stormwater utility fee for stormwater management.

- Sewer Bills. Berwyn currently has a funding mechanism for sewer and water service that is collected through its sewer bills. Since Berwyn is a combined sewer community and stormwater is directly related to the existing combined sewer system, a fee could be applied to the sewer bill to fund stormwater management. The fee could be flat or variable based on a variety of factors such as water usage, lot size, impervious area or zoning type. A nominal fee could be provided as soon as the next fiscal cycle. However, it would be recommended to conduct a detailed study on annual and future costs associated with the stormwater management program resulting from this Plan. This would provide the basis for fee development. **This is a high priority recommendation.**

- Development Fee. A stormwater permit fee for development could be considered, but would require a study to determine applicability and legality that would last 1–2 years. This fee would be required in addition to any on-site stormwater management, and could be implemented in addition to a monthly stormwater utility fee or sewer bill fee. However, this mechanism is highly variable and does not necessarily provide a dedicated funding stream for stormwater.

- The City has already established a fee-in-lieu of basis in the Zoning Ordinance (effective 9/22/2017) that allows for payments related to providing stormwater management controls subject to the approval of the Zoning, Planning and Development Commission. Currently the fees would be calculated by the Department of Public Works. The City should establish specific guidelines and protocol for the fee-in-lieu of program for detention regulated by the City. The City should incentivize commercial and industrial developments to meet the detention standard rather than allowing fee-in-lieu of payments. The fee-in-lieu of program should generally be geared toward residential developments or extreme cases of constrained properties. Where detention is required by MWRDGC through the WMO, there is currently no fee-in-lieu of option. Items to consider for the fee-in-lieu of program relative to Berwyn-regulated detention include:

  - Minimum orifice sizes for detention. Once an orifice size gets too small, there can become issues with effectiveness and maintenance. If a development requires a restrictor smaller than the allowable size, then the development may be required to pay a fee based on a volume difference of the minimum allowed restrictor size and the calculated restrictor size. The City should consider a minimum orifice size of 4 inches or the utilization of vortex restrictors similar to those used in the City of Chicago. **This is a high priority recommendation.**

  - Site constraints. Many parcels in a highly urbanized area such as Berwyn are subject to a variety of site constraints that may limit the ability to provide the required detention due to lot size, configuration, utilities, and other infrastructure. Development should generally try to provide detention to an extent practicable and a fee-in-lieu of program may allow for fees based on the volume difference of the detention provided compared to what is required. It is recommended that the City request permittees to setup a pre-application meeting to discuss site constraints and anticipated detention to be provided compared to detention required. This will allow for all parties to work together to identify the site design and layout that can provide both the City and permittee with achievable goals. **This is a high priority recommendation.**

  - Design concepts of a capital plan with design concepts. The City will commit to the development and design of concepts for detention throughout the City which can be paid for via the fee-in-lieu of program. The fee-in-lieu of program shall provide the opportunity to create, expand and manage both local and regional detention facilities and the fees from this program should be used for the planning, design, construction, and operations and maintenance. Establishing design concepts throughout the City, such as those included in Section 4.2 of this plan in opportunity areas shown in **Figure 5** (Page 4-3), can provide developments with the opportunity to pay a fee-in-lieu of to support the nearest detention facility. Costs should be developed on a detention volume basis for each design concept that includes the

planning, design, land and easement acquisition, construction, and operations and maintenance of the facility. Fees can then be calculated for the fee-in-lieu of program based on the nearest detention facilities with volume available. Where no design concepts are available or are too far away from the development, the City should establish a reasonable fee structure that could be based on similar design concept costs per unit volume.

Based on the most recent update to the WMO (effective 2/15/2018), MWRDGC allows for offsite volume control (Article 5 Section 503.3.B) or offsite detention (Article 5 Section 504.14). Offsite detention would need to meet the requirements of Article 5 of the WMO. This can provide an opportunity for developments to utilize offsite facilities to meet detention requirements which may work well in a highly urbanized area such as Berwyn.

- Stormwater Utility. A stormwater utility provides a mechanism to collect fees based use which is typically related to certain property characteristics including, but not limited to lot size, zoning, and impervious area. The collected fees would be placed into a dedicated fund for stormwater services which may include developing detailed stormwater alternatives (i.e., a Stormwater Master Plan), implementing capital projects, funding program staff, funding operations and maintenance program. Depending on the program, utility fees can range from $2 to $20 per month which is also typical of other stormwater utilities in Illinois.

  The traditional basis for stormwater utilities came from the fact that many municipalities did not have an explicit mechanism for installing and maintaining storm sewer systems whereas they had funding in place for sanitary sewers and water service. This becomes more difficult in combined sewer communities where there is difficulty and challenges associated with the policy of trying to allocate portions of the combined sewer system funding to the stormwater utility or attempting to separate the funding basis for stormwater and typical sanitary sewer fees. According to the "2014 Stormwater Utility Survey" by Black & Veatch, out of all the communities with a mix of combined sewer and separate sewer system, there are zero communities that have a stormwater utility with over 75% of their system being combined sewer. This demonstrates the difficulty of establishing a utility and creating the separation or coordination with the combined sewer system. A stormwater utility for Berwyn is potentially available as a funding mechanism but a detailed and thorough study would have to be performed to provide the basis and reasoning for its implementation.

  - The first step of a stormwater utility would be to conduct a study which would typically require one to two years to provide adequate time for research, analysis, public outreach, and recommendations for implementation. This study would have to explicitly look at current funding for sewer service and determine the appropriate means and methods for documenting the separation and need for stormwater funding.
  - If the study recommends an acceptable stormwater utility, it would likely take an additional one to two years to fully implement the program.

3.1.2 Flood Control Assistance

The Flood Mitigation Shared Cost Program currently provides financial assistance to homeowners with the installation of overhead sewers, backflow preventers, and disconnecting of downspouts. This program can be expanded in the short term, with the goal of scaling back in future years when the majority of the community has implemented these measures. Below are strategies to strengthen the Flood Control Assistance program.

Example of downspout disconnection to a rain garden in Berwyn.

- Continue funding for flood control assistance (Flood Mitigation Shared Cost Program and Downspout Disconnection Program). This should also include education and outreach on the program, as well as the Single Family Rehab (SFR) Loan Program, to direct homeowners to the assistance that best suits their needs and encourage aldermanic offices to do the same. The program can continue to help residents with addressing issues on their property while providing the opportunity for further education and outreach related to stormwater and other infrastructure. **This is a high priority recommendation.**

- Develop a suite of financing options to remove cost share obstacles for residents with the highest need. Based on feedback during the development of this Plan, low- and moderate-income households face financial difficulties with the current requirements of the cost share program. As discussed in the climate vulnerability assessment (Appendix 3), low-income households and minority or limited English proficiency populations are often at greater risk of experiencing serious social, economic, and environmental impacts from flooding. Expanding funding and financing options for flood control assistance can provide a way to improve the quality of life and provide opportunities to homeowners with the most need.

  The City should explore opportunities to leverage other grant or loan assistance provided to residents with low incomes. As a first step, the Public Works Department and Community Development Department should discuss how the Flood Mitigation Shared Cost Program could be paired with the SFR Loan Program and identify potential barriers that exist. For moderate-income households that exceed the requirements of the SFR Loan Program, the City could explore establishing a sliding pay scale that is based on income. **This is a high priority recommendation.**

- For a nominal fee ($25–$50), offer opinions on basement flooding issues as a City service (public works, engineer, plumber) and provide information on options to address problems and potential funding sources. Such a service would help educate residents on the issues and potential solutions before they hire a contractor to make improvements. **This is a high priority recommendation.**

- Review opportunities to provide residents with economy of scale benefits. An example of this would include providing backflow preventers to homeowners on a block at the same time as significant road improvements are made. Coordinating improvements has the potential to save the City money and reduce the risk of basement backups for homeowners.

3.1.3 Capital Improvements

The Capital Improvements program details proactive, strategic investments in the City's capital assets and provides an opportunity to integrate short- and long-term stormwater management goals. Below are strategies to strengthen the planning and programming of capital improvement projects.

Example of parkway rain garden with curb cuts to capture street runoff.
Courtesy of Center for Neighborhood Technology

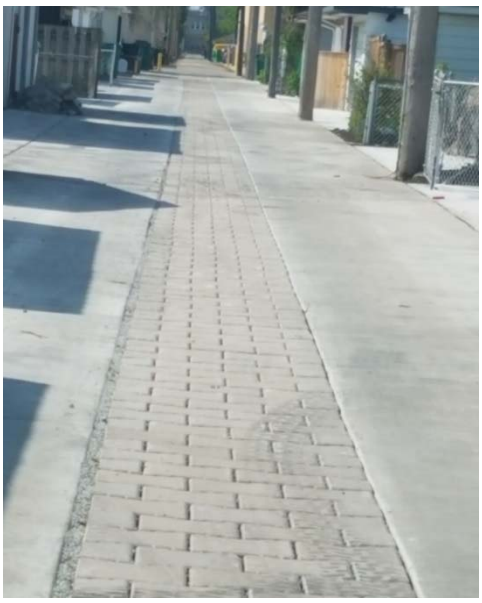
The City of Berwyn currently engages in planning for stormwater management in their Capital Improvements program. Current activities include:

- Citywide soil boring program for assistance with Green Alleys and other green infrastructure opportunities.

- Green Alley program.

- Review of planned road and water projects for stormwater improvements.

Green Infrastructure



Green alley in Berwyn with permeable pavers.

- Target key locations for green infrastructure based on sandy soil locations, public visibility, educational opportunities, and location within a sewershed, with priority given to high risk sewersheds. Additional consideration should be given to low-income populations, shown in Figure 5 (Page 4-3), since they are often at greater risk of experiencing serious social, economic, and environmental impacts from flooding. Review **Figure 4** (Page 1-12) for current locations of opportunities. Continue to update data based on future soil borings. **This is a high priority recommendation.**
- Continue Green Alley program and develop alternative designs for alleys without sandy soils, and alleys with existing, combined sewers. Review Figure 5 (Page 4-3) for additional project opportunities to potentially incorporate into new projects. The green alley program is a great opportunity to promote enhanced stormwater management and even without sandy soils for infiltration, there are additional benefits related to water quality and runoff attenuation. **This is a high priority recommendation.**
- Continue citywide soil boring program for assistance with green alleys and other green infrastructure opportunities. This can provide quick opportunities to implement localized stormwater management. Review Figures 3 and 4 for risk areas and opportunities to further refine locations of new soil borings. **This is a high priority recommendation.**
- Review planned road, sewer, and water projects for green infrastructure opportunities. At a minimum, the 50-year storm should be used as a design standard for detention, as well as capturing the first 0.5 inches of rainfall. Any conveyance improvements should be a minimum 10-year design standard. These design standards are the minimum recommended standards for development and projects not regulated by other agencies (i.e., MWRDGC Watershed Management Ordinance). Providing and promoting stormwater runoff volume capture can provide a cumulative benefit over time to the City's overall stormwater peak runoff while improving water quality.
- Incorporate green infrastructure in complete streets and streetscape projects. Green infrastructure can be designed in a way to provide aesthetic enhancements while also providing stormwater management enhancements. **This is a high priority recommendation.**

Grey Infrastructure and Modeling

Require additional hydrologic/hydraulic modeling in low capacity sewershed areas when projects are designed, with a final goal of a model for the entire City in conjunction with a detailed stormwater master plan. The U.S. Army Corps of Engineers hydrologic/hydraulic SWMM model for the region can be used as a foundation to enhance and expand the Berwyn portion of model especially with a focus on low-capacity sewersheds. This modeling should be part of an overall detailed stormwater master plan that evaluates grey and green infrastructure improvements including but not limited to upsizing sewers, implementing detention, and attenuation of volume and flow. A stormwater master plan should provide recommendations on appropriate design goals (i.e., 10-, 25-, or 100-year level of service) for projects on a case-by-case basis or as an overall goal for the City. These costs can be rolled into funding needs to help refine the funding mechanism goals. **This is a high priority recommendation.**

At a minimum, the 50-year storm should be used as a design standard for detention, as well as capturing the first 0.5 inches of rainfall. Any conveyance improvements should be a minimum 10-year design standard. These design standards are the minimum recommended standards for development and projects not regulated by other agencies (i.e., MWRDGC Watershed Management Ordinance). Establishing a basis for design will provide for detailed project understanding and planning. Although the City may identify other areas that may need a higher level of service based on detailed hydrologic/ hydraulic modeling. The City should also continue to review planned road and water projects for opportunities to replace/improve existing sewers, as well as update the complete streets policy to facilitate the integration of stormwater#management in complete streets and streetscape projects.#

Coordination and Partnerships

- Coordinate with outside agencies such as MWRDGC, IEPA, USEPA, Illinois State Revolving Fund, and the Cook County Planning and Development Department for funding. The City has successfully coordinated with agencies and obtained grants through some of these agencies and should continue to prioritize seeking external sources of funding for improvements. Leveraging funding can provide for greater opportunities to enhance and expand the scope and goals of the project. **This is a high priority recommendation.**

- Continue to provide input and support for MWRDGC's ongoing regional programs and initiative projects, including watershed workgroups such as the Lower Des Plaines River Watershed Planning Council. Participating in these programs can provide opportunities to hear what other municipalities and agencies are doing, stay up to date on regulations, and discuss challenges facing each community. **This is a high priority recommendation.**

- Coordinate with MWRDGC, Illinois Department of Transportation (IDOT), and Cook County on local projects to see if additional stormwater benefits can be implemented. It is recommended that the City establish regular coordination meetings to identify and discuss current and future opportunities for collaboration. **This is a high priority recommendation.**

- Coordinate with schools and park districts to implement holistic projects that incorporate specific stormwater goals. An example of an opportunity is provided in Section 4.2.2 with improvements to a school property to provide multiple benefits including stormwater management as well as recreational amenities. **This is a high priority recommendation.**

- Continue to work with local organizations and institutions to reach seniors and residents with limited English proficiency. Low-income residents may have a hard time paying for flood mitigation tools, and after experiencing a flood, may have a harder time replacing damaged property. Minority and limited-English speaking residents, especially recent immigrants, may have difficulty accessing loan or cost share services. **This is a high priority recommendation.**

3.1.4 Maintenance and Monitoring

The City of Berwyn Public Works Department performs regular maintenance of the City's stormwater components. Current activities include: limited GIS mapping of the sewer system and its components, sewer lining improvements, and operation and maintenance plans for green infrastructure projects.

A strong maintenance and monitoring program can extend the life and value of a stormwater system. Asset management, either through a purchased system or done internally, can be a tool in decision making for strategic, operational, and financial reasons. Data gathering and reporting can support this effort in the short-term and is an on-going effort. Below is a menu of options to strengthen the ongoing maintenance and monitoring program in the City of Berwyn.

- Enhance GIS data as it relates to stormwater. This will promote a thorough understanding of the system and assets and can facilitate future planning. **This is a high priority recommendation.**:

  - Develop protocol for Public Works field check and updating data management tracking system in GIS.

  - Develop complete GIS information of sewer system, including sewer depths. This could be accomplished by temporary staff or other support to help with data collection and GIS management. MWRDGC has a GIS/GPS assistance program that municipalities can participate in which allows the municipality to borrow GPS units at no cost to map sewer infrastructure. Berwyn would have to coordinate with MWRDGC and enter into in intergovernmental agreement.

Installation of StormTrap system in Proksa Park.

- Enhance GIS and map sewer lining improvements, problem areas, basement assessments, flood assistance program installations, other backflow preventer or overhead sewer installation, drainage structure cleaning program, soils (either from the soil boring program, or any development permit that may have boring data).
- Obtain planimetric impervious coverage, which will help in the event of a future stormwater utility, or could be used as a tool to regulate development or as data when applying for grants.
- Determine if a purchased asset management system is needed.

- Consider inlet restrictors similar to Chicago's Rainblocker program, while considering overland flow routes to prevent damage to structures. The Janura Park concept outlined in Section 4.2.1 could serve as a pilot program. Include ample education and engagement with residents, businesses, other property owners that will be affected. **This can be a high priority recommendation as it relates to current and planned projects.**
- Coordinate with other agencies (e.g., IDOT, MWRDGC) to obtain sewer information to enhance GIS. For example, the model created for USACE has some sewer information, but doesn't include the entire network. This will promote a thorough understanding of how other agency systems connect or interact with City infrastructure.
- Add better signage for flooding at underpasses. This will promote awareness to drivers and help prevent damages to vehicles. **This is a high priority recommendation.**
- Develop long-term maintenance and monitoring protocol for various types of stormwater management and green infrastructure projects. Consider implementing green infrastructure inspections as part of the process to renew a business license when the business has previously implemented these practices as part of the permitting process. This will help ensure the facilities are functioning as designed.

Signage example for a rain garden.
Courtesy of Center for Neighborhood Technology

3.1.5 Education and Outreach

Stormwater education and outreach efforts can be effective in changing certain resident behaviors and actions that generate stormwater pollution in the community while promoting an understanding of how and why these systems work. Coordinated outreach carried out by City departments and aldermanic offices is critical to educate residents on flood mitigation programs available to them and other actions they can take to reduce the impacts of flooding and seepage. These recommendations are typically ongoing, but several can be implemented in the short term. Below are strategies to strengthen stormwater education and outreach.

- Educate on the design and operation of the City combined sewer system as well as the MWRDGC Tunnel and Reservoir Plan (TARP) system. This should include education on Berwyn's location within the system and how there is a continued need local investments in the City's sewer system to mitigate flooding. MWRDGC created an "Understanding Your Sewer" brochure that explains combined sewer systems which should be distributed at every available opportunity (e.g., public meetings, sale of homes, yearly with water bills).

- Provide assessments and repair options for basement flooding types, including seepage. Tools such as CNT's My RainReady tool[4] can be promoted to better educate homeowners. The City can also utilize Cook County Assessor data in conjunction with GIS to identify timeframes of home construction to understand what type of basement foundation the home might have (i.e., limestone, brick, concrete, etc.) given known timeframes of typical home construction style (i.e., Victorian, farmhouse, bungalow, etc.). For more information, see the climate vulnerability assessment in Appendix 5.

- Conduct internal education and outreach for the City and its staff about consistency and uniformly enforcing the 2017 Zoning Ordinance; update staff annually on pertinent changes and updates. Education content should include helping staff understand the policies and strategies discussed in Section 3.1.1. of this Plan and other pertinent material.

- Promote the Flood Mitigation Shared Cost Program and Single Family Rehab Loan Program to homeowners. The Public Works Department and Community Development Department should work together to educate other City Departments on the program, such as the Building, Fire, and Police Departments, and encourage aldermanic offices to promote the programs as well. See Section 3.1.2.

- Provide educational and informational signage with projects to communicate benefits. On streets where inlet restrictors are used or standing water is common after a storm, the City should convey the message that if water is in the streets, that means it is not in basements. Update manhole covers and/or catch basins to state "water in streets protects your basements" or similar message as projects occur.

- Replacing trees lost to the emerald ash borer is a top priority for many communities in the Chicago region, but in some cases, residents may oppose the installation of new trees in their front yard or parkway due to concerns about roots clogging sewer pipes. The City should continue to educate residents on tree roots and strategies to avoid clogs in old sewer laterals. Generally, tree roots do not directly damage pipes, but if a pipe is already damaged (due to age, faulty connections, or other causes) roots may enter the pipes, causing a clog. Often, this threat can be mitigated by ensuring all pipes are in good condition, that the tree is well mulched and has ample room for healthy roots near the surface, and by avoiding certain fast-growing wetland species.

- Maintain and build new partnerships. The City should partner with park districts, school districts, and the Pav YMCA to educate students, coordinate tours with MWRDGC, and identify new community partners. For example, School & Community

[4] CNT, MyRainReady. See http://myrainready.cnt.org

Assistance for Recycling and Composting Education (SCARCE)[5] is an environmental education nonprofit that uses innovative and hands-on education programs to promote good stormwater management, sustainable communities, and to engage the broader community through events and program.

[5] SCARCE website. See https://www.scarce.org/

4.0 Opportunities and Concept Plans

4.1 Project Opportunities

Schools present opportunities to manage stormwater while improving the schoolyard

To help Berwyn prioritize its efforts to address the sewersheds at a higher risk of flooding, the sewershed analysis ranked flooding problem areas based on their outlet capacity and whether they are served by alley sewers Figure 3 (Page 1-11). When considering which stormwater projects to implement, the City should assess the severity of the flooding problem area weighted against the expected performance of the project, as well as ease of implementation. Based on initial Steering Committee input, identified areas of opportunity included locations with sandy soils; certain land use opportunities such as open spaces in parks or on school property; wide rights-of-way (i.e., Cermak Road); residential rights-of-way, and commercial areas. The City should use the opportunities map **Figure 5** (Page 4-3) to identify potential projects in areas of high flooding risk and areas with high infiltration potential/sandy soils.

Potential neighborhood detention for fee in-lieu projects for the City to consider include:

- Partnerships with the Berwyn South School District 100 and Berwyn North School District 98 for schoolyard and stormwater projects. The Irving Elementary School Concept could serve as a pilot project for this type of collaboration to be replicated elsewhere in the City. Other schools such as Havlicek, Hiawatha, Pershing, and Piper Elementary could be considered for a similar schoolyard and stormwater project.

- Partnerships with the Park Districts for park and stormwater projects. The City and Berwyn Park District have previously collaborated for the Proksa Park detention area.

- Vacin Fairway parking lot retrofits. These City-owned parking lots are considered low hanging fruit to improve capacity in high need sewersheds.

- Green Alley projects modified to serve areas without sandy soil, with the inclusion of an underdrain and design capacity for the 10-year storm event. Green Alley projects in alleys with existing, combined sewers could be studied to determine if the alley sewers could be placed deeper or increased in size to provide basement flooding relief in conjunction with the stormwater benefit provided by a traditional green alley.

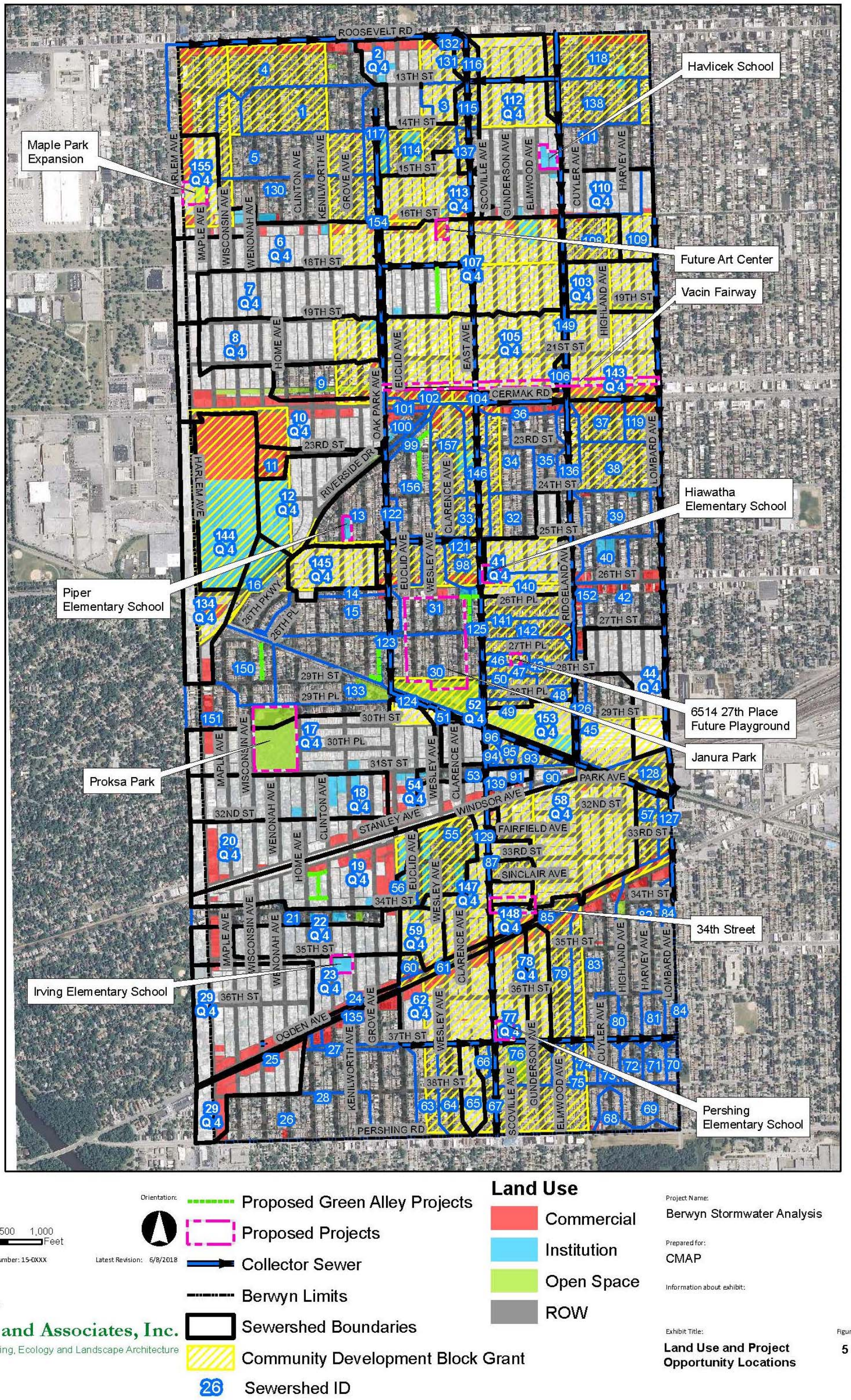
- Additional residential street modifications in low-capacity sewersheds similar to the 34th Street Concept.

To jumpstart implementation of stormwater improvements, three concept plans were developed in areas with lower-capacity sewersheds and can serve as pilots for distinct project types: Janura Park, Irving School, and 34th Street.

It should be noted that these projects could potentially be incrementally phased over several years depending on funding sources and partnership agreements.

Water quality benefits for the concept projects were evaluated using the US Environmental Protection Agency's (US EPA) Spreadsheet Tool for Estimating Pollutant Load (STEPL). STEPL uses simple calculations in a spreadsheet-based format for the analysis of nutrient and sediment loads for different land uses in a watershed. STEPL calculates the total load of nitrogen, phosphorus, and total suspended solids of the tributary area as well as the load reduction provided by best management practices. This analysis can be used on a wide variety of projects; it was used on each concept plan to quantify water quality benefits related to the proposed improvements.

Figure 5: Land Use and Project Opportunity Locations



4.2 Stormwater Concept Plans

4.2.1 Janura Park Concept

The conceptual Janura Park project would serve approximately 24 acres of residential neighborhood to the north of Euclid Avenue, Wesley Avenue, and Clarence Avenue. Because the sewers in this area are combined sewers, they cannot be directly connected to a detention system. Instead, flow restrictors would be placed in the street inlets, forcing excess water to flow overland to the detention area. This would serve the function of keeping additional stormwater out of the combined sewer system, with the goal of alleviating the risk of basement flooding due to sewer backups. Flow paths should be verified at the design stage to ensure positive drainage and incorporate minor grading as necessary.

Given the existing grade, the surface water from the north would flow across 28th Street and enter parkway rain gardens through curb cuts placed along the south side of the street. The rain gardens would have underdrains that convey stormwater to the underground detention area in Janura Park. The ground surface of the detention area will be graded to maximize stormwater capture, including overflow from the raingardens. The ground surface of the detention area would be graded to maximize stormwater capture. The underground detention volume is approximately 6 acre-feet, which is estimated to capture up to a 10-year storm event. The detention would need to be refined with detailed hydrology and hydraulics calculations and undergo preliminary and final engineering design. Once the detention area reaches capacity, it would overflow to a low area south of the detention area within the baseball fields. The detention system is designed to infiltrate stormwater back into the ground which would depend on soil conditions. An outlet is designed to release into the 20-inch combined sewer on 28th Street. Depending on funding and land availability, additional detention could be provided throughout the park space. This project could also be phased into several construction contracts based on funding availability but that may increase overall costs of the project when compared to constructing as a single contract.

Educational signage would be incorporated in this project. Medallions can be placed on the inlets with flow restrictors reading, “Water in the streets reduces water in your basement.” Educational signage should be placed in the rain gardens showing how the system feeds into the underground detention. Educational signage should also be placed near the underground detention quantifying the service area and stormwater benefits provided.

Water Quality Benefits

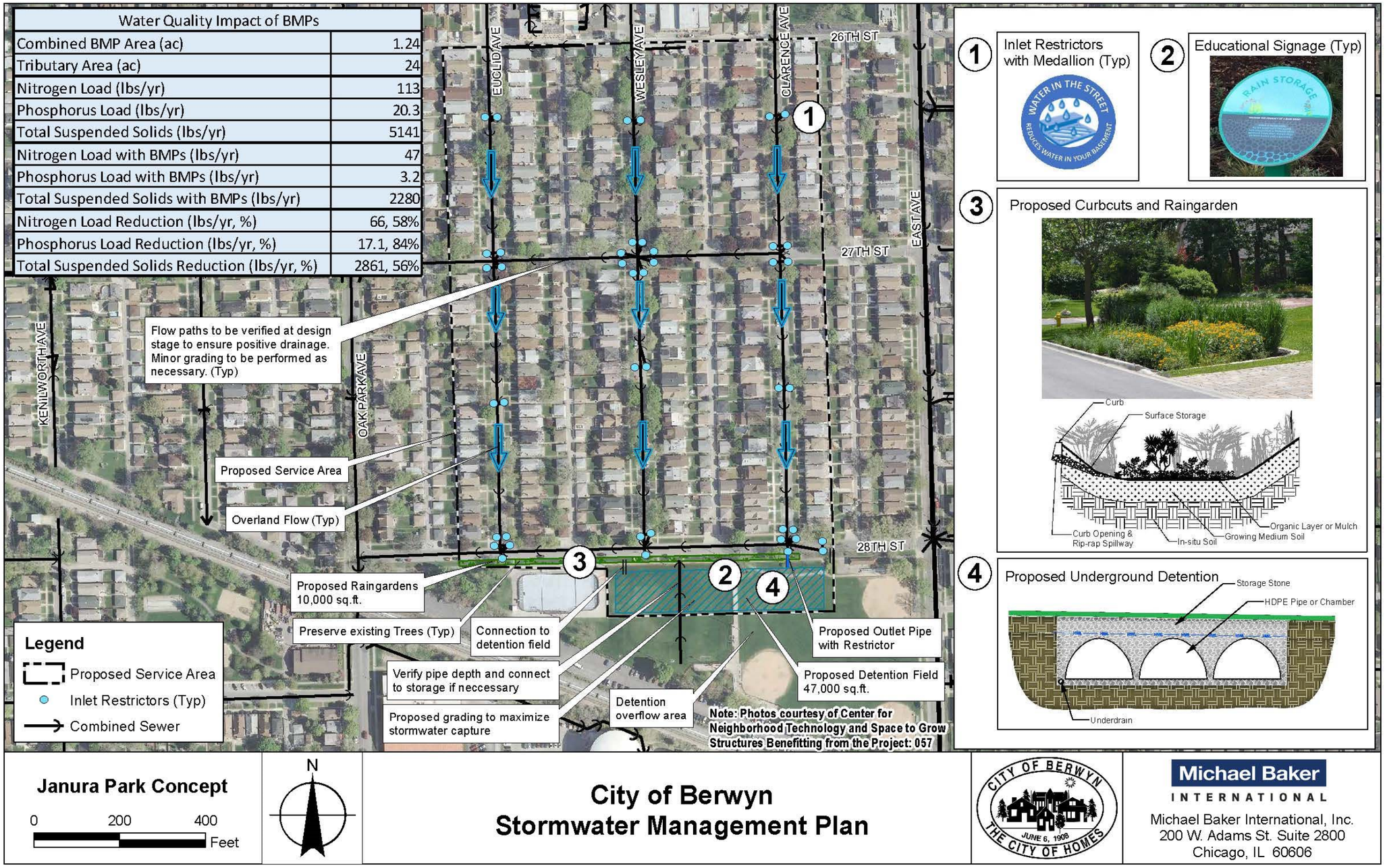
Water quality benefits will be provided in the rain gardens and underground detention areas. These will provide reductions in nitrogen, phosphorus, and total suspended solids. A summary table of the benefits is provided in **Table 2** below.

Table 2: Janura Park Concept Water Quality Benefits

Water Quality Impact of BMPs	
Combined BMP Area (ac)	1.24
Tributary Area (ac)	24
Nitrogen Load (lbs/yr)	113
Phosphorus Load (lbs/yr)	20.3
Total Suspended Solids (lbs/yr)	5141
Nitrogen Load with BMPs (lbs/yr)	47
Phosphorus Load with BMPs (lbs/yr)	3.2
Total Suspended Solids with BMPs (lbs/yr)	2280
Nitrogen Load Reduction (lbs/yr, %)	66, 58%
Phosphorus Load Reduction (lbs/yr, %)	17.1, 84%
Total Suspended Solids Reduction (lbs/yr, %)	2861, 56%

Cost Estimate

An Engineer's Opinion of Cost was developed for this project and is $3,527,748. Backup documentation for the Opinion is included in the **Appendix 5.1**.


Water Quality Impact of BMPs
Combined BMP Area (ac) 1.24
Tributary Area (ac) 24
Nitrogen Load (lbs/yr) 113
Phosphorus Load (lbs/yr) 20.3
Total Suspended Solids (lbs/yr) 5141
Nitrogen Load with BMPs (lbs/yr) 47
Phosphorus Load with BMPs (lbs/yr) 3.2
Total Suspended Solids with BMPs (lbs/yr) 2280
Nitrogen Load Reduction (lbs/yr, %) 66, 58%
Phosphorus Load Reduction (lbs/yr, %) 17.1, 84%
Total Suspended Solids Reduction (lbs/yr, %) 2861, 56%
EUCLID AVE
WESLEY AVE
CLARENCE AVE
26TH ST
27TH ST
28TH ST
EAST AVE
KENILWORTH AVE
OAK PARK AVE
Flow paths to be verified at design stage to ensure positive drainage. Minor grading to be performed as necessary. (Typ)
Proposed Service Area
Overland Flow (Typ)
Proposed Raingardens 10,000 sq.ft.
Preserve existing Trees (Typ)
Connection to detention field
Verify pipe depth and connect to storage if neccessary
Proposed grading to maximize stormwater capture
Detention overflow area
Proposed Outlet Pipe with Restrictor
Proposed Detention Field 47,000 sq.ft.
Note: Photos courtesy of Center for Neighborhood Technology and Space to Grow Structures Benefitting from the Project: 057
Legend
Proposed Service Area
Inlet Restrictors (Typ)
Combined Sewer
1 Inlet Restrictors with Medallion (Typ)
WATER IN THE STREET
REDUCES WATER IN YOUR BASEMENT
2 Educational Signage (Typ)
RAIN STORAGE
3 Proposed Curbcuts and Raingarden
Curb
Surface Storage
Curb Opening & Rip-rap Spillway
In-situ Soil
Growing Medium Soil
Organic Layer or Mulch
4 Proposed Underground Detention
Storage Stone
HDPE Pipe or Chamber
Underdrain
Janura Park Concept
0 200 400 Feet
N
City of Berwyn
Stormwater Management Plan
CITY OF BERWYN
JUNE 6, 1908
THE CITY OF HOMES
Michael Baker
INTERNATIONAL
Michael Baker International, Inc.
200 W. Adams St. Suite 2800
Chicago, IL 60606

4.2.2 Irving School Concept

The project at Irving Elementary School is an opportunity to provide the surrounding area and the school with stormwater benefits as well as an upgraded learning and play space.

On the surface, the project would incorporate permeable surfaces, new play equipment, outdoor education features, signage regarding the project, and an open play area. The design could also include a learning garden for native plants or fruits and vegetables. The various surfaces in the schoolyard would be designed to drain into an underground detention area designed to capture approximately 0.25 acre-feet, which could provide storage up to a 10-year storm event. The detention would need to be refined with detailed hydrology and hydraulics calculations and undergo preliminary and final engineering design. The bottom of the detention area would be designed to infiltrate the water into the ground or slowly release it back into the existing 12-inch sewer. Downspouts from the school should be disconnected and directed to the underground detention where possible.

This project could also be phased into several construction contracts based on funding availability and partnership agreements but that may increase overall costs of the project when compared to constructing as a single contract.

Permeable pavers would be installed in the parking areas along Clinton and 35th Street to intercept the stormwater and drain it to the detention area. Permeable pavers should follow the latest and best-available design guidance and standards. Optional inlet restrictors could be placed on the surrounding streets to direct additional flow to the detention facility, but may require additional grading depending on the existing flow paths. The detention area is currently shown to service only the Irving School property and roadway areas adjacent to the permeable pavers, but should be expanded if inlet restrictors are installed.

This project would serve as a pilot project for a partnership between the City of Berwyn and the Berwyn South School District 100. The Healthy Schools Campaign could be contacted to aid in the planning process, as it is currently involved in a similar program in Chicago. Key steps for establishing a partnership include:

- Engaging the community and other stakeholders in the process to determine their wants and needs.

- Exploring the possibility to manage off-site stormwater from adjacent streets on the school property.
- Identifying potential resources to cover design and construction costs.
- Establishing long-term maintenance needs and responsibilities.

Water Quality Benefits

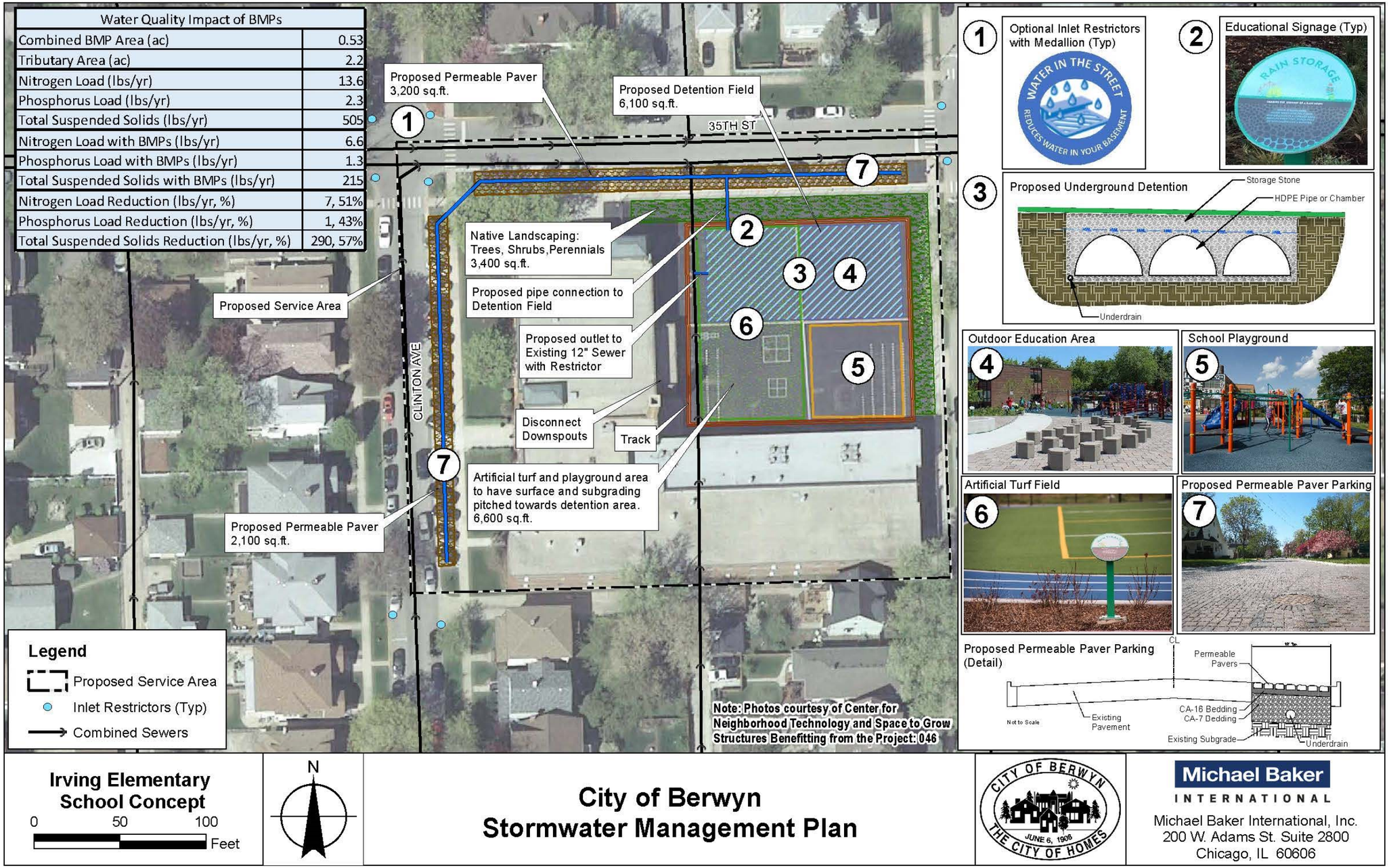
Water quality benefits will be provided in the permeable pavers and underground detention areas. These will provide reductions in nitrogen, phosphorus, and total suspended solids. A summary table of the benefits is provided in **Table 3**.

Table 3: Irving School Concept Water Quality Benefits

Water Quality Impact of BMPs	
Combined BMP Area (ac)	0.53
Tributary Area (ac)	2.2
Nitrogen Load (lbs/yr)	13.6
Phosphorus Load (lbs/yr)	2.3
Total Suspended Solids (lbs/yr)	505
Nitrogen Load with BMPs (lbs/yr)	6.6
Phosphorus Load with BMPs (lbs/yr)	1.3
Total Suspended Solids with BMPs (lbs/yr)	215
Nitrogen Load Reduction (lbs/yr, %)	7, 51%
Phosphorus Load Reduction (lbs/yr, %)	1, 43%
Total Suspended Solids Reduction (lbs/yr, %)	290, 57%

Cost Estimate

An Engineer's Opinion of Cost was developed for this project and is $687,268. Backup documentation for the Opinion is included in the **Appendix 5.2**.


Water Quality Impact of BMPs
Combined BMP Area (ac) 0.53
Tributary Area (ac) 2.2
Nitrogen Load (lbs/yr) 13.6
Phosphorus Load (lbs/yr) 2.3
Total Suspended Solids (lbs/yr) 505
Nitrogen Load with BMPs (lbs/yr) 6.6
Phosphorus Load with BMPs (lbs/yr) 1.3
Total Suspended Solids with BMPs (lbs/yr) 215
Nitrogen Load Reduction (lbs/yr, %) 7, 51%
Phosphorus Load Reduction (lbs/yr, %) 1, 43%
Total Suspended Solids Reduction (lbs/yr, %) 290, 57%
Proposed Permeable Paver 3,200 sq.ft.
Proposed Detention Field 6,100 sq.ft.
35TH ST
CLINTON AVE
Native Landscaping: Trees, Shrubs,Perennials 3,400 sq.ft.
Proposed pipe connection to Detention Field
Proposed Service Area
Proposed outlet to Existing 12" Sewer with Restrictor
Disconnect Downspouts
Track
Artificial turf and playground area to have surface and subgrading pitched towards detention area. 6,600 sq.ft.
Proposed Permeable Paver 2,100 sq.ft.
Legend
Proposed Service Area
Inlet Restrictors (Typ)
Combined Sewers
Note: Photos courtesy of Center for Neighborhood Technology and Space to Grow Structures Benefitting from the Project: 046
1 Optional Inlet Restrictors with Medallion (Typ)
WATER IN THE STREET
REDUCES WATER IN YOUR BASEMENT
2 Educational Signage (Typ)
RAIN STORAGE
3 Proposed Underground Detention
Storage Stone
HDPE Pipe or Chamber
Underdrain
Outdoor Education Area
School Playground
Artificial Turf Field
Proposed Permeable Paver Parking
Proposed Permeable Paver Parking (Detail)
CL
Permeable Pavers
CA-16 Bedding
CA-7 Bedding
Existing Subgrade
Existing Pavement
Not to Scale
Underdrain
Irving Elementary School Concept
0 50 100 Feet
N
City of Berwyn
Stormwater Management Plan
CITY OF BERWYN
JUNE 6, 1908
THE CITY OF HOMES
Michael Baker
INTERNATIONAL
Michael Baker International, Inc.
200 W. Adams St. Suite 2800
Chicago, IL 60606

#

4.2.3 34th Street Concept

The homes along 34th Street currently connect to the combined sewer system through alley sewers, which tend to be smaller and shallower than combined sewers and are more likely to result in basement backups when the system is overwhelmed. The goal of this concept is to provide stormwater benefits along 34th Street to relieve the alley sewers.

Permeable pavers would be placed in the parking lanes of the street to capture street runoff and drain to the existing, shallower 15-inch diameter combined sewer along East Avenue. Permeable pavers should follow the latest and best-available design guidance and standards. Optional detention could be included in the street during final design when utility conflicts and sewer depths are known.

Homeowners along 34th Street would be encouraged to direct flow from their downspouts toward 34th Street so that roof drainage can be captured before entering the combined sewer system. Where space is available, the downspouts can be directed to new parkway rain gardens with underdrains feeding into the permeable paver system.

Educational signage can be placed on either end of the street, illustrating the scope of the project and the stormwater benefits provided.

Water Quality Benefits

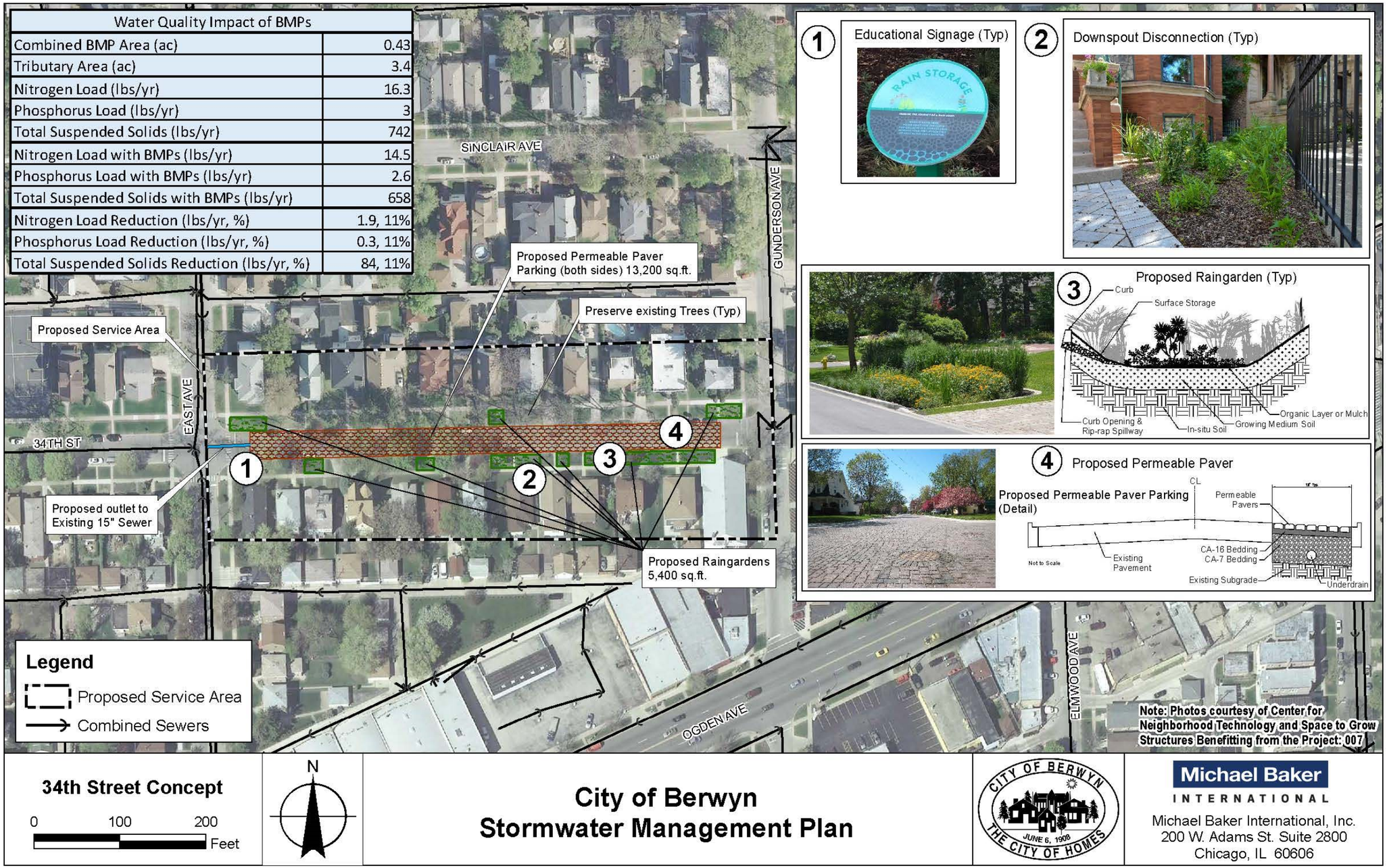
Water quality benefits will be provided in the raingardens and permeable paver areas. These will provide reductions in nitrogen, phosphorus, and total suspended solids. A summary table of the benefits is provided in **Table 4**.

Table 4: 34th Street Concept Water Quality Benefits

Water Quality Impact of BMPs	
Combined BMP Area (ac)	0.43
Tributary Area (ac)	3.4
Nitrogen Load (lbs/yr)	16.3
Phosphorus Load (lbs/yr)	3
Total Suspended Solids (lbs/yr)	742
Nitrogen Load with BMPs (lbs/yr)	14.5
Phosphorus Load with BMPs (lbs/yr)	2.6
Total Suspended Solids with BMPs (lbs/yr)	658
Nitrogen Load Reduction (lbs/yr, %)	1.9, 11%
Phosphorus Load Reduction (lbs/yr, %)	0.3, 11%
Total Suspended Solids Reduction (lbs/yr, %)	84, 11%

Cost Estimate

An Engineer's Opinion of Cost was developed for this project and is $523,244. Backup documentation for the Opinion is included in the **Appendix 5.3**.


Water Quality Impact of BMPs
Combined BMP Area (ac) 0.43
Tributary Area (ac) 3.4
Nitrogen Load (lbs/yr) 16.3
Phosphorus Load (lbs/yr) 3
Total Suspended Solids (lbs/yr) 742
Nitrogen Load with BMPs (lbs/yr) 14.5
Phosphorus Load with BMPs (lbs/yr) 2.6
Total Suspended Solids with BMPs (lbs/yr) 658
Nitrogen Load Reduction (lbs/yr, %) 1.9, 11%
Phosphorus Load Reduction (lbs/yr, %) 0.3, 11%
Total Suspended Solids Reduction (lbs/yr, %) 84, 11%
SINCLAIR AVE
GUNDERSON AVE
Proposed Permeable Paver Parking (both sides) 13,200 sq.ft.
Preserve existing Trees (Typ)
Proposed Service Area
EAST AVE
34TH ST
Proposed outlet to Existing 15" Sewer
Proposed Raingardens 5,400 sq.ft.
OGDEN AVE
ELMWOOD AVE
1
2
3
4
Educational Signage (Typ)
RAIN STORAGE
Downspout Disconnection (Typ)
Proposed Raingarden (Typ)
Curb
Surface Storage
Organic Layer or Mulch
Curb Opening & Rip-rap Spillway
In-situ Soil
Growing Medium Soil
Proposed Permeable Paver
Proposed Permeable Paver Parking (Detail)
CL
Permeable Pavers
CA-16 Bedding
CA-7 Bedding
Existing Pavement
Not to Scale
Existing Subgrade
Underdrain
Legend
Proposed Service Area
Combined Sewers
Note: Photos courtesy of Center for Neighborhood Technology and Space to Grow Structures Benefitting from the Project: 007
34th Street Concept
0 100 200 Feet
N
City of Berwyn
Stormwater Management Plan
CITY OF BERWYN
JUNE 6, 1908
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Michael Baker
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Chicago, IL 60606

Appendix 1
Existing Plan Review Memorandum

Hey and Associates, Inc.
Engineering, Ecology and Landscape Architecture

Memorandum

TO:	Kate Evasic (MWRD)	Proj. No.	17-0256
CC:	Wendy Vachet, AICP (Michael Baker International)		
FROM:	Patrick Lach, P.E., CFM (Hey and Associates) Anna Culcasi, P.E., CFM (Hey and Associates)		
DATE:	December 13, 2017		
RE:	Berwyn Existing Plan Review		

Several plans and studies have been developed for Berwyn in recent years, and that data is summarized below and can serve as a starting place for the updated Stormwater Master Plan.

Active Transportation Plan

The City of Berwyn partnered with the Active Transportation Alliance to produce an active transportation plan for the community. The plan is composed of improvements to the physical infrastructure, policies, and programs that make it safer and more convenient for people to walk, bike, and use transit in Berwyn.

Key points and concerns

The plan goals include near-term, mid-term, and long-term goals. Near-term goals include intersection and corridor improvements in areas that are currently used for active transportation. Mid-term goals include improving corridors and intersections where current conditions could easily become more walkable and bikeable. Long-term goals include new paths, trails, and bike lanes, and updating intersections.

Comprehensive Plan

The City of Berwyn Comprehensive Plan was adopted in August 2012. The plan outlines land use and development goals and objectives to achieve a high quality of life for residents, business owners, and visitors through a diversity of land uses and balance between the built and unbuilt environment.

The plan outlines goals for land use and development, image and identity, economic development, housing, open space and recreation, and transportation. Plan recommendations and implementation strategies were organized into four categories: 1) redevelopment; 2) community health; 3) neighborhood preservation and enhancement; 4) image and identity.

Key points and concerns

Commercial redevelopment should be focused on the following areas: Berwyn Metra Station Area including the Depot District, commercial nodes along Ogden Avenue, Cermak Road, and Roosevelt Road, and neighborhood commercial areas along 26th Street. This will include identifying parcels for consolidation and redevelopment, identifying public and private partnerships for joint development

opportunities, support of transit improvements, creation of development guidelines for commercial nodes and transitional zones, and creation of a capital improvement plan.

Community health is focused on strategies to enhance individual physical health as well as strategies to build upon the health sector of Berwyn's economy. The physical health goals include implementing the goals of the Active Transportation Plan, enhancing existing open space, and identifying opportunities for new recreational amenities. Supporting the economic health sector includes goals to increase collaboration between workforce trainers and residents and improve the educational attainment levels of Berwyn residents to increase the number of employment opportunities for which they are qualified.

Neighborhood preservation and enhancement outlines policies and strategies to help the City continue preservation efforts and neighborhood revitalization. Strategies include:

- Create a prioritized list of historic properties for landmark designation
- Coordinate marketing efforts with the BDC and regional entities
- Provide employer assisted housing
- Designate a bungalow-focused historic district
- Create redevelopment guidelines for residential neighborhoods
- Develop financial incentives for property rehabilitation and maintenance
- Identify and define specific areas for rehabilitation and redevelopment
- Target deployment of CDBG funds to revitalize key neighborhoods

Image and identity strategies to enhance the community are:

- Identify partners and form alliances for beautification of public spaces and rights of way
- Allocate staff time and resources for promoting arts and culture
- Encourage display of art in public places
- Create a centralized guide to increase awareness of community events for residents and visitors
- Create a comprehensive marketing and branding strategic plan
- Create a wayfinding signage plan
- Create a Public Art Ordinance and an Arts and Culture Committee

<u>Complete Streets Policy</u>

The Complete Streets Policy outlines the steps Berwyn will take to improve safety, access, and mobility for users of the public way and recognize bicycle, pedestrian, and transit modes as integral elements of the transportation system.

Key points and concerns

The Complete Streets Policy will be implemented by considering users of the public way in the scoping, planning, programming, design, construction, and operations and maintenance activities on the City's transportation network. Future projects will be reviewed by the City Administrator, Public Works Director, and City Traffic Engineer as members of the Complete Streets Committee.

Draft Stormwater Master Plan

A Draft Stormwater Master Plan was prepared in 2014. It provides background information, problem identification, recent improvements, and future plans.

Background information provided in the Plan covers the hydrologic cycle, the basics of a combined sewer system, general information regarding the City of Berwyn.

The Past Flooding section includes a table of major flooding events between 2001 and 2013.

The Current Issues section provides information on sewer backup, street flooding, bursting water mains, leaking pipes, and undersized water mains.

The Recent Improvements section details the improvements at Proksa Park and the Liberty Cultural Center.

The Future Plans section notes that the Depot District study would be complete by the end of 2013 to fully assess the existing conditions in the Depot District. This section also outlined the benefits for engineering studies. Relief sewer construction, green infrastructure, green alleys, videotaping, and downspout disconnections were discussed.

Ordinance changes recommended include downspout disconnections, overhead sewer system installation, footing drain disconnection, impervious area addition provisions.

Additional programs suggested include improvements in the Depot District, a Stormwater Utility, sewer lining, overhead sewer cost sharing program, and general residential and commercial practices.

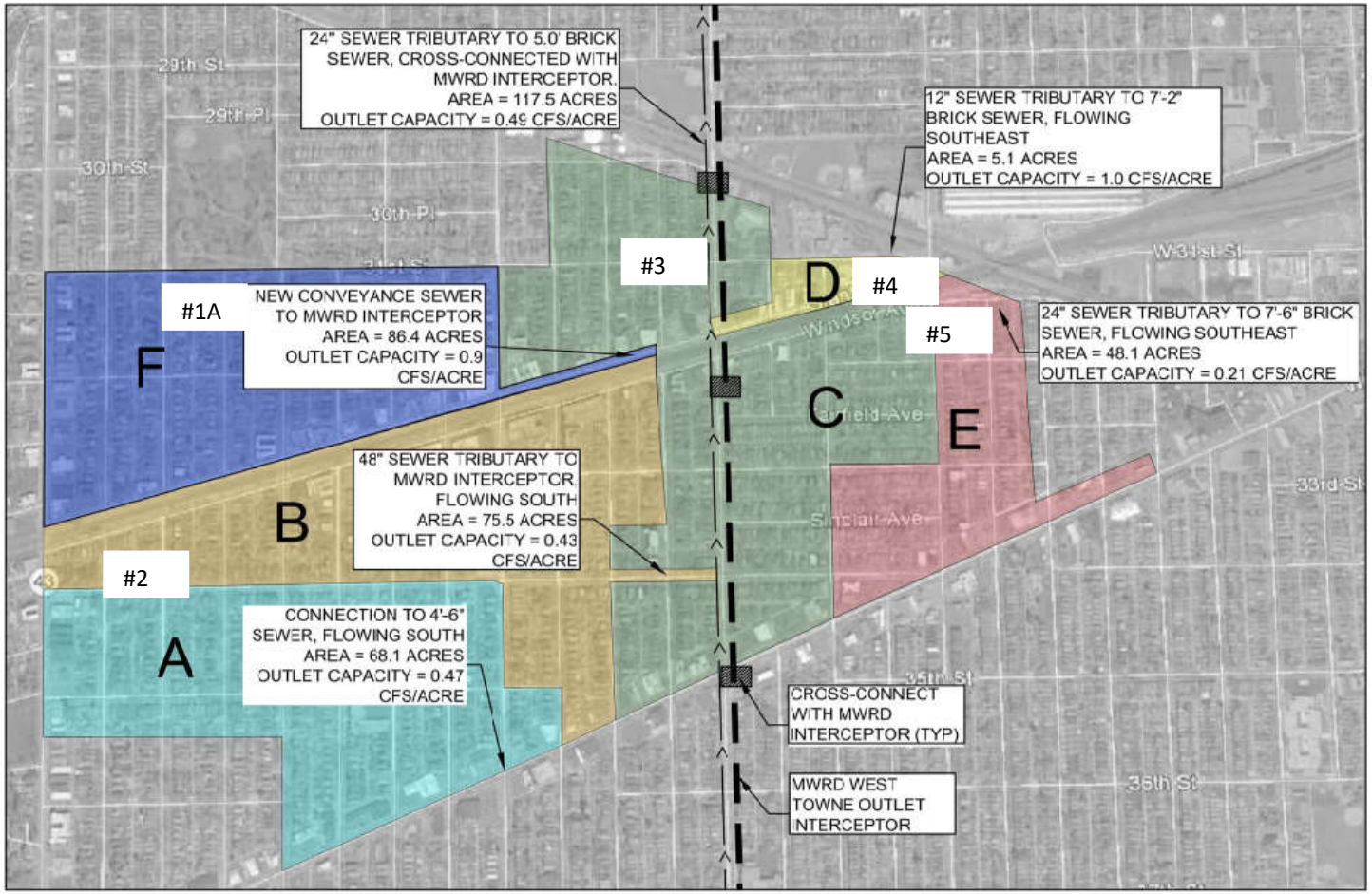
Key points and concerns

The background information and past flooding section had incomplete data and would need to be expanded in the updated version of Stormwater Master Plan.

The stormwater utility section discusses different options for funding a stormwater utility fee, but additional analysis could be performed for estimating results.

Depot District Drainage Study

The purpose of this report was to evaluate the City of Berwyn Depot District Drainage Area and its upstream tributaries and identify conditions that results or potentially result from the flooding conditions. The study area boundaries were approximately 28th Street, Lombard Avenue, Ogden Avenue, and Harlem Avenue. Five sewersheds were defined in this area. Recommendations were made for increasing sewer capacity. Sewersheds were evaluated for the 2-year, 10-year, and 100-year storm events using the Rational Method. Eight options were developed and evaluated for their costs and benefits, shown in the figure and table below.


24" SEWER TRIBUTARY TO 5.0' BRICK SEWER, CROSS-CONNECTED WITH MWRD INTERCEPTOR, AREA = 117.5 ACRES OUTLET CAPACITY = 0.49 CFS/ACRE
12" SEWER TRIBUTARY TO 7'-2" BRICK SEWER, FLOWING SOUTHEAST AREA = 5.1 ACRES OUTLET CAPACITY = 1.0 CFS/ACRE
#3
#4
#5
#1A
NEW CONVEYANCE SEWER TO MWRD INTERCEPTOR AREA = 86.4 ACRES OUTLET CAPACITY = 0.9 CFS/ACRE
24" SEWER TRIBUTARY TO 7'-6" BRICK SEWER, FLOWING SOUTHEAST AREA = 48.1 ACRES OUTLET CAPACITY = 0.21 CFS/ACRE
F
D
C
E
B
A
48" SEWER TRIBUTARY TO MWRD INTERCEPTOR, FLOWING SOUTH AREA = 75.5 ACRES OUTLET CAPACITY = 0.43 CFS/ACRE
#2
CONNECTION TO 4'-6" SEWER, FLOWING SOUTH AREA = 68.1 ACRES OUTLET CAPACITY = 0.47 CFS/ACRE
CROSS-CONNECT WITH MWRD INTERCEPTOR (TYP)
MWRD WEST TOWNE OUTLET INTERCEPTOR
29th St
29th Pl
30th St
30th Pl
31st St
W 31st St
Windsor Ave
Sinclair Ave
33rd St
35th St
TERRA ENGINEERING LTD.
225 W. Ohio Street, 4th Floor
Chicago, Illinois 60654
(312) 467-0123 (312) 467-0220 fax
EXHIBIT 19: REVISED SEWER NETWORK LEGEND
SCALE: 1" = 600'
CITY OF BERWYN

Summary of Options, Opinion of Cost, Reduction of Total Flow within sewer, and % Area Impacted				
Option	Increase to Sewer Outlet Capacity (% Increase from Existing Condition)	Increase to 10-Year Peak Flow/Capacity Ratio (% Increase from Existing Condition)	% Area Benefited by Improvements	Opinion of Cost (Order of Magnitude)**
#1 - Conveyance sewer to MWRD Interceptor	180%	32%	32%	
#1A				$1,500,000
#1B				$1,800,000
#1C				$1,400,000
#2 - Divert flow from Network "A" to "B"	60%	20%	24%	$1,100,000
#3 Upsize East Ave Sewer	0%	14%	26%	$350,000
#4 Upsize Stanley Ave Sewer	380%	52%	1%	$300,000
#5a - Divert Windsor Avenue drainage to East Avenue	0%	2%	16%	$450,000
#5b - Divert Windsor Avenue roadway drainage and south lots to East Avenue	40%	22%	16%	$650,000

** Order of Magnitude Opinion of Cost is based upon length of sewer construction, street restoration, assumed drainage structures every 300 feet, manholes every 600 feet, and a 20% design contingency. These values are meant to provide a rough comparison between amount of the investment cost and payback with sewer efficiencies. Final Opinion of Probable Construction Costs should be based upon engineered construction documents.

DRAFT

Key points and concerns

The recommendations were to implement options #1A and #2 to provide relief to the sewer networks in the Depot District and flooding conditions in high traffic pedestrian areas.

<u>The Zoning Ordinance</u>

Stormwater regulations in the zoning ordinance are generally found in Chapter 1250: Landscape Standards. The standards apply to the following developments:

- New developments that require site plan approval;
    - All development, redevelopment, and additions to existing structures that result in an increase in gross floor area, capacity or number of dwelling units by 15 percent or more, with the exception of single-family and two-family developments require approval of a site plan.
- Planned Developments;
- The construction of any new parking lot of 15 spaces or more;

- The expansion or reconstruction of any existing parking lot that results in a total of 15 aggregate parking spaces or more.

The standards include design criteria for the following:

- Runoff Detention shall be designed to meet the 50-year, 24-hour return frequency and incorporate green infrastructure, post-construction stormwater management measures, and BMPs.
- The maximum allowable discharge rate shall be 0.15 cfs/ac.
- Runoff from impervious surface shall not sheet flow to the public right-of-way.
- Any development or redevelopment may satisfy the stormwater requirements through payment of a fee-in-lieu subject to approval by the Zoning, Planning, and Development Commission. This shall not be allowed in lieu of stormwater management controls required by any other agency.
    - The fee shall be made based upon a calculation made by the Department of Public Works for construction and ongoing maintenance of the required on-site controls.
- Maintenance of stormwater management facilities located on private property shall be the responsibility of the property owner. An O&M plan must be signed by the owner and submitted to the City.

Key points and concerns

1250.01.B states that the requirements of the Chapter apply to new developments that require site plan approval. 1252.03.B2 states that the site plan review applies to development, redevelopment, and additions to existing structures that result in an increase in gross floor area, capacity or number of dwelling units by 15 percent or more, with the exception of single-family and two-family developments require approval of a site plan. Clarification could be made between these two sections to denote whether stormwater requirements only apply to new development, or new development, redevelopment, and additions to existing structures.

<u>Hazard Mitigation Plan</u>

Cook County and participating municipalities developed a hazard mitigation plan to reduce risk from all hazards by identifying resources, information, and strategies for risk reduction. The purpose of this report is for Berwyn to provide an annual update on the implementation of the action plan identified in the Cook County Multi-Jurisdictional Hazard Mitigation Plan. Categories include:

- Natural Hazard Events
    - None reported in 2016
- Mitigation Success Stories
    - Secured $9.5M in grand funds for Depot District Streetscape Project
    - Received grant funds for Green Alley Program
    - Secured $60K in grant funds for active transportation enhancement project
    - Continuation of MWRD Residential Rain Barrel program with MWRD
    - Continuation of Residential Flood Mitigation Program
    - Installed new water main on 6500 block of Windsor Avenue
    - Completed 13th Street Pavement and Sewer Replacement Project
    - Completed 19th Street Generator project
    - Implementation of snow removal notification system

    - 800 feet of spot repairs to sewer system
- Review of Action Plan
    - Where appropriate support retrofitting, purchase, or relocation of structures in hazard prone areas to prevent future structure damage. Give priority to properties with exposure to repetitive losses.
        - No action
    - Continue to support the countywide actions identified in this plan
        - No action
    - Actively participate in the plan maintenance strategy identified in this plan
        - No action
    - Consider participation in incentive-based programs such as Tree City, and StormReady
        - No action
    - Consider participation in the National Flood Insurance program as non-mapped, participating community
        - No action
    - Where feasible, implement a program to record high water marks following high-water events
        - No action
    - Integrate the hazard mitigation plan into other plans, programs, or resources that dictate land use or redevelopment
        - No action
    - Consider having the City's building code enforcement program evaluated under the Building Code Effectiveness Grading Schedule
        - No action

Appendix 2
Stormwater Analysis Memorandum

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

8755 W. Higgins Road, Suite 835
Chicago, Illinois 60631
Phone (773) 693-9200

MEMORANDUM

To: Kate Evasic (CMAP)

CC: Wendy Vachet, AICP (Michael Baker International)

From: Patrick Lach, P.E., CFM (Hey and Associates)
Anna Culcasi, P.E., CFM (Hey and Associates)

Date: November 11, 2017

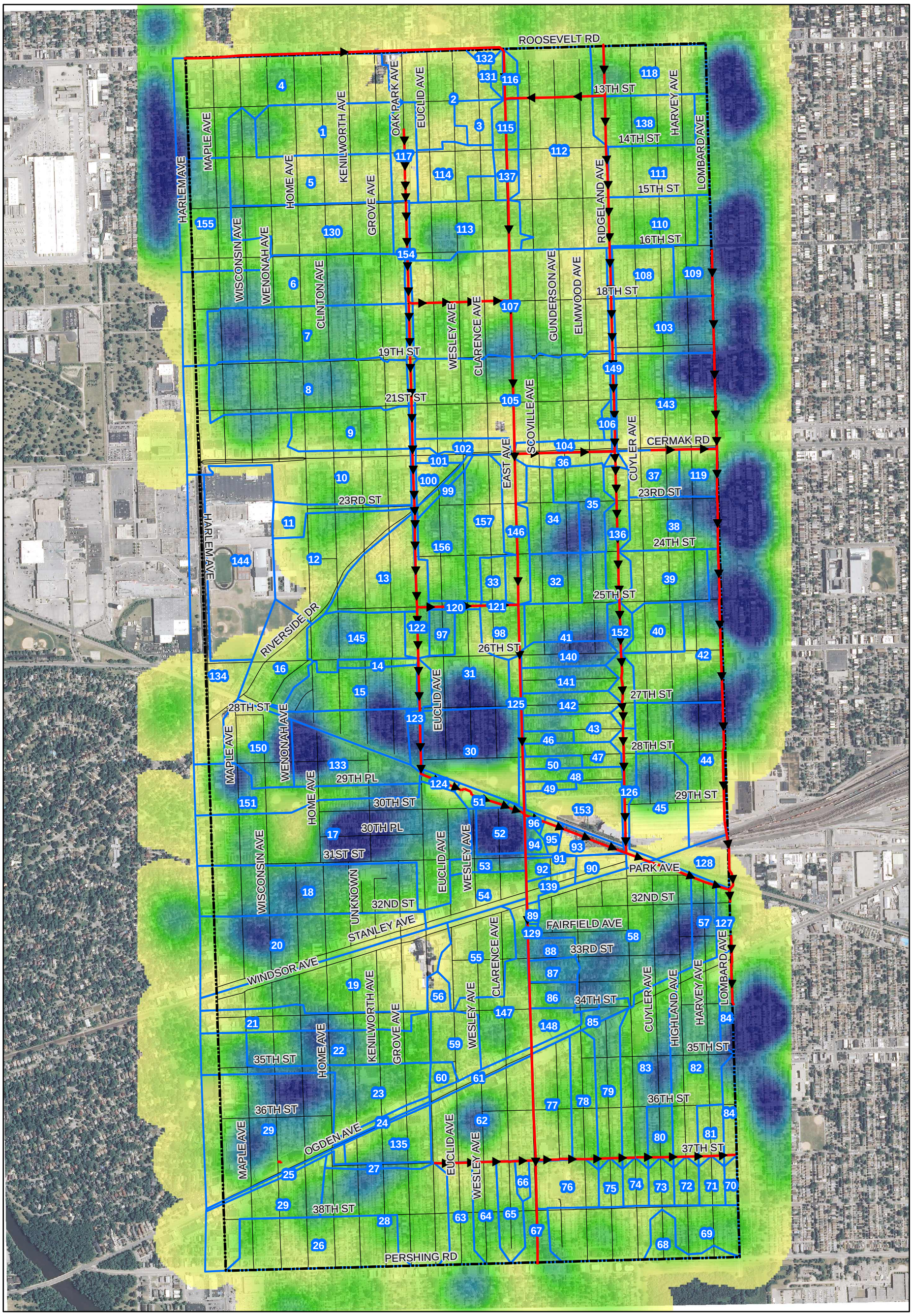
Re: Berwyn Stormwater Analysis

Project No. 17-0256

Problem Understanding

Berwyn is an older, urban community that was originally developed with a combined sewer system as opposed to separate stormwater and sanitary sewage systems that exist in newer communities. In the combined system, raw sewage and stormwater runoff are combined and carried through the local pipe system to the MWRD interceptors and ultimately to the Stickney Treatment Plant. When the volume of water exceeds the pipe capacity as typically seen in significant rain events, the combined stormwater runoff and raw sewage can back up into basements, street drains, and adjacent waterways. The storms of April 2013 caused widespread flooding in Berwyn, including backups into many home (Appendix B).

Berwyn is at the downstream end of the MWRD interceptor system. Chicago, Oak Park, Forest Park, River Forest, and Elmwood Park are all contributors to this system upstream of Berwyn. If Berwyn's combined, local sewer system had adequate capacity, it would be able to discharge its stormwater runoff to the interceptor system before the peak flow from the upstream communities utilized the interceptor's capacity. However, the limited capacity of Berwyn's combined sewer system means that sewers flow at their maximum capacity very quickly and additional stormwater runoff moves slowly through the system. The MWRD interceptors are likely already conveying runoff and sewage from upstream communities while the Berwyn sewer peak flow is reaching the interceptors. This causes a delay in the ability of the Berwyn sewers to drain until the MWRD interceptors have the capacity to accept the additional flow from Berwyn. See Figure 1 below, which shows the distribution of reported flooding locations.



Scale:

0 200
Feet

Orientation:

Project Number: 15-0XXX

Latest Revision: 11/8/2017

Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Legend:

Legend

- Collector Sewer
- Berwyn Limits
- Sewershed Boundaries

Density of Reported Flood Occurrences*

- High
- Low

*Includes FEMA Individual Assistance claims and City flood reports

Project Name:

Berwyn Stormwater Analysis

Prepared for:

CMAP

Information about exhibit:

Exhibit Title:

Reported Flooding Locations

Figure:

1

Sewershed Analysis

Because Berwyn's main flooding problem is related to sewer capacity, a sewershed analysis was performed. 157 sewersheds were delineated with methodology based on similar delineations completed in other communities. The location where the local sewer (approximately 12"-30" diameter) joined a significantly larger collector sewer (60"+ diameter) was used as the downstream point of each sewershed. There are cases of cross-connected sewers in Berwyn, and the sewershed delineations were estimated in these areas based on the assumption that the pipes were generally flowing towards the larger sewers.

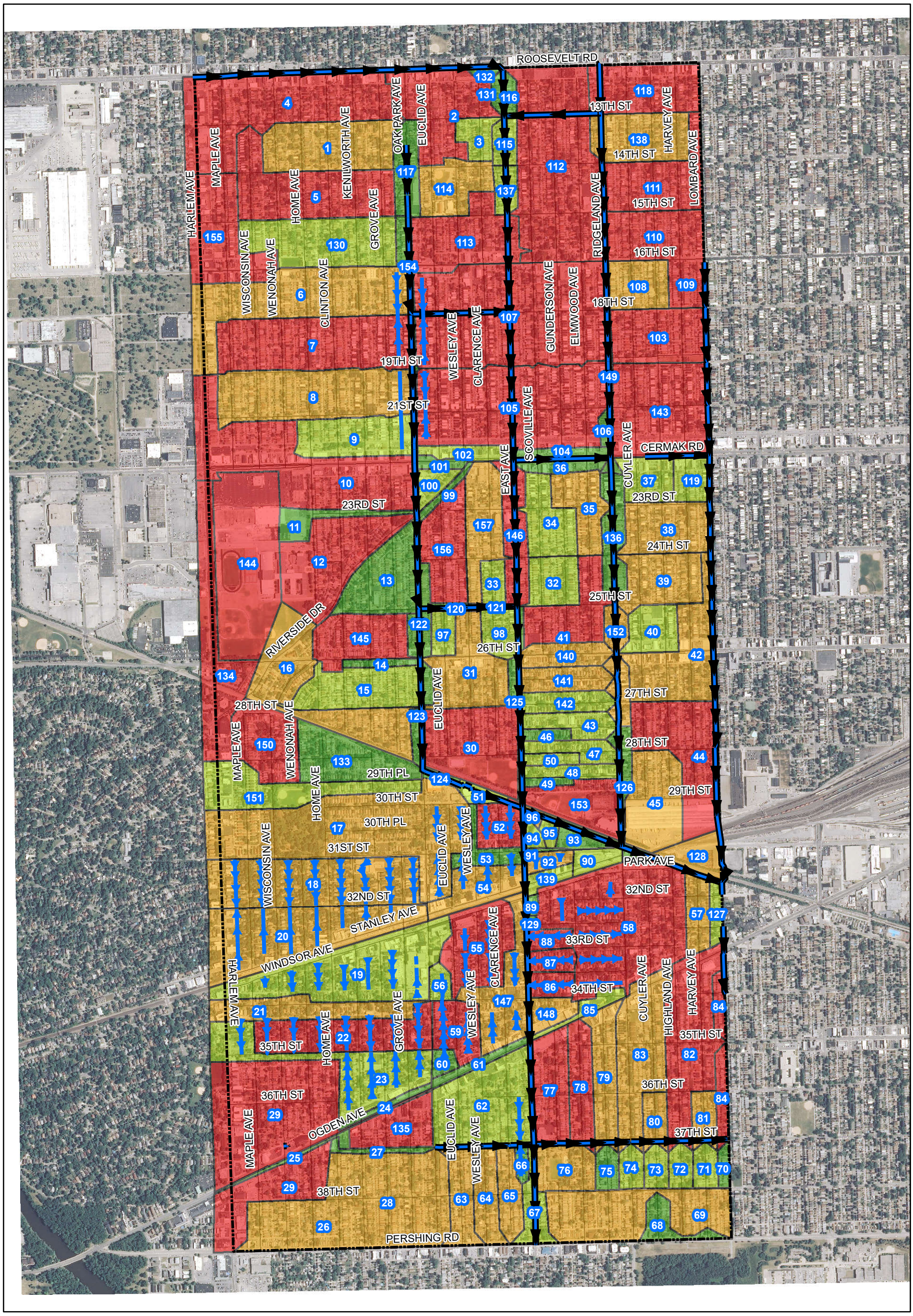
The next steps of this analysis involved determining the capacity of the local outlet sewer based on the corresponding sewershed area and the assumed design capacity of the local sewer based on industry standards. The capacity of the sewersheds was calculated and assigned a point value of one through four based on a quartile distribution. These results are summarized in the Sewershed Table in Appendix A.

In addition, based on Steering Committee information, it was noted that in much of Berwyn where homes discharge to alley sewers that these sewers are shallow and have low capacity, causing a higher incidence of basement flooding than homes that discharge to street sewers. Sewersheds that have alley sewers were noted as having a higher risk of flooding and were assigned a binary ranking value of three points. Figure 2 below shows the sewersheds ranked by quartile based on their capacity and highlights the location of the alley sewers.

The sewershed capacity and alley rankings were combined to determine the sewersheds with the highest risk for flooding. Figure 3 below shows the sewershed ranking of the flood risk levels based on capacity and alley sewers. The table below shows the range of calculated sewer capacity and alley sewer presence for each quartile. Full detail is provided in the Sewershed Table in Appendix A. The highest quartile sewersheds are highlighted in the Sewershed Table in Appendix A.

Quartile	Alley Sewer	Calculated Sewer Capacity Range (cfs/ac)
1	N	0.56-9.83
2	N	0.29-0.56
3	N	0.15-0.28
4	Y	0.10-0.33

Table 1. Range of Calculated Sewer Capacity and Alley Sewer Presence for each Sewershed.



Scale:

0 500 1,000 Feet

Orientation:

Project Number: 17-0256

Latest Revision: 11/8/2017

Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Legend:

Legend

- Alley Sewers
- Collector Sewer
- Berwyn Limits
- 26 Sewershed ID

Capacity Quartiles

- 1
- 2
- 3
- 4

Project Name:

Berwyn Stormwater Analysis

Prepared for:

CMAP

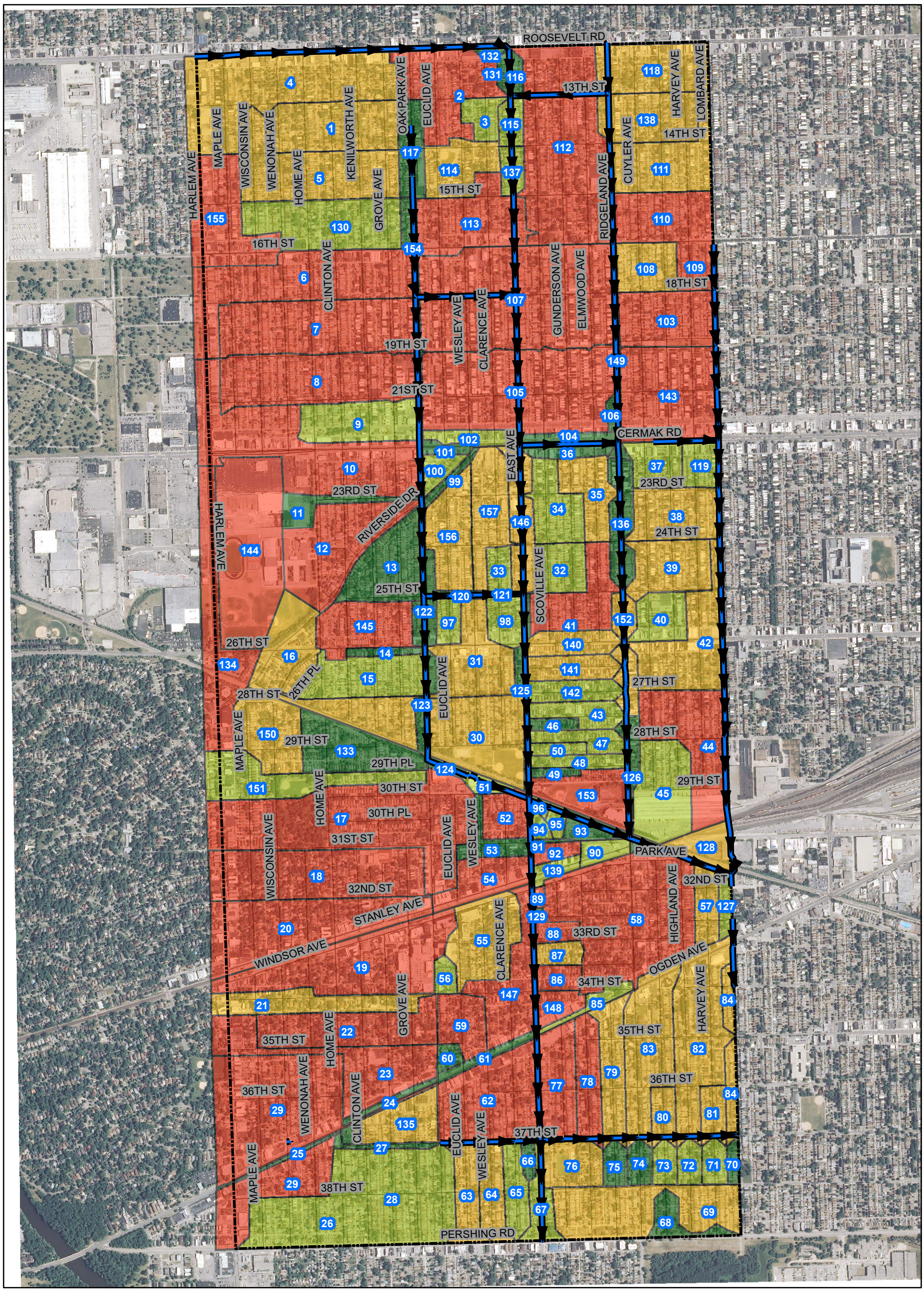
Information about exhibit:

Exhibit Title:

Sewershed Capacity Quartiles

Figure:

2



Scale:

0 500 1,000 Feet

Orientation:

Legend:

Collector Sewer

Berwyn Limits

26 Sewershed ID

Sewershed Boundaries

Higher Risk Quartiles

1

2

3

4

Project Number: 17-0256

Latest Revision: 11/14/2017

Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Project Name:

Berwyn Stormwater Analysis

Prepared for:

CMAP

Information about exhibit:

Exhibit Title:

Flood Risk Ranking

Figure:

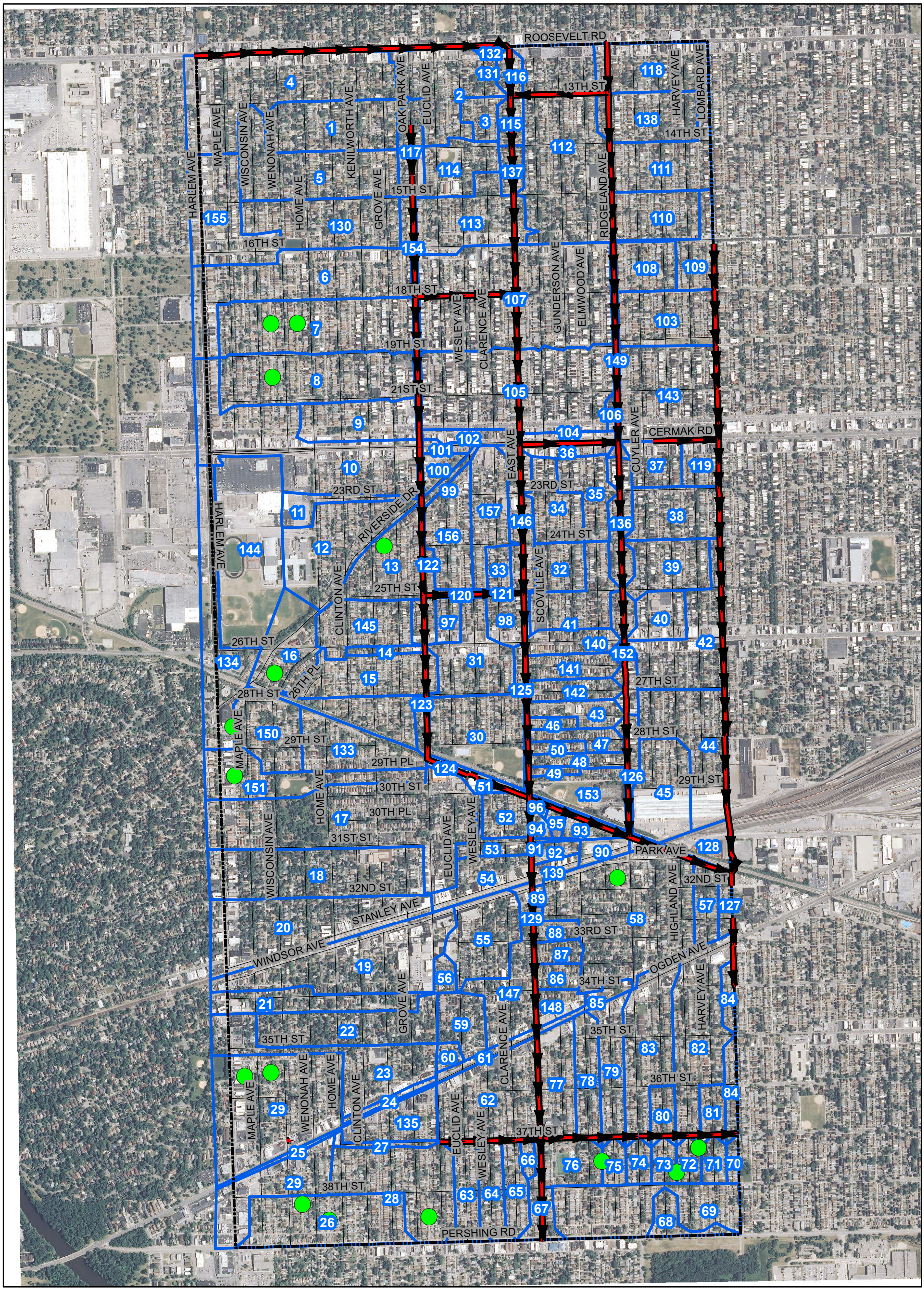
3

Opportunity Analysis

To help Berwyn prioritize their efforts to address the sewersheds at a higher risk of flooding, potential opportunities were explored. Areas of opportunity identified based on the initial steering committee meeting input were locations with sandy soils, and certain land use opportunities such as open spaces in parks or on school property, wide rights-of-way (e.g. Cermak), and commercial areas.

Berwyn had 66 soil borings performed to locate sandy soils that may have the opportunity for increased stormwater infiltration. These borings were evaluated based on the depth and quality of the sandy soil. Figure 4 shows the location of the sandy soil borings.

Land uses were also analyzed for opportunities. Commercial areas, large rights-of-way, open space areas, and educational/institutional areas were noted as having potential for community-level stormwater improvements. Figure 5 shows the sewersheds with potential land use opportunities.



Scale:

0 500 1,000 Feet

Orientation:

Legend:

- Sandy Soil Borings
- Collector Sewer
- Berwyn Limits
- 26 Sewershed ID

Project Number: 17-0256

Latest Revision: 11/8/2017

Prepared by:

Hey and Associates, Inc.
Engineering, Ecology and Landscape Architecture

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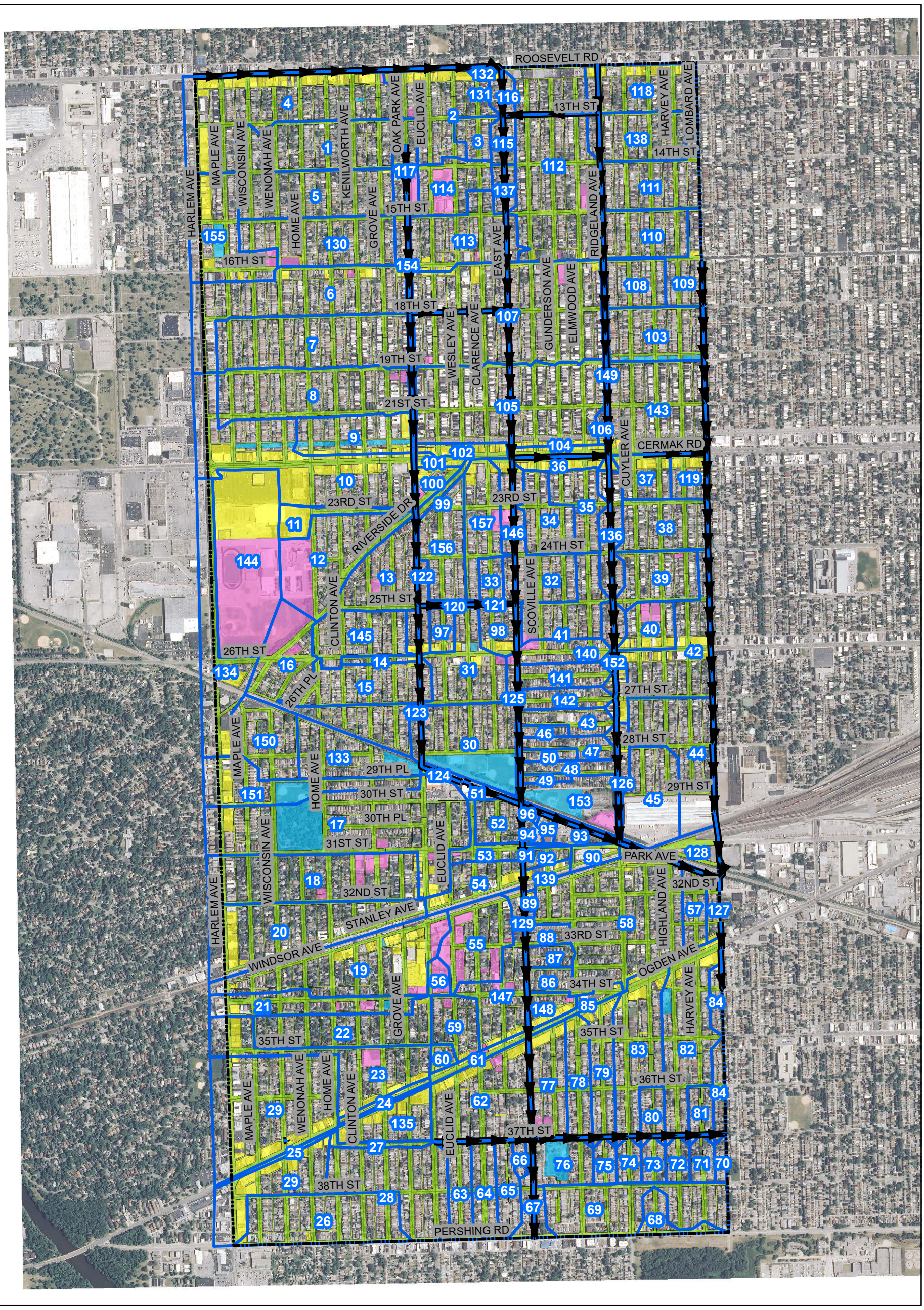
Information about exhibit:

Exhibit Title:

Sandy Soil Boring Locations

Figure:

4



Scale:

0 500 1,000 Feet

Orientation:

Legend:

Collector Sewer

Berwyn Limits

26 Sewershed ID

Land Use Opportunities

- Commercial
- Institution
- Open Space
- ROW

Project Number: 15-0XXX

Latest Revision: 11/8/2017

Prepared by:

Hey and Associates, Inc.
Engineering, Ecology and Landscape Architecture

Project Name:
Berwyn Stormwater Analysis

Prepared for:
CMAP

Information about exhibit:

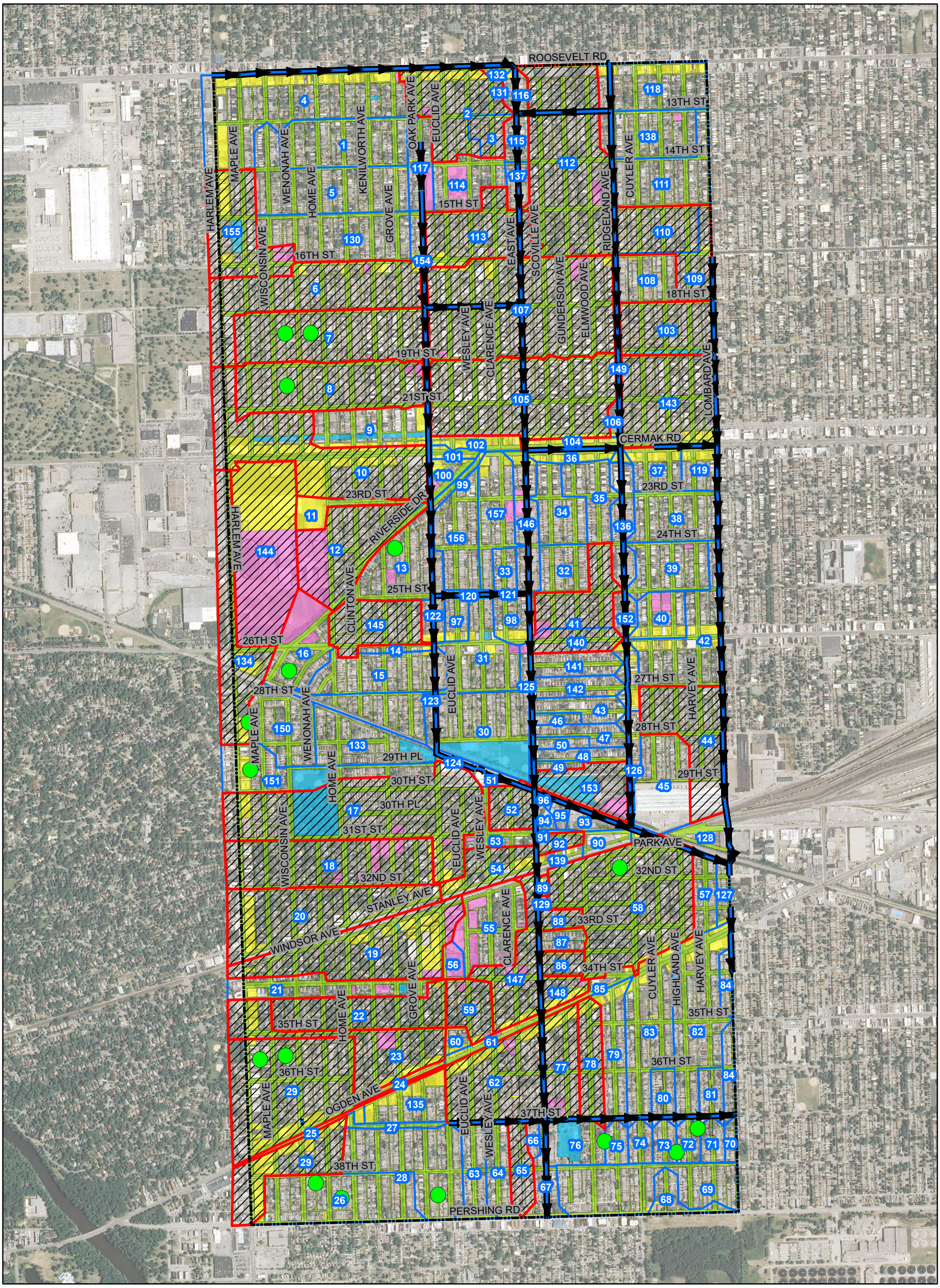
Exhibit Title:
Land Use Opportunity Locations

Figure:
5

Results

The sewershed analysis identified areas with the lowest capacity where there are also alley sewers. These sewersheds were then compared with sewersheds that have sandy soils or potential land use opportunities as a way to focus Berwyn's initial efforts in addressing its stormwater problems.

Figure 6 shows the 4th quartile flooding risk sewersheds, sandy boring locations, and land use opportunities.



Scale:

0 500 1,000 Feet

Orientation:

Project Number: 17-0256

Latest Revision: 11/14/2017

Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Legend:

- 4th Quartile Flooding Risk Sewersheds
- Sewershed Boundaries
- Sandy Soil Borings
- Collector Sewer
- Berwyn Limits
- 26 Sewershed ID

Land Use Opportunities

- Commercial
- Institution
- Open Space
- ROW

Project Name:

Berwyn Stormwater Analysis

Prepared for:

CMAP

Information about exhibit:

Exhibit Title:

Sewershed Flooding Risk And Opportunities

Figure:

6

Appendix A

Sewershed Analysis Table

Sewershed Analysis Summary Table

Sewershed Id	Area (AC)	Sewershed Outfall Pipe Diameter	Assumed Outfall Pipe Capacity	Calculated Sewershed Allowable Discharge (cfs/ac)	Alley Sewer	Capacity Quartile Points	Alley Binary Points	Flooding Risk Points	Flooding Risk Quartile	Sandy Soil	Commercial/ ROW	Open Space/ Institutional	Res. Parcels Reporting Flooding	% of Res. Parcels Reporting Flooding*
1	27.36	24.00	6.28	0.23	N	3	0	3	3	N	N	N	12	6%
2	33.54	18.00	3.53	0.11	N	4	0	4	4	N	Y	Y	5	2%
3	5.98	15.00	2.45	0.41	N	2	0	2	2	N	N	N	1	2%
4	54.22	30.00	9.82	0.18	N	4	0	4	3	N	Y	Y	23	9%
5	35.93	24.00	6.28	0.17	N	4	0	4	3	N	Y	N	13	5%
6	46.62	33.00	11.88	0.25	Y	3	3	6	4	N	Y	Y	29	11%
7	42.77	27.00	7.95	0.19	Y	4	3	7	4	Y	N	N	39	12%
8	40.63	27.00	7.95	0.20	Y	3	3	6	4	Y	N	Y	31	13%
9	18.99	24.00	6.28	0.33	N	2	0	2	2	N	Y	Y	9	11%
10	55.82	27.00	7.95	0.14	N	4	0	4	4	N	Y	Y	18	10%
11	7.25	33.00	11.88	1.64	N	1	0	1	1	N	Y	Y	2	20%
12	32.41	20.00	4.36	0.13	N	4	0	4	4	N	Y	Y	9	8%
13	20.95	33.00	11.88	0.57	N	1	0	1	1	Y	Y	N	5	4%
14	2.52	21.00	4.81	1.91	N	1	0	1	1	N	Y	N	3	13%
15	20.80	24.00	6.28	0.30	N	2	0	2	2	N	Y	N	20	15%
16	34.70	27.00	7.95	0.23	N	3	0	3	3	Y	N	Y	26	18%
17	72.14	36.00	14.14	0.20	Y	3	3	6	4	N	Y	Y	75	24%
18	43.40	30.00	9.82	0.23	Y	3	3	6	4	N	Y	Y	34	18%
19	45.64	36.00	14.14	0.31	Y	2	3	5	4	N	Y	Y	17	12%
20	44.47	30.00	9.82	0.22	Y	3	3	6	4	N	Y	N	30	23%
21	17.71	18.00	3.53	0.20	N	3	0	3	3	N	Y	Y	7	13%
22	26.39	18.00	3.53	0.13	Y	4	3	7	4	N	Y	N	25	19%
23	30.45	33.00	11.88	0.39	Y	2	3	5	4	N	Y	Y	27	23%
24	2.42	15.00	2.45	1.01	N	1	0	1	1	N	Y	N	0	0%
25	2.70	15.00	2.45	0.91	N	1	0	1	1	N	Y	N	0	0%
26	32.89	30.00	9.82	0.30	N	2	0	2	2	Y	Y	N	13	6%
27	2.62	42.00	19.24	7.34	N	1	0	1	1	N	Y	N	3	N/A
28	66.07	42.00	19.24	0.29	N	3	0	3	2	Y	N	N	37	8%
29	77.92	24.00	6.28	0.08	N	4	0	4	4	Y	Y	N	58	21%
30	29.99	20.00	4.36	0.15	N	4	0	4	3	N	N	Y	42	27%
31	21.94	21.00	4.81	0.22	N	3	0	3	3	N	Y	Y	20	15%
32	10.26	21.00	4.81	0.47	N	2	0	2	2	N	N	N	9	13%
33	4.41	15.00	2.45	0.56	N	2	0	2	2	N	N	N	1	3%
34	14.23	21.00	4.81	0.34	N	2	0	2	2	N	Y	N	13	14%
35	13.05	18.00	3.53	0.27	N	3	0	3	3	N	Y	N	13	15%
36	4.78	21.00	4.81	1.01	N	1	0	1	1	N	Y	N	0	0%
37	9.86	18.00	3.53	0.36	N	2	0	2	2	N	Y	N	6	11%
38	19.16	21.00	4.81	0.25	N	3	0	3	3	N	N	N	15	11%
39	17.17	21.00	4.81	0.28	N	3	0	3	3	N	Y	Y	9	8%
40	10.09	18.00	3.53	0.35	N	2	0	2	2	N	Y	Y	6	15%
41	26.97	18.00	3.53	0.13	N	4	0	4	4	N	N	Y	29	16%
42	28.56	24.00	6.28	0.22	N	3	0	3	3	N	Y	N	14	8%
43	8.20	15.00	2.45	0.30	N	2	0	2	2	N	Y	N	4	10%

*Percentages may be inconsistent due to sewersheds crossing parcel boundaries. Percentages are meant to be used as a general guide.

Sewershed Analysis Summary Table

Sewershed Id	Area (AC)	Sewershed Outfall Pipe Diameter	Assumed Outfall Pipe Capacity	Calculated Sewershed Allowable Discharge (cfs/ac)	Alley Sewer	Capacity Quartile Points	Alley Binary Points	Flooding Risk Points	Flooding Risk Quartile	Sandy Soil	Commercial/ ROW	Open Space/ Institutional	Res. Parcels Reporting Flooding	% of Res. Parcels Reporting Flooding*
44	31.75	20.00	4.36	0.14	N	4	0	4	4	N	N	N	26	13%
45	21.98	24.00	6.28	0.29	N	3	0	3	2	N	N	N	15	19%
46	2.46	12.00	1.57	0.64	N	1	0	1	1	N	N	N	1	6%
47	6.61	15.00	2.45	0.37	N	2	0	2	2	N	N	N	4	9%
48	5.54	15.00	2.45	0.44	N	2	0	2	2	N	N	N	6	17%
49	1.83	12.00	1.57	0.86	N	1	0	1	1	N	N	N	0	0%
50	2.84	12.00	1.57	0.55	N	2	0	2	2	N	N	N	1	5%
51	3.07	12.00	1.57	0.51	N	2	0	2	2	N	N	N	0	0%
52	8.84	12.00	1.57	0.18	Y	4	3	7	4	N	N	N	27	33%
53	6.29	18.00	3.53	0.56	N	1	0	1	1	N	N	Y	4	17%
54	13.29	18.00	3.53	0.27	Y	3	3	6	4	N	Y	N	3	6%
55	21.97	18.00	3.53	0.16	N	4	0	4	3	N	N	Y	6	8%
56	3.17	12.00	1.57	0.49	N	2	0	2	2	N	N	N	0	0%
57	8.20	12.00	1.57	0.19	N	3	0	3	3	N	Y	N	13	28%
58	63.61	24.00	6.28	0.10	Y	4	3	7	4	Y	Y	Y	54	15%
59	11.05	12.00	1.57	0.14	N	4	0	4	4	N	Y	Y	3	4%
60	2.50	12.00	1.57	0.63	N	1	0	1	1	N	Y	N	2	20%
61	3.93	15.00	2.45	0.62	N	1	0	1	1	N	Y	Y	0	0%
62	42.45	36.00	14.14	0.33	Y	2	3	5	4	N	Y	Y	22	9%
63	11.02	15.00	2.45	0.22	N	3	0	3	3	N	Y	N	2	3%
64	10.25	15.00	2.45	0.24	N	3	0	3	3	N	N	N	6	9%
65	8.54	15.00	2.45	0.29	N	3	0	3	2	N	N	N	3	6%
66	2.00	12.00	1.57	0.78	N	1	0	1	1	N	N	N	0	0%
67	7.51	15.00	2.45	0.33	N	2	0	2	2	N	N	N	7	20%
68	6.22	18.00	3.53	0.57	N	1	0	1	1	N	Y	Y	4	13%
69	33.61	27.00	7.95	0.24	N	3	0	3	3	N	Y	Y	17	7%
70	2.15	12.00	1.57	0.73	N	1	0	1	1	N	N	N	1	7%
71	4.49	12.00	1.57	0.35	N	2	0	2	2	Y	N	N	2	7%
72	4.35	12.00	1.57	0.36	N	2	0	2	2	Y	N	N	2	7%
73	4.32	12.00	1.57	0.36	N	2	0	2	2	Y	N	N	1	3%
74	4.37	15.00	2.45	0.56	N	2	0	2	1	N	N	N	2	6%
75	4.16	15.00	2.45	0.59	N	1	0	1	1	Y	N	N	2	6%
76	11.68	15.00	2.45	0.21	N	3	0	3	3	Y	N	Y	1	2%
77	17.41	14.00	2.14	0.12	N	4	0	4	4	N	Y	Y	6	7%
78	12.76	12.00	1.57	0.12	N	4	0	4	4	N	Y	N	4	5%
79	15.09	18.00	3.53	0.23	N	3	0	3	3	N	Y	N	15	16%
80	5.70	12.00	1.57	0.28	N	3	0	3	3	N	N	N	8	20%
81	5.80	12.00	1.57	0.27	N	3	0	3	3	N	N	N	2	5%
82	34.68	22.00	5.28	0.15	N	4	0	4	3	N	Y	Y	21	11%
83	28.98	27.00	7.95	0.27	N	3	0	3	3	N	Y	Y	19	11%
84	8.51	12.00	1.57	0.18	N	4	0	4	3	N	N	N	2	3%
85	4.17	12.00	1.57	0.38	N	2	0	2	2	N	Y	N	4	N/A

*Percentages may be inconsistent due to sewersheds crossing parcel boundaries. Percentages are meant to be used as a general guide.

Sewershed Analysis Summary Table

Sewershed Id	Area (AC)	Sewershed Outfall Pipe Diameter	Assumed Outfall Pipe Capacity	Calculated Sewershed Allowable Discharge (cfs/ac)	Alley Sewer	Capacity Quartile Points	Alley Binary Points	Flooding Risk Points	Flooding Risk Quartile	Sandy Soil	Commercial/ ROW	Open Space/ Institutional	Res. Parcels Reporting Flooding	% of Res. Parcels Reporting Flooding*
86	4.90	8.00	0.70	0.14	N	4	0	4	4	N	N	N	3	9%
87	4.61	8.00	0.70	0.15	N	4	0	4	3	N	N	N	5	15%
88	3.98	6.00	0.39	0.10	Y	4	3	7	4	N	N	N	10	29%
89	1.08	12.00	1.57	1.45	Y	1	3	4	4	N	Y	N	0	0%
90	4.36	12.00	1.57	0.36	N	2	0	2	2	N	Y	N	0	0%
91	0.60	18.00	3.53	5.86	N	1	0	1	1	N	N	N	0	0%
92	3.65	9.00	0.88	0.24	Y	3	3	6	4	N	Y	N	2	10%
93	5.06	18.00	3.53	0.70	N	1	0	1	1	N	N	N	0	0%
94	1.98	10.00	1.09	0.55	N	2	0	2	2	N	N	N	0	0%
95	2.26	10.00	1.09	0.48	N	2	0	2	2	N	N	N	0	0%
96	1.33	6.00	0.39	0.29	N	3	0	3	2	N	N	N	0	0%
97	4.59	12.00	1.57	0.34	N	2	0	2	2	N	Y	N	7	24%
98	7.67	18.00	3.53	0.46	N	2	0	2	2	N	Y	Y	3	7%
99	2.09	12.00	1.57	0.75	N	1	0	1	1	N	Y	N	0	0%
100	4.33	12.00	1.57	0.36	N	2	0	2	2	N	Y	Y	0	0%
101	2.32	12.00	1.57	0.68	N	1	0	1	1	N	Y	N	0	0%
102	5.38	15.00	2.45	0.46	N	2	0	2	2	N	Y	N	0	0%
103	21.94	16.00	2.79	0.13	N	4	0	4	4	N	N	Y	17	13%
104	4.42	18.00	3.53	0.80	N	1	0	1	1	N	Y	N	0	0%
105	64.29	24.00	6.28	0.10	N	4	0	4	4	N	Y	N	28	8%
106	1.21	12.00	1.57	1.30	N	1	0	1	1	N	Y	N	1	11%
107	81.09	20.00	4.36	0.05	N	4	0	4	4	N	Y	Y	29	5%
108	12.27	15.00	2.45	0.20	N	3	0	3	3	N	Y	N	3	3%
109	10.84	15.00	2.45	0.23	N	3	0	3	3	N	Y	N	12	15%
110	28.09	12.00	1.57	0.06	N	4	0	4	4	N	Y	N	20	10%
111	22.93	18.00	3.53	0.15	N	4	0	4	3	N	N	N	7	4%
112	66.58	18.00	3.53	0.05	N	4	0	4	4	N	Y	Y	14	3%
113	26.43	18.00	3.53	0.13	N	4	0	4	4	N	Y	Y	15	8%
114	14.46	18.00	3.53	0.24	N	3	0	3	3	N	N	Y	2	3%
115	4.95	12.00	1.57	0.32	N	2	0	2	2	N	N	N	3	8%
116	2.53	12.00	1.57	0.62	N	1	0	1	1	N	N	N	4	27%
117	9.96	60.00	39.27	3.94	N	1	0	1	1	N	Y	Y	1	2%
118	22.75	18.00	3.53	0.16	N	4	0	4	3	N	Y	Y	10	8%
119	7.35	18.00	3.53	0.48	N	2	0	2	2	N	Y	N	6	14%
120	1.69	12.00	1.57	0.93	N	1	0	1	1	N	N	N	1	25%
121	0.40	12.00	1.57	3.93	N	1	0	1	1	N	N	N	0	0%
122	10.11	60.00	39.27	3.88	N	1	0	1	1	N	Y	Y	2	4%
123	5.73	60.00	39.27	6.86	N	1	0	1	1	N	N	N	5	13%
124	1.61	60.00	39.27	24.46	N	1	0	1	1	N	N	N	0	0%
125	5.72	24.00	6.28	1.10	N	1	0	1	1	N	N	N	1	8%
126	7.07	60.00	39.27	5.56	N	1	0	1	1	N	Y	Y	1	3%
127	3.69	12.00	1.57	0.43	N	2	0	2	2	N	Y	N	2	10%

*Percentages may be inconsistent due to sewersheds crossing parcel boundaries. Percentages are meant to be used as a general guide.

Sewershed Analysis Summary Table

Sewershed Id	Area (AC)	Sewershed Outfall Pipe Diameter	Assumed Outfall Pipe Capacity	Calculated Sewershed Allowable Discharge (cfs/ac)	Alley Sewer	Capacity Quartile Points	Alley Binary Points	Flooding Risk Points	Flooding Risk Quartile	Sandy Soil	Commercial/ ROW	Open Space/ Institutional	Res. Parcels Reporting Flooding	% of Res. Parcels Reporting Flooding*
128	7.90	12.00	1.57	0.20	N	3	0	3	3	N	N	N	0	0%
129	0.58	12.00	1.57	2.71	N	1	0	1	1	N	N	N	0	0%
130	30.01	33.00	11.88	0.40	N	2	0	2	2	N	Y	Y	11	5%
131	1.83	12.00	1.57	0.86	N	1	0	1	1	N	Y	N	0	0%
132	1.25	12.00	1.57	1.26	N	1	0	1	1	N	Y	N	0	0%
133	20.71	33.00	11.88	0.57	N	1	0	1	1	N	N	Y	29	27%
134	30.08	14.00	2.14	0.07	N	4	0	4	4	Y	Y	N	0	0%
135	13.44	15.00	2.45	0.18	N	4	0	4	3	N	Y	N	6	10%
136	11.64	70.00	53.45	4.59	N	1	0	1	1	N	Y	N	4	5%
137	4.64	12.00	1.57	0.34	N	2	0	2	2	N	N	N	0	0%
138	20.14	21.00	4.81	0.24	N	3	0	3	3	N	N	Y	10	8%
139	3.44	12.00	1.57	0.46	N	2	0	2	2	N	Y	N	0	0%
140	8.89	15.00	2.45	0.28	N	3	0	3	3	N	Y	Y	14	26%
141	9.28	15.00	2.45	0.26	N	3	0	3	3	N	Y	N	6	10%
142	8.15	15.00	2.45	0.30	N	2	0	2	2	N	Y	N	8	14%
143	38.16	21.00	4.81	0.13	N	4	0	4	4	N	Y	N	28	13%
144	48.75	12.00	1.57	0.03	N	4	0	4	4	N	N	Y	0	0%
145	18.80	15.00	2.45	0.13	N	4	0	4	4	N	N	N	15	11%
146	14.42	15.00	2.45	0.17	N	4	0	4	3	N	Y	Y	3	4%
147	20.60	20.00	4.36	0.21	Y	3	3	6	4	N	Y	Y	11	11%
148	5.66	10.00	1.09	0.19	Y	3	3	6	4	N	Y	N	4	24%
149	5.44	70.00	53.45	9.83	N	1	0	1	1	N	N	N	0	0%
150	19.10	18.00	3.53	0.19	N	4	0	4	3	Y	N	N	13	12%
151	22.84	27.00	7.95	0.35	N	2	0	2	2	Y	Y	Y	21	26%
152	9.88	15.00	2.45	0.25	N	3	0	3	3	N	Y	N	6	13%
153	15.90	12.00	1.57	0.10	N	4	0	4	4	N	Y	Y	0	0%
154	7.43	60.00	39.27	5.29	N	1	0	1	1	N	Y	Y	1	7%
155	28.17	15.00	2.45	0.09	N	4	0	4	4	N	Y	Y	19	22%
156	18.62	18.00	3.53	0.19	N	4	0	4	3	N	N	N	17	13%
157	17.43	21.00	4.81	0.28	N	3	0	3	3	N	Y	Y	7	9%

*Percentages may be inconsistent due to sewersheds crossing parcel boundaries. Percentages are meant to be used as a general guide.

Appendix B

April 2013 Floods and the City of Berwyn

Appendix B. April 2013 Floods and the City of Berwyn

In May 2013, President Obama declared that a major disaster (DR-4116) occurred from the severe storms, straight-line winds, and flooding experienced from April 16 to May 5, 2013 in Illinois, including Cook County. The most significant aspect of the storm was the heavy rainfall that fell on April 17 and 18, resulting in urban and riverine flooding. The weather gauge at the Cicero Station recorded a total of 4.86 inches in a two-day period.[1] This level of rainfall is what one would expect to see fall only once every 40 years.[2] Intense storms like this can result in more flooding as the soils and sewers quickly reach capacity. In addition, this storm hit the region after a fairly wet April, which means the region was at a higher risk of flooding due to already saturated soils, full detention ponds, and higher water levels of rivers and streams.

After the storm, Cook County engaged the City of Berwyn in a needs assessment to understand the damages experienced by the community. The City reported 87 homes and 3 public schools affected by the storm and that storm sewers reached capacity causing sewer line failures and backups into many homes.[3] Payments totaling $1,267,203 via 303 claims were paid to residents in the City as a result of the April 2013 storm from Individual Assistance grants federal program.[4] In 2015, IDNR conducted a study of the cost and prevalence of urban flooding and found that 90 percent of damage claims were for locations outside of the mapped 100-year floodplain, highlighting the prevalence of urban flooding that occurs.[5] Given that private insurance claims are not accounted for and some residents and businesses may not have filed a claim or been aware of assistance programs, Berwyn likely experienced additional damages beyond the $1,267,203 documented.

While no road closures were documented within the community by Cook County, there are several low-lying streets, especially beneath the Canadian National viaducts at Oak Park Avenue and East Avenue that may have become flooded during the storm and could have impeded transportation access of both commercial, personal, and emergency trips. Floodwaters can include an array of pollutants and results in water quality impairments of the river from both combined and separate sewers. According to data from the Metropolitan Water Reclamation District, combined sewer overflow events occurred at outfalls in the Chicago Sanitary and Ship Canal near the Stickney Water Reclamation Plant from April 17 through April 21.[6]

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[1] The Cicero Cook County Precipitation Network station was chosen based on proximity to Midlothian. See Illinois State Water Survey. Cook County Precipitation Network, http://www.isws.illinois.edu/data/ccprecipnet/livedata.asp

[2] Masters, Jeff. Extreme Drought to Extreme Flood: Weather Whiplash Hits the Midwest. April 19, 2013. See https://www.wunderground.com/blog/JeffMasters/extreme-drought-to-extreme-flood-weather-whiplash-hits-the-midwest.html

[3] Cook County Department of Planning and Development. 2014. CDBG Disaster Recovery Grant Action Plan. See https://www.cookcountyil.gov/sites/default/files/action_plan_cdbg-dr.pdf

[4] FEMA, 2016

[5] State of Illinois Department of Natural Resources. 2015. Report for the Urban Flooding Awareness Act. Prevalence and Cost, p.8. See www.dnr.illinois.gov/WaterResources/Documents/Final_UFAA_Report.pdf.

[6] Metropolitan Water Reclamation District. Archived Data: Status of CSOs and Pumping Station Activity. See https://www.mwrd.org/irj/portal/anonymous/cso

Appendix 3
Climate Vulnerability Assessment

Berwyn Stormwater Management Plan Vulnerability Assessment

Introduction

Climate vulnerability refers to the degree to which a community is exposed to climate change, is sensitive to its impacts, and is able to adapt to those impacts.[1] This assessment explores climate-related hazards affecting stormwater issues in the City of Berwyn, as well as the community's projected future exposure to hazards and its adaptive capacity. Because of climate change's anticipated effect on precipitation, it is a highly relevant consideration in stormwater planning. The vulnerabilities identified in this report will help inform the Berwyn Stormwater Management Plan, which will identify a wide range of strategies for local implementers. This assessment focuses primarily on stormwater vulnerabilities, but provides information on other climate-related hazards as well.

This assessment was developed in partnership with the National Oceanic and Atmospheric Administration (NOAA), the American Planning Association (APA), and Illinois-Indiana Sea Grant, with the goal of identifying new ways to integrate climate science into the local planning process. The methodology and data sources used to develop this analysis will be compiled by the American Planning Association and integrated into a guidebook for local planners. The finding of the assessment will inform the recommendations of the Berwyn Stormwater Management Plan.

Key Findings

1. The Chicago region has been experiencing increases in annual precipitation and the number of very large storms. Climate models suggest that the region will see greater variation in annual precipitation, with wetter wet years and drier dry years. These models also suggest that a larger proportion of precipitation will fall during a small number of very large storms, rather than being distributed evenly throughout the year.

2. Urban flooding is a significant concern for Berwyn residents. Basement flooding—including sewer backups and groundwater seepage—is the most common form of flooding experienced by homeowners and renters across the City. Projected increases in precipitation and storm intensity will place increased strain on the combined sewer

[1] Intergovernmental Panel on Climate Change, 2007, "Synthesis Report," https://www.ipcc.ch/publications_and_data/ar4/syr/en/mains5-2.html.

system and continue to put vulnerable residents, businesses, and infrastructure at risk of flooding.

3. Because Berwyn is located far from a river or stream, many new residents are not aware of the risk for flooding in their community. Flood insurance policies do not always cover urban flooding. Homeowner rider policies can be purchased to cover sewer backups which are not covered by the National Flood Insurance Program (NFIP). Neither policy protect homeowners from damage caused by seepage.

4. Many Berwyn neighborhoods have high concentrations of households that are more vulnerable to economic and environmental hazards. Areas with high concentrations of low-income households and minority or limited English proficiency populations are often at a greater risk of experiencing serious social, economic, and environmental impacts from natural hazards.

Community Profile

Berwyn, Illinois is located in Cook County, within ten miles of downtown Chicago. It is known for its affordable Chicago-style bungalow homes, multi-modal transportation infrastructure, and a diversity of stores and restaurants. The City is home to a stretch of Historic Route 66, well-maintained parks, good schools, and an assortment of recreational and cultural institutions. Neighboring communities include Oak Park, Cicero, Stickney, Riverside, North Riverside, and Forest Park.

As of 2015, Berwyn has a growing population of 56,706. The City is a diverse, mixed-income community. Berwyn has a large Latino community that makes up 61.6 percent of its total population, a higher percentage of the population than in Cook County (24.7 percent) or the Chicago region (22.4 percent) as a whole. The City's median household income is $57,355, which is similar to that of Cook County ($55,251) and the region ($63,441). Berwyn's population is of a similar age to that of the county and the region, with a median age of 34.5 years, compared to 35.9 in Cook County and 36.5 in the region. More than one-third of Berwyn residents work in the City of Chicago.

From the early 1900s, Berwyn's appeal as a residential community has fueled its development. The numerous bungalows built in the first decades of the 20th century gave rise to Berwyn's nickname, the "City of Homes." Today, Berwyn is a dense, developed community that supports a variety of residential, commercial, industrial, and institutional land uses, served by three Metra stations, several Pace bus lines, and two nearby expressways. The City has undertaken several planning efforts in recent years, including partnerships with CMAP to develop a new comprehensive plan (2012), a capital improvement plan (2015), parking management plan (2016), and zoning ordinance (2017). Throughout these long-range planning projects, stormwater management has emerged as a major area of focus. Unlike some nearby communities, Berwyn is at little risk of flooding from rivers and streams. However, because the

City is flat, densely developed, and has little permeable surface, it is vulnerable to flooding from stormwater runoff.

Climate and Natural Hazards

The City of Berwyn has a continental climate characterized by hot, humid summers and cold, dry winters. Summer temperatures typically peak in July, with average daytime highs of 84 degrees Fahrenheit. Winter temperatures are lowest in January, when daily lows average 18 degrees Fahrenheit. Annual precipitation in the City averages 39.09 inches.[2] The City's proximity to Lake Michigan helps to moderate temperatures during both the summer and winter, while the large amount of impervious surfaces in Berwyn and surrounding communities increases local temperatures by an average of 5 degrees Fahrenheit.[3]

Severe storms, flooding, extreme heat, drought, heavy snowfall, and ice accumulation are the most commonly experienced natural hazards in the Berwyn area. The City's most recent federally declared disaster took place in April 2013. During a two-day period, 4.86 inches of rain fell on Berwyn and surrounding communities, prompting a major disaster declaration from President Obama.

Weather vs. Climate

The terms are sometimes confused, but weather and climate are quite different.

Weather refers to temporary atmospheric conditions, typically lasting a few hours or days. Thunderstorms, cold spells, heat waves, droughts, and blizzards are all examples of weather.

Climate refers to long-term atmospheric trends, typically measured by 30-year "normals." Climate is the sum total of many weather events, occurring over a long period of time.

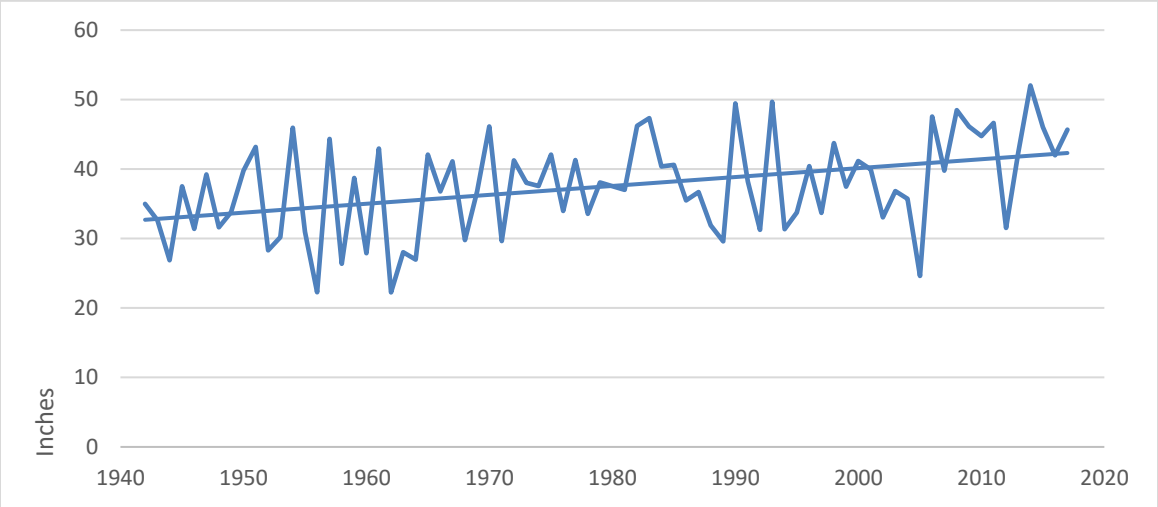
While it can be tempting to point to individual weather events as a sign that climate change is or is not happening, a single storm or heat wave is not a trend. Instead, climate scientists analyze records going back many decades to find evidence of long-term changes in weather patterns. These changing patterns may mean individual weather events are stronger, or more frequent, but individual weather events themselves do not constitute a change in climate.

Average annual temperatures in the Midwest have increased by 1.5 degrees Fahrenheit since 1900, resulting in warmer and more variable weather.[4] Because warmer air can hold more water vapor than cooler air, the temperature increase has resulted in a comparable increase in precipitation. Figure 1 shows annual precipitation at Midway International Airport (3 miles south of Berwyn), from 1942 to 2017. During this period, average annual precipitation has

[2] National Oceanic and Atmospheric Administration, Annual/Seasonal Normals, 1981-2010: Chicago Midwater Airport, IL US, https://www.ncdc.noaa.gov/cdo-web/datatools/normals.
[3] Chicago Metropolitan Agency for Planning, 2016, Climate Resilience Strategy Paper, http://www.cmap.illinois.gov/documents/10180/517388/Climate+Resilience+Strategy+Paper.pdf/dd610883-d00f-407d-808b-484f9800a3f6.
[4] National Climate Assessment, "Chapter 18: Midwest," https://nca2014.globalchange.gov/report/regions/midwest

steadily increased. Region-wide, northeastern Illinois has also seen an increase in the number of very large storms—those producing more than one inch of precipitation. This trend has been most noticeable during the last 30 years, which saw a 40 percent increase in storms producing one inch of precipitation compared to the previous 30-year period.[5]

Figure 1: Annual precipitation at Midway International Airport, 1942-2017



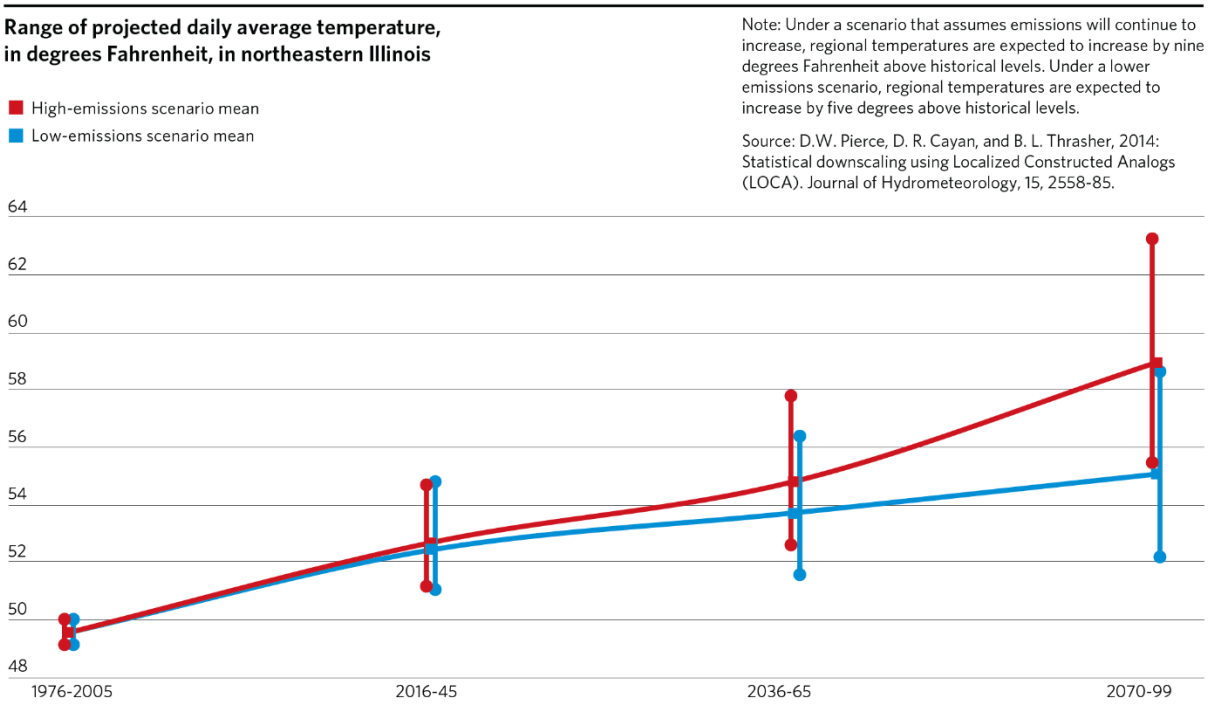
Source: National Centers for Environmental Information, "Global Summary of the Year Station Details," National Oceanic and Atmospheric Administration, https://www.ncdc.noaa.gov/cdo-web/datasets.

During the years to come, the region's warming trend is expected to continue and intensify. This warming trend is primarily due to increasing concentrations of greenhouse gases in the Earth's atmosphere.[6] To determine future climate conditions, scientists create models using greenhouse gas emissions scenarios. Generally, these models include a low-emissions scenario that assumes drastic reductions in global greenhouse gas emissions, and a high-emissions scenario that assumes emissions will continue to increase. These climate models predict the Chicago region could see temperature increases of between three and thirteen degrees Fahrenheit by the year 2100. Figure 2 shows the range of temperature change for high and low-emissions scenarios in the Chicago region.

[5] Illinois Department of Natural Resources, 2015, "Urban Flooding Awareness Act," https://www.dnr.illinois.gov/WaterResources/Documents/Final_UFAA_Report.pdf.

[6] Intergovernmental Panel on Climate Change, "Climate Change 2014: Synthesis Report," https://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf.

Figure 2: Temperature projections for the Chicago region, 1976-2099



These models also suggest the Chicago region—including Berwyn—will see greater variation in annual precipitation, with wetter wet years and drier dry years. By 2100, climate scientists project annual precipitation increases of between four to fourteen inches under a high-emissions scenario, and three to nine inches under a low-emissions scenario, with a considerable amount of variation between dry and wet years. These models also suggest that a larger proportion of precipitation will fall during a small number of very large storms, rather than being distributed evenly throughout the year.[7][8]

Flooding

The City of Berwyn is not located near a major waterway, and the entire City is outside of the 100-year regulatory floodplain.[9] Nonetheless, urban flooding is a major issue for residents, business owners, and other stakeholders. Urban flooding in Berwyn is generally caused by the City's dense development patterns and limited combined sewer capacity to manage the runoff generated during large or intense storms. Impervious surfaces created by rooftops, parking lots,

[7] Pierce, D. W., D. R. Cayan, and B. L. Thrasher, 2014: Statistical downscaling using Localized Constructed Analogs (LOCA). Journal of Hydrometeorology, 15, 2558-2585.

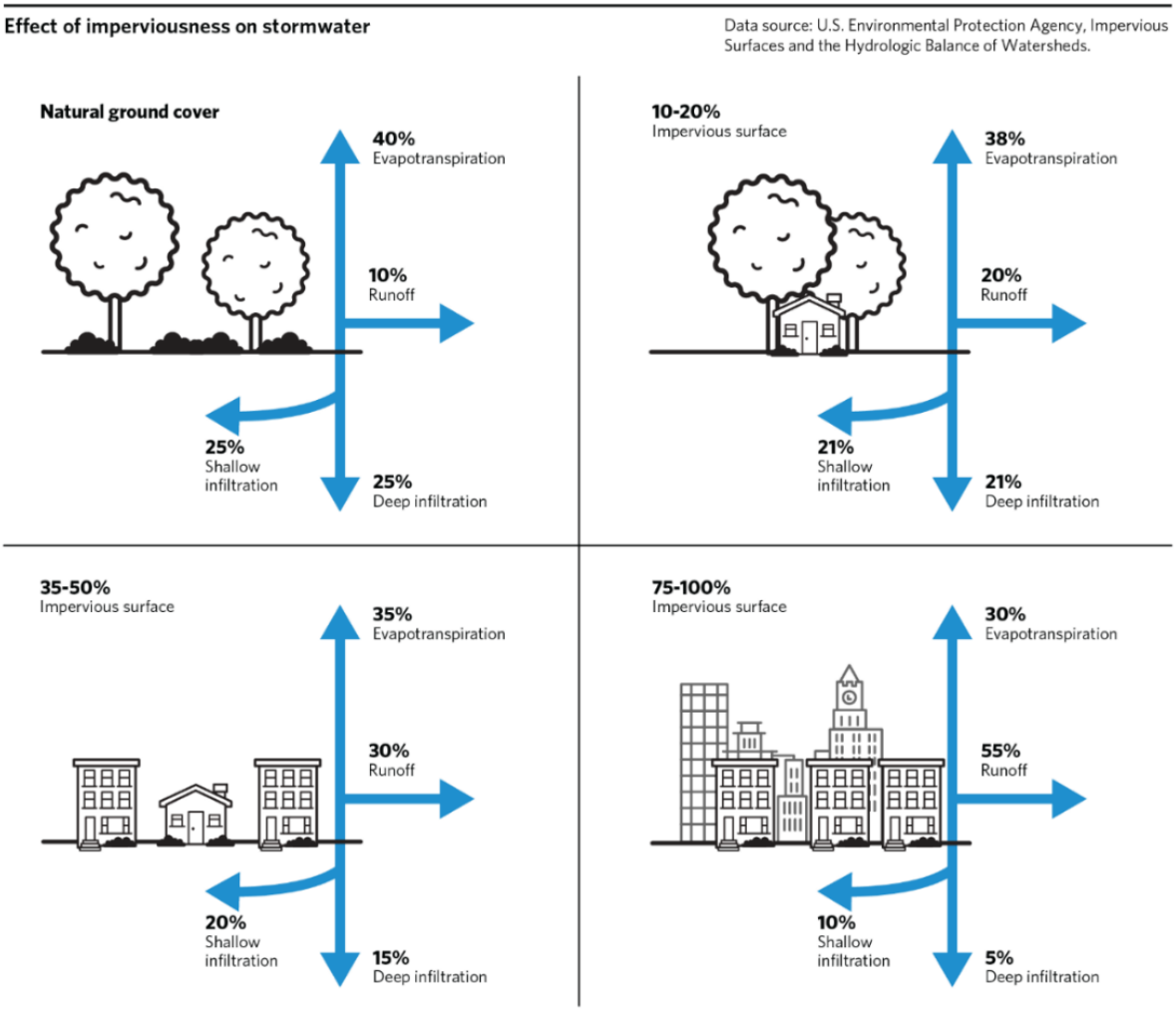
[8] Localized Constructed Analogs, U.S. Global Change Research Program, 2017: Localized Constructed Analogs (LOCA) designated scenarios for the Fourth National Climate Assessment. https://scenarios.globalchange.gov/

[9] The 100-year regulatory floodplain refers to areas near a river, stream, lake, or other waterway that have a one percent chance of experiencing a riverine or costal flood during a given year. These areas are identified by the Federal Emergency Management Agency (FEMA).

and streets increase the risk of urban flooding by preventing water from being absorbed into the soil and generating stormwater runoff (Figure 3). Basement seepage is a concern due to both high groundwater and poor drainage that causes runoff to pond against building foundations.

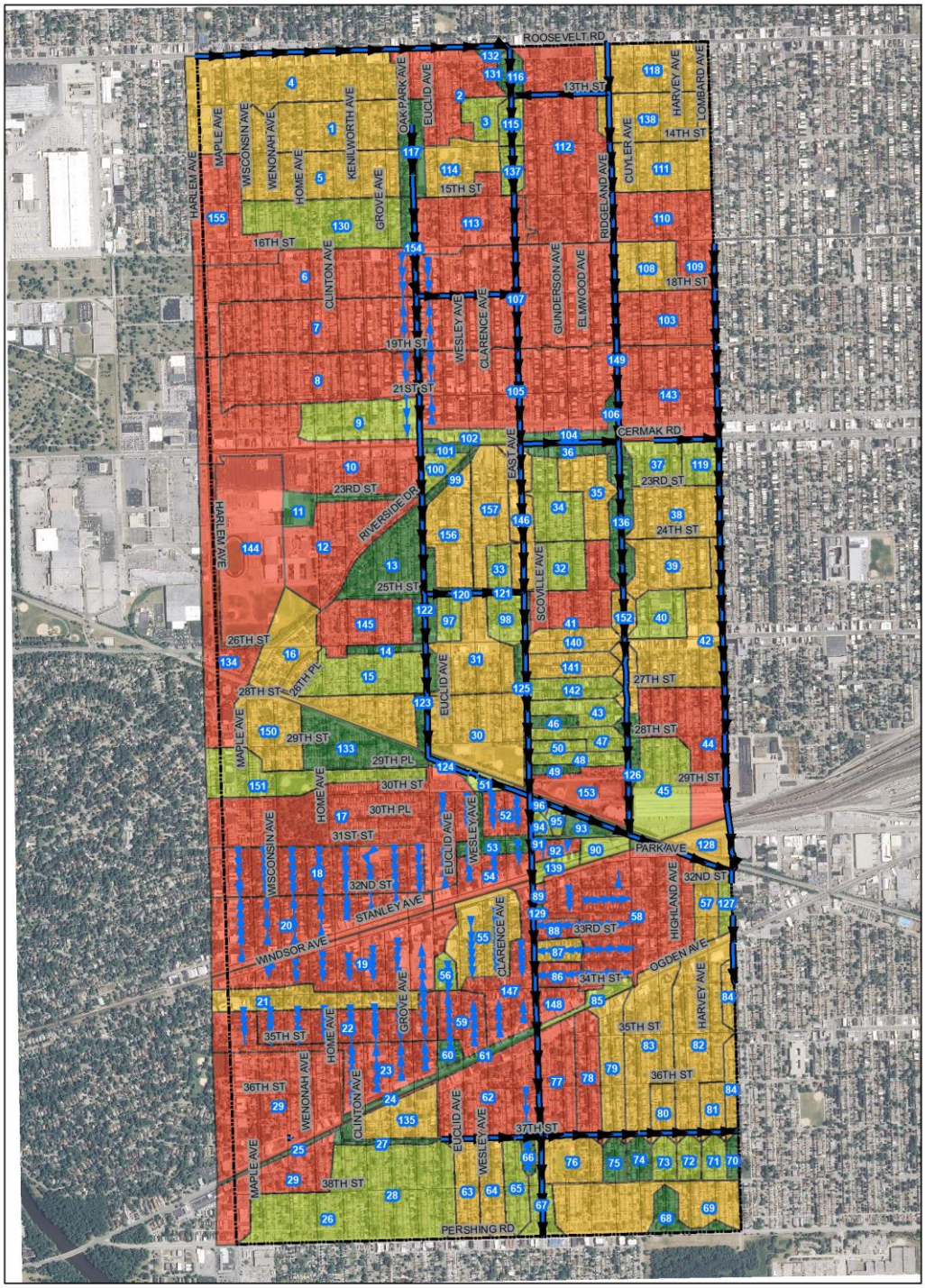
Berwyn is served by a combined sewer system that carries stormwater and sanitary sewage in a single pipe. Because of this dual function, the capacity of combined sewers can easily be exceeded during rainstorms, causing sewage and stormwater runoff to back up into basements and streets, and water to pond in low-lying areas, such as streets, parking lots, and yards. Another factor contributing to flooding in the community is the City's location at the downstream end of the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) interceptor system, which transports stormwater and wastewater from Berwyn and the surrounding communities to the MWRDGC Stickney Water Reclamation Plant. Due to the City's downstream location, the interceptor system often has limited capacity to convey runoff generated in Berwyn, which contributes to backups in the community. MWRDGCs' Tunnel and Reservoir Plan (TARP), which includes the McCook Reservoir, was designed to reduce the number of combined sewer overflows and reduce flooding in the MWRDGC service area. However, the limited capacity of local sewers and interceptors in Berwyn can limit the effectiveness of the TARP system to relieve flooding in the City.

Figure 3: Effect of impervious surfaces on stormwater runoff



To identify areas in Berwyn with the greatest exposure to flooding, CMAP worked with a consulting team to conduct a sewershed analysis. A sewershed refers to the area of land that drains into a particular sewer pipe. The team calculated the sewer pipe capacity for each sewershed to identify areas where the system has a greater likelihood of restricting flow during larger storms, resulting in sewer backups. The analysis also evaluated sewersheds based on whether they are served by small, shallow sewers in alleys that are prone to backups. The analysis combined the evaluation of these two flood risk factors to determine the sewersheds with the highest risk for flooding. Figure 4 illustrates the result of the analysis.

Figure 4: Results of flood risk analysis, by sewershed, in Berwyn



Scale: 0 500 1,000 Feet

Orientation:

Legend:

- Collector Sewer
- Alley Sewers
- Berwyn Limits
- 26 Sewershed ID

Sewershed Boundaries

Sewershed Flooding Risk

- 1 Lower Risk
- 2
- 3
- 4 Higher Risk

Project Name: Berwyn Stormwater Analysis

Prepared for: CMAP

Information about exhibit:

Exhibit Title: **Flood Risk Ranking**

Figure: **3**

Project Number: 17-0256

Latest Revision: 6/4/2018

Prepared by:

Hey and Associates, Inc.
Engineering, Ecology and Landscape Architecture

Severe Storms

Severe storms, some capable of producing hail and strong winds, are common in Berwyn and the Greater Chicago area. The Cook County Hazard Mitigation Plan lists severe storms (excluding snow/ice) as the most significant hazard in the community, a reflection of the high probability and high impact of these events. Specific impacts of severe storms include flooding, blackouts due to downed power lines, damage and potential loss of life from lightning strikes, and transportation delays due to unsafe driving conditions.

In recent years, strong winds have caused damage to trees and structures in Berwyn on several occasions. In 2010, a microburst was responsible for downing approximately 50 trees, primarily in the public parkway. Replacing these trees—and those lost to the emerald ash borer—is an ongoing project.[10]

Other Hazards

Flooding and severe storms are the hazards most likely to have significant impacts on the City of Berwyn, and are the natural events that are most likely to influence stormwater planning. However, local business and residents also face a range of other climate-related hazards, including extreme heat, winter weather, and drought.

Extreme Heat

Due to the prevalence of impervious surfaces in the City of Berwyn and surrounding communities, the area experiences a significant urban heat island effect. This phenomenon occurs when impervious surfaces—including streets, parking lots, rooftops, and other paved surfaces—heat up during the day, and remain warm long into the night. In northeastern Illinois, areas with greater than 50 percent impervious coverage have been found to be five to six degrees warmer than the regional average.[11] In Berwyn, the effect is seen in the form of elevated temperatures on streets and sidewalks. During periods of persistent, extreme heat, as climate models project for the region's future, an increase of just a few degrees Fahrenheit significantly increases the risk of dehydration, heat stroke, and other health effects.

During the years to come, the Berwyn area is expected to see increases in both average annual temperatures and the number of very hot days—those over 90 degrees Fahrenheit. These changes will not only increase the risk of health impacts to sensitive populations, but may also affect local businesses that rely on pedestrian traffic, especially in areas with high amounts of imperviousness and little vegetation.

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[10] Stakeholder interview, December 5, 2017.

[11] CMAP, "Climate Resilience Strategy Paper," http://www.cmap.illinois.gov/documents/10180/470714/Climate%20Resilience%20Strategy%20Paper/dd610883-d00f-407d-808b-484f9800a3f6.

Winter Weather
Snow, freezing rain, and extreme cold are all common in the Berwyn area. Recent climate models suggest the Chicago region will see higher average winter temperatures, causing more precipitation to fall as rain, rather than snow. However, these models also suggest the winter months will see an overall increase in precipitation, which will likely cause total snowfall levels to remain relatively constant during the decades to come.

As the climate continues to change, warmer winter temperatures may lead to more freeze-thaw events, which occur when the temperature of roadways and other infrastructure fluctuate between several degrees above to several degrees below the freezing point. Because materials expand and contract as temperatures change, the freeze-thaw cycle can cause stress on infrastructure and increase the likelihood of cracks, potholes, and fractures. Similarly, the area could see an increase in freezing rain, which is particularly damaging to transportation and energy transmission systems.

Drought
Although droughts are relatively common in Illinois (occurring roughly once every 16 years in Cook County), the City of Berwyn has only limited exposure the impacts of drought.[12] The City's access to Lake Michigan for drinking water insulates it from the impact of droughts on the water supply, and the lack of agriculture and natural spaces in the area means that its demand for water during drought conditions does not increase as dramatically. Nonetheless, drought and drought-like conditions are expected to become more frequent during the years to come, especially during the summer and fall.

Vulnerability and Risk Assessment

The City of Berwyn faces a range of natural hazards, including several that are expected to become more frequent and more powerful during the years to come. Understanding the community's vulnerability to these hazards—in addition to the level of exposure—is a crucial step for preparing a comprehensive approach to reducing the impact of climate change.

The following section of this report assesses the vulnerability of Berwyn residents, businesses, and infrastructure to observed and projected hazards. The assessment considers both the likelihood of an event and the severity of the impacts caused by the event to gain a better understanding of the area's true vulnerability.

In many cases, the community can address these vulnerabilities through proactive planning and incremental investments. In some cases, collaborative approaches involving neighboring municipalities and several levels of government may be necessary.

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[12] Cook County Multi-Hazar Mitigation Plan, Cook County, September 10, 2015, https://www.cookcountyhomelandsecurity.org/sites/default/files/Cook_County_HMP.pdf.

Critical Infrastructure

Streets, railroads, sidewalks, power lines, trees, and other vegetation are critical for sustaining a high quality of life in the City of Berwyn. Because of their prominent role in the function of the City, these assets have a high level of exposure to natural hazards, and will face significant challenges as the climate continues to change.

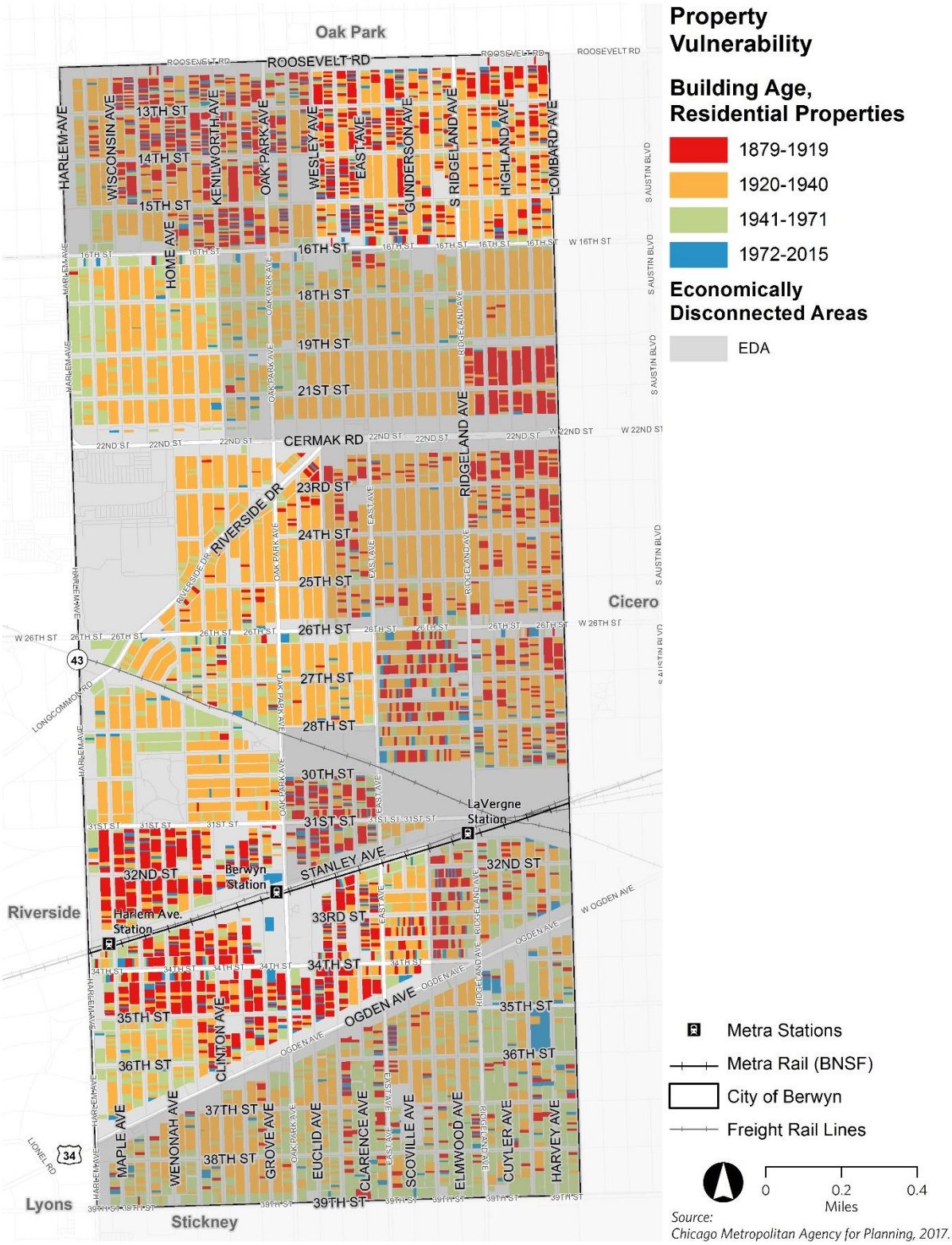
Private property

Homes, businesses, and automobiles are all susceptible to damage from flooding and other natural hazards. Due to the prevalence of sewer backups and groundwater seepage, buildings with a basement are the most vulnerable to damages during periods of heavy rain or snowmelt. Basement backups and seepage occur based on a variety of property, building, and sewer system conditions and can vary from block to block and house to house. Basement backups are less likely to occur in buildings with overhead sewers or a flood control device, such as backflow prevention. Buildings with disconnected downspouts also have a reduced risk of experiencing a backup, due to their ability to divert rainwater away from the sewer and into lawns, flowerbeds, and rain gardens, thereby reducing rainwater volume within the sewer system.

While location is a key indicator of flood risk, there are several general risk factors including building age and land use that can be used to identify higher-risk properties. Figure 5 illustrates residential building age in Berwyn classified into four ranges. Newer buildings, especially those built after 1972, are more likely to feature flood-mitigating features, such as overhead sewers and watertight foundations. Older buildings, on the other hand, are less likely to have these improvements, and often feature porous limestone foundations, rather than cement foundations, which are more common today. This is especially true for buildings built before 1920.

Socioeconomic factors also play a large role in a household's vulnerability to flooding. To identify residents who may have a higher vulnerability to environmental, social, and economic hardships, CMAP has mapped Economically Disconnected Areas, or EDAs (Figure 5). Generally, these areas have high concentrations of residents living in poverty and minority or low-English proficiency households. While these factors do not make an area more likely to flood, they are key indicators for a household's ability to prepare for and recover from a natural hazard, which has important implication for the vulnerability of private property. Economically Disconnected Areas are discussed at greater length on page 19: Social Vulnerability.

Figure 5: Building age in Berwyn



While all basement flooding is disruptive, the effects of flooding are felt most acutely when the basement is used as a living space, rather than storage or recreation. Figure 6 shows the current, registered use of basements in the City of Berwyn and EDAs. When reviewing this data, it is important to note that, while it is the most current and accurate information available, it likely undercounts the number of basement dwelling units. As shown in this map, basement apartments are found throughout Berwyn, but have the greatest concentrations in the north central and south central parts of the City. Most basement apartments are located in buildings built before 1972, though some may have been retrofitted with overhead sewers or other flood control devices.

Figure 6: Basement use in Berwyn

Because Berwyn is located far from a river or stream, many new residents are not aware of the risk for flooding in their community and may not have an insurance policy that covers damages. Flood damages are not covered by most homeowners and renters insurance policies. Instead, residents must purchase insurance through the National Flood Insurance Program (for overland flooding), or as a rider on an existing policy (to cover sewer backups). Neither policy protect homeowners from damage caused by seepage, which is considered to be a maintenance issue. As a result, homeowners, property owners, and renters often have to cover the cost of flood damages themselves. One exception is during federally declared disasters, such as the April 2013 flood. During these types of events, residents may be eligible for grants and loans from the federal government, but this aid is only available under very specific conditions.

Streets, roads, rail, and sidewalks

Streets, roads, rails, sidewalks, and other forms of transportation infrastructure are vulnerable to flooding, extreme heat, extreme cold, and winter weather. In the Berwyn area, transportation infrastructure—especially roads and parking lots—also contribute to flooding and the urban heat island effect because of their large concentrations of impervious surfaces. Pavement and railways are susceptible to buckling during periods of extreme heat, although the occurrence is rare. More commonly, streets, parking lots, and other paved surfaces develop cracks and potholes due to freeze-thaw events, which are expected to become more frequent as winters become warmer.

In addition to higher maintenance costs, natural hazards affect transportation systems by increasing travel times. Nearly 84 percent of Berwyn residents commute to work by car (alone or carpool). When inclement weather forces road closures, or merely increases travel time, these residents may have difficulty accessing work. While data covering other personal trips is not available, it is likely that a similar percentage of the community relies on automobiles for meeting day-to-day needs, such as grocery shopping, accessing childcare, and medical visits.

Street flooding and ponding is most common on Oak Park Avenue and East Avenue, where the streets pass under the railroad viaduct. During heavy rains, these low-lying underpasses sometimes accumulate water that could make the streets impassible. Physical damage from ponding in these areas is rare, but it does disrupt the flow of traffic and increase travel times.

Critical Facilities and Emergency Services

Critical facilities are physical assets that provide services or functions that are essential to a community, especially during and after a natural hazard.[13] Such facilities include fires stations, hospitals, nursing homes, and wastewater treatment plants. Schools, libraries, and community centers also serve critical roles. Often these facilities require uninterrupted access to basic

[13] Federal Emergency Management Agency, "Critical Facilities and Higher Standards Fact Sheet" https://www.fema.gov/media-library-data/1436818953164-4f8f6fc191d26a924f67911c5eaa6848/FPM_1_Page_CriticalFacilities.pdf

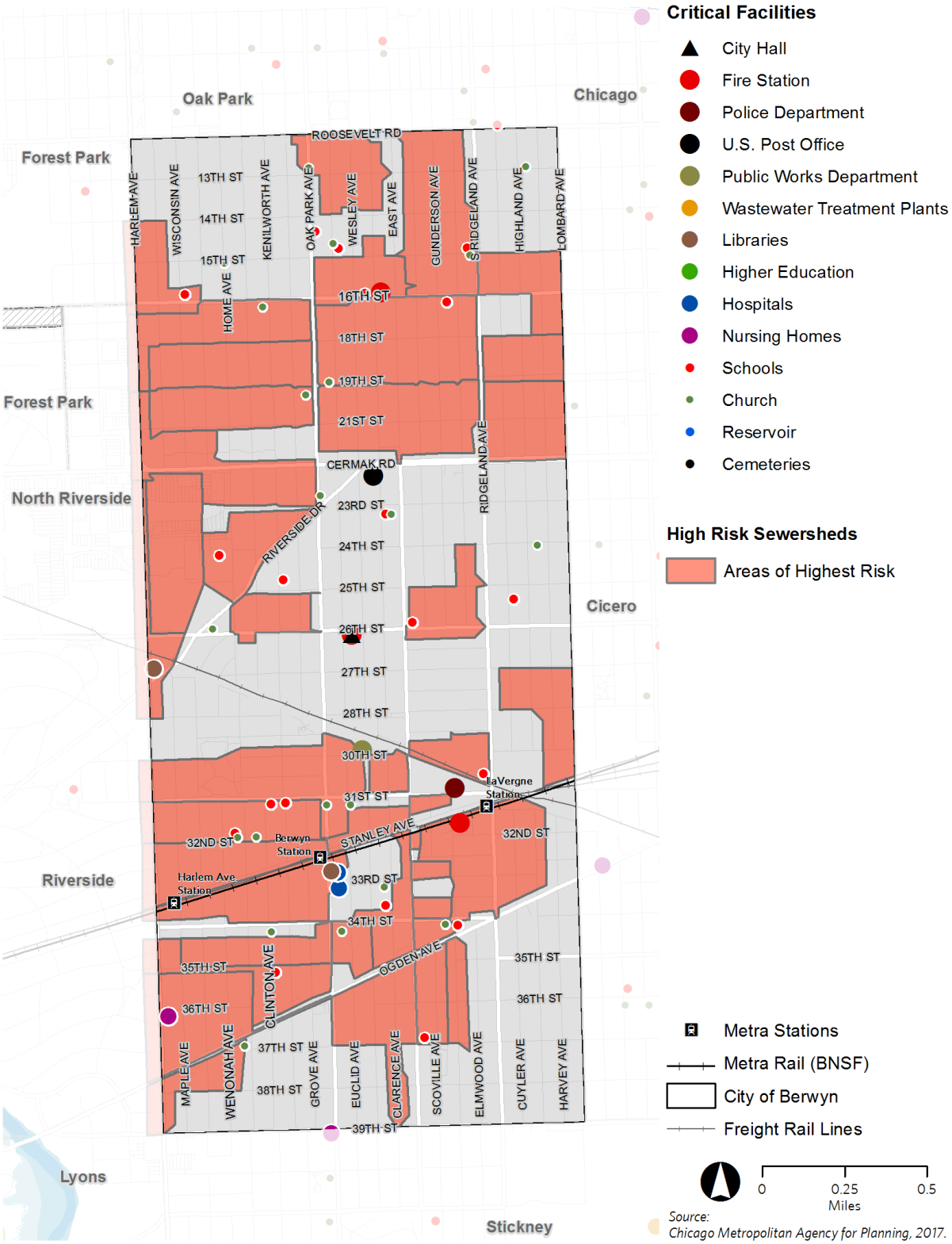
utilities—power, water, communications, etc.—to ensure supporting systems and equipment remain in operation. A comprehensive understanding of a community's critical facilities and local assets can help the community assess infrastructural and social vulnerabilities as well as prioritize which assets are in greatest need of protection.

The City of Berwyn has a wide range of critical facilities, which are vulnerable to natural hazards to varying degrees. Figure 7 identifies the location of critical facilities in the City of Berwyn in relation to sewersheds with a high risk for flooding (see Figure 4). Several of these facilities are at risk for impacts from stormwater and other hazards. These facilities include two fire stations, a nursing home, and several schools. The age of the City's schools make them particularly vulnerable to urban flooding. Many of these buildings are older with basements that are susceptible to seepage, and some of which are used as classrooms. In recent years, sump pump, detention systems, and other flood control improvements have been successfully used to mitigate flood risk, but as climate change intensifies, these challenges may return.

The City of Berwyn operates three fire stations, each covering approximately one third of the community. In total, the department employs 80 professional firefighters, 30 paramedics, and 3 EMTS. The City also participates in the Mutual Aid Box Alarm System (Division 11), which ensures help will arrive from surrounding communities if Berwyn-based emergency first responders are unavailable or require additional assistance.

The even distribution of emergency services in the City, as well as Berwyn's street grid and participation in mutual aid agreements, mean that residents are unlikely to be isolated from emergency services, even during and after severe weather events. The only significant interruption in the City's street grid is caused by the two railroads that cross through town. In some areas, the railroad has grade crossing that block auto and pedestrian traffic, especially during rush hour. In other areas, the train right of way blocks the street entirely, creating a dead end. Nonetheless, the City's proximity to numerous hospitals and medical centers further ensures that first responders will have quick access to emergency health care.

Figure 7: Critical facilities and sewershed flooding risk in Berwyn



Water supply

The City of Berwyn receives its water from Lake Michigan, via the City of Chicago. Because of the large size of Lake Michigan, and careful regulations under a United States Supreme Court Decree, communities with access to water supply drawn from the lake water are relatively resilient to the effects of seasonal and annual droughts. Nonetheless, as groundwater supplies in the region experience more pressure, competition for Lake Michigan water may become more intense, leading to higher rates for customers, and creating a greater urgency for infrastructure projects aimed at reducing water loss through leaking pipes.

Energy

Electricity in the City of Berwyn is provided by Commonwealth Edison (ComEd), and is transmitted by overhead and underground wires. In areas with overhead wires, strong winds and freezing rain can knock down transmission lines, leading to local power outages. This is a particularly serious concern in areas that have concentrations of dead trees. To reduce the risk of outages from downed trees, the City has been proactive in removing ash tress affected by the emerald ash borer. The City's power transmission system is also vulnerable to flood damages. During the April 2013 floods, a ComEd substation in neighboring Forest Park was inundated, resulting in service disruptions in Berwyn.

Power outages, even those lasting just a few hours, may seriously affect sensitive populations, including senior citizens, infants, and residents with disabilities. The risk of adverse health effects during blackouts is greatest during extreme heat and extreme cold. To mitigate the risk of health-related impacts from extreme temperatures, the City of Berwyn operates five warming and cooling centers, including two—the Berwyn Police Department and the Fire Department on 16th Street—that are open 24 hours a day, 7 days a week.[14]

Nicor Gas provides natural gas for residents and business in the City of Berwyn. Because most natural gas infrastructure is underground, it is generally more resilient to the effects of extreme weather than electricity. In many cases, natural gas can also provide backup electricity during a power outage through natural gas generators that automatically activate when the primary electricity source interrupted.[15] Individual natural gas systems may, however, be vulnerable to damage during floods, especially if a home's gas meter or gas-powered appliances are submerged. If this occurs, Nicor Gas may shut off service to the affected area until Nicor personnel are able to inspect the site and confirm it is safe to resume service.[16]

Green infrastructure and open space

The City of Berwyn is home to a number of parks that provide important recreational opportunities. These open spaces, in combination with the City's larger urban forest, also

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[14] Berwyn Police Department, Cooling/Warming Centers," http://www.berwynpd.com/general_information/cooling__warming_centers.

[15] Nicor Gas, "Generators," https://www.nicorgas.com/residential/appliances/generators.

[16] Nicor Gas, "Flood Fact Sheet," https://nicorgas.com/-/media/Files/NicorGas/PDF/16400_NG_Flood_factsheet.pdf.

provide important ecosystem services, including stormwater management, heat and noise reduction, and air purification.

Natural hazards, such as flooding and extreme heat, and long-term changes in the local climate, such as warmer winters and more variable weather, can reduce the ability of these natural amenities to provide ecosystem services. The arrival of the emerald ash borer in 2008 greatly reduced the City's tree canopy, and continued climate changes may allow new invasive (and non-invasive) species to establish themselves in Berwyn and the surrounding area.

Replacing trees lost to the emerald ash borer is a top priority for many communities in the Chicago region, but in some cases, residents may oppose the installation of new trees in their front yard or parkway due to concerns about roots clogging sewer pipes. Generally, tree roots do not directly damage pipes, but if a pipe is already damaged (due to age, faulty connections, or other causes) roots may enter the pipes, causing a clog. Often, this threat can be mitigated by ensuring all pipes are in good condition, that the tree is well mulched and has ample room for healthy roots near the surface, and by avoiding certain fast-growing wetland species. At the neighborhood and city level, a healthy urban canopy is a critically important asset for reducing the risk of flooding and alleviating the urban heat island effect.

Flooding is currently an issue in Proska Park, and it is likely that additional open spaces will experience comparable challenges during the coming years. Park space is particularly scarce in northern Berwyn, and if new parks are added, through land acquisitions or redevelopment projects, designing these spaces to provide stormwater management functions, in additional to recreational space, may be crucial.

Social vulnerability

Natural hazards do not affect everyone in the same way or to the same degree. The capacity of a community or an individual to prepare for and recover from a natural hazard is often correlated with key social, demographic, and economic factors. Identifying these groups is critical for development an inclusive strategy for addressing natural hazards.

Community and health

Climate change and related natural hazards typically have the most severe impacts in areas already experience economic, social, and environmental challenges. Often these communities not only have limited capacity to prepare for and recover from natural hazards, but also have the highest level of exposure to their effects. In Cook County, low-income neighborhoods account for a higher portion of reported flood damages than more affluent areas,[17] and region

[17] Center for Neighborhood Technology, "The Prevalence and Cost of Urban Flooding: A Case Study of Cook County, IL. https://www.cnt.org/sites/default/files/publications/CNT_PrevalenceAndCostOfUrbanFlooding2014.pdf.

wide, the top 10% hottest census tracts by land surface temperature tend to be disproportionately low-income, minority, and limited-English speaking.[18]

To help plan for these areas, CMAP has created a map of Economically Disconnected Areas (EDAs) that identifies census tracts with large concentrations of low-income and minority or limited English proficiency households in the Chicago region. Figure 8 shows CMAP-identified Economically Disconnected Areas and Community Development Block Grant (CDBG) eligible census tracts in the City of Berwyn. The EDAs layer is an important input for a range of local planning activities, including hazard mitigation and disaster recovery plans. The CDBG program provides federal funding for affordable housing, economic development, infrastructure, and other anti-poverty programs. These funds may be an important tool for addressing the unique challenges facing Economically Disconnected Areas.

Over half of the City of Berwyn is located in an area identified as an EDA, including several areas that are at high risk of flooding and have clusters of older buildings or basement apartments (Figures 5 and 6). Because these areas are statistically more likely to be severely affected by flooding and other natural hazards, they should be given additional consideration for stormwater management projects, including green infrastructure interventions. Elderly, disabled, and very young residents also have an elevated risk of being disproportionately affected by natural hazards, but the Economically Disconnected Areas map does not identify these population groups.

People living in basement apartments have a significantly higher level of exposure to urban flooding than those who live in ground floor apartments. This high level of exposure can be exacerbated by other socioeconomic factors, such as those highlighted in Figure 8. Low-income residents may have a hard time paying for flood improvements and after experiencing a flood, may have a harder time replacing damaged property. Minority and limited-English speaking residents, especially recent immigrants, may have difficulty accessing mitigation and recovery services.

[18] Chicago Metropolitan Agency for Planning, "Climate Resilience Strategy Paper," http://www.cmap.illinois.gov/documents/10180/517388/Climate+Resilience+Strategy+Paper.pdf/dd610883-d00f-407d-808b-484f9800a3f6.

Figure 8: Economically Disconnected Areas and CDBG eligible census tracts in Berwyn

Source:
Chicago Metropolitan Agency for Planning, 2017.

Municipal capacity

The City of Berwyn has a high-functioning government that provides quality services for businesses and residents. In recent years, the City has collaborated with CMAP to conduct a number of plans, including a comprehensive plan, capital improvement plan, parking study, and zoning code update. The City has also made investments and obtained grant funding to improve stormwater management through gray and green infrastructure projects in alleys, the Depot District, and Proksa Park to name a few.

Like many communities in the Chicago region, the scale of flood-related challenges paired with the ongoing need to maintain and rehabilitate aging sewer infrastructure requires significant resources and investment from all units of government, as well as private property owners. The Stormwater Management Plan will identify future steps the City should take to further mitigate flood risk, including establishing sustainable streams of funding, continuing regional partnerships, and coordinating investments.

Economic impacts

Natural hazards are more than inconveniences. The damages, travel delays, and business closures they produce have very real effects on the local and regional economies. These impacts can be difficult to fully measure. In many cases, these impacts can be mitigated or avoided by cost effective solutions, such as green infrastructure interventions, or simply having an emergency preparedness plan.

Travel delays and disruptions

For most severe weather events, traffic delays and disruptions are the most common impact. Nationwide, up to 70 percent of all winter storm-related injuries occur in auto crashes, and 22 percent of all crashes nationwide are weather related.[19,20] Because flooding in Berwyn is caused by ponding and sewer backups rather than rivers, there is low risk of drivers being washed away when crossing flooded streets (a leading cause of flood-related deaths in the United States), but flooded streets still create dangerous driving conditions by increasing stopping distances, reducing visibility, and creating conditions that cause hydroplaning.

Road closures and travel delays reduce the ability of residents and visitors to participate in the economy. Workers may lose wages, and businesses, especially those reliant on non-local customers, may experiences revenue losses. In both of these cases, the City is affected by lost tax revenue.

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[19]Will County, "County-Wide All Hazard Mitigation Plan," https://www.plainfield-il.org/pages/documents/2013WillCountyAHMP_10-19-14.pdf.

[20] Federal Highway Administration, "How Do Weather Events Impact Roads?" U.S. Department of Transportation, https://ops.fhwa.dot.gov/weather/q1_roadimpact.htm.

Business closures and lost revenue

Most commercial properties in Berwyn either do not have a basement, or do not rely on their basement for day-to-day operations. As a result, flooding in commercial areas is typically a nuisance, rather than an emergency. Nonetheless, flooding and other natural hazards can negatively impact businesses and the economy in significant ways.

Business closures, even those lasting a few hours or days, can have significant impacts on the economy. Short-term closures, typically due to snow and ice accumulation, roadway flooding, or power outages, are most common and may result in budget shortfalls for local residents. Long-term closures are most commonly associated with large storm events. According to the Federal Emergency Management Agency (FEMA) 40 to 60 percent of small businesses that are forced to close due to a flood never reopen their doors.[21] This is a problem not only for the business owner, but also for employees and residents who rely on City services supported by tax revenue.

Weakened market

For many Berwyn residents, home ownership is an important investment. Flooding, especially basement flooding, can reduce the value of a home, and ultimately, affect the finances of the household. For rental properties, including commercial buildings, recurrent flooding may have a similar impact.

These challenges are not unique to Berwyn. Flooding and other hazards affect homes and businesses throughout the region and beyond. This presents the City of Berwyn with a unique opportunity to use flood mitigation strategies, such as its successful shared cost program, to not only preserve current home values, but to provide the City and its residents with a competitive advantage for years to come. Several non-flood-related hazards such as extreme heat and severe storms may also affect life in Berwyn, but will likely not have significant impacts on local markets, as these events are less predictable and more regional in nature.

Looking forward

The analysis contained within this report will inform the recommendations presented in the Berwyn Stormwater Management Plan. Specially, the Plan will recommend strategies related to local policy and regulations, flood control assistance for residents, green and gray infrastructure improvements, system maintenance and monitoring, and education and outreach. To ensure improvements provide the greatest return on investment, the City should prioritize them in areas that have the greatest exposure to flooding and provide special consideration to those areas facing social vulnerability. Additionally, implementation of these strategies should emphasize not only the ability of green infrastructure to reduce flooding, but also the various co-benefits of these tools, including a reduction of the urban heat island effect, improved air quality, reduced noise pollution, and expanded habitat for insects, birds, and other animals.

[21] FEMA, "Make Your Business Resilient," https://www.fema.gov/media-library/assets/images/116921.

Appendix 4
Understanding Your Sewer - MWRDGC

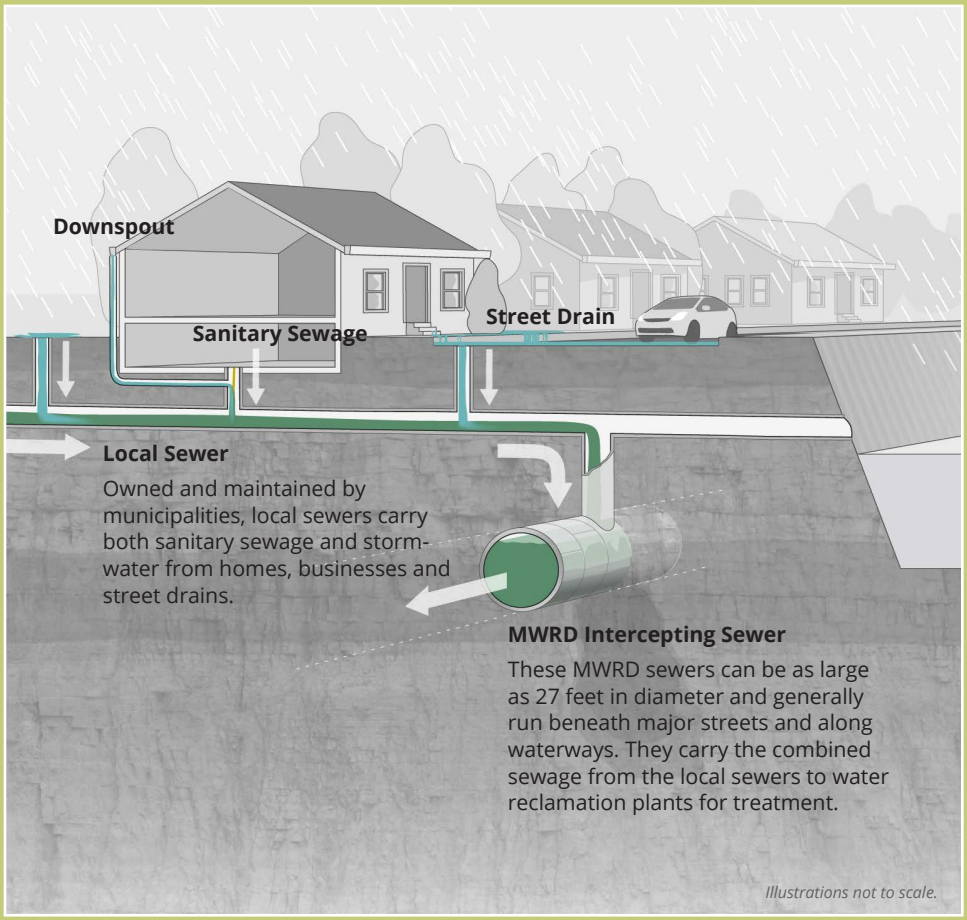
Understanding Your

An Introduction to the Chicago Area's Combined Sewer Systems

Metropolitan Water Reclamation District *of* Greater Chicago

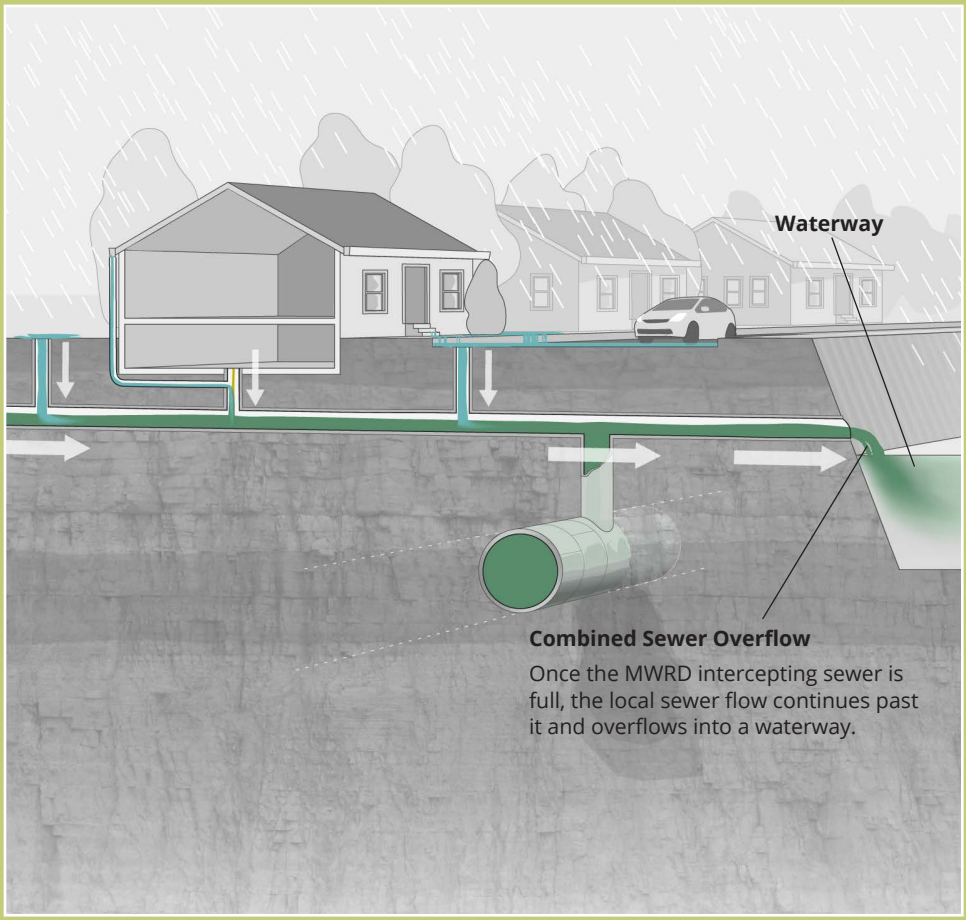
What is a combined sewer?

In a combined sewer system, sanitary sewage and stormwater drain into the same pipes. Homes, businesses and street drains are connected to the local sewers, which are owned and maintained by municipalities. Local sewers flow by gravity into the Metropolitan Water Reclamation District of Greater Chicago (MWRD) intercepting sewers, which then convey the flow to MWRD water reclamation plants for treatment.



What is a combined sewer overflow?

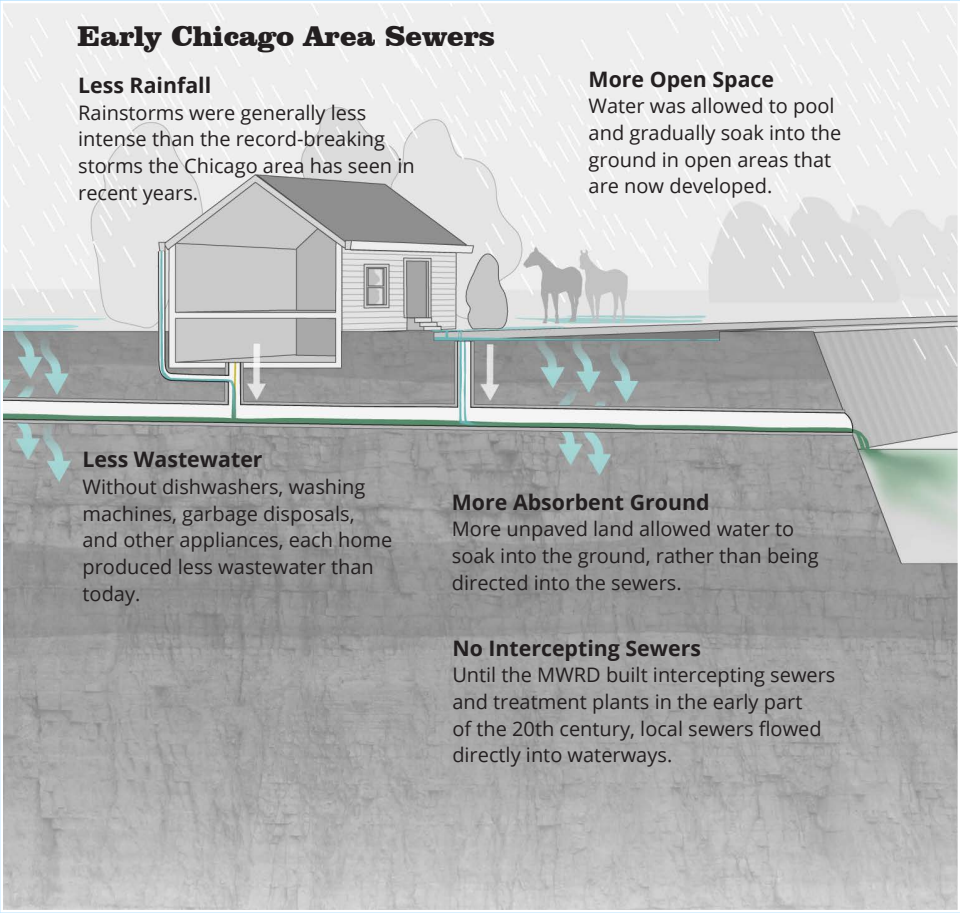
If the intercepting sewers and water reclamation plants reach capacity during heavy rain, the local sewer continues to drain, or “overflow,” to a waterway.



Why do our sewers overflow into waterways?

They were designed that way. Most local sewers in the Chicago area (and in other older cities around the world) were built over 100 years ago, before wastewater treatment existed. They were designed to drain sanitary flow and a limited amount of stormwater directly to the river.

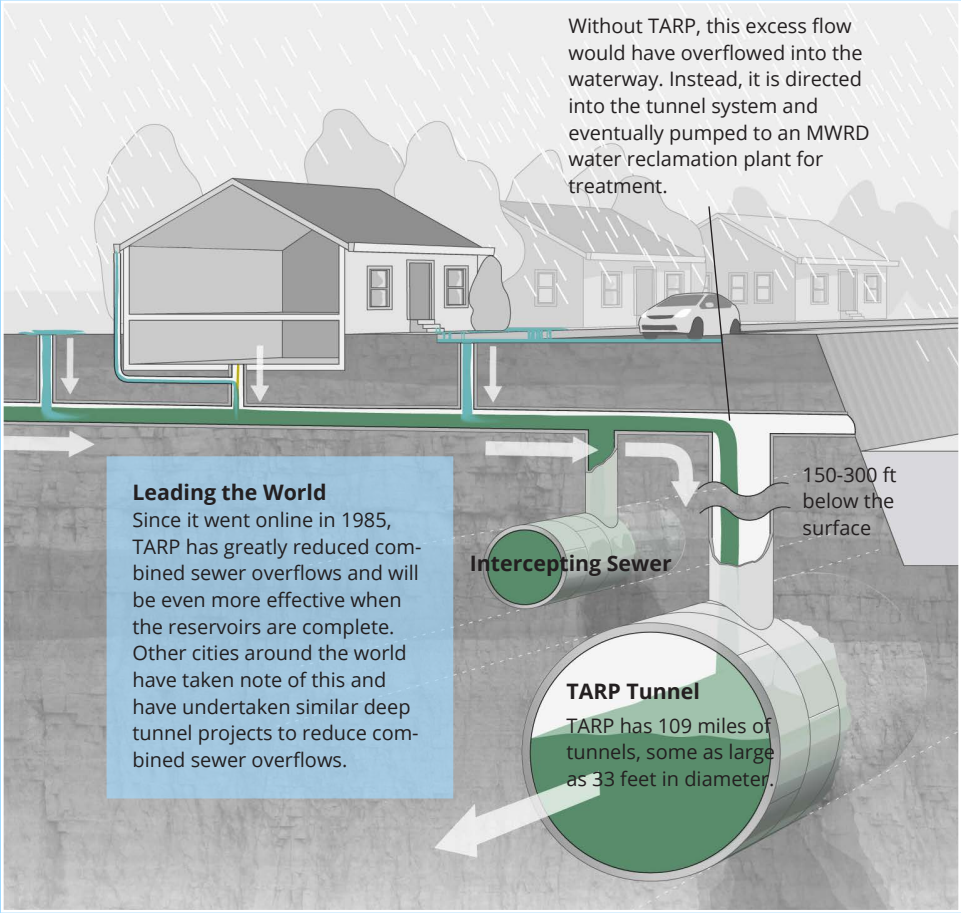
Most of these local sewers are required to carry much more water today than they did when they were first put into service, and as a consequence, they can exceed their flow capacity, causing backups.



What is the purpose of the "Deep Tunnel," or TARP (Tunnel and Reservoir Plan)?

The MWRD's Tunnel and Reservoir Plan (TARP) or "Deep Tunnel" system is designed to reduce flooding and pollution caused by combined sewer overflows.

TARP tunnels act like very large intercepting sewers, capturing the excess flow from the combined sewers before it can reach the waterway. Excess flow is stored in the tunnels but will also be sent to the large storage reservoirs. The "tunnels" portion of TARP was completed in 2006 and is fully operational. The "reservoir" portion of TARP is currently under construction. The stormwater captured by TARP is eventually pumped to the MWRD water reclamation plants for treatment.

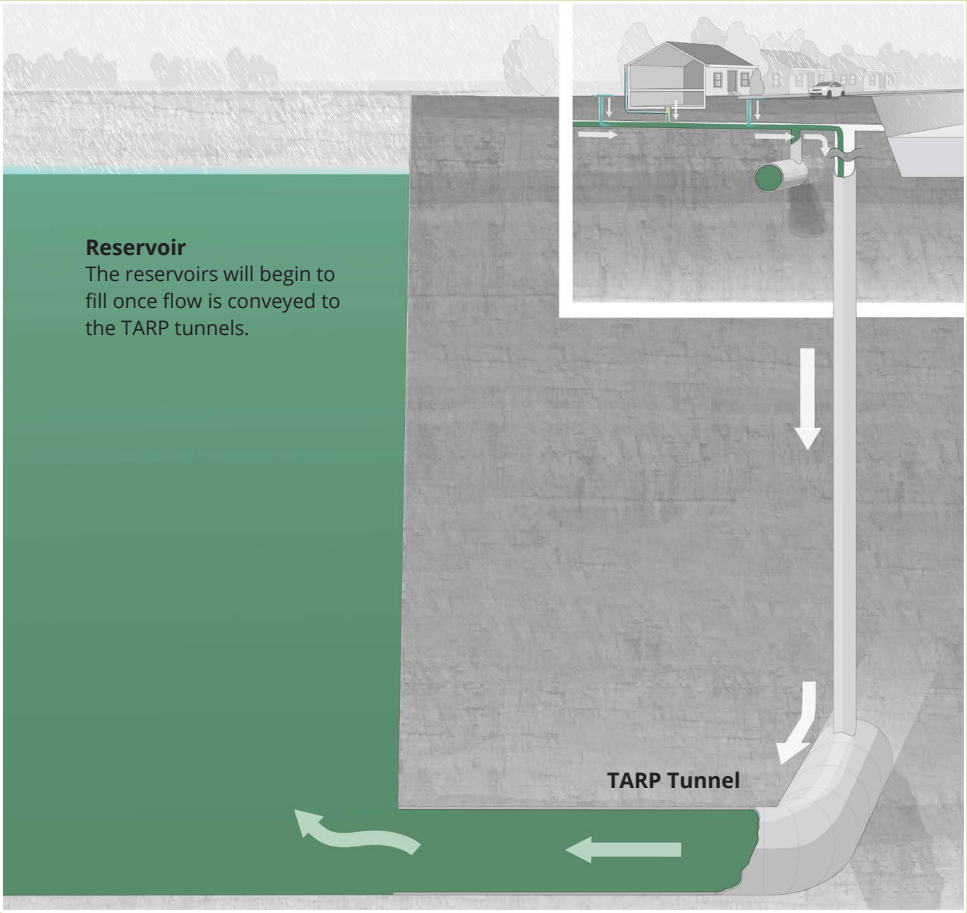


Leading the World
Since it went online in 1985, TARP has greatly reduced combined sewer overflows and will be even more effective when the reservoirs are complete. Other cities around the world have taken note of this and have undertaken similar deep tunnel projects to reduce combined sewer overflows.

How will the reservoirs help?

The reservoirs will increase the storage capacity of TARP and will capture and store combined sewage that would otherwise overflow into the waterways.

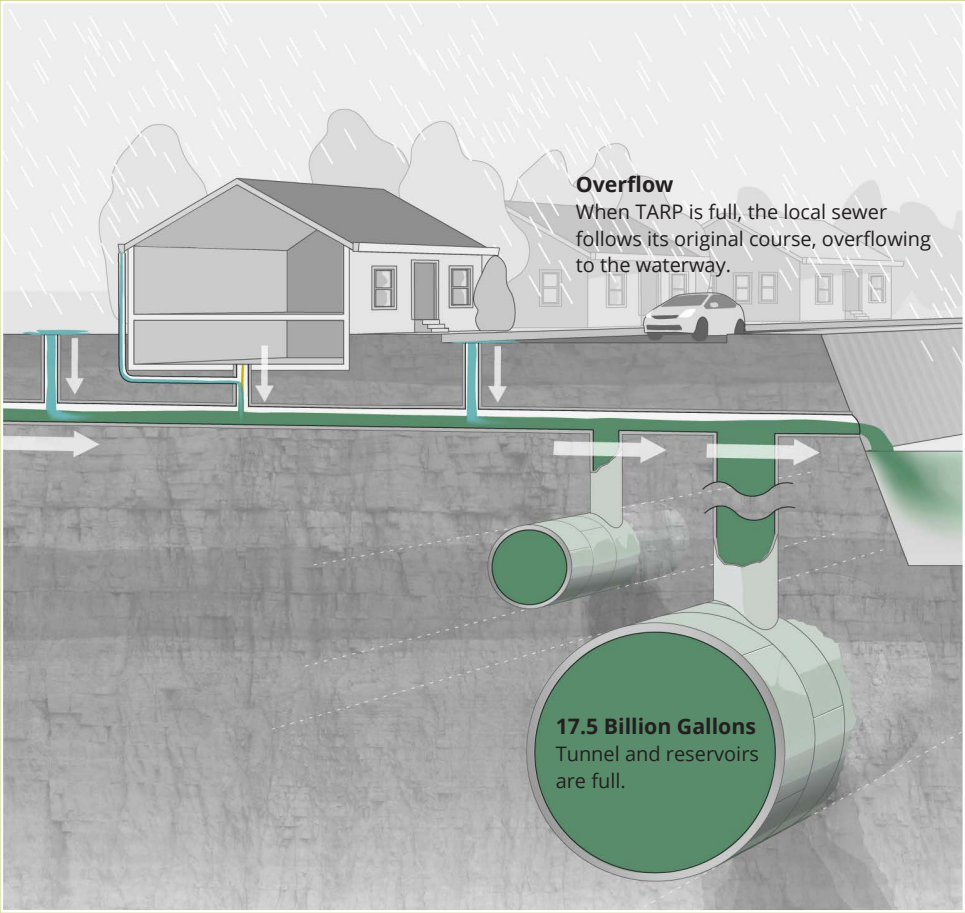
The TARP system includes three reservoirs to receive and store the flow from the tunnels during heavy storms. Two of the three reservoirs are still under construction. When the reservoirs are complete, the system will have a total capacity of 17.5 billion gallons.



What if TARP is full?

Although it is one of the largest civil engineering projects ever undertaken, TARP capacity is not unlimited and can fill during intense storms. When TARP is full, the local sewers overflow by gravity into the waterways, as they did before TARP was built.

The tunnels currently are used for storage and can hold 2.3 billion gallons. The completed reservoirs will add 14.8 billion gallons of capacity but it will still be possible for the system to fill during extreme storms.



What causes sewer backups?

Backups are usually caused by **insufficient flow capacity** at some point in a sewer system. The system cannot drain as quickly as it is being filled.

One way to understand the concept of flow capacity and the difference between normal sewer flow and a sewer backup is to imagine a kitchen sink being filled with water.

Normal Flow

If the faucet is turned on and there are no obstructions in the sink, the water flows into the sink and exits through the drain. The flow from the faucet is slow enough for the drain to keep up, and as a result the water never spills over the edge of the sink.

Backup

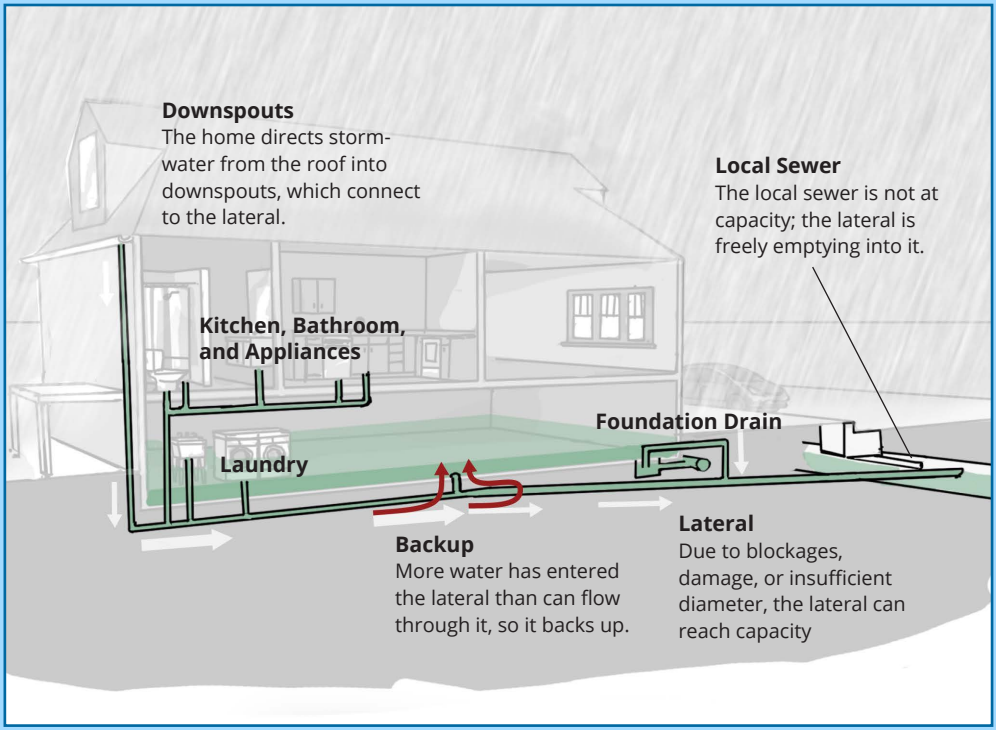
If the faucet is still turned on and you quickly pour a large pan of water into the sink, the drain can not empty the sink as quickly as it is being filled and the water level rises until it overflows. This does not mean the sink or drain is somehow defective; it only means its flow capacity has been exceeded.

What is a lateral connection?

A lateral connection is the pipe that connects your home to the local sewer system. Your lateral connection - which is usually 6 inches in diameter and runs from your house to the local sewer under your street - is your property and it is your responsibility to maintain it.

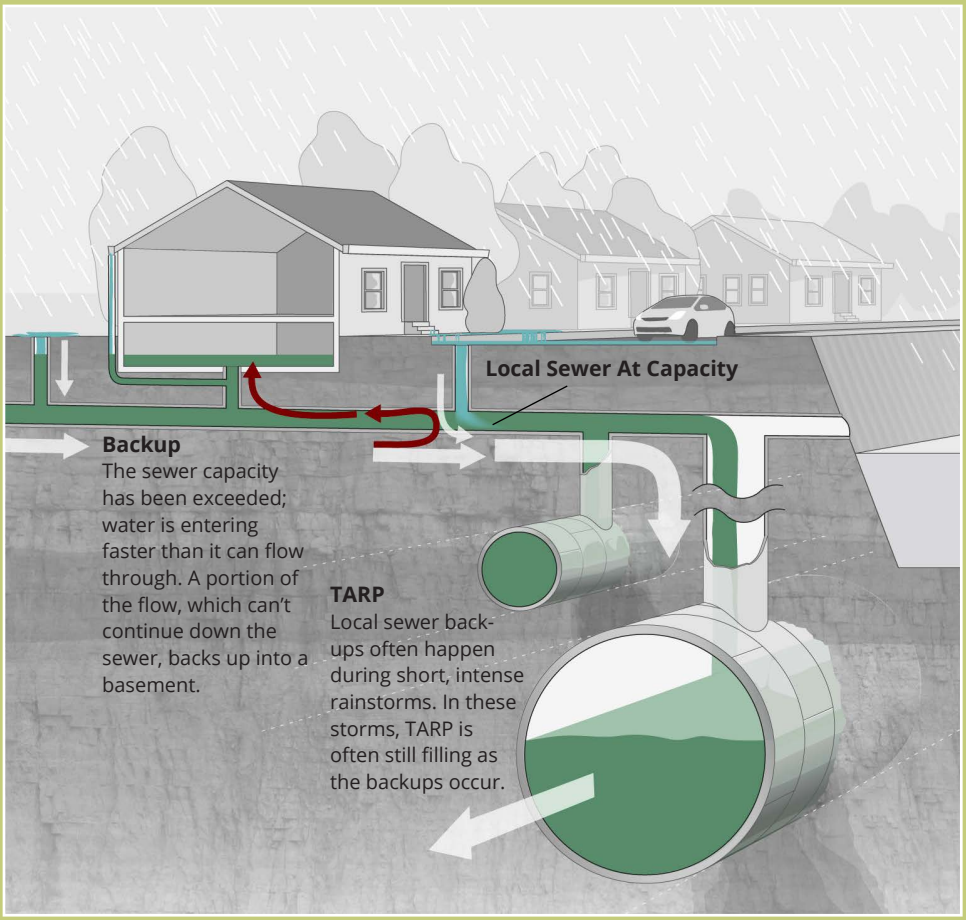
If your lateral connection is clogged with debris, damaged, or flowing at capacity, a storm can cause a backup on your property even if the local sewer is not at capacity. Regular cleaning and maintenance by a qualified, experienced plumber are required to keep the system operating efficiently.

A house with a roof that is 800 square feet can send about 500 gallons of water to its lateral connection during a one inch storm. During storms, water enters the sewer system from a home's roof via downspouts. Appliances, kitchen and bathroom drains also add to the flow volume.



Sewer Backups

Sewer backups may not be limited to an individual property. When a lot of rain falls in a concentrated area over a short period of time, stormwater may enter sewers faster than it can flow through them, exceeding their flow capacity. When this happens, some of the combined sewage cannot reach TARP or the waterway quickly enough and it can back up into streets and unprotected basements.



What **you** can do to prevent sewer backups

- Have a qualified, experienced plumber who guarantees their work inspect your basement. To protect your home from sewer backups, have a check valve or overhead sewer installed. These are valuable home improvements that will prevent sewer backups if properly installed.

- Disconnect your home's downspouts so they drain onto pervious (absorbent) surfaces instead of into the sewer system. It is important to make sure the disconnected downspout does not direct water toward your foundation or a neighbor's foundation. Consider directing flow to a rain barrel or rain garden area. Your neighbors are likely served by the same local sewer, so encourage them to do the same.

- You can connect downspouts to rain barrels (available at cost from the MWRD) to save the rainwater for reuse.

- Consider replacing your driveway and other paved areas on your property with pervious surfaces that can absorb stormwater.

- Don't flood yourself. Have your lateral connection inspected for blockages or damage that could cause basement backups.

For more information about preventing backups, search for "sewer backup prevention" at cityofchicago.org and fema.gov.

What **your municipality** and the **MWRD** are doing to prevent sewer backups

- The MWRD and your municipality are committed to working together to prevent problems with the sewer systems.

- The MWRD and your municipality regularly inspect, maintain, and clean sewers to ensure they are operating properly.

- The MWRD is completing the two remaining TARP reservoirs, which will provide an additional 14.8 billion gallons of storage.

- The MWRD is working with municipalities and non-governmental organizations to adopt green infrastructure. Technologies such as porous pavement, rain gardens, native plant landscaping, bioswales, green roofs, and greenways allow stormwater to be absorbed into the ground instead of flowing into the sewer system. Reducing the burden on the sewer system will help reduce sewer overflows and the likelihood of backups.

The Metropolitan Water Reclamation District of Greater Chicago (MWRD) produced *Understanding Your Sewer* to provide an overview of the combined sewer systems in the Chicago area and explain how they operate during rainstorms.

The MWRD welcomes public understanding of this vital infrastructure and encourages our residents to become informed participants in the discussion about sewers, stormwater and flooding.

For additional information about the MWRD's operations, intercepting sewers, treatment facilities, TARP, and more, contact MWRD Public Affairs at 312.751.6633, go to mwrd.org, or write to public.affairs@mwrd.org.

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Appendix 5
Stormwater Concept Plan Opinions of Cost

Appendix 5.1
Janura Cost Estimate

CMAP
Berwyn Janura Park Concept
Cost Estimate

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
EARTH EXCAVATION, REMOVAL AND DISPOSAL	CU YD	15,037	$ 35.00	$ 526,296
ENGINEERED TOPSOIL, FURNISH AND PLACE	CU YD	1,611	$ 90.00	$ 145,000
SIDEWALK REMOVAL	SQ FT	400	$ 2.00	$ 800
CONCRETE SIDEWALK	SQ FT	400	$ 6.00	$ 2,400
CA-6 FOR CONCRETE SIDEWALK (6")	CU YD	7.4	$ 31.00	$ 230
SEEDING, NATIVE MIX	ACRE	0.2296	$ 15,000.00	$ 3,444
EROSION CONTROL BLANKET	SQ YD	6,333	$ 3.00	$ 19,000
CURB REMOVAL	LN FT	50	$ 7.40	$ 370
UNDERDRAIN - 8" PERF PVC	LF	800	$ 22.00	$ 17,600
CONNECT TO EXISTING SEWER, REPAIR PAVEMENT	LSUM	1	$ 6,000.00	$ 6,000
UNDERGROUND DETENTION	LSUM	1	1,650,000.0	$ 1,650,000
INLET RESTRICTORS (3" VORTEX)	EACH	43	$ 500.00	$ 21,500
SEEDING, CLASS A2	ACRE	1.079	$ 15,000.00	$ 16,185
EDUCATIONAL SIGNAGE	EACH	4.000	$ 210.00	$ 840
			Sub-Total	**$ 2,409,664**
MOBILIZATION	LSUM	1	$ 120,483.20	$ 120,483
ENGINEERING DESIGN	LSUM	1	$ 289,159.68	$ 289,160
CONSTRUCTION MANAGEMENT	LSUM	1	$ 120,483.20	$ 120,483
			Sub-Total	**$ 2,939,790**
CONTINGENCY (20%)				$ 587,958
			Total	**$ 3,527,748**
ADDITIONAL RAINGARDEN PLANTS (ALTERNATIVE)	EACH	1,000	$ 8.00	$ 8,000

Appendix 5.2
Irving Cost Estimate

CMAP
Berwyn Irving Elementary School Concept
Cost Estimate

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
STORMWATER IMPROVEMENTS				
EARTH EXCAVATION, REMOVAL AND DISPOSAL	CU YD	3,763	$ 35.00	$ 131,704
ASPHALT REMOVAL	SQ FT	19,700	$ 1.50	$ 29,550
ENGINEERED TOPSOIL, FURNISH AND PLACE	CU YD	378	$ 90.00	$ 34,000
TREES, SHADE	EACH	4	$ 900.00	$ 3,600
ORNAMENTAL TREES	EACH	4	$ 600.00	$ 2,400
SHRUBS	EACH	6	$ 10.00	$ 60
PERENNIALS	EACH	100	$ 8.00	$ 800
MULCH	SQ FT	3,400	$ 0.80	$ 2,720
EROSION CONTROL BLANKET	SQ YD	378	$ 3.00	$ 1,133
UNDERDRAIN - 8" PERF PVC	LF	550	$ 22.00	$ 12,100
8" PVC	LF	15	$ 22.00	$ 330
UNDERGROUND DETENTION	LSUM	1	57,600.0	$ 57,600
PERMEABLE PAVERS & BASE	SQ FT	5,300	$ 16.00	$ 84,800
EDUCATIONAL SIGNAGE	EACH	2	$ 210.00	$ 420
INLET RESTRICTORS (3" VORTEX) OPTIONAL	EACH	8	$ 500.00	$ 4,000
			Sub-Total	**$ 365,217**
SCHOOL YARD IMPROVEMENTS				
PLAYGROUND EQUIPMENT	LSUM	1	$ 100,000.00	$ 100,000
RUBBER PLAY SURFACE & BASE	SQ FT	10,640	$ 20.00	$ 212,800
SYNTHETIC TURF FIELD & BASE	SQ FT	7,600	$ 11.00	$ 83,600
OUTDOOR EDUCATION AREA/BENCHES	EACH	10	$ 2,000.00	$ 20,000
			Sub-Total	**$ 416,400**
MOBILIZATION	LSUM	1	$ 39,080.85	$ 39,081
ENGINEERING DESIGN	LSUM	1	$ 78,161.70	$ 78,162
CONSTRUCTION MANAGEMENT	LSUM	1	$ 39,080.85	$ 39,081
			Sub-Total	**$ 572,723**
CONTINGENCY (20%)				$ 114,545
			Total	**$ 687,268**

Appendix 5.3
34th Cost Estimate

CMAP
Berwyn 34th Street Concept
Cost Estimate

ITEM DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
EARTH EXCAVATION, REMOVAL AND DISPOSAL	CU YD	1,578	$ 35.00	$ 55,222
ENGINEERED TOPSOIL, FURNISH AND PLACE	CU YD	400	$ 90.00	$ 36,000
SEEDING, NATIVE MIX	ACRE	0.1240	$ 15,000.00	$ 1,860
EROSION CONTROL BLANKET	SQ YD	600	$ 3.00	$ 1,800
ASPHALT REMOVAL	SQ FT	13,200	$ 1.50	$ 19,800
CURB REMOVAL	LN FT	30	$ 7.40	$ 222
PERMEABLE PAVERS & 24" SUB-BASE	SQ FT	13,200	$ 16.00	$ 211,200
UNDERDRAIN - 8" PERF PVC	LF	1,220	$ 22.00	$ 26,840
CONNECT TO EXISTING SEWER, REPAIR PAVEMENT	LSUM	1	$ 10,000.00	$ 10,000
EDUCATIONAL SIGNAGE	EACH	2	$ 210.00	$ 420
			Sub-Total	**$ 363,364**
MOBILIZATION (5%)	LSUM	1	$ 18,168.19	$ 18,168
ENGINEERING DESIGN (10%)	LSUM	1	$ 36,336.37	$ 36,336
CONSTRUCTION MANAGEMENT (5%)	LSUM	1	$ 18,168.19	$ 18,168
			Sub-Total	**$ 436,036**
CONTINGENCY (20%)				$ 87,207
			Total	**$ 523,244**
ADDITIONAL RAINGARDEN PLANTS (ALTERNATIVE)	EACH	500	$ 8.00	$ 4,000